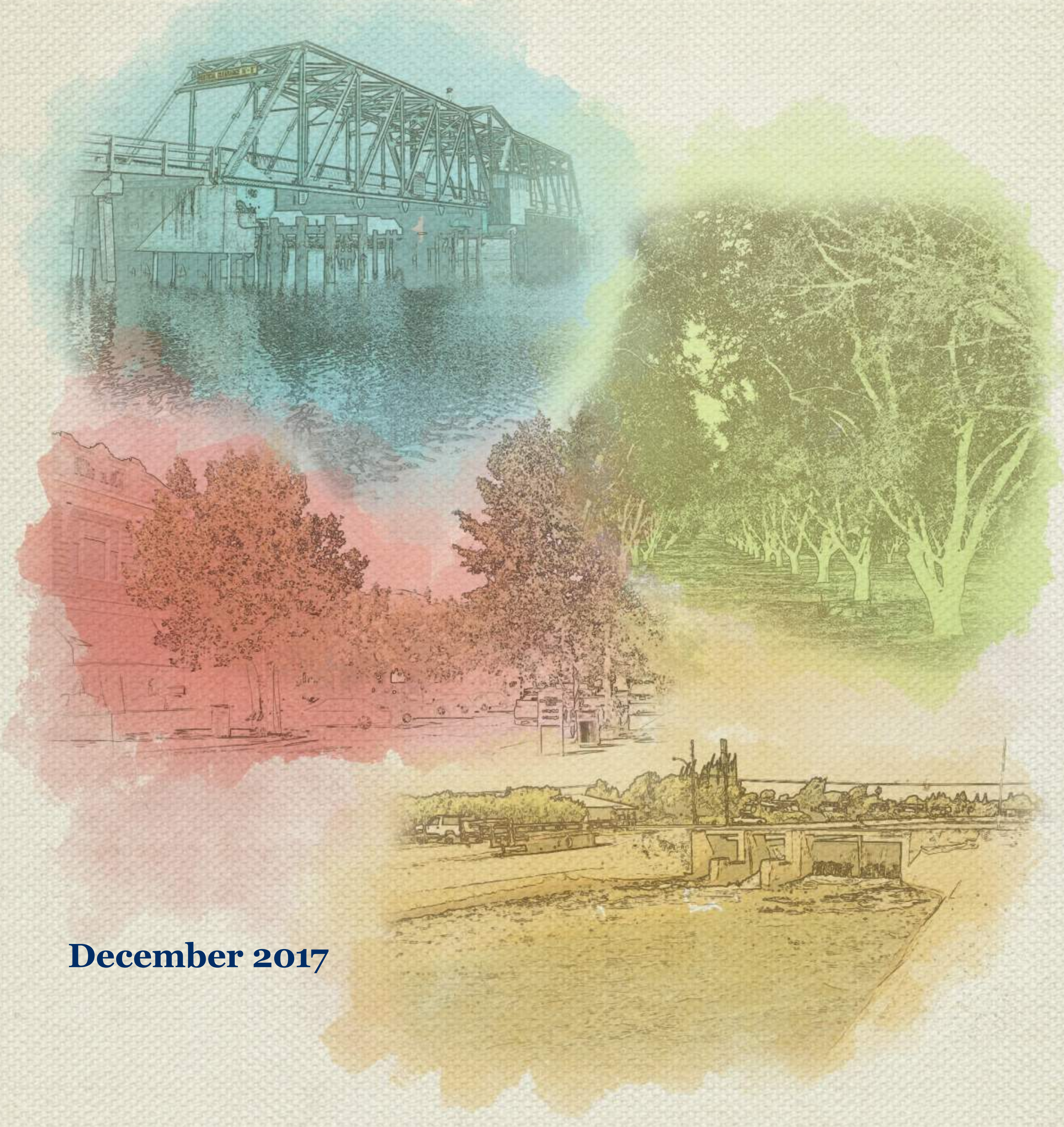
East Stanislaus Region

Integrated Regional Water Management Plan Update

PUBLIC DRAFT



December 2017

Table of Contents

List of Figures

List of Tables

Appendices

List of Abbreviations

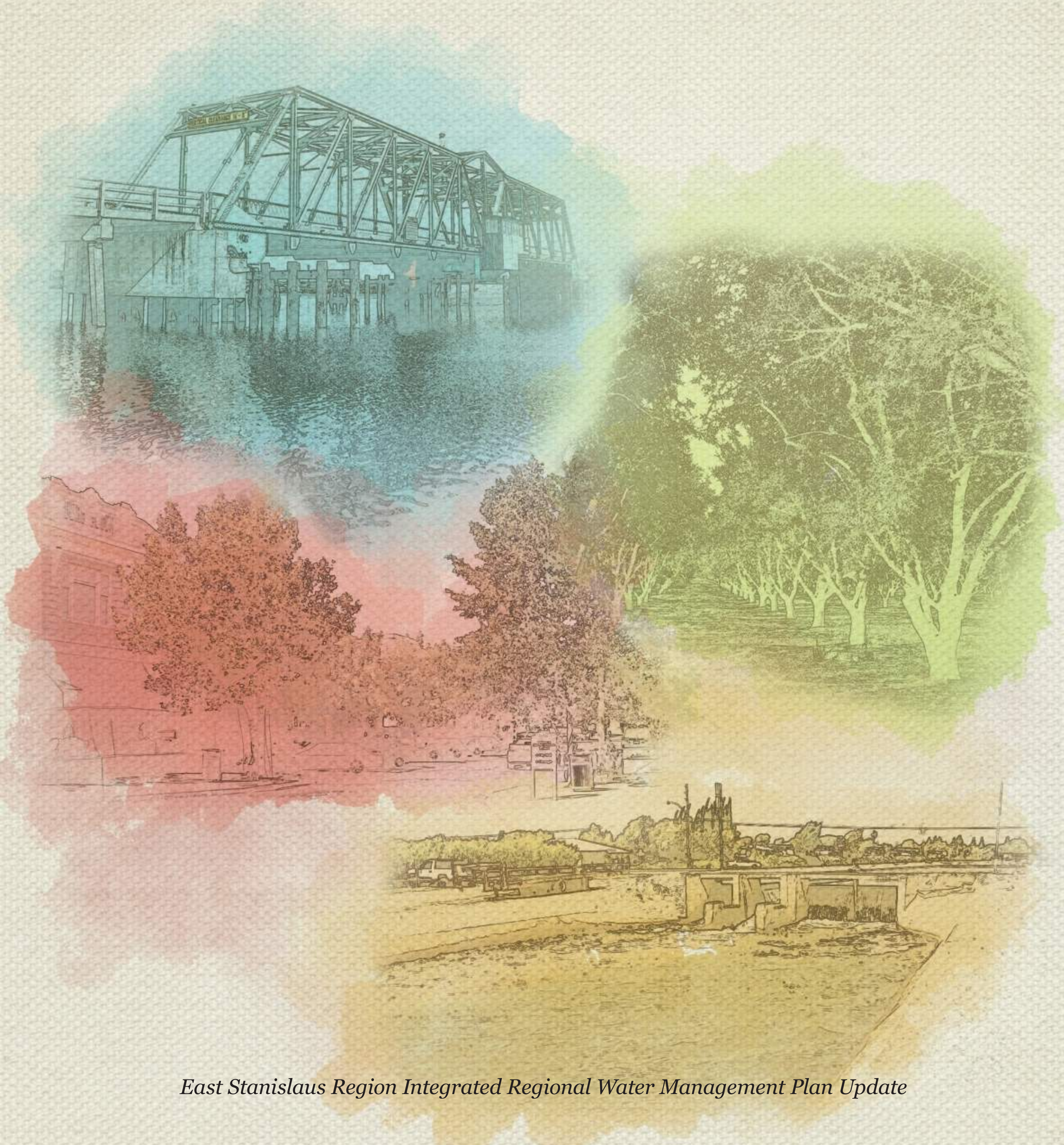
AB	Assembly Bill
ACS	American Community Survey
AF	acre-feet
AFY	acre-feet per year
AWMC	Agricultural Water Management Council
AWMP	agricultural water management plan
B/C	benefit-cost
BIA	Bureau of Indian Affairs
BMO	basin management objective
BMP	best management practice
BNR	biological nutrient removal
CAAP	Climate Adaptation Advisory Panel
CalEPA	California Environmental Protection Agency
CARB	California Air Resources Board
CAS	climate adaptation strategy
CASGEM	California Statewide Groundwater Elevation Monitoring
CAT	Climate Action Team
CCR	consumer confidence report
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
CDP	Census designated places
CDPH	California Department of Public Health
CEDEN	California Environmental Data Exchange Network
CEIC	California Environmental Information Catalog
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CII	commercial, industrial and institutional
CIMIS	California Irrigation Management Information System
CIP	capital improvement plan
CREAT	Climate Resilience Evaluation and Awareness Tool
CRWU	Climate Ready Water Utilities
CSD	community services district
CT	centroid timing
CVFPP	Central Valley Flood Protection Plan
CVP	Central Valley Project
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
CWC	California Water Code
CWP	California Water Plan
DAC	disadvantaged community
DDW	SWRCB Division of Drinking Water
Delta	Sacramento-San Joaquin Delta
DER	Stanislaus County Department of Environmental Resources
DFA	Dairy Farmers of America
DMM	Demand Management Measure
DMS	Data Management System
DPWD	Del Puerto Water District
DSC	Delta Stewardship Council

DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
EDA	Economically Distressed Area
EIR	environmental impact report
EIS	environmental impact statement
EJ	Environmental justice
EO	Executive Order
ESIRWM	East Stanislaus Integrated Regional Water Management
ESRWMP	East Stanislaus Regional Water Management Partnership
ET	evapotranspiration
EWMP	efficient water management practice
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GAMA	Groundwater Ambient Monitoring and Assessment
GCM	General circulation model
GHG	greenhouse gas
GIS	geographic information system
gpcd	gallons per capita per day
gpm	gallons per minute
GPS	geographic positioning system
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWMP	groundwater management plan
HCP	habitat conservation plan
ICM	initial conceptual model
IPCC	Intergovernmental Panel on Climate Change
IRWM	integrated regional water management
IRWMP	integrated regional water management plan
JPA	joint powers authority
LAFCo	Local Agency Formation Commission
LFD	low flow deviation
LID	low impact development
MAF	mean annual flow
M&I	municipal and industrial
MDWP	Modesto Domestic Water Project
MG	million gallons
mgd	million gallons per day
MHI	median household income
MID	Modesto Irrigation District
mL	milliliter
MOU	memorandum of understanding
MPO	metropolitan planning organization
MRWTP	Modesto Regional Water Treatment Plan
MS4	small municipal separate storm sewer system
MSR	municipal service review
MW	megawatt
NDWAC	National Drinking Water Advisory Council
NEPA	National Environmental Policy Act
NGO	non-governmental organization

NPDES	National Pollutant Discharge Elimination System
NPS	Non-point source
NVRRWP	North Valley Regional Recycled Water Program
O&M	operations and maintenance
QA/QC	quality assurance and quality control
OCAP	operations criteria and planning
OID	Oakdale Irrigation District
OPR	Office of Planning and Research
PG&E	Pacific Gas and Electric Company
PAC	Public Advisory Committee
ppm	parts per million
Prop	proposition
RAP	Region Acceptance Process
RD	reclamation district
RFMP	Mid-San Joaquin River Regional Flood Management Plan
RM	river mile
RMS	resource management strategies
RSWSP	Regional Surface Water Supply Project
RTP	ready to proceed
RWMG	regional water management group
RWQCB	Regional Water Quality Control Board
RWQCF	Turlock Regional Water Quality Control Facility
SB	Senate Bill
SC	Steering Committee
SCADA	supervisory control and data acquisition
SDAC	severely disadvantaged community
SED	Substitute Environmental Document
SDMP	storm drain master plan
SJR	San Joaquin River
SJRNWR	San Joaquin River National Wildlife Refuge
SNMP	salt and nutrient management plan
SOI	sphere of influence
SRF	State Revolving Fund
SRWA	Stanislaus Regional Water Authority
SSJID	South San Joaquin Irrigation District
StanCOG	Stanislaus Council of Governments
STRGBA	Stanislaus and Tuolumne Rivers Groundwater Basin Association
SWAMP	Surface Water Ambient Monitoring Program
SWMP	storm water management plan
SWP	State Water Project
SWRA	Stanislaus Regional Water Authority
SWRCB	State Water Resources Control Board
SWRP	storm water resource plan
TAF	thousand acre-feet
TDS	Total Dissolved Solids
TGBA	Turlock Groundwater Basin Association
TID	Turlock Irrigation District
TMDL	Total Maximum Daily Load
UC	University of California

USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWMP	urban water management plans
WAS	waste activated sludge
WDL	Water Data Library
WEAP	Water Evaluation And Planning System
WMI	watershed management initiative
WSMP	water supply master plan
WWTP	wastewater treatment plant

Chapter 1



Chapter 1 Introduction

1.1 IRWMP Overview

In 2002, the Integrated Regional Water Management Act was created with the passage of Senate Bill 1672. The purpose of the Act was to encourage local agencies to coordinate and collaboratively manage water resources to improve water quality, quantity and reliability. Following creation of the Act, in November 2002, the voters of the State of California recognized and codified the need for integrated regional planning for the management of water resources with the passage of Proposition (Prop) 50, the *Water Security, Clean Drinking Water, Coastal and Beach Protection Act*. Central to Prop 50 was the preparation of Integrated Regional Water Management Plans (IRWMPs). IRWMPs define planning regions and identify strategies that allow for the regional management of water resources in what began as four main areas: water supply, groundwater management, ecosystem restoration, and water quality. Prop 50 provided $500 million to fund competitive grants for preparing IRWMPs and for implementing projects that were consistent with IRWMPs. Since its inception, the IRWM program has evolved. In November 2006, California voters passed Prop 84, the *Safe Drinking Water, Water Quality, and Supply, Flood Control, River and Coastal Protection Bond Act*, providing $1 billion for planning and implementation grant funding through the IRWM program. Prop 1E, referred to as the *Disaster Preparedness and Flood Prevention Bond Act*, was also passed at that time, providing $300 million for IRWM Stormwater Flood Management. In 2014, California voters approved Prop 1, the *Water Quality, Supply, and Infrastructure Improvement Act,* which provided $510 million in IRWM funding. The California Department of Water Resources (DWR) administers the IRWM grant program as currently funded by Prop 1. As part of that program administration, DWR released the *Proposition 1 Integrated Regional Water Management Guidelines* (Guidelines) in July 2016, a set of guidelines for IRWM implementation and planning grants, including descriptions of what must be included in an IRWMP to be eligible for the grant program.

The IRWMP is intended to be a living plan that is to be updated regularly. The Plan summarizes regional goals and objectives for water resources management, and identifies strategies, projects, and programs intended to fulfill those goals and objectives for the East Stanislaus IRWM (ESIRWM) Region. Projects and programs included in the IRWMP are designed to integrate multiple resource management strategies (RMS) and projects to provide multiple-benefit solutions and beneficiaries, both locally and regionally. This IRWMP Update has been prepared for the ESIRWM Region with funding assistance provided by DWR through a Prop 1 planning grant award in 2016. It is consistent with the Prop 1 Guidelines, the priorities and objectives for regional planning, and reflects local resources and environment.

1.2 Regional Water Management Group

The East Stanislaus Regional Water Management Partnership (ESRWMP), the official Regional Water Management Group for the region, is presently comprised of the Cities of Modesto, Hughson, Ceres, Turlock, and Waterford, and Stanislaus County. According to California Water Code (CWC) §10539, a Regional Water Management Group (RWMG) is a "group in which three or more local agencies, at least two of which have statutory authority over water supply or water management, as well as those other persons who may be necessary for the development and implementation of a plan that meets the requirements of CWC §10540 and §10541, participate by means of a joint powers agreement (JPA), Memorandum of Understanding (MOU), or other written agreement, as appropriate, that is approved by the governing bodies of those local agencies." For the East Stanislaus IRWM region, all six entities have statutory authority over water supply or management in their respective jurisdictions. The ESRWMP was initially formed by Modesto, Hughson, Ceres, and Turlock in 2011, with Waterford and Stanislaus County being added in 2017. All ESRWMP members signed an MOU over a series of months in 2017, (included in Appendix A) which formalized the ESRWMP.

The East Stanislaus IRWM Region completed the Region Acceptance Process (RAP) application to become an official IRWM region, approved by DWR, in 2011. This Region and its associated RWMG were developed to foster regional communication and cooperation and to cooperatively resolve potential water resources conflicts in the Region.

1.3 IRWMP Development

The State of California established IRWM Plan Standards as described in the Prop 1 Guidelines that define aspects that must be addressed in each IRWMP. This IRWMP has been constructed to meet or surpass each of those standards. The Plan Standards and required documentation for each are summarized as follows.

> "IRWM Plan Standards are used to describe the required contents of an IRWM Plan and can be used as criteria in Implementation Grant applications."
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 36

- *Governance* – The governance structure for a region's IRWMP development and implementation. A description of the RWMG responsible for development and implementation of the Plan and the project proponents who will adopt the Plan.
- *Region Description* – The watersheds and water systems within the Region; internal boundaries; and water supplies and demands, including potential effects of climate change. Comparison of current and future water quality conditions in the Region. Detailed water quality information for specified constituents. Description of social and cultural makeup of the regional community. Description of major water related objectives and conflicts. Explanation of how the IRWM regional boundary was determined and why it is appropriate. Identification of neighboring and/or overlapping IRWM efforts and explanation of planned/working relationships.
- *Objectives* – Objectives of the IRWMP that are measurable, and the process used to develop them. Explanation of prioritization of objectives.
- *Resource Management Strategies* – Resource management strategies considered to meet IRWM objectives and which strategies were incorporated into the Plan. Effects of climate change on the region's water resources and the potential for climate change adaptation and/or mitigation using each RMS.
- *Integration* – Structures and processes that provide opportunities to develop and foster integration.
- *Project Review Process* – Procedures for submitting a project to the RWMG. Procedures for review of projects considered for inclusion into the Plan. Displaying the lists of selected projects. Consideration of climate change and greenhouse gas (GHG) impacts.
- *Impact and Benefit* – Discussion of potential impacts and benefits of implementation of the IRWMP.
- *Plan Performance and Monitoring* – Performance measures and monitoring methods to ensure the objectives of the IRWMP are met. Particular consideration of Native American Tribal communities, adaptive management, and climate change.
- *Data Management* – Process of data collection, storage, and dissemination to IRWM participants, stakeholders, public, and the State.

