MADERA

Integrated Regional Water Management

PLAN

FINAL DRAFT

September 2014

Madera Integrated Regional Water Management Plan

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September 2014

Prepared by:

Provost & Pritchard Consulting Group

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Madera Regional Water Management Group
Memorandum of Understanding Signatories

Chowchilla Red Top Resource Conservation District
Chowchilla Water District
City of Chowchilla
City of Madera
Coarsegold Resource Conservation District
Fairmead Community and Friends
Gravelly Ford Water District
Madera County
Madera County Special Districts
Madera Irrigation District
Madera Valley Water Company
Madera Water District
North Fork – Mono Rancheria
Root Creek Water District
Self Help Enterprises
SEMCU - Southeast Madera County United - Madera Ranchos
Yosemite/Sequoia Resource Conservation and Development Council

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ABBREVIATIONS

µg/L	Micrograms per liter
µmhos/cm	Micromhos per centimeter
µS/cm	Microsiemens per centimeter
AF	acre-feet
AWMP	Agricultural Water Management Plan
BMP	Best Management Practices
CALFED	CALFED Bay Delta Program
CAS	California Aquifer Susceptibility
CASGEM	California State Groundwater Elevation Monitoring
CCID	Central California Irrigation District
CDEC	California Data Exchange Center
CDPH	California Department of Public Health
CEDEN	California Environmental Data Exchange Network
CEIC	California Environmental Information Clearinghouse
CEQA	California Environmental Quality Act
CERES	California Environmental Resources Evaluation System
CHSC	California Health and Safety Code
CII	commercial, industrial and institutional
CIMIS	California Irrigation Management Information System
CIWQS	California Integrated Water Quality System
CNRA	California National Resources Agency
CSA	County Service Area
CTS	California Tiger Salamander
CV-SALTS	Central Valley Salts Coalition
CVP	Central Valley Project
CWAP	California Water Action Plan

CWC	California Water Code
CWI	California Water Institute
CWP	California Water Plan
CZO	Critical Zone Observatory
DAC	Disadvantaged Community
DDW	State Water Resources Control Board, Division of Drinking Water
DFW	Department of Fish and Wildlife
DMM	Demand Management Measures
DWR	Department of Water Resources
EA	Environmental Assessment
EC	Electrical Conductance
ET	Evapotranspiration
EWMP	Efficient Water Management Practices
GAMA	Groundwater Ambient Monitoring and Assessment
GHG	Greenhouse Gas
GMP	Groundwater Management Plan
I&M	Inventory and Monitoring
Index	Chronological Reconstructed Sacramento and San Joaquin Valley Water Year Hydrologic Classification Indices
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
IWRIS	Integrated Water Resource Information System
JPA	Joint Powers Authority
KDSA	Kenneth D. Schmidt and Associates
KRCD	Kings River Conservation District
KREW	Kings River Experimental Watershed
KRFMP	Kings River Fisheries Management Program
KRWA	Kings River Water Association
LAFCO	Local Agency Formation Commissions
mAF	million acre feet
MCL	Maximum Contaminant Level
MD	Maintenance District
MHI	Median Household Income
MOU	Memorandum of Understanding
MSL	mean sea level
MSR	Municipal Service Review
mya	Million Years Ago
NEPA	National Environmental Policy Act
NGO	Non-Governmental Organization
NPDES	National Pollution Discharge Elimination System
NRCS	Natural Resources Conservation Service
O&M	Operation and Maintenance

RNHA	Regional Housing Needs Allocation
RWMG	Regional Water Management Group
RWQCB	Regional Water Quality Control Board
SFPUD	Sierra Foothills Public Utility District
SIEN	Sierra Nevada Network
SJER	San Joaquin Experimental Range
SLDMWA	San Luis & Delta Mendota Water Authority
SNAMP	Sierra Nevada Adaptive Management Project
SWAMP	Surface Water Ambient Monitoring Program
SWRCB	State Water Recourse Control Board
SWFM	Stormwater Flood Management
SWWG	Sierra Water Workgroup
TMF	Technical, Managerial and Financial
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VA	Vulnerability Assessment
WDL	Water Data Library
WSJV	Western San Joaquin Valley
WWTF	Waste Water Treatment Facility

EXECUTIVE SUMMARY

The Madera Integrated Regional Water Management Plan (IRWMP) is a collaborative effort among the 17 public, private and not-for-profit groups and agencies which are signatory to the Memorandum of Understanding (MOU) which formed the Madera Regional Water Management Group (RWMG), along with other interested groups and agencies who have participated in the process and are not signatory to the agreement, but who share an interest in managing water resources throughout Madera County and its watersheds.

The Region's initial IRWMP, approved in 2008, was developed to improve coordination and collaboration between these agencies and stakeholders, and to serve as a basis for pursuing funding to accomplish the goals set forth in the IRWMP. This update revises, reformats and adds to the original IRWMP content to conform to the updated State requirements set forth in Proposition 84, the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006.

This Report is organized in the order set forth in the Department of Water Resources Guidelines for Integrated Regional Water Management Plans. The content of the 16 chapters is summarized below.

Introduction

CHAPTER 1 provides an introduction to the Madera Regional Water Management Group, the body responsible for preparing this report, selecting and prioritizing goals, objectives, resources management strategies and projects, and for coordinating the applications for implementation funding on behalf of the various Member Agencies. This Chapter also describes the purpose of the IRWMP.

Governance Structure

CHAPTER 2 describes the governance structure of the RWMG, along with some history on how it formed, how public outreach is accomplished and how others can participate in the RWMG. It is important to note that the RWMG is a fully-independent entity and is not subordinate to any other government subdivision or district within the Madera IRWMP area.

The governance structure adopted is very simple, with the Members of the RWMG operating as the decision-making body on most matters. The MOU allows for creation of subcommittees "for addressing issues affecting particular areas of the Madera Region or for certain issues within the general jurisdiction of the RWMG" but does not create any standing committees.

Any stakeholder organization with an interest or role in water management in the IRWMP area may become a Member of the RWMG. Stakeholders could include such organizations as water

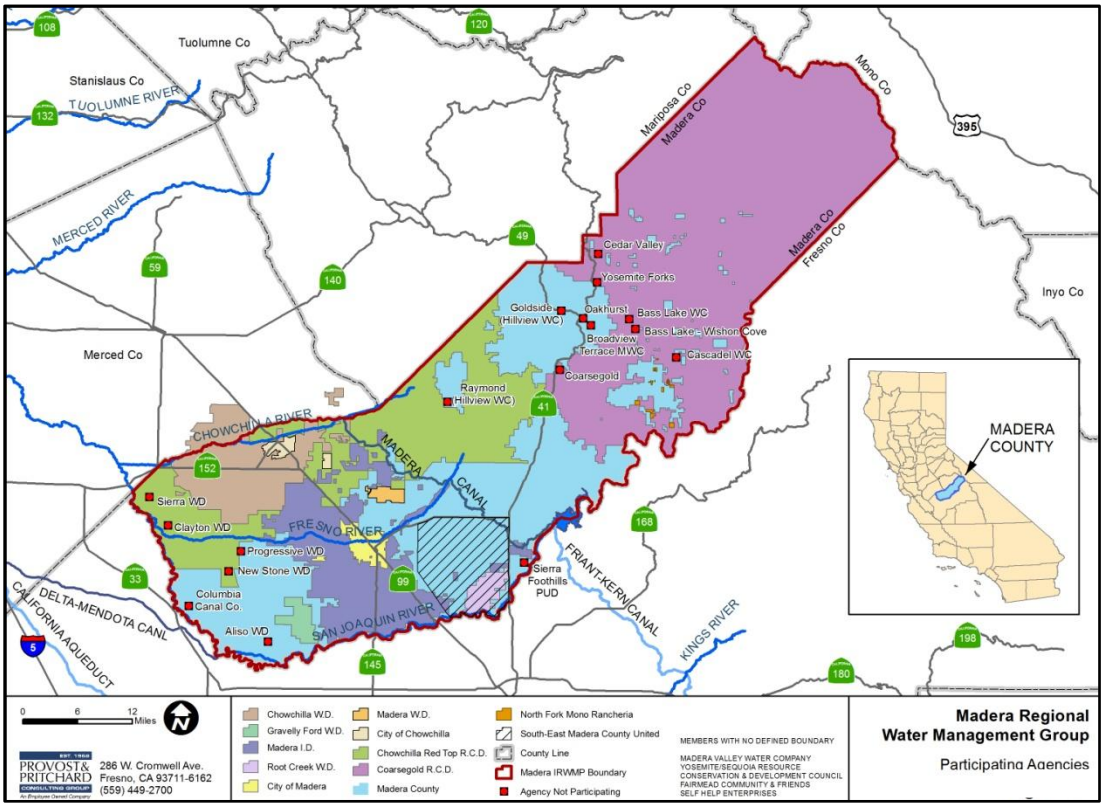
agencies, conservation groups, agriculture representatives, tribal groups, land use entities, local, state, and federal agencies, and private entities.

Organizations can become members by signing a Memorandum of Understanding, adopting the IRWMP, submitting a signed resolution from the organization's governing body, and in some cases paying annual dues. Each of the Member Agencies has an equal voice in the RWMG, while the Disadvantaged Community (DACs) Members, who are exempt from dues, are granted a unified single vote. The DACs select their voting representative themselves. A full list of the Member Agencies is included in the chapter. Non members, also called interested parties, are also welcomed and encouraged to participate in RWMG efforts.

The RWMG makes consistent efforts to include more interest groups and the public in this process. Meeting agendas and minutes are circulated to a broad and inclusive group of interests including members and interested parties. Meeting notices, agendas and minutes will be posted at the RWMG web page beginning in late 2014: http://www.madera-id.org/index.php/rwmg.

Region Description

CHAPTER 3 is a description of the region and discusses a wide variety of topics. It opens with discussions of regional geography, hydrogeology, natural water resources, potential climate change impacts on water supplies, geology, geomorphology and soils, and the Region's experience with land subsidence due to unsustainable and significant groundwater pumping.



The Madera Region is located in the geographic center of the California, in the San Joaquin Valley and extending to the crest of the Sierra Nevada mountains. The Region includes all lands within Madera County. The borders of the Region are generally defined by the crest of the Sierras to the east, the San Joaquin River on the south and west, and the Chowchilla River on the north. The Region includes two cities, numerous special districts, state and federally controlled lands, and unincorporated County lands that are not under the jurisdiction of any City, active water district or irrigation district. The Region was accepted as a RWMG by the California Department of Water Resources because its borders have a strong political and hydrologic basis.

The climate of the Valley portion of the Region is characterized by mild winters and hot, dry summers. Temperatures in the summer often exceed 100 degrees. Fog is often experienced for long periods in the winter, with low temperatures in the mid-30s. Average annual precipitation is about 10 inches, with 80 percent of the rainfall occurring in the winter months.

Climate in the foothill and mountain portion of the Region varies substantially with elevation. While all areas are characterized by warm, dry summers, peak summer temperatures decline with increasing elevation to as low as the mid-80s near the crest of the Sierras. Winter conditions transition with elevation as well. Precipitation typically increases with elevation, as does snow accumulation. Areas above 7,000 feet elevation typically see accumulating snow

throughout the winter, with peak accumulations near April 1. Water contained in that snowpack makes up the spring and summer runoff which provides surface water supplies to the Region and which replenishes regional groundwater aquifers.

Water supplies can vary substantially year to year due to wide variations in precipitation in the Region and its upper watersheds. Water supplies in 2012, 2013 and 2014 have been less than one-half of the average. Groundwater serves an important reserve supply to supplement surface water deliveries. Over the past 30 years, groundwater levels in the Region have experienced significant declines due to overdraft. In general, average annual declines are greater on the eastern side of the valley portion of the Region, at up to five (5) feet or even more in the southeast and northeast. Increased agricultural demands, particularly due to the conversion of native grasslands to permanent crops, has increased the rate of decline in the eastern portion of the Valley. A detailed water budget is not currently available for Madera County, but is critically needed and a high priority for the region.

There is a brief discussion in the chapter on significant biological species. Some of the primary species of concern include California tiger salamander, vernal pool fairy shrimp and San Joaquin Valley kit fox. Other sections of the chapter describe ecological processes and environmental resources, groundwater elevations and flow directions (including groundwater contour maps) and the geologic potential for groundwater recharge within the Region.

The Valley portion of the Region is underlain by the San Joaquin Valley Groundwater Basin. The San Joaquin Valley Groundwater Basin covers a vast area and encompasses the alluvial deposits under the valley floor. The San Joaquin Valley Groundwater Basin covers approximately 13,900 square miles and has been divided into 16 subbasins. The Madera Region is also within the San Joaquin River Hydrologic Region and is underlain by three groundwater subbasins as defined by the California Department of Water Resources (DWR) in "*California's Groundwater, Bulletin 118 – Update 2003*". These are the Chowchilla, Madera, and Delta-Mendota subbasins.

Land subsidence in the Valley portion of the Region is caused by pumping groundwater from the deeper confined aquifer that is separated from the shallower unconfined aquifer by the Corcoran Clay. The area of greatest land subsidence in the Region coincides with the area underlain by the Corcoran Clay, in western Madera County, particularly along the Eastside Bypass. Land subsidence in the Region is of historic and ongoing significance. Between 1926 and 1972, subsidence resulted in between 1.0 and 4.0 feet of ground surface elevation drop within the western half of the Valley portion of the Region. The majority of the subsidence has occurred since 1940, when large turbine pumps came into widespread use for extracting water from the deeper confined aquifer. Availability of surface water from the Delta Mendota Canal and the California Aqueduct resulted in decreased groundwater demand, stabilization of groundwater levels and a reduced rate of subsidence. Drought and regulatory reductions in surface water deliveries (especially from the San Joaquin River Restoration) from 2007 through

2014 have brought about unprecedented withdrawals of water from the deeper confined aquifer to meet local water demand, and a return to high subsidence rates.

Domestic water demands in the Valley are at least 24,000 AF/year. Agricultural water demands total slightly over 1,000,000 AF/year. Groundwater quality within the Valley portion of the Region is generally good for both domestic supply and agricultural use. However, variations in groundwater quality mean some groundwater within the Region is unacceptable for domestic and even agricultural uses without treatment. Groundwater contamination can be a result of naturally occurring point source contamination, and/or regional contamination. Some common elements of concern include dissolved salts (as measured by the specific conductance or electrical conductance [EC]), boron, manganese, arsenic, iron, hexavalent chromium, bacteria, uranium, and methane.

The chapter concludes with summary discussions of the social and cultural makeup of the Region, the major water-related objectives and conflicts that have been identified, how the Regional boundary was determined and defined, ways in which the RWMG has been interacting and working with other adjacent and nearby Integrated Regional Water Management (IRWM) groups, and a notation that the Region does not make use of Delta water.

Disadvantaged Communities

CHAPTER 4 discusses the identified Disadvantaged Communities (DACs) in the Region, as measured by those residential, mobile home park and group home communities where Median Household Income falls below 80% of the state average. The chapter discusses the social and cultural values and makeup of the Region, and how some of these have contributed to the less-affluent nature of the Region's communities. The two federally-recognized Native American tribes within the Region are discussed, as are the economic trends and conditions, including jobs, housing and unemployment, which have been observed. The chapter tabulates the 29 identified DAC communities, and further identifies the Small and Severely Disadvantaged Communities (SDACs). DACs and SDACs have disadvantages in terms of their ability to prepare competitive grant applications, participate in regional efforts, and stay apprised of technology and regulations.

Because of their oftentimes very limited resources, DACs may have trouble regularly participating in forums such as the RWMG. The chapter looks at those challenges in detail, and describes the proactive steps the RWMG took to ensure inclusion of the DACs' needs and interests in the planning process of the IRWMP and in the identification of potential regional projects. The DACs have several significant obstacles to surmount in order to obtain sustainable safe drinking water supplies, provide sewer services and plan for flooding/stormwater related issues. Those obstacles include water quality, Technical, Managerial and Financial (TMF) Capacity, economies of scale, aging or inadequate infrastructure, and geographical location. The chapter deals with each of these issues in turn.

Finally, the chapter discusses methodologies and strategies the Region will implement to overcome barriers and promote increased DAC involvement in the RWMG.

Goals and Objectives

CHAPTER 5, the heart of this Plan, sets forth the RWMG's adopted regional goals and measurable objectives, which will become the point of focus of future planning efforts. Separate goals and objectives are presented for the Valley area and the Foothill/Mountain area of the Region, given the widely-varying geography, climate and hydrogeological conditions.

The chapter provides a discussion of how goals and objectives were selected, and how progress toward objectives will be measured over time. The objectives were also ranked using a stakeholder survey. Groundwater recharge, improving water reliability, and stakeholder education were some of the higher ranking objectives.

Resource Management Strategies

CHAPTER 6 deals with Resource Management Strategies, the next level of planning detail beyond setting objectives. Where the Plan's goals are the over-arching themes for the report and the objectives are designed to measure quantifiable progress toward reaching those goals, resource management strategies describe how the Region will work toward reaching the objectives themselves.

In the 2013 California Water Plan Update, the Department of Water Resources describes 36 different resource management strategies necessary to help achieve a wide variety of water-related objectives. The chapter reviews all 36 of these, and finds 32 of them to be applicable to the Region's objectives in some way. The Region added an additional strategy on Drought Planning. Each of the 33 strategies is tabulated and then discussed in more detail.

Project Review Process

CHAPTER 7 describes the process developed and adopted by the RWMG to review, select and prioritize projects submitted both by Member Agencies and others within the Region, for inclusion on the RWMG's list of projects. The projects listed are those identified as working toward accomplishment of resource management strategies and measurable goals, but also for inclusion in specific funding solicitations as those may become available.

The chapter also includes a suggested process and schedule for completing the project solicitation and grant application process. Appendices include a list of implementation projects, the adopted Project Description Form, a Pre-Application Outline, and a sample Pre-Application.

Impacts and Benefits of Plan Implementation

CHAPTER 8, Impacts and Benefits, lays out the overall benefits and some specific impacts of creating an IRWMP, including some benefits and impacts that may be unique to the Madera Region. The chapter is limited to higher-level and less-detailed analysis, with more-detailed analysis reserved to the environmental review that will occur more appropriately at the time of specific project development.

Later sections of the chapter set forth the anticipated impacts and benefits of the 33 identified resource management strategies. Many times lost in the focus on impacts and benefits to the immediate or regional area is the reality that many strategies will have consequences, both positive and negative, outside of the region itself. When considering project benefits and impacts, it is easy for project proponents to focus on the immediate project area. However, the nature of water management projects means that benefits and impacts are often much more widespread. Complete analysis of every project's benefits and costs is an integral part of the CEQA work needed prior to project implementation and is essential to understanding regional water management.

In addition, the chapter discusses specific impacts and benefits that may accrue to surrounding IRWM groups as a result of the Madera Region pursuing its objectives and implementing its adopted resource management strategies. Almost every action benefitting the Madera Region can be construed as having an equivalent, offsetting and sometimes negative impact on the adjacent or collaborating IRWM regions. This effect is outlined in the chapter but more detailed analysis will be done as individual projects are developed. The chapter also looks at impacts and benefits to the various Member Agencies and to the included DACs. In these cases it appears the benefits will substantially outweigh any potential for adverse impacts.

Plan Performance and Monitoring Standards

CHAPTER 9 sets forth plan performance and monitoring standards. Monitoring performance and progress toward measurable objectives is essential to understanding the effectiveness of the IRWMP, and useful in reporting that progress to the public and to regulatory officials. This chapter describes existing monitoring programs in the Madera Region, and discusses planned monitoring programs that will result from implementation of resource management strategies and projects in the region. It also discusses guidelines for preparing project-specific monitoring and reporting plans, and monitoring progress in meeting the goals of the IRWMP.

Data Management

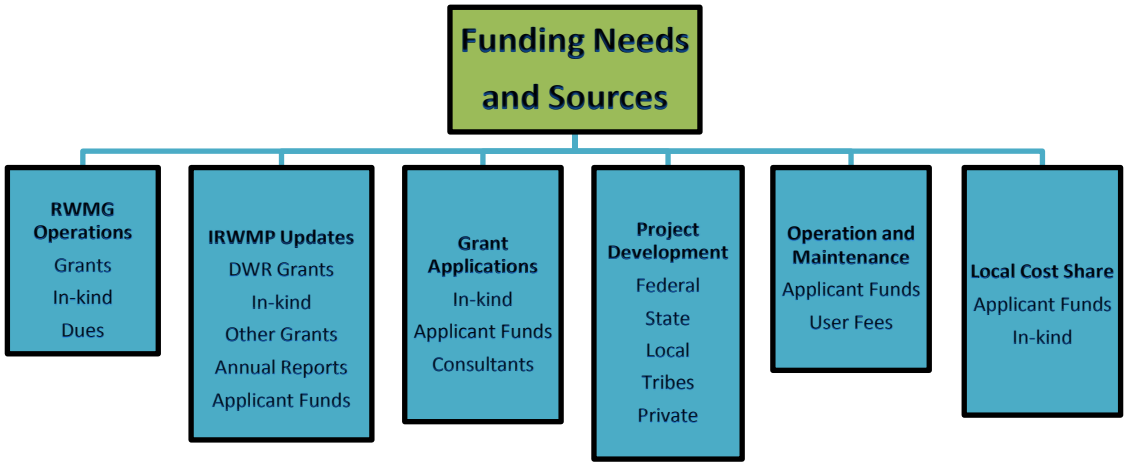
CHAPTER 10 describes the collection, storage, management and dissemination of data to RWMG participants, stakeholders, the public and the State. Beginning with a discussion of data needs within the Region, the chapter discusses data collection techniques, contribution of existing and ongoing data from member agencies, and data management responsibilities of the RWMG and the member agencies.

The RWMG will be maintaining a website, which will be used as a clearinghouse for links to regional data stored on the servers of member agencies, state and federal agencies, and other stakeholders. Data will be shared and distributed to local stakeholders and government organizations that maintain databases by RWMG and the associated entities.

The chapter concludes with a listing and discussion of other state and local databases that contain water management information relevant to regional stakeholders.

Financing

CHAPTER 11 provides information on existing and potential sources of on-going and capital project funding for the Region and the member agencies. The chapter notes that the RWMG requires a stable source of on-going funding to allow for its operational needs, while the preponderance of project funding may come from one-time sources.



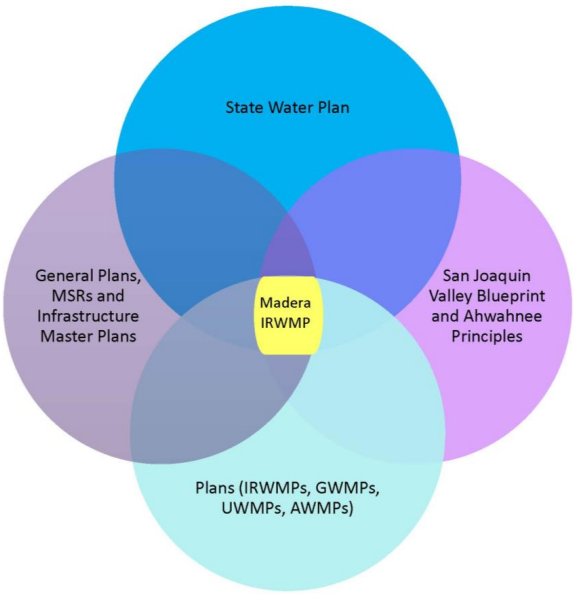
Other options for project funding may include State and federal grants, direct assistance through the legislative bodies, special assessment funding approved by local residents, and even private commercial funding. Opportunities will be sought to pursue Public-Private partnerships where they make sense.

Technical Analysis

CHAPTER 12 enumerates the technical analyses that were relied upon during the preparation of the Plan. The chapter lists and describes the documents from which the Plan draws. It notes that very little analysis was done directly for the Plan, but that the Plan makes use of other analyses done for documents that have already been published.

Relationship to Current Land Use and Water Planning

CHAPTER 13 discusses the relationship between the DWR Integrated Regional Water Management Plan (IRWMP) process and current adopted local land use and water planning efforts for the Madera County area, as well as future plans to further a collaborative, proactive relationship between land use planners and water mangers.



It includes an extensive listing of available and recently-completed land use planning documents within the Region, most but not all of which were prepared by Madera County. Also inventoried are Urban Water Management Plans, Water, Wastewater and Stormwater Master Plans, Groundwater Management Plans, Agricultural Water Management Plans and Water Management Plans that have been prepared within the Region.

The chapter describes how the Madera RWMG will coordinate its water management planning activities with other groups, both those of Member Agencies and those of non-allied stakeholders.

Stakeholder Involvement

CHAPTER 14 describes the practices and policies developed by the RWMG to help assure stakeholder involvement in the IRWM process. The chapter discusses a public outreach

strategy, stakeholder recruitment, outreach performed to update the IRWMP, and future plans for public outreach. Any stakeholder organization with an interest or role in water management in the IRWMP area may join the RWMG as a formal member or interested party.

The RWMG represents a broad range of interests including water supply, water quality, environment/habitat, recreation, agriculture, resource management, hydropower, sanitation, Disadvantaged Communities, non-profit organizations, tribal governments, and local and state agencies. The Interested Parties, who participate but are not formal members, include a similar range of interests. A stakeholder organization who wants to join the Madera RWMG should notify the RWMG and sign the MOU to signify their good faith effort to join.

As part of this update, the RWMG openly discussed which stakeholders were not involved in the IRWMP and should be directly contacted. As a result, the outreach coordinator directly contacted DACs, local water companies, prisons and Native American Tribes to encourage their participation.

The chapter describes the public outreach process used during the preparation of the 2014 IRWMP update, including announcements, public noticing, public meetings at a variety of locations and venues, solicitation of verbal and written comments on the draft chapters and the final draft document. The RWMG has also developed policies to involve stakeholders that choose not be become full members, including Affiliate (non-paying, non-voting) membership, DAC membership (no dues, voting limited to a single combined vote for all participating DACs via a selected representative), and Interested Party status, which confers no voting benefits but places an agency on the RWMG mailing list. All Interested Parties are welcome to attend meetings.

Coordination and Integration

CHAPTER 15 describes coordination and integration of the IRWMP and the work of the RWMG to bring stakeholders together as a unified group and help assure that all projects are coordinated to create a seamless holistic effort without unnecessary duplications. The chapter gives a summary of historical coordination efforts within the Region, and discusses the beneficial and synergistic impacts that coordination can have on both the natural and constructed resources within the Region.

The chapter also discusses coordination efforts with neighboring IRWM regions, including email lists, start up assistance, MOUs, and attendance at other IRWM meetings. Coordination with DACs and Native American tribes is discussed, as well as coordination with state and federal agencies.

Climate Change

Climate change is a long-term alteration of temperature, precipitation and other measures of climate, and is accompanied by changes in shorter-term weather patterns. Climate change can have both natural (e.g. influences from the Earth's natural orbital cycle) and anthropogenic (resulting from the influence of humans) causes. California is expected to experience dramatically warmer temperatures during this century, 2-5^{o}F by 2035-64 and 5-9^{o}F by 2070-99 (California Energy Commission, 2012). Climate-change impacts projected to affect the Madera Region, associated with these magnitudes of warming, include: i) more critically-dry periods, including multi-year droughts, ii) increasing demand from a growing population as temperatures rise, iii) earlier snowmelt and runoff, iv) and increased competition for water among urban and agricultural water users and environmental needs.

CHAPTER 16 brings together and summarizes work done by numerous researchers, particularly some at the University of California, Merced, who have focused on the impacts of potential climate change on the rainfall, snowpack and runoff characteristics of the Central Sierras. The chapter discusses potential general impacts from climate change on the Madera Region, concluding that while the magnitudes of specific impacts are uncertain, warmer average temperatures will result in a number of impacts on precipitation, hydrology, agriculture, water demand, and ecosystems. Higher elevations of the Madera Region are especially sensitive to the effects of a warmer climate. Earlier snowmelt, higher temperatures and longer dry periods over a longer fire season will directly increase wildfire risk. The Madera Region water delivery system in the lower elevations is designed for a specific historic climate, and warmer temperatures will generally be detrimental since they will increase water demands and reduce snowpack storage in a water-short area.

The climate change chapter also includes a vulnerability assessment that investigated potential impacts to water demand, water supply, water quality, flooding, ecosystems and habitats, and hydropower. Conclusions from the assessment indicate a need for more backup water supplies, more water storage, investigations into climate sensitive crops, and improved flood control measures.

Madera Regional Water Management Group

The Madera Regional Water Management Group encourages participation from all stakeholders in Madera County that have an interest in regional water management. Please contact Jeannie Habben at info@cfwatershed.org or visit their website at http://www.madera-id.org/index.php/rwmg for more information.

Funding for updating this IRWMP was partially provided by the California Department of Water Resources through a Proposition 84 IRWM Planning Grant.

CHAPTER 1- INTRODUCTION

This Madera Integrated Regional Water Management Plan (IRWMP) Update was developed to improve coordination and collaboration on regional water management in Madera County for the watersheds of all the streams which flow through the County. The idea of integrated regional water management first surfaced in the state of California in Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002, Water Code Section 79500, et seq., which was passed by California voters in the November 2002 general election. In response to this substantial new challenge and opportunity from the State, Madera County solicited a planning grant to prepare the region's initial Integrated Regional Water Management Plan (IRWMP), which was adopted in 2008. Madera County was the lead agency for the initial IRWMP, but they soon began to contact and engage other agencies and organizations. The County Plan was approved by DWR, and as the idea of integrated planning gained traction in the region, the Madera Regional Water Management Group (RWMG) Formation Committee was formed to develop and implement a governance structure for a RWMG. The RWMG grew and evolved to include a more diverse group of stakeholders who formally organized under a Memorandum of Understanding in 2010.

The RWMG is made up of agencies and other stakeholders who share an interest in managing water resources throughout Madera County and its watersheds and to serve as a lead for pursuing funding to accomplish the goals set forth in the IRWMP. This update revises, reformats and adds to the original IRWMP content to conform to the DWR 2012 Guidelines regarding current State requirements set forth in Proposition 84, the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 and in the related Stormwater Flood Management (SWFM) Grant Program, funded by Proposition 1E, The Disaster Preparedness and Flood Prevention Bond Act of 2006.

1.1 - Background

The Madera Region is located in Central California, spanning from the westerly edge of the San Joaquin Valley on the west to the crest of the Sierra Nevada Mountains on the east and encompassing all of Madera County. The Valley portion of the Region is primarily agricultural in nature, making extensive use of both surface water runoff and pumped groundwater for irrigation. The Foothill/Mountain area, on the other hand, is primarily open space and is primarily public lands, with the majority of the acreage owned and controlled either by the State of California, the National Forest Service or the National Park Service. Primary surface water supplies in the Region include the San Joaquin River and its tributaries, the Fresno River and its tributaries, the Chowchilla River, and a portion of the Merced River.

These surface supplies do not begin to meet the water demand in the Region, so in addition to managing those surface supplies through a combination of surface storage and canal distribution, the water agencies within the Region manage a large number of groundwater

wells. Much of the land in the Valley area is supplied via conjunctive use, or the combination of groundwater and surface water supplies to maximize the productive use of both. Even so, demands have outstripped the combined available supplies and the Region has been operating at a groundwater deficit for many years. This deficit, or overdraft, was estimated in the recently-completed Madera Regional Groundwater Management Plan to be on the order of 250,000 acre-feet per year. (Provost & Pritchard, 2014.) Overdraft, as used in this document, means that on an average annual basis more water is pumped from the groundwater aquifer than is naturally and artificially replaced. This has resulted in substantial declines in the groundwater table all throughout the Valley area. The groundwater deficit has been exacerbated by San Joaquin River Restoration Settlement, which results in lower surface water deliveries to several agencies in the County, while slightly increasing groundwater inflow from the river channel. This is a new and permanent contributor to the overdraft problems of the Madera and Chowchilla groundwater sub-basins. Due to the low storage capacity of the hard rock aquifers in the foothills and mountains, those areas have a similar shortage of groundwater.

Groundwater demand has increased significantly over the past 10 years as strong prices for tree crops such as almonds, pistachios, mandarins and pomegranates have driven expansion of the acreages planted in these and similar crops. Not only has this planting increased the overall water demand, but it has "hardened" the demand as well. Where the historical annual and row crop acreage could be varied and reduced in drier years to match with reduced water supply availability, tree crops must receive water every year in order for the trees to survive. This change in the nature of the demand has meant that groundwater demands in drier years are distinctly higher than they have been historically. Managing these increased and more firm demands requires improved cooperation and collaboration among all the affected water agencies and stakeholders; water in the underground does not respect political boundaries and subdivisions and decisions made by one agency affect water users all across the basin.

Final approval of the RWMG's organizational structure and operating rules by the Member Agencies came in 2009 and 2010. Since that time, additional Member Agencies have signed on, as have a number of Disadvantaged Communities (DACs). The DACs are not required to pay the Member Agency's annual financial contribution, and are allowed a single bloc vote through a selected representative on RWMG business matters.

During the years when the RWMG was working out its organizational and government details, it sought and was awarded a planning grant for preparation of its initial IRWMP, which was completed and adopted in 2008. This IRWMP update was also partially funded by a grant from the California Department of Water Resources (DWR).

This Region covers all of Madera County. The boundaries of the RWMG service area as well as its neighboring IRWMPs are shown on **Figure 1-1**. The IRWMP planning process included the County of Madera government, the Cities of Madera and Chowchilla (the only two city governments in the Region), irrigation and water districts, sewer districts, storm drainage

districts, maintenance districts, County Service Areas, non-governmental organizations and other stakeholders. This diverse range of perspectives has been valuable in developing a consensus and selecting water management strategies for inclusion in the IRWMP that have a broad array of support.

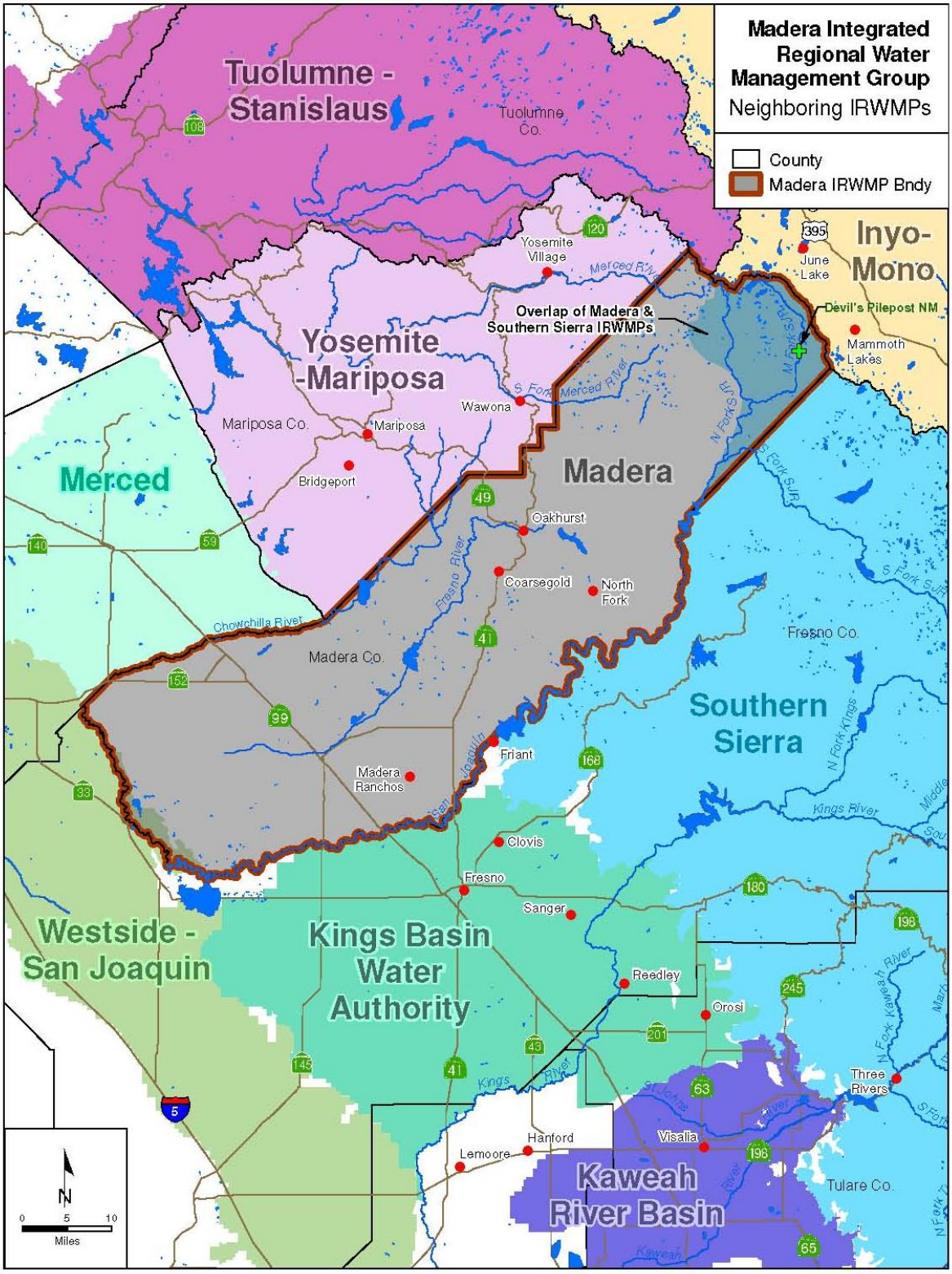


Figure 1-1 – Madera and Neighboring IRWMPs

1.2 - Mission of the RWMG

The RWMG adopted a mission statement as part of its organizational work in 2010, which guides the selection of goals and objectives within the Region as well as informing the collaborative planning and decision-making process. The IRWMP defines issues, guiding principles, regional goals, objectives, strategies, actions, and projects to enhance the beneficial uses of water for the Madera Region and to help ensure the sustainability of the water supply.

Madera RWMG Mission Statement

"The mission of the Regional Water Management Group (RWMG) will facilitate future coordination, collaboration, and communication for comprehensive management of water resources in the Madera Region. Through the mutual understanding among entities in the Madera Region regarding their joint efforts toward Integrated Regional Water management governance, development, planning, funding, and implementation to ensure that clean, adequate and affordable water supplies are available now and in the future to sustain this region and its responsible growth."

The RWMG represents the most broad and long-lasting collaborative water planning effort seen to date in Madera County. Relationships developed through the group have led to increased willingness to share information and efforts. This is partly illustrated by the recent Madera Regional Groundwater Plan, which was commissioned by a subset of RWMG membership and takes a broad, long-lens look at the status and future of groundwater in the Valley area of the Region.

The RWMG has recognized that all of the stakeholders in the region, whether public agencies or non-governmental organizations, have unique perspectives and that all of the individual interests need to be recognized if the IRWMP is to be successful. In order to realize the full benefit of collaboration, participating entities must continue to support the concept that regional integration will enhance their ability to manage their operations and collective resources, will increase their water supply reliability, and will provide a framework to improve water management across the region. More importantly, all participating entities must have confidence that by participating in an Integrated Regional Water Management (IRWM) program they will not lose the ability to control their own future, nor will they lose their autonomy. Regional integration does not seek to diminish the individual agency's decision-making power nor local government's police and discretionary powers. Rather, it seeks to enhance the collective power of the local entities and increase their overall ability to manage their collected resources. Participating entities would also be able to address water management issues more effectively on a much larger scale through an integrated planning framework, rather than on an individual basis.

By working with a range of stakeholders and their agendas, the IRWMP planning process has opened the doors for partnerships, funding opportunities, operational connectivity, and increased awareness of planning efforts, projects and opportunities. Implementation of these collaborative goals has only begun, but will continue as funding becomes available in the future.

In developing regional plans and prioritizing multi-benefit projects, it is important not only to coordinate efforts with other planning agencies within the region, but also to coordinate across regional boundaries. The RWMG is working to build bridges with surrounding IRWM efforts, and has identified Resource Management Strategies, including acquiring surface water supplies from outside the Region, that would require such collaboration.

For this IRWMP update, the RWMG has brought together a significant amount of data and communication concerning complex and controversial issues and has developed wide-ranging goals to address water supply and water quality issues in the region. The RWMG is prepared to address the continuing challenges related to coordinating groups with widely differing missions, agendas, and interests. Implementation of the IRWMP cannot succeed without continuous review and modification to meet new and unanticipated challenges.

The RWMG is pleased to have been part of the collaborative efforts, both within the Region and with neighboring RWMGs, that have already begun, and is proud of its role in creating a forum for communication, collaboration and data-sharing for the Madera Region.

1.3 - Purpose, Need and Common Understanding for the IRWMP

Historically, water management in the Madera Region has been limited to independent operations by the two cities, the County and its numerous special districts, the water agencies and all of the individual landowners who have private wells. In other words, there had been no overall coordinated management. With the creation and establishment of the RWMG as a consolidation of stakeholders, the Region now has a vehicle to improve communication, collaboration, and cooperation; to develop a consensus on the regional problems and solutions; and to resolve or proactively avoid conflicts. A general consensus has been achieved concerning the purpose of the Madera IRWMP, which includes:

- Documentation of how the RWMG worked through a collaborative process to identify issues, goals, and objectives for water resources management in the Region;
- Improve water management, reduce conflicts, protect water quality, and ensure sustainable water resources management through regional cooperation;
- Identify water related vulnerabilities and deficiencies
- Identify and define different water management scenarios for the Region, evaluate alternatives to reduce groundwater overdraft in the Valley area, determine the most economical projects and programs to manage, and develop the surface and groundwater supplies in a sustainable manner;
- Prioritize immediate, near-term, mid-term, and long-term investments
- Define program priorities, institutional approaches and engineering solutions to implement the IRWMP; and
- Provide a roadmap to work together within the Region and surrounding regions to further develop and manage the available water supplies.

The need for and value of the IRWMP update is clear. Continued groundwater overdraft, particularly at the rates identified in the Regional Groundwater Management Plan, is not sustainable. Rapid expansion of the agricultural industry coupled with planned urban growth in the region mandate improved water resources management in the Madera Region.

1.4 - IRWMP Development

The Madera Region's initial IRWMP, adopted in 2008, was the outcome of a collaborative planning process that included compilation of data from a wide range of technical studies, public meetings, workshops to facilitate stakeholder involvements and numerous meetings among various work groups and participants. The local funding for these efforts was supplemented by a Proposition 50 Planning Grant from DWR.

The Region has been working since 2011 to get the IRWMP updated, for several reasons:

- To comply with new IRWMP standards set forth in Proposition 84
- To complete and include information on the newly-adopted governance structure
- To document changes in policies and procedures
- To add information regarding the large number of Disadvantaged Communities, new members and interested parties which have joined the RWMG since the original report was published
- To incorporate revised goals, objectives and resource management strategies which have come into focus since 2008
- To update the list of potential beneficial projects for which to pursue funding.

The RWMG, acting as a Committee of the Whole, took on the IRWMP update with assistance from Provost & Pritchard Consulting Group, who served as lead author. Each chapter was individually reviewed and discussed through an open and transparent process. The IRWMP follows the required standards documented in '*Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines*' (DWR, 2010). Funding for the IRWMP update was provided by a Proposition 84 IRWMP Planning Grant and in-kind support from the representatives of each of the Member Agencies.

1.5 - Planning Horizon

The IRWMP planning horizon extends 20 years or more into the future - through 2034 and in some cases beyond. This is consistent with the standard 20-year planning horizon for IRWMPs. Long-term projections for groundwater overdraft and climate change go beyond that horizon.

1.6 - Organization of the Report

This report is organized according to the sixteen IRWM Plan Standards listed by the Department of Water Resources in its 2012 Guidelines. A few standards have been combined, but most are addressed in their own chapter. The IRWMP also includes an additional chapter dedicated to Disadvantaged Communities due to their socio-demographic importance to the region's predominantly agricultural way of life and unique economic needs. A brief summary of this report's organization and descriptions of each chapter follows in **Table 1.1**.

Table 1.1: Organization of the Report and Summary of Chapters

Chapter	Subject	Description
ES	Executive Summary	A brief summation of the entirety of this IRWMP Report.
1	Introduction	Provides background information on the Madera Region, explains the RWMG's mission for the Madera IRWMP, the purpose and need for the Plan, and the organizational structure of the RWMG.
2	Governance	Describes the history of the IRWM process in the County, the formation of the RWMG, the existing governance structure and decision making protocols, and the role of governance in implementing the IRWMP.
3	Region Description	Describes members and interested parties, local hydrology, geology, and physiography of the Region, the basis for the IRWMP boundary, and the local water infrastructure.
4	Disadvantaged Communities	Describes the geography, demographics, economic conditions, and water resources problems in DACs in the Region.
5	Goals and Objectives	Documents regional goals and objectives that were established to resolve identified issues. Includes results of a public survey to rank each objective in terms of greater and lesser importance as perceived by the Member Agencies.
6	Resource Management Strategies	Presents over 30 Resource Management Strategies (RMS) that the RWMG considers relevant in the Region, and describes their applicability and potential use.
7	Project Review Process	Describes the processes the RWMG will use to solicit and review projects for possible funding and for inclusion in specific grant applications.
8	Impacts and Benefits of Plan Implementation	Discusses the general benefits of regional water management, impacts and benefits of the adopted Resource Management Strategies, the potential impacts and benefits of these strategies to neighboring IRWM planning areas, DACs, and interested parties, and methodologies for evaluating impacts and benefits for specific projects.

Chapter	Subject	Description
9	Plan Performance and Monitoring	Identifies and describes several regional monitoring plans, describes the RWMG's plan to monitor progress in meeting IRWMP goals and implementing projects, presents reporting procedures and responsibilities and guidelines for project-specific monitoring, and discusses the content of periodic reports regarding RWMG projects.
10	Data Management	Describes the RWMG's existing data management operations and future plans for data collection, storage, and dissemination.
11	Financing	Provides a general overview of existing and potential funding sources for RWMG operations, IRWMP updates, regional studies, grant application preparation, project implementation, operation and maintenance.
12	Technical Analysis	Provides a compilation of the previously-published technical analyses relied upon in the IRWMP.
13	Relation to Local Water and Land-use Planning	Describes local water plans prepared by cities, the County, water agencies, and other special districts, and their relationship to the IRWMP, describes local land-use plans prepared by the cities and the County, their policies related to water management, the compatibility of the water management policies with the IRWMP, and possible future collaborations between land-use planners and water managers.
14	Stakeholder Involvement	Discusses public outreach efforts during the IRWMP update, and a plan for future public outreach.
15	Coordination and Integration	Discusses the RWMG's efforts to coordinate projects and activities with local agencies, stakeholders, neighboring IRWM groups, state agencies, and federal agencies.
16	Climate Change	Includes predicted impacts within the Region from climate change, a vulnerability assessment for the Region, proposed adaptation measures, plan for monitoring climate change, and a process for evaluating greenhouse gas emissions in project selection.
17	References	Lists the documents cited in the Madera IRWMP.

CHAPTER 2- GOVERNANCE

2.1 - Introduction

This chapter discusses the governance structure for the Madera Regional Water Management Group (RWMG). The RWMG is the governing body responsible for implementing the Madera Integrated Regional Water Management Plan (IRWMP). The Madera RWMG has developed a strong governance structure that provides equal opportunity for participation, enhances communications, and provides decision making protocols for the RWMG.

Below several terms are used including Members, Stakeholders and Interested Parties. Members are organizations that have signed the RWMG Memorandum of Understanding and are formally involved with the RWMG. Some Members pay annual dues, but disadvantaged community Members are exempt from the dues. Interested Parties refers to individuals and organizations that are not Members, but still have interest and may participate in the RWMG. Stakeholders is a collective term that includes both Members and Interested Parties.

2.2 - Description of Regional Water Management Group

The Madera Integrated Regional Water Management Planning effort was initiated through the ad hoc actions of Madera Irrigation District, Chowchilla Water District, Root Creek Water District, Gravelly Ford Water District and the County of Madera. Current signatory members are listed in Section 2.3 -below.

The early objective of the organizational phase was to establish a group that could make necessary decisions such as identifying and approving IRWMP boundaries, developing and approving a governance structure for the RWMG, identifying funding mechanisms, seeking and acquiring funding, and developing a public participation process. This ad hoc group worked to adopt a governance structure, through a consensus-based process documented in the Memorandum of Understanding (MOU) for Integrated Regional Water Management in the Madera Region. The MOU, originally adopted January 2, 2010, is included in **Appendix A.** Appendix A also includes the RWMG's current Bylaws and Ground Rules.

The Madera IRWMP effort has been carried out to this point with very limited fiscal resources supplied from local and regional sources, supplemented by a strong core of in-kind professional support from government and non-governmental organizations (NGOs), and technical support from state and federal agencies.

Definition of Regional Water Management Group

According to DWR, a regional water management group must include at least three members with two that have statutory authority for water management. The Madera RWMG has seventeen members, eight of whom have statutory authority for water management, and therefore meets the definition of a regional water management group.

IRWMP Boundaries

The RWMG covers a large geographic area (refer to **Figure 3-1**in the Region Description Chapter) including portions of the watersheds of the San Joaquin, Fresno and Chowchilla Rivers, in addition to several smaller stream watersheds. The IRWMP boundary contains lands representing several Native American Tribes, and jurisdictional areas for several Federal land agencies (National Forests, National Parks and National Monuments), State Parks and local agencies (Madera, Chowchilla, and many smaller communities). A list of the members and interested parties of the RWMG is provided below.

2.3 - Members

Stakeholders can become formal members of the RWMG by signing the MOU and adopting the IRWMP. The following organizations have signed the MOU as of September 2014:

Table 2.1: Memorandum of Understanding Signatories

MOU Members	Statutory Authority
Chowchilla Red Top Resource Conservation District	
Chowchilla Water District	X
City of Chowchilla	X
City of Madera	X
Coarsegold Resource Conservation District	
Fairmead Community and Friends	X
Gravelly Ford Water District	X
Madera County	X
Madera County Special Districts[1]	X
Madera Irrigation District	
Madera Valley Water Company	X
Madera Water District	
North Fork – Mono Rancheria	X
Root Creek Water District	
SEMCU - Southeast Madera County United - Madera Ranchos	
Self Help Enterprises	
Yosemite/Sequoia Resource Conservation and Development Council	

Note 1- Madera County special districts include: CSA 01: Indian Lakes, CSA 03: Parkdale, CSA 14, CSA 16, CSA 21, MD 1: Hidden Lakes, MD 5: Mountain Ranches, MD 6: Lakeshore, MD 7: Marina View, MD 8: North Fork,

MD 10A: Madera Ranchos, MD 19: Parkwood, MD 22A: Oakhurst Sewer, MD 24: Teaford, MD 28, MD 33: Fairmead, MD 36: Eastin Arcola, MD 37: La Vina, MD 40: Sunset Ridge, MD 42: Meadow View Drive, MD 43: Miami Creek Knolls, MD 46: Ahwahnee Country Club, MD 58: Sierra Highlands, MD 60: Dillon Estates, MD 63: Coarsegold South, Zone A, MD 73: Quartz Mountain, MD 85: Valeta, MD 95: Ranchos West.

Breadth of Membership

The current RWMG consists of seventeen organizations that represent a broad range of interests including: water supply, water quality, environment/habitat, recreation, agriculture, ranching, resource management, hydropower, sanitation, disadvantaged communities, non-profit organizations, and local, state and federal agencies. The Interested Parties, who participate but are not formal members, include a similar range of interests.

Statutory Authority for Water Management

Nine members of the RWMG are recognized by the State of California as having statutory authority for water management. These members include: Chowchilla Water District, City of Chowchilla, City of Madera, Gravelly Ford Water District, Madera County, Madera County Special Districts, Madera Irrigation District, Madera Water District, and Root Creek Water District.

2.4 - Governance Structure

The Governance structure is documented in an MOU, Bylaws and Ground Rules (**Appendix A**). The structure adopted is very simple, with the MOU signatories of the RWMG operating as a "committee of the whole" on most matters. The MOU allows creation of subcommittees "for addressing issues affecting particular areas of the Madera Region or for certain issues within the general jurisdiction of the RWMG" but does not create any standing committees.

The MOU creates categories of membership including MOU signatories (full members with all voting rights), Disadvantaged Community (DAC) Group Members (voting allowed by one selected representative on behalf of all DACs), and Affiliate Members (non voting).

The MOU also allows for Special Projects under certain conditions, which is defined as ". . . an activity undertaken by fewer than all the Parties in the RWMG. The activity must be consistent with the scope of the RWMG's efforts."

Memorandum of Understanding

The MOU is a statement of mutual understanding among the signatories on how the RWMG governs. Major topics addressed in the MOU include RWMG membership, geographic boundaries, committees, responsibilities, public outreach, and decision making. These topics are discussed throughout this chapter. Since originally adopted in 2010, the MOU has been signed by seventeen organizations.

Regional Water Management Group

The Regional Water Management Group (RWMG) is the primary governing and decision making body of the group. Any qualifying entity which signs the MOU and pays the necessary dues will become a full Member of the RWMG.

Madera Region The RWMG generally meets every month, depending on their workload. Each member organization must identify their lead representative for the RWMG, who must make their best effort to attend RWMG meetings. Member organizations may also identify additional representatives, but only the lead representative is eligible to vote on behalf of the member organization. Stakeholders are also expected to regularly attend meetings, and can have their membership revoked if they miss more than three consecutive meetings.

Any stakeholder organization with an interest or role in water management in the Region may join the RWMG. Stakeholders could include, but are not limited to, such organizations as water agencies, conservation groups, agriculture representatives, businesses, tribal groups, land use entities, local, state, and federal agencies and private entities. A group which wants to join the Madera RWMG should notify the RWMG and sign the MOU to signify their good faith effort to join, adopt the IRWMP, submit a resolution of its governing board stating an intention to join, in some cases pay dues, and be approved by the existing RWMG members. An organization must have a governing body to become a formal member. Any entity which would like to discontinue their participation may do so at any time. The MOU is non-binding and non-regulatory.

The benefits of signing the MOU and becoming a dues-paying Member of the RWMG include:

1. Right to vote on decisions, including setting regional goals and which projects are included in grant applications
2. Greater influence on consensus based decisions
3. Proof of a good faith effort to improve local water management
4. Larger public benefit to the region by having more entities involved

Subcommittees

As provided for in the MOU, the RWMG may choose to create subcommittees to advance specific tasks addressing issues affecting particular areas of the Madera Region or for certain issues within the general jurisdiction of the RWMG. These tasks would be undertaken outside of regular RWMG meetings. The RWMG will specify a clear purpose for any subcommittees including expected work products and completion dates. All subcommittees will provide a status update on their activities at the regular RWMG meetings. All work products will be submitted in draft to the RWMG for revisions and/or adoption. While the subcommittees may make day-to-day decisions to advance their assigned efforts, the subcommittees are entirely advisory to the RWMG and thus have no final decision-making authority. Subcommittees will

consist of volunteers from the RWMG and Interested Parties.

Stakeholder Interface
Stakeholders can interface with the RWMG and any active subcommittees at regular RWMG meetings. Work products will also be posted on the RWMG website for public review.

2.5 - Public Outreach Process

Public outreach is one of the great strengths of this RWMG. Since its initial session in 2009, the RWMG has maintained a regular monthly meeting schedule, rotating the meeting location among three locations around the Region (Madera, Oakhurst and Chowchilla) in order to equalize the various members' travel times. Members have encouraged public involvement, and all the meetings have been open to the public. All attendees are allowed to participate in discussions.

The RWMG makes consistent efforts to include more interest groups and the public in this process. Additionally, meeting agendas and minutes are circulated (via email and by paper copies to those without email access) to a broad and inclusive group of interests including members and interested parties. Meeting notices, agendas and minutes will also be posted at the RWMG web page, beginning in late 2014: http://www.madera-id.org/index.php/rwmg, and at the MID office two weeks in advance of each meeting.

While stakeholder participation can always be increased, the RWMG is confident they have made contact with the vast majority of the relevant stakeholders in this region The RWMG used lists of interested parties from past water resource projects, as well as recommendations from other agencies, the public and NGOs, to solicit interest. Every attempt was made to facilitate stakeholder participation. These stakeholders have been informed about the process and given an opportunity to participate. No entity has been shut out of the process and at this time the RWMG is unaware of any entities that are purposefully boycotting the process or have serious concerns about the actions and decisions made by the RWMG to date.

The RWMG also maintains a list of other important stakeholders that have been contacted but are not currently involved. The Interested Parties and other stakeholders listed in CHAPTER 14 have been contacted regularly by email and other forms of outreach to inform them of meetings and workshops. The public outreach process is described in more detail in CHAPTER 14– Stakeholder Involvement.

2.6 - Decision Making

The members of the RWMG serve as the decision-making body. The ad hoc subcommittees, which can be created by the overall group can give input and recommendations to the RWMG, but are not allowed decision-making authority. The RWMG strives for consensus among participants in all of its decision-making. In reaching consensus, some RWMG members may

strongly endorse a proposal, others may accept it as 'workable', and others may not support it yet allow it to proceed if it does not compromise their own interests. Any of these positions is still considered to be consensus.

The MOU also includes a non-traditional voting process to assess preliminary support for issues prior to formal voting. From the MOU:

6.2.2. Non-Binding Poll of All Meeting Participants: The RWMG will use polling to assess the degree of preliminary support for an idea before it is submitted as a formal proposal for a vote. The poll results will potentially indicate the need for subsequent work to revise the text of a recommendation and to prepare it for a vote. The RWMG will use the following three levels to indicate a degree of approval & support for a proposal or being considered.

6.2.2.1. Thumbs Down / I do not agree with the proposal. I feel the need to block its adaptation and propose an alternative.

6.2.2.2. Thumbs Sideways / I can accept the proposal although I do not necessarily support it.

6.2.2.3. Thumbs Up / I think this proposal is the best choice of the options available to us.

6.2.2.3.1. The RWMG will strive to have participants in the 'Thumbs Up' or 'Thumbs Sideways' indicators of support on a given proposal. If a participant is at a 'Thumbs Down' level, that person should provide a counter proposal that legitimately attempts to achieve his/her interests and the interests of all the RWMG members. The RWMG will evaluate how best to proceed when a counterproposal is presented.

6.2.2.3.2. 'Thumbs Down' viewpoints will be documented in the meeting minutes. If a participant would also like to document their alternate view, the said participant may submit a write up to the RWMG Administrative Assistant within one week of the meeting in which the discussion took place. The write up will be attached to the meeting minutes. The write up should be expressed in the following manner: a) Outlines the key concern from an organizational or interest-based stance. b) Provides a recommendation for improving the decision/product in question.

Only MOU signatories and the single DAC Member representative can participate in the voting process. Refer to the MOU for more details on the definition of regular Members, Affiliate Members and DAC Members.

Information for decision making can be gathered by subcommittee and then presented to the RWMG. Issues for decision can be brought to the RWMG by any member or by the RWMG staff. They must be included on a meeting agenda in order to be considered as an 'action item'. Non-dues paying members such as "stakeholder" and "affiliate" level members (except the selected DAC representative) are not entitled to vote on decisions, but are free to voice opinions, recommendations and concerns.

2.7 - Opportunity for Participation

The governance structure provides equal opportunities for participation and helps ensure a balanced group of members through the following policies and procedures.

Regional Water Management Group. Regular membership in the RWMG is open to any agency, organization, or company which signs the MOU, adopts the IRWMP, submits a resolution from its governing board with an intention to join, pays the dues (if applicable), and is approved by existing RWMG members. The right to become a member is based primarily on having a local presence in the IRWMP area and an interest in water resources management. The type and size of an organization are not factors. Each regular member of the RWMG is given one vote. Voting power is not weighted based on size, area or financial status.

Organizations not willing or able to pay the per-member dues are invited to join the RWMG as Affiliate Members. An Affiliate Member may fully participate in all RWMG meetings and projects, but may not vote in either the informal polls described above or in the formal policy decisions. There are no dues associated with becoming an Affiliate Member.

Qualified Disadvantaged Communities (DACs) may join the RWMG as DAC members. As with the Affiliate Members, there is no limitation on participation by DAC members. Voting by DAC members is limited to a single vote on behalf of all the DAC members, by a representative selected from among the several DAC members as the official DAC Representative.

General Public. The general public is welcome to attend RWMG meetings or contact the Administrative Assistant directly with contact information via the IRWMP website (http://www.madera-id.org/index.php/rwmg). Private individuals may not become formal members of the RWMG, but may be added to the list of Interested Parties. Interested parties are put on email and/or mail lists to receive information on RWMG activities. Input from any member of the general public is considered regardless of their associations or history.

Official Positions

Official positions within the RWMG include Chairperson, Chair Pro Tem, Lead Agency, Administrative Assistant, and Fiscal Agent/Agency Sponsor/Grantee. The positions have no governance authority and therefore are not shown in the organization chart. Their roles are related to managing RWMG meetings, stakeholder outreach and grant contracts.

Chairperson. The Chairperson is elected by the RWMG in March of each year. The person holding the chair position must have participated as a representative for a RWMG member for one year. The chairperson does not have to be a representative of the Lead Agency. The Chairperson is the presiding officer of the RWMG and as such, has the following duties:

- In coordination with the RWMG Administrative Assistant set meeting agendas.
- Convene the meeting and call the RWMG to order at the time at which the RWMG is to meet, when a quorum is present, or when there is no prospect of there being a quorum.
- Announce the business before the RWMG in the order in which it is to be acted upon.
- Conduct public hearings as provided.
- State and put to vote all motions which are regularly made, or necessarily arise in the course of the meeting, and announce the result of the vote.
- Expedite business in every way compatible with the lawful conducting of business.
- Enforce on all occasions the observance of order and decorum among members and the public.
- Decide all questions of order and procedure, subject, however, to an appeal to the RWMG as a whole. In the event of an appeal, the decision of the majority of the members present at the meeting shall decide questions of order and procedure.
- Gather the information/topics from the group and create the agenda for each meeting.
- If the Administrative Assistant is unable to attend a meeting, the chair will appoint a temporary note taker for that meeting.

Chair Pro Tem. The Chair Pro Tem is elected in the same manner and at the same time as the Chairperson, and has all the rights, powers and responsibilities of the Chairperson, in the absence of the Chairperson.

Lead Agency. The MOU states that the RWMG must mutually agree upon a designated signatory Local Agency to facilitate IRWMP implementation and coordinate RWMG activities in furtherance of the MOU. The Lead Agency serves at the pleasure of the RWMG. Unless otherwise designated as the Grant Administrator responsible for funding or the Project proponent for an individual Project pursuant to the MOU, the Lead Agency is not responsible for any Project, including completion, funding, or environmental review thereof.

Administrative Assistant. The Administrative Assistant provides notice of all meetings as required by law; prepares, keeps and maintain the files, minutes, findings, resolutions, orders, and all other documents and papers relative to those items of business which are or have been

before the RWMG; and attends each meeting and records each item of business. This person may be a designee from one of the MOU signatory entities.

Fiscal Agent/Agency Sponsor/Grantee. The Fiscal Agent/Sponsor is designated as the Project Manager and Grant Administrator for any Planning grants as well as Grant Administrator for any Implementation Grants received. They are charged with completing the reporting, invoicing, and contracting with funding agencies and consultants or employees to manage projects and provide administrative support.

2.8 - Effective Communication

Internal Communication

Two-way communication is available in many forms, including opportunities to speak at meetings or directly contacting RWMG staff. The governance structure also helps to foster communication primarily through the subcommittees and an open door policy to the general public. The subcommittees allow stakeholders to provide detailed input on RWMG projects and policies, which are directly relayed to the decision-making board, the RWMG. The RWMG has an open door policy and any agency, organization, company or individual is free to attend RWMG meetings or directly contact the Chairman.

External Communication

External communication is with other IRWMPs, the media and the general public. The Chairperson or other designated representatives may make public statements on behalf of the Madera RWMG as an entity.

2.9 - Long-Term Implementation of IRWMP

The Madera RWMG is relatively new and has only been formally organized since 2010. The group was established for many reasons including to share information, share ideas, seek grant funds, collaborate on projects, educate the public, and promote better water management. A major motivation for forming the group was to secure IRWM Grants. It is recognized that these funds may be available for only a limited time, or there may be a long hiatus in their availability. In addition, grant applications submitted for these funds may not be successful. The group is committed to staying active even in the absence of state funding. The group survived several years with no funding and above all has shown the importance of patience, perseverance, and the power of maintaining strong relationships among water interests in the region. The group is also active in seeking other funding sources besides DWR grants (see Chapter 11 – Finance).