- *Finance* – Possible funding sources, programs, and grant opportunities for the development and ongoing funding of the IRWMP. Funding mechanisms (e.g. rate structures) for projects that implement the IRWMP. Explanation of the certainty and longevity of known or potential funding for the IRWMP and projects included. Explanation of how operations and maintenance (O&M) costs for projects would be covered.
- *Technical Analysis* – Data and technical analyses that were used in the development of the IRWMP.
- *Relation to Local Water Planning* – A list of local water plans used in the IRWMP. Discussion of how the IRWMP related to planning documents, including Storm Water Resource Plans, and programs established by local agencies. Description of the dynamics between the IRWMP and local planning documents.
- *Relation to Local Land Use Planning* – Current relationship between local land use planning, regional water issues, and water management objectives. Future plans to further a collaborative, proactive relationship between land use planners and water managers.
- *Stakeholder Involvement* – Description of the public process that provides outreach and an opportunity to participate in the IRWMP development and implementation. Process used to identify, inform, invite and involve stakeholder groups in the IRWM process. Discussion of how the RWMG will endeavor to involve DACs and Native American tribal communities in the IRWM planning effort. Description of the decision-making process. Discussion regarding how stakeholders are necessary to address the objectives and RMS. Discussion of how collaborative processes will engage a balance of the interest groups regardless of their ability to contribute financially to the IRWMP's development or implementation.
- *Coordination* – Identification of the process to coordinate water management projects and activities of participating local agencies and stakeholders to avoid conflicts and take advantage of efficiencies. Identification of neighboring IRWM efforts and how cooperation/coordination with these efforts will be accomplished. Identification of areas where a State agency may be able to assist in communication, cooperation, or implementation of IRWMP components, processes, projects, etc.
- *Climate Change* – Discussion of the potential effects of climate change on the IRWM region, including an evaluation of the IRWM region's vulnerabilities to the effects of climate change and potential adaptation responses. Process that discloses and considers GHG emissions when choosing between project alternatives.

As described in the Guidelines, although the Plan Standards name specific topics the IRWMP should cover, they do not constitute an outline for the Plan. The following table shows which sections of the IRWMP address the Plan Standards previously described. All of the Plan Standards are addressed which helps ensure the creation of a high quality, implementable IRWMP.

Table 1-1: Plan Standards Addressed in the East Stanislaus IRWMP

Plan Standard	East Stanislaus IRWMP Section to Reference
Governance	4.1
Region Description	Chapter 2
Objectives	Chapter 5
Resource Management Strategies	Chapter 6
Integration	7.2
Project Review Process	7.1, 7.2, 7.3
Impacts and Benefits	7.4
Plan Performance and Monitoring	9.1, 9.3, 9.4
Data Management	8.2
Finance	9.2
Technical Analysis	8.1
Relation to Local Water Planning	5.6, 5.7
Relation to Local Land Use Planning	5.8
Stakeholder Involvement	4.2
Coordination	4.3, 4.4, 4.5
Climate Change	Chapter 3

Ongoing information about the development and implementation of this IRWMP can be found on the East Stanislaus IRWM Region's website at www.eaststanirwm.org.

1.4 IRWMP Adoption

ESRWMP member agencies and project proponents are expected to adopt the IRWMP upon completion, and any stakeholder entities can choose to accept or adopt the completed Plan to demonstrate support and commitment to implementation. Upon completion of the East Stanislaus IRWMP, the following entities adopted this Plan at meetings of their governing boards which were open to the public:

- City of Modesto on <insert date>
- City of Turlock on <insert date>
- City of Ceres on <insert date>
- City of Hughson on <insert date>
- City of Waterford on <insert date>
- Stanislaus County on <insert date>

Appendix B contains the notices of intent to adopt and the adopting resolutions.

As described in Section 9.4, Plan Updates, the East Stanislaus IRWMP will continue to be updated periodically to reflect changing conditions, the development of parallel water-related planning programs, and IRWMP project implementation. When the IRWMP is updated, it will be re-adopted by the participating agencies. There may, however, be interim changes to the IRWMP that will be administrative in nature; for example, the project list may be updated prior to a grant proposal solicitation. This IRWMP does not require re-adoption of this Plan for interim or administrative changes.

Chapter 2

East Stanislaus Region Integrated Regional Water Management Plan Update

Chapter 2 East Stanislaus IRWM Region

2.1 Region Description

An IRWMP must include a description of the region being managed by the RWMG. This section should describe:

- Watersheds and water systems within the region.
- Internal boundaries within the region.
- Water supplies and demands for a minimum of a 20-year planning horizon.
- Current and future water quality condition in the region as well as description of groundwater contamination to comply with AB 1249.
- Social and cultural makeup of the regional community.
- Major water related objectives and conflicts (in Section 4.1 of this Plan).
- How the IRWM regional boundary was determined.
- Neighboring and/or overlapping IRWM efforts.
- How the plan will help reduce dependence on the Sacramento-San Joaquin Delta for water supply.
- Climate change impacts on the region.

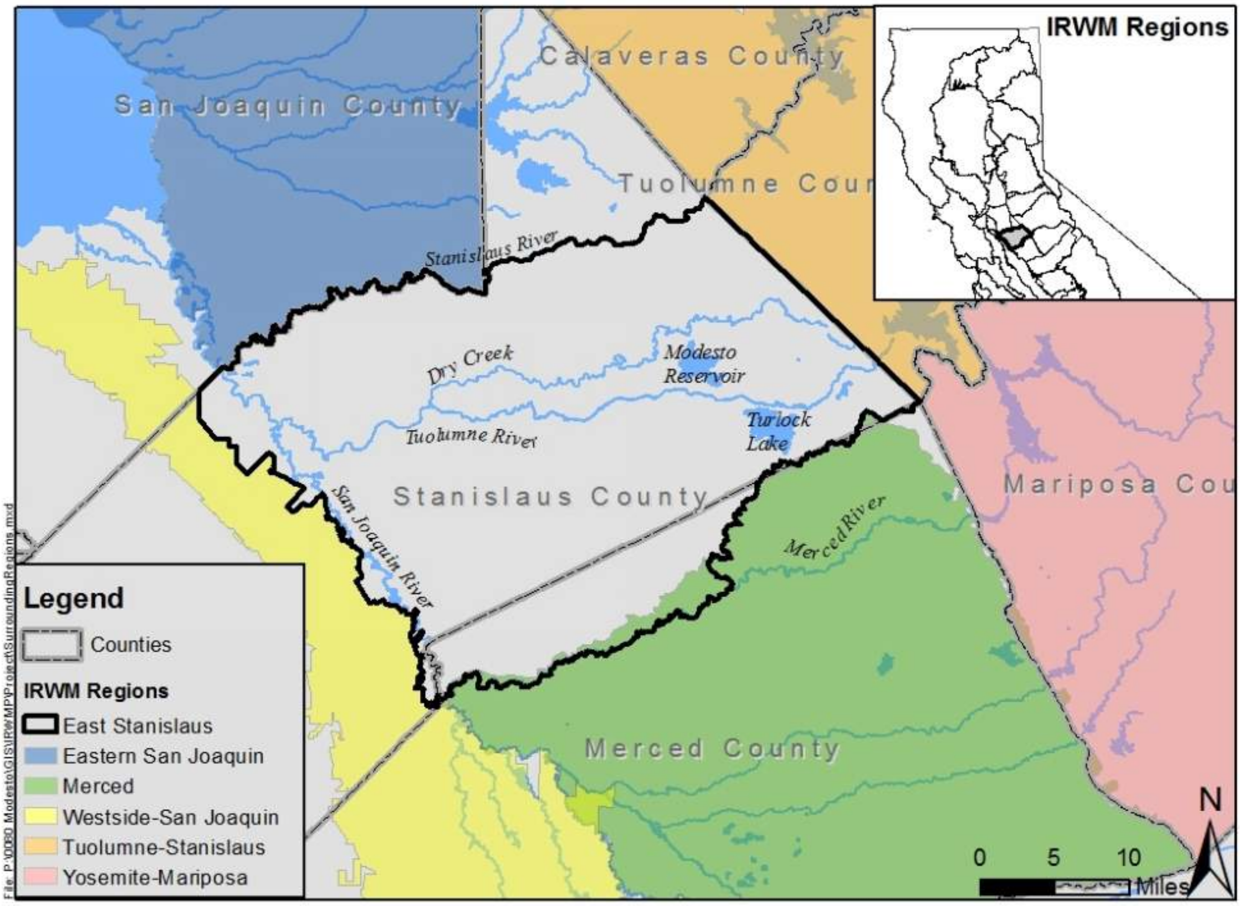
- *Proposition 1 IRWM Guidelines*, July 2016, Page 38

2.1.1 Region Boundaries

The need for integrated regional water planning in Stanislaus County, and therefore the need for an IRWM region, was most easily noted visually when viewing DWR's 2010 IRWM Regional Map. At the time, multiple IRWM Regions were approved by DWR and had been actively participating the IRWM planning process, but there was a void in IRWM coverage over central Stanislaus County including the Cities of Modesto, Hughson, Turlock, and Ceres, in between the following five IRWM regions: Central California (now referred to as Yosemite-Mariposa), Merced, Eastern San Joaquin, Tuolumne-Stanislaus and Westside-San Joaquin. As with other areas of the Central Valley, water resource conflicts are present as agricultural and urban demands collide, groundwater and surface water resources become impacted, and as the region continues to grow and change.

The agencies that initiated the East Stanislaus IRWM Region through the first MOU creating the ESRWMP (the Cities of Modesto, Turlock, Ceres, and Hughson) understood the importance of integrated water resources management and have practiced those principles in the past by working together to evaluate water resources-related issues, seeking solutions together rather than in a piecemeal fashion. In forming the East Stanislaus IRWM Region, they strove to formalize their past relationships to maximize opportunities for integration, project and program efficiencies, and benefits through shared vision and collaboration. The East Stanislaus IRWM Region was developed, as shown in Figure 2-1, in an effort to create a regional management solution for long-term water resources management. While the boundaries of the Region have not changed, the ESRWMP members have with the addition of the City of Waterford and Stanislaus County in 2017. The East Stanislaus IRWM Region has common boundaries with the Merced, Eastern San Joaquin, Tuolumne-Stanislaus and Westside-San Joaquin IRWM regions, and with some local agency and environmental boundaries. By using the boundaries of neighboring IRWM regions as a starting point, the East Stanislaus Region was formulated to cover an area of California that lacked integrated regional water planning and to avoid major overlaps with neighboring IRWM regions.

Figure 2-1: Boundaries of the East Stanislaus Region



The boundaries of the East Stanislaus IRWM Region result from a combination of IRWM and local jurisdictional boundaries and geographical and environmental considerations, and are as follows:

North Boundary: The north boundary of the East Stanislaus IRWM Region is defined by the Stanislaus River, Modesto Groundwater Subbasin, and a portion of the Stanislaus County border. The boundary also aligns with the Eastern San Joaquin IRWM boundary. Importance was placed on natural water boundaries and source of water supplies used in various areas of the county, and not solely political or jurisdictional boundaries. This resulted in the exclusion of north-eastern portion of Stanislaus County. This area was not chosen to be part of the IRWM region because it cannot be justified from a watershed and a source water perspective (that is, the source of water supplies used in this portion of Stanislaus County lie within other IRWM regions). However, the communities in this area are invited to participate in the East Stanislaus Region.

South Boundary: The Merced River, the Turlock Groundwater Subbasin, and the Turlock Irrigation District (TID) boundaries were used to delineate the southern boundary of the East Stanislaus IRWM Region. The southern boundary of the Region is located within the Merced IRWM Region and creates a small overlap. The two IRWM regions have been coordinating during the plan development process and have discussed the overlap during development of each region's boundaries. At present, it has been agreed that each region will address its entire region in the planning process, and as such, the

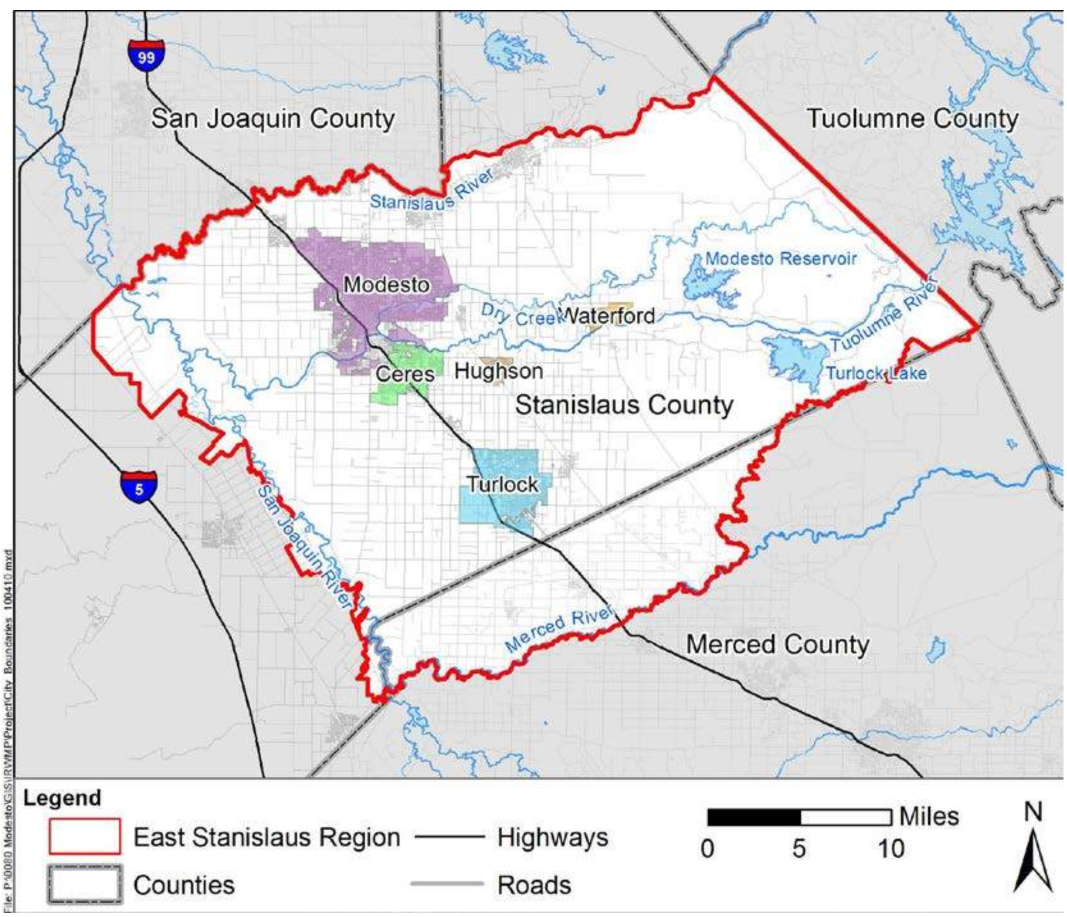
East Stanislaus Region is including its entire region, including the overlap area in the planning efforts currently underway. Should a project be identified in the overlap area or a need arise that further coordination with the Merced IRWM Region be required, the ESRWMP will do so accordingly. Both IRWM regions recognize coordination in this area is required and both are willing to cooperate.

Eastern Boundary: The existing Tuolumne-Stanislaus IRWM Region boundary was used to form the eastern boundary of the East Stanislaus Region. By aligning the region boundary with the neighboring IRWM region's boundary, unnecessary confusion is avoided and inter-regional water management strategies can still be employed. The location of the eastern boundary also ensures that the Turlock and Modesto Groundwater Subbasins are located within the East Stanislaus Region.

Western Boundary: The San Joaquin River and the Westside-San Joaquin IRWM Region boundaries were used for the western boundary of the East Stanislaus region. The western boundary of both the Turlock and Modesto Groundwater Subbasins is the San Joaquin River; therefore, the East Stanislaus Region fully encompasses these groundwater subbasins.

The East Stanislaus Region incorporates portions of both Stanislaus and Merced Counties. The cities located within the Region that comprise the ESRWMP are the Cities of Modesto, Hughson, Turlock, Ceres, and Waterford (Figure 2-2) (in addition to Stanislaus County); however, all cities within Stanislaus and Merced Counties, as well as neighboring counties, have been, and will continue to be, invited to participate in the IRWM process. The entire East Stanislaus Region is located within Central Valley Regional Water Quality Control Board's (CVRWQCB) jurisdiction.

Figure 2-2: ESWRMP Cities Located in the East Stanislaus Region



2.1.2 Climate

The East Stanislaus IRWM Region has a Mediterranean climate with hot, dry summers and cool winters, with most of the annual precipitation occurring between November and April. The average annual maximum temperature is 74.6 degrees Fahrenheit (°F), as shown in the following table, but it is not uncommon for summer temperatures to exceed 100°F. Extreme winter lows can reach the teens with the first freeze usually in December and the last in February.

Table 2-1: Average Temperatures and ET in the East Stanislaus Region

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly Average ET (in)[a]	1.10	1.88	3.63	5.18	6.87	7.81	7.96	6.90	5.15	3.43	1.74	1.08	52.74
Average Total Precipitation (in)[b]	2.44	2.07	1.93	1.03	0.46	0.13	0.02	0.04	0.17	0.63	1.24	2.05	12.21
Average Max Temperature (°F)[b]	53.8	60.9	66.9	73.3	81.2	88.3	94.3	92.3	87.7	77.9	64.6	54.4	74.6
Average Min Temperature[b]	37.6	40.8	43.5	46.8	51.8	56.6	60.0	58.8	56.0	49.6	41.7	37.7	48.4

a. Data from California Irrigation Management Information System (CIMIS) Station#71.
b. Data from Western Regional Climate Center for Modesto, CA. Period of record is March 1, 1906 to June 9, 2016.