The planning and implementation horizon for the RWMG is approximately twenty years into the future, into 2034. However, many discussions and actions will be guided by horizons of up to fifty years into the future.

2.10 - Coordination with Neighboring IRWMPs

The RWMG takes several active steps to coordinate with neighboring IRWMPs including participation in IRWMP 'Round Table of Regions' meetings. The Roundtable of Regions is an ad hoc group of representatives from IRWMP regions around the State. The group provides a forum for IRWMP practitioners (people working on IRWM planning and implementation) to discuss their interests, share information, and provide recommendations to the Department of Water Resources on the IRWM grant program. This group holds regular conference calls and occasional face-to-face summits.

The RWMG has also worked successfully with the neighboring IRWMPs to mutually develop reasonable and logical IRWMP boundaries. Chapter 15 – Coordination and Integration includes more information on work with neighboring IRWMPs.

2.11 - Coordination with State and Federal Agencies

Internal rules at many State and Federal agencies prevent them from signing the MOU and paying dues, but they can participate as Interested Parties.

State Agencies

The RWMG has also worked closely with the Department of Water Resources (DWR) since the group began informal meetings in 2007. DWR has played an important role in helping the group form, identify funding opportunities, and collect data. The RWMG considers DWR a strong ally and hopes to continue their partnership with DWR as the RWMG matures.

Federal Agencies

One federal agency, the Sierra National Forest, has signed the Madera RWMG MOU. The Forest Service is an important participant since they cover a large portion of the IRWMP area. They have also been active participants at RWMG meetings. The RWMG would like to increase coordination with the Natural Resources Conservation Service.

2.12 - Collaborative Process to Establish Objectives

The IRWMP goals and objectives were established through a collaborative process including numerous public meetings and workshops, and recommendations from the Regional Water Management Group, Interested Parties, consultants, general public and DWR. The process followed is documented below.

1. Input was solicited on goals, objectives and priorities at several public meetings between 2013 and early 2014.
2. The goals were summarized in a Draft IRWMP chapter prepared by consultants.
3. The RWMG approved the draft list of goals and objectives.

4. The objectives were ranked by the RWMG members and interested party using an on-line survey. The results are presented in Chapter 5 – Goals and Objectives.
5. The Draft IRWMP was released for public input.
6. The final goals and objectives were adopted when the RWMG adopted the Final IRWMP.

2.13 - IRWMP Updates

The RWMG has established a goal of updating the IRWMP as needed to update information and regional goals, or to satisfy new IRWMP standards established by DWR. (This update is driven by the need to conform to the current requirements as set forth in DWR's 2012 Proposition 84/1E Guidelines, versus the structure given in the Proposition 50 Guidelines.) To document on-going progress, the RWMG plans to periodically prepare a report which will include an updated project list, progress on current projects, changes to policies and procedures, and other relevant information that should be included in an IRWMP. These annual reports will be considered attachments to the current IRWMP and the information will be formally incorporated when the IRWMP is updated. This will help to formally archive important information each year and reduce the concentrated effort needed to accomplish the IRWMP updates.

2.14 - Public Noticing and Plan Adoption

The IRWMP was updated and adopted through a formal public noticing process according to California Government Code §6066. This included notices in local newspapers declaring 'Intent to update the IRWMP', and 'Intent to Adopt the Updated IRWMP'. This procedure is documented in more detail in **CHAPTER 14- STAKEHOLDER INVOLVEMENT**, and the public notices are included in **Appendix J – Public Notices**.

The IRWMP was formally adopted by the RWMG on ____ ___, 2014. **Appendix B – Resolution Adoption** includes a copy of the RWMG resolution adopting the IRWMP. Member agencies are required to adopt this IRWMP through separate action by their local governing bodies and provide the RWMG with proof of adoption.

CHAPTER 3- REGION DESCRIPTION

This chapter provides information about the Madera Region in terms of its geography, natural water supply, climate, land uses and other characteristics. Information provided herein is intentionally regional in nature and not specific to individual agencies, districts or other entities.

3.1 - Geographic Location

The Madera Integrated Regional Water Management Plan (IRWMP) includes all the lands within Madera County. Hereafter, this area will be called the Madera Region or Region. The Madera Region is located in the geographic center of California, in the San Joaquin Valley and extending into the Sierra Nevada mountains. The borders of the Region are generally defined by the crest of the Sierras to the east, the San Joaquin River on the south and west, and the Chowchilla River on the north. The Region includes the incorporated areas of the City of Madera and City of Chowchilla, and all County lands, water districts, irrigation districts, or similar municipal services districts that are not under the jurisdiction of any City, State or Federal agency.

Within the RWMG boundaries are the Participating Agencies, as shown on **Figure 3-1**. The County of Madera is a participating agency, and it oversees numerous Maintenance Districts and County Service Areas in both the Valley floor and foothill and mountain portions of the region. The western districts (primarily on the valley floor) are illustrated in **Figure 3-2** and the eastern districts (primarily in foothills and mountains) appear in **Figure 3-3**.

3.2 - Climate

The climate of the Valley portion of the Region is characterized by hot, dry summers and cool, mild winters. Temperatures in the summer often exceed 100 degrees Fahrenheit. Fog can be experienced for long periods in the winter, with low temperatures typically in the mid-30s and occasionally dropping into the 20s. Average annual precipitation is about 10 inches, with 80 percent of the rainfall occurring in the winter months. The frost-free growing season averages around 250 days per year.

Climate in the foothill and mountain portion of the Region varies substantially with elevation. While all areas are characterized by warm, dry summers, peak temperatures decline with increasing elevation to as low as the mid-80s near the crest of the Sierras. Winter conditions transition with elevation as well. Areas above 1,500 feet elevation are generally fog-free. Precipitation typically increases with elevation, as does snow accumulation. Areas above 7,000 feet elevation typically see accumulating snow throughout the winter, to a peak near April 1. Water contained in that snowpack makes up the spring and summer runoff which provides surface water supplies to the Region, and which replenishes a portion of the regional groundwater aquifers.

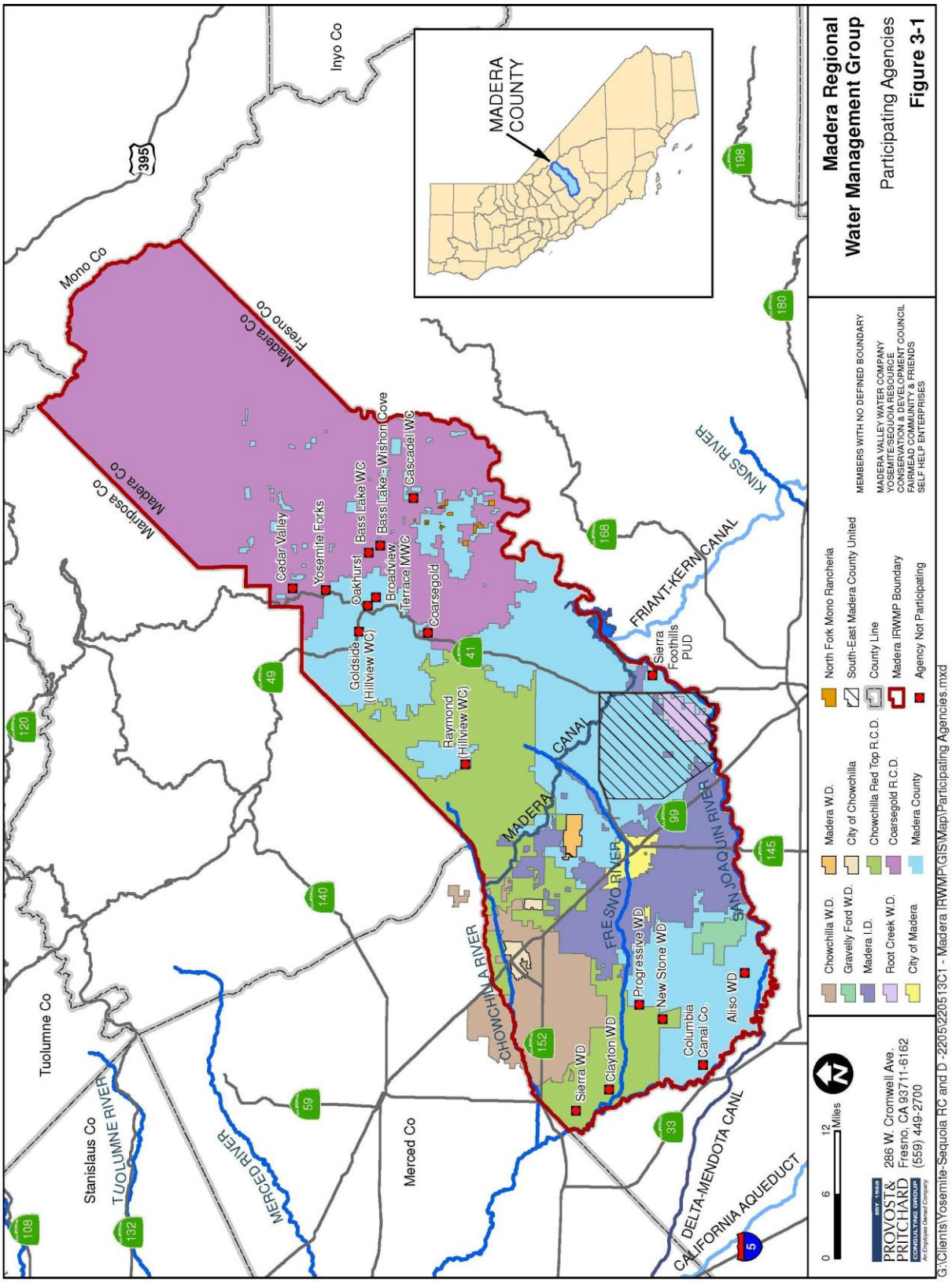


Figure 3-1 – Participating Agencies

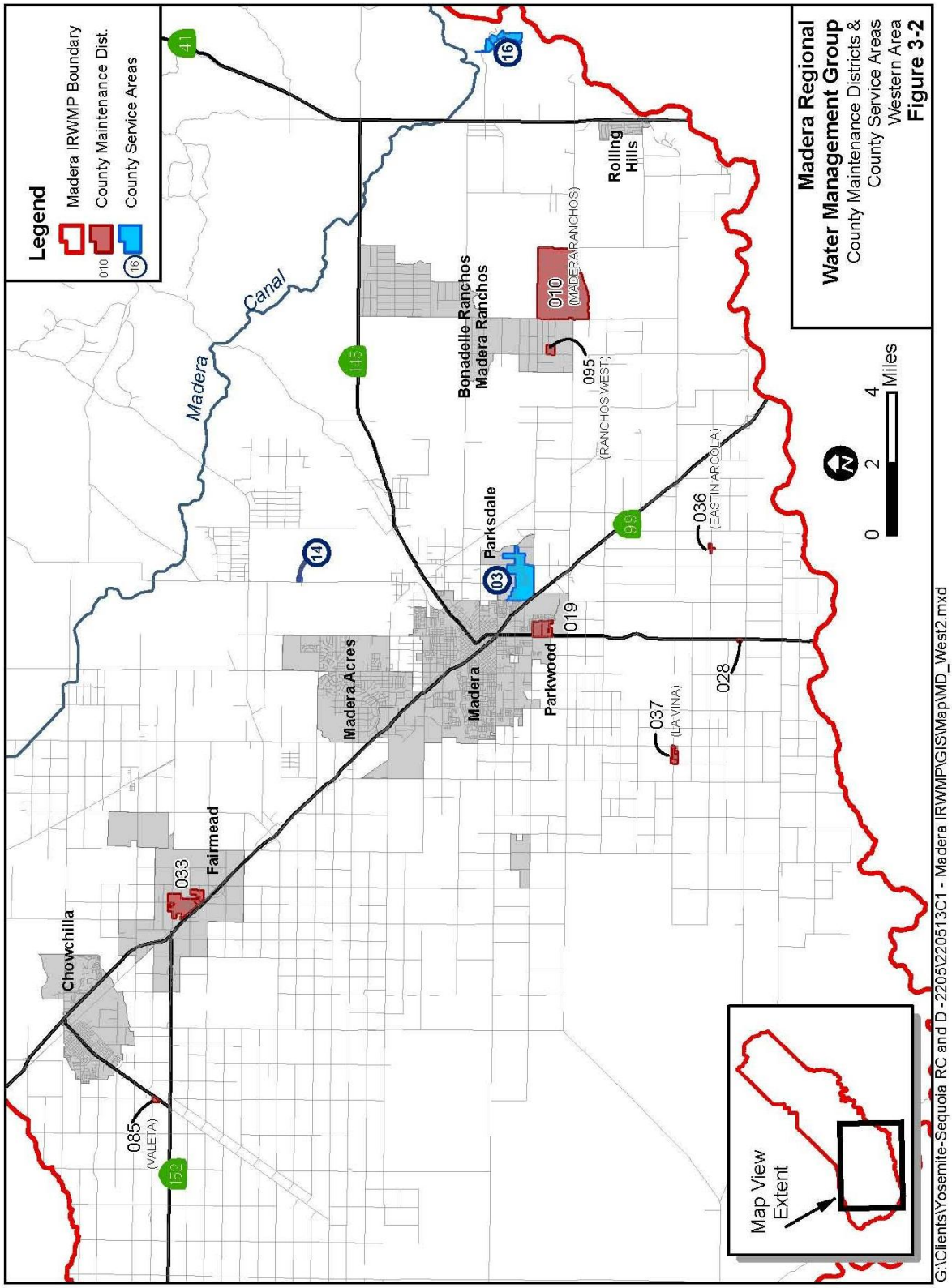


Figure 3-2 – County Maintenance Districts & County Service Areas - Western Area

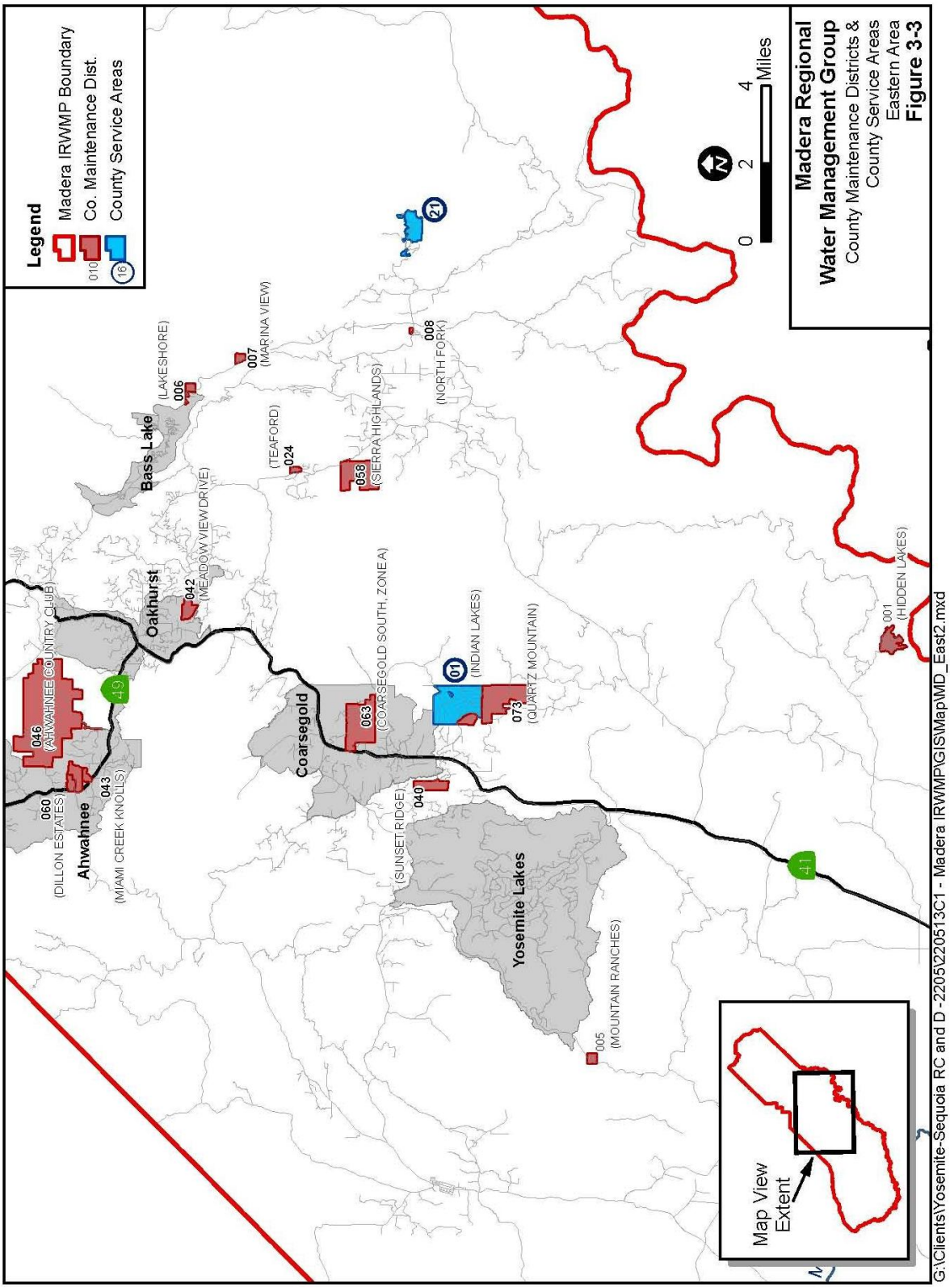


Figure 3-3 – County Maintenance Districts & County Service Areas - Eastern Area

Areas below 7,000 feet elevation do not typically accumulate snowpack through the winter, although they do experience snowfall occasionally to frequently depending upon elevation and the number and type of storms passing through during the winter months. Minimum snow elevations are usually around 3,000 feet, though colder storms can on rare occasions bring snow levels down to near the Valley floor.

Evapotranspiration (ET) rates for the Madera Region and the rest of California are provided by the California Irrigation Management Information System:
(http://www.cimis.water.ca.gov/App_Themes/images/etozonemap.jpg).
The valley portion of Madera County has moderately high ET rates compared to the rest of California, resulting in relatively-large water demands for crops and landscaping.

Water supplies can vary substantially year to year due to wide variations in precipitation in the Region and its upper watersheds. The California Department of Water Resources created an index that provides a comparison of normal, single dry and multiple dry years in the San Joaquin Valley. The data are presented as the Chronological Reconstructed Sacramento and San Joaquin Valley Water Year Hydrologic Classification Indices (Index)[1], and cover the period from 1901 to 2013. The index is based on a formula that considers the current year's and previous year's runoff and is intended to reflect the soil moisture and surface water supply conditions. DWR has defined certain base years as average, single dry and multiple dry. These are presented in **Table 3.1** with the estimated unimpaired runoff each year.

Table 3.1: Comparison of Unimpaired Runoff in Normal and Dry Years

Description	Base Year	Runoff (mAF)	Percentage of Average Year	Water Supply Index
Average Water Year	1921	5.90	100%	3.23
Single Dry Water Year	1977	1.05	18%	0.84
Multiple Dry Water Years	1929-1931	2.58[1]	44%	1.74[2]
Single Dry Year	2012	2.76	47%	2.18
Single Dry Year	2013	3.05	52%	1.76
Single Dry Year	2014	--	<40%[3]	<1.5[3]

Notes: [1] **Average annual runoff over 3-year period.**
[2] **Average annual index over 3-year period**
[3] **DWR estimates as of 5/1/14 that 2014 will be the driest year of the three recent dry years.**

As indicated by the Water Supply Index in Table 3-1, the water supplies can be substantially lower than average in dry years, and, in the case of 1929-1931, less than half of average for at least three consecutive years. As well, to illustrate the most current condition in the region,

[1] http://cdec.water.ca.gov/cgi-progs/iodir/wsihist

water supplies in 2012, 2013 and 2014 have collectively been about 56% of the long-term average. Absent greatly increased rainfall and snowpack, it is possible that due to a lack of storage in the watershed (i.e. lack of natural recharge, soil moisture and minimal snow pack), that 2015 may be another year with below-average water supply.

3.3 - Hydrologic Features

The major hydrologic features in the Region, including reservoirs, rivers, streams, flood bypass channels, and canals are shown schematically in **Figure 3-4**. Major rivers in the Region include the San Joaquin, Fresno and Chowchilla. **Figure 3-5** illustrates the watersheds and the sub-watersheds that come together to form each of the major rivers within the region.

No substantial flood control or irrigation facilities exist to serve the foothill or mountain areas. The Region is home to several reservoirs which provide both irrigation water and flood protection to the Valley area. Hidden Lake (Hensley Lake) is on the Fresno River. The Fresno River watershed is detailed on **Figure 3-6**.

Eastman Lake, operated by the US Army Corps of Engineers, is in the foothills on the Chowchilla River. The Chowchilla River watershed is detailed on **Figure 3-7**. Bass Lake, operated by Pacific Gas & Electric, is impounded by Crane Valley Dam, and is located in the foothills on Willow Creek, which flows into the San Joaquin River above Millerton Lake. Millerton Lake, behind Friant Dam, operated by the United States Bureau of Reclamation , is on the San Joaquin River in the foothills at the eastern edge of the Valley. Mammoth Pool and Dam 6 Lake are each located along the San Joaquin River above Millerton Lake and are operated by Southern California Edison. The San Joaquin River watershed above Friant Dam is shown on **Figure 3-8**.

The Eastside Bypass and the Chowchilla Bypass are the backbone of the flood control conveyance facilities in the Valley, providing additional flow capacity above and beyond that available in the San Joaquin River channel below Friant Dam. The San Joaquin River watershed below Friant Dam is shown on **Figure 3-9**. Madera Irrigation District and Chowchilla Water District have extensive irrigation canal systems supplied with water primarily from the San Joaquin, Chowchilla and Fresno Rivers.

A portion of the Merced River watershed lies within the Region, although it drains into the Merced IRWM planning area to the north, and the Merced River comes together with the San Joaquin River in Merced County, north of the Region boundary. The Merced River watershed is shown on **Figure 3-10**.

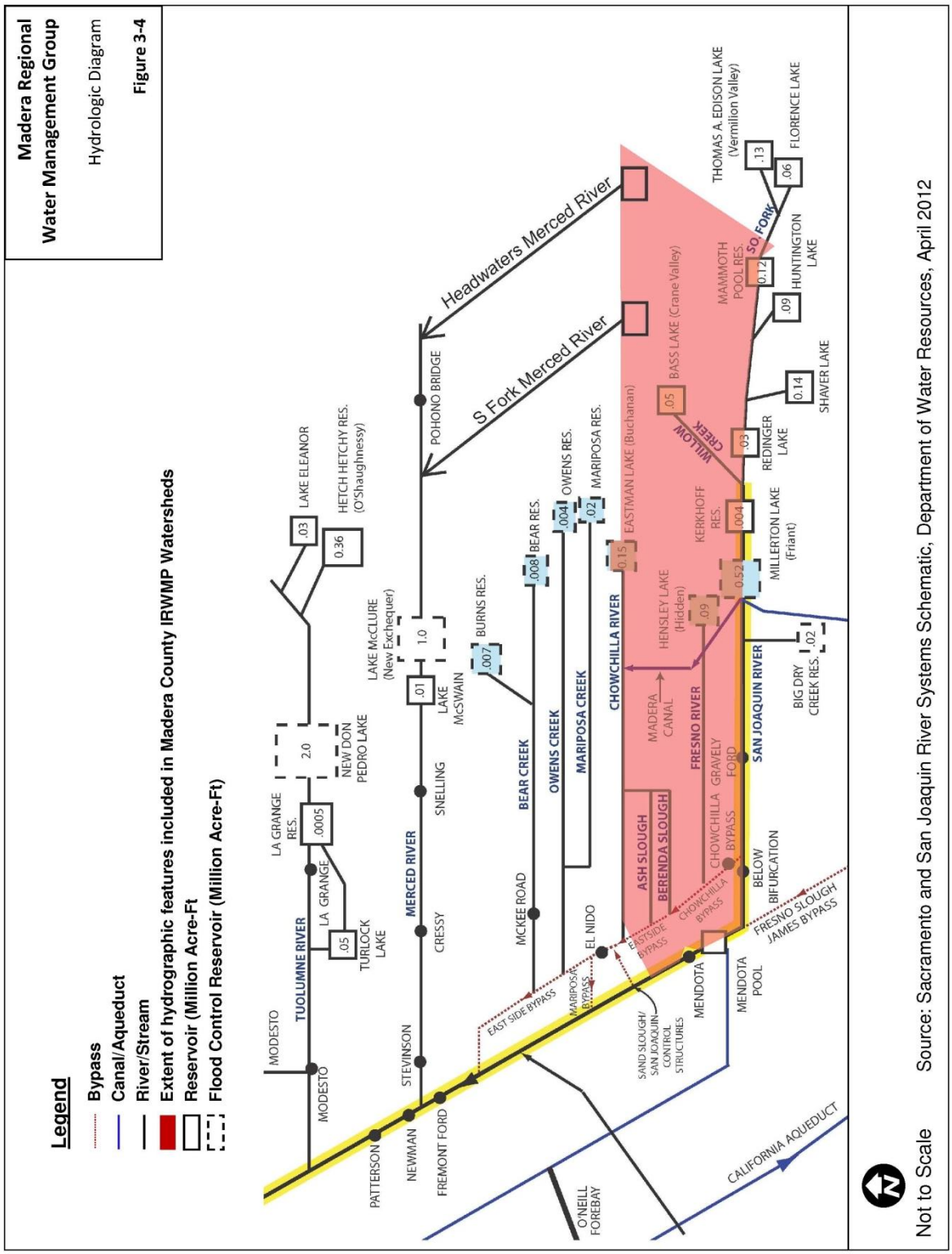


Figure 3-4 – Hydrologic Diagram

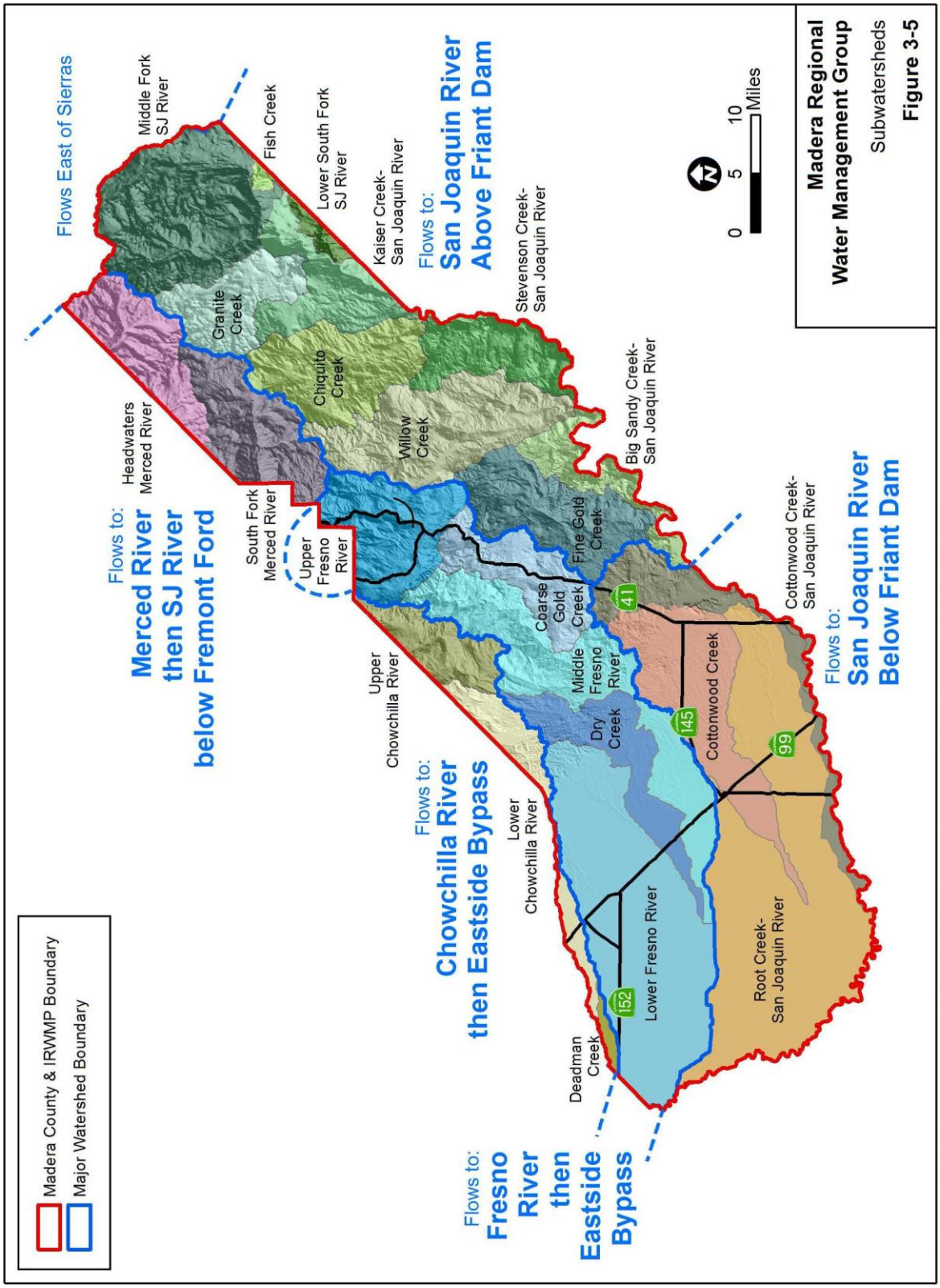


Figure 3-5 – Sub-watersheds

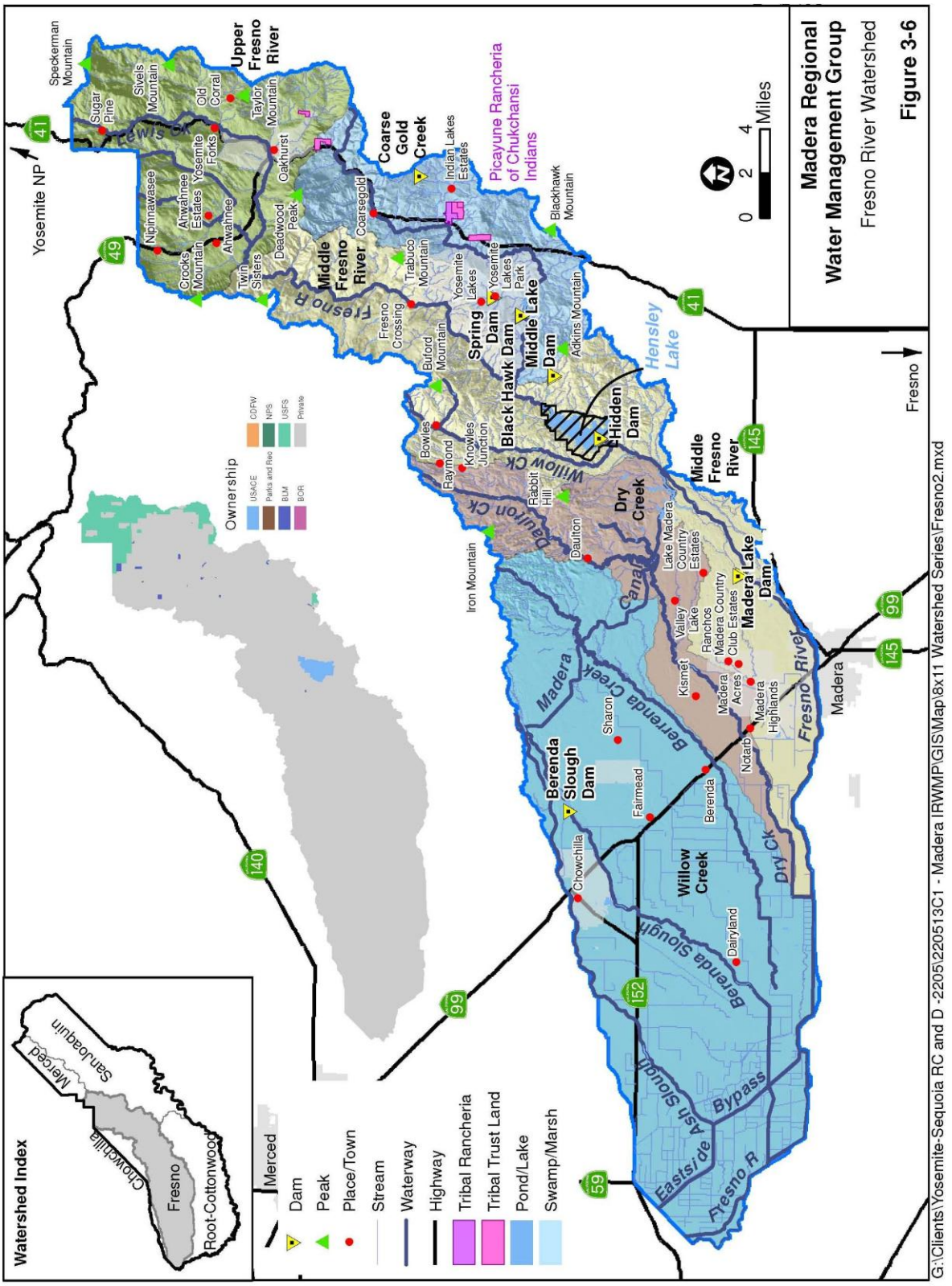


Figure 3-6 – Fresno River Watershed

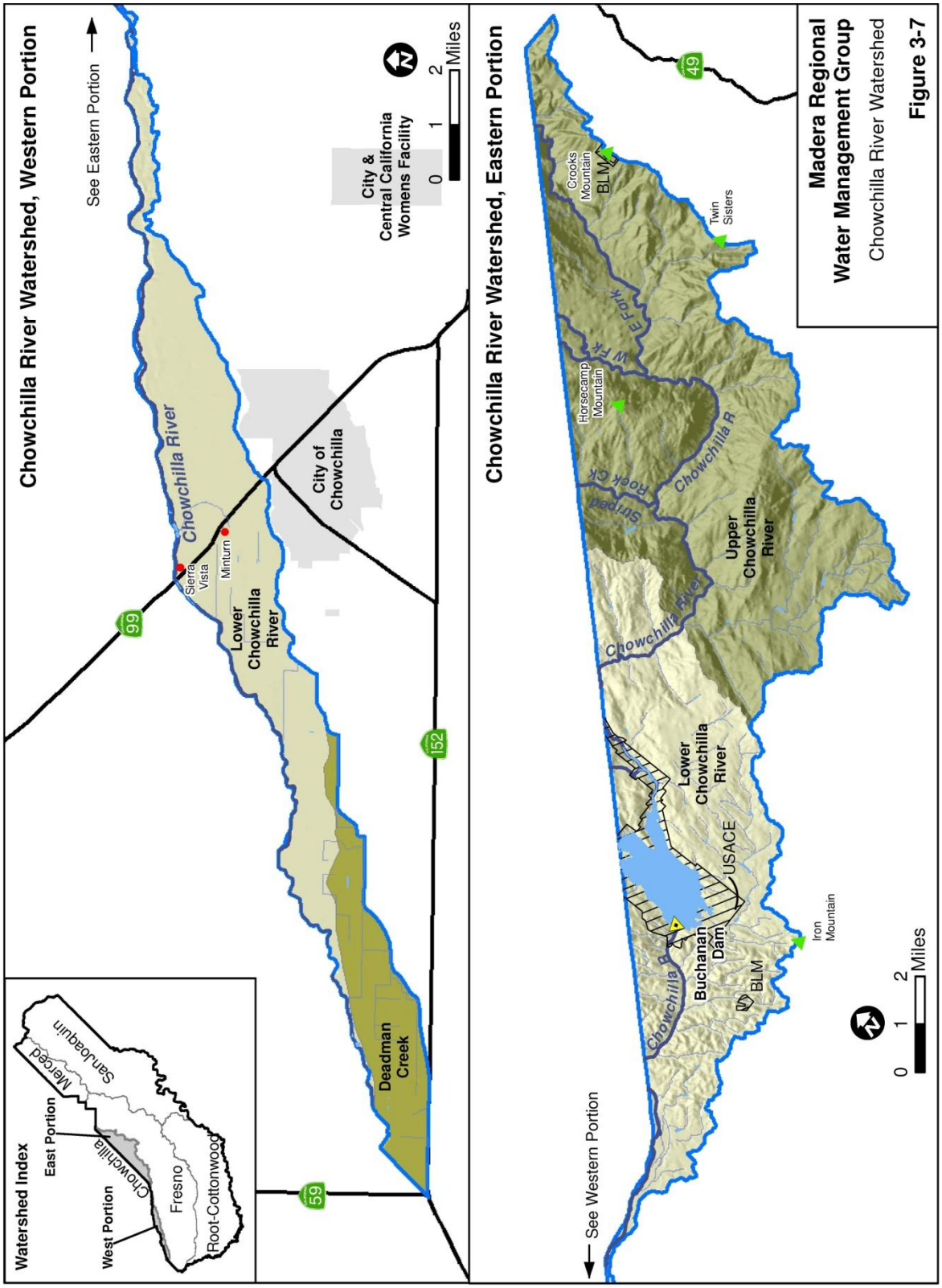


Figure 3-7 – Chowchilla River Watershed

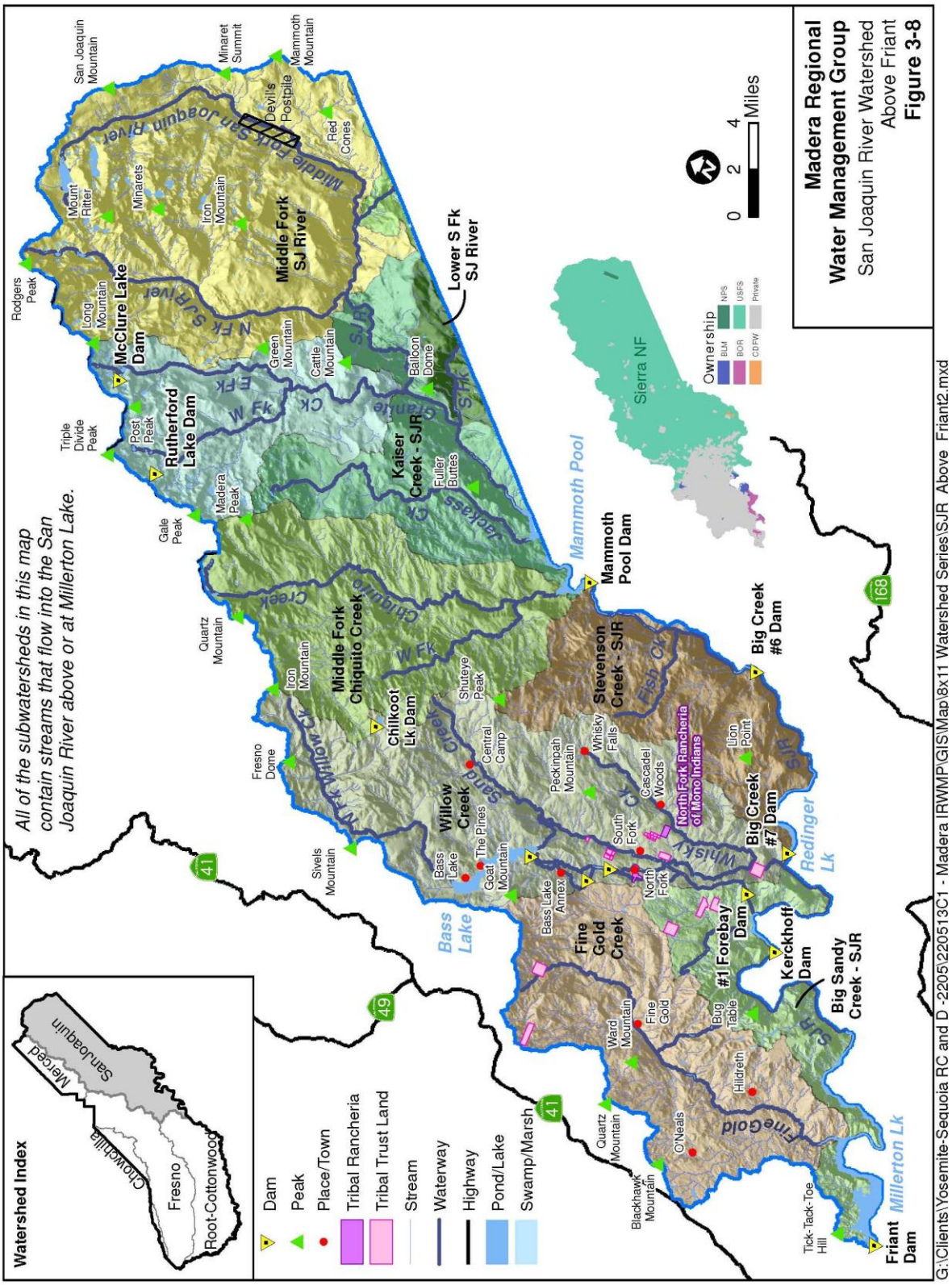


Figure 3-8 – San Joaquin River Watershed Above Friant

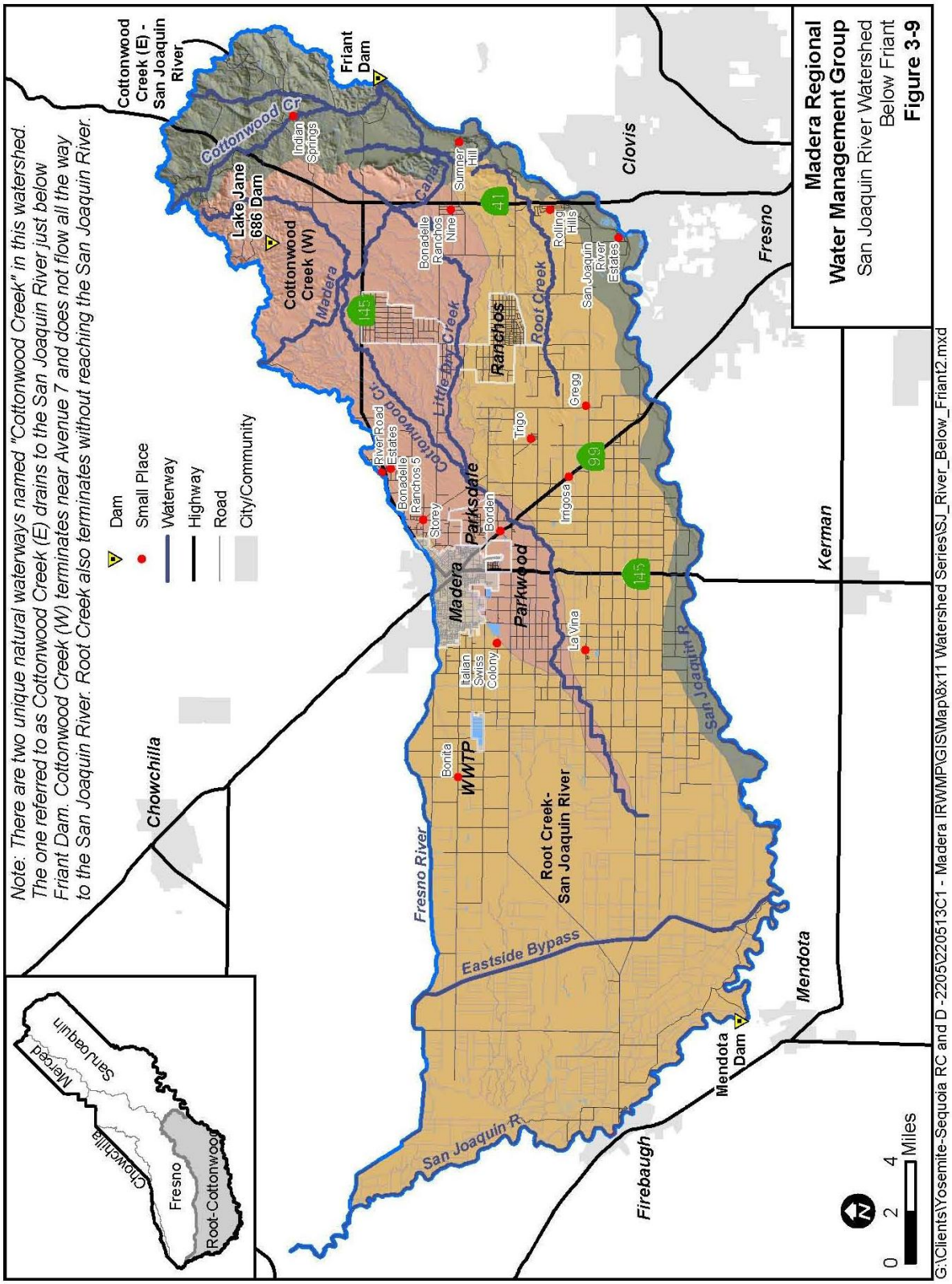


Figure 3-9 – San Joaquin River Watershed Below Friant

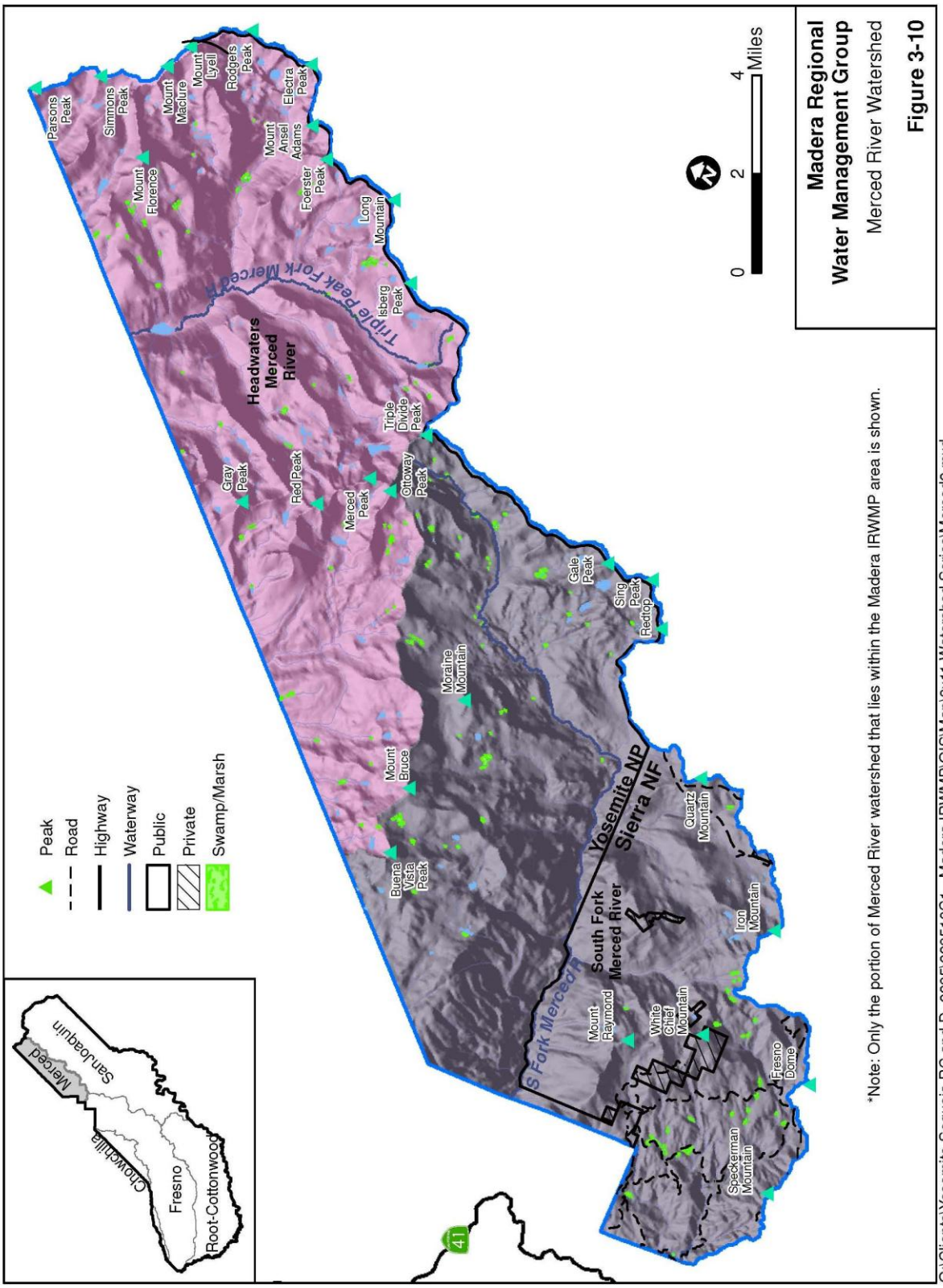


Figure 3-10 – Merced River Watershed

3.4 - Groundwater Supplies

All of the local water agencies use groundwater to meet at least a portion of their water demands. Groundwater serves an important reserve supply to supplement surface water deliveries. **Table 3.2** is a summary of groundwater usage for ***some*** of the primary groundwater users in the valley. The data does not include all of the agencies in the Valley, but only those that had readily-available data compiled for the 2014 Madera Regional Groundwater Management Plan. The data includes groundwater used directly by the agency and groundwater pumped from private wells within the agency boundaries. Table 3.2 does not include all of the groundwater demands in the Madera Region.

Table 3.2: Estimated Average Annual Groundwater Pumped (2004-2013)

Agency	Agency Groundwater Pumping (AF)	Private Groundwater Pumping (AF)	Total Pumping (AF)
Chowchilla Water District	0	118,600	118,600
City of Chowchilla	4,100	2,600	6,700
City of Madera	12,700	600	13,300
County of Madera	3,700	398,800	402,500
Gravelly Ford Water District	0	16,300	16,300
Madera Irrigation District	0	185,000	185,000
Total	20,500	721,900	742,400

Notes:
1. Values are total groundwater pumping. Net pumping is less due to deep percolation of irrigation and percolation of wastewaters.
2. These are historical values. Future pumping will likely increase due to surface water reductions for the San Joaquin River restoration.
3. Values are estimates provided in the Draft Madera Regional Groundwater Management Plan (P&P, 2014)

Average Annual Groundwater Level Decline

Over the past 30 years, groundwater levels in the Region have experienced significant declines due to overdraft. In general, average annual declines are greater on the eastern side of the valley portion of the Region, at up to five (5) feet or even more in the southeast and northeast. Increased agricultural demands, particularly the conversion of native grasslands to permanent crops, has increased the rate of decline in the eastern portion of the Region.

There have been virtually no groundwater-level declines during the past three decades near the San Joaquin River downstream of Mendota Pool. There is insufficient long-term data to make

the same conclusion upstream of Mendota Pool along the San Joaquin River. Rates of groundwater-level decline generally increase with distance from the Chowchilla River, Fresno River and San Joaquin River, confirming the importance of recharge from river seepage. For example, near the Fresno River east of the City of Madera, the average groundwater-level decline has been less than one foot per year.

A major impact on groundwater levels has been increased and intensified agricultural development. Since 2003, about 80,000 acres of new orchards have been developed. A substantial percentage of these new plantings occurred along the western edge of the Valley floor. Some orchards replaced existing annual crops, but many were planted on previously fallow land. While the trees have a lower irrigation demand than annual crops when they are immature, water use from those orchards will continue to increase over the next few years as the trees grow to maturity. That means that even absent additional plantings in coming years, agricultural water demands in those areas of new plantings will increase from the present rate and peak around the year 2017. Insufficient data are available on the maturity of existing tree crops to estimate the current demand versus the anticipated demand in 2017. Another major impact on groundwater levels has been the San Joaquin River Restoration Settlement, which has substantially reduced surface water deliveries to several agencies in Madera County.

Groundwater Resources in the Foothills and Mountains

Groundwater resources in foothill and mountain areas are generally developed in hard rock aquifers. In these situations traditional groundwater contours cannot be accurately developed and groundwater storage is difficult to assess. In 2002, Todd Engineers prepared a report entitled "*Draft Technical Memorandum – Groundwater Conditions in Eastern Madera County*". The report addresses groundwater in the foothill and mountain regions east of the alluvial groundwater basins. Topics addressed include the regional geology, groundwater occurrence, groundwater use, groundwater quality, and groundwater quantity. In addition,, Kenneth D. Schmidt & Associates performed groundwater evaluations for several foothill/mountain communities in 2007 including Oakhurst, North Fork, Coarsegold, and Raymond and Daulton Ranch-Hensley Lake Areas. These are the most comprehensive evaluations in those areas and provide significant information on water supplies and water quality issues.

Specific yield is the quantity of water which a unit volume of aquifer, after being saturated, will yield by gravity. In other words it is a measure of the water available to wells. Specific yields in the Valley were estimated to be 12-13% in the Draft Madera Regional Groundwater Management Plan. In contrast, the Department of Water Resources publication "*Water Facts – Ground Water in Fractured Hard Rock*" states that the specific yield of fractured hard rock is estimated to be less than two percent. This emphasizes the groundwater challenges in the mountain areas with aquifers that have very limited ability to store water.

Groundwater Budget

A detailed water budget for Madera County is not available, but is critically needed and a high priority for the Region. Some components of a water budget were recently calculated for the

2014 Draft Madera Regional Groundwater Management Plan (GMP), and some of those data are summarized in this IRWMP. The work performed for the GMP only covered certain portions of the Valley, and did not cover the foothills or mountains. The water budget was also preliminary in nature and some forms of data were lacking, such as groundwater level data and transmissivity values in certain areas, making a detailed water budget analysis unfeasible. A more detailed water balance study is needed to verify and refine the calculations in the GMP.

Partial water budget numbers are available in **Table 3.1** through **Table 3.4**. However, the reader is cautioned that these are preliminary numbers. A preliminary estimate of 250,000 AF/year for future groundwater overdraft is also available (Provost & Pritchard 2014). More detailed analyses can help to complete this data set and provide a better picture of the regional water budget.

When completed, the 2013 Draft California Water Plan Update may have useful information related to water budgets and regional groundwater supplies.

3.5 - Surface Water Supplies

Madera Irrigation District, Chowchilla Water District and Gravelly Ford Water District each meet significant portions of their water demands with surface water. The County of Madera provides a small amount of surface water to Hidden Lakes, a County Service Area located on the shore on Millerton Lake. In addition, an estimated 10,000 AF/year of riparian water (legacy water right based on having land adjacent to a waterway) is delivered to other private lands in unincorporated areas of Madera County. Surface water is primarily provided through water rights and water contracts on the San Joaquin River, Fresno River and Chowchilla River and a few small streams and creeks.

The Cities of Madera and Chowchilla do not have surface water rights or contracts. However, within the limits of each City there are cropped lands that receive some surface water from local water or irrigation districts. Owners of those parcels pay assessments to the districts, and as a result partially fund the importation of surface water to the area. In 2009, the City of Madera purchased 300 AF of floodwater from Madera Irrigation District (MID) as a pilot study on groundwater recharge. For general awareness, **Table 3.3** summarizes the historical surface water deliveries for most of the major valley water users.

Table 3.3: Historical Surface Water Supplies

Agency	Average Annual Supplies (2004-2013)	Notes
Chowchilla Water District	135,000	Excludes Chowchilla Water District lands in City of Chowchilla
City of Chowchilla	1,400	Chowchilla Water District water delivered to cropped land within the City limits
City of Madera	1,900	MID water delivered to cropped land within the City limits
County of Madera	20,000	Sumner Hills Service Area, riparian agricultural water, some MID water
Gravelly Ford Water District	10,500	
Madera Irrigation District	178,000	Excludes MID lands within the City of Madera boundaries
Total	**346,800**	

Notes:
1. Values include surface water that is delivered directly to growers and recharge basins, and lost as canal seepage.
2. Values are estimates provided in the Draft Madera Regional Groundwater Management Plan (P&P, 2014)

In the past, a significant percentage of water demand has been met with surface water. However, that percentage has lately decreased due to impacts from the San Joaquin River Restoration Settlement. For example, Gravelly Ford Water District now only expects to receive Friant CVP water in one of every three years, greatly increasing reliance on groundwater within the District.

3.6 - Reclaimed and Recycled Water

The term "recycled water" refers to wastewater effluent that has been treated to California's Title 22 standards and can be reused for irrigation and recreational purposes almost without limit. There is currently no recycled water available within the Region since there are no wastewater treatment plants producing that level of effluent. However, wastewater effluent treated to less stringent levels does get reused for certain irrigation purposes. Both the Cities of Chowchilla and Madera deliver their secondary effluent to recharge basins where it percolates into the groundwater aquifer. Also, the County-operated WWTF at Goldside, five miles west of Oakhurst, produces disinfected secondary effluent which is used for irrigation of the local golf course in lieu of potable water. This plant has an operating capacity of approximately 100,000 gallons per day, or 112 AF/year. The Oakhurst wastewater treatment plant (WWTF) has a single purple pipe distribution line running from the WWTF to the

community, but it is not in use since the plant is not yet equipped with the tertiary-level filters necessary to make Title 22-compliant effluent. Other WWTFs within the region discharge effluent to local sprayfields or to percolation ponds. Many residents use septic systems that return wastewater to the groundwater through leach fields.

3.7 - Water Demands for Environmental Needs

Over the past 80 years, surface water on the San Joaquin has been managed by the US Bureau of Reclamation (USBR) primarily for the benefit of landowners, irrigation districts and municipalities in the San Joaquin Valley who have contracts for San Joaquin River water with the USBR. In 2008, that began to change with the San Joaquin River Restoration settlement agreement, which pledges up to 400,000 AF/year of the river's flow to the river channel itself, with the intention of restoring spring- and even fall-run salmon to the lower San Joaquin River.

Implementation of the settlement agreement is progressing slowly, as restoration of the river channel has proven difficult, time-consuming and more expensive than estimated. Much of the lower river channel has not actually been used for water flows in several decades. River levees are not adequate to protect abutting lands and there are numerous other issues and challenges to be resolved before perennial restoration flows become normal.

The impact of the Restoration agreement has been a loss of water to all the various agricultural users dependent upon USBR contracts. Provisions in the settlement agreement limit restoration flows in the lowest water years, and in high water years it is anticipated that restoration flows can be at least partially supplied by water that would otherwise be lost to flood releases. However, the difficulty and expense of managing restoration flows has added burdens to the agricultural users and all are looking for ways to make up the lost water supplies.

The San Joaquin River Restoration project has a goal of a 1:1 return on water lost to Friant CVP contractors, although that goal is not stated in the San Joaquin River Restoration Settlement Agreement. Friant contractors plan to track progress in meeting that goal. The goal can be met in many ways, including funding for recharge basins, expanding the Madera Canal to allow greater deliveries in wet years, and recirculating San Joaquin River water back to the Friant contractors.

The RWMG supports the development of efficiency standards for River Restoration Flows to help ensure that they are used as effectively as possible, benefits to aquatic species are maximized, and impacts to water contractors are minimized

3.8 - Climate Change Impacts on Water Supplies

California is projected to experience dramatically warmer temperatures during this century, with some estimates of 2-5^{o}F by 2035-64 and 5-9^{o}F by 2070-99. Climate-change impacts projected to affect the Region, associated with these magnitudes of warming, include:

- More critically dry periods, including multi-year droughts;
- Increasing demand from a growing population as temperatures rise;
- Earlier snowmelt and runoff; and
- Increased competition for water among urban and agricultural water users and environmental needs.

Climate projections provide a range for future increases in temperature, and even the lowest estimates would have serious impacts. Thus, while it is widely recognized that projections of warming and climate-change impacts are not precise, water managers should prepare to adapt to greater uncertainties in the water-planning process, including regulatory, environmental, economic, social and other conditions affecting water utilities.

The general strategy to plan for climate change in the Region includes:

1) Identify vulnerabilities (to specific water users, aquatic species, and ecosystems that impact water supply and quality);
2) Implement adaptation measures on two levels—no-regret strategies and higher-level planning and implementation strategies; and
3) Monitor for climate-change impacts.

A more-detailed discussion of climate change and potential impacts appears in Chapter 15.

3.9 - Impaired Water Bodies

Both Eastman Lake on the Chowchilla River and Hensley Lake on the Fresno River have been determined by the Regional Water Quality Control Board to be impaired water bodies for nitrate as listed in the 2010 Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report), published by the Regional Water Quality Control Board.

3.10 - Geology

The Valley portion of the Region encompasses the majority of the Madera Groundwater Subbasin, and portions of the Chowchilla and Delta Mendota Groundwater Subbasins. These subbasins are defined by the California Department of Water Resources Bulletin 118-03 and are within both the San Joaquin Valley Groundwater Basin and the San Joaquin Basin Hydrologic Study area.

3.11 - Geology and Hydrogeology

The Valley portion of the Region is underlain by the San Joaquin Valley Groundwater Basin. The San Joaquin Valley Groundwater Basin covers a vast area and encompasses the alluvial deposits under the valley floor from the Sierra Nevada Mountains to the east, the Coast Range mountains to the west, the Sacramento Valley and Delta to the north, and the San Emigdio and Tehachapi mountains to the south. The San Joaquin Valley Groundwater Basin lies within the San Joaquin River and Tulare Lake Hydrologic Regions and covers approximately 13,900 square miles. It has been divided into 16 subbasins. The Madera Region is within the San Joaquin River Hydrologic Region and is underlain by three groundwater subbasins as defined by the California Department of Water Resources (DWR) in "*California's Groundwater, Bulletin 118 – Update 2003*". These are the Chowchilla, Madera, and Delta-Mendota Subbasins. A subbasin is defined as follows:

> *"A groundwater basin is defined as an alluvial aquifer or a stacked series of alluvial aquifers with reasonably well-defined […] features that significantly impede groundwater flow such as rock or sediments with very low permeability or a geologic structure such as a fault. […]*
>
> *"A subbasin is created by dividing a groundwater basin into smaller units using geologic and hydrologic barriers or, more commonly, institutional boundaries […]. These subbasins are created for the purpose of collecting and analyzing data, managing water resources, and managing adjudicated basins."*

DWR was directed by legislation to define critical overdraft in 1978 and report which subbasins were in critical overdraft. The *California Water Plan Update* of 2009 states that the eastern San Joaquin (County), Chowchilla, and Madera Subbasins are in critical overdraft. However, a comprehensive assessment of overdraft in California's subbasins has not been completed since DWR's issuance of Bulletin 118-80 in 1980.

Bulletin 118-80 stated:

> *"A basin is subject to critical conditions of overdraft when the present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts."*

Chowchilla Subbasin

The Chowchilla Subbasin is shown in **Figure 3-11**, and is identified as Basin 5-22.05 by DWR in Bulletin 118. The Subbasin covers an area of 248 square miles and is located in Madera County with a small portion in Merced County. The Subbasin is bounded by the Columbia Canal Company Service Area and San Joaquin River on the west. To the north, the Chowchilla Subbasin is bound by the southern portion of the Merced Subbasin. The southern boundary consists of an irregular pattern and borders the northern portion of the Madera Subbasin. Groundwater recharge is primarily from deep percolation of applied irrigation water.

Madera Subbasin

The Madera Subbasin is shown in **Figure 3-12** and is identified as Basin 5-22.06 by DWR. The Subbasin covers an area of 614 square miles and is located entirely within Madera County. It is bounded on the south by the San Joaquin River, on the west by the eastern line of the Columbia Canal Service Area, on the north by the south line of the Chowchilla Subbasin, and on the east by the crystalline basement bedrock of the Sierra Nevada foothills.

Delta-Mendota Subbasin

The Delta-Mendota Subbasin is shown in **Figure 3-13** and is identified as Basin 5-22.07 by DWR. The Subbasin covers an area of 1,170 square miles. It lies largely in Fresno County along with portions of Madera, Stanislaus and Merced counties. It is bounded on the west by the Coast Range mountains, on the north by the Stanislaus/San Joaquin county line, and on the east generally by the San Joaquin River. The southern boundary is irregular and consists of portions of the western Kings Subbasin and the Westside Subbasin. DWR Bulletin 118 states that groundwater levels within the Delta-Mendota Subbasin have been relatively stable and this Subbasin is not considered to be in overdraft.