2.1.3 Watersheds and Water Systems

Watersheds

Within the Central Valley, three major watersheds have been delineated – the Sacramento River Basin, the San Joaquin River Basin, and the Tulare Lake Basin. The East Stanislaus Region is within the San Joaquin River Basin, which is bound by the crest of the Sierra Nevada on the east and the Klamath Mountains on the west. The San Joaquin River Basin covers about 15,880 square miles and includes the San Joaquin River and its larger tributaries – the Cosumnes, Mokelumne, Calaveras Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers. The San Joaquin River Basin can be further divided into other watersheds and sub-watersheds (CVRWQCB, 2004). The Merced, Stanislaus and Tuolumne River watersheds are three watersheds within the San Joaquin River Basin. These are the primary surface water watersheds that drain to the Middle San Joaquin-Lower Merced-Lower Stanislaus Watershed in which the East Stanislaus region is almost entirely located (Figure 2-3). The Merced, Tuolumne, and Stanislaus Rivers are approximately 135, 155, and 161 miles long, respectively. Table 2-2 summarizes the key characteristics of the four rivers in the East Stanislaus Region.

Figure 2-3: Watersheds Within and Around the East Stanislaus Region

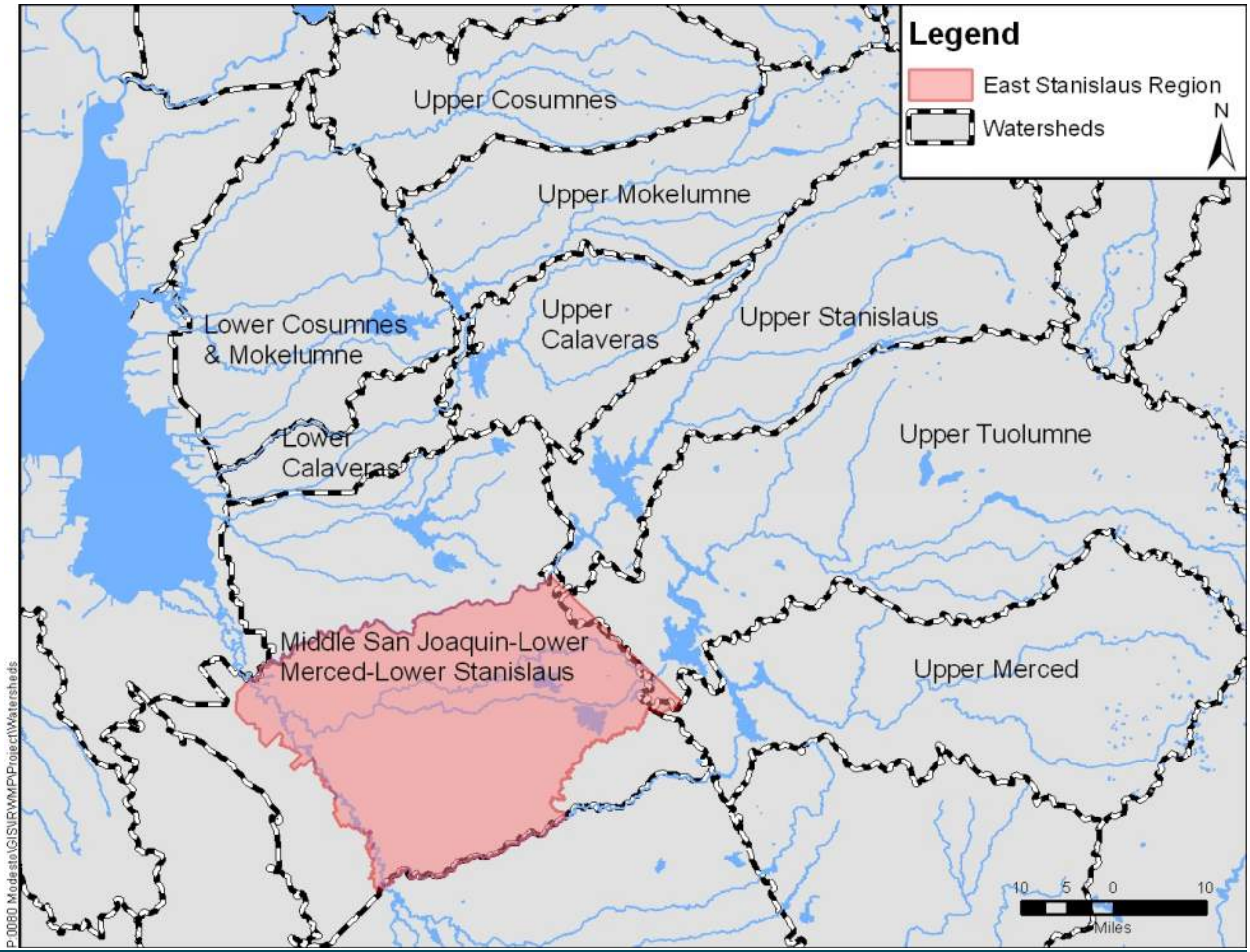


Table 2-2: Watershed and Reservoir Characteristics in the San Joaquin River Basin

Characteristic	Lower San Joaquin River			Upper San Joaquin River
	Stanislaus River	Tuolumne River	Merced River	
Median Annual Unimpaired Flow (1923-2008)	1.08 MAF	1.72 MAF	0.85 MAF	1.44 MAF (upstream of Friant Dam)
Drainage Area of Tributary at Confluence with San Joaquin (and percent of tributary upstream of mouth)	1.195 square miles (82% upstream of Goodwin)	1.870 square miles (82% upstream of LaGrange)	1.270 square miles (84% upstream of Merced Falls)	1.675 square miles (100% upstream of Friant Dam)
Total River Length	161 miles	155 miles	135 miles	330 miles
Miles Downstream of Major Dam	New Melones: 62 miles Goodwin: 59 miles	New Don Pedro: 55 miles LaGrange: 52 miles	New Exchequer: 63 miles Crocker-Huffman: 52 miles	Friant: 266 miles
Confluence with LSJR River Miles (RM) Upstream of Sacramento River Confluence	RM 75	RM 83	RM 118	RM 266
Number of Dams	28 DSOD[a]	27 DSOD	8 DSOD	19 DSOD
Total Reservoir Storage	2.85 MAF	2.94 MAF	1.04 MAF	1.15 MAF
Most Downstream Dam (with year built and capacity)	Goodwin, 59 miles upstream of SJR (1912, 500 AF)	LaGrange, 52 miles upstream of LSJR (1893, 500 AF)	Crocker-Huffman, 52 miles upstream of LSJR (1910, 200 AF)	Friant, 260 miles upstream of the Merced confluence (1942, 520 TAF)
Major Downstream Dams (with year built and reservoir capacity)	New Melones (1978, 2.4 MAF) Tulloch, Beardsley, Donnells "Tri-dams project" (1958, 203 TAF)	New Don Pedro (1971, 2.03 MAF)	New Exchequer (1967, 1.02 MAF) McSwain (1966, 9.7 TAF)	Friant (1942, 520 TAF)
Major Upstream Dams (with year built and reservoir capacity)	New Spicer Meadows (1988, 189 TAF)	Hetch Hetchy (1923, 360 TAF) Cherry Valley (1956, 273 TAF)	None	Shaver Lake (1927, 135 TAF) Thomas Edison Lake (1965, 125 TAF) Mammoth Pool (1960, 123 TAF)

Source: *Evaluation of San Joaquin River Flow and Southern Delta Water Quality Objectives and Implementation*, ICF, December 2012.
a. DSOD dams are those greater than 50 ft. in height and/or greater than 50 AF in capacity, with some exceptions.
MAF – million acre-feet
RM – river mile
DSOD – Division of Safety of Dams
AF – acre-feet
TAF – thousand acre-feet

San Joaquin River

The San Joaquin River Basin covers approximately 32,000 square miles in the northern part of the San Joaquin Valley, roughly from Fresno to Stockton (San Joaquin River Group Authority, 1999). The San Joaquin River is 330 miles in length, from its headwaters to its confluence with the Sacramento River. The portion of the river in the East Stanislaus Region is located north along the western edge of the Region. The primary sources of surface water to the basin are rivers that drain the western slope of the Sierra Nevada Range. Each of these rivers (the San Joaquin, Merced, Tuolumne, Stanislaus, Calaveras, Mokelumne and Cosumnes Rivers) drains large areas of high elevation watershed that supply snowmelt runoff during the late spring and early summer months. Historically, peak flows occurred in May and June, and flooding occurred in most years along all the major rivers. However, construction and operation of the numerous water supply, hydroelectric, and flood control efforts during the 20th century have modified the historic flows (San Joaquin River Group Authority, 1999) and climate change is anticipated to further impact flow patterns in the future.

The Lower San Joaquin River is defined as the river's confluence with the Merced River, north to the Delta. This stretch of the river is characterized by the combination of flows from tributary streams, major rivers, groundwater accretions and agricultural drainage water (San Joaquin River Group Authority, 1999).

Overall, the San Joaquin River is the second longest river in California, and habitats along the river have been heavily affected by river control upstream at Friant Dam and by adjacent land uses. One primary river habitat within the East Stanislaus Region is the San Joaquin River National Wildlife Refuge (SJRNWR). The Refuge is located west of Modesto, within the historic floodplain of the confluences of the San Joaquin, Stanislaus, and Tuolumne Rivers. The Refuge was established in 1987 because of the importance of the area as habitat for the Aleutian Canada goose. Refuge lands consist of oak-cottonwood-willow riparian forest, pastures, agricultural fields, and wetlands, with habitats for a diversity of wildlife including numerous special species such as Swainson's hawks, herons and cormorants, and the endangered riparian brush rabbits. The Refuge presently encompasses more than 6,500 acres. In January 2017, the U.S. Fish and Wildlife Service (USFWS) released a final plan authorizing the expansion of the refuge by up to 10,700 acres. This would link the refuge with the Grassland Ecological Area, a mosaic of floodplain habitats that covers 160,000 acres.