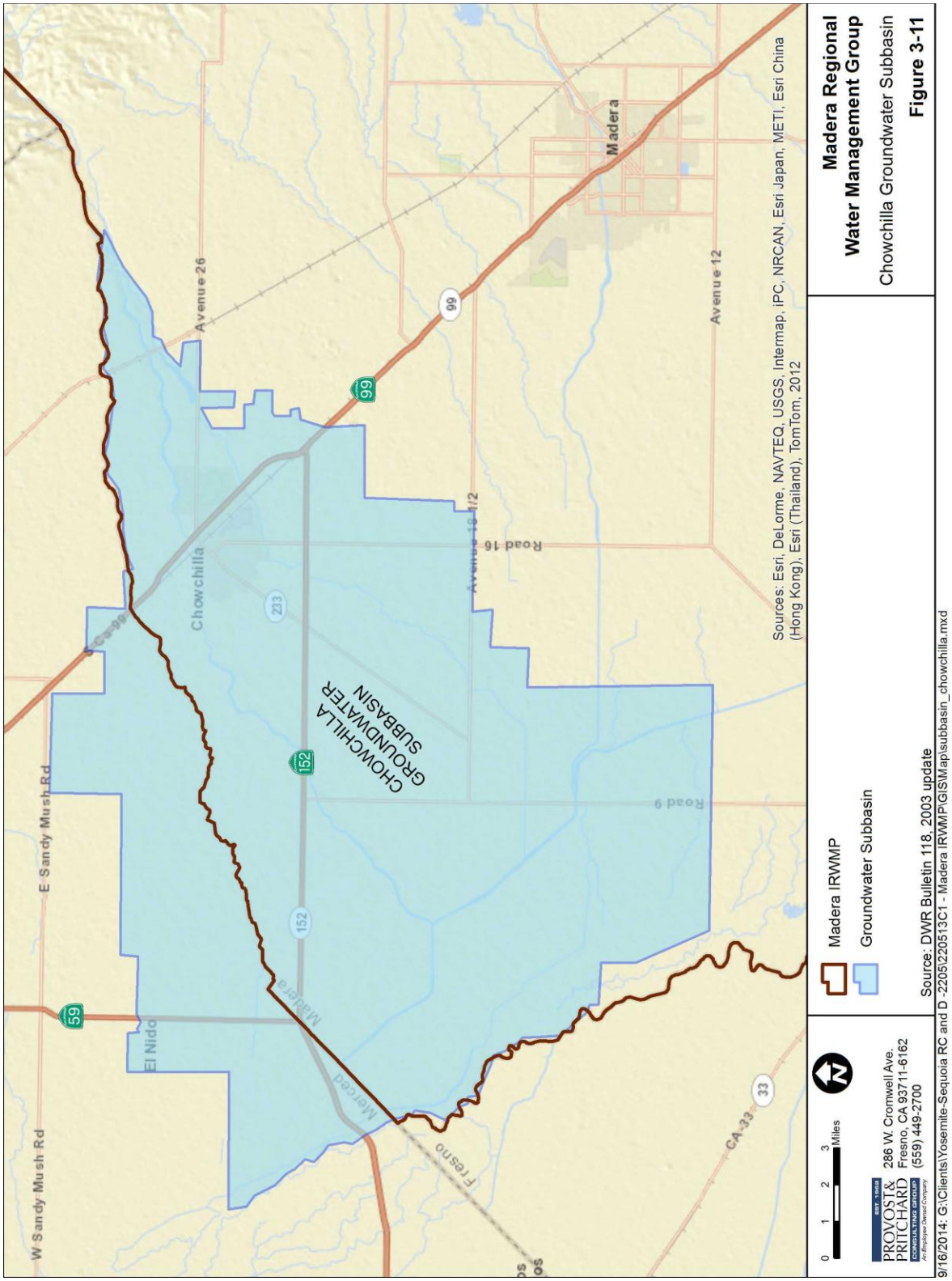


Figure 3-11 – Chowchilla Groundwater Subbasin

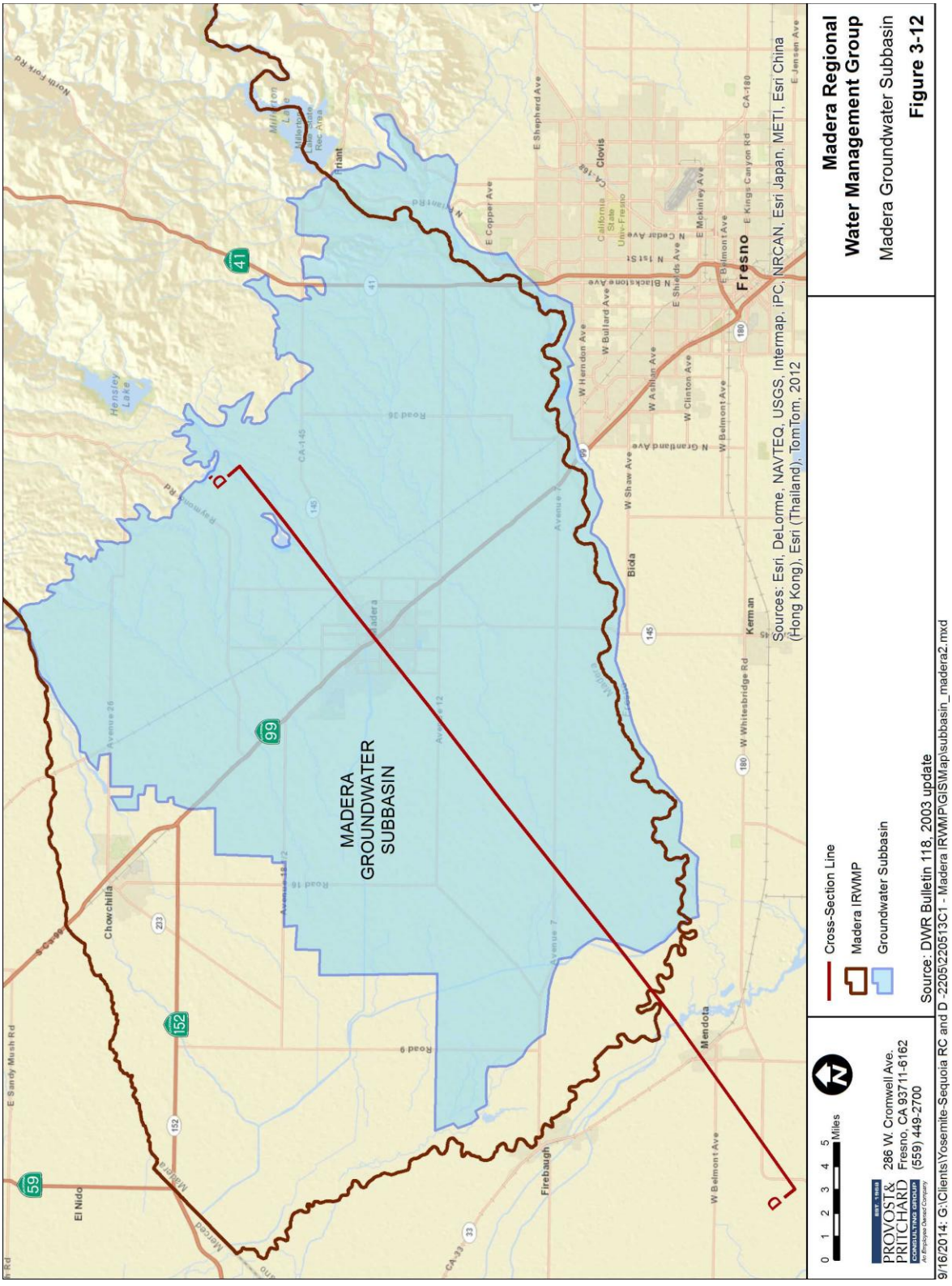


Figure 3-12 – Madera Groundwater Subbasin

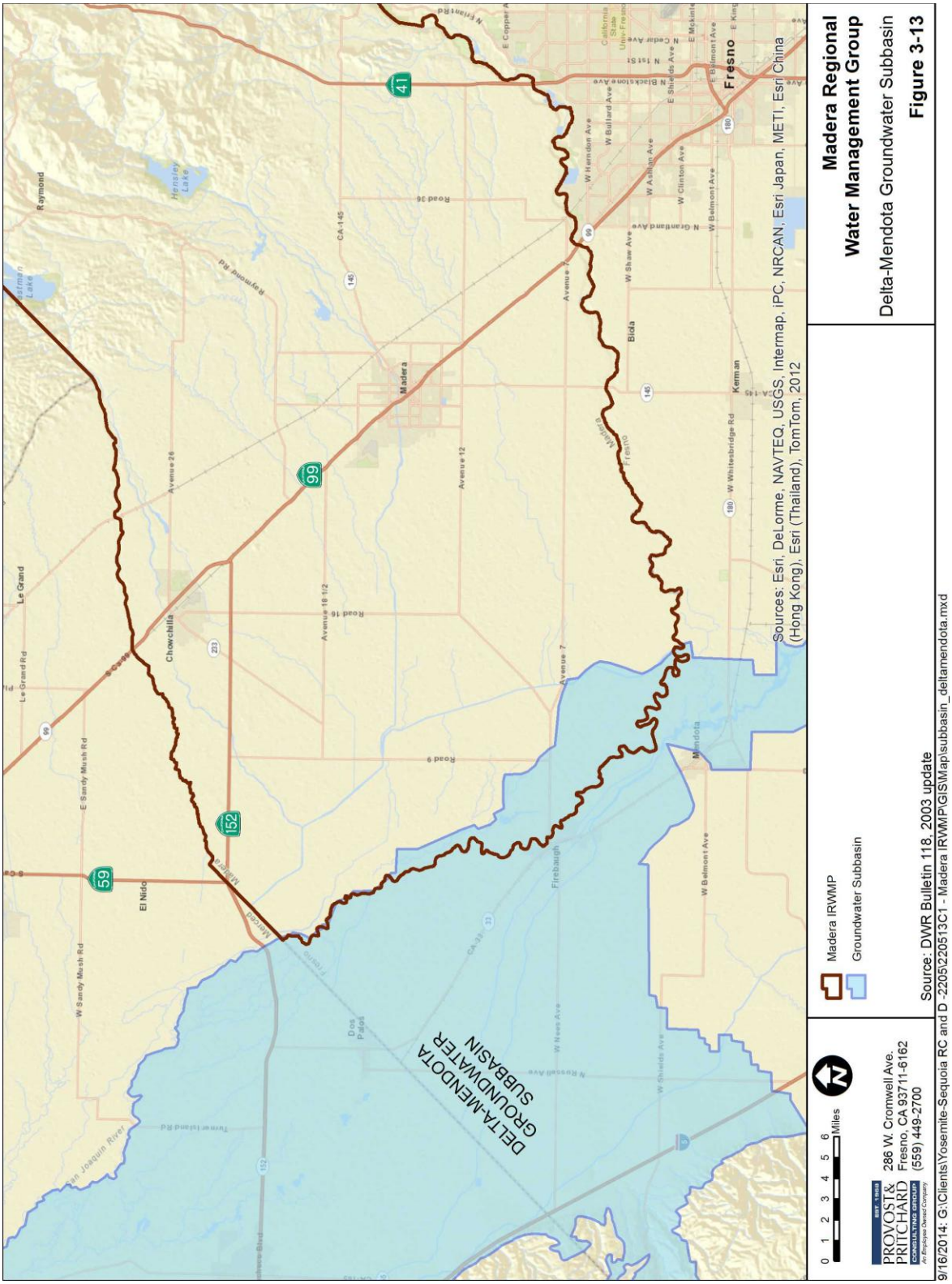


Figure 3-13 – Delta-Mendota Groundwater Subbasin

3.12 - Geomorphology, Statigraphy and Soils

The Great Valley of California is an asymmetrical structural trough filled with Mesozoic (deposited between 248 million years ago [mya] and 99 mya) and Cenozoic (65 mya to present) sediments that reach a thickness of approximately 30,000 feet. The Great Valley consists of the Sacramento Valley in the north and the larger San Joaquin Valley in the south. The San Joaquin Valley represents the lower two-thirds of the Great Valley of California. It is approximately 200 miles long and up to 70 miles wide, bounded on the north by the Sacramento-San Joaquin Delta, the Sierra Nevada Mountains on the east, the Coast Range Mountains on the west, and the Tehachapi and San Emigdio Mountains to the south.

The freshwater aquifer systems underlying the Region consist of the younger alluvium and older alluvium and are contained in the Late Tertiary and Quaternary continental deposits. These deposits increase with thickness from north to south and are up to 3,000 feet thick in the Valley portion of the Region. Sediments generally are coarser at the edges of the alluvial fans, closest to the Sierra Nevada Mountains, and become finer towards the center of the valley. The Valley portion of the Region consists of generally flat agricultural land, sloping to the San Joaquin River towards the west, with the Sierra Nevada Mountains rising to the east. Fluvial and alluvial processes have formed the landforms within the Valley portion of the Region.

Precipitation in the Sierra Nevada Mountains in the Region drains westward and has deposited sediments into the San Joaquin Valley, creating the dominant geomorphic features in the valley. Three major drainages developed east of the Madera area, the Chowchilla, Fresno, and San Joaquin Rivers. Each stream transported sediment out and onto the valley floor, developing overlapping alluvial fans. The alluvial fan size appears to increase to the south. In cross section, alluvial fans are wedge-shaped or lens-shaped. Sediments in alluvial fans decrease in grain size with increasing distance from the source.

The Chowchilla River flows west along the northern portion of Madera County and spills into the Berenda and Ash Sloughs. The Fresno River flows west through the central portion of the county where it joins the San Joaquin River in the west. The San Joaquin River flows west along the southern boundary of Madera County before turning north along the western boundary of the county. Each river deposited sediments on the valley floor. There tends to be a larger amount of coarse-grained sediments near the valley margin and more fine-grained sediments downstream. As flood events occurred, the streams have overbanked their channels and deposited fine-grained sediments to the north and south of each river channel. Alluvial fans have formed multiple stream channels which overlap with other alluvial fans.

The flood plain deposits of each of the major alluvial fans increase in size from north to south. The flood plain of the Chowchilla River is a half-mile wide and less than five (5) miles long. The flood plain of the Fresno River is near one-mile wide and 10 miles long. The flood plain of the San Joaquin River is the largest with a maximum width of about two miles and extends 25 miles below Friant Dam.

The Madera and Chowchilla Subbasins are considered to be "critically overdrafted" by the California Department of Water Resources. Groundwater levels in the Valley portion of the Region have gradually declined over time. The Corcoran Clay, a major confining bed in the San Joaquin Valley, is present in the western portion of the Region.

Stratigraphy

A cross section showing the local stratigraphy in a generally east-west direction through the City of Madera is illustrated in **Figure 3-14**. The location of the cross secton (D-D') is shown on Figure 3-12. The cross section was prepared by the David et al. (1959). Mitten, LeBlanc, and Bertoldi (1970) characterized the subsurface geology underlying the valley portion of Madera County. The geologic units, from deep to shallow (oldest to youngest), consist of crystalline basement rock, marine sediments, marine and undifferentiated continental sediments, consolidated continental sediments (including the Ione Formation and Mehrten Formation), and unconsolidated sediments. The stratigraphic succession of deposits in the valley include, from oldest to youngest: crystalline basement rock, marine and continental sedimentary rocks, Ione Formation, Mehrten Formation, continental deposits of tertiary and quaternary age, and continental deposits of quaternary age. The youngest formation is further divided into the Older Alluvium and the Younger Alluvium.

Crystalline Basement Rock

The basement complex consists of mostly granitic and metamorphic rocks. The basement complex outcrops east of the older alluvium. The crystalline basement rock underlies the entire GMP plan area at depth and is comprised of the Sierra Nevada batholith and partly the western metamorphic belts. This formation likely contains small amounts of groundwater in fractures.

Marine and Continental Sedimentary Rocks

The marine and continental rocks overlie the basement complex and underlie the western part of the Madera area. The formations do not outcrop in the area, but can be tracked in the subsurface. These rocks consist mostly of sandstone, claystone, siltsone, and shale. The marine sedimentary rocks most likely contain connate saline water and do not provide useable groundwater to the area.

Ione Formation

The Ione Formation outcrops in the eastern portion of the valley and caps many of the hills northwest of Friant Dam. The Ione Formation is sedimentary and was deposited in both marine and non-marine environments. The Eocene Ione Formation outcrops discontinuously along the western margin of the Central Valley and consists of sandstone and conglomerates. The Ione Formation does not provide groundwater to the Region. This is significant because the Ione formation has good recharge potential but cannot contribute groundwater to the area due to its absence.

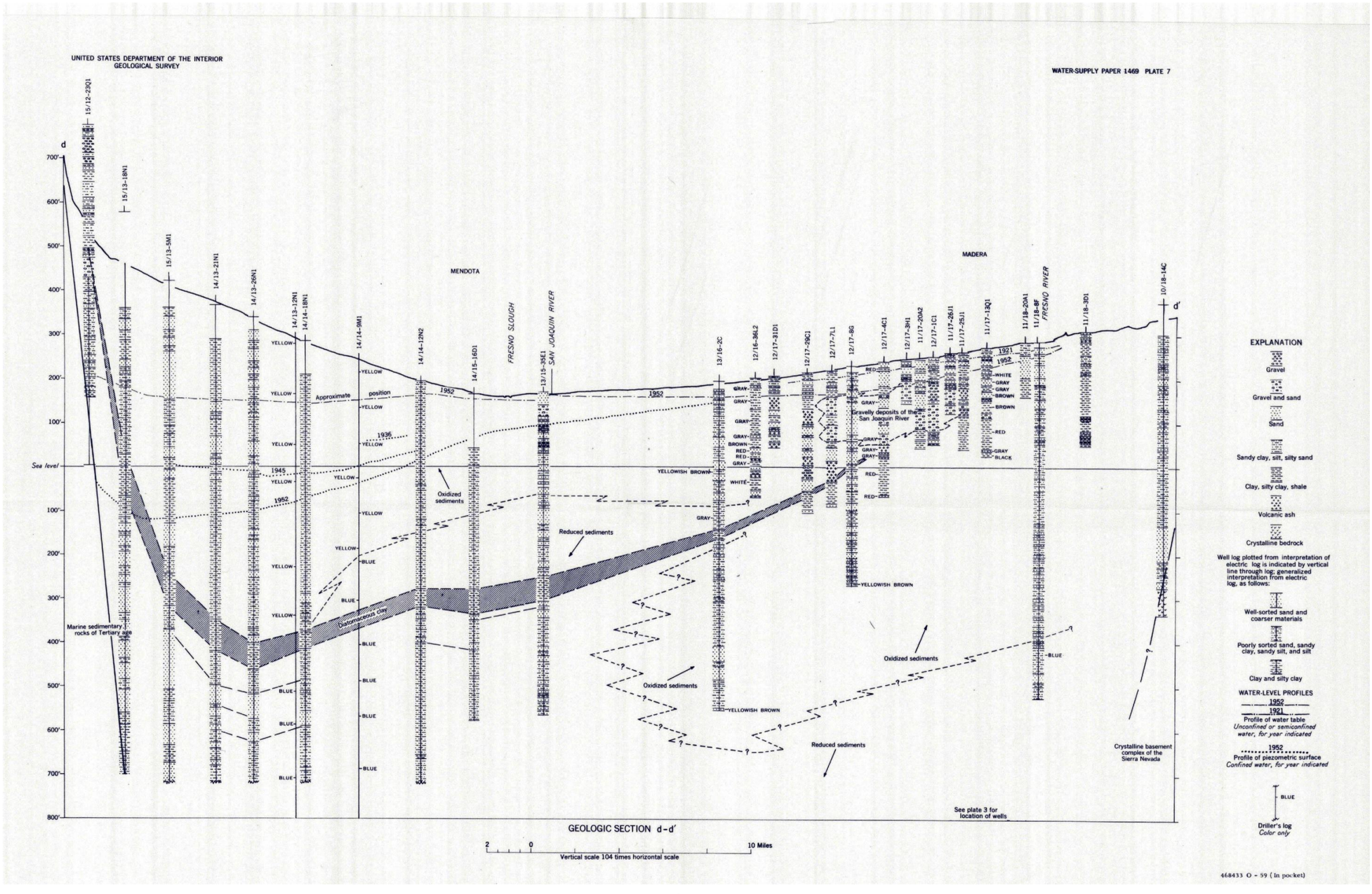


Figure 3-14 Geologic Cross Section

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Mehrten Formation

The Mehrten Formation is a significant geologic formation within the San Joaquin Valley. It consists of a sequence of volcaniclastic and volcanic rocks. The Mehrten Formation unconformably overlies the Ione Formation. It is comprised of two distinct geologic units. The first consists of sediments deposited under alluvial and fluvial conditions which are made up of gravel, sand, silt, and clay size sediments. The second unit consists of dense volcanic flows of tuff breccia with some interbedded conglomerates and sandstones. The Formation outcrops north of the Region and is not present in Madera County.

The Formation is an important aquifer that stretches from Merced County north to Sutter County. The fact that it is not present in the eastern Valley portion of the Region is a significant reason that groundwater recharge does not occur at a rate as it does in the subbasins north of the Madera County.

Continental Deposits of Tertiary and Quaternary Age

The continental deposits of Tertiary and Quaternary age underlie most of Madera County, but do not crop out at the surface. The formation dips gently southwest and overlies the marine and continental rocks. The deposit consists of interbedded, poorly-sorted sand, silt, clay and conglomerate, with layers of hardpan. The deposits become finer grained with depth and distance from the foothills. The lower part of the deposits contains blue and green clays and the upper portion contains red, yellow, and brown clays, which are interpreted to have been deposited under reducing and oxidizing conditions, respectively.

In the past, few water wells penetrated the continental deposits. The water bearing capacity of this formation is unclear at this time; however, many new agricultural wells are drilling deeper into this formation to produce additional groundwater. As these wells are put into production over the next several years, additional information with regard to well yields, water quality, and aquifer recharge will become available.

Continental Deposits of Quaternary Age (Older Alluvium)

The older alluvium of Pleistocene and Holocene age underlies most of the Valley portion of the Region. The older alluvium outcrops south of the San Joaquin River and north of the Chowchilla River. It dips gently southwest and ranges in thickness from zero to about 1,000 feet, overlying the continental deposits of Tertiary and Quaternary age and overlapping the Ione Formation (where present) and the basement complex. The older alluvium consists mostly of interbedded lenses of clay, silt, sand, and some gravel, decreasing in grain size with depth and grades into the underlying fine-grained continental deposits of Tertiary and Quaternary age. Cemented hardpan occurs throughout the area near the ground surface.

Mitten et al. (1970) summarized aquifer characteristics based on aquifer tests made by the USGS in the late 1960s and reported aquifer transmissivity values ranging from 18,000 to 99,000 gallons per day per foot of drawdown (gpd/ft) in the Madera area. Based on multiple well tests throughout the Madera area, transmissivities of deposits above a depth of 500 feet

(with significant coarse-grained deposits) range in transmissivities from 50,000 to 250,000 gpd/ft of drawdown. The transmissivities in the underlying continental deposits normally range from about 10,000 to 30,000 gpd/ft of drawdown (Boyle, 2008).

Continental Deposits of Quaternary Age (Younger Alluvium)

The younger alluvium is a well-sorted sedimentary formation and overlies the older alluvium, covering a significant portion of the valley area in Madera County. It does not contain cemented hard pan, which differentiates it from the older alluvium. It is indistinguishable from the older alluvium in the subsurface. The estimated thickness ranges from zero to fifty feet and is generally not unsaturated, though saturated areas exist near streams and channels.

Corcoran Clay (E Clay)

To better depict the aquitards in the southern San Joaquin Valley, Croft (1972) identified several extensive clay layers in the subsurface that he designated, youngest to oldest, by letters A through F. That study informs the discussion in this section. The A and E clays are the most significant clay layers in the vicinity of the valley area, but only the E clay is present in the Region, based on Croft's mapping. The E clay is the thickest and most laterally extensive of the clay layers identified and mapped by Croft. The A clay has been mapped locally at shallow depths southwest of the Region at depths of 10 to 60 feet and is generally less than 60 feet thick.

The E Clay, which includes the Corcoran Clay Member of the Tulare Formation, is a regional confining layer and underlies approximately 3,500 square miles in the San Joaquin Valley. Within the upper portion of the Older Alluvium, the Corcoran Clay divides the San Joaquin Valley freshwater aquifer system into an unconfined to semi-confined upper system and a largely confined lower system. The Corcoran Clay has been identified in the subsurface in the western portion of the RWMG area, ranging in depth between 80 and 350 feet.

In contrast to other clays in the subsurface, the Corcoran Clay appears gray, greenish gray or bluish gray. Water well drillers commonly referred to this clay as the "blue clay."

Portions of the Corcoran Clay consist of a matrix of diatomaceous clays, which are compressible when the pore pressure is reduced by dewatering. The compression of the diatom rich matrix is thought to be the main reason for the extreme inelastic compression and the associated land subsidence overlying the Corcoran Clay.

3.13 - Land Subsidence

Land subsidence occurs when groundwater levels in confined aquifers decline due to excessive withdrawals of water. This results in compaction of fine-grained sediments (clays) above and within the aquifer system as water is removed from pores between the grains of the sediments. Over time, as more water is removed from the area, the ground level sinks. Land subsidence can lead to reduced conveyance capacity in canals, and damage to structures such as canals,

levees, buildings and wells. Subsidence can also cause flooding by creating low spots or reducing gradients in natural channels.

Cause of Local Land Subsidence

Land subsidence in the Valley portion of the Region is caused by pumping groundwater from the deeper confined aquifer that is separated from the shallower unconfined aquifer by the Corcoran Clay. The Corcoran Clay is the regional aquitard throughout the San Joaquin Valley, and is prevalent throughout the western half of the valley area. The area of greatest land subsidence in the Region coincides with the area underlain by the Corcoran Clay, in western Madera County, particularly along the Eastside Bypass.

History of Land Subsidence in Area

Land subsidence in the Region is of historic and ongoing significance. Between 1926 and 1972, subsidence resulted in between 1.0 and 4.0 feet of ground surface elevation drop within the western half of the Valley portion of the Madera Region. The area of greatest subsidence occurred roughly along the path of the East Side Bypass flood control structure of the San Joaquin River (Bull, 1975).

The majority of the subsidence has occurred since 1940, when large turbine pumps came into widespread use for extracting water from the deeper confined aquifer. Availability of surface water from the Delta-Mendota Canal and the California Aqueduct resulted in decreased groundwater demand, stabilization of groundwater levels and a reduced rate of subsidence. Drought conditions during 1976-1977 and 1987-1992 restricted surface water deliveries, resulting in increased demand for groundwater supply and increased subsidence rates. Drought and regulatory reductions in surface water deliveries (especially the San Joaquin River Restoration) from 2007 through 2014 have brought about unprecedented withdrawals of water from the deeper confined aquifer to meet local water demand.

Loss of Storage Due to Subsidence

According to a 1995 USGS report, the primary cause of land subsidence in the Valley has been the compaction of fine-grained silt and clay sediments in the aquifer system following extensive long-term withdrawal of groundwater in excess of recharge. This subsidence, due to compaction of fine-grained sediments, began in the 1920s. As groundwater levels declined severely during the 1960s, fine-grained sediments lost water from pore spaces and became compacted from the weight of the overlying soil. When withdrawal rates decreased and water levels were allowed to recover, compaction rates slowed significantly.

Increased groundwater pumping during the 1976-77 drought increased the rate of subsidence, some of which even resulted from compaction of coarse-grained sediments. When groundwater levels recovered in 1978 following the end of the drought years, the compacted coarse-grained sediments regained some of their original volume when the former or near former pore pressure was attained and the land surface rebounded. However, the fine-grained sediments remained compacted and will never recover.

The fine grained portions of the aquifer are not typically considered water producing portions. The minimal amount of storage loss in the coarser grained sediments, the usable part of the aquifer, is for the most part recoverable and is not considered an appreciable loss of storage space in the usable parts of the aquifer.

Recent Land Subsidence Impacts

Groundwater pumping that results in renewed compaction and land subsidence in the Valley could cause serious operational, maintenance, and construction-design problems for the California Aqueduct, the San Luis & Delta-Mendota canals, and other water-delivery and flood-control canals in the San Joaquin Valley. Subsidence has reduced the flow capacity of several canals that deliver irrigation water to farmers and transport floodwater out of the valley. Several canals managed by the San Luis & Delta-Mendota Water Authority (SLDMWA) and the Central California Irrigation District (CCID) have had reduced freeboard and structural damages that have already required millions of dollars worth of repairs, and more repairs are expected in the future (Sneed, et al. 2013). These instances of land subsidence are not in the Region but are adjacent to the westerly portions of the area in the vicinity of the San Joaquin River, and indicate that subsidence is occurring in broad area of the central part of the San Joaquin Valley. Within the Region, subsidence in the vicinity of the San Joaquin River and its flood control structures may cause flooding of Highway 152 and a local grade school, threaten valuable farmland and dairies, and jeopardize the San Joaquin River Restoration Program.

Recent work by the USGS, USBR, DWR and Kenneth D. Schmidt and Associates (KDSA) indicates that the greatest amount of subsidence in the Region is in the area of the East Side Bypass. This is also referred to as the Red-Top Area, which is located in the west-northwest portion of the Region near the axis of the valley where the majority of the historic land subsidence has been documented. The maximum subsidence near the Eastside Bypass has amounted to approximately seven (7) feet.

3.14 - Groundwater Elevations and Flow Direction

This section discusses the available groundwater level data, recent groundwater elevation contours, groundwater flow direction and existing cones of depression. Existing groundwater level data is limited and recommendations are given for improving monitoring.

Groundwater Levels

Recent and readily available groundwater level data was obtained from several agencies within the Region as part of the preparation of the Madera Regional Groundwater Management Plan. Fall 2013 data was used because it provides the most recent data and illustrates the condition of the aquifer after a summer of groundwater withdrawals. Groundwater elevation contours were estimated based on the data provided. The following should be noted concerning the data sources used for the groundwater level information:

- Chowchilla Water District monitors 142 wells, of which 79 have fall 2013 water level data.

- Madera Irrigation District monitors 161 wells, of which 85 have fall 2013 water level data.
- Root Creek Water District – water level data available for 22 wells.
- Madera County supplied information from eight wells in valley-floor Maintenance Districts and Service Areas.
- The City of Madera and City of Chowchilla monitor groundwater levels, but the data was not readily available for the analysis.
- No fall 2013 groundwater level data was collected for the Western Madera County Subsidence Study. The participants in the study only measure groundwater levels in the spring.
- The California Department of Water Resources no longer measures wells in Madera County (personal communication with DWR staff, March 2014).
- The USBR reports their water level data to the DWR, and data was only found for eight of those wells.
- No readily available data in the un-districted areas of the county, except for data from Madera County.

Groundwater Monitoring

The majority of the water level data available falls within Madera Irrigation District (MID) and Chowchilla Water District (CWD). Outside of the districted areas readily available water level data is sparse. Water level monitoring programs in the un-districted areas, or areas that receive little or no surface water, are as a whole deficient. Fewer water level measurements are available in the east part of the valley floor, where the greatest water level declines are occurring.

The State of California stores groundwater level data in their Water Data Library (WDL) and in a database for the California Statewide Groundwater Elevation Monitoring (CASGEM) program. Both can be accessed on the DWR website. The WDL contains historical information, and CASGEM includes recent information submitted by regional CASGEM groups. The two systems are likely to be merged in the future.

Derivation of Groundwater Elevation Contours

Groundwater elevation contours were estimated from available water level data. As **Figure 3-15** shows, wells in relatively close proximity to one another can have significantly different water elevations. This is likely caused by several factors: 1) groundwater elevations in wells across the study area appear to be affected to varying degrees by confining conditions, 2) water level measurements are taken with different types of measuring devices, and 3) water levels taken within a season may actually be taken several months apart.

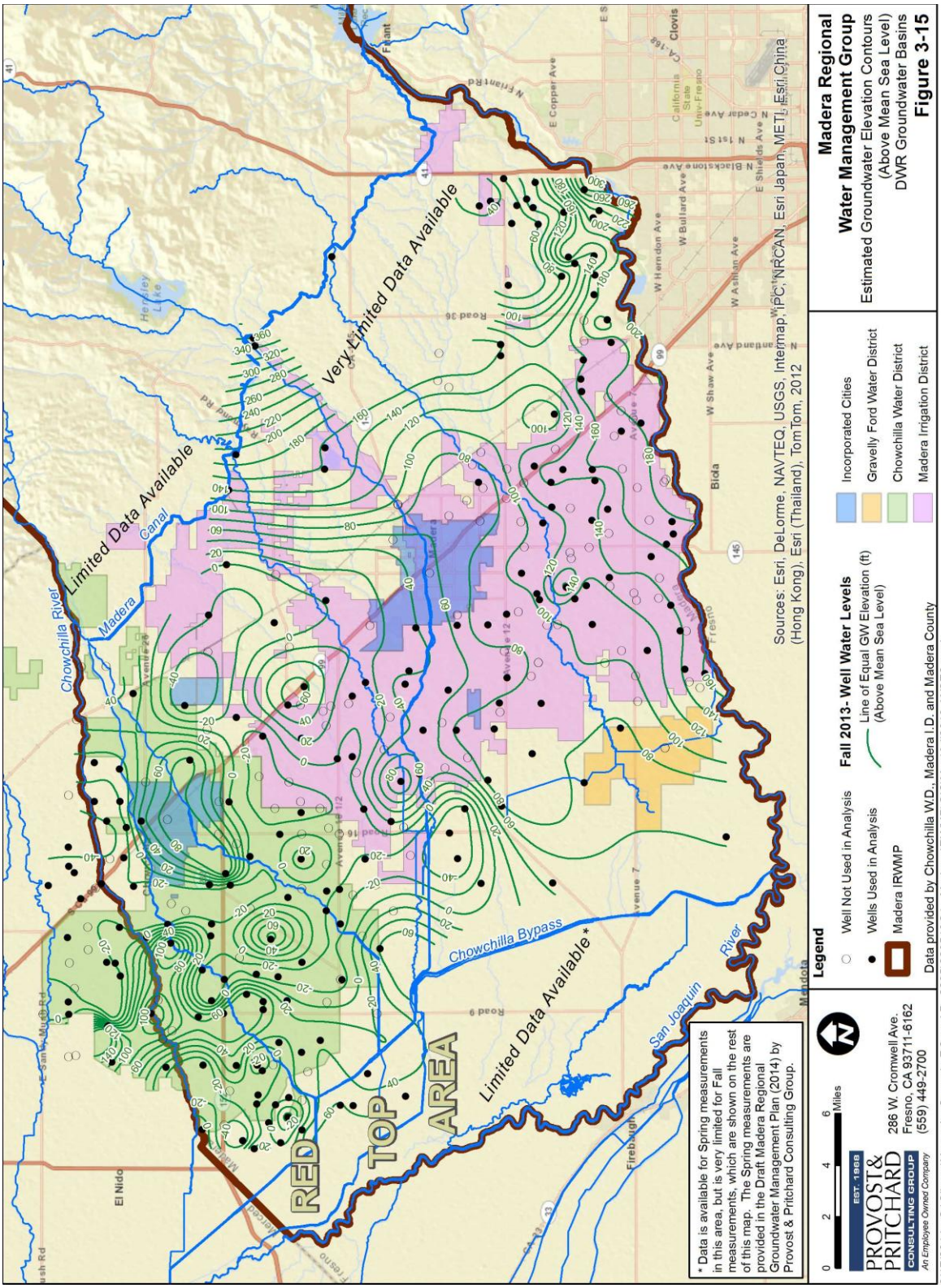

Figure 3-15 – Estimated Groundwater Elevation Contours

Groundwater Flow and Cones of Depression

The most consistent and reliable groundwater elevation contours are found along the San Joaquin River from the Root Creek area to about 5 miles west of Highway 145. Through this area groundwater flows northwest into the region due to recharge from the San Joaquin River. Generally flow is west to southwest across the study area with numerous groundwater mounds and depressions indicating that groundwater can locally flow in any direction - either towards a depression or away from a mound.

Past groundwater contour maps indicate that one of the largest groundwater depressions in the area is south of Highway 145 northeast of the Santa Fe Railroad. This depression coincides with a large area with limited surface water. This groundwater depression is not evident on **Figure 3-15** due to a lack of recent data in this area. Another groundwater depression is evident in the area east of Fairmead, which also coincides with an area with limited groundwater supplies (MID annexed lands and two prisons in Chowchilla: Central California Women's Correctional Facility and the Valley State Prison). Several additional groundwater depressions were present on historic DWR groundwater elevation contour maps of the un-districted areas west of MID and CWD. These depressions are not evident on **Figure 3-15** due to lack of recent data for this area.

Estimating the volume of groundwater resources in Madera County is not currently feasible. The depth to saline groundwater has not been estimated on a regional basis since 1973 when USGS performed a study (Page, 1973). The depth to saline water varies throughout the County, forming an irregular lower limit for the fresh water aquifer. Other constituents, such as arsenic, also impact the depth to usable water. In many areas, no detailed delineation of water quality is available. Other factors, such as the economics of drilling and operating deep wells, also impact the available groundwater supply. A spatial evaluation of total groundwater supplies is necessary to calculate the overall volume of available and useful groundwater, and is considered a high priority goal for the Madera Region.

3.15 - Geologic Potential for Groundwater Recharge

Groundwater recharge is the process by which groundwater is replenished. The geologic formations that comprise the aquifer system underlying Madera County extend well beyond the local agencies' jurisdictional boundaries. Several processes are responsible for natural recharge of the groundwater basin. On a regional scale, surface water flowing over the surface expression of the geologic formations (surface outcrops) allows for direct infiltration into the hydrogeologic system. Locally, groundwater recharge occurs where surface water flows over permeable sediment (gravels and sand) in the river channels, allowing for direct infiltration of surface water. Deep percolation of applied irrigation water also recharges the groundwater basin in areas where impermeable formations do not exist.

The quantity of groundwater that can be recharged is dependent on the available storage space within the aquifer(s). Depending on the relative elevation of the bottom of the river or stream and that of the groundwater, streams can either "lose" water into the underlying aquifer(s) or "gain" water from the aquifer. Where groundwater levels are at or above the elevation of the surface water, groundwater will flow into the stream (gaining stream). Where the groundwater surface elevation is below that of the surface water, water flowing downstream will recharge into the groundwater basin (losing stream). Conversely, if groundwater levels are at the land surface, there will be refusal of any "new" water in the subsurface. All streams in the Region are currently losing streams.

DWR groundwater contour maps indicate that the groundwater basins underlying the Region received recharge through under-seepage from the San Joaquin and Fresno Rivers. Local agricultural interests are increasingly implementing groundwater recharge programs using both percolation basins and in-lieu recharge. Due to the hardpan and low infiltration rates in the eastern portion of the County within the Valley portion of the Region, the majority of surface runoff during storm events flows overland and most water does not percolate into the subsurface.

Those areas conducive to recharge, i.e. underlain by soils with moderate to high infiltration rates, are mainly found west to southwest of the Cities of Madera and Chowchilla. Other areas with soils of high infiltration rates are intermittently found as stream or river deposits radiating from the San Joaquin River and to a lesser extent the Chowchilla River. Along the major rivers and streams areas with the potential for recharge exists as relatively narrow outcrops of soils with moderate infiltration rates that extend easterly to the edge of the groundwater basin. From a regional groundwater recharge perspective, these areas should be the focus of future recharge programs. Since these areas are primarily up gradient from the valley floor area, water recharge in the eastern portions of the major stream and rivers will eventually flow down gradient and recharge the aquifer to the west.

3.16 - Domestic Water Demand

Domestic water demands are defined as water used for domestic (indoor and landscape) purposes in urban and rural areas. The Cities directly provide water to their residents, and the County provides water to residents of the 12 Maintenance Districts and Service Areas in the Madera Region. Rural residents living in the irrigation districts, water districts and other unincorporated areas also pump domestic water from their private wells. **Table 3.4** summarizes domestic water demands for some of the major water users based on the most recent statistics. Table 3.5 is not a summary of all domestic water demands in the Madera Region.

Table 3.4: Domestic Water Demands

Area	Per Capita Usage (gal/day)	Annual Demand (AF/year)
City of Chowchilla	311	3,500
City of Madera	195	12,700
County Maintenance Districts and Service Areas	168	3,700
Unincorporated County Lands	168	1,400
Madera Irrigation District	168	2,200
Chowchilla Water District	168	600
Gravelly Ford Water District	168	20
	Total	24,100

The per-capita water usage values were obtained from the cities' Urban Water Management Plans, the 2008 Madera County IRWMP, and current water use and population statistics.

3.17 - Agricultural Water Demands

Cropping Data

Agricultural cropping data was collected to estimate agricultural water demands in the Region. The RWMG does not directly collect cropping data, but relies on data collected by other agencies. Cropping data was generally only available for the valley portion of Madera County, and cropping in the foothills and mountains is largely excluded from the data presented below. Several sources of cropping data were found including:

1. California Department of Water Resources (DWR) - Land Use Data
2. California Department of Conservation – Farmland Mapping and Monitoring Data
3. Madera County Agricultural Commissioner's office
4. USDA CropScape
5. Local Irrigation and Water District cropping records

The DWR Land Use Data is generally considered the most accurate and reliable source because the data are collected by trained staff who use a combination of aerial photographs and field verification. However, DWR surveys are only performed in each County about once every six years, and the most recent survey was performed in 2011. DWR data were also used in crop demand estimates in the 2008 IRWMP and can provide a meaningful comparison to changes

since that time. As a result, the 2011 DWR data were projected to 2013 based on historical cropping changes since 2003.

The Madera County Agricultural Commissioner's Office had 2013 cropping data, which are based on pesticide permit applications. These data are not field-verified, but are the most recent information available. The data do not include records for organic farms which do not require pesticide permits, but those cover a relatively small part of the County. Nevertheless, the larger organic farms and dairies were identified, and cropping was assumed to be similar to the year before they converted to organic operations.

Crop Water Demands in the Region

General land use in the Region is shown in **Figure 3-16**. The cropping data for this Figure was acquired from the Madera County Agricultural Commissioner's Office **(Appendix C)** and shows that almost 54% of the land is planted in permanent crops, while a total of 69% of the land is cropped. There is potential for further agricultural development since 21% of the land has not been developed at all.

Countywide cropping data for several years are shown in **Table 3.5**. DWR cropping data from 2011 were projected to 2013 based on average annual historical changes between 2003 and 2011. The estimated water demands correlate within 0.5% of those estimated using the 2013 data from the Madera County Agricultural Commissioner's Office.

Table 3.5: County-wide Cropping and Agricultural Water Demands

Year	Cropping Data Source	Acreage	Applied Water Demands (AF/year)
2003	DWR	314,800	1,010,000
2011	DWR	360,900	1,022,000
2013	DWR (projected)	372,600	1,050,000
2013	County Agricultural Commissioner's Office	357,700	1,044,000

The results show about a 5% increase in agricultural water demands from 2003 to 2013. The estimate uses the best available data on cropping and crop water demands.

The projected DWR data and the data from the County Agricultural Commissioner's Office show similar applied water demands, but the total acreage varies by approximately 4%. A review of the data shows that 2013 included a reduction in low-water-use crops, such as grains, and an increase in medium- and high-water use crops, including corn and truck crops, thus explaining the discrepancy.

Agricultural plantings have increased substantially in recent years. Much of the plantings have been tree crops that cannot be fallowed in dry years. In addition, the demand for certain crops, such as almonds, is very strong and may encourage planting of additional acreage.

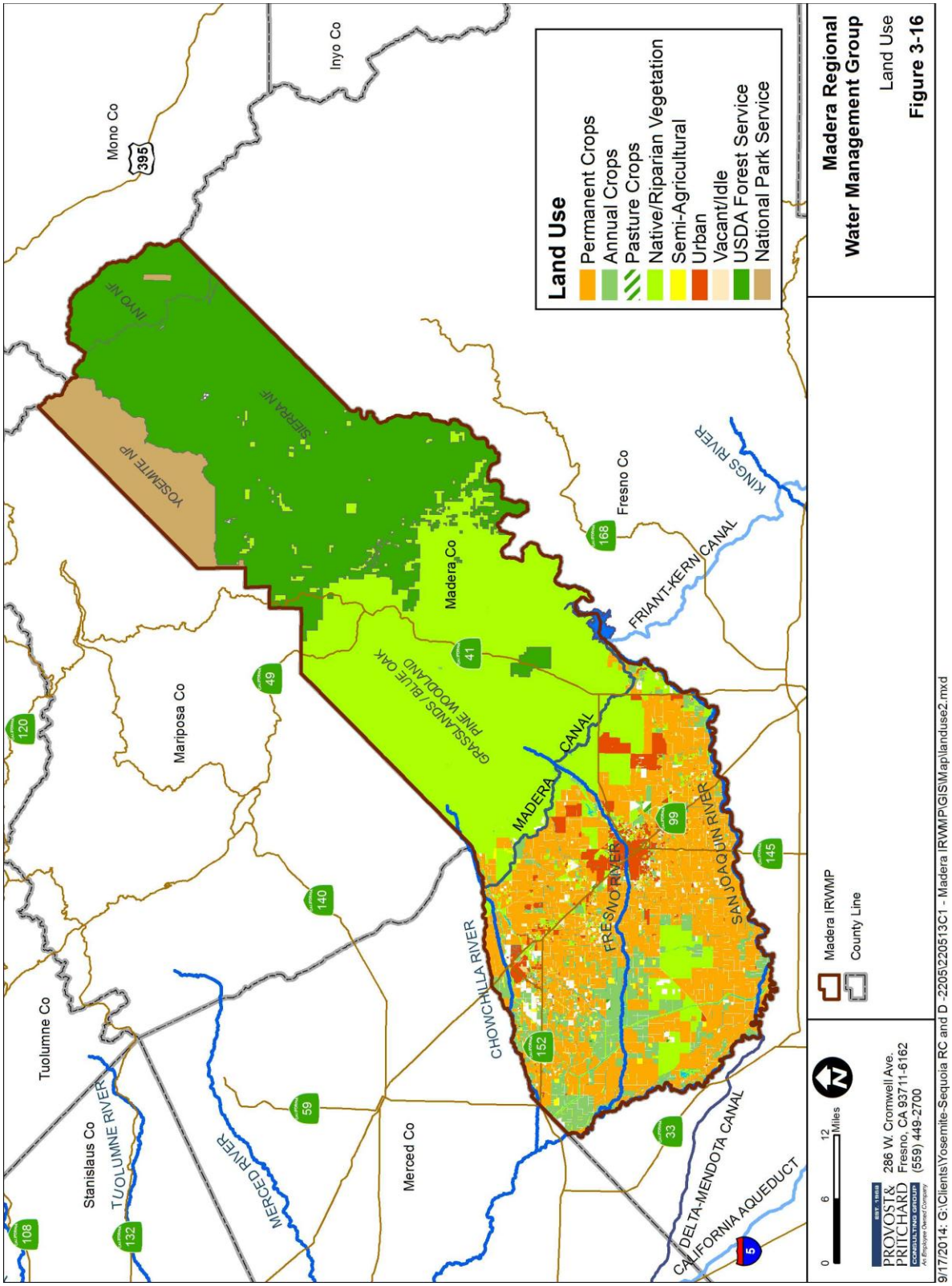

Figure 3-16 – Land Use

3.18 - Groundwater Quality

Groundwater quality within the Valley portion of the Region is generally good for both domestic supply and agricultural use. However, variations in groundwater quality mean some groundwater within the Region is unacceptable for domestic and even agricultural uses without treatment. Groundwater contamination can be a result of naturally occurring, point source contamination, and/or regional contamination. Some common elements of concern include dissolved salts (as measured by the specific conductance or electrical conductance [EC]), boron, manganese, arsenic, iron, hexavalent chromium, bacteria, uranium, and methane. In many cases, these are naturally occurring, but contamination could also be related to regional or point sources. Typical sources of anthropogenic contamination originate from gas stations, dry cleaners, high-density animal enclosures, applied fertilizers, leaky sewer lines, wastewater treatment plants, and septic systems.

Groundwater in the foothill and mountain portion of the Region is also of generally-acceptable quality for domestic and municipal uses without treatment, though many wells do require wellhead treatment to remove naturally-occurring iron, manganese, arsenic and uranium (gross alpha radiation) resulting from granitic decay.

Groundwater quality in the Madera, Chowchilla, and Delta-Mendota Subbasins were investigated as part of the Groundwater Ambient Monitoring and Assessment (GAMA) Priority Basin Project Program. The primary objective of the Priority Basin Project within the Madera-Chowchilla and the Western San Joaquin Valley (WSJV) study units, which included the Delta-Mendota and Westside subbasin, was to provide an assessment of water quality in the primary aquifer system. The assessments conducted in the Madera-Chowchilla and WSJV study relied on water-quality and ancillary data collected by the USGS from 35 wells during April–May 2008 for the Madera-Chowchilla study unit, 58 wells during March to July 2010 for the WSJV study unit, and water quality data reported in the the State's Division of Drinking Water (DDW) database (USGS, 2013). Analysis of the water quality data from these wells was used to characterize both spatial and depth dependent water quality trends.

Below is a general description of the water quality parameters selected for the characterization of the groundwater basins underlying the Region and in the hard rock wells of the foothill and mountain area. The selected constituents include arsenic, boron, specific conductance, manganese, and nitrate (as NO3).

Arsenic

Arsenic is a naturally occurring element commonly found in groundwater. Its presence in groundwater is a result of the dissolution of the element in sediments containing minerals containing arsenic. Exposure to arsenic above the DDW maximum contaminant level (MCL) can cause both short and long-term health effects. Long-term exposure to arsenic has been linked to cancer, while short-term exposure to high doses of arsenic can cause other adverse health

effects. The DDW has established a primary MCL of 10 micrograms per liter (µg/L) for arsenic, which was reduced from 50 µg/L in 2008.

Arsenic is found in numerous Valley areas. In addition, six districts in the mountains have water that exceeds the MCL, including MD6, Lakeshore; MD7, Marina View; MD8A, North Fork; MD 24, Teaford Meadows; MD43, Still Meadows; and MD46, Miami Creek Estates.

Boron

Boron is a necessary element for agriculture, but may become toxic to very sensitive crops in concentrations above 500 µg/L. For public drinking water systems, the DDW has established a notification level of 1,000 µg/L for boron.

Boron is found in some Valley areas, particularly to the west of the San Joaquin River, but has not yet been a constituent of concern in foothill and mountain wells.

Specific Conductance

Specific conductance is a measure of how effectively water will conduct electricity in units of both micromhos per centimeter (µmhos/cm) and microsiemens (µS/cm) per centimeter (which are analogous), and provides for the indirect measurement of the amount of dissolved salts in groundwater. Lower specific conductance values indicates less salt, while higher specific conductance values indicates more salt.

Applied irrigation water containing certain fertilizers, as well as water discharged from salt-regenerated water softeners, add salts to the hydrogeologic system, which increases the specific conductance of the groundwater. Elevated specific conductance values can also be attributed to naturally occurring brackish or saline water, such as geologic formations which are directly connected to a salt water body or where geologic formations were deposited under marine (salt water) conditions.

Elevated specific conductance levels are not present in the foothill and mountain wells but are relatively common around the Valley portion of the Region, particularly in areas where there have been long-term agricultural operations.

Manganese

Manganese is a naturally-occurring element found in rocks and minerals. Its presence in groundwater is a result of the dissolution of the naturally occurring element. In lower concentrations (below the secondary DDW MCL of 50 µg/L), manganese may cause aesthetic problems (odor or staining) for domestic and municipal uses, particularly in the presence of iron, but generally would not pose a health risk.

Elevated manganese levels have been observed in all areas of the Region, including wells in the foothills and mountains.

Nitrate (as NO3)

Nitrate (as NO3) is a contaminant which does not naturally occur in the subsurface. Elevated concentrations of nitrate are widespread in the San Joaquin Valley and have also been observed in wells in the foothill and mountain areas. The most common source of nitrate contamination is from improperly-operating septic systems and leach fields where inadequately-treated effluent is seeping into the shallow groundwater which is then pumped by wells which do not have adequate seals against shallow contamination. Other sources can include applied fertilizer, leaky sewer systems (including collection lines, storage ponds, and wastewater treatment plants) and high-density animal enclosures such as dairies.

The DDW has established a primary MCL of 45 mg/L for nitrate as NO3.

California Assembly Bill 1249

AB 1249, currently undergoing committee hearings in the California Legislature, would add to the requirements pertaining to water quality analysis in IRWMPs by adding the following:

> *If an area within the boundaries of an integrated regional water management plan has nitrate, arsenic, perchlorate, or hexavalent chromium contamination, the bill would require that the plan include a description of (1) the location and extent of that contamination in the region, (2) the impacts caused by the contamination to communities within the region, (3) existing efforts being undertaken in the region to address the impacts, and (4) any additional efforts needed to address the impacts.*

While this bill is not yet law and its requirements do not bind the Region in the preparation of this plan update, there are areas within the Region boundaries where these conditions exist, and these are addressed below to the extent information is available.

Nitrate contamination, at levels above or slightly below the MCL, has been observed in certain water wells in County Maintenance District 10A (MD 10A - Madera Ranchos). Nitrate is not currently a problem in MD 33 – Fairmead, but a current sewer feasibility study is being prepared as a proactive measure. In both cases, the water system consists of wells located within a relatively-densely populated area served by individual septic systems of unknown quality and specification. In both districts, nitrate levels have become higher over the past decade and are expected to continue to increase unless and until community sewers are installed.

Fairmead is currently conducting a feasibility study considering how they might either construct a local WWTF or construct a sewer collection system to connect to the existing WWTF in Chowchilla, five miles to the northwest. Once the study is complete and a recommended alternative selected, the district plans to apply for grant funds either through the IRWM program or another funding program to prepare plans and specifications for the preferred alternative and then to construct that project. Madera Ranchos is not currently taking any action to change their situation but is considering funding a feasibility study regarding a local

sewer collection system and WWTF. There is no other alternative of a nearby existing WWTF available to them.

3.19 - Species of Biological Significance

Numerous Environmental Impact Reports have been prepared within the Region, and all contain evaluations of sensitive biological species. In cases of projects in non-urban areas in the Valley, and in Foothill or mountain areas, the number of both flora and fauna species of concern often runs to the dozens. Not every project area has all the same species, so the total list of species of concern within the Region cannot be determined without a biological evaluation that is beyond the scope of this Report.

In terms of species commonly found which have had significant project impacts, the list is more compact. The following , while not exhaustive, is illustrative of the typical species encountered in the Region.

Table 3.6: Significant Biological Species

Common Name of Species	Notes
Valley elderberry longhorn beetle (VELB)	Found along waterways at elevations up to 1,800 feet MSL. Presence or potential presence requires protection of elderberry bushes, which provide the only known habitat for the VELB.
California tiger salamander (CTS)	CTS live near streams and waterways in the lower elevations, but are believed to hibernate over-winter (aestivate) at distances as great as 0.75 miles from their active habitat. Avoidance of active and aestivation habitats is the only acceptable mitigation of potential impacts.
Vernal Pool fairy shrimp	These small creatures inhabit ephemeral vernal pools and other stagnant waters within wetland habitats. Avoidance of habitat is the preferred mitigation, however some limited habitat creation has been permitted by the Army Corps of Engineers, the primary regulatory agency for this species.
San Joaquin kit fox	The current range of San Joaquin kit fox in Madera County includes an area North of Firebaugh and the Buttonwillow Slough. There have been a few scattered occurrences in other parts of Madera County on the valley floor. Generally San Joaquin kit fox use grasslands or open areas with scattered shrubs. They require friable, sandy soils for burrowing and a nearby prey base.

3.20 - Ecological Processes and Environmental Resources

The region is a complex ecological system, with many inter-related processes and significant resources. An important realization is that the forests and meadows of the mountain areas are significant and major contributors to both the surface- and ground-water resources in the valley area of the Region.

The higher-elevation mountain areas, particularly those above 8,000 feet mean sea level (MSL), store the vast majority of the snowpack that falls each year. The spring and summer snowmelt

feeds the rivers that run through the Region, and water percolating from the snowmelt feeds both the hard-rock aquifers that supply the foothill and mountain communities as well as the regional aquifers which underlie the Valley portion of the Region.

Regional Goal 8, Improve Watershed Management, deals directly with this important relationship. This goal includes promoting best management practices for range, forest and alpine lands to protect ecosystems thereby improving water supplies and water quality. It also includes preserving open space and natural habitats that protect and enhance water resources and native species. Identified objectives include managing forest density to increase surface runoff, managing vegetation to reduce fire risk, reducing erosion and sedimentation, and promoting natural water storage through meadow, stream, wetlands and floodplain restoration.

3.21 - Social and Cultural Makeup of the Region

Since the Region boundaries conform to the boundaries of Madera County, a discussion of the County's demographics provides an accurate representation of the Region as well. Located in the heart of the Central Valley, Madera County shares the low average household income and high unemployment rate characteristic of all Valley counties. Where 2010 Median Household income (MHI) in California was $60,772, in Madera County it was $41,976. The County has a poverty rate of over 23 percent, and the entire county, in addition to both cities and several unincorporated communities and Native American tribes are all designated as Disadvantaged Communities (DACs). Details of the Region's DACs are presented in Chapter 4 of this Report.

Madera County has a distinctive culture and social fabric apart from the DACs. Largely a rural area, it includes only two cities. Its economy is centered on agriculture, from farming and ranching in the Valley to open-range grazing and herding in the higher elevations. The County maintains a Right-to-Farm ordinance to protect legacy agricultural land uses from the impingement of development.

The mountain and foothill areas are equally rural, but are a culture separate from the Valley area. Mountain communities such as Coarsegold, Oakhurst, North Fork, Raymond and Ahwahnee are staunchly proud of their ability to survive in the face of difficult economic conditions and continue to protect their autonomy.

3.22 - Major Water-Related Objectives and Conflicts

The RWMG has established and prioritized water-related goals and objectives for the Region as part of preparation of this Plan update. These goals and objectives are set forth and discussed in detail in Chapter 5 of this Report. Nine goals are identified along with numerous supporting objectives, however the primary goals can be summarized.

For the Valley area, achievement of groundwater sustainability by 2024 is the overarching goal. It is the first goal listed in Chapter 5, and all the other listed goals will help achieve this most important goal of all. Achievement of this goal will be very challenging, since groundwater in the Valley portion of the Region is overdrafted by more than 200,000 AF/year according to the 2014 Madera Regional Groundwater Management Plan. No single stakeholder is likely to be unaffected by measures taken to secure this goal. Water use must be reduced all around the Region, and additional water supplies must be acquired. Both of these measures come with substantial costs that will be borne by all.

Foothill and mountain area goals are listed separately, with the first being to create practical, enforceable policies resulting in sustainable groundwater management. The challenge will be to bring together the separate, independently-minded communities of the foothills and mountains in a coordinated effort to improve water security for all. Again, this effort will come with costs that will have to be borne by the citizens of the Region. Developing and implementing effective and affordable measures acceptable to the majority will be key.

3.23 - Determination of Regional Boundary

The Madera Regional Water Management Group boundary was determined in accordance with the goal of creating agencies focused on water planning that would be beneficial throughout watersheds, across political boundaries, and in ways that previous planning efforts had not.

The RWMG boundary is the same as the boundary of Madera County. This boundary is obviously influenced by political borders, but is also logical because of its strong hydrologic basis, including the crest of the Sierras and major rivers forming most of the border.

The Madera RWMG takes in the watershed of the North Fork and Middle Fork of the San Joaquin River to the crest of the Sierra Nevada Mountains on the east (where a portion of the Region overlaps with the South Sierra RWMG planning area). It includes the watershed of the Fresno River, a major downstream tributary to the San Joaquin River, which joins the San Joaquin River on the Valley Floor in Madera County, a portion of the watershed of the Merced River, which joins the San Joaquin River on the Valley Floor in Merced County north of the Region, and a portion of the watershed of the Chowchilla River, which forms the northern boundary of the Region. Thus virtually all of the foothill and mountain area that drains to the Valley portion of Madera County is included within the RWMG boundary.

The Valley-area boundaries extend to the San Joaquin River on the south and west. The San Joaquin is unique in that the lands which drain to the river on the Valley floor are almost exclusively north of the river, in Madera County. There is a high bluff along most of the southerly edge of the river (the Fresno County side), substantial enough to direct drainage from the bluff top south into the Tulare Lake Basin. The San Joaquin River along the reach from Friant Dam to Mendota is therefore a natural boundary between RWMG areas, and not a central feature of a single area.

This boundary offers the opportunity for the RWMG to plan for improvements in water supply, storage and quality in the foothill and mountain areas which are the primary sources of water supply for the Valley portion of the region, allowing for application of resources from those most likely to benefit from improvements upstream to projects that would otherwise be outside of their reach were it not for the collaborative approach encouraged within the IRWMP program. As well, the RWMG brings together several agencies on the Valley floor who share a common interest in the quantity and quality of groundwater available within the local groundwater basin. Understanding that all such groundwater efforts should be coordinated between all interested stakeholders, the RWMG provides an effective vehicle for joint project efforts that would be impractical without it.

3.24 - Identification of Neighboring IRWM Efforts

Figure 3-17 shows the relationship of the Madera RWMG to its seven IRWM neighbors. Note that with the exception of approximately seven miles downstream of Friant Dam and fifteen miles centered on Mendota Pool, the entire RWMG boundary is contiguous with other IRWM efforts. The Madera RWMG boundary includes lands between the north edge of the watershed of the North Fork of the San Joaquin River and the Madera County line that are also included in the Southern Sierra IRWM planning area.

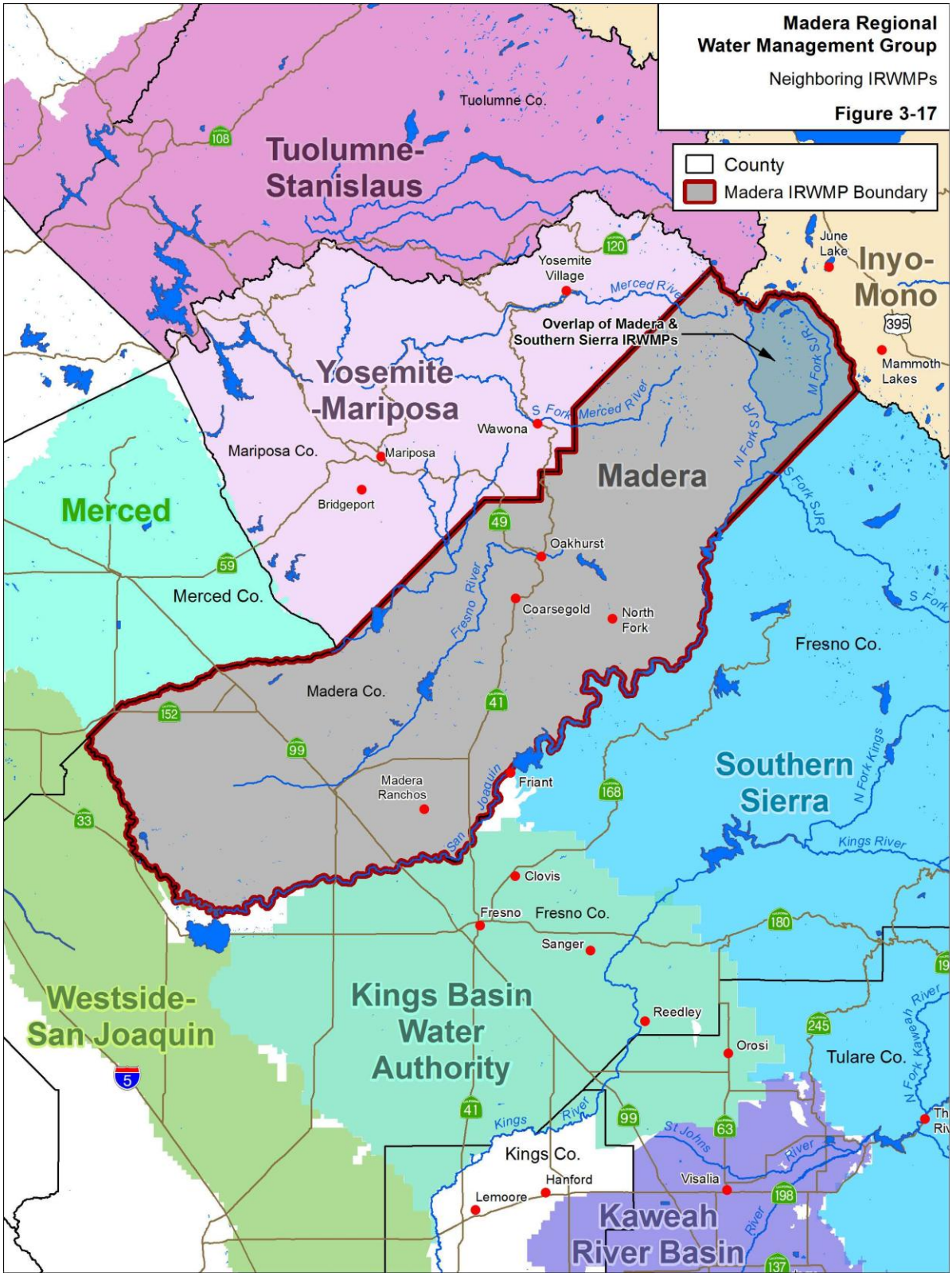

Figure 3-17 – Neighboring IRWMPs

The goals of coordinating with neighboring IRWMPs include the following:

- Reduce current and future conflicts among stakeholders
- Identify opportunities for regional or multi-agency projects
- Increase awareness of adjacent IRWMPs and their efforts
- Improve awareness of tribal, state and federal agency resources, plans and projects
- Effectively use regional technical expertise and knowledge
- Provide opportunities to advance public education

The various RWMG groups have made efforts to coordinate their boundaries as much as possible, and coordinate on water management planning. Inter-RWMG coordination efforts have included:

1. Email Lists. The Madera RWMG and all neighboring RWMGs are on each other's email distribution lists.
2. Start-up Assistance. The Madera RWMG assisted the other RWMGs in getting established, wrote letters of support, and provided copies of work performed to date so they could avoid 'reinventing the wheel'.
3. Letters of Agreement with neighboring RWMGs include:
    - Letter of Agreement on Region's Common Shared Areas – Southern Sierra RWMG
    - Letter of Agreement for Region's Common Boundary and Overall Cooperation and Collaboration – Merced RWMG
    - Letter of Agreement on Coordination and Communication between Regions – Yosemite-Mariposa RWMG
    - Letter of Agreement on Communication between Regions – Kings Basin Water Authority
    - Letter of Agreement – Devil's Postpile National Monument and Mammoth Mountain Ski Area – Inyo-Mono RWMG, Madera RWMG and Southern Sierra RWMG
    - MOU Regarding Coordination among Participants in the Sierra Nevada Water Workgroup
4. Representatives from the Madera RWMG frequently attend meetings for neighboring RWMGs
5. Roundtable of Regions. The Roundtable of Regions is an ad-hoc group of representatives from RWMG regions around the State. This group holds regular conference calls and occasional face-to-face summits.

6. Sierra Water Workgroup. The Sierra Water Workgroup (SWWG) helps coordinate and facilitate the efforts of 12 RWMG areas in the Sierra Nevada Mountains. Its mission is to assist regional efforts to protect and enhance water quality, water supply, and watershed health; to develop cooperative regional responses; and to facilitate investment in watersheds and water resources by all beneficiaries.

Chapter 15 of this Report further discusses coordination efforts with neighboring IRWM groups and their hydrological connections.

3.25 - Reliance on Delta Waters

The Region does not make use of Delta waters at this time, and none of the goals and objectives would change that status.

3.26 - Opportunities for Integration of Water Management Activities

The Region has numerous opportunities for integrating water management activities, as evidenced by the RWMG membership, existing infrastructure, and hydrologic basis for the RWMG boundaries. The RWMG includes most of the major water users in Madera County and is comprised of a diverse group of interests. This helps ensure that different types of projects will be integrated and developed. Existing infrastructure, such as flood bypass channels, major canals and monitoring systems, can help multi-agency projects to be realized. The Region especially benefits from including both the upper and lower watersheds for the three major rivers that provide water to the Valley. There are numerous opportunities to mitigate the upper watershed through projects that will improve forest health while also increasing water supplies and improving water quality for the downstream water users.

CHAPTER 4- DISADVANTAGED COMMUNITIES

4.1 - Introduction

Disadvantaged communities[1] are prevalent in the Madera Region and due to their economic disadvantages have many critical and unique water supply, water quality and wastewater issues and needs. The purpose of this chapter is to identify the Disadvantaged Communities in the Madera Region and highlight their needs. Specific topics that are discussed in this chapter include:

- Important Cultural/Social Values of the Region
- Tribal Government Involvement and Collaboration
- Economic Conditions/Trends of the Region
- Disadvantaged Communities within the Region
- Disadvantaged Community Issues & Barriers to Participation and Building Trusting Relationships
- Strategies to overcome barriers and promote increased involvement

4.2 - Important Cultural/Social Values of the Region

Like the rest of the San Joaquin Valley of California (Central Valley) the Madera Region is a predominantly agricultural area. The relatively less expensive land cost in the Central Valley contributes to it being one of the fastest growing areas in the State. Perpetual population growth in California and rising percentage of that growth occurring in the Central Valley is expected to make this region a leader in the growth rate over the next 20 years. This growth will test an already challenged region that is home to many of California's poorest communities.

Chronic high and seasonal unemployment has plagued Central Valley counties for more than three decades. Low per capita income and isolation from the economic engines of the coastal metropolitan areas between San Francisco Bay Area and San Diego have led to clusters of poverty in many of the smaller incorporated and unincorporated communities in the Central Valley, qualifying them as Disadvantaged Communities.

In these Disadvantaged Communities (while comprised typically of hard-working people, labor leaders, business leaders, and entrepreneurs collaborating to bring about change for the betterment of the region) economic advancements are often hampered by language barriers and limited levels of education. According to the 2010 census, between 20% and 25% of those

[1] The California Water Code (CWC) §79505.5(a) defines a Disadvantaged Community as being "a community with an annual median household income (MHI) that is less than 80 percent of the statewide annual MHI".

residing in the Central Valley counties were foreign-born compared to roughly 12.9% of all U.S. residents. Language barriers are also prevalent in this region. More than 40% of the people in this region speak a language in their home that is other than English, compared to approximately 20% nationwide. Relevant social and economic data is presented below in **Table 4.1**.

Table 4.1: Socio-Economic Information for Madera Region IRWMP

	Madera County	City of Madera	City of Chowchilla+
Population 2000	123,109	43,207	11,127
Population 2000 (Adjusted in 2010)	123,179	43,959	13,932
Population 2010 (July 1)	151,178	61,571	18,673
Population 2012 (July1)	152,235	62,575	18,044
Population Estimate 2013 (January 1)*	152,525	62,960	17,446
Population Estimate 2014 (January 1)*	153,897	63,008	18,971
Percent Population Growth 2013-2014*	0.9%	0.1%	8.7%
Median Age	33.2	27.2	36.3
Median Household Income (MHI)**	$47,937	$43,240	$41,373
MHI as % of State MHI ($ 61,400)**	78%	70%	67%
% of Total Workers Employed in Agriculture	38%	na	na

Sources: 2000, 2010, 2012 Census Data

* California Department of Finance County Population Estimates

** 2012 American Community Survey, U.S. Census. These incomes do not include prisoners or inhabitants of other group quarters such as nursing homes because they are not considered "households."

+ Population numbers for Chowchilla include populations at Valley State Prison (3,291) and Central California Women's Prison (3,651) facilities per Californian Department of Corrections data, 2012.[1]

4.3 - Tribal Government Involvement and Collaboration

Within the Madera IRWM Plan boundary there are two Federally recognized Native American tribes: the Picayune Band of the Chukchansi Indian Tribe and the North Fork Rancheria of Mono Indians. The North Fork Rancheria of Mono Indians is a signatory member of the RWMG.

[1] Offender Information Services Branch, Estimates and Statistical Analysis Section, Data Analysis Unit. Prison Census Data, As of December 31, 2012. Department of Corrections and Rehabilitation, Sacramento, California February 2013. Reference Number CENSUS1. Website accessed July, 2014: http://www.cdcr.ca.gov/Reports_Research/Offender_Information_Services_Branch/Annual/Census/CENSUSd1212.pdf

Income data for these Indian Tribes is not readily available from US Census or CA Department of Finance or other publicly available data bases. Nonetheless, the Tribes were included in this IRWMP's Disadvantaged Community Outreach Program.

4.4 - Economic Conditions/Trends of the Region

The economy of the Madera Region and Central Valley has been largely driven by agriculture and residential development since the second half of the twentieth century. Despite the relative success of the agricultural economies and urban growth, the Region's unemployment rate has remained among the highest in California. As noted previously, average wage levels are low due to the predominantly seasonal nature and low educational criteria of agricultural industry as a whole.

A stable and reliable long term water supply of appropriate quality in the region will need to be sustained into the future in order to allow the agricultural economy to continue to thrive and to invigorate more economic diversity. Water supply reliability and water quality are critical to maintaining the local economy in three primary sectors: jobs creation, economic diversification, and housing. Water districts, counties, cities, private sector, and other organizations will need to create good jobs at a faster rate than population growth and at proportionately higher average wage levels than in the past in order to help the region recover from the past mid-century and early current century recessions.

Jobs

Madera County, the City of Chowchilla and the City of Madera are working to create jobs, expand and diversify the economic base, and prepare the labor force for the changing global economy. Because there are often few non-agricultural employment opportunities in rural areas, proportionally higher income levels for agricultural employment is essential to reducing the economic disadvantages of the Central Valley communities. Therefore, one of the regional priorities is to strengthen the area's historical economic base of agriculture by expanding the region's job base supporting the agricultural industry. It is essential for the region's agricultural economy to remain at the cutting edge in crop selection, growing, packaging and processing practices and this will require adequate water supply and quality. Likewise communities in the foothill and mountain areas are also trying to develop the agricultural, tourism and natural resources economies.

Value-added food processing can become a much stronger industrial sector in the region, creating an increased number of well-paying jobs, but this can only occur with a sustainable supply of good quality water. Advances in harvesting and processing technology, disease and pest control, and marketing strategies have opened up new global markets for the Region's produce. At the same time, shifts in cropping patterns can have very positive impacts for employment opportunities. Shifts in consumer preferences have also created many new economic opportunities in agriculture. Demand for crops well beyond the current production levels is anticipated for the future.

Diversified Economic Base

As noted above, stable and reliable water supply is needed to improve economic stability, accelerate the pace of job growth, maintain the quality of life for residents in the region, and diversify the job base. Opportunities for diversification exist not only in the agricultural sector, but in both old and new industrial sectors. Industries such as metal fabrication and machinery that have emerged from the Region's historical agricultural economy are now heavily engaged in production of a wide range of components for the consumer economy. Newer business opportunities in areas such as information technology have also gained a foothold in the region. Further, as the content, volume and variety of agricultural output increases, opportunities for industries supporting agriculture also increase for everything from baling wire, to motorized vehicles and equipment, to packaging products and related manufacturing.

A diversified economy is critical in supporting the upward mobility of each successive generation. Historically, it has been the more recent immigrants to the region (whether from the Chinese in the 1880s and 90s, from the post-Civil War South in the 1900s, from Europe and the American Midwest in the 1930s, from Southeast Asia in the 1960s and 70s, or from Latin America over several decades) who have performed the field work that is so fundamental to the region's agricultural economy. Over time, each wave of immigrants is gradually replaced by the next, as second-generation immigrants find work in other sectors, or in different parts of the agricultural sector.

Every year, the Region plays hosts to millions of visitors, more than half of which come for recreation on public lands and waterways. As the region's economy diversifies, demand for business- and recreation- related travel will increase, with the need to develop more and better accommodations, amenities, and services.

Housing

Local governments must commit to providing appropriate programs to promote a variety of housing opportunities for all income groups, which is required to be codified in the Housing Element of their General Plan. This plan must contain policy to accommodate the Regional Housing Needs Allocation (RHNA) that is formulated at the state level, and distributed to the Council of Governments for local allocation.

Essential components of housing affordability in the Madera Region and thus, the ability of the County of Madera and Cities of Chowchilla and Madera to meet targeted RHNAs, are providing not only suitable quantity of water but also healthy quality of water. Development Impact Fees and monthly user fees are commonly the primary means of funding treatment and delivery/usage of suitable domestic water supplies by public or private water purveyors.

These water delivery and usage costs commonly constitute a higher percentage of the Disadvantaged Community household incomes and budgets. As a consequence the ability of local governments to meet their housing goals is directly affected. Often times the local government must subsidize the delivery/usage costs with local money or grant funds which are

generally not permanent. This problem is exacerbated in those Disadvantaged Communities who do not have community water systems and must rely on private wells. When groundwater supplies are, or become contaminated, homeowners are then compelled to spend money on bottled water or household treatment, due to the inability to afford to drill deeper wells to reach clean water. This brings the sum total of water expenses to levels exceeding $200 per month in some case in the Madera Region. Some Disadvantaged Communities are unable to afford alternatives to drinking contaminated water.

4.5 - Disadvantaged Communities within the Region

The California Water Code (CWC) §79505.5(a) defines a Disadvantaged Community as being "a community with an annual median household income (MHI) that is less than 80 percent of the statewide annual MHI". Relying on this definition and the most recently available Census data indicating the statewide annual MHI to be $57,385 means communities with MHI of less than $47,908 are considered a Disadvantaged Community.

Severely Disadvantaged Communities are defined in the California Water Code §13476(j) as those communities with a MHI less than 60% of the statewide MHI. Based upon the census numbers noted above, the threshold income to qualify for *Severely Disadvantaged Community* designation for the Madera Region is $34,431.

Table 4.2 lists the County Maintenance Districts, County Service Areas, City, and Private (DDW regulated) water, sewer, and/or storm drain service Districts that fall under the DWR definition of Disadvantaged Community or Severely Disadvantaged Community within the region. The table includes population and income data. **Figure 4-1** shows the general locations of these Disadvantaged Communities within the Madera IRWMP region.

Table 4.2: Madera Region Disadvantaged Communities

Location	Population	Median Household Income (MHI)*, **	% of State MHI*
State			
California	37,707,477	$57,385	100.0%
County			
Madera	153,025	$46,181	80.5%
Cities**			
Chowchilla+	18,044	$41,373	67.4%
Madera	62,575	$43,240	70.4%
County Service Areas (CSAs)			
CSA 1: Indian Lakes	1,175	$44,777	78.0%
CSA 3: Parksdale	1,188	$33,366	58.1%
CSA 5: Eastside Acres	297	$38,457	67.0%
CSA 21: Cascadel Woods (serves recreational facility only)	-	-	0.0%
County Maintenance Districts			

Location	Population	Median Household Income (MHI)*, **	% of State MHI*
No. 006: Lakeshore Park	130	$45,867	79.9%
No. 007: Marina View Heights	200	$45,867	79.9%
No. 008: Zone B: North Fork	264	$44,254	77.1%
No. 019A & B: Parkwood	1,240	$39,823	69.4%
No. 027: Gold Side Estates (sewer only)	334	$45,385	79.1%
No. 028: Ripperdan Self Help	48	$41,115	71.6%
No. 033: Fairmead District	568	$35,589	62.0%
No. 036: Eastin Arcola	150	$43,719	76.2%
No. 037A & B: La Vina	350	$36,571	63.7%
No: 046: Ahwahnee Country Club	300	$45,385	79.1%
No. 73A: Quartz Mountain	375	$44,777	78.0%
CPDH Regulated Water Systems			
Central Camp Water Company	176	$45,867	79.9%
Beashore Meadows	100	$45,867	79.9%
Mammoth Pool Mobile Home Park	60	$44,254	77.1%
Two Twenty Four Mobile Home Park	30	$44,254	77.1%
Minarets Work Center (Group Home)	30	$45,867	79.9%
John Hovannisian Water System	80	$44,254	77.1%
South Fork Mobile Home Park	50	$44,254	77.1%
Pomona Ranch Housing Center (Group Home)	361	$43,719	76.2%
Valley Teen Ranch (Group Home)	50	$43,719	76.2%
Rollin Wagon Trailer Club (MHP)	30	$37,118	64.7%
Hillview Water Co., Coarsegold	66	$44,777	78.0%
MUTUAL WATER COMPANIES			
Cascadel	300	$44,254	77%
Pike Ranch	75	$45,385	79%

* State MHI of $57,385 was derived from ESRI 2012 estimates to match all the Block Group Level data for each DAC listed, to determine percent of State MHI, except at the City level, which was not available from ESRI.

** Therefore, for the two Cities, the Census Bureau's American Community Survey 2012 estimate of $61,400 was used to calculate a percentage of State MHI. These incomes do not include prisoners or inhabitants of other group quarters such as nursing homes because they are not considered "households."

\+ Population numbers for Chowchilla include populations at Valley State Prison (3,291) and Central California Women's Prison (3,651) facilities per Californian Department of Corrections data, 2012.[1]

Severely Disadvantaged Community

[1] Offender Information Services Branch, Estimates and Statistical Analysis Section, Data Analysis Unit. Prison Census Data, As of December 31, 2012. Department of Corrections and Rehabilitation, Sacramento, California February 2013. Reference Number CENSUS1. Website accessed July, 2014: http://www.cdcr.ca.gov/Reports_Research/Offender_Information_Services_Branch/Annual/Census/CENSUSd1212.pdf

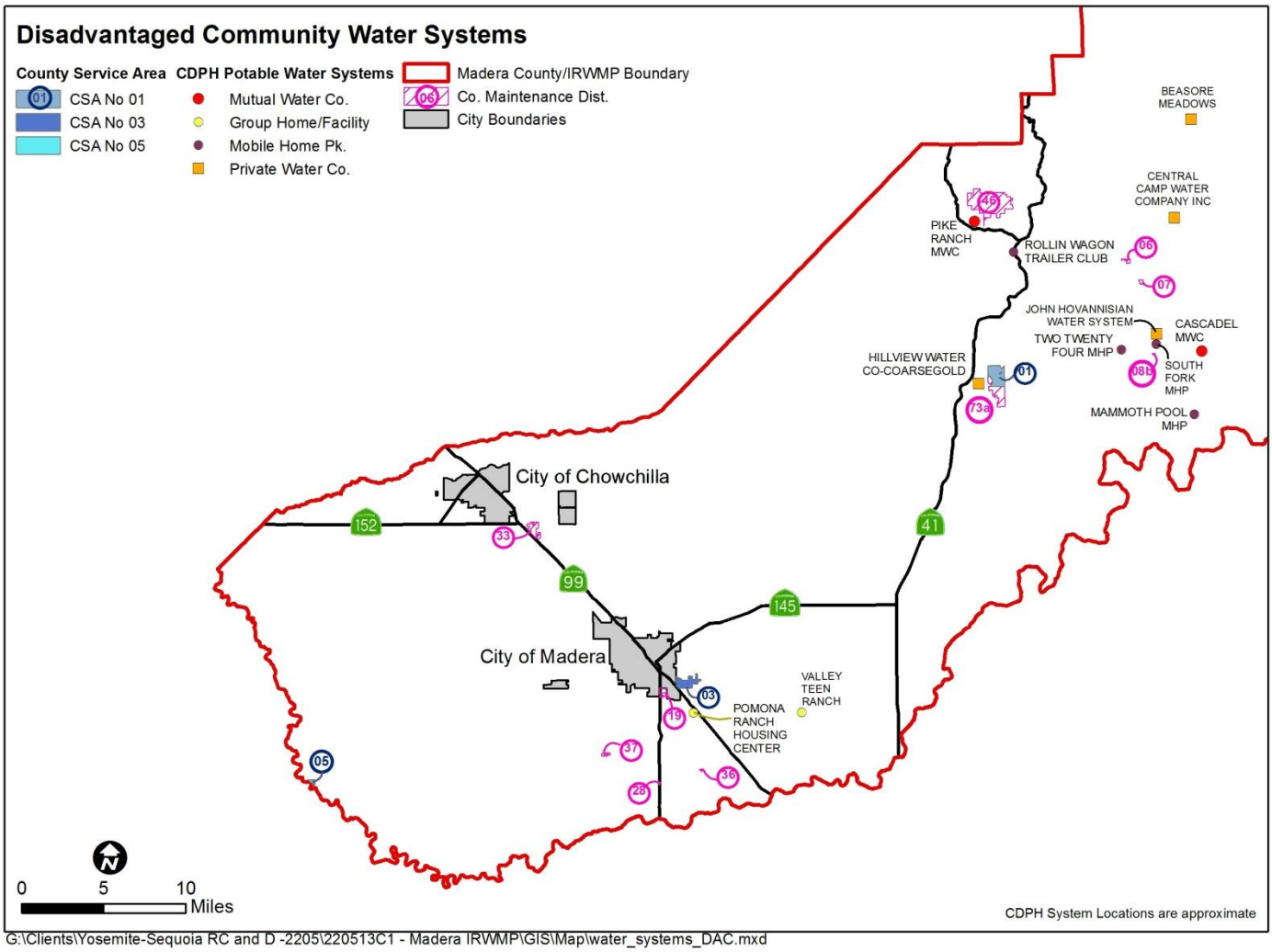

Figure 4-1 – Location of Identified Disadvantaged Community Water Service Systems

Small and Severely Disadvantaged Communities

Due to the lower income levels generally found in the San Joaquin Valley and the Madera Region, most communities meet the definition of a Disadvantaged Community. However, there is a significant difference in capacity between a large Disadvantaged Community such as the City of Madera with approximately 62,575 people and a small or severely disadvantaged community such as Fairmead or Parkwood (population of a few hundred). All disadvantaged communities have needs that should be recognized, but smaller communities may have greater disadvantages in terms of their ability to prepare competitive grant applications, participate in regional efforts, and stay apprised of technology and regulations.

The San Joaquin Valley is traditionally rural by nature, and although Valley cities are growing, the agricultural nature of the region ensures that much of the population remains dispersed throughout the vast expanse of the Valley. The region is peppered with tiny towns, often founded and still populated by farm workers, which can only continue to exist if their basic

infrastructure needs can continue to be met. Water is the most essential, and the most local, of these needs. The entities that provide domestic water service to rural towns (usually small special districts or mutual water companies) have very limited capacity. Operating a well and maintaining a simple distribution system is one thing, but when water treatment plants or other sophisticated improvements are needed, these systems' small size is crippling. They lack the economy of scale to spread costs over many users, and they often lack commercial or industrial users who could contribute revenues.

In addition to economy of scale, other unique challenges faced by small Disadvantaged Communities and Severely Disadvantaged Communities include:

- Geographic isolation, making consolidation challenging
- Low revenues and high delinquency rates
- Small or nonexistent reserve funds
- Dependence on a sole source of water
- Small pools of interested, informed individuals who can run the water systems and governing boards
- Lack of equipment and other resources
- Lack of access to technology in an increasingly technological world
- Limited ability to hire paid staff or consultants
- Isolation or exclusion from regional or state dialogue around water policy
- Lack of office space and record storage

Participation and Involvement of Disadvantaged Communities in IRWMP

The purpose of this section is to describe the involvement of the Disadvantaged Communities in the Madera Region IRWM planning process.

The Madera RWMG undertook proactive steps to ensure inclusion of the Disadvantaged Communities' needs and interests in the planning process of the IRWMP and in the regional project definitions. After the Disadvantaged Community representatives were identified, the Madera RWMG extended invitations to attend the RWMG meetings. Meeting minutes and educational materials were made available to the member representatives to help them become familiar with the Madera RWMG's efforts in developing the IRWMP. The opportunity to join the RWMG was also extended to interested Disadvantaged Communities. Because many Disadvantaged Communities did not have the ability to contribute monetary dues to the RWMG, a process was developed and adopted by the RWMG to encourage participation through a "DAC Group" (Disadvantaged Community Group) that was not asked to pay the standard RWMG annual dues.

To be a member of the DAC Group, the applying organization must, at minimum, adopt a "resolution of support" of the IRWMP. The resolution must be formally adopted by the

governing body or equivalent. (e.g., by a board of directors, or other management entity authorized to bind the entity). The Disadvantaged Community Group is recognized as a single voting entity for the purpose of governance of the full Madera RWMG. The DAC Group has one representative and one alternate representative on the RWMG.

The Madera RWMG utilized the services of a staff person from the Center for Collaborative Policy housed at California State University, Sacramento, to conduct outreach in several Disadvantaged Communities, to educate community members about the purpose of the IRWM process and importance of the Disadvantaged Communities' role in that process. Madera IRWMP Educational and Outreach meetings were held with: the Central Sierra Watershed Council in Oakhurst, with Fairmead Community & Friends, in Fairmead, and the City of Madera through a public study session with the Madera City Council. A copy of the presentation used is found in **Appendix D**.

At these meetings, attendees were canvassed as to their concerns and their opinions regarding issues faced by Disadvantaged Communities. Specifically, questions focused on adequate water availability and quality in Disadvantaged Communities, and participants were also asked to list projects that would be beneficial for their community to allay these concerns. These project ideas are listed in Section 4.3 - below.

Issues and Concerns Expressed at the Central Sierra Watershed Council Meeting:

1) DAC outreach requires time, persistence, creativity, and community specific knowledge
2) The RWMG should utilize unlikely outreach venues
3) There should be further research into alternative definitions of DACs
4) The below median-CA annual income does not always work in an area like ours
5) Promote DAC water system training, technical assistance, and capacity building – from state and local entities.
6) Create different grant proposal and grant administration requirements for the DACs
7) Investigate possibilities for water system consolidation
8) Develop realistic and adequate rate structures
9) The grant system under the IRWM program just does not work for DACs. Make it possible to create a separate grant system where DACs compete with each other, not with the larger areas and water systems.

Issues and Concerns Expressed at the Fairmead Community & Friends Meeting:

1) A second well to help keep the tank for the MD #33 full at all times (lately it's been running very low they said because the current well isn't producing like it used to).
2) Connection to a community sewer system (e.g. Chowchilla).
3) Recharge basin for co-use as a community park; also use for flood control for a portion of the community that has flood issues (with a curb and gutter project).
4) Conservation project: Low-flow fixture retrofits.
5) Extend MD#33 to include all of Fairmead.
6) Wells are running dry now.

From the Madera City Council Meeting:

1) Provide more education about personal water conservation practices and fixtures.
2) Continue to be as inclusive as possible.

Several Disadvantaged Communities have now joined the Madera RWMG. Additional organizations are continually being encouraged to join. The Disadvantaged Communities, as members of the RWMG, participated in the development of the Goals and Objectives for the IRWMP. Additional outreach efforts targeted under-represented communities that were unincorporated and included outreach to the two tribal nations.

4.6 - Disadvantaged Community Issues & Barriers to Participation

Aside from income level, the Disadvantaged Communities of the Madera Region have several significant obstacles to surmount in order to obtain sustainable safe drinking water supplies, provide sewer services and plan for flooding/stormwater related issues. Those obstacles include water quality, Technical, Managerial and Financial (TMF) Capacity, economies of scale, aging or inadequate infrastructure, and geographical location. Informal canvassing of Disadvantaged Community members also revealed the following concerns affecting participation in the IRWM process:

1.) Lack of computer technology to receive info. Disadvantaged Communities often prefer direct mailings and postings at Churches, Community Centers (Self Help has some at their multi-family developments, for example) and printed messages coming home with their kids from school. Those that have access to the internet will commonly spread information they receive by word of mouth.

2.) Method of presentation of information. Print material should not be overly technical, or overly wordy…keep it simple, use lay terms and graphical illustrations to help convey

essential message. Notices should be colorful or in other ways "attention grabbing". Water related notices, surveys, etc. should state boldly the material is IMPORTANT INFORMATION ABOUT WATER. Encouragement in the printed materials and verbal prompts from kids should read "Important: be sure and read!" (Otherwise they won't read it or will just throw it away.)

3.) Meetings are preferable following notices. Residents of Disadvantaged Communities prefer face-to-face contact rather than more impersonal written material. They prefer to attend meetings to ask questions and get additional detail. Being able to meet and build relationships with regulators and consultants face-to-face also builds more trust and helps them to feel less disenfranchised.

4.) Need known points of contact. Residents of Disadvantaged Communities like to have identified community leaders or agency representatives to whom they can express concerns, issues and questions about water by phone or personal contact; not by email, and from whom they can receive regular updates or information from.

5.) There's a lack of meaningful information on the drought reaching the Disadvantaged Communities. Residents of Disadvantaged Communities hear there's a drought, but they don't really understand what that means to them or how or in what ways it may be actually affecting their little community, and more importantly what can or will be done about it to help them. Good imagery that tells the story of how much groundwater levels are dropping, specifically in their community, not just averages county- or state-wide is more useful to them than lots of numbers or statistics. They are hungry to be educated but not with too much technical-speak that is over their heads.

6.) Not as concerned about quality as for availability of water. They know they should be concerned about quality if they get a notice that their water is bad or bordering bad. But they're not sure what to do when they experience declining quantities.

7.) Borderline Disadvantaged Communities still need help. There are many foothill communities in the Madera IRWM Region where average incomes are just above the threshold to be designated as DACs, but who need help with water issues nonetheless.

Water Quality

Occasionally, Disadvantaged Communities are issued "unsafe to drink" or "boil water" orders requiring the use of bottled water exclusively for consumption purposes. Many Disadvantaged Communities with small water supply systems in the region have a long and documented history of water quality issues including nitrate, uranium, arsenic, volatile organics and a variety of other constituents.

Some of the origins of contamination are naturally occurring, such as arsenic or uranium, which are common by-products related to the geology of the area. In other cases, origins of the contaminants are related to land use: point source and nonpoint source discharges from agricultural operations, food processing, dairies, and human wastes from failing or improperly maintained septic systems. The potential solutions are as varied as the contamination sources, and are difficult to standardize across multiple communities due to variables such as geographic location, local hydrologic conditions and chemistry, water system size, water source, and local preference. Solutions often include the following: drilling new or deeper wells, or modifying existing wells to access different parts of the aquifer; treatment facilities; source blending; consolidation in a variety of forms; or conversions to either community water or sewer services. Occasionally, cease-and-desist orders may be issued to individual polluters, but typically this is not an immediate solution since many types of pollution tends to persist long after the discharge stops.

Consumer Confidence Reports for County-operated drinking water systems (Maintenance Districts and Service Areas) are available at the County of Madera website[1]. Complete assessments for these systems can be found at the Division of Drinking Water web site.[2] These reports contain data from sampling results for detection of coliform bacteria, lead, copper, sodium and hardness, and contaminates with a *primary* drinking water standard and with a *secondary* drinking water standard. Some of the Consumer Confidence Reports indicate that while no contaminants exceeding current Maximum Contaminant Levels (MCLs) set by the State were found, the detailed assessments indicate potential for outside contamination sources most often related to local/nearby septic systems, sewer lines or wastewater treatment plants, agricultural chemical use or nearby land uses (e.g. automobile gas stations, landfills).

Technical, Managerial and Financial Capacity & Economies of Scale

Technical, Managerial, and Financial (TMF) capacity is an obstacle that Disadvantaged Communities across the country struggle with on a continual basis. TMF refers to the ability of a community to have Board leadership and personnel with the necessary technical and managerial skills to run the facilities, as well as community-wide financial wherewithal to afford the necessary steps required to obtain safe drinking water, provide sewer service or prevent flooding.

Due to financial constraints, it is often difficult, if not impossible, for a Disadvantaged Community to offer the competitive salaries required to maintain a skilled staff. However, due to the income levels within a Disadvantaged Community, water providers are extremely restricted in their ability to raise rates in order to provide for higher salaries. The result is a perpetual downward spiral where the Disadvantaged Community citizens continue to pay for

1 http://www.madera-county.com/index.php/maintenance-districts-and-service-areas-listing/annual-consumer-confidence-reports

2 http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/publicwatersystems.shtml.

services that can be substandard or virtually non-existent, and the water provider struggles to meet basic expenses; systems go into disrepair, often, ultimately failing, and then requiring an even greater magnitude of financial assistance to restore.

Economies of scale refer to the cost advantages that an enterprise obtains due to its relatively large size. Small Disadvantaged Communities often come out on the losing side of the economy of scale ratio. They shoulder many of the same costs for maintenance, permitting, pumping and staffing as any other water system would, but with a smaller, poorer customer base over which to spread the cost. In this situation, the smaller Disadvantaged Communities would often benefit from operating jointly with one or more other small Disadvantaged Communities or being absorbed into a larger nearby purveyor. Each Disadvantaged Community would then only be responsible for a smaller pro-rata portion of the staffs' salaries, operating costs, consultants cost, etc. By consolidating with other nearby Disadvantaged Communities or non-Disadvantaged Communities, they could potentially hire more skilled staff and solve a portion of the TMF capacity deficiencies.

Other TMF challenges for Disadvantaged Communities can include the inability to afford to hire an adequately skilled manager. Consequently system management often falls by default to volunteer Board members, or to an administrative person that lacks proper technical training or experience. Staff turnover, poor management and technical deficiencies can result from this situation. A small rate base also makes accumulation of reserves difficult. Small water systems often find themselves stuck in a "reactionary" operations cycle, continually focused on crises and putting out fires rather than planning ahead for capital improvements to the system. Some systems operate on a month-to-month basis like a family living from paycheck to paycheck.

These are only a few examples of the TMF challenges that Disadvantaged Communities cope with. Closer scrutiny of individual communities reveals unique situations that carry unique problems and unique solutions.

Geographical Location

As discussed previously, several of the issues associated with the Disadvantaged Communities can be solved by collaboration or consolidation with other nearby communities. However, many of the Disadvantaged Communities are geographically isolated or lack the "political mass" to negotiate with a larger nearby communities. There needs to be a motivation for collaboration or consolidation with all parties.

The efforts of the Madera RWMG are intended to provide a forum where Disadvantaged Communities and non-Disadvantaged Communities can come together to seek solutions to the regional water supply and quality issues, regardless of geography.

Aging or Inadequate Infrastructure

The water and wastewater infrastructure of many Disadvantaged Communities is substandard or aging. The communities often lack public drinking water infrastructure and rely on shallow,

inadequately constructed or sealed private wells or have old and severely leaking distribution systems that result in poor water pressure, bacterial contamination, and other drinking water challenges. Frequently, small Disadvantaged Communities lack meters and are therefore unable to monitor water use or implement conservation policies effectively. Many small Disadvantaged Communities also have inadequate or failing septic systems.

Summary of Issues in County Districts

This chapter does not provide details on each DAC in the region, but **Table 4.2** lists the issues at several of the County Districts. These serve as examples of common problems in local DACs.

Table 4.2 – Water Supply Issues in County Districts

		Number of Connections		Water Quality		Water Supply Issues		
District	Name	Existing	Ultimate	Primary MCLs	Contaminant	Max Daily Demand	Fire Flow	Single Source
MD-8A	North Fork	155	200	1	Arsenic	Yes	Yes	Yes
MD-19A	Parkwood	263	263			No	No	Yes
MD-19B	Parkwood	346	346			No	No	Yes
MD-24	Teaford	62	72	1	Arsenic	Yes	No	No
MD-28	Ripperdan	16	16			Yes	No	Yes
MD-33	Fairmead	168	237			No	No	Yes
MD-36	Eastin Arcola	20	22			No	No	Yes
MD-37	La Vina	172	174			Yes	No	No
MD-43	Miami Crk Knolls	27	27	1	Nitrate	Yes	No	No
MD-85	Valeta	19	20			No	No	Yes
CSA-03	Parksdale	510	556			Yes	Yes	No
CSA-3B	Parksdale	51	128			Yes	Yes	No
CSA-14	Chuckchanse	32	32			No	No	Yes

4.7 - Strategies to Overcome Barriers and Promote Increased Involvement

The Madera RWMG and Madera Region IRWMP plans to focus on continued outreach to the Disadvantaged Communities and encourage participation in the IRWM process, as well as support project development and implementation to accomplish water quality Goals and Objectives as part of the Madera Region plan. The Madera RWMG will produce an annual report, when deemed necessary, with an updated list of proposed projects in the region, which will include Disadvantaged Community projects that meet regional Goals and Objectives. To support this goal the Madera RWMG will be committed to continuing to encourage them to join the RWMG, fostering relationships with the Disadvantaged Communities, and maintaining an

updated list of the Disadvantaged Communities within the region and their primary contact information.

CHAPTER 5- GOALS AND OBJECTIVES

5.1 - Introduction

The Madera Regional Water Management Group (RWMG) has developed regional goals and measurable objectives to provide focus to their planning efforts. This chapter describes the adopted goals and objectives, the process for their development, methods of measuring success, and how the Region ranked and prioritized the goals. **Figure 5-1** illustrates the hierarchal relationship between a regional mission, goals, objectives, strategies, projects and funding.

Figure 5-1 – Goals and Objectives Hierarchy

Below are definitions of the terms found in **Figure 5-1.**

Regional Mission: Image or understanding of what the RWMG and its Participant Agencies will accomplish and what conditions in the IRWMP area will be like after all goals have been reached. The RWMG's Mission Statement is provided in Section 1.2 -.

Regional Goals: Desired outcomes on specific issues that support the Regional Mission. To the greatest extent practical, these goals should be specific, measurable, attainable, relevant and should have timelines attached. When goals are stated in this fashion, it is possible to know

when they have been reached. That is important so that the RWMG can accountably report progress toward achieving its Regional Mission.

Measureable Objectives: Measurable actions and methods for achieving the goals. A measurable objective can apply to more than one goal, and usually several objectives must be completed in order to fully realize a Regional Goal.

Resource Management Strategies: Land and water management strategies for achieving the Measurable Objectives and Regional Goals.

Project and Programs: Projects and programs that fit within the identified Resource Management Strategies and provide progress toward achieving one or more Measureable Objectives.

Funding: Internal and external funding to implement projects and programs.

This chapter discusses the Regional Goals and Measurable Objectives. Resource Management Strategies are discussed in Chapter 6 - Resource Management Strategies, proposed projects are discussed in CHAPTER 7 - Project Review Process, and funding alternatives are described in CHAPTER 11 - Financing.

5.2 - Goals and Objectives

The Regional Goals and Measurable Objectives for the Madera RWMG are summarized in **Table 5.1**, and are discussed in detail below. Goals are numbered in the table, and objectives are lettered below each goal. The goals and objectives are not listed in any specific sequence or priority in this table. Prioritization was addressed through a public survey that ranked the importance of each measurable objective.

The RWMG set separate goals and objectives for the Valley area and for the Foothill/Mountain area due to the distinct differences both in water sources and in felt needs. Some of the priorities of the Valley area are not as important in the mountain communities, and vice-versa. Rather than try to pit one sub-region against the other and create a Plan that is less than satisfactory to either, the Plan spells out the needs and perceived priorities of each sub-region. Doing so has allowed goals to be more fully realized and objectives made specific to each group, resulting in a Plan that is more clear and better suited to achieving the overall vision of the Madera RWMG.

Table 5.1: Summary of Goals and Objectives

Valley Goals

1 - Achieve groundwater sustainability by 2024 a. Increase regional capacity for direct recharge by 50,000 AF/Year b. Integrate flood/storm water conveyance infrastructure and regional irrigation system c. Expand CASGEM groundwater monitoring network to semi-annually measure regional groundwater on a per-aquifer basis d. Improve water reliability e. Expand water conservation efforts	**2 - Create independent local organization to manage groundwater resources** a. Determine most desirable form of organization and achieve buy-in from RWMG member agencies. b. Identify sources for ongoing operational funding for the independent local organization. c. Seek special legislation as required to create the chosen special district
3 - Expand Stakeholder Education a. Community education on water issues	**4 - Assure groundwater quality meets drinking and irrigation water quality standards** a. Identify problem areas b. Identify strategies to address chemical Constituents of Concern c. Propose projects to address waters which do not meet State Public Health Goals or irrigation standards
5 – Improve Flood Control and Protection a. Improve flood conveyance capacity b. Improve water storage capacity	

Foothill/Mountain Goals

6 - Create practical, enforceable policies resulting in sustainable groundwater management a. Determine strategies to enhance sustainability in foothill and mountain water supplies b. Develop policies to improve hard rock well sustainability and quantity c. Develop sources of surface water supply d. Implement water conservation policies to achieve the State's "20 x 2020" goal e. Fully utilize recycled wastewater from County-maintained districts and urban areas f. Develop and implement a comprehensive groundwater monitoring program by 2020	**7 - Improve water quality** a. Promote community awareness of potential water quality issues b. Protect source water areas

Proposed Foothill/Mountain Goals, continued

8 – Improve Watershed Management a. Manage forest density to increase surface runoff b. Manage vegetation to reduce fire risk and attempt to keep fires within their natural range of variability. c. Reduce erosion and sedimentation. d. Promote natural water storage through meadow, stream, wetlands and floodplain restoration.	**9 - Expand Stakeholder Education** a. Community education on water issues

Valley Goals

Goal No. 1: Achieve groundwater sustainability by 2024

This is really the over-arching goal of the entire IRWMP process. Madera County as a whole experiences groundwater overdraft currently calculated to be approximately 250,000 AF/year. This is calculated from the recently-approved Madera Regional Groundwater Plan (Provost & Pritchard, 2014) and the Root Creek Water District Groundwater Management Plan (Provost & Pritchard, 2012). All stakeholders recognize that this is not sustainable and equally recognize that the problem is of such magnitude that effective and lasting changes cannot be instantly implemented.

Achieving groundwater sustainability, which this report defines as limiting net groundwater use to not more than the natural recharge of the underlying aquifers, will require a coordinated and ongoing effort. The objectives are presented in order of desired implementation.

Objective 1a: Increase regional capacity for direct recharge by a minimum of 50,000 AF/Year. Current direct recharge capacity within the RWMG boundaries is limited to losses within canals and river channels and a number of basins operated by local water and irrigation districts. Several studies by members and stakeholders over the past decade have identified areas where direct recharge could be effectively used to replenish the deep aquifer, but to date funding limitations have precluded construction of any of these major facilities.

Land and facilities are only a part of the recharge challenge. Without water supplies, there is no recharge, so also included in this objective is expansion of the variety and volume of water supplies available to the Group members for recharge use. As a practical matter, firm water supplies are expensive and difficult to secure, so it is expected that this effort will focus on increasing the capacity to convey and retain high-flow supplies in the years when those are available.

Funding for both facilities and water supplies may come from grants, local operational funds, property assessments or other mechanisms selected by the Members and as discussed in more detail in the Chapter 11 - Finance. Local funding will be focused on a sub-regional basis on projects benefitting those supplying the funds.

Groundwater recharge will be an important part of achieving the goal of groundwater sustainability. Under this objective, the RWMG will identify potential sites for recharge facilities, water supplies that can be used for recharge, and funding opportunities.

Objective 1b: Integrate flood/storm water conveyance infrastructure and regional irrigation system.

Storm water remains an under-utilized resource within the RWMG area. The RWMG plans to develop the means and facilities to capture, retain and make beneficial use of storm water flowing through the region which is now lost to evaporation because it is impounded in areas with impermeable soils and does not effectively percolate to the groundwater. This may include construction of new retention/percolation basins sited in areas where percolation can reach the aquifer.

This objective may also include strategies to convey flood water into public irrigation canals to supplement surface water delivered from the San Joaquin River. All strategies will require compliance with NPDES regulations for storm water management.

Objective 1c: Expand CASGEM groundwater monitoring network to semi-annually measure regional groundwater on a per-aquifer basis.

Several of the RWMG members have been collaborating on an area-wide groundwater monitoring program since 2011. Known as the California State Groundwater Elevation Monitoring program, or CASGEM, this program was developed first in response to the requirements of SB 7x-7. The program is a solid start toward developing a more regional knowledge of groundwater conditions and has already generated useful data for the participating agencies.

There is, however, a need for greater data precision and integration as the RWMG moves toward management of the groundwater aquifer throughout the region. Semi-annual well monitoring will enhance the understanding of aquifer variations resulting from rainfall and irrigation pumping throughout the year. Integrating data on a per-aquifer and sub-regional basis will aid in creating specific sustainability parameters in each area of the RWMG's boundaries in a manner that is most equitable for all stakeholders. The regional monitoring program could be expanded to include additional agencies and monitoring entities.

Objective 1d: Improve Water Reliability.

Water is necessary for human consumption, personal hygiene and many economic activities in Madera County. Improved water reliability can allow agencies to meet peak demands, provide water supplies during power outages, maintenance and facility malfunctions, and provide minimum water supplies during droughts. This can be achieved by developing new water supplies, establishing a diverse portfolio of water supply options, securing outside water agreements to import water to the RWMG area, making greater use of floodwater supplies through surface and subsurface storage projects, and increasing redundancy in water systems.

Objective 1e: Expand Water Conservation Efforts.

There are limited water supplies in Madera County and stretching the existing water supplies is important. This can be achieved through water conservation by urban, industrial, commercial, landscape, municipal and agricultural water users. Urban water conservation can include many methods such as metering, public education, low-flow devices, ordinances, etc. Numerous methods are also available for agricultural water conservation such as tailwater recovery, spill prevention, metering, etc. The ultimate goal is to reduce consumption on a per capita or per acre water basis and achieve more with the same water supplies.

Goal No. 2: Create an independent local organization to manage groundwater resources

Several agencies within the RWMG area have legislative authority to regulate groundwater use within their boundaries, as a result of those agencies having adopted Groundwater Management Plans pursuant to AB 3030. The RWMG believes that the interests of all the members and stakeholders would be best served by creating a more regional, independent local organization vested with the power and resources to regulate groundwater resources within the RWMG boundaries.

This is a step short of actually adjudicating the basin. There are 22 adjudicated basins in California, where the courts has been asked to settle disputes over how much groundwater can rightfully be extracted. The courts have then determined an equitable distribution of water that will be available for extraction each year. In these adjudicated groundwater basins, the courts typically appoint a Watermaster to administer the court judgment. The RWMG is not in favor of pursuing adjudication of the basin at this time.

Objective 2a: Determine most desirable form of organization and achieve buy-in from RWMG member agencies.

This organization could take a number of forms, from a Joint Powers Authority (JPA) to several types of special districts formed under state law. The most obvious is a Groundwater Management District, which can be formed in non-adjudicated groundwater basins in California pursuant to special legislation. Currently there are 12 special districts in California charged with management of their local groundwater resources. Currently, a JPA Formation Committee has

been formed and is preparing a report on organizational options. The RWMG would like to be engaged by this Committee to offer input on the formation of a new organization.

Members have looked at several alternative organizational structures and are at this time most favorable to a Joint Powers Authority (JPA) for its ease and simplicity of creation and adequacy of authority. Numerous JPAs have been created for groundwater management within the State of California and the organizational agreements for those agencies will guide the RWMG in creating an amenable and effective agreement for use within this region.

Objective 2b: Identify sources for ongoing operational funding for the independent local organization.

Funding above and beyond what is currently available for the RWMG will be required to create and operate an independent groundwater management organization. While creation funding can come from one-time sources such as contributions and grants, operational funding will require on-going revenue streams that are secure and not subject to the votes of future agency boards of directors.

There is precedent in the RWMG for solicitation of one-time funds from member agencies. The RWMG itself is funded by the membership fees paid by the member agencies. It is possible that the member agencies would be willing and able to assess themselves again to finance the formation of an independent district. Work must still be done to create a budget for such activity, and at that time the feasibility of internally funding the creation can be better evaluated. Grant funding, however, is not sustainable or guaranteed and other funding sources will need to be developed.

Another revenue source for creation of the independent agency may be grant funding. This activity may be eligible under the Program Guidelines for the third round of Implementation Funding for the IRWM program, or from other funding sources yet to be identified. If that is the case, consideration will be given to including this project in any funding application the RWMG makes for those grants. Other grant funding sources will be explored as well, both as stand-alone funding and as potential matching funds for the IRWM implementation grants. Grant funding, however, is not sustainable or reliable, but can be effective for organization start-up or specific projects.

On-going funding might come from agency contributions or direct assessments on property owners within the independent agency's boundary. Ensuring the long-term sustainability of RWMG member contributions would be problematic given restrictions on binding future boards and councils to decisions made today. Imposition of property-based taxes or assessments would require compliance with state law and Proposition 218 requirements for elections and so would take effort to put in place as well, but would be a much more secure source of operational funding over the long term.

Objective 2c: Seek special legislation as required to create the chosen special district.

While this would be unnecessary if the RWMG chooses to create a JPA, if the group chooses to pursue a groundwater management district instead, that requires specific approval by the Legislature, which typically takes the form of special legislation carried by a local Assemblyman or state Senator. No work would be done toward this objective until a final decision is made to seek formation of a groundwater management district.

Goal No. 3: Expand Stakeholder Education

Implement strategies to raise stakeholder and citizen awareness of groundwater management issues including the magnitude of the challenge, potential mitigations, feasible projects, funding options, and consequences for failure to take effective action. This objective is critical to the success of other objectives, for many of the objectives require the support or at least the consent of the stakeholders and citizens throughout the RWMG plan area to be implemented.

Objective 3a: Community education on water issues.

Develop programs and resources for use by members in a variety of public educational settings. Subjects to be addressed will include description of the regional water situation, the seriousness and urgency of the problem at hand, how and why the situation has developed over time, how other areas within California have addressed similar situations, options for mitigation that have been identified locally, options for financing those mitigations, and potential consequences of failing to take timely and effective action. A focus of these efforts will be reaching out to the thirty disadvantaged communities identified in Madera County (see **Section 4.5**).

Numerous venues are available for public education. These may include:

- Presentations to agencies and organizations
- Service club and interest-group presentations
- Flyers and informational handouts
- Public Service Announcements to be released on radio, television or in the press
- Development of educational websites to be linked to member and other agency sites
- Other public outreach methods described in CHAPTER 14 – Stakeholder Involvement

Goal No. 4: Assure groundwater quality meets drinking and irrigation water quality standards

Certain areas within the RWMG boundaries, including both municipal and agricultural users, face water quality issues. These issues range from excessive TDS that makes irrigation less effective, to levels of contamination that exceed State Public Health Goals and Maximum Contaminant Levels for a variety of constituents of concern. Within the RWMG area, certain wells have needed treatment for nitrates, iron, manganese, arsenic, and high heterotrophic plate count (which leads to a “blue slime” in the water).

Objective 4a: Identify problem areas.

Map areas of the RWMG boundaries where quality issues have been identified. These maps will include extent of contaminant, the depth range where the contaminant has been found, and typical concentrations that have been found in groundwater.

Objective 4b: Identify Strategies to address chemical Constituents of Concern.

Once the extent of each contaminant is identified, the RWMG members will work together to identify common solutions for each constituent of concern, looking for ways to apply a common solution to a problem that may affect more than one member agency. Such solutions may include wellhead treatment, blending to improve quality, centralized treatment, and zone selection for new wells to avoid contaminated water altogether.

Objective 4c: Propose projects to address waters which do not meet State Public Health Goals or irrigation standards.

Improvement projects will be conceived to address problematic waters. These will include treatment projects but could also include alternatives for supplies that would eliminate the need to use a contaminated supply. These projects will be formalized and considered by the RWMG for including in future funding applications.

Goal No. 5: Improve Flood Control and Protection

Much of the valley is relatively flat and susceptible to flooding from various creek, sloughs and rivers. Recent history has shown that flooding can cause major damage in Madera County. Flood control and protection can be enhanced with building ordinances, water storage and flood conveyance. Climate change could also alter the timing, frequency and magnitude of flooding. A range of future conditions needs to be identified and new policies, programs and projects developed to accommodate the anticipated changes in flooding.

Objective 5a: Improve flood conveyance capacity.

Many sloughs, streams, flood bypass channels, irrigation canals and rivers convey flood flows in Madera County. Maintaining or increasing the capacity of these channels will allow some flood waters to pass through the County without causing flooding or damage. Greater capacity could also increase the ability to convey and deliver water to flood control and recharge basins. Land subsidence is believed to have reduced the capacity of some facilities. In addition, vegetation such as Arundo Donax has clogged some sloughs and reduced their conveyance capacity. Vegetation removal and eradication is a viable alternative to restore these facilities.

Objective 5b: Improve water storage capacity.

Increasing storage capacity can provide better re-regulation of water supplies and also conserve water for later use. Storage can be increased with new dams, raising existing dams, off-channel reservoirs, and groundwater recharge basins. Raising existing dams provides the greatest potential benefits in the IRWMP area. Recharge basins have lower ability to quickly capture flood flows, but are still considered effective and an important part of the overall strategy.

Foothill and Mountain Goals

Goal No. 6: Create practical, enforceable policies resulting in sustainable groundwater management

This is a task that will fall primarily to the County of Madera since there are no irrigation districts or other water management agencies with service areas extending into the foothill and mountain areas. While the County should take a lead role in tasks such as organizing stakeholder meetings and outreach into the communities, final decisions on policies will be brought back to the RWMG for discussion and approval in order to keep decision-making on policies affecting the region under a single body.

Objective 6a: Determine strategies to enhance sustainability in foothill and mountain water supplies.

In contrast to the large aquifer underlying the Valley portion of the RWMG area, water supplies for foothill and mountain users come almost exclusively from hard-rock wells. Nearly all stream and river supplies are controlled by Valley water interests who established appropriative water rights over a century ago. As a result, water management options in the foothill and mountain area are limited. Many actions that come to mind (i.e. forest thinning) would primarily enhance surface supplies rather than hard-rock supplies and would benefit Valley appropriators but not local users. Under this objective the members will work to identify viable and beneficial strategies to stabilize and enhance supplies from hard rock wells.

Objective 6b: Develop policies to improve hard rock well sustainability and quantity.

These policies may include enhancing supply to the hard rock aquifers, managing the number and size of extractions and other measures.

Objective 6c: Develop sources of surface water supply.

As discussed above, virtually all surface water in the area is controlled by long-time riparian and appropriative rights-holders. Actions under this objective must include a dual-pronged approach to possibilities for increasing surface runoff while at the same time negotiating with existing rights-holders to allow increases in surface water runoff, as a result of new practices, to be diverted by foothill and mountain users, so that those increases do not automatically accrue to the existing rights-holders.

Objective 6d: Implement water conservation policies to achieve the State's 20x2020 goal

SB7x-7, also known as the Water Conservation Act of 2009, set a goal of reducing per-capita water use by 20% by 2020. This is known as the State's 20x2020 goal. As with the Valley, achieving sustainability is a balance between increasing supply while reducing demand. This objective addresses the latter. Because of the nature of foothill and mountain development, characterized by native landscapes with little need for irrigation, the indoor/outdoor water demand balance in the foothill/mountain area is skewed farther to the indoor side. As a result,

implementation of effective indoor demand reduction measures will have a proportionally-greater impact on demand reduction here. Concerted efforts to replace traditional indoor water fixtures and older appliances with water-conserving fixtures and appliances conforming to the latest standards will be an effective tool for achieving demand reduction goals.

Objective 6e: Fully utilize recycled wastewater from County-maintained districts and urban areas.

In areas such as Oakhurst, where municipal wastewater treatment is available, the potential exists to make and utilize recycled water for outdoor irrigation of public spaces and landscaping. Doing so will require construction of additional WWTF facilities to treat at least a portion of effluent to Title 22 standards and construction of sufficient "purple pipe" recycled water distribution systems to serve eligible public spaces and landscape areas in these communities.

Objective 6f: Develop and implement a comprehensive groundwater monitoring program by 2020.

Groundwater monitoring is an effective tool to understand the change in underground storage of water, as well as gaining information about sources and flow directions of the underground. Groundwater monitoring is difficult in hard-rock aquifers, but understanding the current conditions as well as possible is important.

Goal No. 7: Improve Water Quality

Existing issues include certain wells with levels of arsenic, iron, manganese, nitrate, gross alpha radiation and uranium in excess of DDW Maximum Contaminant Levels. Each of these is a naturally-occurring substance, characteristic of water stored in decomposing granite aquifers. As a result, prevention of these contaminants is not possible. Objectives under this goal must focus on treatment and mitigation of these natural effects.

Objective 7a: Promote community awareness of potential water quality issues.

Since many wells in the foothill and mountain areas are private and serve only the property owner, quality testing requirements are less rigorous than those imposed on public water systems. Strategies under this objective should focus on the need for regular water testing and on the symptoms of contamination where those are observable by the user.

Objective 7b: Protect Source Water areas.

Identify source water areas for the local aquifers and determine feasible means to protect water supplies from contamination before the water enters the underground.

Goal No. 8: Improve Watershed Management

A large portion of the Madera IRWMP area includes wild watershed lands that hold the source waters used in large quantities for agricultural, urban, and environmental uses. This goal includes promoting best management practices for range, forest and alpine lands to protect ecosystems thereby improving water supplies and water quality. It also includes preserving open space and natural habitats that protect and enhance water resources and native species.

Objective 8a: Manage forest density to increase surface runoff.

Many forests in the IRWMP area have been modified from natural conditions. Lack of old growth trees allows greater sunlight and precipitation to reach the forest floor resulting in more dense forests. Thinning forests to reduce tree density and underbrush can increase runoff while having the ancillary benefit of reducing fire risks. Removal of exotic vegetation, that has higher water use than native vegetation, can also improve water supplies.

Objective 8b: Manage vegetation to reduce fire risk and attempt to keep fires within their natural range of variability.

Forest and brush fires can lead to erosive conditions that contribute soil, nutrients, debris and ash to water supplies. Local landowners can be educated and encouraged to reduce fire risk by using fire resistant and retardant landscaping. Land managers can reduce fire risk by creating strategic fuel breaks, conducting fuel treatments and forest restoration, thinning underbrush, and allowing low-intensity fires to consume accumulated fuel.

Objective 8c: Reduce erosion and sedimentation.

Excessive erosion and sedimentation can negatively impact wetlands, water courses and storage capacity of reservoirs. Several measures can be taken to reduce erosion and sedimentation including slope stabilization, road maintenance and decommissioning, grading and drainage improvements, and best management practices during construction.

Objective 8d: Promote natural water storage through meadow, stream, wetlands and floodplain restoration.

Natural features such as streams, meadows, wetlands and floodplains have been impacted and their ability to store water has been reduced. Restoration projects can help restore the natural habitat conditions, while simultaneously restoring natural hydrologic functions. Restoring these features can help to regulate water and reduce peak flows.

Goal No. 9: Expand Stakeholder Education

Implement strategies to raise stakeholder and citizen awareness of groundwater management issues including the magnitude of the challenge, potential mitigations, and consequences for failure to take effective action.

Objective 9a: Community education on water issues.
See Objective 3a under Valley Goals. Similar objectives and strategies will apply in the Foothill/Mountain area.

5.3 - Process to Develop Goals and Objectives

Water is used by a diverse group of stakeholders in the Madera Region for a variety of needs including municipal and industrial, agriculture, hydropower, and environmental flows. Water management issues for the region are broad and include water supply, water quality, flood management, environmental stewardship, regional self-sufficiency, and infrastructure development. This wide spectrum of water users and issues challenges water managers in the region. The regional goals expressed in this Plan were created to address the entirety of the Region's water management needs, issues and conflicts.

The regional goals and measurable objectives were established through a collaborative process that included meetings, stakeholder surveys, public workshops, and open discussions. This process included several iterations from 2006 through 2014. The groups involved included the Regional Water Management Group and the general public. The process produced several lists of issues, conflicts, potential goals and objectives in the region. The information in **Chapter 3- Region Description** and **Chapter 6 – Resource Management Strategies** was used extensively in developing the Goals and Objectives. These were combined into the final list of regional goals and measurable objectives found in this Plan. The final list was reviewed and approved by the RWMG in the form of a Draft Goals and Objectives Chapter and then subsequently with approval of the IRWMP.

5.4 - Methods for Measuring Objectives

The guidelines set forth by DWR require that each objective supporting a regional goal include success measures, which may either be qualitative or quantitative depending upon the nature of the goal itself. Success measures will be used to help determine if objectives are achieved. These monitoring activities will be used for the following purposes:

1. Document success in RWMG annual reports
2. Document information needed in progress reports for implementation grants
3. Document overall success of the RWMG in efforts to secure additional grant funds
4. Provide information to RWMG members for evaluating progress and priorities to achieving regional goals

Table 5.2 summarizes how objectives will be measured. These are merely suggestions for RWMG stakeholders. Actual monitoring metrics will need to be determined for specific projects when they are implemented.

Table 5.2: Measurement Criteria for the Objectives of the MIRWM Plan.

No.	Objective	Methods for Measurement
1a	Increase regional capacity for direct recharge by a minimum of 50,000 AF/Year	• Number of groundwater recharge facilities in operation • Number of acres developed for intentional recharge • Number of acre-feet of water available for recharge use • Number of acre-fee of water actually diverted for recharge use • Quantity of groundwater irrigation replaced by imported surface water irrigation (in-lieu recharge) • Quantity of potential recharge water lost to evaporation in recharge facilities
1b	Integrate flood/storm water conveyance infrastructure and regional irrigation system	• Number of projects integrating flood/storm and irrigation system conveyance completed • On-going evaluation of remaining opportunities to integrate flood/storm and irrigation system conveyance
1c	Expand CASGEM groundwater monitoring network to semi-annually measure regional groundwater on a per-aquifer basis	• Number of monitoring well sites in operation • Number of monitoring wells for which a well log is available • Number of member and affiliate agencies participating in the monitoring program • Number of wells being monitored and reported twice annually
1d	Improve water reliability	• Number of water reliability projects implemented • Increase in dry year water supply in acre-feet • Number of acres/people with improved water reliability
1e	Expand water conservation efforts	• Number of acre-feet of water conserved • Number of water conservation projects implemented
2a	Determine most desirable form of organization and achieve buy-in from RWMG member agencies	• Completion of internal report on available organizational options • Completion of member vote on most desirable form of organization
2b	Identify sources for ongoing operational funding for the independent local organization	• Report to IRWMG summarizing funding options for the independent local organization
2c	Seek special legislation as required to create the chosen special district	• Identify local Assemblyman • Complete Special Legislation bill • Assemblyman introduces special legislation in the Assembly
3a, 9a	Community education on water issues	• Number of new programs • Number of days of educational activity provided • New materials and dissemination
4a	Identify problem areas	• Number of water quality studies • Number of problem areas identified and characterized

No.	Objective	Methods for Measurement
4b	Identify strategies to address chemical constituents of concern	• Number of water quality studies • Number of projects implemented to improve water quality
4c	Propose projects to address waters which do not meet State Public Health Goals or irrigation standards.	• Number of projects implemented • Number of projects completed that mitigate water quality violations
5a	Improve flood conveyance capacity	• Number of projects completed • Miles of channels improved • Total increase in conveyance capacity in cfs
5b	Improve water storage capacity	• Number of storage projects completed • Additional acre-feet of storage capacity developed
6a	Determine strategies to enhance sustainability in foothill and mountain water supplies	• Number of local stakeholder meetings to discuss strategies and recommend to IRWMG • IRWMG adopts foothill/mountain water supply sustainability strategies
6b	Develop policies to improve hard rock well sustainability and quantity	• Number of local stakeholder meetings to discuss strategies and recommend to IRWMG • IRWMG adopts foothill/mountain hard rock well sustainability strategies
6c	Develop sources of surface water supply	• Number of meetings with Valley-based water rights-holders • Number of local stakeholder meetings to discuss strategies and recommend to IRWMG • IRWMG adopts foothill/mountain surface water enhancement strategies
6d	Implement water conservation policies to achieve the State's 20x2020 goal	• Number of local stakeholder meetings to discuss strategies and recommend to RWMG • Number of outreach meetings with foothill/ mountain water purveyors • IRWMG adopts foothill/mountain water conservation policies
6e	Fully utilize recycled wastewater from County-maintained districts and urban areas	• Identify and contact foothill/mountain Publicly Owned Treatment Works operators • Number of outreach meetings with identified POTW operators • Number of potential recycled water projects identified • Quantity of potential recycled water to be produced in identified projects

No.	Objective	Methods for Measurement
6f	Develop and implement a comprehensive groundwater monitoring program by 2020	• Number of local stakeholder meetings to discuss strategies and recommend to RWMG • Number of potential groundwater monitor wells identified • Percentage of identified wells committed to a monitoring program • Number of semi-annual monitoring reports prepared
7a	Promote community awareness of potential water quality issues	• Number of new programs • Number of days of educational activity provided • New materials and dissemination
7b	Protect Source Water areas	• Number of local stakeholder meetings to discuss strategies and recommend to IRWMG Number of source water areas identified • Percentage of source water identified • Number of source water protection projects and programs identified
8a	Manage forest density to increase surface runoff	• Area of forest thinned • Estimated volume of increased runoff
8b	Manage vegetation to reduce fire risk and attempt to keep fires within their natural range of variability.	• Number of projects completed • Area of land managed to reduce unnaturally large fires • Number of acres of fuel breaks
8c	Reduce erosion and sedimentation	• Amount of development that is relocated away from sensitive areas • Acreage of protected lands • Number of properly employed sediment/erosion BMPs • Number of studies evaluating land use and erosion/sedimentation
8d	Promote natural water storage through meadow, stream, wetlands and floodplain restoration.	• Number of meadows, wetlands, streams or floodplains restored • Number of acres/miles of areas restored. • Water temperatures pre-and post restoration • Groundwater level change • Number of special status species' habitat improved in restored areas • Number of acre-feet stored or delayed in runoff

5.5 - Goal and Objective Ranking

The regional objectives under each goal were ranked according to a survey of local stakeholders. The nine broad regional goals were not ranked and are considered co-equal by the RWMG.