In December 2012, the State Water Resources Control Board (SWRCB) issued a Draft Substitute Environmental Document (SED) in Support of Potential Changes to the Water Quality Control Plan for the Bay-Delta: San Joaquin River Flows and Southern Delta Water Quality. The preferred alternative identified in the SED called for 35 percent unimpaired flows from February through June within the Merced, Tuolumne and Stanislaus Rivers to support spring fish populations. This proposed action has the potential to significantly change water management on all three rivers, restricting water purveyors' ability to divert surface water and conjunctively manage the rivers and their underlying groundwater subbasins. Additionally, the proposed action has the potential to negatively impact fall-run Chinook as the changes will likely lead to increased temperatures of releases from reservoirs. A Draft Revised SED was released in September 2016, with the public comment period closing in mid-March of 2017. The SWRCB is currently in the process of responding to comments and revising the draft. The final draft must be approved by the SWRCB and the Office of Administrative Law before taking effect.

Stanislaus River

The Stanislaus River watershed is approximately 578,000 acres, located in the central Sierra Nevada, and is one of the largest tributaries to the San Joaquin River in the Central Valley. Snowmelt runoff contributes the largest portion of the flows in the Stanislaus River, with the highest monthly flows in May and June (San Joaquin River Group Authority, 1999). Within the Stanislaus River watershed, there are 18 dams and 10 powerhouses. The lower Stanislaus River also has 16 parks or river access areas. There are 11 riverside parks between Knight's Ferry and the confluence with the San Joaquin River that are managed by the U.S. Army Corps of Engineers (USACE). The parks provide camping, fishing, and boating access to the River. The Stanislaus River at State Highway 99 and downstream includes Caswell Memorial State Park, as well as smaller parks such as Modesto's Oak Grove Park. USACE developed a plan for a series of access parks along the Stanislaus River called the "String of Pearls" (ESA, 2013).

Flow control in the lower Stanislaus River is provided by the New Melones Reservoir, which has a capacity of 2.4 million acre-feet (AF) and is operated by the U.S. Bureau of Reclamation (USBR). Releases from New Melones Reservoir are re-regulated downstream at Tulloch Reservoir. The main water diversion point on the Stanislaus River is Goodwin Dam, which provides deliveries to Oakdale Irrigation District (OID) and the South San Joaquin Irrigation District (SSJID) in San Joaquin County. Goodwin Dam is also used to divert water into the Goodwin Tunnel for deliveries to Central San Joaquin Water Conservation District and the Stockton East Water District, also in San Joaquin County (San Joaquin River Group Authority, 1999).

The major habitat type along the lower Stanislaus River is valley foothill riparian, primarily bordering the river. This habitat is characterized by a canopy layer of cottonwoods, California sycamores and valley oaks. Annual grassland is also found in this area, within reach of the river. This habitat is characterized as an open habitat dominated by annual grasses. The California Department of Fish and Wildlife (CDFW) conducted surveys along 59 miles of the Stanislaus River from the confluence with San Joaquin River upstream to Goodwin Dam. Some of the identified species of concern in the watershed include fall-run Chinook salmon (species of concern), steelhead trout (threatened), California tiger salamander, California red-legged frog, riparian brush rabbit, and riparian woodrat (CDFW, 1995).

Tuolumne River

The headwaters of the Tuolumne River begin in Yosemite National Park in the Sierra Nevada at an elevation of about 13,000 feet. The Tuolumne River's two primary sources begin on Mount Dana and Mount Lyell, the tallest peak in the Park. The Dana and Lyell tributaries meet at the eastern edge of Tuolumne Meadows forming the Tuolumne River. From Tuolumne Meadows, the river descends 4,000 feet to the Hetch Hetchy Reservoir. Other creeks also enter Hetch Hetchy Reservoir, including Return, Paiute, Rancheria, and Falls Creeks above the O'Shaughnessy Dam. At the dam, approximately 33% of the river's flow is diverted through Canyon Tunnel, and ultimately to the San Francisco Bay Area, where it provides water to nearly 2.5 million people. Below O'Shaughnessy Dam, the Tuolumne River exits Yosemite National Park and enters the Stanislaus National Forest. Between Kirkwood Powerhouse and Don Pedro Reservoir, the Tuolumne River is known for its world-class whitewater rapids for recreation. The main branch of the Tuolumne River and Dry Creek, a major tributary, are both within the Region. The various reaches of the Tuolumne River are described below:

- The Middle Tuolumne River begins at an elevation between 7,000 and 8,000 feet inside Yosemite National Park and joins the South Fork of the Tuolumne River outside the Park.
- The South Fork of the Tuolumne River's headwaters is between White Wolf and Yosemite Valley, at an elevation of about 8,000 feet. The South Fork exits the park slightly north of Hodgdon Meadow and upstream of its confluence with the main branch of the Tuolumne River.
- The North Fork of the Tuolumne River begins near Dodge Ridge, south of Highway 108 in Stanislaus National Forest. It joins the Tuolumne River above Don Pedro Reservoir.
- Dry Creek is the largest tributary to the Tuolumne River, beginning north of La Grange and entering the Tuolumne River in the City of Modesto.

Flows in the lower portion of the Tuolumne River are controlled primarily by the operation of New Don Pedro Dam, which was constructed in 1971 jointly by TID and Modesto Irrigation District (MID) with participation by the City and County of San Francisco. The 2.03 million AF reservoir stores water for irrigation, hydroelectric generation, fish and wildlife enhancement, recreation, and flood control purposes. The Districts divert water to the Modesto Main Canal and the TID Main Canal a short distance downstream from New Don Pedro Dam at La Grange Dam (San Joaquin River Group Authority, 1999).

The Tuolumne River watershed has an area of approximately 980,000 acres and provides wildlife habitat supporting many species of wildlife, including bald eagles, spotted owls, prairie falcons, and trout. The lower Tuolumne River is a site to which thousands of Chinook salmon return every fall to spawn. Within the Tuolumne River itself, a diverse assortment of animals seeks food, water and shelter, including many special-status species. Some of these species include fall-run Chinook salmon (species of concern), steelhead trout (threatened), Riparian Brush Rabbit (endangered), Riparian Wood Rat (endangered), Valley Elderberry Longhorn Beetle (threatened), Least Bell's Vireo (threatened), and Swainson's Hawk (species of concern) (CNRA, 2017).

The Tuolumne River Regional Park (TRRP), near Highway 99 and the cities of Modesto and Ceres, is being developed by the two cities and Stanislaus County. It is being developed on 500 acres of public land along seven miles of the Tuolumne River and consists of a series of separate parks. Upon completion, it will include 150 acres of park lands, pedestrians/bike trails, and over 350 acres of land designated for riparian habitat conservation and restoration. Five of the parks have been fully or partially developed to date, and one more will be completed in the future. Other river-oriented County parks are also located along the Tuolumne River (e.g. Riverdale Park). The Tuolumne River Trust has an active Lower Tuolumne River Parkway initiative, working with a larger coalition of interests to accomplish an array of goals (ESA, 2013).

Merced River

The Merced River watershed is also located in the central Sierra Nevada with its upper reaches in Yosemite National park. The watershed encompasses about 663,000 acres from its headwaters near Triple Divide Peak to a major hydroelectric project at the New Exchequer Dam that impounds 1 million AF at Lake McClure. Releases from Lake McClure pass through a series of power plants and small diversions, and are re-regulated at McSwain Reservoir. Below McSwain Dam, water is diverted to Merced Irrigation District at the Pacific Gas and Electric Company (PG&E) Merced Falls Dam and further downstream at the Crocker Huffman Dam (San Joaquin River Group Authority, 1999).

A large portion of the Merced River watershed lies within Yosemite National Park, while another large portion falls under National Forests and Bureau of Land Management jurisdiction. Much of the watershed is considered alpine climate; the upper portion receives heavy snowfall during winter months which is usually enough to feed the Merced River and its tributaries the remainder of the year. The middle and lower portions of the watershed are considered to have Mediterranean or semi-desert climates. Like the Tuolumne River, the Merced River provides habitat to many wildlife species. A study was conducted in 2006 which identified 31 species of fish, 129 bird species, and 177 insect and invertebrate species within the Merced River watershed. Of the 31 species of fish, 26 species were found in the lower Central Valley portion of the river (Stillwater Sciences, 2008). The Chinook salmon, Pacific lamprey, and striped bass are three anadromous fish species found in the lower Merced River.

Water Systems

The interior of the East Stanislaus Region includes Dry Creek, the Merced, San Joaquin, Stanislaus, and Tuolumne Rivers, as well as Modesto Reservoir and Turlock Lake. The Region overlies the San Joaquin Valley Groundwater Basin, which is divided into nine subbasins, three of which are within the Region (Turlock and Modesto Subbasins, and a small portion of the Delta-Mendota Subbasin) (Figure 2-4). Percolation of water used for irrigation on lands overlying the groundwater subbasins is the largest inflow to the groundwater subbasins and provides an important role in maintaining groundwater storage and sustaining recharge. Additional information about the Turlock and Modesto Groundwater Subbasins is included in Section 2.2.1 below.