The survey was sent to the RWMG members and all 85 contacts on the RWMG's email list. Respondents were asked to rank each objective as Low (1), Medium (2) or High (3) importance. Specific definitions for these categories were not provided because they are already basic and descriptive. The results of the survey are shown in **Table 5.3.** Detailed results are provided in **Appendix E**.

The survey was completed by twelve stakeholders and included a diverse range of participants including local farmers, concerned citizens, watershed groups, Native American tribes, non-profit organizations, disadvantaged communities, water districts, irrigation districts, and County government. Three participants did not state their affiliation. Some stakeholders only completed a portion of the survey, typically just the Valley goals or just the Foothill/Mountain goals

The sample size is not considered large enough to form strong conclusions but the results are still useful. The average importance for 26 out of 27 goals fell within Medium and High importance (2 to 3), indicating that almost all the objectives are considered important. Out of all the individual votes, 92% were Medium or High importance

The highest priority objectives relate to groundwater recharge, water reliability and stakeholder education. These survey results are provided for informational purposes and to help set focus and goals. The results may or may not be used in selecting which projects should be included in grant applications or supported by the RWMG.

Table 5.3: Results of Survey - Ranking Regional Objectives

No.	Objective	Low	Medium	High	Ave
1a	Increase regional capacity for direct recharge by 50,000 AF/Year	0	2	12	2.86
3a	Community education on water issues (Valley)	0	3	11	2.79
1d	Improve water reliability	0	3	11	2.79
9a	Community education on water issues (Foothills and Mountains)	0	3	9	2.75
2a	Determine most desirable form of groundwater mang. org. and achieve buy-in from RWMG	1	2	11	2.71
5b	Improve water storage capacity	1	2	11	2.71
7b	Protect source water areas	0	4	8	2.67
1e	Expand water conservation efforts	0	5	9	2.64
6c	Develop sources of surface water supply	0	5	7	2.58
6f	Develop and implement a comprehensive groundwater monitoring program by 2020	0	5	7	2.58
4a	Identify (water quality) problem areas	2	2	10	2.57
2b	Identify sources for ongoing operational funding for the independent local organization.	0	6	8	2.57
8a	Manage forest density to increase surface runoff	1	4	7	2.50
7a	Promote community awareness of potential water quality issues	0	6	6	2.50
8d	Promote natural water storage through meadow, stream, wetlands and floodplain restoration.	1	4	7	2.50
4b	Identify strategies to address chemical Constituents of Concern	1	6	7	2.43
8b	Manage vegetation to reduce fire risk and keep fires within natural range of variability	2	3	7	2.42
6a	Determine strategies to enhance sustainability in foothill and mountain water supplies	1	6	6	2.38
1c	Expand CASGEM groundwater monitoring network	1	7	6	2.36
6d	Implement water conservation policies to achieve the State's 20x2020 goal	1	6	5	2.33
4c	Propose projects to address waters which do not meet State Public Health Goals	2	6	6	2.29
5a	Improve flood conveyance capacity	2	7	5	2.21
1b	Integrate flood/storm water conveyance infrastructure and regional irrigation system	2	7	5	2.21
6b	Develop policies to improve hard rock well sustainability and quantity	2	6	4	2.17
6e	Fully utilize recycled wastewater from County-maintained districts and urban areas	3	4	5	2.17
8c	Reduce erosion and sedimentation.	3	6	3	2.00
2c	Seek special legislation as required to create the chosen special groundwater management district	4	6	3	1.92
	Total	**30**	**126**	**196**	
	Percent	**8%**	**36%**	**56%**	

Notes: Valley objectives are numbered 1 to 5 and shown in green text; foothill/mountain objectives are numbered 6 to 9 and shown in brown text

CHAPTER 6- RESOURCE MANAGEMENT STRATEGIES

6.1 - Introduction

A resource management strategy (strategy) is defined as a project, program, or policy that helps local agencies and governments manage their water and related resources (DWR, 2013 California Water Plan Update). Resource management strategies include structural and non-structural solutions. Structural solutions involve development of capital facilities such as conveyance structures (pipelines or canals), recharge ponds, and water treatment plants. Non-structural solutions are programmatic or policy solutions, such as drought response plans or water conservation ordinances.

The 2013 California Water Plan Update describes 36 different resource management strategies. The State does not expect that all strategies be practiced in every region, but encourages water managers to employ as many strategies as practical to diversify their water management portfolio. This Integrated Regional Water Management Plan (IRWMP) evaluates all 36 strategies listed in the 2013 California Water Plan Update, including a strategy on Drought Planning added by the Madera Regional Water Management Group. The evaluations include the following:

- Description of the strategy
- Discussion of current use in the Madera Region
- Evaluation of applicability in the Madera Region
- Constraints the strategy may place on development
- Impacts of climate change on the effectiveness of the strategy
- Potential flexibility of strategy applications to adapt to climate change

The 37 State strategies were evaluated through an open and transparent process by the RWMG and interested parties, in accordance with the criteria listed above.

Table 6.1 shows the evaluated strategies and their applicability to the Madera Region in the Valley area and the foothill/mountain area. Thirty three of the strategies are currently applicable to some portion of the IRWMP area. Those that are not currently applicable will be periodically re-evaluated as part of the IRWMP's adaptive management strategy.

Table 6.1: Resource Management Strategies

Category	Strategy	Applicable to Valley Area	Applicable to Foothill/ Mountain Area
Reduce Water Demand	Agricultural water use efficiency	X	
	Urban water use efficiency	X	X
Improve Operational Efficiency and Transfers	Conveyance — Delta		
	Conveyance — Regional/Local	X	
	System Reoperation		
	Water Transfers	X	
Increase Water Supply	Conjunctive Mang. & Groundwater Storage	X	
	Desalination (Brackish and Sea Water)	X	
	Precipitation Enhancement		X
	Recycled Municipal Water	X	
	Surface Storage — CALFED		X
	Surface Storage — Regional/Local	X	X
Improve Flood Management	Flood Management	X	
Improve Water Quality	Drinking Water Treatment and Distribution	X	X
	Groundwater/Aquifer Remediation	X	
	Matching Water Quality to Use	X	X
	Pollution Prevention	X	X
	Salt and Salinity Management	X	
	Urban Stormwater Runoff Management	X	
Practice Resource Stewardship	Agricultural Land Stewardship	X	
	Ecosystem Restoration	X	X
	Forest Management		X
	Land Use Planning and Management	X	X
	Recharge Area Protection	X	
	Sediment Management	X	X
	Watershed Management		X
People and Water	Economic Incentives	X	X
	Outreach and Engagement	X	X
	Water and Culture		X
	Water-Dependent Recreation	X	X
Other	Crop Idling for Water Transfers	X	
	Dewvaporation & Atmospheric Pressure Desal.	X	
	Fog Collection		
	Irrigated Land Retirement	X	
	Rain-fed Agriculture	X	
	Waterbag Transport/Storage Technology		
	Drought Planning	X	X

Following is a general description of each strategy and its use in the Madera Region. Refer to the draft 2013 California Water Plan Update for further detail on each strategy.

6.2 - Reduce Water Demand

Agricultural Water Use Efficiency

Agricultural water use efficiency has received a great deal of attention both by the County and the member irrigation/water districts as growers have been encouraged to move from flood irrigation to sprinklers and then to drip and micro-spray systems. Irrigation efficiency can be further improved through a variety of measures which can feasibly be taken by the governing irrigation or water district, and/or by local growers. The 2013 California Water Plan Update lists 16 Efficient Water Management Practices (EWMPs) including:

Critical EWMPs:

- Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of California Water Code Section 531.10 and to implement rates based on volume used.
- Adopt a pricing structure for water customers based at least in part on quantity delivered.

Other EWMPs:

- Facilitate alternative land use for lands with exceptionally high-water duties or whose irrigation contributes to significant problems including drainage.
- Facilitate use of available recycled water that otherwise would not be used beneficially, meet all health and safety criteria, and do not harm crops or soils.
- Facilitate the financing of capital improvements for on-farm irrigation systems.
- Implement an incentive pricing structure that promotes one or more of the following goals:
    a. More efficient water use at the farm level
    b. Conjunctive use of groundwater
    c. Appropriate increase of groundwater recharge
    d. Reduction in problem drainage
    e. Improved management of environmental resources
    f. Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions
- Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage.
- Increase flexibility in water ordering by, and delivery to, water customers within operational limits.
- Construct and operate supplier spill and tail water recovery systems.

- Increase planned conjunctive use of surface water and groundwater within the supplier service area.
- Automate canal control structures.
- Facilitate or promote customer pump testing and evaluation.
- Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.
- Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following:
    A. On-farm irrigation and drainage system evaluations.
    B. Normal year and real-time irrigation scheduling and crop evapotranspiration information.
    C. Surface water, groundwater, and drainage water quantity and quality data.
    D. Agricultural water management educational programs and materials for farmers, staff, and the public.
- Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.
- Evaluate and improve the efficiencies of the supplier's pumps.

Regulated deficit irrigation can also help to reduce water demands, especially in years when water supply is limited. Regulated deficit irrigation requires intensive monitoring. More information is provided in the 2005 California Water Plan Update (pages 4-207 to 4-210).

Anti-transpirants (chemicals applied to foliage that reduce plan transpiration) may hold promise for conserving water in the future. Currently they are commercially available and used in gardens, nurseries, on cut flowers and on Christmas trees. Use on large-scale agriculture is still experimental and has several obstacles to overcome, including potential reduction in crop yields, high cost, and difficulty applying to large leaf/foliage areas of some crops.

California Senate Bill 7x-7 (SB7x-7) requires agricultural water suppliers to prepare an Agricultural Water Management Plan (AWMP) by the end of 2012, which addresses each of the aforementioned EWMPs. Agencies that do not complete an AWMP will not be eligible for certain State grants or loans. Water Management Plans prepared for the USBR will be considered suitable replacements for the State AWMP if they include some supplementary material.

Drip and micro-irrigation systems have been widely promoted as a method to reduce water demands. Some local irrigators and water managers have found that these systems do not conserve total water consumed over time, because they result in reduced deep percolation, and their precise water application paradoxically increases yields and thereby increases

evapotranspiration demands. These systems have also allowed sloped land that is unsuitable for flood or furrow irrigation to be developed, thus increasing water demands. In summary, these systems have helped to increase agricultural output, but have not likely reduced water consumption.

Some obstacles to implementing EWMPs include: lack of grower interest, funding and cost-effectiveness, high water-use efficiencies in some areas that reduce feasibility or urgency of further water conservation, and local conditions such as topography, micro-climates, etc., that make certain EWMPs impractical.

Urban Water Use Efficiency

Significant reductions in urban demands could make a measurable difference in overall water use. Since the overwhelming majority of urban water supplies are drawn from groundwater, these demand reductions would affect the current overdraft within the Region directly. In addition to the water supply benefits, certain Best Management Practices (BMPs) and Demand Management Measures (DMMs) discussed below will also benefit regional water quality. These BMPs are taken from the 2013 Water Plan issued by the Department of Water Resources and are updated and revised from the BMPs which appeared in earlier versions of the Water Plan.

Table 6.2: Best Management Practices

BMP No.	BMP Title	Description
1.1	Utility Operations Programs — Operations Practices	Designate a water conservation coordinator for the agency. Implement and maintain a water waste prohibition ordinance or regulation. Implement prohibitions on gutter flooding, single-pass cooling systems, and non-recirculating water. Monitor water softener efficiency and usage.
1.2	Utility Operations Programs — Water Loss Control	Implement a full-scale system water audit, maintain in-house records of audit results and completed American Water Works Association audit worksheets.
1.3	Utility Operations Programs — Metering	Install water meters for all new connections and bill by volume of use. Implement a program for retrofitting existing unmetered connections and bill by volume of use.
1.4	Utility Operations Programs — Pricing	Implement rate structures and volumetric rates for water service by customer class.
2.	Education Programs — Public Information Programs	Maintain an active public information program about water conservation. Implement a school education program to promote water conservation.
3.	Residential	Conduct indoor and outdoor residential water use surveys. Implement an enforceable ordinance or provide incentives to replace high-flow water use fixtures with low-flow counterparts. Offer rebates for high-efficiency washers. Offer rebates for high-efficiency, low-flow toilets.

BMP No.	BMP Title	Description
4.	Commercial, Industrial, and Institutional (CII)	Rank commercial, industrial, and institutional customers according to use. Implement either a CII b water use survey and customer incentives program or CII conservation program targets.
5.	Landscape	Develop marketing and targeting strategies for landscape surveys. Implement water use budgets for large landscapes.

Source: California Urban Water Conservation Council

Many of these BMPs are practiced in the Madera Region, but the level of practice varies by agency. Most of these BMPs are more oriented to municipal/industrial uses than to agriculture, and this is reflected in the number of these BMPs that are in use by each agency. For example, both cities and the County have implemented BMPs 1.1, 1.3 and 1.4 to one degree or another, and all three have residential water conservation ordinances (BMP 3) and landscape water use ordinances (BMP 5) in place.

SB7x-7, also known as the Water Conservation Act of 2009, set a goal of reducing per-capita water use by 20% by 2020. The 2013 CalGreen building code sets a goal of 20% reduction of indoor water use in new buildings. To meet these goals, some agencies will need to increase their urban water conservation efforts. Urban Water Management Plans are the primary document for recording urban water conservation measures. A list of agencies that have current Urban Water Management Plans (UWMPs) is provided in Chapter 13 – Relation to Local Water Planning.

Obstacles to implementing urban water use efficiency measures include funding, public acceptance, reduced revenue from lower water sales, and poor economics (other alternatives such as developing new water supplies may be less expensive).

6.3 - Improve Operational Efficiency and Transfers

Conveyance- Delta

None of the Madera member agencies receive water through the Delta, and accordingly there is no opportunity in the Region to implement projects, policies or procedures to impact the efficiency of Delta conveyance options.

Conveyance – Regional/Local

The strategy deals with improvements to facilities, practices and procedures relative to moving water into and through the region from the source to areas of use. It includes both natural channels and constructed facilities, such as canals, pipelines, pumping plants, and diversion structures, of all sizes from small, local end-user distribution systems to large systems that deliver water to and within each of the irrigation districts. Specific objectives for natural and managed water conveyance activities include enhancements to urban and agricultural water

deliveries, flood management, consumptive and non-consumptive environmental uses and recreational opportunities.

All conveyance facilities have maximum capacities. Depending upon the way the facility is used, these capacity limitations may come into play when managing flood releases, or when there are competing demands for conveyance during peak summer irrigation periods. The region can cite examples of effective cooperative use of conveyance facilities. For example, the two cities both allow recharge of irrigation district water in City storm drain basins during non-peak rainfall months, and likewise the irrigation districts allow the cities to use certain irrigation canals to convey storm water from City basins after rainfall events, to prepare the basins for the next event in a timely manner.

There is opportunity to improve overall system flexibility and capacity through implementation of more cooperative agreements as well as through installation of automation and control systems. Increased water brought into the region as a result of conveyance improvements may be used directly for irrigation or, following treatment, for delivery to municipal water users. It might also be used in an expanded direct recharge program benefitting both the irrigation districts and the cities, and potentially other member agencies who participate in the necessary facilities projects.

The need for increased conveyance to capture flood-related surface flows would be even more important if the predicted changes in precipitation timing and intensity due to climate change occur. In general, the consensus among climate scientists is that the local precipitation season will change over time to become heavier earlier in the water year, particularly in the fall months. While the overall quantity of precipitation has been forecasted to drop by about 5 percent over the next 50 years, models anticipate that precipitation will come increasingly as rainfall rather than as snowpack, meaning the annual stream runoff cycle would change, and more water would be expected early in the season. It is very possible this change would result in the current reservoir system becoming inadequate to regulate as great a percentage of the overall runoff as has happened historically and this will result in an increasing percentage of runoff becoming uncontrolled or “flood release.”

Increased storage capacity (on-stream or off-stream) as well as increased regional conveyance capacities may be needed to adequately deliver water during different times of the year, and to deliver higher volumes to recharge or off-stream storage facilities during the available short flow windows.

System Reoperation

System reoperation refers to changes to existing operational procedures of existing reservoirs and conveyance facilities, in an effort to increase water-related benefits. System reoperation can potentially improve the efficiency of existing water uses, and it may increase the use of one resource relative to another. In the largest sense, system reoperation could involve changing reservoir release schedules to improve fisheries or provide flood control. Reoperation may require additional facilities or permits, and is sometimes legally challenged.

In the case of the San Joaquin River, the USBR manages operation of Friant Dam and the rest of the Central Valley Project (CVP) Friant Division. As a Reclamation dam, the priority of Friant operations was originally provision of maximum irrigation water to the various contracted users. Subsequent court decisions and agreements have modified that strategy over the years, but the operation of the reservoir remains in the hands of the Bureau and modification by the member agencies is not considered feasible. Friant Dam is already being reoperated in attempt to meet river restoration demands at minimal cost to other water users. The US Army Corps of Engineers and large power companies operate other reservoirs in the region, and likewise there is little the RWMG can do change operations.

It is believed that the water supplies are likely being operated as efficiently as possible, within existing legal obligations. However, individual members, such as irrigation districts, may be able to adjust their own operations to reduce uncontrolled and flood releases. Changes in water demands and climate change could provide the need for the Bureau to consider re-operation of the dam.

Water Transfers

The California Water Code (CWC) defines water transfers as the temporary or long-term change in the point of diversion, place of use, or purpose of use as a result of a transfer or exchange of water or water rights. Water transfers have become a common part of the local water management landscape. Inbound transfers can help areas such as the region obtains new water supplies, increase supply reliability, reduce overdraft. Conversely, outbound transfers can and do generate substantial revenue that can be used for facility and operational improvements, or to offset operations and maintenance expenses that would otherwise be paid by user fees or assessments.

Constraints to water transfers in the region include: 1) consistency with Friant Division CVP regulations; 2) consistency with other local policies; 3) local and state political acceptability; 4) regulatory issues; 5) cost effectiveness; and 6) availability of facilities to facilitate the transfer.

Water transfers can be made either within the San Joaquin river basin (intra-basin) or between agencies located in different geographic areas (inter-basin). Intra-basin projects can be useful for conjunctive use projects, and to reduce the volume of water that flows out of the basin in wet years, but don't necessarily increase the total available water within the basin. Inter-basin transfers, on the other hand, can become a sustainable source of additional water supplies.

Depending upon the structure of the transfer agreement, these supplies may be available every year regardless of water conditions, or may be available only in high-flow water years. The latter are useful mainly for recharge and field irrigation projects, while the former can be the basis for long term irrigation plans for permanent crops or even for municipal and industrial supplies subject to water reliability requirements in the state Water Code.

Intra-basin transfer agreements are already in place between Root Creek Water District and both Madera Irrigation District and Chowchilla Water District, and between Chowchilla Water District and Merced Irrigation District. One inter-basin agreement already exists, between Root Creek Water District and Westside Mutual Water Company in Kern County, to supply water for both for recharge (direct recharge and by in-lieu recharge agreements with neighboring farmers) and municipal supply for the Riverstone development project.

6.4 - Increase Water Supply

Conjunctive Management and Groundwater Storage

Maximizing efficient use of both groundwater and surface water resources within the Region requires coordination and planned management of both. Sometimes called conjunctive use, or conjunctive management, these strategies of coordination can be used to improve overall water supply reliability, improve environmental habitats, reduce groundwater overdraft (and related impacts including land subsidence) and protect or improve water quality. Overdraft and its related consequences are already having profound impacts on water users within the Region, motivating the RWMG to seek out new conjunctive management strategies as part of the overall program of mitigation.

Overdraft causes conflicts between water users, economic losses to both urban and agricultural interests, as well as significant and sometimes permanent impacts to the environment. A conjunctive use strategy includes several parts, including both percolated and in-lieu recharge during high-flow years to build up aquifer storage, followed by groundwater pumping and use during dry periods, and a robust monitoring program to help prevent negative impacts and verify the quantity of water available in underground storage.

Conjunctive management has great potential to increase groundwater storage and water reserves. Millerton Lake, behind Friant Dam, can store up to 520,000 acre-feet (AF) of water. However, the San Joaquin watershed has an average runoff of over 1.5 million acre-feet per year. The almost-one-million acre-feet that cannot be captured and regulated by Friant Dam is potentially lost if it cannot be diverted and used in real time by the member agencies. Because the river flow often comes at a very high rate at a time of year when irrigation demands are less than peak, there is a limit to how much water can be beneficially used directly by agricultural interests. Conjunctive management opportunities also exist with water from the Fresno and Chowchilla Rivers. Construction of large and effective water sinking basins has the potential to add several hundreds of thousands of acre-feet of effective storage within the Region with a relatively low cost of water supply.

Water impounded in recharge and storm water basins can also be used to meet local demands. For example, the Fresno Metropolitan Flood Control District in the neighboring Upper Kings RWMG is now using surface water in many of its storm water retention basins as a source of landscaping irrigation within and around the basins.

The MID Water Supply Enhancement Project (Project), as proposed, is a major conjunctive use project that involves water-banking facilities to recharge groundwater for water supply enhancement. The Project is located on Madera Ranch and consists of approximately 13,646 acres, located in southwestern Madera County south of the Fresno River, approximately five miles southwest of the City of Madera. The water bank could ultimately have capacity to store up to 250,000 AF/year. The water will recharge the groundwater basin through natural swales (ancient creek beds) and with 323 acres of recharge basins. The Project aims to bank available surplus surface water in wet years for use in dry years. Currently, the Project is in the planning phase.

Constraints to developing conjunctive use facilities include:

- Access to prime recharge lands;
- Cost of purchasing land and developing recharge basins and recovery wells;
- Limitations in conveyance capacity to deliver large quantities of water to basins;
- High operational costs, especially if recharged water is not later recovered and sold;
- Risk that water stored cannot be extracted when needed because of infrastructure limitations, water quality or water level concerns, political obstacles, and institutional or contractual provisions;
- Lack of assurances to prevent third-party impacts and increase willingness of local citizens to participate;
- Potential for recharge to cause migration of known contaminants that would affect municipal or domestic supplies.

In the long term, the RWMG should seek opportunities for inter-basin conjunctive use programs that include water importation and groundwater banking involving member agencies and third parties, as long as these projects benefit the Region and appropriate safeguards are established.

Desalination – Brackish and Seawater

As in many other areas of the world, the shortage of water within the Region is really a shortage of fresh, usable water. A relatively large amount of salty or brackish water underlies most of the valley portion of the Region. Desalination is a water treatment process for the removal of salts from water to allow for beneficial use. Desalination is not only used on seawater, but also on lower-salinity (brackish) water from groundwater or other sources.

In California, reverse osmosis has been the principal method for desalination, though progress is being made with other processes including thermal distillation. Reverse osmosis, which is at its essence a form of extremely fine filtration, can also be used to remove other specific contaminants in water, such as trihalomethane precursors, volatile organic carbons, nitrates, and pathogens. The benefits of desalination include:

- Increased water supply;
- Reclamation and beneficial use of impaired waters;
- Increased water supply reliability during drought periods;
- Diversified water supply sources;
- Improved water quality; and
- Public health protection.

The constraints for desalination in the Region include capital cost for plant construction, operational expenses, and the necessity for brine disposal. These constraints limit the applicability of desalination within the Region to users which can support a water cost of approximately $1,000 per acre-foot. While some urban areas in the state pay that much for their water, all of the urban areas in the Region currently have less-expensive supplies available. As a result, there are no current opportunities for application of desalination within the Region and it is not considered a viable strategy at this time.

Precipitation Enhancement

Precipitation enhancement, more commonly called "cloud seeding," involves artificial stimulation of clouds by injecting into them seeding agents that enable snowflakes and raindrops to more easily form. This produces more rainfall and/or snowfall than would naturally occur. Precipitation enhancement is not a remedy for drought, since opportunities are generally fewer in dry years. Rather, it works better in combination with surface or groundwater storage to increase "average" supplies. Most enhancement projects suspend operations during very wet years once enough snow has accumulated to meet all reasonable water needs. The reality in the Region is that if more storage were available, more precipitation enhancement would make sense.

Analyses of the seeding effectiveness have been made at intervals throughout the project's history. A recent published estimation indicates a long-term average increase in Pine Flat Reservoir (in the neighboring Kings Basin IRWMP) inflow of about "5.1%, with 90% confidence that the true effect of seeding is somewhere between +1.5% and +8.8%" (Silverman, 2007). Recent estimations using April 1 snowpack data indicate that, over the full seeded history of that project, an average increase of approximately 4% to 6% has occurred. These numbers fall within the typical 2 to 15 percent range of increase cited by the 2009 California Water Plan Update for other successful cloud seeding programs.

Silver iodide is the most-commonly-used seeding agent. There is no clear consensus on the environmental impacts of silver iodide, in the concentrations introduced during cloud seeding, on aquatic habitat and wildlife – some studies suggest impacts and other do not. It continues to be used as a cloud seeding agent, however, research into new and alternative cloud seeding agents is on-going.

Climate change could impact the timing and nature of precipitation events, making it more challenging to operate cloud seeding operations since past weather may not be a good indicator of future weather patterns. However, in the snow zone, cloud seeding could offset some of the loss in snowpack expected from global warming. The 2009 California Water Plan Update recommends that the State support research on potential new seeding agents, particularly ones that work at higher (above freezing) temperatures. Global warming may limit the effectiveness of silver iodide, which requires cloud temperatures well below freezing, around -5°C, to be effective.

Recycled Municipal Water

Recycled water, which is defined in Title 22 of the State Public Health Code as being wastewater which has been aerated, clarified, denitrified, filtered and disinfected to meet certain maximum constituent limits, can be used for a wide variety of agricultural, horticultural and recreational purposes. Some of these uses include crop irrigation, freeway and roadway landscaping, groundwater recharge, public open space, park and schoolyard landscape irrigation, water features and industrial processes. Often called "tertiary treatment," the level of treatment required to achieve Title 22 requirements for recycled water is the highest level of treatment commonly applied to municipal wastewater. Wastewater treated to lesser levels (reclaimed wastewater) can still be used for certain agricultural and horticultural applications, under the authority of the State Water Resources Control Board, Regional Water Quality Control Boards and Division of Drinking Water.

The State is supporting the use of recycled water, as documented in the State Water Plan and the recommendations of California's Recycled Water Task Force (DWR, 2003). DDW (formerly California Department of Public Health) publishes "The Purple Book," which contains health laws related to reuse of recycled water (CDPH, 2001). DDW defines the appropriate legal uses based on the level of treatment (primary, secondary, or tertiary). One of the most common uses for recycled water is groundwater recharge. However, groundwater recharge projects that use recycled water or reclaimed wastewater require DDW and Regional Water Quality Control Board (RWQCB) approvals based on effluent quality and quantity, spreading area operations, soil characteristics, hydrogeology, residence time, and distance to withdrawal.

Within the Region most wastewater is percolated to the groundwater (often via private septic systems) or evaporated. This includes effluent from both the City of Madera and the City of Chowchilla. To increase direct use of recycled water the Region would need to make substantial investments in new treatment and distribution infrastructure. Obstacles to using

recycled water include high cost, lack of water supply benefits when recycled water is already being recharged, regulatory issues, public acceptance, and marketability of recycled water.

The Region recognizes that some recycled water supplies are an untapped source, and they will gradually be developed as demands increase. This will occur particularly in new Greenfield residential and mixed-use developments which are being entitled within the southeast portion of the County. There, two developments which will combine for over 11,000 residential units have been approved, and more applications are in process with the County. Each of these developments relies on construction of Title 22 wastewater treatment facilities which will make recycled water available to offset potable water use within these planned communities. In addition, reclaimed water will be utilized in areas within the Rio Mesa area plan.

Surface Storage – CALFED

In 2009, the Delta Stewardship Council replaced the CALFED Bay-Delta Program, also known as CALFED, as a department within the State government. Its mission is to focus on interrelated water problems in the Sacramento-San Joaquin River Delta. "CALFED Surface Storage" is the legacy name for a resource management strategy to improve surface storage while simultaneously improving water conditions in the Delta. The strategy includes potential creation of five surface storage reservoirs in California, including one on the upper reaches of the San Joaquin River. This reservoir could provide water supply benefits to Friant CVP contractors in the Region including Madera Irrigation District, Chowchilla Water District, Gravelly Ford Water District and Root Creek Water District.

Surface Storage – Regional/local

Surface water storage, primarily in Millerton Lake behind Friant Dam on the San Joaquin River, has played an important role in the Region. Storage is especially important in the arid West region of the United States where the pattern and timing of water use does not match the natural runoff pattern. Since its completion in the late 1930s, Millerton Lake has provided benefits in the areas of conjunctive management and flood control. The US Bureau of Reclamation manages Millerton Lake and upstream reservoirs (including Shaver Lake, Huntington Lake, Bass Lake behind Crane Valley Dam, Mammoth Pool, Kerckhoff Reservoir and Reddinger Lake) to provide water to the various water agencies and districts who hold contracts for water supply.

Building large-scale surface storage in California, and the nation as a whole, is difficult because many of the prime sites already have been dammed, and the regulatory, political, and economic constraints make planning for and construction of dams extremely time-consuming. Small-scale reservoir projects may hold more promise due to the relatively-lower regulatory and environmental burdens those projects may face compared with large-scale dams. Off-channel reservoirs have been successfully developed by irrigation and water districts in the San Joaquin Valley, and offer potential to some local agencies with suitable lands available in proximity to the San Joaquin River.

In the future, if changing climate patterns result in reduced snow pack and increased fall and winter runoff, the priority for surface storage for water supply and flood control purposes could foreseeably increase.

6.5 - Improve Flood Management

Flood Management

The water management benefits that accrue to landholders and communities along major rivers and streams are countered to some extent with the challenges of managing flooding risk to those lands when streams and rivers run uncommonly high.

Flood risk management is a strategy to assist individuals and communities in managing irregular flood flows by preparing for, responding to, and helping recover from the effects of a major flood. Some examples of this strategy include construction of levees, floodwalls, and other water-management infrastructure; floodplain zoning and land use regulation; floodplain function restoration; disaster preparedness; and flood emergency response.

The San Joaquin River is the major flood risk in the Region. Lesser risks include the Fresno River, Chowchilla River, and several smaller streams, creeks and sloughs which are tributary to the San Joaquin. There are several existing flood management strategies in place in the Region. An existing levee system, maintained by the Lower San Joaquin River Levee Protection District, protects primarily rural agricultural lands along the river. Other flood protection strategies with both flood control and water supply benefits include recharge basins, off-channel reservoirs, and flood control basins. Examples of these facilities are operated by several member agencies including Madera Irrigation District, Chowchilla Water District, the cities of Madera and Chowchilla, and the County. Gravelly Ford Water District has an off-stream pond that is used to divert flood flows for recharge. The District also diverts floodwater from Cottonwood Creek into the Gravelly Ford Canal for recharge. Root Creek Water District is currently planning an off-stream recharge facility that would take peak flows from Root Creek, providing a flood protection benefit.

Predicted climate change could increase the severity and intensity of seasonal flooding, particularly in the fall and winter, by shifting precipitation to earlier in the water year and bringing an increased portion of normal precipitation in the form of rainfall. This would increase the need for containment in surface reservoirs as opposed to snowpack requiring no storage until the melt season when irrigation demands are typically peaking. This would

necessitate prudent monitoring of changes in runoff to evaluate changes in flood risk and anticipate the need for new flood protection infrastructure.

6.6 - Improve Water Quality

Drinking Water Treatment and Distribution

The primary goal of municipal water systems is providing an adequate and reliable supply of safe, healthful, drinking water. Achievement of this goal requires adequate water resources, water treatment and distribution facilities. All water delivered to municipal customers must meet State and Federal drinking water standards. In the Region, not all municipal water purveyors meet every part of those tests. While there is not a public agency in the Region that regularly supplies water out of compliance with water quality requirements, there are numerous systems, both in the Valley and in the Foothill/mountain areas, which face serious challenges with water supply quantity, reliability, storage and peak delivery capacity.

Key constraints to developing water treatment and distribution systems include capital cost, high operations and maintenance costs, and citizen opposition to higher water rates. These constraints are in tension with the direction of both State and Federal regulations, which are consistently being drawn tighter and resulting in the need for treatment systems for newly-regulated chemicals and constituents where historically none has been required.

Predicted climate change could impact water quality and impact the need for or type of water treatment provided, in ways that may not at first be obvious. For instance, more intense precipitation could increase turbidity of surface waters for longer periods each year. This would result in the need for added raw water coagulation and sedimentation treatment for those water systems using surface water. Also, higher ambient air temperatures may lead to eutrophic conditions in enclosed water storage tanks.

The two cities in the Region, Madera and Chowchilla, rely exclusively on groundwater to meet municipal needs. This is true of the overwhelming majority of the County's municipal water systems as well. There are two small exceptions.

County Service Area No. 1 serves the Hidden Lakes subdivision on the western shore of Millerton Lake, and draws surface water directly from the Millerton Lake pool. Madera County MD 16A, serving the Sumner Hill development, takes its water supply directly from the San Joaquin River under the authority of a Holding Contract issued by the US Bureau of Reclamation, in exchange for any and all water rights which the then-owners of the Sumner Hill property may have acquired up to the time of the Holding Contract.

Use of surface water in-lieu of groundwater helps reduce groundwater overdraft, leaving water in storage in the groundwater basin for use in dry years when surface supplies may be less-widely available. If the Region can acquire reliable surface water supplies suitable for municipal use, construction of regional water treatment plants, shared by multiple agencies, could be

very attractive and would be more economical than constructing separate treatment plants for each agency.

Groundwater Remediation/Aquifer Remediation

Groundwater remediation involves extracting contaminated groundwater from the aquifer, treating it, and either discharging it to a water course, using it for some other purpose, or injecting it back into the aquifer for later use. Contaminated groundwater can result from a multitude of both naturally-occurring and anthropogenic sources. Remediation results in enhancement of a water source and making it available to users who would not be suitable without remediation. Constraints include the fact that groundwater treatment is typically very expensive (on the order of several hundred dollars per acre-foot of water pumped and treated), numerous regulatory agencies are involved in permitting such a project, the timeline to the start of project operations is several years at minimum, and additional years or decades may be required to remediate contaminated groundwater sites.

Groundwater in the Region is remediated in a number of specific locations under the jurisdiction of regulatory programs. These projects typically address specific contaminant plumes and are not widely beneficial to the aquifer. Groundwater quality in the Region varies dramatically with location and depth. Remediation is not considered to be a broadly-applicable strategy within the Region.

Matching Water Quality to Intended Use

Within the Region, groundwater users have widely-varying needs for groundwater quality in order to meet the needs of their particular uses. Water which may be perfectly suitable for irrigation purposes may require expensive well-head treatment to remove chemicals such as iron, manganese or arsenic to be suitable for municipal use. Matching water quality to intended use is a strategy to avoid using high quality water for uses that do not require it.

In the Region, providing treated surface water to municipalities rather than groundwater can implement this strategy since groundwater underlying many municipal areas requires treatment. This approach also helps mitigate groundwater overdraft. After replacement with surface water, the lower-quality groundwater can then be used for other applications, such as agricultural or open-space irrigation.

Making use of recycled water, as discussed in Section 6.4 -above, is another way to match water quality to its intended use. Recycled water is very high-quality and can be used for a broad variety of purposes, but it cannot currently be made potable. Making maximum use of recycled water in place of potable water reduces overall treatment costs and conserves high-quality water resources, thereby implementing this strategy. Other uses of lower-quality reclaimed wastewater, and using non-potable raw surface water for open-space irrigation, are also examples of this strategy.

Potential obstacles to matching quality to use are public acceptance of using lower quality water (even if it is acceptable to all regulatory agencies for the intended use), and the geographical distribution of the water supplies with different qualities, which may not be in or near places they can be beneficially used.

Pollution Prevention

Certain areas within the Region are affected by pollution of otherwise-usable groundwater resources. In the vast majority of cases, pollution prevention is simpler and less expensive than pollution remediation. However, because of the nature and sources of some contaminants, a pollution prevention approach may not always be possible, cost-effective, or desirable

In the Region, pollution prevention is practiced primarily through regulatory programs for irrigation, confined animal facilities, urban activities, wastewater disposal, and industrial activities. Pollution prevention also overlaps with the Forest Management and Watershed Management strategies that aim to reduce eroded sediment and pollution from entering water sources.

Salt and Salinity Management

A major consequence of the long-term irrigation and cultivation of the Valley soils within the region has been the build-up of salts within the upper soil profile. Historically salt buildup was managed by growers by over-irrigation from time to time, which in most situations would flush salts from the root zones and deeper into the soils profile. An unfortunate consequence was the transport of salts into the freshwater aquifer. While the quantity of salts is relatively small in comparison with the volume of water in the aquifer, the increase in TDS in the aquifer has been measurable.

In other locations, the soil profile was relatively impermeable and did not allow for flushing of the root zone. This has created some areas which are no longer able to support agriculture due to high salt content in the soil. Neither of these situations is sustainable over the long term, and the current strategy of salt and salinity management is intended to address both issues.

Salt and salinity management includes efforts to limit buildup of salts in the soil and water, and mitigate lands currently impacted by salts. The Region is participating in several programs to manage salinity and limit salt buildup in the soil, wastewater and groundwater. These measures include:

1. Participation in the Irrigated Lands Regulatory Program, which monitors salt contents in water supplies;
2. Encourage growers to use surface water in preference to groundwater whenever it is available; and
3. Participation in the Central Valley Salts Coalition (CV-SALTS).

Urban Stormwater Runoff Management

For many years and in most of the country, stormwater was treated as a waste product rather than a resource. The 1991 National Pollution Discharge Elimination System (NPDES) created by Congress pursuant to the Clean Water Act has changed much of that attitude. Under the latest round of regulations and guidelines promulgated by the EPA, urban stormwater runoff management is a broad series of activities intended to manage both stormwater and dry weather runoff into waters of the United States.

Dry weather runoff occurs when, for example, excess landscape irrigation water flows to the storm drain. Urban runoff management has as its primary goal prevention of pollution of waters of the United States, but also focuses on prevention of damage from stormwater or urban water used, and considers multiple purposes such as water supply and habitat enhancement.

Increased urbanization usually has resulted in increased paved areas and runoff, changing local conditions and potentially affecting percolation of natural precipitation into the groundwater. Newer drainage management strategies such as Low Impact Development (developed in Maryland in 1999 under a contract with the EPA and now widely adopted nationwide) have now raised awareness of the desirability of not simply transporting storm water down the line as discharge. Consequently, including groundwater recharge as part of stormwater management is considered very important in the Region.

The two cities provide urban runoff management within the Region. Typically, each captures stormwater through collection facilities where it is piped to basins which provide detention or retention and some level of groundwater recharge. Some joint-use facilities, designed for both flood control and groundwater recharge, are operated in both Madera (along with Madera Irrigation District) and Chowchilla (along with Chowchilla Water District). Some recharge/retention ponds also provide recreational benefits.
Climate change could alter precipitation patterns and the intensity of precipitation events. This may require re-evaluating, re-designing or re-operating stormwater systems.

6.7 - Practice Resource Stewardship

Agricultural Lands Stewardship

Agricultural lands stewardship broadly means the conservation of natural resources and protection of the environment on agricultural land. Because Madera County is a Right-to-Farm county, the on-going stewardship of agricultural lands is an intrinsic value. Land managers can practice stewardship by improving land cultivation practices for food, fiber and bio-fuel production, as well as conserving open lands to provide watershed functions, soil, air, energy, plant and animal and other conservation purposes.

Agricultural land stewardship also protects open space and the traditional characteristics of rural communities. As more land becomes developed in the Region, there will be increasing

pressure on agricultural land to help provide flood control, water conservation, habitat preservation, and carbon sequestration, while maintaining ongoing production of crops. Some agricultural land stewardship examples include wind breaks, noxious weed control, riparian buffers, cover crops, composting, fish friendly farming, and creation of wetland reserves.

Constraints to developing land stewardship projects within the Region include funding, financial incentives for landowners, landowner interest and recognition of benefits, and regulatory barriers.

Ecosystem Restoration

Over 100 years of development and activity within the Region have made indelible marks on the local environment. Along with the development of communities collectively supporting over 100,000 residents and extensive agricultural lands which contribute a significant portion of the crops used in California, the nation and the world, there have been changes forced on the ecosystem, resulting in a local environment really quite different from what existed in the region 200 or even 100 years ago.

Local Wildlife

Ecosystem restoration focuses on restoration of aquatic, riparian and floodplain ecosystems, which are the natural systems most directly affected by water and flood management actions, and the ones most likely to be affected by climate change. Examples of ecosystem restoration include curtailing waste flows into natural water bodies, reducing barriers to fish migration, meadow restoration, native plant preservation, forest restoration and wetland restoration. Ecosystem restoration can also be directly incorporated into engineered projects, such as groundwater recharge basins. These types of projects are often carried out in collaboration with government agencies or non-governmental organizations.

The RWMG recognizes the importance of ecosystem restoration to protection of water rights, improvement of regional water quality, provision of flood protection, and gaining public support for water projects. An example of ecosystem restoration in the region is the Root Creek restoration project that is an integral component of the Riverstone development project in southeastern Madera County. Constraints to developing ecosystem restoration projects include funding, high land costs in some areas, feasibility of integrating restoration elements into proposed projects, regulatory constraints, political acceptance, weed control when near agricultural lands, and concerns for spillover of endangered species onto adjoining lands.

Forest Management

The RWMG has long recognized the importance of proper forest management to sustainability and even increase of water resources within the Region. Forests in the region contribute to

sustainable production of resources such as water, timber, native vegetation, fish, wildlife, and livestock, as well as offering extensive outdoor recreational opportunities. Amidst all that activity, the economic value of water produced by forests equals or exceeds that of any other forest resource (CWP 2009 update). Nearly every forest management activity can affect water quantity and quality. This strategy focuses on those forest management activities that are designed to improve the availability and quality of water for downstream users. These strategies can include meadow restoration to regulate stream flows, forest fire management, and ecosystem restoration.


Sierra National Forest

Much of the eastern half of the Region, including most of the San Joaquin river watershed in the Foothill and Mountain area, is forested. Most of that forest land is managed by the US Forest Service or National Park Service. The RWMG therefore is not directly involved in forest management, but can assist and facilitate these efforts through: 1) Communications with local watershed organizations; 2) Letters of support for forest management projects; and 3) Collaboration with neighboring IRWM Groups in the Sierra Nevada Mountains.

Dr. Roger Bales, UC Merced, presented to the RWMG his observations regarding Sierra Nevada conditions, and indicated that forest-thinning prescriptions for fuels reduction and decreasing the risk of catastrophic wildfire are similar to those for enhancing water yield. More-active forest vegetation management may thus be a “no-regret” strategy to develop more water supplies. Dr. Bales and colleagues hypothesize that across the Sierra Nevada, runoff yield can increase by approximately 9% with a 40% reduction in forest density (Bales et al., 2011).

Much of the forested watershed within the Region could benefit from forest thinning both to reduce the risk of catastrophic forest fires and to increase water yield. Expenses associated with forest thinning can vary from low hundreds of dollars to a thousand or more dollars per acre for “first entry” (to achieve sustainability). “Second entry” costs would be those related to long term maintenance. Expenses would be dependent on a variety of site-specific conditions, including: how much thinning is needed, the appropriate method of thinning and maintenance to be used, whether follow-up work is needed, access conditions, topography of the area being cleared, equipment/worker mobilization, what types of trees and undergrowth are in the grove already, and current health and size of the trees being removed. Frequency would be on a case-by-case basis depending on the growth characteristics of the grove.

Expenses could conceivably be offset by revenues potentially derived as a result of the thinning project; that is, considerations for values of usable timber and lumber, biomass energy generated, contributions from headwater protection agencies, or others.

Climate change could have significant impacts to forest health, snow accumulation and ultimately the quality and quantity of water that flows to the Valley. Many forest management activities, such as forest thinning, can help to adapt to these changes.

Land Use Planning and Management

The patterns and types of land use, transportation and level of intensity designated for geographic areas ends up having a direct effect upon the water supply, water quality, flood management, and other water issues faced by an area. Integrating land use planning and water management requires planning for the housing and economic development needs of a growing population, while providing for the efficient use of water resources and preservation of water quality.

Areas being planned for intensive uses such as housing, commercial or industrial developments must have access to adequate, reliable and healthful water resources. Since 2001, the State Water Code has mandated such water supply planning for larger developments. This takes the form of a Water Supply Assessment, which must be prepared by the proposed water purveyor prior to preparation of the environmental review of, or approval of, any land use entitlement for a project of 500 homes or equivalent size of commerce or industrial development. The Assessment must evaluate the proposed water supply and determine if it is adequate to meet the projected water demands of a project in normal, dry and multiple-dry water years over a 20-year planning horizon. In reality, the 20 year horizon does not fully address the need, for once approved, most developments will be in place for much more than 20 years and some reviewing agencies are looking for even greater assurances of stable water supplies prior to project approvals.

Apart from planning the water supply, land use planners can impose restrictions on land uses aimed at reducing overall project consumption. For example, regulations could require xeriscape to reduce water demands, or permeable pavement to reduce storm drainage runoff while potentially enhancing the groundwater aquifer.

In the past, planning for land use and water supplies has been conducted by different agencies, at different times, for different planning horizons, often using different methodologies, assumptions, and data. This has resulted in inconsistencies in the plans, poor coordination of public investments, and has subjected agencies to legal challenges. Some local land use plans do not address, or merely acknowledge, regional water issues such as overdraft. Consequently, integrating land and water use planning is an important goal in the Region.

Planning for adequate water quality is equally important. In 1996, the federal Safe Drinking Water Act included a requirement for states to develop Technical, Managerial and Financial (TMF) capacity requirements for public water system operations to ensure sustainability and long-term compliance with drinking water standards. California put forth Section 116540 of the California Health and Safety Code (CHSC) in response to the federal requirements, which

applies TMF criteria to community water systems, as well as non-community water systems and water systems changing ownership or seeking funding from the State.

DDW has a sample TMF criteria document and assessment form available on their website, which local land use agencies are able to use to facilitate compliance with TMF requirements for new water systems or those undergoing facility improvements.

California Senate Bill 375, The Sustainable Communities and Climate Protection Act of 2008, is an important bill related to land use planning. The bill encourages more-dense developments to reduce transportation, air pollution and water consumption.

The IRWMP process provides an ideal opportunity to integrate land and water supply planning. Relationships to local water planning and land-use planning are discussed in more detail in CHAPTER 13.

Recharge Area Protection

As much as increased groundwater recharge has the potential to benefit the Region's groundwater balance, the reality is that Madera County's underlying soil profile is not optimally suited to facilitating efficient or high-rate recharge to the groundwater aquifer except in limited areas. There are extensive areas of low-permeability soils either at the surface or in lenses ranging from 35 to 100 feet or more below ground surface. Accordingly, the Madera Region is generally lacking large areas suitable for groundwater recharge (Provost & Pritchard, 2014). These limitations make it all the more important that the Region prioritize protection of potentially-suitable recharge areas from a variety of threats.

Protection of recharge areas is based on two primary goals: 1) ensure that areas suitable for recharge are protected from development into urban infrastructure; and 2) preventing pollutants from entering groundwater to avoid expensive treatment that may be needed prior to potable, agricultural, or industrial uses. Local city and county land use agencies can apply their land use authorities to develop policies to protect recharge areas, or require mitigation for groundwater impacts associated with new development. Agencies can also develop cash reserves or other means to acquire prime prospective recharge lands quickly from willing sellers when those lands come onto the market.

Constraints to protecting prime recharge areas include high land costs, lack of readily available capital, and inability to rapidly act when land is on the market. Detailed local studies are also needed in the County, City and special district lands to identify prime recharge areas. These studies could include a review of soils maps, geologic maps, and site investigations (drilling, soil sampling, etc.)

Climate change impacts could reduce surface water supplies or increase the frequency of flooding or both. This would increase the demand for recharge projects, and increases in high flows would also make them more beneficial and economical projects.

Sediment Management

Sediment transport is the process by which organic and inorganic materials carried in surface water by sheet flow, streams, and rivers are eventually deposited in low velocity environments (e.g. recharge basins, reservoirs and river sand bars). Sediment and sediment transport are critical to healthy aquatic ecosystems. In the wrong quality, type and time of season sediments can cause significant damage to those systems. In addition, sediments carrying contaminants not indigenous to an area, or in extreme concentrations, can have long lasting effects that may require costly and long-term human intervention (e.g. oil spills, heavy metals from mining operations).

Several impacts associated with excessive sediment loading include reduction in water clarity, reduction in available oxygen, excessive stream and lake-bottom loading, reduced recharge capacity, and altering of the physical aquatic habitat. Each of these impacts have many resulting implications for aquatic habitats and the flora and fauna that occupy them, human use of the water for recreation and consumption, and long term alteration of the habitat.

Sediment management can be divided into several keys areas: Source Management, Transport Management and Deposition Management. Each of these areas has unique aspects, management strategies and BMPs. Proper sediment management also has significant implications on other Resource Management Strategies in the Madera IRWMP area including: Ecosystems Restoration, Flood Management, Forest Management, Urban Storm-water Management, Water Dependent Recreation, and Watershed Management.

Many state and federal agencies are involved in the management of sediment loading including the RWQCB for course-grained sediment to the coast (i.e. San Joaquin River), the USEPA, State Lands Commission, the NRCS, and others. Each agency has authority for aspects of sediment management respective to its own jurisdiction.

Sediment management is important to reduce sedimentation in reservoirs and preserve their storage capacity. Comprehensive watershed management plans using a variety of practices are needed to achieve this. In addition, preventing or reducing wildfires can help reduce sedimentation into reservoirs. Sediment management is also important in recharge facilities, including streams, recharge basins and stormwater basins. These types of sediment can be managed through periodic removal, disking or ripping. This is especially important if streams are used for intentional recharge so that the natural habitat is preserved.

Climate change could have very significant impacts on sediment management. If certain predictions concerning the increase in warm weather and higher intensity and duration rain events are realized, then it can be expected that short duration sediment loading will increase.

Watershed Management

Watershed management is the process of evaluating, planning, managing, restoring, and organizing land and other resource uses within an area of land that has a single common

drainage point. The Madera IRWMP area is unique compared to neighboring IRWMPs in that it includes valley, foothill and mountain lands. The seven neighboring IRWMPs are focused either on valley lands, or foothill/mountain lands. As a result, the Madera RWMG can focus on comprehensive watershed management including the upper and lower watersheds of the San Joaquin, Fresno and Chowchilla Rivers. Watershed management is important to maintain surface water quality, adequate water supply and a healthy ecosystem in the mountains, foothills, and where most of the water is beneficially used in the valley. Methods of watershed management are diverse and include forest-fire fuel reduction, sediment management, vegetation management, abandoned mine reclamation, pollution prevention, management of new developments, and many others. Watershed management is performed by numerous organizations in the region including the National Forest Service, National Park Service and Bureau of Land Management.

Climate change could significantly alter watershed conditions through changes in precipitation, temperatures, flooding and snowpack. This would require an adaptive management strategy to help maintain healthy watersheds.

6.8 - People and Water

Economic Incentives (Loans, Grants and Water Pricing)

Economic incentives include financial assistance, water pricing, and water market policies intended to influence water management. Examples of economic incentives include low interest loans, grants, free services, rebates, and water rate structures. Economic incentives can influence the amount of use, time of use, wastewater volume, and source of supply. Economic incentives can also produce environmental and social benefits, and avoid or delay construction of new facilities.

Economic incentives are prevalent throughout the Madera IRWMP area, although they vary by agency. Some specific incentives include: tiered pricing, metering, and rebate programs for installing conservation devices.

Grants and loans are also an important incentive for some agencies. Numerous grants are available to the region and are listed in Chapter 11 – Financing. Major funding sources include the United States Bureau of Reclamation, Department of Water Resources and State Water Resources Control Board (SWRCB). The Madera RWMG has secured funding for implementation projects and preparing and updating their IRWMP through the States IRWM funding program. The IRWM grants present a significant and major source of funding for the group.

Climate change will not impact the efficacy of economic incentives. These incentives can be effective in conserving water, and could be important adaptation tools if climate change reduces water supplies.

Outreach and Engagement

The Madera RWMG and its stakeholders already perform a wide range of public outreach and engagement. CHAPTER 14 – Stakeholder Involvement describes past, present and planned future outreach in the area. Extensive outreach was performed during the development of the initial IRWMP in 2006-2008 and has continued through efforts of RWMG participants. Many local agencies also have their own outreach and educational programs. Outreach efforts have included: special events, field trips, workshops, flyers, websites, educational materials, RWMG meetings, email lists, and sundry other methods.

Outreach and education are important to address the major water resources issues in the region, namely groundwater overdraft, land subsidence, and surface water curtailments due to the San Joaquin River restoration. Other issues such as water quality and flood control also require some outreach. Educating the general public, politicians and other agencies about these issues is important to gain support for new projects or funding sources.

Constraints to outreach and engagement include the large area covered by the Madera IRWMP, which includes many remote and sparsely populated areas in the mountains.

Outreach and engagement is considered an important component of climate change mitigation and adaptation. Most of the general public lacks the education and training to have a comprehensive understanding climate change, and the reliability of existing data and predictions.

Water and Culture

The Water and Culture Resource Management Strategy relates to the importance of water in the culture of Native American tribes. The Department of Water Resource (2014) provides the following statement on the importance of cultural recognition and preservation in water management:

> *"Water and culture are connected in a myriad of ways, with subtle and complex implications for water management in California. Some cultural relationships to water are so pervasive, they may be easy to overlook. Other cultural considerations are less apparent and may be difficult to recognize. Increasing the awareness of how cultural values, uses, and practices are affected by water management, and how these have an effect on water management as well, such information will help inform policies and decisions*."

The Madera RWMG area includes two federally recognized tribes (North Fork Rancheria of Mono Indians and Picayune Rancheria of Chukchansi Indians). Native American cultural activities related to water resources include hunting, fishing, food gathering, recreation, religious and spiritual practices, and historical preservation. Preserving water quality and the natural hydrology are important to maintain these activities. Native American tribes can also

contribute to water resources management through unique ideas, tribal ecological knowledge, and through the water management authorities they have on their tribal lands.

Cultural connections to the land and water can involve a wide range of places, activities and norms. Maintaining natural flows and qualities are a critical portion of preserving the ability for groups to continue to experience these water dependent cultural connections. Understanding the cultural histories, perspectives and activities is important for proper decision making by water managers.

Climate change is and will continue to play an important role in the ability to manage water for many historic and cultural activities and needs. Native plants and animals may become scarce or migrate to changing belts. Water itself may be less available in certain areas. Attention to these issues will be critical for continued connections to cultural practices, documenting histories and protecting future uses.

Water-Dependent Recreation

Recreation and public access include the management of lands and water resources by local, city, state, and federal public agencies under an implied principle of public trust responsibility. As trustee to public resources, the state and federal agencies must consider the benefit and use of land and water resources for recreational opportunities. Natural resource values often define the character and aesthetic appeal of water-dependent recreation, making it desirable and interesting to visitors. However, poorly planned use, misuse, or overuse of any recreation resource can degrade natural resource values and recreational experiences.

Providing public recreation benefits, and planning to integrate benefits into water projects, may increase public approval for them. In other words, if a project provides recreational opportunities, the public may be more supportive of the project overall thus helping to protect its water supply benefits. Climate change could modify hydrologic patterns and impact existing recreational opportunities. An adaptive management philosophy is needed by recreational facility managers so that opportunities remain available.

Recreational opportunities are provided throughout the Madera IRWMP area including reservoirs, rivers, streams, snow sports, and others. Where cost effective and feasible, recreational elements should be included in new facilities in order to provide multiple benefits. Cost, timing, liability, and other issues may constrain the ability to integrate recreational benefits into water resources projects.

6.9 - Other Strategies

Crop Idling for Water Transfers

Crop idling for water transfers is removal of lands from irrigation so the water supply can be transferred to other lands. The strategy is a temporary measure and the idled land would be returned to irrigation at a later time. Crop idling is not the same as idling lands with the intent

to improve soil and crop sustainability and productivity (i.e. crop rotation). Permanent agricultural land retirement is discussed in a later Chapter.

This strategy would involve idling crops in Madera County to transfer the water to other lands within the County. Transferring the water outside of the County would worsen the local water conditions. This strategy could also include implementing crop idling in parts of the state with surplus water, and transfer of that water to Madera County.

Benefits from crop idling include payment to farmers who sell their water supply, and redistribution of water to another area that needs it. The payments could be used for on farm-related investments, or to develop water conservation measures. Costs include loss of crop production and annual costs to manage the land to avoid negative impacts, such as weed spreading. Loss of crop production can have numerous socio-economic impacts on local communities. Crop idling is not feasible with permanent crops, which comprises 78 percent of the cropped area in the valley portion of Madera County (Provost & Pritchard, 2014).

Crop idling is sometimes practiced within irrigation and water districts. Some districts allow growers to fallow their land for a season and sell the water to another grower in the same district. Crop idling is not currently performed on a regional scale between different water agencies due to legal issues regarding water transfers, and some public opposition to transferring water out of their service area. However, this strategy could have some benefit in the region if these obstacles can be overcome.

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 process may be applicable to areas that have saline perched water, or for treatment of deep connate water that has high salinity.

Fog Collection

Fog collection involves collecting fog on a fine mesh or array of parallel wires that drips into collection containers. There has been some interest in fog collection for domestic water supply in dry coastal areas that have frequent fog. Because of its relatively small production, fog collection is limited to producing domestic water where little other viable water sources are available. Fog collection has not yet been used as a water source in California. Some areas in the Madera IRWMP area, especially in the Valley, experience dense fog during the winter months. However, the fog is sporadic and typically occurs at a time of year when water demands are low, and more often in wet years when the need for such marginal strategies is at a low. Therefore, this strategy is not considered applicable to the Region.

Irrigated Land Retirement

Irrigated land retirement is the removal of farmland from irrigated agriculture to provide water supplies elsewhere and/or take unproductive land out of production. Land retirement can enhance water reliability by making water available for redistribution. Land use changes from land retirement can impact neighboring lands, such as through the spread of weeds or wildlife. In addition, retiring land can have large socioeconomic impacts on local community including loss of jobs and income. However, retired land can be converted to other uses with low water demands such as grazing, solar farms, wildlife habitat, hunting preserves, etc., which could offset some of the socioeconomic impacts. Costs for retiring land include the price of land and the annual cost of managing the land to avoid environmental impacts. Land retirement should only be performed on a voluntary basis. When retiring lands, the highest priority should be given to lands of poor quality, low productivity, and with land management problems, such as poor drainage of irrigation waters.

No permanent land retirement has been performed in the Madera IRWMP area. However, permanent land retirement has been successfully implemented in the neighboring Westlands Water District, located west of the Madera IRWMP. Most of the retired lands had serious drainage problems. The Westlands program was implemented to address chronic water shortage and drainage problems, but it has successfully retired thousands of acres and resulted in increased water reliability for other landowners. Other similar programs have allowed small water usage on the retired land so other uses, such as grazing, are still feasible.

The RWMG believes that land retirement can be an effective method to reduce water demands and increase water reliability for other uses. Lands that may be candidates for retirement are those with little to no surface water supply entitlement, no infrastructure to use surface water, or which are experiencing significant land subsidence. However, it is considered a measure of last resort and the other resource management strategies, especially floodwater capture, should be further developed before land retirement is considered.

The County or other special districts could buy and retire agricultural land from willing sellers. Also, some state and federal agencies will pay landowners to convert land to conservation easements, which are reserved for habitat protection or soil conservation. These programs also help to reduce water demands. Some examples include the California Department of Fish and Wildlife Permanent Wetland Easement Program, and the United Stated Department of Agriculture Conservation Reserve Program.

The following policies are recommended regarding irrigated land retirement:

- As long as the demand for farm commodities remains relatively high, the retirement of irrigated lands in one location may naturally lead to the conversion of other native or non-irrigated agricultural lands in another location. For this reason, a program focusing on irrigated land retirement may be less effective at achieving conservation goals within

the Region without a limitation on the conversion of other lands to uses that require an increase in water consumption.

- Should the Region look to a land retirement as a tool to reduce overall consumption or to facilitate water balance on a project or sub-regional level, a program should be developed to encourage consistency regarding key elements such as mechanisms that that can be used to enforce land retirement; methodology for calculating net reductions in water usage; and subsequent uses of the properties after they have been retired.

Climate change may reduce surface water supplies or increase water demands, resulting in a greater need to retire lands. Climate change could also impact water quality, leading to increased salinity buildup in certain lands and providing a higher incentive to retire the lands. Land retirement would still be a suitable alternative if the climate changes, but some impacts, such as wildlife or weed spreading, may differ from historical retirement programs.

Rainfed Agriculture

Rainfed agriculture is the practice of providing all crop consumptive use directly by rainfall. Due to the unpredictability of rainfall frequency, duration and amount, there is significant uncertainty and risk in relying solely on rainfed agriculture. However, rainfed agriculture is practiced to a limited extent in the Madera IRWMP area.

Some growers plant crops such as winter wheat and safflower that can be watered entirely by rainfall during the rainy season. However, some winter crops have been planted and subsequently lost during dry years. Rainfed agriculture is less risky if the growers have the option to apply irrigation water as an emergency measure. Due to the inherent risks with rainfed agriculture, there is likely only a small potential for increased implementation of this strategy.

Climate change has the potential to change precipitation patterns, which may benefit or adversely impact rainfed agriculture. According to the 2013 California Water Plan update, water supply improvements using rainfed agriculture will require development of new varieties of plants, and new and innovative soil and water management techniques.

Waterbag Transport/Storage Technology

Waterbag transport/technology involves diverting water from areas that have unallocated freshwater supplies, storing the water in large inflatable bladders, and towing them to an alternate coastal region. This strategy is not currently being used in California and would likely have high costs and extensive permitting requirements in multiple jurisdictions.

The Madera IRWMP area is roughly 100 miles from the coast. Any water delivered by waterbags would need to be conveyed directly to the Region by means that do not currently exist, or delivered indirectly through complex exchanges with water agencies located more conveniently to the coast.

Transporting the bladders by rail has also been proposed, but this would also be costly and only limited quantities could be transported on a bladder that fits on rail cars. Due to its high cost, difficulty in permitting, and difficulty conveying the water to the Region, this alternative is not considered feasible.

Drought Planning

The Department of Water Resources (DWR) list of resource management strategies did not include drought planning. In recognition that drought is a regular occurrence in the Madera Region, the RWMG decided to include drought planning as a resource management strategy. The Valley portion of the Madera Region has a productive, but declining, groundwater aquifer that can be used as a reserve supply in droughts. During droughts, impacts from higher water costs, accelerated groundwater level declines and higher groundwater pumping costs are all experienced throughout the Region. In prolonged droughts, some wells can and do go permanently dry. Despite these groundwater impacts, water users that rely primarily or solely on surface water are the most impacted in droughts because the supply can be reduced to zero under the most severe conditions, such as those being experienced in 2014.

Water supplies can vary substantially year to year due to wide variations in precipitation in the IRWMP area. Chapter 3 – Region Description discusses a hydrologic index for the San Joaquin Valley presented as the Chronological Reconstructed Sacramento and San Joaquin Valley Water Year Hydrologic Classification Indices (Index), and covers the period from 1901 to 2013. The data shows that water supplies can be substantially lower than average in dry years, and less than half of normal for as many as three consecutive years. As well, to illustrate the current condition in the region, water supplies in 2012 and 2013 have been about one-half of the average runoff, and it is likely that due to a lack of storage in the watershed, in terms of lack of soil moisture and minimal snow pack, that 2014 may be as dry a year as 1977, which had runoff only 18% of the long-term average.

In the Madera Region, the most appropriate response to drought planning is to develop conjunctive use and groundwater banking projects that reduce overdraft, and capture wet year water for storage in the groundwater basin. Water conservation measures are also effective as responses to droughts.

Some local agencies have drought response plans. However, the Madera IRWMP area does not have a regional drought response plan that can guide a coordinated, regional response effort. Such a plan should identify participants and their responsibilities, develop a drought monitoring plan, and develop drought response measures. A regional drought response plan would help to better characterize drought conditions, allow water users to pool and share their water resources, and help to minimize regional impacts during the most severe events.

CHAPTER 7 - PROJECT REVIEW PROCESS

This chapter documents the procedures and processes the Madera RWMG has developed to identify projects for inclusion in the IRWMP, and then to select projects from the list for inclusion in specific funding applications. Projects selected for inclusion in the Plan will meet the RWMG's goals and objectives and will be responsive to the funding criteria for the identified funding opportunities. The process includes the gathering of certain basic project information so that the proposed projects will be in the "inventory" of the RWMG. Later, more-detailed project pre-applications can be prepared when target funding sources are identified. Projects can be selected from the inventory based upon a combination of priority to the RWMG and "fit" with the funding opportunity goals and priorities.

This process is intended to be flexible, transparent and easily understood by all stakeholders. The proposed project documentation is designed to facilitate cost-effective project preparation, with information requested only as it is required. Initially, project proponents are only required to submit brief Project Description Forms, but more extensive Pre-Applications are recommended for screening projects for grant applications.

The result of the project review process is the production of a list of implementation projects, along with enough supplemental information to allow later prioritization for specific funding opportunities.

The adopted project review process accomplishes four key objectives identified in the IRWMP Guidelines:

1. Project Identification and Solicitation: The adopted process allows the RWMG to solicit, and the Partners to identify, proposed projects which have the potential to meet the IRWMP goals and objectives.

2. Project Selection: The adopted process allows the RWMG to review and select projects from the proposals made by the Members and to list those selected projects in the IRWMP.

3. Publishing the Project List: The adopted process allows the RWMG to communicate the list of projects in the IRWMP to stakeholders and the public.

4. Matching Projects to Funding Opportunities: The adopted process further allows the RWMG to rank and select the most promising projects to include in specific grant applications, based upon the funding program's published scoring and ranking criteria, thereby increasing the chances that the RWMG's grant application will be favorably reviewed, scored and funded.

Figure 7-1 is a flowchart illustrating the process of creating a project list. This process is described in Section 7.1 below.

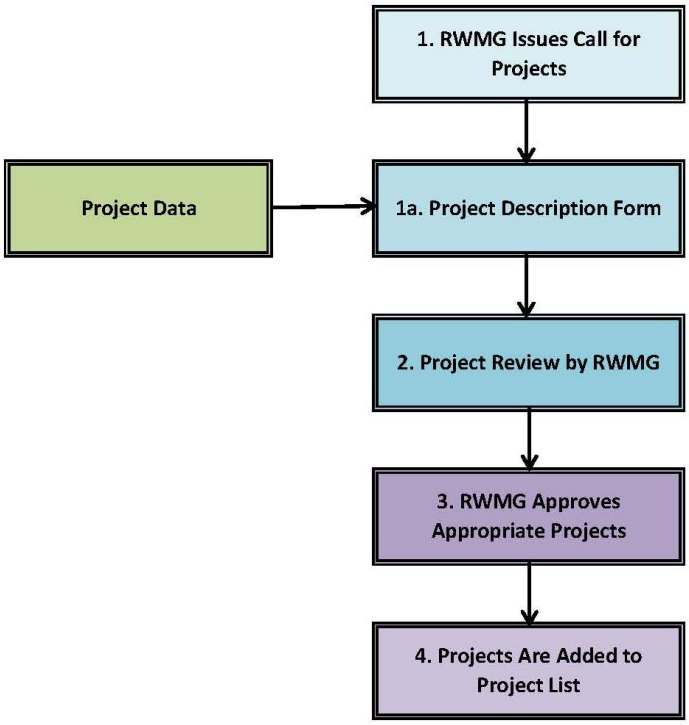

Figure 7-1 – Project Solicitation and Review Process

Because there are continual efforts by Members and interested stakeholders to develop new and improve existing projects, the list of projects included in this chapter is not intended to be final or exhaustive. As additional project proposals are received, they will be considered as discussed below, and an updated list of projects will be made available on the RWMG's website at http://madera-id.org/index.php/rwmg. The project list will be updated at least semi-annually, in accordance with the RWMG by-laws.

7.1 - Inclusion of Projects in the IRWMP

The RWMG regularly accepts new project applications from Members; this subject is discussed at most RWMG monthly meetings and will continue on a regular basis, with the RWMG staff circulating information about upcoming funding opportunities to Members as it becomes available. Specific calls for projects are made when funding opportunities become known. Since each funding opportunity is unique, the specific goals and scoring criteria for new funding opportunities are expected to encourage Members to submit additional potential projects intended to both accomplish IRWMP goals and objectives and to match well with funding opportunity scoring criteria.

The RWMG has identified potential projects from past solicitation efforts. These projects form the current project list (**Appendix F**). The RWMG will encourage all types of projects and programs, provided each addresses at least one of the IRWMP's regional goals and/or measurable objectives. As indicated in Chapter 5, the regional goals are broad statements of the purpose of the IRWMP. These goals and their underlying objectives are intended to address water management and ecosystem problems and conflicts in the region. Projects addressing any of the goals or objectives are accepted for consideration.

RWMG policy and IRWM program requirements both dictate that projects be submitted and accepted to the project list before they can be considered for inclusion in a grant application. This policy encourages Members to carefully plan and document their projects in advance, and discourages including projects in grant applications that have not been properly developed and supported by factual information.

The following process has been developed for solicitation and identification of projects for inclusion in the IRWMP. The following steps are intended to standardize information submitted to the RWMG for project consideration and allow for efficient review.

1) RWMG Issues a Call for Projects
2) Submitted Projects are Reviewed by the RWMG
3) Appropriate Projects are Approved by the RWMG
4) Projects are added to the IRWMP Project List.

The Project List is updated at least semi-annually, as required.

Step 1 RWMG Issues a Call for Projects

The RWMG will, from time to time, issue a Call for Projects. Calls for projects will be made when specific grant programs are announced, in order to assure that the highest-priority, best-fitting projects are included in every grant application. Calls may also be issued when revised RWMG goals or objectives are published. These calls will be made in several contexts including:

- Announcements will be made at regularly-scheduled RWMG meetings
- Announcements will be made at Members' and stakeholders' agency board and management meetings
- E-mails will be sent to stakeholders and interested parties
- The Call for Projects will be posted on the RWMG website

Projects must be submitted by a Member or official interested party. The project selection process is open for consideration of all projects, regardless of the current project development status. Projects at the conceptual level are encouraged and may be added to the list for broader

awareness, to prevent duplication of effort and to facilitate project integration and development. It is hoped that awareness of one Member's early project concepts may stimulate interest in joining the project among other members and stakeholders.

Project proponents will be asked to complete a standardized Project Description Form (see sample in **Appendix G**). The form asks for basic information that might appear on a State or federal grant application, including:

- Project name
- Project proponent(s)
- Location
- Size (defined in terms relevant to the project itself)
- Development status (conceptual, planning, feasibility study, preliminary design)
- Background description (or project need of concept)
- Regional Goals and Objectives addressed
- Resources Management Strategies addressed
- Estimated budget
- Estimated time to construction

This information will be sufficient to select and prioritize projects for consideration in grant application packages as funding opportunities arise. Since each grant has its own goals and selection priorities, additional information will be required for each project once the program requirements for the funding opportunity are known. The proponents of those projects selected for consideration in the grant application will then be asked to provide additional information necessary to respond directly to grant selection criteria in a customized pre-application.

The RWMG may add to or modify the Project Description Form in the future. The most-current version of the form will be available at the RWMG website at http://madera-id.org/index.php/rwmg. Instructions for submittal of the completed form are included.

Step 2 Submitted Projects are Reviewed by the RWMG

The RWMG will receive each Project Description Form and review each for content and consistency. If necessary, the RWMG will request additional information from the project proponents if needed for clear understanding of the proposal. In addition, the review will evaluate the following criteria. Each criterion will be given a rating as shown, to assist the RWMG in selecting and ranking projects for funding opportunities.

- Does the project effectively address Regional Goals, Measurable Objectives and Resource Management Strategies? (One, Two, Three or more)
- What is the project's status, and how long would it require to develop to the point of grant-readiness? (Conceptual, Preliminary Design, Ready to Construct)

Projects that are determined to meet the necessary criteria will be considered by the RWMG for addition to the IRWMP Projects List.

Step 3 Appropriate Projects are Approved by the RWMG

The RWMG, at one of its regular meetings, will consider recommended projects and will vote to add them to the Project List. This project list will not be ranked. Project ranking will be based upon funding criteria as discussed in Section 7.2.

Step 4 Projects are Added to the Project List.

The project list will then be generated or updated including projects added in the steps above. An initial list of projects is provided in **Appendix F**.

7.2 - Selecting and Prioritizing Projects for Specific Funding Opportunities

As discussed above, each funding program has its own goals and scoring criteria, and not every project considered important or urgent by the RWMG will be equally responsive to those varying criteria. In order to maximize the chances of being selected to receive funding, it will be important to objectively evaluate, rank and select listed projects for inclusion in a particular funding application. This is particularly necessary for certain grants, including the DWR IRWMP Implementation Grant program, which score applications based on the collective merit of all proposed projects included in the application, and do not fund projects individually. The RWMG has developed the following five-step process for project prioritization based on funding opportunities. A flowchart of this grant-specific process is shown in **Figure 7-2.**

Presentation of Funding Opportunity Information

Funding opportunity information is brought to the RWMG by Members, interested parties, consultants and other stakeholders. These opportunities come from a variety of sources for a wide range of projects and programs, and when these opportunities arise, it is important that all Members and stakeholders gain a basic understanding of the opportunity, project eligibility and selection criteria. The RWMG, through its regular meetings and pro-active communications, provides a clearinghouse for information regarding such opportunities.

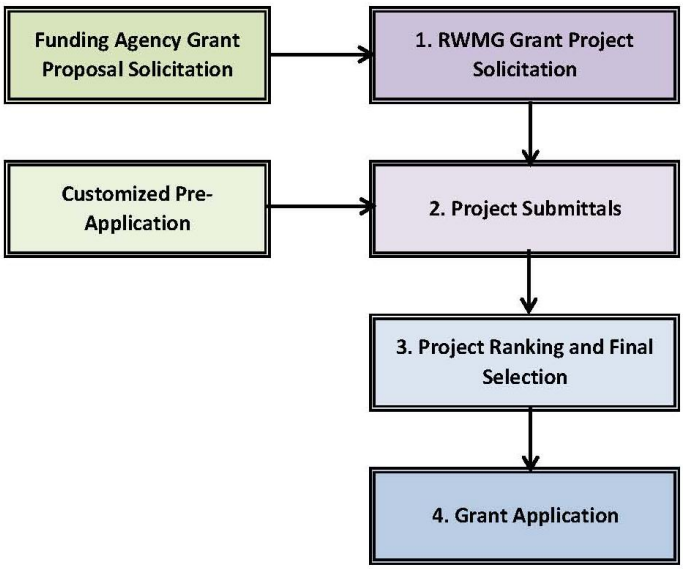

Figure 7-2 – Grant Project Solicitation and Prioritization Process

Establish Project Selection Criteria

Upon the decision to consider specific funding opportunities which require project prioritization, the RWMG will develop custom-tailored Scoring Criteria in the form of a Pre-Application based on the goals, objectives and scoring criteria of the specific funding opportunity. The Pre-Application will match that of the funding opportunity, and may include additional other information and categories considered for prioritization. A Pre-Application outline and sample Pre-Application are included in **Appendix G**. In addition to the Project Description Form already on file, information requested in a Pre-Application may include some or all of the following. Some of these categories are duplicated from the Project Description Form, because information may have changed since the project was first submitted for inclusion on the IRWMP projects list:

- Grant-Specific Requirements
- Project Sponsor(s)
- Measurable Objective(s) addressed, how the project addresses the Objective(s), and a description or estimate of the benefits to be received
- Current Project Status
- Detailed Timeline for Completion
- Work Plan
- Demonstration of Technical Feasibility
- Demonstration of Economic feasibility including Benefit/Cost Ratio
- Funding of Local Cost Share (if required)
- Environmental Justice Concerns

- Climate Change and Greenhouse Gas (GHG) reduction considerations

Organizations that propose projects for grant applications must have also adopted the IRWMP prior to preparing a grant application. The lands within the Region do not receive Delta water, so impacts to reducing dependence on the Delta are not considered in project evaluations.

Pre-Application Request

The RWMG will request that Sponsors of the projects being considered for inclusion in the funding package submit Pre-Applications, as described above. Sponsors will be asked to make efforts to keep the Pre-application length between 5 and 15 pages, excluding attachments and appendices. The Pre-Applications can be submitted by email, mail, hand delivered, or through the RWMG web site. Pre-Applications will be used to:

1) Verify that the project is suited to the grant application at hand;
2) Demonstrate commitment on part of the Sponsor;
3) Help the Sponsor(s) further evaluate the proposed project and determine if they can prepare a competitive grant application within the available timeframe; and
4) Develop information that can be re-used in the grant application

Final Project Scoring and Selection

Once Pre-Applications are received, the RWMG will score each project in accordance with the funding opportunity criteria, and will select a final prioritized list of projects for consideration for inclusion in the final grant application.

The prioritized project list may include more projects or funding requested than is eligible or reasonable to submit for the specific funding opportunity. The RWMG will choose a recommended short list of projects based on the prioritized scoring to be included in the funding application request and the estimated total amount of funds available.

It is possible that a highly prioritized project may not be ready to proceed to application or feasibly be completed within the required timeframe. As part of this step, the RWMG will solicit confirmation from each of the recommended project proponents to ensure that they are prepared to proceed with additional efforts required to prepare the full application, and discuss possible mechanisms to assist with application preparation. An agreement for funding of the application process, contract legal review of funding master agreement and sub-agreements, and funding agreement between Member sponsors for interested parties (if necessary), will be developed amongst the applicants and included in the RWMG's final recommendation.

Funding Application Development and Submission

Following approval by the RWMG, the project Sponsors will complete the necessary information for the funding application preparation and submittal.

Conceptual Grant Application Schedule

An important step in preparing a successful IRWMP grant application is starting early. The DWR typically provides estimated deadlines and draft Proposal Solicitation Packages (PSP) six months before a final grant deadline. The RWMG should start the process as soon as preliminary information is available. **Table 7.1** shows a conceptual schedule for responding to a grant solicitation. This schedule is just a guide, but following it will provide sufficient time to select the best projects and prepare a competitive grant application. The time to combine multiple applications into a single document is often underestimated.

Table 7.1: Conceptual Schedule for Submitting IRWMP Grant Applications

Task	Days prior to Final Deadline
Review Draft PSP and identify potential projects	Before 90
Prepare and submit Project Description Forms	Before 90
RWMG reviews Project Descriptions and selects likely projects for Pre-Applications	90
Prepare Pre-Applications	90-60
RWMG reviews Pre-Applications and selects best projects	60
Complete individual grant applications	60-21
Combine individual grant applications into single application	21-0

CHAPTER 8 - IMPACTS AND BENEFITS

This chapter lays out the overall benefits and some specific impacts of creating an Integrated Regional Water Management Plan (IRWMP), including some benefits and impacts that may be unique to the Madera Region. The DWR IRWM Program Guidelines anticipate that participants will understand the likely benefits to be derived from development of a Plan, as well as some of the more negative effects that may occur. The Guidelines assume that while a general analysis of these benefits and impacts can be made during plan preparation, a more thorough and complete analysis would be part of environmental review at the time of specific project development. Accordingly, this chapter is limited to higher-level and less-detailed analysis.

Identifying the general impacts and benefits of implementing the IRWMP is important for three reasons:

1. The analysis of impacts and benefits of the program can help inform development of resource management strategies and selection of projects.
2. Analysis of potential negative impacts at this early stage is important to provide time to revise strategies and projects and/or create mitigation measures that will be effective in bringing project benefits with minimized negative impacts.
3. The benefit and impact analysis can form the basis of a monitoring program for each project that will be helpful in monitoring IRWMP performance and goal achievement.

8.1 - General Benefits of Regional Water Management

The history of water rights and water management in California is unique among Western states in that rights are vested in the individual or local agency water user rather than commonly in the State. This system has applied both to riparian and correlative rights regarding surface water diversion as well as to the rights of overlying landowners to make beneficial use of the groundwater they are able to pump from beneath their lands. This system worked well for many years, in particular so long as there was an abundance of water. However, there is now a shortage of both surface and groundwater resources within the Region (as well as within neighboring regions) which has led to substantial and damaging groundwater overdrafts and significant shortfalls of surface water.

Continued local and independent management of water resources will allow this competition and conflict to continue, with increasing incidences of water quality impairments, ground subsidence, increased overall pumping and delivery costs, litigation and long-term water resources loss. Regional management, as encouraged by the IRWMP program, will help bring cooperative and collaborative methods to solve what will otherwise be intractable problems. Some key benefits of regional management methods include the following:

- Management of water resources within a recognized hydrologic boundary rather than many isolated political boundaries
- Development of a common long-term vision for regional water management for water supply and water quality issues
- Establishment of common goals and policies for economical and efficient use of available water resources
- Shared development and use of the same hydrologic model and analytical tools for project evaluation
- Improvement in regional water supply reliability
- Increased operational flexibility of the water infrastructures in the region for common benefit
- Protection and improvement of groundwater quality and implementation of regional water management strategies to address drinking water issues
- Reduced cost of developing one regional plan versus individual agency plans
- Reduced cost of data collection, data sharing, and data management
- Increased political influence needed to protect and preserve water resources
- Reduced potential for conflicts and litigation
- Increased chances for obtaining state/federal grant funds as a region rather than as a local agency.

None of these benefits would accrue without the RWMG or some similar regional management structure, and none will continue if the actions taken by the RWMG, including preparation and maintenance of this IRWMP, are not continued through implementation of regional project and management strategies. Such discontinuance would lead to recurring and increasing impacts to water supplies, groundwater, and sensitive ecosystems, resulting in some or all of the following:

- Declining groundwater levels
- Increased pumping costs
- Increased capital costs to lower pumps, deepen wells or construct new wells
- Reduced supply reliability
- Potential conflicts between water users for available groundwater supplies
- Inability to respond to dry year or extended drought conditions
- Degraded ecosystems
- Loss of habitats
- Inability to address regional drinking water quality issues
- Loss of regional economic activity

8.2 - Impacts and Benefits of Resource Management Strategies

The screening level analysis of impacts and benefits from implementing 35 different resource management strategies are included in **Table 8.1**. These strategies come from a list of 37 resource management strategies listed in the California Water Plan Update (DWR, 2009) and

draft 2013 update. Thirty five of those 2013 strategies were deemed applicable to the Region and are discussed in detail in Chapter 5 (Resource Management Strategies).

The impacts and benefits of implementing these strategies broadly approximate the potential benefits and impacts of implementing the IRWMP. **Table 8.1** was developed through interactive discussions by the RWMG. **Table 8.1** presents many of the potential benefits and impacts on the Madera IRWM area and adjoining IRWMP areas, if a given management strategy is implemented.

Table 8.1: Benefits and Impacts of Resource Management Strategies

Strategy		Madera IRWM		Interregional	
		Benefits	Impacts	Benefits	Impacts
Reduce Water Demand	Agricultural Water Efficiency	• Reduced water costs • More efficient use of chemicals • Reduced subsurface drainage • Protection of water quality	• Reduced groundwater recharge in some areas • Requires operational changes • Irrigation hardware needed • Hardware maintenance requirements • Irrigator training requirements	• More interregional basin • exchanges possible • Reduced subsurface • drainage	• Reduction in spills and off-site drainage
	Urban Water Efficiency	• Extend supply • Reduced cost • Reduced home chemical use • Delayed capital costs • Protection of water quality • Reduced energy use • Reduced groundwater (Fracture controlled) overdraft	• Causes operational changes • Lost revenue if usage based • Inconvenient watering times • Creates hard demand that reduces opportunities for drought response	• Possible increase in supply (if fractures traverse regions) • Reduced wastewater treatment • Stretch existing water supplies	• Reduced in spills and off-site drainage
Improve Operational Efficiency and Transfers	Conveyance - Delta	Not applicable in this Region	Not Applicable in this Region	Not Applicable in this Region	Not Applicable in this Region
	Conveyance - Regional/Local	• Maintain water rights • Revenue generation • Conjunctive use • Improved water quality • Increased flood control capabilities • Could deliver surface water to areas that use only groundwater	• Increased use of facilities • Shortened maintenance periods • Greater costs for larger facilities	Not Applicable	Not Applicable

Strategy		Madera IRWM		Interregional	
		Benefits	Impacts	Benefits	Impacts
Improve Operational Efficiency and Transfers	System Reoperation	• Water quality improvements • Flood protection • Recreation benefits • Power generation • Ecosystem restoration	• Loss of historical supplies to other uses	• Temperature control for local fisheries • Flood protection • Ecosystem restoration • Litigation reduction	• Greater management requirements •
	Water Transfers	• Increase recharge options • Reduce groundwater pumping • Reduce overdraft • Expand irrigable acreage	• High capital cost • Potential high annual cost	• Raise capital for other water infrastructure projects • Equalize water supply and demand	• Potential to reduce water in other regions
Improve Flood Management	Flood Management	• Enhanced flood protection • Reduce risk to lives & property • Recharge possible if captured • Riparian habitat improvements • Possible floodplain restoration	• Structural approaches are costly • Permitting requirements involved • Long term ongoing maintenance costs • Emergency response planning required • Limit development in some areas	• Reduce downstream flood risk • Reduce flood recovery costs • Manage upstream water • Regional planning required	• Limit development in some areas • Revisions to flood insurance mapping • Multiple County communications system
Increase Water Supply	Conjunctive Management & Groundwater Storage	• Dry year supply • Extends use of existing basin • Overdraft reduction • Improved water supply reliability • Fracture controlled and Groundwater recharge • Better groundwater management	• Increased pumping costs compared to surface water • Litigation challenges • Increased data collection needs & costs • Uncertainty of impacts to facility neighbors • Facility capital costs • Land use changes for facilities	• Water quality improvement • Improved water supply reliability • Drought relief • Reduction in flood flows below reservoirs	• Water supply uncertainty if surplus flows diverted more frequently

Strategy		Madera IRWM		Interregional	
		Benefits	Impacts	Benefits	Impacts
Increase Water Supply	Precipitation Enhancement	• Quick project development • Increase in water supply	• Accuracy of location & timing	Not Applicable	• Increase in supply in one area at the expense of downwind area • Added snow removal burden in some area • Public concern over accumulation of seeding agent
	Recycled Municipal Water	• Reliable supply • Improved water quality • Allows for development • Drought resistant supply	• Increased operations & maintenance cost • Public acceptance • Water quality concerns with microbial contaminants, salinity, heavy metals, and pharmaceuticals	• Interregional exchange	Not Applicable
	Surface Water Storage - CalFed	• Water supply reliability & augmentation • Flood control • Hydroelectric power generation • Recreation • Sediment transport management	• Permitting requirements • Environmental mitigation • Cost • Limited sites available • Failure impacts • Beneficiary determination • Property tax losses • Habitat losses • Operational control	None	• Reduction in downstream flows • Habitat migration

Strategy		Madera IRWM		Interregional	
		Benefits	Impacts	Benefits	Impacts
Increase Water Supply	Surface Storage - Regional/local	• Water supply reliability & augmentation • Flood control • Hydroelectric power generation • Recreation • Sediment transport management	• Permitting requirements • Environmental mitigation • Cost • Limited sites available • Failure impacts • Beneficiary determination • Property tax losses • Habitat losses • Operational control	• Water transfers • Ecosystem management	• Reduction in downstream flows • Habitat migration
Improve Water Quality	Drinking Water Treatment & Distribution	• Protect public health • Maintain regulatory compliance	• Increased O&M costs • Increasingly stringent regulations • Trained operators • Facility security • Treatment residual disposal • Deteriorating infrastructure	None	None
Improve Water Quality	Groundwater Remediation/ Aquifer Remediation	• Protect public health • Maintain regulatory compliance • Avoided costs of purchasing additional supply	• Costly • Highly trained operations staff • Public perception/acceptance of treated water	• Contaminant plumes kept from spreading	None
	Matching Quality to Use	• Best use of available local water supplies • Most economical choice • Treatment avoided or limited	• Possible environmental impacts • Infrastructure costs • Conveyance costs	• Upstream and downstream partnerships	• Water quality degradation • Effluent dominated streams • Salinity increases
	Pollution Prevention	• Improved water quality • Consistent with anti-degradation policies • More cost effective than remediation or "end of the pipe" treatment	• Increased regulations • Increased costs • Increased management needs • Increased monitoring costs	• Protect water at source • Agriculture irrigation	• Difficult to distinguish between level of impacts of natural and introduced contaminants at times • Lack of access to some recreational areas

Strategy		Madera IRWM		Interregional	
		Benefits	Impacts	Benefits	Impacts
Improve Water Quality	Salt and Salinity Management	• Increase groundwater usefulness • Improve groundwater quality	• Increase costs for irrigation • Reduce irrigable land area	• Increase demand for surface water transfers	• Reduce surface water supply
	Urban Surface Water Runoff Management	• Water source for local recharge • Improve flood protection • Reduce surface water pollution • Minimize soil erosion & sedimentation problems • Local resource from waters historically lost to an area • Mimic natural hydrologic cycles	• Cost to treat and manage runoff • Increased cost to urban developments • Disease from standing water in basins	• Regional collaboration and coordination	• Possible groundwater contamination from recharged water
Practice Resources Stewardship	Agricultural Lands Stewardship	• Reduces pressure to agricultural lands from urban development • Increased economic viability for agricultural lands • Habitat improvement • Encourages agricultural practices which also benefit environmental and restoration concerns	• Conservation easement costs • Cost to implement BMPs	• Preservation of open spaces & agricultural land • Regional planning urban growth strategy • Flood impact reduction • Food security • Recreational opportunities	• Reduced tax base for county and state governments
	Ecosystem Restoration	• General quality of life increase • Protection and enhancement of meadows, fish & wildlife and water resources	• Increased short term costs • Water supply loss	• Increased recreational opportunities • Increase in native species • Water quality improvements • Sustainability to water and flood management projects	• Conflicting objectives in flood management • Opposition to conversion of farmland to habitat

Strategy		Madera IRWM		Interregional	
		Benefits	Impacts	Benefits	Impacts
Practice Resources Stewardship	Forest Management	• Reduction in sedimentation in local rivers and streams • Water quality betterment • Reduced risk of fire • Reduction of carbon footprint	• Economic impacts to loggers and other forest users •	• Air quality protection • Water quality improvement • Winter snowpack improved • Recreational opportunities • Increased water storage • Protection of water supplies • Reduced risk of fire • Reduction of carbon footprint	None
Practice Resources Stewardship	Land Use Planning and Management	• Improved communication among different agencies • Proper planning helps ensure new developments have reliable and sufficient water supplies • Potential for reduced water demands based on development designs	• Difficulty in getting some land and water use planners to cooperate • Increased costs to coordinate efforts	• Potential for reduced inter-regional conflicts • Reduce flooding and increase recharge	• Financial savings • Economy of scale by avoiding conflict
	Recharge Area Protection	• Provide sustainable and reliable water supply of good quality • Removal of some microbes and contaminants during recharge • Flood protection	• Vectors and odors	• Reduces pollutants entering groundwater	None
	Sediment Management	• Reduces sediment loading in aquatic environments • Improves aquatic health • Reduction in erosion	• Economic impacts to loggers and other forest users if roads closed.	• Reduces sediments in lower reaches of rivers, lakes, and reservoirs. • Reduces contamination transport downstream.	None

Strategy		Madera IRWM		Interregional	
		Benefits	Impacts	Benefits	Impacts
Practice Resources Stewardship	Watershed Management	• Community level solutions • Water quality improvement • Protection of local water rights • Flow attenuation	• Difficulty of diverse stakeholders working together	• Community collaboration • Flood mitigation • Quality of life • Habitat provision • Mineral/Nutrient cycling • Recreation opportunities	None
People and Water	Economic Incentives (Grant, Water Pricing)	• Decreased costs for grant recipients • Reduced wait for needed infrastructure • Reduction in water demand from water pricing structures • Reduces use through step charges • Extends supply • (See "Reduce Water Demand") • Provide Capital Funding	• Burdensome application processes • Increased federal or state directives in local issues • Increased administrative costs • Funding is intermittent • Impacts poor disproportionately • May require matching funds	• Local return from statewide obtained funds • Societal goals obtained	• Increase in State debt burden • Social inequities
	Outreach and Education	• More informed public are more engaged in decision making	None	None	None
	Water and Culture	• Raises awareness of cultural impacts on resources and the lack of resource on culture	None	None	None
	Water Dependant Recreation	• Positive agency public relations • Revenue generation • Quality of life benefits to health	• Increased liabilities • Water quality degradation • Addition facility O&M costs • Lack of funding	• Recreational opportunities for travelers	None

Strategy		Madera IRWM		Interregional	
		Benefits	Impacts	Benefits	Impacts
Other Strategies	Crop Idling for Water Transfers	• Drought water supply reliability • Stable farm income in water short years	• Introduction of wildlife, weeds, pests and trash dumping to the area • Changes to local community way of life	None	None
	Dewvaporation or Atmospheric Pressure Desalination	• Increased water supply • Remediation of saline water supplies	• Disposal of salts • Energy costs	None	None
	Irrigated Land Retirement	• Generation of stable water supplies • Reduction in agricultural drainage to an area	• Taxpayer burden of land cost • Increased management costs of government owned retired lands • Lower income and higher unemployment	None	• Possible growth inducement due to increased water supplies • Community and region may lose way of life, jobs • Local tax base losses • Changes in school populations
	Rainfed Agriculture	• Reduction in runoff with no-till systems	• Increased uncertainty of crop production • Low value of viable crops in historical irrigated agricultural areas • Increased runoff and erosion potential	None	None
	Drought Planning	• Improved water reliability	• Costs to develop and maintain drought response plan • Implementing plan may be unpopular • Lack of funds for additional storage	• Lower regional groundwater overdraft • Lower demand for dry year water supplies • Prevent loss of crops or crop idling	None

8.3 - Regional Benefits and Impacts

Many times lost in the focus on impacts and benefits to the immediate or regional area is the reality that many strategies will have consequences, both positive and negative, outside of the region itself. When considering project benefits and impacts, it is easy for project proponents to focus on the immediate project area. However, the nature of water management projects means that benefits and impacts are often much more widespread. Complete analysis of every project's benefits and costs is an integral part of the CEQA work needed prior to project implementation and is essential to understanding regional water management. Many projects within the region may affect surrounding areas. See **Figure 3-17** in Chapter 3 – Region Description for a map of the surrounding RWMG organizations.

The Madera RWMG is regionally unique in that it contains large areas of valley, foothill and mountain lands. As a result, the Madera RWMG covers much of the watershed that delivers water to the valley portion of Madera County. The Madera RWMG is also hydrologically connected to several neighboring RWMGs. These neighboring RWMGs are generally limited to just valley lands or just foothill/mountain areas.

Southern Sierra IRWM Region

The Madera IRWM Region is located north of the South Sierra IRWM Region. The South Sierra and Madera IRWM Regions are generally separated by the San Joaquin River, which creates a partial hydrological boundary, but the two regions are still hydrologically connected. Both Regions share an area south of the San Joaquin River and east of the South Fork of the San Joaquin containing the watershed of the Middle Fork of the San Joaquin River. Both regions would also be affected by projects that impact the flow rate or water quality in the San Joaquin River.

East–Inyo-Mono IRWM Region

The Inyo-Mono IRWM Region includes lands to the east of the Madera IRWM Region and is hydrologically disconnected. The topographic boundary between the two regions is the crest of the Sierra Nevada mountain range, which separates surface flows west and east. Direct benefits or impacts on the Inyo-Mono IRWM region are not anticipated from policies or actions in the Madera IRWM Region.

Kings Basin Water Authority IRWMP

The IRWMP for the Kings Basin Water Authority (also called the Upper Kings Basin Water Forum) lies to the southwest of the Madera IRWM Region boundaries. The two IRWM Regions share a common boundary along the San Joaquin River. This area receives most of their surface water from the Kings River and relies heavily on watershed management in the Southern Sierra to provide reliable and high quality surface waters. The area also relies on San Joaquin River water that originates in Madera County to meet some water demands. The Kings Basin Water Authority region is experiencing groundwater overdraft, and water management strategies that

address or exacerbate overdraft would affect the Kings Basin Water Authority region.

Merced IRWM Region

The Merced IRWM Region is located along the northwest border of the Madera Region. They share a common border along the Chowchilla River. As a result, projects that impact the Chowchilla River impact both IRWM Regions.

Tuolumne-Stanislaus IRWM Region

The Tuolumne-Stanislaus IRWM Region shares a small part of the border on the far eastern end of the Madera IRWM Region. The Tuolumne-Stanislaus IRWM Region is generally upstream of the Madera IRWM Region so projects in Madera would generally not impact them, but their projects could impact water resources in the Madera Region.

Yosemite-Mariposa IRWM Region

The Yosemite-Mariposa IRWM Region is located north of the eastern part of the Madera IRWM Region. Both IRWM Regions have portions of the upper watersheds of the Chowchilla, Fresno and Merced Rivers. The Yosemite-Mariposa IRWM Region consists mostly of mountain and foothill areas, and has similar physiography and climate to the eastern portion of Madera County. The two regions are hydrologically connected by rivers and streams, and projects in each IRWM Region could impact the other.

Westside-San Joaquin IRWM Region

The Westside San Joaquin IRWM Region is located west of the Madera IRWM Region and they share a common border along the San Joaquin River.

8.4 - Impacts and Benefits to Interested Parties and DACs

The Madera RWMG, during the preparation of this IRWMP update, has taken several steps to engage interested parties and Disadvantaged Communities (DACs) in the IRWMP development and implementation. Some local agencies, organizations and DACs are not full members of the Madera RWMG, but can participate in a meaningful way as Interested Parties. Implementation of the IRWMP is expected to have the following benefits to DACs and Interested Parties:

- Discussion Forum. Provide a forum and a voice for discussion of water management issues, concerns, and priorities, especially those important to DACs throughout the Madera Region.
- Information Dissemination. Share information to which DACs or Interested Parties may not normally have access. For instance, DACs and Interested Parties may not have the staff to regularly track Department of Water Resources (DWR) grant projects or attend other regional or statewide meetings. This is typically summarized for the benefit of all members and interested parties at regular RWMG meetings and in RWMG emails.
- Funding Opportunities. RWMG members can apply for a variety of grant programs from DWR, including some that are specifically for RWMG members and stakeholders.

- Special DAC Efforts. DACs can get greater recognition, publicity and input on their water resources issues through special DAC-benefitting projects.

DACs and Interested Parties are not expected to bear significant impacts from the IRWMP implementation, except local impacts that may occur from certain new projects. These impacts would require mitigation before the project is supported by the RWMG, as discussed below.

8.5 - Project Specific Impact/Benefit Analysis

In accordance with state law, the potential environmental impacts of all projects pursuant to the Madera IRWMP will be evaluated under the California Environmental Quality Act (CEQA). When funding requirements so dictate, additional environmental review will be done pursuant to the National Environmental Policy Act (NEPA).

As required under CEQA and NEPA, mitigation measures will be developed whenever feasible, for impacts which are determined to be significant. Project impacts and benefits must be described when projects are submitted to the Madera RWMG in the Project Information (Project Review Process) Form and prior to funding consideration. Grant Pre-applications must include thorough discussions of potential benefits and impacts, but will not require completion of CEQA. However, if an agency chose to complete CEQA review of a potential project, it could improve the chances of that project being recommended for inclusion in a funding application since there would be: 1) an increased certainty of the project's scope, benefits and impacts; and 2) a reduction in the time required to move the project to construction after approval of funding.

As a minimum, the benefit/impact analysis should address the topics found in a CEQA Environment Assessment (EA), including: aesthetics, air quality, biological resources, climate change, cultural resources, geology and soils, hydrology and water quality, land use and planning, noise, population and housing, public services and utilities, recreation, and transportation and circulation.

8.6 - Revisions and Updates to Benefits and Impacts

The evaluation of the overall impacts and benefits of IRWMP implementation will be revised according to the following guidelines:

- Impacts and benefits will be reviewed and revised whenever the IRWMP is updated or DWR establishes new guidelines for this standard, recognizing that as laws, regulations and even climate change that these impacts and benefits will require re-evaluation.
- Impacts and benefits will be revised, as appropriate, to reflect anticipated or observed changes in the regional climate.
- Impacts and benefits will be revised to reflect lessons learned, or new impacts or benefits identified during implementation of local or regional projects.

CHAPTER 9- PLAN PERFORMANCE AND MONITORING

Monitoring performance and progress toward measurable objectives is essential to understanding the effectiveness of the IRWMP, and useful in reporting that progress to the public and to regulatory officials. This chapter describes existing monitoring programs in the Madera Region, and discusses planned monitoring programs that will result from implementation of resource management strategies and projects in the region. It also discusses guidelines for preparing project-specific monitoring and reporting plans.

9.1 - Regional Monitoring Efforts

Following are descriptions of some of the major on-going monitoring programs in the region. Each of these programs monitors specific information in limited geographic areas within the Region.

California Department of Water Resources (DWR) Data Exchange Center – The California Data Exchange Center (CDEC) maintains and operates an extensive hydrologic data collection network, which includes automatic snow reporting gages for the Cooperative Snow Surveys Program and precipitation and river stage sensors for flood forecasting, including various locations within the Madera RWMG region. The CDEC website is located at http://cdec.water.ca.gov and can be accessed at any time. The mapping tool within the website at http://cdec.water.ca.gov/cgi-progs/mapper can be used to locate monitoring stations within a limited geographical area.

The California Department of Water Resources runs a comprehensive survey of snow depths throughout the Sierra Nevada Mountains, including the San Joaquin River watershed within the Madera RWMG region. Information on the snow survey program can be found at http://cdec.water.ca.gov/snow/. Active snow courses are highlighted at http://cdec.water.ca.gov/misc/SnowCourses.html, and are monitored by the National Park Service, Forest Service, Department of Water Resources, utility companies and water associations.

Sierra Nevada Adaptive Management Project (SNAMP) – SNAMP includes a team of university scientists that is monitoring the effects of vegetation management treatments in two Sierra Nevada locations: Sugar Pine and Last Chance (in the Tahoe National Forest). The SNAMP science teams are made up of researchers from various universities. The science teams study fire and forest health, wildlife (focusing on fish and spotted owl), water, and public participation. All science teams are supported by remote sensing, spatial analysis and Geographic Information Systems techniques. This is a seven-year project, ending in 2015, with on-going monitoring. For more information: http://snamp.cnr.berkeley.edu/ .

National Park Service, Sierra Nevada Inventory and Monitoring Program - The Sierra Nevada Network Inventory & Monitoring Program is one of 32 National Park Service Inventory &

Monitoring (I&M) networks across the country established to facilitate collaboration, information sharing, and economies of scale in natural resource monitoring. The Sierra Nevada Network (SIEN) comprises four national park units located on the west slope of the Sierra Nevada mountain range in California, including Yosemite National Park. Yosemite National Park works closely with each park's natural resources program to develop and implement long-term monitoring and provide sound scientific information to park managers. The river monitoring efforts for 2012 are summarized in the linked document: https://irma.nps.gov/App/Reference/DownloadDigitalFile?code=453888&file=SierraNevadaHydrology_Andrews_20120818.pdf. More information on the program can be found at the following website: http://science.nature.nps.gov/im/units/sien/index.cfm.

US Geological Survey (USGS) – The USGS monitors stream flow and surface water quality in multiple locations throughout California. California daily stream flow locations can be accessed here: http://waterdata.usgs.gov/ca/nwis/rt.

California Water Institute – The California Water Institute (CWI) was founded to be a forum for unbiased, open, collaborative discussion, research and education on water-related issues benefiting the entire state. Housed at California State University, Fresno, CWI serves as an independent center for research, education, planning, policy evaluation, and information transfer. Some of the specific functions within its mission statement include conducting watershed-based studies, developing monitoring and reporting modalities, develop water resources management strategies and maintaining databases. The Institute is lead by Dr. David Zoldoske, Director of the Institute. More information on current research available from CWI may be found at: http://www.californiawater.org/cwi/CurrentProjects.html

San Joaquin Experimental Range - The San Joaquin Experimental Range (SJER) is operated by the US Forest Service. It was established in 1934 and was California's first range research station. It was originally conceived as a cooperative interdisciplinary research center to identify cost-effect methods of commercial livestock production in the annual grass-oak pine woodlands, while maintaining the integrity of the ecosystem. The SJER performs research and monitors several parameters relevant to watershed management. More information on the SJER can be found on their website: http://www.fs.fed.us/psw/ef/san_joaquin/.

Southern Sierra Critical Zone Observatory – The Southern Sierra Critical Zone Observatory (CZO) is a platform and program for investigating how the water cycle drives Critical Zone processes, focusing on water balance, nutrient cycling, and weathering across the rain-snow transition. The Southern Sierra CZO was established in fall 2007, under a grant from the National Science Foundation. More information on the observatory can be found at http://criticalzone.org/sierra/.

Groundwater Monitoring - Root Creek Water District, Madera Irrigation District, Chowchilla Water District, Madera County (through its Maintenance Districts and Service Areas), Columbia

Canal Company, the City of Madera and the City of Chowchilla all monitor groundwater levels in their wells.

The County Districts and the cities monitor groundwater quality related to their drinking water supplies, and the cities monitor water quality and quantity related to their wastewater treatment and disposal. The data collected is localized within each agency's boundaries. Madera Irrigation District, Chowchilla Water District, Madera County, Root Creek Water District, and Gravelly Ford Water District are part of a regional monitoring effort under the California State Groundwater Elevation Monitoring (CASGEM) program.

Three additional programs provide active monitoring of the Kings River watershed (adjacent to the Madera Region, to the south). The data collected in these areas could be transferable to the Madera Region. These programs include:

Kings River Fisheries Management Program (KRFMP) - The Kings River Fisheries Management Program (KRFMP) partners include the Kings River Water Association, Kings River Conservation District, and California Department of Fish and Wildlife. For a number of years the program has been collecting information on the habitat conditions, stream flows, water quality, water temperature, hatchery planting programs and fisheries studies within the lower Kings River and the Pine Flat Reservoir (see http://www.krfmp.org/monitoring.html).

Monitoring activities include: Telemetry Studies, Water Quality Surveys, Population Surveys and Macro-invertebrates. Two monitoring sites are located downstream of Pine Flat Dam, one at the Army Corps of Engineer's bridge about one-half mile below the dam, and another on Mill Creek, upstream of its confluence with the Kings River. Initial monitoring activity was carried out by the Program itself, whereas more recent water monitoring has been conducted by staff from the Kings River Conservation District.

Kings River Water Association (KRWA) – KRWA is the agency that manages storage and release at Pine Flat Dam on behalf of the 37 member agencies and companies with water rights along the Kings River. KRWA reports daily water conditions on its website. These daily reports consist of information regarding water storage, natural and actual stream flows in the river and tributaries, dam releases, precipitation and other information (see http://www.kingsriverwater.org/water_conditions/hydro_data.php).

Kings River Experimental Watershed - The Kings River Experimental Watershed (KREW) is a watershed-level, integrated ecosystem project for headwater streams in the Sierra Nevada. Eight sub-watersheds have been chosen and fully instrumented to monitor ecosystem changes. The program is managed by the US Forest Service. More information can be found on the KREW website: http://www.fs.fed.us/psw/programs/snrc/water/kingsriver/.

9.2 - Monitoring IRWMP Objectives

On a regular basis, the RWMG will measure progress towards meeting the IRWMP objectives. In order to capture the full extent of work being accomplished within the region, this measurement will include both projects under the direction of the RWMG, and projects/programs being carried out by member agencies that were funded through RWMG grant efforts.

Each objective is listed in **Table 5.1** in Chapter 5 – Goals and Objectives, along with its metric and how it will be monitored. Informal progress reports will be prepared by the RWMG on a regular basis. These regular reports will be used to meet regulatory requirements, to report back to member agency decision-makers and to aid in preparation of future funding applications.

9.3 - Monitoring Progress in Implementing Projects

The RWMG will monitor progress in implementing projects which are funded through the efforts of the RWMG, with assistance from the RWMG, or are being implemented by other agencies throughout the Region, to keep an accurate tally of cumulative progress being made. Each year the following will be documented:

- List of projects submitted to the RWMG
- Projects included in grant applications sponsored by the RWMG
- Projects approved for funding
- Projects addressing Region goals and objectives which are underway or completed by other agencies within the Region
- Anticipated benefits of projects that are underway or completed.
- Summary of total Region-wide progress toward goals and objectives.

9.4 - Project-Specific Monitoring

Project monitoring is important to track the successes and benefits of a project, ensure it is being operated properly, comply with laws and regulations, and to monitor the IRWM process and benefits. Examples of project-specific monitoring can include monitoring water quality, groundwater depth, flood frequency, and effects a project may have on habitat or particular species. Project-specific monitoring is the responsibility of the agency(s) or group(s) that are implementing a project and expect to directly benefit from the project. These agency(s) are also responsible for developing project monitoring plans.

The RWMG will require draft monitoring plans for projects that are considered for funding. Final monitoring plans are prepared after final designs are completed, and are typically approved by regulatory or funding agencies. The RWMG will request copies in order to provide complete reporting within the RWMG.

Draft monitoring plans typically include the following information when applicable:

General Information

- Project description
- Describe what is being monitored (water quality, water flows, etc.).
- Need for monitoring

Monitoring Program Parameters

- Frequency and schedule
- Overall time period (e.g. 5 years, life of project, etc.)
- Locations
- Protocols
- Tools and equipment
- Pertinent laws and regulations
- Quality control procedures

Data Management Procedures

- Data storage and tracking
- Incorporation into Statewide databases
- Targets to be reached (if any)
- Measures to remedy or react to problems encountered during monitoring
- Reporting procedures

Other Topics

- Funding source for on-going monitoring
- Responsibility for on-going monitoring

An important component of monitoring and data management is qualitative or quantitative trend analysis. When relevant, appropriate trend analysis should be a part of project monitoring plans.

9.5 - Regional Water Management Group Summary Reports

From time to time, the RWMG will prepare annual summary progress reports. The report will document the aforementioned monitoring, give a current project list, discuss any proposed amendments to the IRWMP, and note changes in governance, policies, and membership.

Periodic summary reporting is considered important for the RWMG and will offer the following benefits:

1. Help to validate the RWMG by documenting successes and achievements.

2. Increase awareness of RWMG efforts with the members, stakeholders and general public. The annual report could be used for educational, informational and promotional purposes.
3. Serve as a reference document for RWMG administrators.
4. Document information that may be needed for future IRWMP updates.

The frequency, content and preparation of these summary reports will be determined by the RWMG. The detail needed in the reports will be assessed at the time of preparation, and may vary based on the needs and recent accomplishments of the RWMG and the member agencies.

CHAPTER 10- DATA MANAGEMENT

10.1 - Introduction

This chapter describes the collection, storage, management and dissemination of data to Regional Water Management Group (RWMG) participants, stakeholders, the public and the State. The Data Management Standard was developed for the IRWMP process to ensure the efficient use of available data, stakeholder access to data, and integration of the data collected through the IRWMP process into existing databases.

Coordination of data management within Madera RWMG has been limited up to this point. Madera RWMG contains numerous agencies, with no single lead agency charged with collecting, organizing and making accessible data for the region. Data that are collected are managed by multiple public agencies and private organizations. The following are members of the RWMG who maintain their own data, and will also be submitting information and data, when applicable, to the RWMG.

- Chowchilla Red Top Resource Conservation District
- Chowchilla Water District
- City of Chowchilla
- City of Madera
- Coarsegold Resource Conservation District
- Fairmead Community and Friends
- Gravelly Ford Water District
- Madera County
- Madera County Special Districts
- Madera Irrigation District
- Madera Valley Water Company
- Madera Water District
- North Fork – Mono Rancheria
- Root Creek Water District
- Self Help Enterprises
- SEMCU – South East Madera County United
- Yosemite/Sequoia Resource Conservation and Development Council

The Madera RWMG will utilize their website (http://www.madera-id.org/index.php/rwmg) as the main portal for storing and distributing data, and providing web links to where data can be found. RWMG does not have the resources necessary to build and maintain new databases, so existing databases managed by various public and private entities are utilized to provide the background for the data management plan while the website is used to aid in distributing the information to interested parties.

10.2 - Data Needs in the Madera Region

Data availability in the Madera Region varies depending on the location. The western third of the region consists of relatively flat land that is primarily used for agriculture, and the eastern two-thirds include foothill and mountain areas. These two areas have different data needs.

Valley Area

Local water resources information for this area is primarily available from Root Creek Water District, Madera Irrigation District, Chowchilla Water District, Madera County (through its Maintenance Districts and Service Areas), Columbia Canal Company, the City of Madera and the City of Chowchilla. Because of the development in this area, there is substantially more information available regarding groundwater and surface water than there is in the remainder of the area.

However, this area still needs better data on groundwater levels in most areas. Insufficient data is available to perform detailed water balances, provide reasonable estimates of groundwater, and prepare accurate groundwater contour maps. Provost & Pritchard (2014) identifies areas in better groundwater monitoring.

Foothill and Mountain Area

The eastern two-thirds of the area consist of foothills and mountainous regions. Due to the rugged terrain, poor accessibility and limited development in this area, limited water resources information is available. For instance, soil survey maps have not been developed for this area and groundwater elevation and water quality information for this area is sparse. Increased data collection, organization and analysis are needed to improve the ability of local and state agencies to make policy decisions and develop projects for the area. More specifically, information regarding the following water resources needs to be developed: 1) groundwater resources; 2) resource management strategy justification; 3) watershed management plans, and 4) stream monitoring.

Information regarding groundwater resources in the eastern portion of the RWMG is limited. Much of this area consists of fractured bedrock aquifers with unknown sustainable use rates. Groundwater provides the drinking water source for many communities, disadvantaged communities and individuals that reside in the region. Further development of the area requires that greater understanding of the region's aquifer is achieved through studies and data collection.

The IRWMP prepared for this region includes resource management strategies that could be further developed and justified if additional data regarding the region's water resources is collected. Understanding of the region's interrelationships between watershed management, surface water impacts and groundwater conditions will aid in the further development and implementation of management strategies.

Management of the watersheds located in the eastern portion of the RWMG plays a significant role in the region's water management strategies. However, further information regarding the watersheds and the proper management strategies for them is needed. Integration and implementation of the existing watershed management plans would improve the water management in the area. Potential teaming opportunities with agencies such as the National Forest Service, USGS and the US Army Corps of Engineers need to be further investigated.

In conjunction with the watershed management strategies, stream monitoring of the numerous small streams located in the region would improve knowledge of the water resources and how the watershed management strategies implemented are changing the stream conditions. Monitoring of hydrologic, chemical and biological parameters is needed for this area. In addition to the stream analysis, further development of the potential flood risk is needed. Although the area has limited flood potential, runoff from the region's streams can cause localized flooding.

A detailed inventory of all water resources infrastructure both in the valley and foothills/mountains would also assist with regional water management.

10.3 - Data Collection Techniques

Data collected for the RWMG needs to be consistent and compatible with existing databases. Additionally, where possible, data collected should be shared with State clearinghouses for incorporation into publically available databases. Incorporation into existing databases provides a cost effective method of ensuring that the information is readily available for future studies and for other interested parties.

10.4 - Stakeholder Contributions of Data

Data collected by stakeholders on RWMG sponsored projects is provided to the RWMG for storage and to facilitate cooperative efforts within the region. Additionally, stakeholders provide descriptions of proposed projects to the RWMG. This information helps facilitate multi-benefit and cooperative efforts while preventing duplicating efforts. The RWMG combines the project information submitted into a formal project list and stores the data on the RWMG website. See CHAPTER 7 – Project Review Process for more detail on this process and a current list of potential projects.

10.5 - Data Management Responsibilities

Data management by the RWMG will be primarily accomplished by publishing the data on the RWMG's website. Information from projects implemented by the RWMG or from projects funded through RWMG sponsored grant applications will be provided through the website.

The RWMG does not have the financial or staff resources available to develop and maintain databases specific for the area. Databases for the area could be developed through grant funding, however on-going maintenance of the databases would require a new funding source. Project specific data and reports prepared by the RWMG will be available to interested stakeholders on the RWMG website.

10.6 - Regional Water Management Group Website

Data and information transfer from the RWMG to interested stakeholders will be primarily accomplished through the RWMG's website. The website will be updated to include the following information or web links to the following information:

- Integrated Regional Water Management Plan
- Copies of studies, reports, designs and data for projects funded by RWMG applications
- Historical RWMG documents
- RWMG Annual reports
- Information on proposed, current and completed projects

10.7 - Quality Control and Quality Assurance Measures

Quality Control and Quality Assurance Measures ensure that data obtained from projects and entered into databases are accurate and reflect conditions within the RWMG. The RWMG will review relevant information pertaining to projects funded by the IRWMP process. When deemed necessary, the RWMG will form technical committees to review information submitted and oversee its use.

Additionally, projects funded through the IRWMP grant process must have Quality Control and Quality Assurance measures developed and submitted in the grant applications. Projects without fully developed Quality Control and Quality Assurance measures will not be included in grant applications sponsored by the RWMG.

10.8 - Data Sharing and Distribution

Data will be shared and distributed to local stakeholders and government organizations that maintain databases by RWMG and the associated entities.

Local stakeholders. Data will be shared with local stakeholders including RWMG members, stakeholders, local agencies and the general public through the following mechanisms:

1. Final reports for RWMG projects will be placed on the RWMG website
2. Annual reports identifying the data collected will be posted in the website

3. Public outreach efforts, such as website postings, RWMG meetings, public workshops, and targeted outreach will inform stakeholders of data that is or has been collected.
4. When appropriate, copies of reports and data will be sent to specific stakeholders that may have a high interest in the data.

State Databases. Data collected for RWMG projects will be forwarded to the appropriate State agency for inclusion in their databases. In general, State databases have specific requirements for data submittal (format and procedural) that will need to be followed. Grant applicants need to consider what State databases they may be contributing data to, because the legislation supporting a given grant program may specify a State database for data submittal. Following is a list of some state databases that may be applicable to future projects:

- *California Environmental Data Exchange Network (CEDEN)* – CEDEN is a system designed to facilitate integration and sharing of data collected by many different participants. The CEDEN data templates are available on the CEDEN website: http://www.ceden.org.
- *Water Data Library (WDL)* – DWR maintains the State's WDL which stores data from various monitoring stations, including groundwater level wells, water quality stations, surface water stage and flow sites, rainfall/climate observers, and well logs. Information regarding the WDL can be found at: http://wdl.water.ca.gov/.
- *California Statewide Groundwater Elevation Monitoring Program (CASGEM)* – CWC §10920 et seq. establishes a groundwater monitoring program designed to monitor and report groundwater elevations in all or part of a basin or subbasin. These requirements also limit counties and various entities (CWC §10927.(a)-(d), inclusive) ability to receive State grants or loans in the event that DWR is required to perform ground monitoring functions pursuant to CWC §10933.5. Requirements of the CASGEM Program can be found here: http://www.water.ca.gov/groundwater/casgem/.
- *Surface Water Ambient Monitoring Program (SWAMP)* – The SWRCB has developed required standards for SWAMP. Any group collecting or monitoring surface water quality data, using funds from Propositions 13, 40, 50, and 84 must provide such data to SWAMP. More information on SWAMP is available at: http://www.swrcb.ca.gov/water_issues/programs/swamp.
- *Groundwater Ambient Monitoring and Assessment Program (GAMA)* – GAMA provides a comprehensive assessment of water quality in water wells throughout the State. GAMA has two main components, the California Aquifer Susceptibility (CAS) assessment and the Voluntary Domestic Well Assessment Project. The CAS combines age dating of water and sampling for low-level volatile organic compounds to assess the relative susceptibility of public supply wells throughout the State. The Voluntary Domestic Well Assessment Project provides sampling of water quality in domestic wells, which will assist in assessing the relative susceptibility of California's groundwater to contaminants. Because water quality in individual domestic wells is unregulated, the

program is voluntary and will focus, as resources permit, on specific areas of the State. Constituents to be analyzed include nitrate, total and fecal coliform bacteria, methyl tert-butyl ether, and minerals. Additional information on the GAMA program is available at: http://www.swrcb.ca.gov/gama.

- *California Environmental Information Clearinghouse (CEIC)* – The California Natural Resources Agency (CNRA) maintains the CEIC, which is a statewide metadata clearinghouse for geospatial data. The CEIC is accessible at: http://ceic.resources.ca.gov/. The online directory is used for reporting and discovery of information resources for California. Participants include cities, counties, utilities, State and federal agencies, private businesses, and academic institutions that have spatial and other types of data resources.
- *Integrated Water Resources Information System (IWRIS)* – DWR maintains IWRIS, which is a data management tool for water resources data and not a database. IWRIS is a web based GIS application that allows entities to access, integrate, query, and visualize multiple sets of data simultaneously. Information on IWRIS is available at: http://www.water.ca.gov/iwris/
- *California Environmental Resources Evaluation System (CERES)* – CERES is an information system developed by CNRA to facilitate access to a variety of electronic data describing California's rich and diverse environments. The goal of CERES is to improve environmental analysis and planning by integrating natural and cultural resource information from multiple contributors and by making it available and useful to a wide variety of users.
- *California Integrated Water Quality System* (CIWQS) - CIWQS is a computer system used by the State and Regional Water Quality Control Boards to track information about places of environmental interest, manage permits and other orders, track inspections, and manage violations and enforcement activities. CIWQS also allows online submittal of information by permittees within certain programs and makes data available to the public through reports. The CIWQS database can be found at: http://www.waterboards.ca.gov/water_issues/programs/ciwqs/index.shtml

10.9 - Other Data Sources

Following is a list of other sources that contain important data on the region and its water resources:

- California Irrigation Management Information System (CIMIS) (http://wwwcimis.water.ca.gov/)
- California Water Plan (http://www.waterplan.water.ca.gov/)
- California Department of Fish and Wildlife – Numerous endangered species studies throughout the RWMG area

- US Fish and Wildlife Service - Landscape Conservation Cooperatives
- Sierra Nevada Conservancy - Geographic Information Systems data
- Geotracker database (environmental data for regulated facilities in California) - http://geotracker.waterboards.ca.gov/
- DWR Well completion reports for the Madera County
- National Park Service, Sierra Nevada Network Inventory and Monitoring Program; http://science.nature.nps.gov/IM/units/sien/index.cfm
- National Park Service Searchable Report Database; https://irma.nps.gov/App/
- Millerton Area Watershed Coalition; http://www.sierrafoothill.org/watershed/
- Upper Fresno River Watershed Portal; http://www.fresnoriver.org/ (contains copies of all known documents and records on the Upper Fresno River)
- Upper San Joaquin River Watershed Portal; www.usjrcouncil.org (contains copies of all known documents and records on the Upper San Joaquin River)
- Monitoring programs listed in Section 9.1 -Regional Monitoring Efforts

CHAPTER 11- FINANCING

The Madera Region Regional Water Management Group (RWMG) requires funding for on-going operations, updating the Integrated Regional Water Management Plan (IRWMP), preparing grant applications, project development (studies, design and construction), project operation and maintenance, and local cost share for grant funded projects. This Chapter provides a general overview of potential funding sources, programs, and project partnerships available from tribal, federal, state, local and private sources.

11.1 - Funding Sources

The primary sources of funding are illustrated in **Figure 11-1** and discussed below.

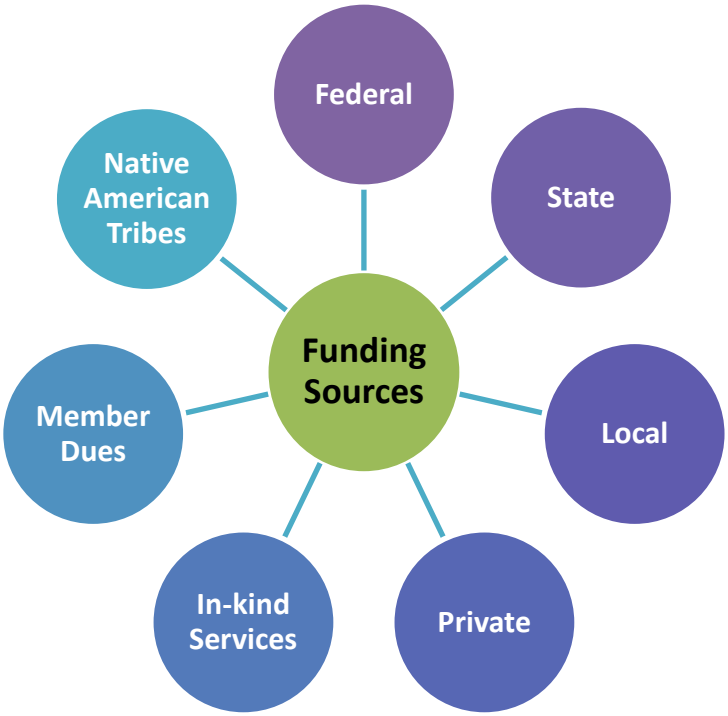

Figure 11-1 – Funding Sources

Professional In-Kind Services

Professional in-kind services include time donated by members and stakeholders to assist with RWMG efforts. Professional in-kind services have been an important part of the funding for the RWMG. In-kind services have helped with institutional development, RWMG operations, grant applications, public outreach, and the IRWMP update.

Member Dues

The current model for the Madera Region RWMG requires that voting members fund RWMG general administrative and operation costs through the collection of dues (set forth in the Memorandum of Understanding and Bylaws). Members of the RWMG include dues paying

members, disadvantaged community members, and affiliate members. Disadvantaged community members are not required to pay dues, nor are affiliate members. Affiliate members are agencies or organizations that are procedurally precluded from contributing monetary dues.

In July of each calendar year, an administrative operating budget is proposed for the August 1 to July 31 fiscal year. MOU signatories each pay an equal dues amount. However, members organizations that provide in-kind administrative support, may subtract from their dues the cost of providing administrative services for the year. For the 2013/2014 fiscal year, dues were $1,200 per member.

Native American Tribal Funding

Native American tribes can be a source of funding for water resources projects on reservations. Tribes also fund projects throughout the Madera Region that help to restore native habitats so they can perform traditional activities and customs, such as indigenous food gathering. Some project examples include exotic species removal and stream restoration. The Chukchansi Tribe also offers grants to certain public agencies and non-profit organizations in Madera County through a settlement program known as the Community Grant Program (see **Appendix H**).

Federal Funding

Federal funds are available through a variety of mechanisms, including legislative appropriations, federal agency interest, and federal assistance programs (grants and loans). Federal earmarks have largely disappeared during the last few years due to the poor economy, and local agencies must usually work with departments in the Federal government several years in advance to help secure funding. Examples of these funding mechanisms are described below.

Legislative Approach

Federal funding may be secured through the legislative process to directly fund an approved project. A public agency working with a local congressional representative can initiate this process. The project may require the establishment of federal interest through an act of Congress (authorization) and then be funded in subsequent years (appropriation). An appropriation can be made the same year if the project is consistent with the goals and objectives of an existing federal program. Competition for congressional funds is formidable and requires broad support of local, regional, and state interests for projects to be successful in obtaining funding.