The East Stanislaus Region encompasses the service areas of multiple local agencies and maximizes opportunities for integrated water management activities. All five ESRWMP member cities and Stanislaus County have jurisdiction over water supply and quality, wastewater, recycled water, stormwater, and/or watershed/habitat in their respective service areas. The other entities that have water management responsibilities within the Region include other cities and communities, irrigation and water districts, and Merced County. Other (non-ESRWMP) local agencies within the Region include:

- City of Riverbank
- City of Oakdale
- Keyes Community Services District
- Denair Community Services District
- Community of Del Rio
- Community of Grayson
- Community of Hickman
- Community of Empire
- Community of Riverdale
- TID
- MID
- Eastside Water District
- OID
- Merced Irrigation District
- Ballico-Cortez Water District
- Delhi County Water District
- Hilmar County Water District
- Merced County
- Monterey Park Tract Community Service District (CSD)

Figure 2-5 shows the locations of the primary water services areas within the East Stanislaus Region. Water system facilities in the Region are summarized in Table 2-3. Because critical groundwater basins, surface water supplies, habitat features and the agencies managing these resources are all located within the East Stanislaus Region, water supply reliability, water quality, environmental and flood protection can be effectively integrated through the development of the East Stanislaus IRWMP.

Figure 2-4: Surface Water and Groundwater Features in and Adjacent to the East Stanislaus Region

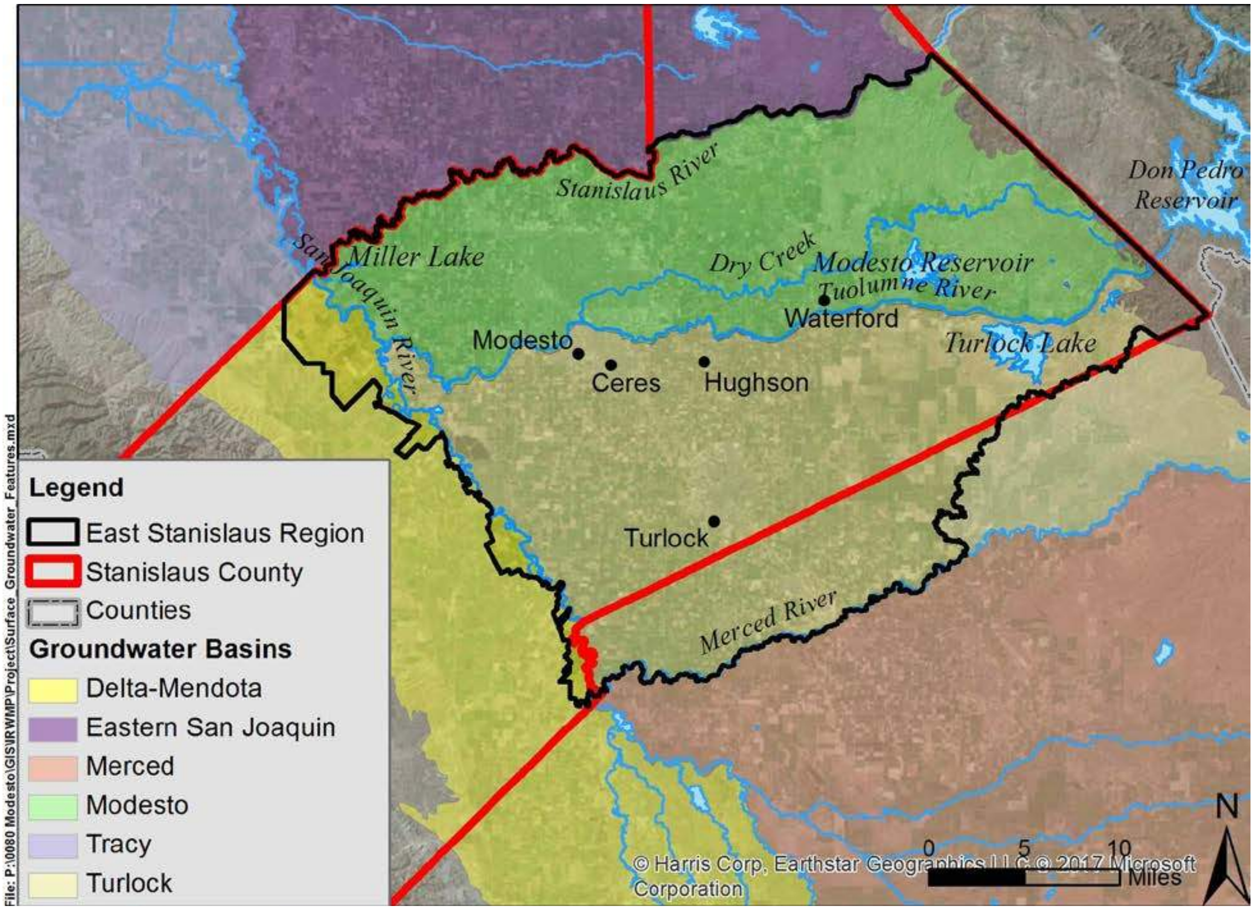
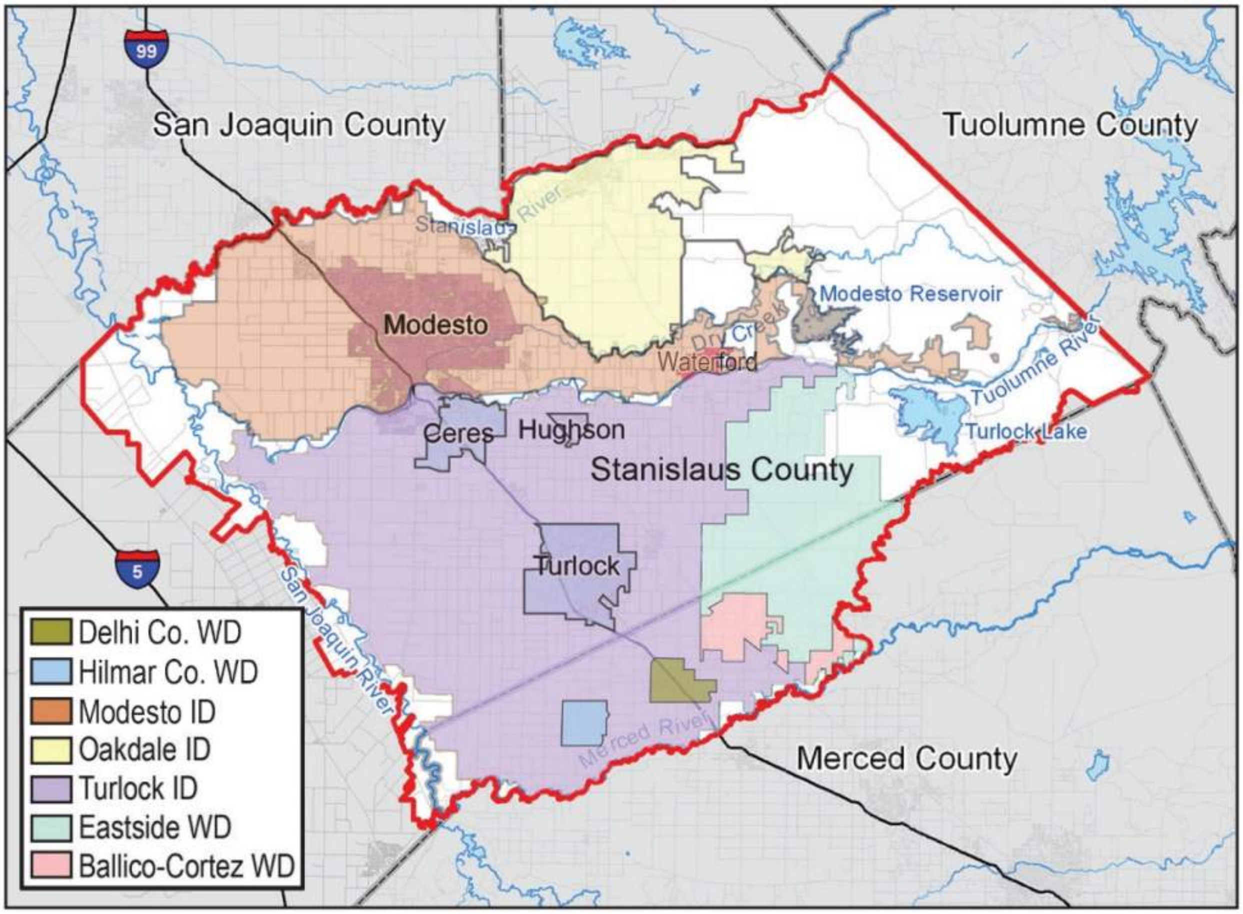


Figure 2-5: Primary Water Services Areas in the East Stanislaus Region



The water system facilities owned and operated by the ESRWMP entities are summarized in the following table. Additional facilities (such as groundwater wells) are owned by other regional stakeholders such as the irrigation districts and community services districts.

Table 2-3: Major Water System Facilities in East Stanislaus Region

Water System Facility	Owner	Description
Modesto Reservoir	MID and Stanislaus County	A raw water reservoir completed in 1911 that is owned and operated by MID. It has a gross capacity of 28,000 AF and serves as a regulating reservoir for irrigation and domestic water. It is also a recreational area operated by Stanislaus County.
New Don Pedro Reservoir	MID & TID	Don Pedro Reservoir is located outside the Region boundaries (about 2 miles east of the Region). A raw water reservoir located 4 miles northeast of La Grange in the Sierra Nevada foothills, completed in 1971, and owned and operated by MID and TID. It provides recreation, water storage, power production for MID and TID, and flood control for the Army Corps of Engineers. It has a capacity of 2.03 million AF.