Federal Agency Interest

Funding can also be secured directly from federal agencies. Local projects may be eligible for funds and in-kind services through directed actions and partnerships. Federal agencies commit to projects during their respective internal budgeting processes and have the flexibility to disperse funding over several years.

Federal Assistance Programs

A third federal option is to apply for project funding under an existing federal agency grant, loan, or assistance program. Potential grant programs funded by federal agencies are listed in **Appendix H**. Eligibility, cost sharing, and application requirements vary among the programs.

State Funding

State funds are similar to the federal funding mechanisms and include legislation, state agency interest and state assistance programs.

State Legislative Approach

Although the dollar amounts available from the state are usually not as substantial as federal funding opportunities, the state legislative process is somewhat more straightforward. Appropriating funds through the state legislature is extremely competitive and subject to the state budget conditions.

State Agency Interest

Discretionary funds may be available in the form of directed action assistance or in-kind services. Partnerships with agencies such as the DWR Division of Integrated Water Management, Department of Fish and Wildlife (DFW), and the State's Division of Drinking Water (DDW) may yield monies and services.

State Assistance Programs

A third option is to apply for project funding under an existing grant, low-interest loan, or assistance program administered by any of the various state agencies. In the past, Propositions 13, 204 and 50 have all provided substantial state-wide funds for water resources projects. Proposition 84 provided significant funds specifically for IRWMP updates and implementation projects and continues to be a source of funding through DWR. DWR anticipates that a third and final round of implementation funding will become available in late 2014 or early 2015. Additional propositions will be needed to maintain the current level of state IRWMP funding. **Appendix H** lists some of the major state grants that fund water resources projects.

Local Funding

Local funding will vary by source and agency authority. City and county government can generate local funding from a variety of sources including: general funds, water rates, development or impact fees, sales tax connection fees, capital improvement programs, revenue bonds, acreage or ad valorem assessments, user fees and sales taxes. Water and irrigation districts can generate local funds through benefits assessment, water standby and availability charges, sales taxes, water service fees, developer fees; or by generating revenue through water sales, groundwater banking, exchange, or transfer related contracts.

Increasing benefits assessments or fees by the overlying district or the land use agency may require studies and a special election and/or protest hearing pursuant to state laws including

Proposition 218. Local funding is often the funding source for grant cost sharing and project operation and maintenance.

Private Funding

Private funding can come from individuals, private foundations, development interests, corporations or non-governmental organizations. Private funding is an important source that is often overlooked by Regional Water Management Groups. Some organizations do not solicit applications but choose projects themselves. In these cases it is worthwhile to introduce the RWMG to the organization for future consideration of Public-Private partnerships and other funding opportunities that make sense to the private sector. Private organizations generally, but not always, provide smaller grants than state and federal programs. **Appendix H** lists some foundations, organizations and corporations that fund water-related projects.

11.2 - Funding Needs

Funding is needed for RWMG operations, IRWMP updates, grant applications, planning and project development, operation and maintenance, and local cost share for grant-funded projects. The various funding needs are shown in **Figure 11-2** along with potential funding sources for each need. The funding needs are described below in more detail.

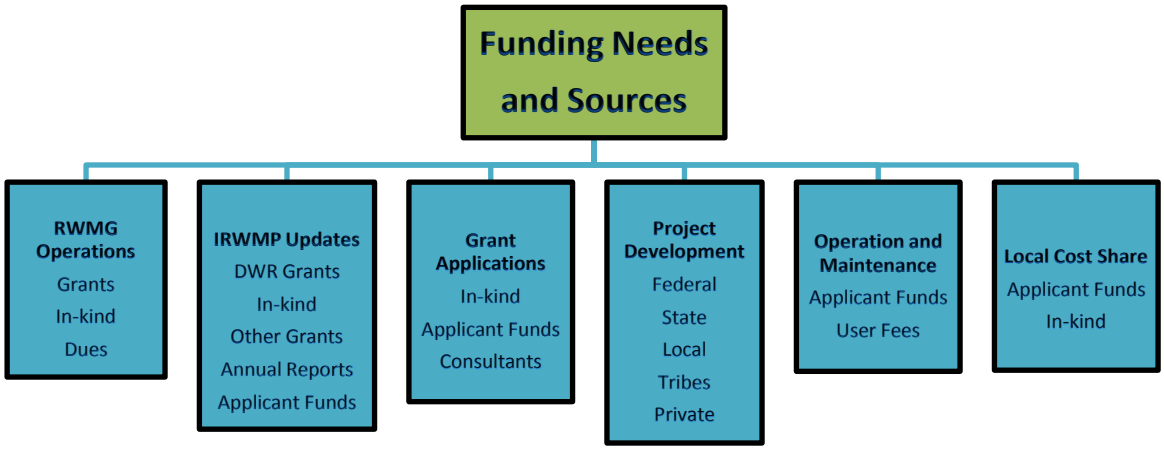

Figure 11-2 – Funding Needs and Sources

Regional Water Management Group Operations

Regional Water Management Group (RWMG) operations include administration, governance, public outreach, regular meetings and special workshops. Funding for the RWMG operations has come from annual membership dues and in-kind services. In-kind services from participants have also been used to organize and operate the RWMG since its inception.

Funding for Updating the IRWMP

The 2008 IRWMP was developed with in-kind professional services and work from two Department of Water Resource grants funded by AB303 and Proposition 50 respectively. The 2008 IRWMP was updated and expanded using a $271,438 grant from the California Department of Water Resources through a Proposition 84 Integrated Regional Water Management Planning Grant. The cost share for future IRWMP updates will be provided through professional in-kind salary costs for stakeholders. The RWMG will seek DWR funds for future IRWMP updates, but realizes that these funds may not be available, or that their timing may not coincide with the appropriate time for an update. If DWR funding is not available, updates could be funded through a combination of in-kind costs, fees collected from RWMG members, or other grant programs. **Appendix H** list numerous grant programs including some that fund water resources planning, and may fund updates to the Madera IRWMP. The RWMG also plans to periodically prepare a report, when deemed necessary, to document progress, data collected, changes to policies, and other pertinent information. These annual reports will become the basis for future plan updates, and will reduce the cost of such plan updates.

Funding for Grant Applications

The RWMG has submitted grant applications benefitting the entire RWMG area and others that directly benefit only one or more agency. Applications that benefit the entire RWMG, such as for an IRWMP update or regional study, will be funded by the RWMG. To date this has been performed with in-kind work from stakeholders and consultants. Applications for project funding that directly benefit only one or more agency will be funded by those agencies which would receive the benefits. Requiring members to fund their own applications helps to ensure that they are serious and committed to their projects. An IRWMP Implementation Grant application in 2011/2012 was funded with applicant funds and in-kind services from the applicants, and helped the RWMG to secure their first IRWMP implementation grant.

Funding for Project Development

Project development includes feasibility studies, design and construction. Federal, state, local, tribal and private funding are options for project development. **Appendix H** list potential funding programs from each of these sources. The list in **Appendix H** is not comprehensive, but includes well-known and likely sources of funding. The national grant database eCivis (http://www.ecivis.com), which is a subscription service, can provide a more comprehensive list of funding options.

The certainty and longevity of the funding sources is not well known. Grant programs are constantly evolving. Some are cancelled each year while new programs emerge. Funding generally waxes and wanes with the economy and government focus. Stakeholders need to stay constantly apprised of current opportunities. Chances for success are usually highest with new grant programs, before they becomes well known and receive a large number of applications. This emphasizes the importance of closely tracking grant opportunities. A major source of funding for project development are the IRWMP Implementation Grants funded by Proposition 84. The final round of applications for Prop 84-funded Implementation Grants is

expected to begin in mid-2015. Future funding rounds will be dependent on the passage of State Propositions. These Propositions can provide funding for periods lasting up to five to ten years. However, funding from state general funds is unlikely for the IRWMP Program, which will likely rely on State Propositions for the foreseeable future.

In 2012, the RWMG was granted full funding from the Round 1 Implementation Grant of $9,413,947 for four projects:

1. Ash Slough Arundo and Sediment Removal
2. Cottonwood Creek, Dry Creek, & Berenda Creek - Arundo and Sediment Removal
3. Root Creek Recharge Project
4. Fuel Reduction for Forest Health & Fire Safety in the Sierra National Forest (The first Forest Management Project funded as part of an IRWM which recognizes watershed health as a whole).

Operation and Maintenance Funding

Operation and maintenance (O&M) for infrastructure projects is generally funded by those agencies directly benefitting from the project. The RWMG is not responsible for project O&M expenses and grant and loan programs typically do not cover these expenses. Before undertaking a new project, a grant applicant must estimate the O&M expenses and define a secure long-term funding source. These typically come from applicant reserves, on-going revenue, or new fees. Projects should not be pursued if long-term O&M funding is uncertain.

Local Cost Share Funding

Many grant programs require applicants to pay a portion of the project cost, which is called the local cost share. Local cost shares vary but are commonly 25% or 50% of the project cost. These are typically funded with applicant reserves, on-going revenue, bond sales or new fees. They can also be funded with monies from another grant. Some grant programs have not required cost share for DAC projects, and they have been eligible for full grant funding. The RWMG has established the following guidelines regarding local cost share funding:

1. Local funding sources must be firmly defined for all projects requiring local funds.
2. Local funding match requirements are to be provided by the project stakeholder or stakeholders (partners) that are the direct beneficiaries as defined by engineering and economic evaluations.
3. Specific agreements between project partners must clearly define the mechanism for cost sharing and on-going project O&M.
4. All new projects not already covered by an existing funding mechanism will need to expeditiously engage their communities and obtain approvals for any new project funding, whether for capital construction or O&M costs.

5. User fees are appropriate for cost share where the beneficiaries are clearly defined and increases in fees are approved according to appropriate rules and regulations.

11.3 - Funding Opportunity Awareness

The RWMG members will track tribal, federal, state, local and private funding sources and keep the group apprised of opportunities for grants, loans or other forms of assistance. A standing agenda item on funding sources will be included in RWMG meetings to brief the community. Funding opportunities will also be listed on the RWMG website. The list of grant opportunities in **Appendix H** should be updated annually and a revised list distributed to RWMG members.

CHAPTER 12- TECHNICAL ANALYSIS

This chapter documents the technical information and data which inform various other chapters of this report. Very little original analysis was carried out in the process of this report update; rather, the report relies on other work accomplished in the Region which relates directly to the goals and objectives of this report.

Available analysis for some subjects is thorough and up to date. Data for other subjects is less complete, and the following identifies gaps that can and should be filled through additional analysis and/or data monitoring as funding is available. For the time being, the information used in the preparation of this report update is believed to be the best available.

12.1 - Chapter 1: Introduction

This chapter does not include technical analysis nor does it present data summaries.

12.2 - Chapter 2: Governance and Coordination

This chapter does not include technical analysis nor does it present data summaries.

12.3 - Chapter 3: Region Description

This chapter relies heavily on the recently-completed Madera Regional Groundwater Management Plan (GMP), July, 2014, prepared by Provost & Pritchard Consulting Group. In addition to its analysis of historic and current groundwater conditions in much of the Valley portion of the Region, this report provides extensive background information on the geology and hydrogeology of the Region, quantifies surface water supplies and current groundwater pumping, discusses current groundwater monitoring programs, sets forth land uses and cropping patterns and provides a discussion of land subsidence in the western portion of the Region. In addition to the original analysis contained in the GMP, it references related work completed by the USBR and the California Department of Water Resources.

The 2008 Madera IRWMP also includes some important water resources analysis and statistics that were referenced in this section. The appendices of the 2008 IRWMP includes groundwater evaluations for the Oakhurst area, North Fork area, Coarsegold area, and Raymond.

12.4 - Chapter 4: Disadvantaged Communities

This chapter relies on US Census and California Department of Finance data to identify qualifying Disadvantaged Communities within the Region. The available data was adequate for the purpose.

12.5 - Chapter 5: Goals and Objectives

This chapter relies on the 2014 GMP cited above to inform the groundwater-related goals and objectives, particularly in the Valley portion of the Region. A clear understanding of the current groundwater situation is necessary in order to establish sustainable, attainable, and realistic goals for the Region.

A weakness of the available data is pointed out in the GMP. While there is extensive groundwater monitoring data available across the Valley portion of the Region, not all of the monitoring wells are completely documented. This results in monitoring data that is ambiguous. The primary deficiency is in knowing exactly where monitor wells are perforated and sealed. Not knowing means that there is no way to determine if those ambiguous wells are monitoring water levels in the shallow or deep aquifers. This leads to limitations in understanding the actual groundwater contours. The GMP calls for an expanded effort, funded by the water users, to create monitor wells in both the shallow and deep aquifers, which would allow for improved data to be collected over time.

12.6 - Chapter 6: Resource Management Strategies

This chapter relies on the resource management strategies described in the 2013 California Water Plan Update. The report subjectively evaluates the potential of each of the 36 strategies named in the Update to benefit all or a portion of the Region.

This chapter also relies on climate change projections from numerous sources (cited in Chapter 15 of this report) to make certain conclusions about future climatic conditions and how those changes will affect water availability within the Region. Those conclusions are used to develop strategies to make the wisest use of the available resources in the future.

While the level of certainty regarding specific climate change predictions cannot be known at this time, there is a degree of consensus among the cited researchers that is adequate to allow for long-term strategic planning. The group has determined that they should prepare for climate change, even if the exact trajectory of impacts in unknown.

12.7 - Chapter 7: Project Review Process

This chapter is descriptive of the project review and selection process developed by the RWMG and does not rely on outside technical analysis or data.

12.8 - Chapter 8: Impacts and Benefits of Plan Implementation

This chapter analyzes the impacts and benefits of implementing the chosen resource management strategies, both to the Region itself and to surrounding regions that may also be involved in specific management strategies.

The level of analysis prepared for this report is qualitative and geared to understanding the potential environmental impacts of projects that would result from implementation of the proposed resource management strategies. No data was collected or relied upon and no technical analysis was carried out. The chapter notes that as individual projects are brought forward, additional environmental analysis under CEQA and/or NEPA may be required to satisfy funding agency requirements. Similarly, additional technical analysis of specific project benefits, costs and negative impacts may be required as well. Such higher levels of analysis are not appropriate for all the proposed projects at this time, until funding becomes available and proposed project timelines are understood.

12.9 - Chapter 9: Plan Performance and Monitoring

Chapter 9 does not so much provide analysis and data gathering as it describes how those activities will be carried out as the IRWMP moves forward in time, and specific projects are carried out to advance chosen goals and objectives.

12.10 - Chapter 10: Data Management

This chapter discusses the variety of methodologies used by the partner agencies to store data, and the unified portal set up by the RWMG to provide more streamlined access to data that will be shared between the partner agencies.

This chapter again discusses the Region's need for better and more thorough groundwater information, particularly in the Valley portion of the Region, and the Foothill/Mountain area's need for several kinds of monitoring and data including the following: 1) groundwater resources; 2) resource management strategy justification; 3) watershed management plans, and 4) stream monitoring.

The chapter identifies the Region's website as being a central repository of shared data and notes that data will be shared and distributed to local stakeholders and government organizations that maintain databases by RWMG and the associated entities.

The chapter also identifies a number of state databases that are expected to be useful in future activities, including the California Environmental Data Exchange Network, the DWR Water Data Library, the California Statewide Groundwater Elevation Monitoring Program, the Surface Water Ambient Monitoring Program, Groundwater Ambient Monitoring and Assessment Program, the California Environmental Information Clearinghouse, the Integrated Water Resources Information System, the California Environmental Resources Evaluation System and the California Integrated Water Quality System. Details of each database listed appear in CHAPTER 10.

Additional data sources beyond those listed above are also set forth in **Section 10.9 - Other Data Sources.**

12.11 - Chapter 11: Financing

This chapter includes a discussion of potential revenue sources for both capital projects and ongoing day-to-day operations for the RWMG. At this level, the report makes no effort to determine whether one funding source is more appropriate for or better suited to a project than any other. That level of analysis and determination is left to the time of individual grant program solicitations, when the specific goals and objectives of a grant program and funding agency can be matched to the goals and objectives met by particular projects.

12.12 - Chapter 12: Technical Analysis

Not an applicable discussion for this chapter. No technical analysis were performed for developing this chapter.

12.13 - Chapter 13: Relation to Local Water and Land Use Planning

This chapter discusses how the new IRWMP relates to existing water and land use plans. It recaps record information on available water and land use plans but does not provide any new analysis of data of any kind.

12.14 - Chapter 14: Stakeholder Involvement

This chapter sets forth information about plan stakeholders and the efforts to bring all stakeholders into the Plan update process, but does not provide any new analysis of data of any kind.

12.15 - Chapter 15: Coordination and Integration

This chapter does not include technical analysis nor does it present data summaries.

12.16 - Chapter 16: Climate Change

This chapter provides a review of contemporary scholarly papers and conclusions on climate change and discusses the effects of the predicted change on regional groundwater and surface water supplies. The chapter itself contains complete references to the sources used and they are not repeated here.

CHAPTER 13- RELATION TO LOCAL LAND USE & WATER PLANNING

13.1 - Introduction and Background

The IRWM process provides for many opportunities to collaborate and integrate with local land use and water planners at the city, county, and district agency and private and non-profit non-governmental (NGO) entity levels. Integration of city and county land use plans with water supply/demand plans and the water planning process is an important strategy for the Madera IRWMP. This chapter discusses the relationship between the DWR Integrated Regional Water Management Plan (IRWMP) process and current adopted local land use and water planning efforts for the Madera County area, as well as future plans to further a collaborative, proactive relationship between land use planners and water managers. This purpose of this Chapter therefore, is as follows:

1. To provide an inventory of local City and County land use planning general plan elements and other land use and water planning documents integral to the Madera IRWMP
2. Describe the relationship between this IRWMP and other local land use planning documents and programs, regional water issues and water management objectives
3. Describe the dynamics between the IRWMP and land use and water planning documents
4. Identify opportunities to enhance proactive collaboration between local land use and water planning efforts in order to avoid duplication and working at cross-purposes, and better coordinate and maintain consistency between the local land use and water planning efforts with the Madera IRWMP

13.2 - Land Use and Water Plans/Policies Integral to Madera IRWM

The Madera Regional Water Management Group (RWMG) membership includes representatives of the Madera County Board of Supervisors, Madera and Chowchilla City Councils, and these agencies' respective Planning and Public Works Departments (directors), who oversee their long-range General Plan land use planning policies and implementation of county water capital improvements. Inclusion of land use planning and public works personnel in the IRWMP process allows for more complete understanding of the regional County and City goals, policies, objectives, and implementation strategies to be and integrated into IRWMP project development. As well, representatives of local public and private water districts, irrigation districts and public utility districts can share and collaborate regarding their efforts on a different but not less important scale of service.

Various city, county, public and private agencies and organizations were consulted to determine General Plans, Community or Area Plans, Specific Plans, Municipal Service Reviews

(MSR), and Agricultural and Urban Water Management Plans pertinent to the IRWMP process. These documents and plans are catalogued in **Table 13.1** through **Table 13.6** below along with their adoption dates.

Table 13.1 - Land Use Planning Documents

Agency or Entity	Land Use Planning Documents
MADERA COUNTY	
APPROVED PLANS	
Madera County	General Plan - October 1995
O'Neals	Area Plan - April 1980
North Fork	Study Plan - May 1980
Gunner Ranch West	Area Plan - October 1994
Gunner Ranch West	Specific Plan - July 2014
Rio Mesa	Area Plan - March 1995
Northshore at Millerton Lake	Specific Plan - December 2009
Tesoro Viejo	Specific Plan - November 2012
State Center Community College	Specific Plan - July 1995
Ahwahnee	Area Plan - 1999
Oakhurst	Area Plan - 2005
Coarsegold	Area Plan - 2006
Gateway Village	Area Plan - September 2007
Gateway Village	Specific Plan - September 2007
Raymond	Area Plan - 2009
COUNTY INITIATED PLANS IN PROCESS	
Fairmead	Area Plan
Southeast Madera County	Area Plan
O'Neals	Area Plan
DEVELOPER INITIATED PLANS IN PROCESS	
Liberty Groves	Area Plan
Liberty Groves	Specific Plan
Castellina	Area Plan
Castellina	Specific Plan
San Joaquin River Ranch	Area Plan
San Joaquin River Ranch	Specific Plan

Agency or Entity	Land Use Planning Documents
Tatham	Area Plan
Tatham	Specific Plan
City of Chowchilla	General Plan - May 2011
City of Chowchilla	Municipal Service Review - September 2011
Rancho Calera (City of Chowchilla)	Specific Plan - April 2011
City of Madera	General Plan - October 2009
City of Madera	Climate Action Plan (in progress)
City of Madera	Municipal Source Review -
Madera State Center Community College	Specific Plan July 1995
Chowchilla Water District	Municipal Service Review - September 2011
Madera Irrigation District	Municipal Service Review (info is within the Eight Public Water Districts Document) October 2007
County Service Areas #1 & #2	Municipal Service Review - April 2008
LAFCO	Municipal Service Review (for eight public water districts) - October 2007
Oakhurst	This MSR covers five county service areas, sixteen maintenance districts, and two of the privately operating water companies, Hillview Water Company and Broadview Terrace Water Company. Water Service only • Hillview Water Company (a privately owned company) • Broadview Terrace Water Company (a privately owned company) • Water Service and Road Maintenance • Maintenance District 42 – Meadowview Drive • Sewer Collection and Disposal only • Maintenance District 22 – Oakhurst Sunnydale - July 2012
Greater Rio Mesa	This MSR is intended to cover five special districts and two maintenance districts that provide some level of urban services in what is known as the greater Rio Mesa area of Madera County. These seven districts are: • County Service Area 16 (CSA 16) • County Service Area 19 (CSA 19) • County Service Area 22 (CSA 22)

Agency or Entity	Land Use Planning Documents
	• Sierra Foothills Public Utility District (SFPUD) • Root Creek Water District (RCWD) • Maintenance District 14 (MD 14) • Maintenance District 57 (MD 57) • All of these districts are adjacent to, fully, or partially, within the boundaries of the Rio Mesa Area Plan adopted by Madera County - May 2010.

Table 13.2 - Urban Water Management Plans

Members & Interested Parties	Water Planning Documents
City of Chowchilla	Urban Water Management Plan - September 2008
City of Madera	Urban Water Management Plan - October 2011

Table 13.3 - Water, Wastewater and Stormwater Master Plans

Members & Interested Parties	Water Planning Documents
County of Madera	Storm Water Quality Management Program - January 2002
City of Madera	Storm Water Quality Management Program - June 2004

Table 13.4 - Groundwater Management Plans

Members & Interested Parties	Water Planning Documents
County of Madera	AB 3030 Ground Water Management Plan - January 2002
Root Creek Water District	AB 3030 Ground Water Management Plan - October 13, 1997
Gravelly Ford Water District	AB3030 Ground Water Management Plan – April 1998
City of Chowchilla, City of Madera, Madera County, Chowchilla Water District, Madera Irrigation District	Madera Regional Ground Water Management Plan (in progress)
Chowchilla-Red-Top-City Joint Powers Authority	AB3030 Ground Water Management Plan – October 1997
Aliso Water District	Ground Water Management Plan January 2002

Table 13.5 - Agricultural Water Management Plans

Members & Interested Parties	Water Planning Document
Gravelly Ford Water District	Agricultural Water Management Plan, December 2012 (2008 criteria)
Madera Irrigation District	Agricultural Water Management Plan

Table 13.6 - Water Management Plans

Agency or Entity	Water Planning Document
Chowchilla Water District	Water Management Plan (2008 criteria), 3-21-11

13.3 - Relationship Between IRWMP and Local Land Use/ Water Management Policies

In his Forward to the *2014 California Water Action Plan* (CWAP), Governor Brown succinctly stated the State's challenge regarding maintaining water for all, as follows:

> *Among all our uncertainties, weather is one of the most basic. We can't control it. We can only live with it, and now we have to live with a very serious drought of uncertain duration.*
>
> *Right now, it is imperative that we do everything possible to mitigate the effects of the drought. I have convened an Interagency Drought Task Force and declared a State of Emergency. We need everyone in every part of the state to conserve water. We need regulators to rebalance water rules and enable voluntary transfers of water and we must prepare for forest fires. As the State Water Action Plan lays out, water recycling, expanded storage and serious groundwater management must all be part of the mix. So too must be investments in safe drinking water, particularly in disadvantaged communities. We also need wetlands and watershed restoration and further progress on the Bay Delta Conservation Plan.*
> *It is a tall order.*
>
> *But it is what we must do to get through this drought and prepare for the next.*
>
> *Edmund G. Brown Jr.*
> *State of the State Speech*
> *January 22, 2014*

This statement captures the essence of the critical nature of integrating and coordinating land use planning not just for the transient term of our current drought but for the longer range growth and continuing economic vitality of the state with a careful understanding of how available water supplies can be enhanced, conserved, sustained and better managed to meet future demands

The California Water Plan, Update 2009 for Integrated Water Management[1] (CWP Update,) and accompanying *California Water Plan Highlights* brochure[2] describes the challenges for managing the state's water resources and identifies a diversified portfolio of six broad topical management objectives, summarized as follows *(Note to Reader: At the time of preparation of*

[1] State of California, Natural Resources Agency and Department of Water Resources: *California Water Plan – Update 2009 for Integrated Water Management* (Bulletin 160-09, Volume 2 – Resource Management Strategies), December 2009

[2] www.waterplan.water.ca.gov/docs/cepu2009/0310final/highlights_cwp2009_spread.pdf

this Plan, the California Water Plan, Update 2013 was only available in draft and was not yet adopted. Consequently, this Plan only reflects the content of the most recently adopted Update 2009):

1. Reduce water demand
   - Maximizing both agricultural and urban water use efficiency
2. Improve Operational Efficiency and Transfers
   - Maximize utilization of statewide (Delta), regional and local conveyances, water transfers and system re-operations
3. Increase Water Supply
   - Maximize conjunctive management and water storage, desalinating brackish and sea water, recycling municipal water and pursuing CalFed and regional and local opportunities for surface water storage
4. Improve Water Quality
   - Improving drinking water treatment, distribution, salt, salinity and urban runoff management, maximize pollution prevention and groundwater/aquifer remediation, match water quality with appropriate use or re-use,
5. Practice Resources Stewardship
   - Maximize agricultural forest and land use planning stewardship and management, increase economic incentives for stewardship and recharge area protections, maximize watershed management, and pursue water-dependent recreation.
6. Improve Flood Management
   - Maximize pursuit of flood risk management.

To begin to meet the challenges associated with these six water management tools, the CWAP sets forth the following Actions that must be taken statewide by all water management and planning entities:

Actions

1. Make conservation a California way of life;
2. Increase regional self-reliance and integrated water management across all levels of government;
3. Achieve the co-equal goals for the Delta;
   a. Providing a more reliable water supply for California , and

b. Protect, restore and enhance the Delta ecosystem

4. Protect and restore important ecosystems;
5. Manage and prepare for dry periods;
6. Expand water storage capacity and improve groundwater management;
7. Provide safe water for all communities;
8. Increase flood protection;
9. Increase operational and regulatory efficiency;
10. Identify sustainable and integrated financing opportunities.

These ten actions directly correlate to the six essential water management tools identified in the CWP Update. As well, the management tools cannot achieve effective results without taking the actions identified in the CWAP. To maximize results within the Madera Region, land use and water planners, managers, and decision makers must all share the strategic vision of the necessity to collaborate, coordinate and integrate plans to achieve maximum beneficial water management results within the Madera Region.

The Madera Region is home to two incorporated cities, Chowchilla and Madera, and numerous unincorporated communities within the County of Madera's jurisdiction as shown on several figures in CHAPTER 3. The land use and water planning representatives from the various urbanized communities, rural county areas and public and private water purveyors/districts serve as a link between the IRWMP and local land and water planning efforts and are encouraged to actively participate in Madera RWMG. Accordingly, many take advantage of the IRWM process to be involved in regional efforts. These representatives provide important data and information and provided critical guidance during the planning process. Further, the local agency members and interested parties individually adopt this IRWMP as a separate action by their respective Boards and Councils.

Jurisdictions of Local Plans

The local planning documents are confined to the area under the county, city, community or other local entity's purview. For the cities and communities, the jurisdiction is limited by the city limits or sphere of influence depending on the document. The county's jurisdiction is limited by the county limit lines and typically applies only to the unincorporated areas of the county. Special districts such as water, conservation, irrigation or flood control, community services and public utility districts will have an adopted district boundary which serves as the jurisdiction limit. Special districts may also have a Local Agency Formation Commission (LAFCO) approved spheres of influence.

Local Plan Updates

The majority of local planning documents are either mandated for periodic update or the local agency elects to update them for accuracy. To the extent feasible, the IRWMP will consider the

most current documents during IRWMP Update processes but will not amend or update the IRWMP based solely on a local planning document update. Members and interested parties should refer to the IRWMP in their local plans where applicable.

Regional Efforts Lead to Local Efforts

The regional planning efforts are intended to serve as a base map or guideline for the entire region to follow in regards to water resources. The foundation of the IRWMP will continue to be the successful implementation of local projects and programs that help accomplish the region's Goals and Objectives. Local agencies without planning documents in place may elect to use the IRWMP in-lieu of or as a beginning point for their own local planning documents.

Planning Document Inconsistencies

Inconsistencies may occur occasionally between the regional and local planning documents. Some of these occurrences may be solved through discussion and collaboration between the local agency and the Madera RWMG. If it is determined the inconsistency is of vital significance to the IRWMP and out of sequence with a planned update, the Madera RWMG will incorporate updated information into an Annual Report or, if necessary, prepare a special update.

The link between IRWM and land use planning has a considerable number of common considerations, both providing an opportunity to garner important input on a multitude of issues. The key IRWM issues which could be affected by local planning policy include: the gamut of water resources management and land stewardship tools, such as flood management, groundwater recharge, conjunctive water use, water quality/treatment facilities, water conservation, municipal and recreational development, rural, urban and agricultural activities, conservation, and planning and development reviews and approvals.

Government sector and private water agencies and land owners can encourage local land use agencies to protect groundwater recharge areas; restrict and provide alternatives to development in floodplains; evaluate adequacy of water quality and septic system disposal for new developments; encourage conservation and development of local water, wastewater and storm drain projects to integrate and maximize the potential for meeting regional goals and measureable objectives.

DWR is recommending that land use planning be one of the water management strategies included in an IRWMP. A review of the existing City of Chowchilla, City of Madera, and County of Madera General Plans and Area/Specific Plans, Municipal Service Reviews, and various water planning documents listed in Section 13.2 - above was conducted. **Table 13.7** and **Table 13.8** below, are matrices showing columns for the following 6 essential (and one "other" category) water management attributes or tools defined in the California Water Plan - Update 2009 for Integrated Water Management:

- Reduce Water Demand
- Improve Operational Efficiency and Transfers

- Increase Water Supply
- Improve Water Quality
- Practice Resources Stewardship
- Improve Flood Management
- Other

Each existing land or water planning documents (shown in the rows) were reviewed to determine which water management attribute, if any, is addressed. Consequently, checkmarks were placed in the respective cells according to whether a policy was in place addressing the various attributes. Blank cells then become a quick way to identify where the agency/entity may be lacking a policy to address a particular attribute. The agency/entity can then determine whether it is appropriate they have a policy for that attribute or whether it's "not applicable" to their jurisdictional authorities or responsibilities. In this way the Matrix serves as a checklist showing what agencies/entities are implementing policies addressing what specific management attributes. So the Matrix can be used as a living tool -- amended as agencies adopt policies to fill the gaps, visually monitoring the collective efforts to be comprehensive in activating consistent water management activities. Some agencies may be implementing policies or strategies that aren't documented in formal planning documents. The Table therefore can help to identify which strategies may need to be specifically addressed in formal documents.

The purpose of the matrix was to distill into useable form the range of adopted Cities' of Chowchilla and Madera and County Madera General Plan goals, objectives, policies, and programs to show the extent to which they address or deal with essential water resources management tools. The review specifically evaluated how each general plan recognizes regional water resources issues; incorporates water management strategies; and how achievement of these goals could be supported by the IRWMP being developed by the Madera RWMG. The matrix was presented to the Madera RWMG as a way to summarize key local land use and water policies pertinent to water management. The matrix can serve to identify the policy "drivers" that provide a basis for integrating land use, water supply plans, and the planning process. To the extent plans or policies do not address a water management attributes indicates where future collaboration or attention is needed to assure efforts are being made on all fronts to implement the essential tools.

For example, some of plans are lacking policies directed to the Salt and Salinity Management tool under the "Improve Water Quality" attribute. This strategy is not applicable to all agencies, but is relevant to some in the Madera Region. While this may not necessarily reflect an inconsistency, it may represent an opportunity for coordination between the land use agencies and water management entity to collaborate on the development of reasonable policies that could be developed in this area and that could be feasibly implemented by each agency or entity in a complimentary manner.

Table 13.7 - Water Management Attributes Employed by Local Planning Agencies

	Reduce Water Use / Demand		Improve Operation Efficiency and Transfers				Increase Water Supply						Improve Water Quality						Practice Resources Stewardship								Improve Flood Management	Other
Agencies/Organizations and Type of Plan	Ag Water Use Efficiency	Urban Water use Efficiency	Conveyance - Delta	Conveyance - Regional & local	System Reoperation	Water Transfers	Conjunctive Management & Groundwater	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage - Regional & Local	Drinking Water Treatment & Distribution	Ground Water & Aquifer Remediation	Matching Water Quality to Use	Pollution Prevention	Salt & Salinity Management	Urban Runoff Management	Ag Lands Stewardship	Economic Incentives (Loans, Grants, & Water Pricing)	Ecosystem Restoration	Forest Management	Land Use Planning & Management	Recharge Areas Protection	Water-dependent Recreation	Watershed Management	Flood Risk Management	Other Strategies
LAND USE PLANNING DOCUMENTS																												
City of Chowchilla (GP/EIR)	✓	✓		✓		✓	✓					✓	✓					✓		✓	✓		✓	✓	✓		✓	
City of Madera		✓				✓	✓			✓		✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓			✓	
County of Madera		✓	✓							✓			✓			✓			✓	✓	✓	✓	✓		✓	✓	✓	
Ahwahnee Area Plan		✓																					✓					
Ahwahnee Comprehensive Rehabilitation Plan	No specific policies in the doc that apply.																											
Coarsegold Area Plan - Madera County	No specific policies in the doc that apply.																											
Fairmead Colony Area Plan		✓																✓					✓				✓	
Fairmead Neighborhood Mobility and Revitalization Strategy Theme																		✓										
Gunnar Ranch West Area Plan		✓																✓					✓				✓	
Madera State Center Community College-Specific Plan 1995	No specific policies in the doc that apply.																											

Agencies/Organizations and Type of Plan	Reduce Water Use / Demand: Ag Water Use Efficiency	Reduce Water Use / Demand: Urban Water use Efficiency	Improve Operation Efficiency and Transfers: Conveyance - Delta	Improve Operation Efficiency and Transfers: Conveyance - Regional & local	Improve Operation Efficiency and Transfers: System Reoperation	Improve Operation Efficiency and Transfers: Water Transfers	Increase Water Supply: Conjunctive Management & Groundwater	Increase Water Supply: Desalination	Increase Water Supply: Precipitation Enhancement	Increase Water Supply: Recycled Municipal Water	Increase Water Supply: Surface Storage - CALFED	Increase Water Supply: Surface Storage - Regional & Local	Improve Water Quality: Drinking Water Treatment & Distribution	Improve Water Quality: Ground Water & Aquifer Remediation	Improve Water Quality: Matching Water Quality to Use	Improve Water Quality: Pollution Prevention	Improve Water Quality: Salt & Salinity Management	Improve Water Quality: Urban Runoff Management	Practice Resources Stewardship: Ag Lands Stewardship	Practice Resources Stewardship: Economic Incentives (Loans, Grants, & Water Pricing)	Practice Resources Stewardship: Ecosystem Restoration	Practice Resources Stewardship: Forest Management	Practice Resources Stewardship: Land Use Planning & Management	Practice Resources Stewardship: Recharge Areas Protection	Practice Resources Stewardship: Water-dependent Recreation	Practice Resources Stewardship: Watershed Management	Improve Flood Management: Flood Risk Management	Other: Other Strategies
LAND USE PLANNING DOCUMENTS																											
North Fork/South Fork Community Center Area Plan																						✓					
Oakhurst Area Plan		✓																✓	✓			✓					
Raymond Area Plan		✓																	✓			✓					
River West-Draft Madera Master Plan	No specific policies in the doc that apply.																										
Madera County Local Agency Formation Commission																											
Draft MSR for CSA #1 and CSA #21	No specific policies in the doc that apply.																										
Greater Rio Mesa Area MSR	No specific policies in the doc that apply.																										
Madera Ranchos MSR	No specific policies in the doc that apply.																										
Oakhurst MSR	No specific policies in the doc that apply.																										
MSR for EIGHT PUBLIC WATER DISTRICTS in MADERA COUNTY			✓									✓															
State of California																											
N/A																											

Agencies/Organizations and Type of Plan	Reduce Water Use / Demand		Improve Operation Efficiency and Transfers				Increase Water Supply						Improve Water Quality						Practice Resources Stewardship								Improve Flood Management	Other
	Ag Water Use Efficiency	Urban Water use Efficiency	Conveyance - Delta	Conveyance - Regional & local	System Reoperation	Water Transfers	Conjunctive Management & Groundwater	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage - Regional & Local	Drinking Water Treatment & Distribution	Ground Water & Aquifer Remediation	Matching Water Quality to Use	Pollution Prevention	Salt & Salinity Management	Urban Runoff Management	Ag Lands Stewardship	Economic Incentives (Loans, Grants, & Water Pricing)	Ecosystem Restoration	Forest Management	Land Use Planning & Management	Recharge Areas Protection	Water-dependent Recreation	Watershed Management	Flood Risk Management	Other Strategies
LAND USE PLANNING DOCUMENTS																												
Federal																												
Sierra National Forest - Forrest Land and Resource Management Plan, 1991	No specific policies in the doc that apply.																											
Badger Pass Ski Lodge Rehabilitiation - FONSI		✓															✓											
Ansel Adams, John Muir, and Dinkey Lakes Wilderness																					✓							

Table 13.8 - Water Management Attributes Employed by Local Water Purveyors

	Reduce Water Use / Demand		Improve Operation Efficiency and Transfers				Increase Water Supply						Improve Water Quality						Practice Resources Stewardship								Improve Flood Management	Other
Agencies/Organizations and Type of Plan	Ag Water Use Efficiency	Urban Water use Efficiency	Conveyance - Delta	Conveyance - Regional Local	System Reoperation	Water Transfers	Conjunctive Management & Groundwater	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage - Regional & Local	Drinking Water Treatment & Distribution	Ground Water & Aquifer Remediation	Matching Water Quality to Use	Pollution Prevention	Salt & Salinity Management	Urban Runoff Management	Ag Lands Stewardship	Economic Incentives (Loans, Grants, & Water Pricing)	Ecosystem Restoration	Forest Management	Land Use Planning & Management	Recharge Areas Protection	Water-dependent Recreation	Watershed Management	Flood Risk Management	Other Strategies
WATER PLANNING DOCUMENTS																												
County of Madera / Region																												
County of Madera: General Plan	✓	✓				✓	✓						✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓		✓
County of Madera: AB 3030 Ground Water Management Plan		✓				✓	✓			✓		✓	✓	✓	✓	✓		✓	✓				✓	✓		✓		
County of Madera: Storm Water Quality Management Program							✓								✓	✓		✓						✓		✓		
Madera Regional Groundwater Management Plan, A partnership between: City of Chowchilla, Chowchilla Water District, City of Madera, Madera Irrigation District, South-East Madera County United	✓	✓		✓			✓					✓	✓	✓			✓	✓	✓	✓				✓	✓		✓	✓	
City of Chowchilla (GP/EIR)																												
City of Chowchilla: Draft 2008 Urban Water Management Plan		✓				✓	✓	✓		✓			✓			✓	✓							✓	✓		✓		

Agencies/Organizations and Type of Plan	Reduce Water Use / Demand		Improve Operation Efficiency and Transfers				Increase Water Supply						Improve Water Quality						Practice Resources Stewardship							Improve Flood Management	Other
	Ag Water Use Efficiency	Urban Water use Efficiency	Conveyance - Delta	Conveyance - Regional Local	System Reoperation	Water Transfers	Conjunctive Management & Groundwater	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage - Regional & Local	Drinking Water Treatment & Distribution	Ground Water & Aquifer Remediation	Matching Water Quality to Use	Pollution Prevention	Salt & Salinity Management	Urban Runoff Management	Ag Lands Stewardship	Economic Incentives (Loans, Grants, & Water Pricing)	Ecosystem Restoration	Forest Management	Land Use Planning & Management	Recharge Areas Protection	Water-dependent Recreation	Watershed Management	Flood Risk Management	Other Strategies
WATER PLANNING DOCUMENTS																											
City of Madera																											
City of Madera 2010 Urban Water Management Plan		✓			✓	✓		✓				✓													✓		
City of Madera Storm Water Quality Management Program		✓		✓			✓									✓		✓									✓
Special Districts																											
Aliso Water District: Ground Water Management Plan (information not available)																											
Chowchilla-Red-Top-City Joint Powers Authority, AB 3030 Groundwater Management Plan (1997)	✓					✓	✓	✓				✓	✓	✓		✓	✓		✓				✓	✓		✓		
Chowchilla Water District, Water Management Plan Five Year Update (2008 Criteria)	✓					✓	✓												✓	✓			✓	✓		✓		
Gravelly Ford Water District: 2009 Water Management Plan	✓					✓	✓				✓			✓	✓	✓	✓							✓			✓	✓

Agencies/Organizations and Type of Plan	Reduce Water Use / Demand		Improve Operation Efficiency and Transfers				Increase Water Supply						Improve Water Quality						Practice Resources Stewardship								Improve Flood Management	Other
	Ag Water Use Efficiency	Urban Water use Efficiency	Conveyance - Delta	Conveyance - Regional Local	System Reoperation	Water Transfers	Conjunctive Management & Groundwater	Desalination	Precipitation Enhancement	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage - Regional & Local	Drinking Water Treatment & Distribution	Ground Water & Aquifer Remediation	Matching Water Quality to Use	Pollution Prevention	Salt & Salinity Management	Urban Runoff Management	Ag Lands Stewardship	Economic Incentives (Loans, Grants, & Water Pricing)	Ecosystem Restoration	Forest Management	Land Use Planning & Management	Recharge Areas Protection	Water-dependent Recreation	Watershed Management	Flood Risk Management	Other Strategies
WATER PLANNING DOCUMENTS																												
Madera Irrigation District: (Agriculture) Water Management Plan, 5-year Update 2012	✓					✓																						
Root Creek Water District: AB 3030 Groundwater Management Plan, January 2012	✓				✓	✓	✓							✓										✓				
State of California																												
California Water Action Plan	✓	✓	✓		✓		✓	✓			✓								✓	✓	✓	✓			✓	✓		
Federal																												
Yosemite National Park - Wawona Water Conservation Plan		✓					✓												✓	✓								

13.4 - Dynamics Between IRWMP and Local Land Use/Water Planning Documents

The *San Joaquin Valley Blueprint* is a joint initiative of the San Joaquin Valley Councils of Governments engaging eight central Valley counties (including Madera) and 63 cities for the purpose of working together to convey a regional vision of land use and transportation that will be used to guide growth in the San Joaquin Valley over the next 50 years[1]. A major accomplishment of this group has been its endorsement of a preferred growth scenario in each county. The member counties and cities are in various stages of updating local plans to be consistent with this preferred growth scenario for the Valley.

The *Ahwahnee Principles* are a collection of development strategies written in 1991 by the Local Government Commission to help communities develop in a more resource-efficient manner.[2] Originally a list of 10 Principles, Economic Development and Water Principles have been added (in 1997 and 2005 respectively). The Ahwahnee Principles relate very closely to the statewide Actions discussed above.

The public agencies in Madera County are already using some of the Water Principles below to improve the vitality and prosperity of their communities.

Community Principles

1. Community design should be compact, mixed use, walkable and transit-oriented so that automobile-generated urban runoff pollutants are minimized and the open lands that absorb water are preserved to the maximum extent possible. (See the Ahwahnee Principles for Resource-Efficient Communities)
2. Natural resources such as wetlands, flood plains, recharge zones, riparian areas, open space, and native habitats should be identified, preserved and restored as valued assets for flood protection, water quality improvement, groundwater recharge, habitat, and overall long-term water resource sustainability.
3. Water holding areas such as creek beds, recessed athletic fields, ponds, cisterns, and other features that serve to recharge groundwater, reduce runoff, improve water quality and decrease flooding should be incorporated into the urban landscape.
4. All aspects of landscaping from the selection of plants to soil preparation and the installation of irrigation systems should be designed to reduce water demand, retain runoff, decrease flooding, and recharge groundwater.

[1] San Joaquin Valley Blueprint Planning Process, website http://www.valleyblueprint.org/about-us/faq.html#n588, (accessed 3-24-14), Frequently asked Questions about the SJVBP

[2] Local Government Commission, website http://www.lgc.org/ahwahnee/ahwahnee_principles.pdf accessed 3/24/14

5. Permeable surfaces should be used for hardscape. Impervious surfaces such as driveways, streets, and parking lots should be minimized so that land is available to absorb storm water, reduce polluted urban runoff, recharge groundwater and reduce flooding.
6. Dual plumbing that allows gray water from showers, sinks and washers to be reused for landscape irrigation should be included in the infrastructure of new development.
7. Community design should maximize the use of recycled water for appropriate applications including outdoor irrigation, toilet flushing, and commercial and industrial processes. Purple pipe should be installed in all new construction and remodeled buildings in anticipation of the future availability of recycled water.
8. Urban water conservation technologies such as low-flow toilets, efficient clothes washers, and more efficient water-using industrial equipment should be incorporated in all new construction and retrofitted in remodeled buildings.
9. Ground water treatment and brackish water desalination should be pursued when necessary to maximize locally available, drought-proof water supplies.

Implementation Principles

1. Water supply agencies should be consulted early in the land use decision-making process regarding technology, demographics and growth projections.
2. City and county officials, the watershed council, Local Agency Formation Commission (LAFCO), special districts and other stakeholders sharing watersheds should collaborate to take advantage of the benefits and synergies of water resource planning at a watershed level.
3. The best, multi-benefit and integrated strategies and projects should be identified and implemented before less integrated proposals, unless urgency demands otherwise.
4. From start to finish, projects and programs should involve the public, build relationships, and increase the sharing of and access to information.
5. Plans, programs, projects and policies should be monitored and evaluated to determine if the expected results are achieved and to improve future practices.

California state law requires each city and county to adopt a *general plan* "for the physical development of the county or city, and any land outside its boundaries which bears relation to its planning" (Government Code §65300). The California Supreme Court has called the general plan the "constitution for future development." The general plan expresses the community's unique development goals and embodies public policy relative to the distribution of future land uses, both public and private and well as the delivery of essential public services such as domestic water, water for agricultural purposes, sanitary sewer, wastewater treatment, drainage collection and dispersal, and water for sustaining natural resources.

As a result, land use, capital facility and water planning decision-making have a direct relationship to water demand and can have a direct impact on water supply. Some General Plans are more comprehensive than others in the degree to which they comprehensively integrate across the spectrum of land, water, and natural resources management elements.

The Madera IRWMP boundary is coterminous with the Madera County boundary. The incorporated cities, unincorporated communities, and county boundaries in the Madera Region are shown in CHAPTER 3. City and County planning or public works agency representatives, and special district staff, actively participated in the IRWM process. These representatives provide a conduit to the elected bodies through the planning and capital improvement processes. They also support collection of important data and information and provide critical guidance for planning purposes.

Figure 13-1 shows how local planning efforts in the Madera Region are integrated and how the IRWMP fits into larger scale efforts.

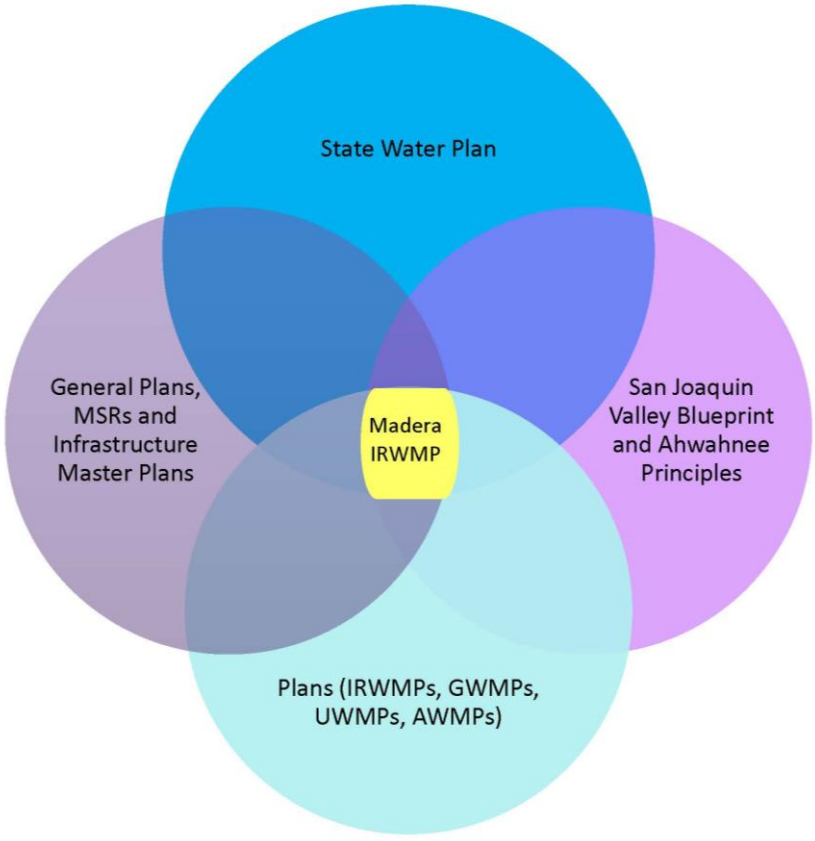

Figure 13-1 – IRWMP Relationship to Land Use and Water Planning

In the past, land use and water supply decisions were made independently; however, in recent years state legislation and court decisions have begun changing the planning process to require a greater degree of integration between land use and its accompanying water needs. Two such pieces of legislation, SB610 and SB 221, are companion measures with the intent to promote

collaborative planning between cities, counties and water suppliers. SB610 requires the preparation of Urban Water Management Plans and water supply assessments for larger development projects or land use plans. SB221 prohibits a land use agency from approving a subdivision map of more than 500 units without a letter of verification that sufficient and reliable water is available.

Similarly, Local Agency Formation Commissions (LAFCOs) are required to ensure water supplies are available before approving city or district boundary amendments. Additionally, they are responsible for approving a Municipal Service Review (MSR) prior to updating a sphere of influence, which must be updated every five years.

Updates to the General Plan Guidelines recommend that local agencies include a Water Element in their general plans with the intent that the general plans would incorporate the city or county's Urban Water Management Plan (UWMP) (if applicable) and codify requirements to comply with SB610/221.

The Madera IRWMP process included consideration of the existing land use plans and water planning documents to evaluate which statewide water planning challenges they address and the needed actions they intend to implement. As an umbrella document this IRWMP provides a means to: 1) coalesce all the activities of Madera regional land use planning agencies and water purveyors; 2) facilitate ways for them to collaborate to avoid potential for conflicts between the plans; and 3) work cooperatively to gain the maximum benefits region-wide to achieve sustainable water resources.

A review of the land-use planning and water planning documents identified in **Table 13.1** through **Table 13.6** showed the following primary characteristics:

- The Madera County General Plan is characteristically more regional in its viewpoint than the two City general plans.
- The Madera County General Plan identifies regional overdraft as a limiting factor to future land use development.
- The cities' general plans, to varying degrees, identify the significance of regional groundwater overdraft in general terms, and include policies that are intended to enhance the sustainability of their water supplies and minimize the factors contributing to overdraft within their respective jurisdictions.
- Water supply reliability and safety is discussed in the County and City general plans but in generalities; the plans could be more specific in directives toward how water supply shall be sustained and assured into the future, and how water quality will be monitored and maintained on an on-going basis.
- The more recent general plan updates focus on more regional efforts overall due in part to new requirements for general plans; however they still discuss water issues in generalities, not specifics.

- It is unknown whether new development proposals are reviewed for their consistency with or conflict with adopted Urban Water Management Plans.
- MSRs typically discuss general information regarding recharge and growth, without listing specific implementation plans needed to achieve these goals.

13.5 - Opportunities for Proactive Coordination and Collaboration between Land Use Planners and Water Managers

As previously discussed, cooperation between land planning and water agency representatives and the IRWM is critical to the successful and effective implementation of regional water management efforts. Establishing new and strengthening existing relationships will contribute to the Madera Region's water management success. Many of the land use and water planning documents acknowledge this already. But greater effort to carry this out is needed. There are several key approaches for facilitating the future relationships with local agencies:

1. Internal discussion within the Madera RWMG regarding inter-related land planning and water planning issues
2. Provide more detailed review of land use and water planning documents to continue to identify further potential inconsistencies with the purposes of the IRWMP, and provide recommendations for modified/new strategies to city and county and private/NGO planning and water policy decision makers.
3. Review and comment on major new land planning projects and policies of the agencies within the Region
4. Encourage land-use and water planners /engineers to attend regular RWMG meetings
5. Give presentation on the inter-relatedness of land use planning and water planning issues to City , County, private and NGO decision makers
6. Give presentations on water planning and IRWMPs at local chapters for land-use planning professional societies
7. Explore projects that will facilitate the modification of land planning policy to encourage implementation of region-wide beneficial water management
8. Conduct bi-annual meetings between the RWMG and local land planning representatives for the purposes of discussing upcoming policy changes or implementation of the IRWMP
9. Promote inter- and intra-agency communication between the land use planning and water management/infrastructure staff
10. Maintain a current list of key staff at all federal, state, regional and local government agencies and NGO entities that govern and serve to influence land use and water planning policy/projects, and assure they are invited to and made aware of the agenda topics at RWMG meetings.

11. The implementation measures of the Ahwahnee Principles discussed above also provide important guidance for collaboration that can be followed or adopted by the Madera RWMG.
12. Annual coordination review meetings pursuant to AB 3030 Groundwater Management Planning requirements should continue.

The RWMG is committed to maintaining open channels of communication and facilitating continued involvement of the land use and water planning community in the IRWMP process and implementation.

CHAPTER 14- STAKEHOLDER INVOLVEMENT

Stakeholder involvement, also called public outreach, includes efforts to recruit and engage a diverse group of stakeholders to participate in all aspects of the Madera Regional Water Management Group (RWMG). Stakeholder involvement is considered fundamental to the success of the RWMG. This chapter discusses a public outreach strategy, stakeholder recruitment, outreach performed to update the IRWMP, and future plans for public outreach. The goals of the public outreach efforts include:

1. Recruit members to participate
2. Inform public of water resources issues in the region
3. Solicit input for IRWMP development, project development and decision making

14.1 - Public Outreach Process

The public outreach process incorporates nine primary outreach methods, which are illustrated in **Figure 14-1:**

Figure 14-1 – Public Outreach Methods

Outreach Coordinator

The RWMG has a part-time Administrative Assistant who also serves as the lead outreach coordinator for the RWMG. Most of the work performed by the Administrative Assistant relates to public outreach, planning, and organization of the monthly RWMG meetings.

Meetings

The RWMG holds monthly meetings with the RWMG members and interested parties. The meetings are open to the public and include a public comment period when any individual or organization can speak. The meetings are rotated each month between three locations: Madera, Chowchilla, and Oakhurst. These locations are geographically spread out to reduce transportation time and costs for local residents and agencies. The meetings are announced by email and in local newspaper calendars (Madera Tribune, Chowchilla News and Sierra Star) each month.

The RWMG has also used professional meeting facilitators to help engage stakeholders and ensure their comments are heard. In 2012 and 2013, the RWMG received grants from the Department of Water Resources for meeting facilitation services from the Center for Collaborative Policy. The facilitator helped to further develop the governance structure, DAC policies and informational packets.

Printed Material

The RWMG developed a brochure to promote the updated IRWMP in 2013 and revised it in 2014 to promote the IRWMP update. A copy of the latest edition of the brochure can be found in **Appendix I**. The brochure is used to educate the public and recruit new members. The brochure is distributed at presentations and sent to parties expressing interest in the RWMG.

Focused Outreach

Focused outreach has been performed on specific groups, such as Disadvantaged Communities (DACs, see Section 4.5 -Disadvantaged Communities within the Region) and Native American tribes. The focused outreach typically includes directly contacting the stakeholders and making presentations to the groups.

Email List

The RWMG maintains an email list that receives announcements of all RWMG meetings, meeting agenda, meeting minutes, important water management news, grant opportunities, and other topics that may be of member interest. The email distribution list is comprised of MOU signatories and others that have expressed interest in the RWMG and IRWMP. In 2014, the email list included 85 contacts. Recipients include engineering consultants, community organizations, homeowner associations, non-governmental associations, water agencies, resource conservation districts, cities, counties, special districts, state agencies, neighboring IRWMP groups, watershed groups and power companies.

Articles

Newsletter articles, newspaper articles, letters to newspaper editors and press releases have been used to promote the RWMG and make important announcements. Three articles were prepared for the IRWMP update.

The first article announced the IRWMP update and invited stakeholders to participate. The article was given to the RWMG members to publish in their newsletters and websites. The article was printed in the Madera Irrigation District newsletter and posted on the RWMG website. A second article was published in the Sierra Star and Sierra Online news. Finally, the completion of the draft IRWMP was announced in a press release. Newspaper articles will continue to be an important form of outreach, especially to announce grant awards, projects underway, completed projects and other RWMG successes.

Presentations

The RWMG develops a live presentation each year to help educate the general public and encourage participation. **Appendix D – Public Outreach Presentations** includes two different presentations that have been recently used. Topics covered in the presentations have included RWMG history, on-going and completed projects, successes, future milestones/goals, and public outreach. Following is a list of some organizations that received presentations during 2013 and the first part of 2014:

- Madera County Water Advisory Commission – 1/17/13
- Central Sierra Watershed Committee – 2/27/13
- Madera Oversight Committee – 5/22/13
- Coarsegold Resource Conservation District – 6/27/13
- Oakhurst Kiwanis – 9/24/13
- Noon Rotary – 10/09/13
- Oakhurst Mountain Lions – 1/08/14
- Chowchilla Lions – 1/16/14
- Chamber of Commerce Women in Business – 2/13/14

The outreach coordinator also regularly attends meetings for the following local agencies. Presentations are given to these agencies every year:

- Central Sierra Watershed Committee
- Chowchilla Red-Top Resource Conservation District
- Coarsegold Resource Conservation District
- Madera Resource Conservation District
- Yosemite/Sequoia Resource Conservation and Development Council
- Sierra-San Joaquin Noxious Weed Alliance
- MD-221 – Oakhurst Sewer Advisory Committee

Lastly, presentations have been given to the Annual Conference of the Sierra Water Workgroup each of the past four years. The Sierra Water Workgroup is a collection of 12 IRWMP groups in the Sierra region and is described in more detail in Chapter 15 – Coordination and Integration.

Website

The Madera RWMG website is hosted on the Madera Irrigation District web server and can be found at: http://madera-id.org/index.php/rwmg. The RWMG website contains information on the RWMG, information on IRWMPs, a timeline of accomplishments, an RWMG meeting calendar, new member packet and a special DAC member application. The website also included an announcement that the IRWMP was being updated.

The New Member Packet includes most of the information a stakeholder will need to learn about the RWMG and the rules and commitments pertinent to joining the group. The packet includes contact information, MOU, Bylaws, Ground Rules, Mission Statement, web links to key reference materials, and a list of MOU signatories. Starting later in 2014, the website will post agenda and minutes for all RWMG meetings.

Local Agency Updates

Numerous local agencies are regularly updated regarding the RWMG and its activities. The RWMG Chairman updates the Madera County Water Advisory Commission monthly. The outreach coordinator also regularly attends meetings for the eight agencies listed above under 'Presentations' and provides regular updates. RWMG updates are a standing agenda item for several of these agencies. Many RWMG members also regularly update their governing bodies during Board and Council meetings.

Outreach and Coordination with Neighboring IRWMPs

Outreach and coordination is also performed with seven neighboring IRWMP groups. These efforts are described in Section 15.7 -Neighboring IRWMPs in the Coordination and Integration chapter. The outreach and coordination includes email lists, Letters of Agreement, and attending meetings and conferences.

14.2 - Stakeholder Identification and Recruitment

Stakeholders are necessary to implement the IRWMP and resource management strategies. Therefore, a strong list of members and interested parties is fundamental to the long-term success of the RWMG. Stakeholder identification and recruitment has taken place for several years and has helped to create a member and interested party list that includes a diverse range of interests.

Breadth of Membership

The current members (MOU signatories) include:

- Chowchilla Red-Top Resource Conservation District

- Chowchilla Water District
- City of Chowchilla
- City of Madera
- Coarsegold Resource Conservation District
- Fairmead Community & Friends
- Gravelly Ford Water District
- County of Madera
- Madera County Special Districts
- Madera Irrigation District
- Madera Valley Water Company
- Madera Water District
- North Fork – Mono Rancheria
- Root Creek Water District
- Self Help Enterprises
- SEMCU - Southeast Madera County United
- Yosemite/Sequoia Resource Conservation and Development Council

The RWMG list above represents a broad range of interests including: water supply, water quality, environment/habitat, recreation, agriculture, resource management, hydropower, sanitation, Disadvantaged Communities, cultural, non-profit organizations, and local and state agencies. The Interested Parties, who participate but are not formal members, include a similar range of interests.

Any stakeholder organization with an interest or role in water management in the IRWMP area may join the RWMG. A group who wants to join the Madera RWMG should notify the RWMG and sign the MOU to signify their good faith effort to join. Any entity who would like to discontinue their participation may do so at any time. The MOU is non-binding and non-regulatory.

The RWMG performed extensive outreach while preparing the 2008 IRWMP. On-going outreach efforts since then have attracted more stakeholders to participate. As a result, most of the major stakeholders in the region are actively participating in the IRWMP as Members or Interested Parties. However, a few are not involved either because they did not respond to previous outreach efforts, or in some cases were not directly contacted. As part of this update, the RWMG openly discussed which stakeholders were not involved in the IRWMP and should be directly contacted. As a result the outreach coordinator directly contacted DACs, local water companies, prisons, school districts, and Native American Tribes to encourage their participation.

14.3 - Stakeholder Involvement in IRWMP Development

Stakeholder involvement in IRWMP development began as early as 2006 when the original IRWMP was developed by Madera County. Five separate involvement groups were formed to discuss local issues. These groups included interests from the Valley, Raymond, Coarsegold, Oakhurst and North Fork. The efforts to develop the initial IRWMP, which was completed in 2008, are not discussed in detail here. More information can be found in the 2008 IRWMP and the RWMG's Regional Acceptance Process application. Since the 2008 IRWMP was developed, the current Regional Water Management Group was formed (see CHAPTER 2– Governance) and the list of formal members has grown to seventeen. The formal members, interested parties and general public are all necessary to implement the IRWMP goals, objectives and resource management strategies. The public agencies play a role developing and implementing projects, while special interest groups, landowners and citizens play an important role in helping to identify and prioritize issues and problems.

Public Outreach for 2014 IRWMP Update

The public outreach process for updating the IRWMP included the following:

- The intent to prepare an updated IRWMP was announced at a regularly scheduled RWMG meeting in mid-2013. The item was noted on an agenda that was publicly noticed.
- In compliance with the California Water Code, the RWMG published notices that the IRWMP was being updated, and that a draft was available for review and will be considered for adoption. Copies of the notices are included in **Appendix J**. The first notice was published in the Madera Tribune, which is the most widely circulated newspaper in Madera County. The notice, published on December 31, 2013 and January 7, 2014, informed the public that the RWMG was updating the IRWMP to address new IRWMP standards, and that the general public was invited to participate. A public notice was also posted on Sierra News Online, and a Letter to the Editor published in the Sierra Star to notify foothill and mountain communities of the IRWMP update. The second notice was published on July 31, 2014 in the Madera Tribune, Chowchilla News, Sierra Star and Sierra News On-line, to inform the public that the RWMG was intending to adopt the updated IRWMP and solicited public comments on the document
- Through a series of ten interactive meetings over a ten month period, the RWMG reviewed each proposed IRWMP standard and the content in the existing IRWMP. During these sessions, the stakeholders shared ideas and concerns, and came to consensus on the information to be included in the updated IRWMP.
- All nine of the public outreach methods listed in Section 14.1 -Public Outreach Process were used to inform the public about the IRWMP update and to solicit input.
- The public was notified that the revised IRWMP was available for review through a local newspaper notice, an announcement on the RWMG webpage, an email notification and

verbally at a RWMG meeting. The draft IRWMP was placed on the RWMG and Madera County websites, and members each had hard copies available at their offices for the public to view. Stakeholders were provided 15 days to review the IRWMP and provide comments.

- 140 comments were received from the general public and RWMG members. A list of comments was developed and discussed at a regular RWMG meeting and incorporated into the IRWMP. These comments can be found in **Appendix L**.

14.4 - Equal Opportunity for Participation

The RWMG policies and governance structure provides equal opportunities for participation and helps ensure a balanced group of members. The RWMG has also developed policies to involve stakeholders that choose not be become full members. The following policies help to ensure balanced and fair participation for all stakeholders:

1. Regular membership in the RWMG is open to any agency, organization or company which signs the MOU, submits a resolution from its governing board with an intention to join, adopts the IRWMP, pays the dues (if applicable) and is approved by existing RWMG members. The right to become a member is based primarily on having a local presence in the IRWMP area and an interest in water resources management. The type and size of an organization are not factors. Each member of the RWMG is given one vote. Voting power is not weighted based on agency size, service area acreage or financial status.
2. Organizations not willing or able to pay the per-member dues are invited to join the RWMG as Affiliate Members. An Affiliate Member may fully participate in all RWMG meetings and projects, but may not vote in either the informal polls described above or in the formal policy decisions. There are no dues associated with becoming an Affiliate Member.
3. Qualified Disadvantaged Communities (DACs) may join the RWMG as DAC members. As with the Affiliate Members, there is no limitation on participation by DAC members. Voting for DAC members is limited to a single vote on behalf of all the DAC members, to be voted by a representative selected by the DACs from among the several DAC members.
4. Organizations that join as Interested Parties participate in the RWMG but choose not to sign the MOU or pay dues. They are free to attend meetings, voice opinions and recommendations, and can submit projects for grant applications. They are not given the right to vote in either the informal polls described above or on formal decisions.
5. The general public are welcome to attend RWMG meetings. Private individuals are not allowed to become formal members of the RWMG, but can be added to the list of Interested Parties. Input from any member of the general public is considered regardless of their associations or history.

Technology and Information Access

Some stakeholders, especially DACs, may not have access to technology or transportation needed to participate in RWMG meetings and other activities. The RWMG has made several efforts to overcome these barriers:

1. Meetings are announced by email and on the RWMG website, but for those that lack access to computer technology, they are also announced in local newspaper calendars each month.
2. Meeting agenda, minutes and handouts are printed and mailed to some stakeholders that lack access to or knowledge of computers.
3. Meetings are rotated each month between Madera, Chowchilla and Oakhurst to reduce travel distances for local residents and agencies.

14.5 - Disadvantaged Communities

Critical water supply and water quality issues relevant to the Disadvantaged Communities (DACs) within the Region are important concerns for the Madera RWMG. Many communities within the RWMG boundaries meet the state definition of a disadvantaged community, which is having a median household income less than 80 percent of the statewide average.

The RWMG has developed policies which allow DACs to become members without paying dues. A special DAC Application Packet was also developed and can be found on the RWMG website. A special DAC Group was added to the by-laws. This group includes all of the member DACs and has a single vote in RWMG decisions. The vote is cast by a DAC representative, selected by the member DACs from their own ranks.

Special efforts have also been made to educate and engage DACs within the planning area, including targeted outreach with a professional meeting facilitator. These efforts are described in CHAPTER 4– Disadvantaged Communities. Chapter 4 also describes the social and cultural makeup of the region, the process for identifying DACs, and typical water resources problems and issues of concern to the communities.

14.6 - Native American Tribes

The IRWMP area includes two federally recognized sovereign Native American tribes (North Fork Rancheria of Mono Indians and Picayune Rancheria of Chukchansi Indians) as well as many unrecognized tribes. The outreach coordinator has reached out to the local Native American Tribes to encourage their participation and membership. This outreach was performed several years ago and then again as part of this IRWMP update. The tribes are also on the email distribution list. One tribe, the North Fork Rancheria of Mono Indians, is an MOU signatory.

14.7 - Decision Making

The RWMG's decision-making process is transparent and all stakeholders are afforded the opportunity to provide input on decisions. The RWMG has a decision-making structure that requires the group to debate and discuss issues and document dissenting views. The MOU also includes a non-traditional voting process to assess preliminary support for issues prior to formal voting. Decisions are generally made by the formal members who are comprised of the MOU signatories. However, all stakeholders have opportunities to provide input, comments and recommendations on decisions at RWMG meetings or through participation in work groups and special committees. In addition, DAC members are collectively provided one vote in decisions even though they are exempt from the annual dues.

14.8 - Future Outreach

Future public outreach will follow the model developed during past outreach efforts. The future Public Outreach Plan will include the nine methods described in Section 14.1 -Public Outreach Process, with greater emphasis on publicizing the successes of the group. The Public Outreach Plan will be assessed annually and modified as deemed appropriate. Important topics for future educational efforts include groundwater overdraft, land subsidence, and the impacts from the San Joaquin River Restoration on water supplies.

Most organizational stakeholders in the region are already members or interested parties, but some have not actively participated. The RWMG recognizes that the opportunity for a stakeholder to become involved is not limited to the beginning stages of plan development. A stakeholder may become involved later as their awareness of IRWM increases or new issues or concerns develop. Consequently, the RWMG will continually recruit new stakeholders to further increase the depth and diversity of membership and participation.

CHAPTER 15- COORDINATION AND INTEGRATION

15.1 - Introduction

Coordination and integration are two closely related Integrated Regional Water Management Plan (IRWMP) standards intended to help ensure IRWMP members are working together. For the purposes of the IRWMP these two standards have been combined. This IRWMP describes a variety of processes for RWMG members and stakeholders to coordinate and integrate water management efforts. This chapter also references other chapters of the IRWMP where specific efforts are discussed in greater detail.

Coordination

Coordination involves public outreach and facilitation efforts to bring stakeholders together and work as a unified group. Coordination efforts can include specific tasks or implementation of on-going policies and procedures. The goals of coordination include the following:

- Reduce current and future conflicts among stakeholders
- Identify opportunities for regional or multi-agency projects
- Increase awareness of adjacent IRWMPs and their efforts
- Improve awareness of tribal, state and federal agency resources, plans and projects
- Effectively use regional technical expertise and knowledge
- Provide opportunities to advance public education
- Resource identification and pooling

Integration

Integration is defined as combining separate pieces into an efficient unified effort. The broad goal of regional water management is to integrate the stakeholders into a single entity for addressing water-related regional issues. The development and implementation of the IRWMP should demonstrate that the RWMG is forming, coordinating, and integrating separate efforts in order to function as a unified effort.

The Madera Regional Water Management Group (RWMG) was formed with the intent of establishing a foundation for coordination and integration within the region. This foundation includes the five main components shown in **Figure 15-1**. The central component is Project Selection and Implementation. Each of these components will be discussed in subsequent sections.

Figure 15-1 – Coordination and Integration Components

Coordination and integration efforts generally overlap, and therefore they are jointly discussed below. Coordination and integration are also covered in several other IRWMP chapters, so the discussions below are introductory and refer to other IRWMP Chapters for more details.

15.2 - History of Coordination and Integration

In 2006, the County of Madera obtained a Proposition 50 IRWM Planning grant and began the process of developing an IRWMP for managing and protecting its water resources. Coordination and integration efforts began immediately with this effort. This IRWM began with Madera County as the lead agency. The County then formed a RWMG Formation Committee to develop and implement a governance structure for a RWMG. The RWMG grew and evolved to include a more diverse group of stakeholders who formally organized under a Memorandum of Understanding in 2010. Prior to the RWMG, Madera County did not have comprehensive IRWM planning. Several efforts had been in place to coordinate efforts, such as watershed groups and multi-agency efforts, but the RWMG represented the first truly integrated planning effort. The lack of specific IRWM planning efforts does not mean planning has not taken place, however it had largely been done individually by agencies with responsibility over specific areas. Past efforts usually involved agencies meeting just to discuss certain projects, but there is now a desire to meet regularly to discuss policies, collaboration, and ways to prevent future conflicts.

15.3 - Stakeholders

The RWMG has established a governance structure that fosters both integration and coordination of stakeholders through the following:

1. The RWMG uses a variety of public outreach methods to inform stakeholders of their efforts and accomplishments, and solicit comments on projects and studies (see CHAPTER 14 – Stakeholder Involvement for details on past and future public outreach efforts).
2. Outreach to disadvantaged communities (DACs) is important since they have some of the greatest needs, are often underrepresented, and provide some of the best opportunities to receive grant funding. The RWMG will continue focused efforts to recruit more DACs to attend meetings and become formal members of the RWMG. Chapter 4 – Disadvantaged Communities provides details on DAC demographics, typical DAC issues and challenges, and outreach efforts to DACs, including special outreach efforts during the IRWMP update.
3. The members are organized under the RWMG Memorandum of Understanding (MOU) which provides a formal and structured organization to manage regional water resources (CHAPTER 2- Governance). All RWMG members are integrated through the Regional Water Management Group.
4. The governance structure allows any stakeholder to participate as an interested party. Interested parties do not need to sign the MOU; they can participate in all RWMG efforts but are not entitled to vote on decisions. The RWMG also has the authority to establish Work Groups that can provide stakeholders opportunities to provide input on specialized topics. Stakeholders participate primarily through monthly RWMG meetings.

15.4 - Natural and Constructed Resources

The watersheds of the Madera IRWMP include valuable natural resources and constructed water infrastructure. Several agencies working together can have significantly more natural/constructed resources than one working alone. Therefore, the integration of resources has the ability to enhance the outcome of any project. Resource integration can include sharing data, technical expertise or access to infrastructure. Resources integration is addressed as follows:

1. The IRWMP provides various details on the members, interested parties, water infrastructure, regional water supplies and other natural resources in the IRWMP region (CHAPTER 3– Region Description). This data informs stakeholders on the roles and responsibilities of other stakeholders, and the infrastructure and natural resources within their area of responsibility (as appropriate). This ensures that stakeholders have the necessary background data to participate in regional planning and decision making.

2. This IRWMP includes a climate change vulnerability assessment in Section 16 – Climate Change. This is an integrated assessment for the watersheds of the Madera RWMG, and helps to show potential climate change impacts to the region as a whole.
3. The IRWMP area includes two federally recognized sovereign Native American tribes (North Fork Rancheria of Mono Indians and Picayune Rancheria of Chukchansi Indians) as well as many unrecognized tribes. These tribes have separate governance and land management structures than the local, state and federal agencies. Sharing data, technical expertise and infrastructure with the tribes can benefit both the tribes and other RWMG stakeholders.

15.5 - Project Selection and Implementation

The RWMG coordinates and integrates projects through the following policies and procedures:

1. The RWMG solicits and publishes a list of projects so each stakeholder is aware of proposed projects. This list can also help prevent duplication in new projects, or identify multi-agency projects. The list will be updated semi-annually and added to the RWMG website.
2. The RWMG uses an integrated process to solicit, review and recommend projects for funding based on the RWMG's goals and objectives (CHAPTER 7– Project Review Process). The process requires a pre-application and input from the RWMG.
3. The RWMG has listed the general benefits of regional water management (CHAPTER 8– Impacts and Benefits). The goal of this list is to inform stakeholders of the value of coordinating and cooperating on regional efforts.
4. The RWMG has identified the benefits and impacts of implementing different types of projects (Chapter 8 – Impacts and Benefits). This information is provided for stakeholders within the Madera Region and neighboring IRWMPs. The purpose of this list is to help improve coordination among parties benefiting and impacted by new projects.

15.6 - Data Management and Reporting

The RWMG has successfully developed several programs to coordinate and integrate data management among the different parties in the Madera RWMG. These programs include the following:

1. In each future year, the RWMG will evaluate whether there is merit in preparing an annual report. The decision will be based largely on accomplishments during the year, and the need for supplemental documentation. The annual report would evaluate progress in meeting regional goals and objectives, document progress in implementing projects, and document proposed amendments to the IRWMP. The annual report will

be useful for archiving important data, and could also be used for informational, educational and promotional purposes. In the past the RWMG has prepared a PowerPoint presentation and a brochure each year which have documented major accomplishments for the RWMG, and this has served as its annual report.

2. The RWMG website will be expanded to include links to important information relevant to regional water management, and data collected through RWMG supported projects.

15.7 - Neighboring IRWMPs

The Madera RWMG abuts seven different IRWM Regions as shown in **Figure 15-2.** Below is a discussion on these IRWM Regions and their similarities, differences and existing relationships with the Madera RWMG.

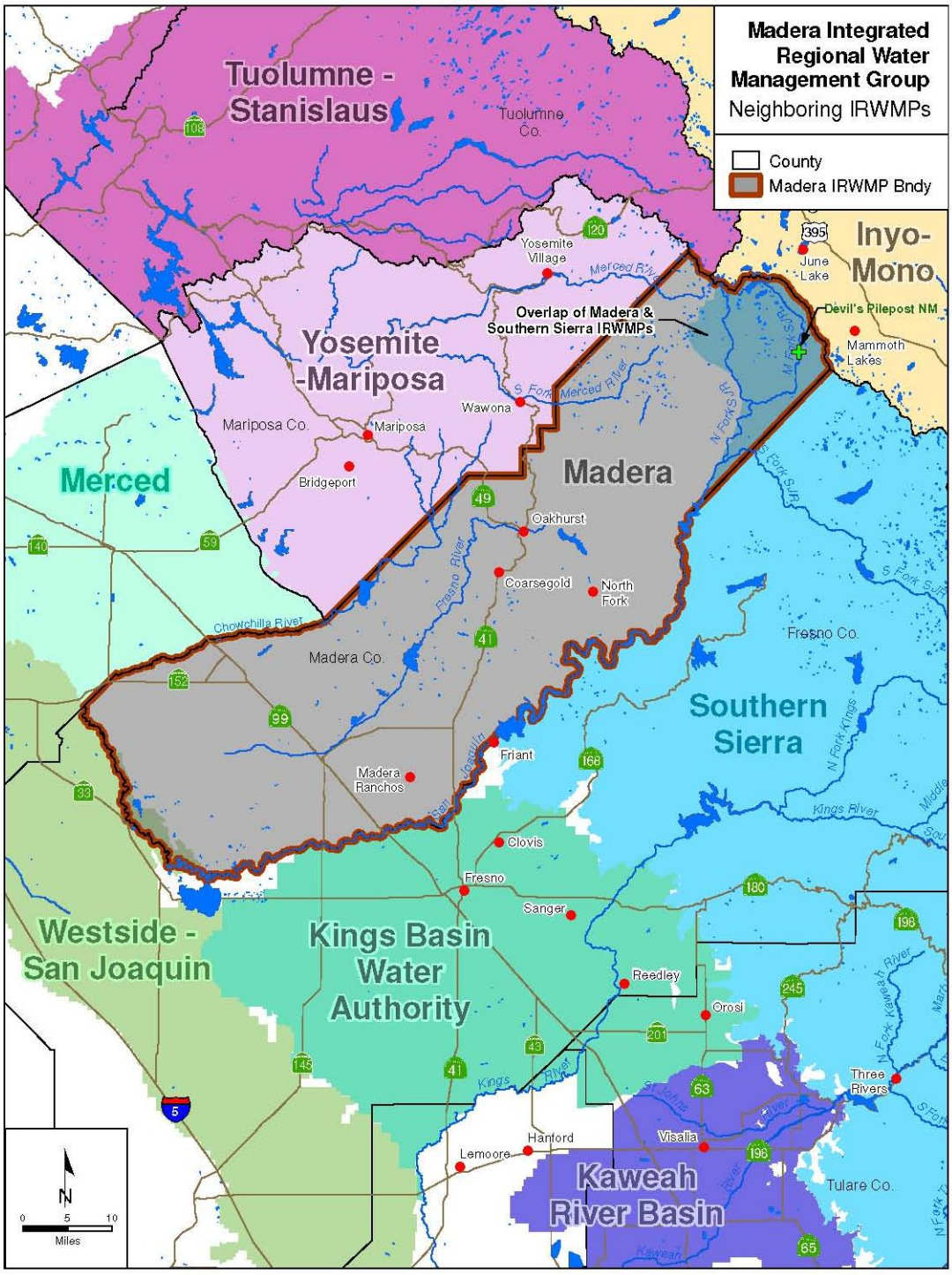

Figure 15-2 – Neighboring Regional Water Management Groups

The various IRWM Regions have made efforts to coordinate their boundaries as much as possible, and coordinate on water management planning. Inter-IRWM Region coordination efforts have included:

1. Email Lists. The Madera RWMG and all neighboring IRWM Regions are on each other's email distribution lists.
2. Start-up Assistance. The Madera RWMG began forming and writing an IRWMP before most other IRWM Regions. As a result, they assisted the other IRWM Regions in getting established, wrote letters of support, and provided copies of work performed to date so they could avoid 'reinventing the wheel.'
3. Letters of Agreement with neighboring IRWM Regions(see **Appendix K**) include:
    - Letter of Agreement on Region's Common Shared Areas – Southern Sierra IRWM Region
    - Letter of Agreement for Region's Common Boundary and Overall Cooperation and Collaboration – Merced IRWM Region
    - Letter of Agreement on Coordination and Communication between Regions – Yosemite-Mariposa IRWM Region
    - Letter of Agreement on Communication between Regions – Kings Basin Water Authority
    - Letter of Agreement – Devil's Postpile National Monument and Mammoth Mountain Ski Area – Inyo-Mono IRWM Region, Madera RWMG and Southern Sierra IRWM Region
    - MOU Regarding Coordination among Participants in the Sierra Nevada Water Workgroup
4. Representatives from the Madera RWMG frequently attend meetings for neighboring IRWM Regions
5. Roundtable of Regions. The Roundtable of Regions is an ad-hoc group of representatives from IRWM Regions around the State. The group was formed on the notion that each IRWM Region is unique but that all have many of the same interests. The group provides a forum for IRWM Region practitioners (people working on IRWM planning and implementation) to discuss their interests, share information, and provide recommendations to the Department of Water Resources on the IRWM grant program. This group holds regular conference calls and occasional face-to-face summits.
6. Sierra Water Workgroup. The Sierra Water Workgroup (SWWG) was formally organized in 2011 to help coordinate and facilitate the efforts of 12 IRWM Regions (covering 22 different counties) in the Sierra Nevada Mountains. The mission of the SWWG is to assist regional efforts to protect and enhance water quality, water supply, and watershed health; to develop cooperative regional responses; and to facilitate investment in watersheds and water resources by all beneficiaries. This is accomplished through coordination, advocacy, and information exchange. A representative of the Madera RWMG attends an annual summit held by the SWWG. The Participating groups that neighbor the Madera RWMG include the Southern Sierra IRWM Region, Inyo-Mono IRWM Region, Yosemite-Mariposa IRWM Region and Tuolumne-Stanislaus IRWM

Region. The Madera RWMG has signed the MOU Regarding Coordination among Participants in the Sierra Nevada Water Workgroup.

The Madera RWMG is regionally unique in that it contains large areas of valley, foothill and mountain lands. The seven neighboring IRWM Regions are limited, in general, to just valley lands or just foothill/mountain areas. The Madera RWMG therefore must manage and coordinate with a diverse range of internal stakeholders and neighbors. Following are discussions on each neighboring IRWM Region and their relation with the Madera RWMG. Copies of Letters of Agreements mentioned below can be found in **Appendix K**.

Southern Sierra IRWM Region. The Southern Sierra IRWM Region is located south of the eastern end of the Madera IRWM Region. The eastern portion of the Madera IRWM Region has many similarities to the Southern Sierra IRWM Region including large mountainous area, upper watersheds of major water systems, generally low, rural population centers that rely on hard rock wells, and high fire risks. The Southern Sierra IRWM Region desired to include the entire portion of the San Joaquin River watershed located west of the Sierra Nevada divide and south of the San Joaquin River. This has created a small overlap with the Madera IRWM Region (see **Figure 15-2**). The two IRWM Regions signed a *Letter of Agreement on Region's Common Shared Areas* in 2010. The overlap area is to facilitate holistic management of the Upper San Joaquin River watershed, which is almost entirely within the Sierra National Forest. Important issues related to the San Joaquin River include restoration efforts, watershed management, flooding in Madera County from river flows, and the importance of river supplies to meet valley water demands. The two IRWM Regions also share the area covered by the Devils Postpile National Monument and Mammoth Mountain Ski Area, which is documented in a letter from the National Park Service.

Inyo-Mono IRWM Region. The Inyo-Mono IRWM Region shares most of the eastern border of the Madera IRWM Region. The two IRWM Regions also share the area covered by the Devil's Postpile National Monument and Mammoth Mountain Ski Area, which is described in letters from the Inyo-Mono IRWM Region and National Park Service, both from 2010. This area has relatively small overlap, but was included due to issues of accessibility (the area is only accessible from the eastern side of the Sierra Nevada and cannot be directly accessed from the Madera IRWM Region.) The remainder of the borderline is the Sierra-Nevada divide so they do not share water resources, but have similar physical environments near the crest of the Sierras.

Kings Basin Water Authority. The Kings Basin Water Authority (also called the Upper Kings Basin Water Forum) IRWM Region lies directly south of the Madera IRWM Region. The two IRWM Regions are separated by the Madera County/Fresno County border, which is essentially the San Joaquin River. The Kings Basin IRWM Region primarily covers the Valley floor. This area receives some of their water from the San Joaquin River and therefore relies partially on water management in some portions of the Madera IRWM Region. The two IRWM Regions signed a *Letter of Agreement on Communication between Regions*.

Yosemite-Mariposa IRWM Region. The Yosemite-Mariposa IRWM Region is located north of the eastern part of the Madera IRWM Region, and covers the exact borders of Mariposa County. Both IRWM Regions have portions of the upper watersheds of the Chowchilla, Fresno and Merced Rivers. The Yosemite-Mariposa IRWM Region consists mostly of mountain and foothill areas, and has similar physiography and climate to the eastern portion of Madera County. The two regions also signed a *Letter of Agreement on Coordination and Communication between Regions* in 2011.

Tuolumne-Stanislaus IRWM Region. The Tuolumne-Stanislaus IRWM Region is located north of the Madera IRWM Region and borders a small strip on the eastern end of the Madera IRWM Region. The Tuolumne-Stanislaus IRWM Region consists mostly of mountain and foothill areas, and has similar physiography and climate to the eastern portion of Madera County.

Merced IRWM Region. The Merced IRWM Region is located north of the western end of the Madera IRWM Region. Both IRWM Regions have land within the Chowchilla River watershed. The two IRWM Regions signed a *Letter of Agreement for Regions Common Boundary and Overall Cooperation and Collaboration* in 2011.

Westside-San Joaquin IRWM Region.
The Westside San Joaquin IRWM Region is located west of the Madera IRWM Region and they share a common border along the San Joaquin River.

The group will continue to coordinate with other IRWM Regions to help identify potential inter-regional projects. Unifying projects could include responses to a natural disaster, emergency preparedness, catastrophic wildfire management, and watershed management. In the past DWR has set aside some RWMG implementation funding specifically for inter-regional projects.

15.8 - Coordination with Native American Tribes

The IRWMP area includes two recognized tribes, North Fork Rancheria of Mono Indians and Picayune Rancheria of Chukchansi Indians, and numerous unrecognized tribes. Coordination with the tribes is important since they share many common goals with the other stakeholders, and they often bring unique ideas for project development. Outreach and communication will continue through focused efforts to encourage membership and participation in the RWMG governance and project development.

15.9 - Coordination with State and Federal Agencies

State Agencies
The California Department of Water Resources (DWR) has played an important role since efforts to develop an IRWMP begin in 2006. DWR has helped the group identify funding opportunities, develop an IRWMP, and provided funding for several projects under the Round 1 Implementation Grant program, and provided grants for professional facilitation services. The

RWMG considers DWR a strong ally and hopes to continue their partnership with DWR as the RWMG matures. Other important State agencies include the California Department of Public Health, California Department of Conservation, and California Department of Fish and Wildlife. Coordination with experimental forests, watersheds and rangeland is also important, since these areas have valuable information for improving local water management. Some experimental lands in the IRWMP area include the National Science Foundation Sierra Nevada Critical Zone Observatory, and USFS San Joaquin Experimental Range (SJER). State agencies are encouraged to participate and attend monthly RWMG meetings.

In some cases, State agencies may play roles in providing regulatory approval for a project. This could occur if the project is on State-owned land, or if permits or approvals are required from one or more agencies. The California Department of Fish and Wildlife, Department of Conservation, and State Water Resources Control Board's Regional Water Quality Control Board and Division of Drinking Water all fall into these categories.

Federal Agencies

The Madera RWMG includes significant areas of land owned by Federal agencies, including the Sierra National Forest, Yosemite National Park, United State Army Corps of Engineers, US Fish and Wildlife Service, US Bureau of Land Management, US Bureau of Reclamation and small areas of land owned by several other Federal agencies. The Sierra National Forest was a grant recipient in the first Round of IRWMP Implementation Grant funding for a forest-fire fuels-reduction project. These federal agencies are considered important stakeholders and manage lands that are important to the supply and quality of water delivered to most of the RWMG area. They are encouraged to participate and attend monthly RWMG meetings.

The signatories to the San Joaquin River Restoration Settlement hope to coordinate and communicate more with the USBR on their monitoring of the Restoration Project. This would include updates on the success of the program, evaluation on how efficiently the environmental flows are being used, and progress toward meeting the goal of a 1:1 return of lost water supplies to the water contractors.

In some cases Federal agencies may play roles in providing regulatory approval for a project. This could occur if the project is on Federally-owned land, or if permits or approvals are required from one or more agencies. All of the agencies listed above, in addition to the Environmental Protection Agency, fall into these categories.

CHAPTER 16- CLIMATE CHANGE

16.1 - Introduction

Climate change is a long-term alteration of temperature, precipitation and other measures of climate, and is accompanied by changes in shorter-term weather patterns. Climate change can have both natural (e.g. influences from the Earth's natural orbital cycle) and anthropogenic (resulting from the influence of humans) causes. The recent and unprecedented rise in the Earth's temperature (1.4°F over the past century) is caused largely by increasing concentrations of greenhouse gases in the atmosphere. This global warming is causing climate and weather patterns to change. The international scientific community has stated that "It is *extremely likely* that human influence has been the dominant cause of the observed warming since the mid-20th century."[1] This consensus conclusion regarding the current global warming has been in place for over a decade. Further anthropogenic increases in greenhouse-gas concentrations, primarily carbon dioxide but also methane, nitrous oxide and other atmospheric constituents, will continue to drive global warming and changes in all components of the climate system.[1]

Paleoclimatic data, including ice cores, lake varves (annual layers of sediment), and tree rings show that the past century has been the most climatically stable period since the last ice age, with most periods showing strong decade-to-century variability in climate. Two climate extremes, droughts and floods, are of particular interest to California water managers and water users. While California has experienced multi-year droughts in the past century, including a 6-year drought in 1987-92, the paleoclimate record shows evidence of multi-decadal droughts during the past millennium.[2]

California is expected to experience dramatically warmer temperatures during this century, 2-5°F by 2035-64 and 5-9°F by 2070-99.[3] Climate-change impacts projected to affect the Madera Region, associated with these magnitudes of warming, include: i) more critically dry periods, including multi-year droughts, ii) increasing demand from a growing population as temperatures rise, iii) earlier snowmelt and runoff, and iv) increased competition for water among urban and agricultural water users and environmental needs. Climate projections provide a range for future increases in temperature, and even the lowest estimates would have serious impacts. Thus while it is widely recognized that projections of warming and climate-change impacts are not precise, the California Department of Water Resources (DWR) requires that climate-change planning be acknowledged and incorporated to the greatest degree

1 IPCC, 2013: Summary for Policymakers. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

2 DWR, 2014. D.M. Meko, C.A. Woodhouse, and R.Touchan. Klamath/San Joaquin/Sacramento Hydroclimatic Reconstructions from Tree Rings. Draft Final Report to California Department of Water Resources. February 7, 2014

3 CEC, 2012. S. Moser, J. Ekstrom, and G. Franco. Vulnerability & Adaptation to the Increasing Risks from Climate Change in California CEC-500-2012-007.

possible into Integrated Regional Water Management Plans (IRWMP). Further, due to the inherent uncertainty in projections, water managers should prepare to adapt to greater uncertainties in the water-planning process, including regulatory, environmental, economic, social and other conditions affecting water utilities.[1]

The general strategy to plan for climate change in the Madera Region includes: 1) identify vulnerabilities (to specific water users, aquatic species, and ecosystems that impact water supply and quality); 2) implement adaptation measures on two levels—no-regret strategies and higher-level planning and implementation strategies; and 3) monitor for climate-change impacts. This climate change planning process is shown in **Figure 16-1** below.

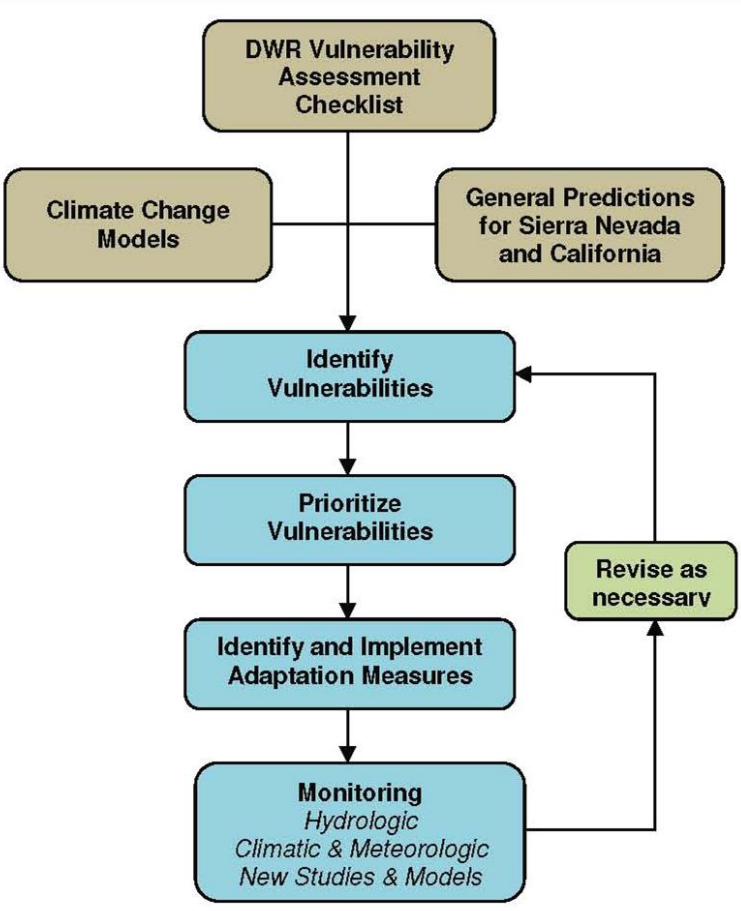

Figure 16-1 – Process for Climate Change Planning

Specific topics addressed in this chapter include: climate change literature, general impacts from climate change, a vulnerability assessment for the Madera IRWM area, Madera IRWM specific climate change modeling effects, adaptation and mitigation strategies, climate change monitoring, and consideration of greenhouse gas emissions in the project review process.

[1] Gary Pitzer. Water Education Foundation; *Linking Climate Change Science to Water Management Decisions*.

16.2 - Literature Sources

Multiple documents were used to evaluate climate change in the Madera Region. The primary document was the *Climate Change Handbook for Regional Water Planning*, (DWR and EPA, 2011). This handbook is the most recent and most practical climate change document published by the DWR, and provides some very basic tools for addressing climate change. This document is not required for preparing IRWMPs; however, DWR does recommend that it be used.

Other important Regional and Local climate change references included California Natural Resources Agency (2009), California State University at Fresno (2008), Conrad (2012), Climatewise (2010), DWR (October 2008), Hunsaker et al. (2012), and U.S. Global Change Research Program (2009). Other relevant documents include:

1. Guide to Climate-Smart Conservation
2. Vulnerability Assessment and Adaptation Strategies for Local Resources of the Sierra Nevada
3. Managing Resources in the Face of Rapid Change and an Uncertain Future, workshop; final Report and Presentations (hosted on http://climate.calcommons.org/).

Lastly, several reports that describe climate change modeling results were reviewed. These are discussed in Section 16.5 -Climate Change Projections.

Some local water and land use documents address climate change, including the City and County General Plans, the City of Madera Climate Action Plan, City of Madera Urban Water Management Plan, and the Environmental Impact Reports for the Gateway Village and Tesoro Viejo Specific Plans in unincorporated Madera County. To the extent that they are enumerated, the climate change goals and policies in these documents are consistent with this IRWMP. Typical climate change mitigation measures include energy efficiency requirements at new developments, compact urban development and promoting development of renewable energy. Climate change is missing from many older planning documents (pre-2000); however, it is being addressed in most new planning efforts.

16.3 - General Impacts from Climate Change

This section discusses potential general impacts from climate change on the Madera Region. While the magnitudes of specific impacts are uncertain, it is known that warmer average temperatures will result in a number of impacts on precipitation, hydrology, agriculture, water demand, and ecosystems. Some of the climate-change impacts listed by DWR (Oct. 2008), California Natural Resources Agency (2009) and the U.S. Global Change Research Program (June 2009) include:

Precipitation

- Changes in the seasonality of precipitation
- Increase in frequency and intensity of droughts
- A shift from snowfall to rainfall, resulting in less water stored in the snowpack
- Increased frequency of rain-on-snow events
- Changes in temperatures and cloud cover that inhibit or prevent cloud seeding
- Lower overall precipitation and increased aridity

Stream Flow

- Changes in the timing of spring runoff
- Lower summer base flow
- Increased flood risk, creating conflicts between water storage and flood control

Water Demands

- Higher temperatures leading to higher evapotranspiration rates from plants, and evaporation from soils and open water surfaces
- Extended growing seasons resulting in higher evapotranspiration for mountain forests, urban landscape and permanent crops

Water Quality

- Higher water temperatures leading to fish distress and algae growth
- Changes in erosion patterns resulting from changes in runoff and overland flow

Other

- Increased fire risk to rangeland and forests
- Potential for increase in diseases, pest invasions and weed invasions
- Heat waves and crop stress leading to lower crop yield
- Overall geographic changes in distribution of flora and fauna

The California water system is especially vulnerable to climate change due to its dependence on mountain snow accumulation and snowmelt runoff. Sierra Nevada snow is the largest water "reservoir" in California and snowpack storage is important for the state in general, for the downstream Madera Region, for other IRWM areas and for the entire interconnected San Joaquin Valley surface-water delivery system and users. Rising temperatures and changing precipitation patterns resulting in earlier peak runoff, more intense storms that quickly move through the hydrologic system, and reduced snowpack levels could all contribute to lower surface water availability, reduced groundwater recharge potential and thereby increased demand on already dropping groundwater levels.

Model projections for precipitation over California continue to show the Mediterranean pattern of wet winters and dry summers with seasonal, year-to-year, and decade-to-decade variability. However, several recent climate models shift toward drier conditions by the mid-to-late 21st century in Central and Southern California. This drying trend is caused by an apparent decline

in the frequency of rain and snowfall. Even in projections with relatively small or no declines in precipitation, central and southern parts of the state can be expected to be drier from the warming effects alone as the spring snowpack will melt sooner, and the moisture contained in soils will evaporate during long dry summer months. Both because uncertainty exists as to the magnitude of projected changes, and future climate will likely be more variable than in the past, water managers should plan for a range of new conditions.

Climate change could also have some positive impacts including less frost damage to crops, longer agricultural growing seasons, and less demand for winter heat. However, some crops need cold nighttime temperatures to germinate, cold nighttime temperatures also help control some pests, warmer temperatures affects pollinators, and earlier germination of some crops can affect productivity. Overall, agriculture will need to adopt several adaption measures to avoid declines in yield.

Higher elevations of the Madera Region are especially sensitive to the effects of a warmer climate. Earlier snowmelt, higher temperatures and longer dry periods over a longer fire season will directly increase wildfire risk. The Madera Region water delivery system in the lower elevations is designed for a specific historic climate, and warmer temperatures will generally be detrimental since they will increase water demands and reduce snowpack storage in a water-short area. The risks to the region from no action are clear and include a reduction in available water supply, greater groundwater overdraft, urban water shortages, higher water costs, and lower agricultural output.

16.4 - Vulnerability Assessment

The primary water features in the Madera Region include the San Joaquin and Fresno Rivers, Chowchilla River, Cottonwood Creek (east branch and west branch), Little Dry Creek, Ash Slough, Berenda Slough, Berenda Creek, Dry Creek, Root Creek, Madera Canal and Eastside Bypass. These rivers and creeks help define 5 watersheds within Madera County named: Lower San Joaquin, Upper San Joaquin, Fresno, Chowchilla and Merced (see **Figure 3-5 to Figure 3-10** in the Region Description Chapter). Two reservoirs and associated dams along the Fresno and Madera County boundaries are Mammoth Pool Reservoir (Mammoth Pool Dam) and Millerton Lake (Friant Dam).

A local vulnerability assessment (VA) was performed using the 'Vulnerability Assessment Checklist' found in the *Climate Change Handbook for Regional Water Planning* (DWR and EPA, 2011). This checklist, provided below, evaluates vulnerabilities to water demand, water supply, water quality, flooding, ecosystems and habitats, and hydropower from potential climate change.

1. Water Demand

1.a - Are there major industries that require cooling/process water in your planning region?

Yes. The region includes a large number of fruit, vegetable, and meat processing plants, but the temperature of the process water is not likely a major factor. No other major thermal power plants are located in the region.

1.b - Does water use vary by more than 50% seasonally in parts of your region?

Yes, seasonal water use varies substantially (greater than 50%) in the region. Much of water in the Madera Region is used by agricultural interests, with the remainder used by urban (residential, commercial and industrial) water systems. Nearly all agricultural water is used in spring and summer for crop irrigation. A large percentage of water is also used for environmental flows, including water for the San Joaquin River Restoration, in-stream flows, wildlife refuge water and other environmental flows. Urban and agricultural water demands are very low in the winter when much of the farmland is idle, most permanent crops are dormant, and effective precipitation provides most of the needed moisture. Approximately one-third of urban water demands occur in the winter with the other two-thirds in the summer.

1.c - Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?

Yes. The region experiences hot dry summers, and, as a result, most of the crops grown have relatively good heat resistance. Yes, changes in heat patterns would probably only impact crop yields if there is a significant increase in temperature. Changes in heat patterns could increase the demand for crop irrigation water. Although freezing temperatures do harm some crops, they are beneficial to some permanent crops that need a certain number of chilling hours below freezing for an effective dormancy. Freezing temperatures also kills some types of pests. Therefore, a reduction in the number of freezing days could negatively impact some crops.

1.d - Do groundwater supplies in your region lack resiliency after drought events?

Yes. Groundwater provides an important supplement to surface water in the Madera Region. Groundwater is used to meet demands not met by surface water, and the demand for groundwater increases during droughts. The region has experienced several severe droughts and the groundwater supply has proven important in providing a reserve supply, but groundwater levels are declining fairly rapidly. This decline is markedly worse in certain areas of the region than in others. With proper management groundwater supplies in the region can be resilient and go further toward meeting the needs of the region.

1.e - Are water use curtailment measures effective in your region?

Yes. Surface water curtailments include urban water conservation measures and reductions in surface water allocations within irrigation districts and agricultural water districts. Historically, water users have been able to supplement surface water supplies with groundwater, resulting in few water shortages. However, if groundwater levels continue to decline then groundwater will become less reliable as a backup supply. Demand within the region has "hardened" in recent years due to a large number of permanent plantings, so new water conservation programs may have to be implemented in the future if less surface water is available.

1.f - Are some in-stream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?

Historically, yes, the San Joaquin River has not flowed past Gravelly Ford during the driest parts of the year. However, pursuant to the San Joaquin River Restoration Agreement, minimum in-stream flow requirements have been instituted which provide for flows sufficient to support aquatic life all along the river to the Delta. These flows have one of the highest priorities for the surface waters, and flows are insufficient only in an extreme drought. The impacts from the San Joaquin River Restoration Settlement has been devastating to local water agencies that depend on San Joaquin River water.

2. Water Supply

2.a - Does a portion of the water supply in your region come from snowmelt?

Yes, much of the surface water in the San Joaquin River comes from snowmelt in the Sierra Nevada. Headwaters of the Fresno River and other lower-elevation streams receive less snow and more rain; but water yield is greater in snow-dominated elevations. This surface water is used throughout the region. Therefore, the Madera Region is vulnerable to potential climate change impacts on snow including earlier spring runoffs, less water storage as snowpack, and more frequent rain-on-snow events that could cause early or more prolonged flood releases out of reservoirs.

2.b - Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?

No. Delta water is not used in Madera County.

2.c - Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?

No, the region does not rely on coastal aquifers.

2.d - Would your region have difficulty in storing carryover supply surpluses from year to year?

Typically, no, but sometimes yes. The local reservoirs have some capacity to store carryover water from year to year without encroaching on flood control space. The space to store the water, and ability to keep it in storage, depends on the hydrology of the particular year. In some years, agencies can carryover water and in other years the combination of rainfall, snow accumulation and previous year's carryover means they cannot. The USACE operates Hidden Dam on the Fresno River and has strictly adhered to its flood control criteria, making it very difficult to store any carryover water. Additional carryover storage capacity would be welcomed by the local water agencies. The region does have the potential to store very large quantities of runoff in sub-surface storage. New groundwater banks, including recovery wells and pumps, are needed to utilize this underground storage space to any great extent.

2.e - Has your region faced a drought in the past during which it failed to meet local water demands?

Yes. Some areas within the Region have only surface water supplies available, with no groundwater supplies available as backup. When surface water supplies are reduced during droughts, those lands have no supply and are forced to remain fallow or even take out permanent crops. In addition, the San Joaquin River Restoration will compound the problem during "normal" water years putting more pressure on groundwater demand. In most areas, groundwater is the primary or backup supply and groundwater is used to meet dry-year surface water shortfalls, in addition to some urban water conservation. As a result, most water demands have been met in past droughts. However, this has come at the cost of extensive groundwater overdraft and is not sustainable, and in the future groundwater may no longer be a reliable backup supply.

2.f - Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?

Yes. Some invasive plant species can clog natural channels and canals if they are not properly managed, so most agencies include this as part of their maintenance activities. Arundo Donax (Arundo) has been a particular problem in sloughs and other flood conveyance channels. Agencies in the area have been alerted to the potential for invasive species such as quagga mussels and how to help prevent their spread.

3. Water Quality

3.a - Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?

Yes. Sierra Nevada forests are very susceptible to increased wildfire severity and frequency as climate warms. Several reservoirs are located in the Madera IRWMP area. Vegetation surrounds these reservoirs, but it is generally sparse in the immediate vicinity of the larger reservoirs and would not pose a large water quality concern from increased erosion.

3.b - Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?

Generally no. Eutrophication is the process by which a body of water becomes rich in dissolved nutrients from fertilizers or sewage, thereby encouraging the growth and decomposition of oxygen-depleting plant life and resulting in harm to other organisms. Warmer water could cause conditions that lead to eutrophication. However, the surface waters in the region, including the San Joaquin River, Fresno River, Chowchilla River and numerous small creeks are derived from Sierra snowmelt and rain, and are cold and very pure. These waters have few nutrients that support algae growth and it is generally not a problem in these waterways. However, yes, algae can be a problem in irrigation canals and during very low flows at the distal end of the rivers.

3.c - Are seasonal low flows decreasing for some water bodies in your region? If so, are the reduced low flows limiting the water bodies' assimilative capacity?

No systemic decreases in low flows for the local water bodies have been observed, although no detailed analysis has been performed. Flows do vary dramatically from year to year depending on both precipitation and diversions. It is expected that low flows in some areas are decreasing, and such has been observed in other parts of the Sierra Nevada. Changes in annual low flows from climate change would be difficult to identify since low flows already vary due to management of reservoir releases and natural climate variations.

3.d - Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?

Yes. Local surface water supplies are able to meet all beneficial uses, which include recreation, hydropower, aquatic habitat, irrigation, and municipal water use. However, operational adjustments are often made to improve water quality for fish. Groundwater quality varies throughout the region and is not suitable for municipal use in some areas. Groundwater quality may degrade further if groundwater levels continue to decline. It is also vulnerable to leaching of residuals from irrigation, industry and other sources.

3.e Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?

Yes, even though surface waters in the region generally have excellent water quality, storm activity can cause very high turbidity spikes that can affect the operation of surface water treatment facilities.

4. Sea Level Rise

The Valley portion of the Madera Region is at an average elevation of about 300 feet above mean sea level and is approximately 100 miles from the ocean and separated from the coastal area by the Coastal Range Mountains, with most peaks ranging from 3,800 feet to 6,000 feet. Therefore, sea level rise is not a threat to the region.

5. Flooding

5.a - Does critical infrastructure in your region lie within the 200-year floodplain? DWR's best available floodplain maps are available at: http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/best_available_maps/.

Yes. While large areas of the region are within the 200-year floodplain of the San Joaquin River, most of the floodplain areas in the Madera Region are farmland. Some houses, roads, and water supply infrastructure (wells, canals, etc.) are located in the floodplains. Major flooding would not likely cause serious disruptions to essential emergency-response services.

5.b - Does part of your region lie within the Sacramento-San Joaquin Drainage District?

Yes.

5.c - Does aging critical flood protection infrastructure exist in your region?

No. Major flood control facilities include dams, levees and flood bypass channels. These facilities are all considered to be in good condition.

5.d - Have flood control facilities (such as impoundment structures) been insufficient in the past?

Yes, occasionally. Major flood control facilities including dams and levees have been provided significant flood protection, but in some years water had to be released from dams that flooded areas along waterways.

5.e - Are wildfires a concern in parts of your region?

Yes, wildfires are a significant concern in the foothill and mountain areas of the Madera Region. Wildfires can result in severe short-term erosion and water quality degradation of surface waters. Wildfire can also result in a shift in the timing and amount of runoff.

6. Ecosystem and Habitat Vulnerability

6.a - Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?

No.

6.b - Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?

No.

6.c - Do climate-sensitive fauna or flora populations live in your region?

Yes, a variety of native and imported flora and fauna live in the area and many are likely climate sensitive. Due to urban and agricultural development in the valley, some have limited ability to migrate as a means of adapting to climate change.

6.d - Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?

Yes, several threatened and endangered species are found in the area. While general information on changes in species distribution in the Sierra Nevada and San Joaquin Valley is available in a number of references, site-specific information in the Madera Region is generally not available.

6.e - Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?

Yes, recreation is an important part of the local culture. These recreational opportunities also provide a moderate benefit to the local economy.

6.f - Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?

Yes. The San Joaquin River has schedules for minimum environmental flows. These flows are the highest priority water uses, and are required to be met, except in exceptionally dry years when environmental flow requirements are moderated.

In 2007, the Natural Resources Defense Council published a document entitled "*In Hot Water – Water Management Strategies to Weather the Effects of Global Warming*". The document

outlines potential affects to water supplies and wildlife from global warming, and provides the following conclusions regarding fisheries:

1. Higher temperatures (from climate change) will decrease salmon and other cold water fish habitat. According to studies by the Intergovernmental Panel on Climate Change, up to 38 percent of locations currently suitable for cold-water fish could become too warm to provide habitat by 2090.
2. As water temperatures rise, the percentage of dissolved oxygen (DO) in water drops. On the Lower San Joaquin River, reduced DO has caused fish kills and created temporary seasonal barriers to salmon migration
3. Adequate flows are essential to sustain aquatic ecosystems since higher flows and deeper water can reduce water temperatures. But non-flow actions such as removing migration barriers, improving water quality, and restoring habitat can significantly reduce the need for additional flows.

6.g - Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?

No.

6.h - Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change (http://www.itsgettinghotoutthere.org/)?

Yes. The Madera Region includes a portion of the Sierra Nevada Mountains, which is provided in the list.

6.i - Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?

Yes, due to the large amount of urban and agricultural development, prime wildlife habitat is generally fragmented in the valley portion of the Madera Region. However, wildlife could feasibly travel between prime habitat areas through agricultural land, or along the River corridors. In the foothills and forested areas east of the valley floor area, large wildland areas are found, and include numerous migration corridors for species including black bear, deer, and others. No planned infrastructure projects transect these migration corridors and so no additional inhibition of species movements is anticipated.

7. Hydropower

7.a - Is hydropower a source of electricity in your region?

Yes. Hydropower is generated on the San Joaquin River at powerhouses co-located with several of the storage dams, some of which are owned by Pacific Gas & Electric Company or by Sothern California Edison Company. The electricity generated by the power company is delivered to the electric grid, so it is not necessarily used directly in the Madera Region, but is a valuable resource.

7.b - Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?

Yes, energy demands are likely to increase in the region due to population growth, and to accommodate any climate change. No new major hydropower projects are planned for the area and are probably not likely to be pursued due to permitting difficulties. Some small hydropower projects are being considered along canals or at existing dams to utilize fish release flows. However, the energy generated from these projects would be small.

<u>Conclusions from Vulnerability Assessment</u>
Based on the analysis above the following vulnerabilities were identified for the Madera Region. These vulnerabilities are listed in their order of importance.

1. **Backup Water Supplies.** The region has a reliable water supply, largely because groundwater has been a dependable backup supply during droughts and the dry season. However, groundwater levels are declining and groundwater demands may increase if climate change reduces precipitation and water yield, or causes earlier spring runoff that cannot be stored. If groundwater levels decline too much then the groundwater will become a less reliable supply, and groundwater quality may decline. This vulnerability can be measured by several metrics, including groundwater overdraft, groundwater level decline, groundwater remaining in storage, and changes in well yields.

2. **Inadequate Water Storage.** Storage facilities in the Madera Region include several surface reservoirs and subsurface groundwater storage. These facilities have been successful in helping the region regulate seasonal and year-to-year surface water flows; however, there is still demand for more storage. The current facilities may be inadequate if warming reduces annual seasonal water storage in the form of snow. Obtaining permits to construct new large dams is extremely difficult and time intensive, and, therefore, storage would have to be developed by raising existing dams, and constructing groundwater banks and off-channel reservoirs, each of which still require environmental analysis and impact mitigation. This vulnerability can be measured by

the volume of new storage developed in acre-feet, and the need can be assessed by measuring the quantity of carryover water remaining in storage year to year, or quantity of carry-over water and floodwater lost to the Region.

3. **Climate Sensitive Crops.** Warmer average temperatures could reduce losses from winter freezes to some crops such as citrus, but other crops such as stone fruit and almonds depend on a required number of hours below a certain temperature each winter (known as "chilling hours") to kill pests or ensure an effective dormancy. Higher temperatures could result in lower yields for these crops. No adaptation measures are available for this impact, other than changing crop types, which is expensive and very slow if permanent plantings are impacted. This vulnerability can be measured with the number of chilling hours below freezing, and impacts to crop productivity each year.

4. **Flooding.** Flooding can be a problem in areas of the Valley portion of Madera County lying along the San Joaquin River. Increases in high flows could create future problems since it is unlikely that large new flood control dams can be constructed. Therefore, proper floodplain zoning and limiting high-value development on floodplains is crucial to preventing future problems. Increasing flood channel capacity and constructing additional storage facilities is also important. This vulnerability can be measured by the number of essential structures constructed in the 200-year floodplain.

These vulnerabilities will be re-evaluated at least every five years to reflect changes in local cropping, water demands, water supplies, new facilities, and climate change projections.

16.5 - Climate Change Projections

Climate models are numerical tools that can help identify a range of possible future climatic conditions or possible impacts from climate change. The Madera Regional Water Management Group (RWMG) did not analyze available results of climate modeling, primarily because several other organizations have assessed the available information for the area. The projections from each climate model differ somewhat, due in part to different assumptions and different ways of mathematically representing the earth's processes and feedbacks. Taken as a group, however, climate models present a range of possible future conditions and potential impacts from climate change.

Several publications provide general information on projected climate change in California and the Sierra Nevada range. While these projections are not specific to the Madera Region, similar climate warming and hydrologic effects will be felt across the Sierra Nevada-Central Valley region. Thus they are useful for planning and developing the resiliency to adapt to a warmer climate. Some of the relevant publications and predictions are listed in **Table 16.1**.

Table 16.1: General Climate Change Projections

Source	Projection
Climate Change Adaptation Strategies for California's Water (DWR, 2008)	Water managers should use a drought component that assumes, until more accurate information is available, a 20- percent increase in the frequency and duration of future dry conditions.
	DWR projects that Sierra snowpack will experience a 25 to 40 percent reduction from its historic average by 2050.
Sierra Climate Change Toolkit, 2nd Edition (Sierra Nevada Alliance, 2007)	In most cases, total annual stream flow into major Sierra Nevada reservoirs is projected to drop about 10 to 20 percent before mid-century and 25 to 30 percent before the end of the century.
The Ahwahnee Principles for Climate Change (Local Government Commission, 2009)	The State's largest reservoir (snowpack) is projected to lessen by one third over the next 50 years and to half its historic size by the end of the century.
Vulnerability & Adaptation to the Increasing Risks from Climate Change in California (2012)	Provides temperature projections and multi-sector assessment of impacts, including water supplies, wildfire, energy, agriculture, ecosystems and is a synthesis of many more-detailed studies.

16.6 - Adaptation Measures

Climate change adaptation is one or a series of actions that seeks to reduce the severity of climate change impacts to human and natural systems. The adaptation measures identified below do not address a specific quantified impact, but rather focus on a range of potential measures to begin to adapt to reductions in snowpack, river flows, flooding, and sea levels, and maximize groundwater storage capabilities, water conservation and water re-use where appropriate. Since climate projections provide a range of possible outcomes rather than a single future scenario, flexibility and diversity in adaptation measures is fundamental. The adaptation measures will also help the region to improve resiliency to climate variability, where resiliency is defined as the ability to return to original conditions after a disturbance or impact.

The Department of Water Resources October 2008 publication "Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water", suggests there are multiple strategies that can help reduce the risks presented by climate change. To be successful, however, the report states these adaptation strategies must be well-coordinated at the state, regional and local levels in order to maximize their effect:

> "*No single project or strategy can adequately address the challenges California faces, and tradeoffs must be explicitly acknowledged and decided upon. That said, planning and investing now in a comprehensive set of actions that informs water managers and provides system diversity and resilience will help prepare California for future climate uncertainty*."

The report identified ten general strategies for climate change adaptation, which are shown in **Table 16.2**.

Table 16.2: Climate Change Adaptation Strategies for California's Water[1]

Investment Strategy	Strategy 1: Provide Sustainable Funding for Statewide and Integrated Regional Water Management
Regional Strategies	Strategy 2: Fully Develop the Potential of Integrated Regional Water Management
	Strategy 3: Aggressively Increase Water Use Efficiency
Statewide Strategies	Strategy 4: Practice and Promote Integrated Flood Management
	Strategy 5: Enhance and Sustain Ecosystems
	Strategy 6: Expand Water Storage and Conjunctive Management of Surface and Groundwater Resources
	Strategy 7: Fix Delta Water Supply, Quality and Ecosystem Conditions
Improving Management and Decision-Making Capacity Strategies	Strategy 8: Preserve, Upgrade and Increase Monitoring, Data Analysis and Management
	Strategy 9: Plan for and Adapt to Seal Level Rise
	Strategy 10: Identify and Fund Focused Climate Change Impacts and Adaptation Research and Analysis

Dr. Roger Bales, UC Merced, presented to the RWMG his observations regarding Sierra Nevada conditions, and indicated that forest-thinning prescriptions for fuels reduction and decreasing the risk of catastrophic wildfire are similar to those for enhancing water yield. More-active forest vegetation management may thus be a "no-regret" strategy to develop more water supplies. Dr. Bales and colleagues hypothesize that across the Sierra Nevada, runoff yield can increase by approximately 9% with a 40% reduction in forest density.[2] More detail on this strategy can be found in **Section 6.7 -**of the Resource Management Strategies chapter.

The DWR also defines 'no-regret' strategies as actions that provide measurable benefits today while also reducing vulnerability to climate change (DWR, 2011). In other words, they are strategies that provide benefits with or without climate change. As such, these are actions that can be taken within each IRWM planning area, independent of, but in furtherance of strategies,

1 Department of Water Resources, "Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water", October 2008.

2 R.C. Bales, J.J. Battles, Y. Chen, M.H.. Conklin, E. Holst, K.L. O'Hara, P. Saksa, W. Stewart, Forests and Water in the Sierra Nevada: Sierra Nevada Watershed Ecosystem Enhancement Project, Sierra Nevada Research Institute report number 11.1, November 2011.

particularly Strategy 2, being pursued on a statewide level. For instance, constructing a water bank would provide needed water supply benefits in the present (Strategy 6), but could mitigate climate change impacts through floodwater capture (Strategy 4), increasing water storage, and enhancing wetland habitat (Strategy 7). The Water Education Foundation (2010) believes that planning for climatic uncertainty will also benefit planning for regulatory, environmental, economic, and social uncertainty.

A no-regret strategy that can be implemented through the current IRWM process, and provide a foundation for other measures, is Strategy 8 – Preserve, Upgrade and Increase Monitoring, Data Analysis and Management. In particular, upgrading and increasing monitoring and data analysis is essential if the region is to realize gains from enhanced water storage, resiliency in groundwater supplies, water conservation and new management options. Providing an accurate, timely and transparent water-accounting system is the first step in enhancing water infrastructure and developing management strategies that will meet future challenges. Some of the components of this system would include new measurements of precipitation, snowpack storage, soil moisture, stream flow and groundwater levels. An accounting system for groundwater withdrawals as well as levels could also help the region prepare for future statewide groundwater regulation and management. Recent technological advances provide more-accurate and lower-cost options for new water-measurement systems.

The Madera RWMG concluded that no-regret strategies should comprise the majority of adaptation measures. Most of the resource management strategies described in CHAPTER 5 would assist with climate change adaptation. The following strategies, including “no regret” management practices, are practical and effective for climate change adaptation in the Madera Region:

1. Improve urban and agricultural water efficiency
2. Increase use of recycled water (where energy efficient and/or where minimal greenhouse gases result)
3. Revise land use planning policies to encourage conservation (e.g. low impact development or water efficiency and conservation standards)
4. Develop groundwater recharge and banking projects
5. Develop surface water storage projects inside and outside of the Madera Region
6. Increase ability to capture floodwater both for flood control and water supply
7. Encourage forest thinning, restoration of mountain meadows, wetlands, and riparian areas to regulate flows resulting in more summer runoff
8. Change to crop types that are drought tolerant or use less water to accommodate climate change
9. Continued investment in local water conservation programs and equipment;

10. Increasing water reuse and recycling;
11. Monitoring local and regional water use activities;
12. Tracking related legislation;
13. Investigating water supply/energy relationships and coordinating with larger water utilities; and
14. Following the State's required adaptation strategies and legislation.

Although 'no-regret" strategies provide benefits with or without climate change, the threat of climate change further justifies the need for many water management strategies already being used in the region. Furthermore, climate change adaptation is not in conflict with current Goals and Objectives of the region.

The overall theme with these strategies is to expand the tool box of accommodations and actions that can be taken to help the region adapt to extreme conditions (drought and floods) that climate change and increase of greenhouse gases may cause.

16.7 - Climate Change Monitoring

Climate change increases the importance of hydrologic and climatic monitoring, and having the necessary data is important to make decisions. Monitoring should include: 1) monitoring hydrologic and meteorological attributes for to enhance management decisions given climate change; and 2) monitoring climate-change science, legislation, adaptation challenges and mitigation opportunities.

The Madera Region already includes an operational network for monitoring the hydrology, meteorology, water demands, water use, crop yields and wildlife. As the pace of change increases and additional pressures from population growth and water demand also increase, strategic improvements could provide a sound basis for decision making, planning and public education. The latter is particularly important, in that regional stakeholders need to understand the importance of adapting water infrastructure and operations to change.

Historically water projects have been designed and are operated on the assumption that future hydrology will mimic past hydrology. Climate change will alter future hydrology in unprecedented ways, making the past a poor guide to future decisions. While, the range and extent of changes to hydrology have a degree of uncertainty, the risks are real and adding resiliency to water systems is both prudent and timely. That is, future projects should be designed for a more-variable climate and hydrology than experienced in the past. Uncertainty will remain a hallmark of future climate and hydrology, and both infrastructure and institutions should build in the capacity to accommodate that uncertainty. Thus potential changes in hydrology provide the driving force behind adaptation measures which will be pursued by the RWMG.

The science of climate change, and the tools to mitigate and adapt to climate change, will continue to evolve, as will the knowledge base for efficient and timely responses. Note that strategy 10 in **Table 16.2** explicitly calls out the importance of building the knowledge base for adaptation through research and analysis. As a result, every five years as part of the California Water Plan Update process, DWR will provide revised estimates of changes to sea levels, droughts, and flooding that can be expected over the subsequent 25 years. The RWMG will also stay apprised of new studies, reports, literature, legislation, and climate change model runs that are pertinent to the area. When needed this literature will be shared with the RWMG members and interested parties, and incorporated into the IRWMP updates.

16.8 - Mitigation of Greenhouse Gas Emissions

Mitigation of climate change can be achieved by selecting and promoting projects that help to reduce greenhouse gas emissions (GHG) emissions. While the RWMG is not responsible for air quality management, and they can only have a small impact on global emissions, it is sensible to consider emissions in project selection in view of the negative impacts climate change may have on water resources. The RWMG is also dedicated to helping the State meet GHG emission reduction goals, when practical and economical. These goals, prescribed in the California Global Warming Solutions Act of 2006 (AB 32) and subsequent executive orders, include reaching 2000 emission levels by 2010, 1990 levels by 2020, and 80% below 1990 levels by 2050.

Most of the resource management strategies described in CHAPTER 6 can assist with climate change mitigation through reduction in energy demand, ecosystem enhancement, or carbon sequestration. For instance, water conservation can reduce energy demands to pump, convey, and treat water supplies. Another example is riparian area restoration, which can sequester carbon and create habitat for species impacted by climate change.

Projects are primarily ranked based on their water supply benefits, but GHG emissions and climate change adaptation should be secondary considerations. Specifically, the following questions should be asked when evaluating projects:

1. Will this project result in reduced greenhouse gas emissions? If yes, explain how and quantify.
2. Will this project increase greenhouse gas emissions? If yes, explain how and quantify.
3. Will this project contribute to adaptation strategies to respond to climate change impacts?

Beginning July 1, 2012, GHG emissions for California Environmental Quality Act (CEQA) studies are required to be calculated using the California Emissions Estimator Model (CalEEMod). CalEEMod quantifies potential criteria pollutant and GHG emissions from construction and

operations for a variety projects. The RWMG will also require that this model be used on projects considered for funding.

16.9 - Climate Change in other IRWMP Sections

Climate change is discussed in several other IRWMP Chapters including:

- **CHAPTER 6- Resource Management Strategies –** This chapter discusses the impacts of climate change on the efficacy of different strategies, and the ability of strategies to help adapt to climate change.
- **CHAPTER 7 - Project Review Process –** The project review process includes new questions related to GHG emissions (**Section 7.2 -Selecting and Prioritizing Projects for Specific Funding Opportunities**)
- **CHAPTER 13- Relation to Local Land Use & Water Planning –** This chapter summarizes the climate change adaptation and mitigation strategies from local water plans, and evaluates their consistency with the goals of this IRWMP.

CHAPTER 17- REFERENCES

Note: This list of references does not include the numerous land and water planning documents discussed in Chapter 13 – Relation to Local Land Use Planning & Water Planning. Details of those documents are already provided in Chapter 13.

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