Water System Facility	Owner	Description
Modesto Regional Water Treatment Plant (MRWTP)	MID	The MRWTP and associated storage/delivery facilities were completed in 1995. It treats Tuolumne River water from MID's Modesto Reservoir, which is then conveyed to the City of Modesto's service area for use. Since 1995, it has provided the City of Modesto 30 million gallons per day (mgd) of treated water. Phase 2, to expand the plant by an additional 30 mgd was completed in June 2016, and will provide supply for the City of Modesto's projected increase in demand.
La Grange Dam	MID & TID	The La Grange Dam diverts water for MID and TID. It was completed in 1894.
Groundwater wells	Cities of Modesto, Turlock, Ceres, Hughson, Waterford, Oakdale, Riverbank	The City of Modesto has 86 active groundwater wells located throughout its entire water service area with a total production capacity of 104 mgd. The wells are located in the Modesto, Turlock, and Delta-Mendota Subbasins of the San Joaquin Valley Groundwater Basin. The City of Turlock operates 20 active potable groundwater wells and a handful of non-potable wells used for irrigating landscape in City parks. The City of Ceres pumps groundwater from 12 active municipal supply wells which obtain water from the Turlock Subbasin, part of the San Joaquin Valley Groundwater Basin. The wells can produce a total of 14,500 gallons per minute (gpm), but the current firm groundwater pumping capacity is 12,700 gpm. The City of Ceres also has four inactive wells that are out of service due to water quality concerns. The City of Hughson's water supply source is derived from three groundwater wells scattered throughout the City. Each well has a capacity ranging from 1,000 to 1,200 gpm. The City of Waterford has 10 wells with a combined pumping capacity of 4,000 gpm. Of these, two are part of the Hickman system, and two are part of the River Pointe system. The City of Oakdale operates eight deep groundwater supply wells while the City of Riverbank currently operates 10 municipal supply wells.

Water System Facility	Owner	Description
Transmission and Distribution Pipelines	Cities of Modesto, Turlock, Ceres, Hughson, Waterford, and Riverbank	The City of Modesto's contiguous water service area has about 940 miles of pipelines. A portion of the transmission pipelines within the City is owned by MID. The City of Modesto also serves water to Grayson. The City of Turlock maintains approximately 250 miles of water lines to deliver water to users (118,686 water connections to its raw and potable water system) in a single pressure zone. The City of Ceres' water distribution system consists of a single pressure zone with approximately 150 miles of water pipelines. The City of Hughson conveys water from the wells to consumers via the distribution system that has pipe sizes ranging from 2- to 16-inches in diameter. The City of Waterford has approximately 17 miles of water lines which convey water to 2,260 connections in its Waterford system in a single pressure zone. The River Pointe system serves 330 connections, and the Hickman system has 185 connections. The City of Riverbank conveys water from the wells to its users via a 44-mile distribution system with pipe sizes ranging from 4 to 12 inches in diameter.
Storage Tanks	Cities of Modesto, Turlock, Ceres and Hughson	The City of Modesto has 9 at-grade and partially buried storage tanks with a combined total storage capacity of 18.1 million gallons (MG). Each storage tank has a booster pump station to pump water from the tank to the distribution system. There are also two 5 MG MRWTP reservoirs that MID owns. The only outlying portion of the City of Modesto's service area that has a storage tank (0.22 MG capacity) is Grayson. The City of Turlock has three at grade reservoirs each with a capacity of one million gallons. Each reservoir has a booster pump station to pump water to the water distribution system. The City of Ceres has two at-grade reservoirs with a combined storage capacity of 3.5 MG. The reservoirs have a booster pump station to pump water to the water distribution system. The City of Hughson has a storage reservoir within the distribution system with a capacity of 750,000 gallons. The City of Riverbank maintains two above-grade reservoirs with a combined storage capacity of 2 MG. The City of Oakdale currently maintains one storage tank with a capacity of 1 MG.

Notes:
MID – Modesto Irrigation District
TID – Turlock Irrigation District

2.1.4 Wastewater and Recycled Water

Each of the five ESRWMP partner cities (Modesto, Turlock, Ceres, Hughson, and Waterford) operates a wastewater treatment plant (WWTP) or plants, providing services to their respective service areas. Additionally, the Salida Sanitary District operates a WWTP and provides wastewater collection, treatment, and disposal for the unincorporated community of Salida. It serves a population of 13,000 and has over 4,200 customers (Capitol PFG, 2016).

The cities of Turlock and Modesto produce tertiary-treated recycled water. The Cities of Hughson and Ceres treat wastewater to secondary standards and therefore do not produce recycled water meeting Title 22 standards for unrestricted reuse. However, secondary treated wastewater produced by Ceres is sent to Turlock's Regional Water Quality Control Facility. Ceres also exports approximately 1.3 mgd of wastewater to Modesto's Sutter Treatment Plant which is conveyed to the Jennings Road Treatment Plant, its facility for secondary and tertiary treatment, via Modesto's trunk sewer. Therefore, Ceres' wastewater will contribute to the flows available for the North Valley Regional Recycled Water Program (NVRRWP) (discussed below).

Recycled water is recognized as a beneficial water supply due to its many advantages – adding a reliable water source that is consistently available regardless of droughts or climate change, offsetting potable water for other uses, and diversifying agencies' and cities' water supply portfolios. Several members of the ESRWMP have historically worked together to identify regional opportunities for wastewater treatment and recycled water production. An example of a recent cooperative project is the NVRRWP, an effort to regionalize recycled water use in Stanislaus County. The NVRRWP is expected to begin producing and delivering disinfected tertiary treated recycled water to western Stanislaus County by 2018. Over the next several years, up to 30,600 acre-feet per year (AFY) of recycled water could be produced. The source of recycled water includes treated wastewater from the Cities of Turlock, Ceres, and Modesto. As part of the project, the City of Turlock plans to install a pipeline to convey recycled water to the City of Modesto Jennings Road Treatment Plant where it will join Modesto's recycled water and be conveyed via a new pipeline directly to the Delta-Mendota Canal (DMC). The Canal will be used to convey the blended canal-recycled water to agricultural users in the Del Puerto Water District (DPWD) service area, located in the west side of Stanislaus County within the Westside-San Joaquin IRWM Region. Environmental review for the project was completed in 2015, and construction of the project is underway. Information regarding the NVRRWP can be found on the project website at http://www.nvr-recycledwater.org/.

City of Modesto

Treatment of the City of Modesto's raw wastewater occurs at the Sutter Avenue Primary Treatment Plant and Jennings Road Treatment Plant, located on two sites within the City of Modesto. The Sutter Avenue Primary Treatment Plant provides pumping, screening, grit removal, flow measurement, primary clarification and sludge digestion. The primary effluent is then conveyed to the secondary/tertiary treatment plant, the Jennings Road Treatment Plant, where it is treated further and either discharged or stored until it can be discharged. The City has facilities for treating water to both secondary and tertiary levels. The secondary effluent is treated via biological treatment with fixed film reactors, recirculation, aerated recirculation, and oxidation ponds. The City disposes of the secondary treated effluent in two ways: through irrigation to land that it owns (namely, a 2,526-acre ranch), and through seasonal discharge to the San Joaquin River, both of which are pursuant to National Pollutant Discharge Elimination System (NPDES) Permit No. CA0079103. In 2010, the Jennings Road Treatment Plant was upgraded to a tertiary treatment system with the implementation of Phase 1A of its Tertiary Treatment Project, providing up to 2.3 mgd of tertiary-treated water. Phase 2 of the project was completed in late 2015, and added 12.6 mgd of tertiary treatment, allowing for compliance with the City's NPDES Permit and permitting year-round discharge to the San Joaquin River.

Historically, about 20 mgd of cannery wastewater with high concentrations of organic vegetable solids were sent to the primary treatment plant, causing the treatment plant to operate inefficiently. To address this problem, in the late 1990's, the Cannery Segregation Project was implemented such that now, up to 40 mgd of wastewater from seasonal canneries is segregated and bypasses treatment. These cannery discharges are applied directly to city-owned ranchlands as a soil supplement.

In 2015, the City of Modesto collected and treated 24,000 AF of wastewater (West Yost, 2016a). The WWTPs serve the City's sanitary service area and a small portion of Ceres, as described later in this section. As previously described, the recycled water produced by the City of Modesto will be delivered to DPWD, and potentially other users in western Stanislaus County, for beneficial use with the implementation of the NVRRWP. Although the NVRRWP will not provide a potable water offset directly to the City of Modesto service area, the treated wastewater will provide water supply reliability, public safety, enhanced property values, and increased educational opportunities (West Yost, 2011b).

City of Turlock

In 2006, the City of Turlock's Regional Water Quality Control Facility (WQCF) was upgraded to tertiary treatment, producing recycled water compliant with Title 22 requirements for unrestricted reuse. All existing and future treated wastewater flows will be treated to recycled water standards, potentially available for beneficial reuse. The City is currently permitted to use the recycled water for industrial cooling (2 mgd) and landscape irrigation at Pedretti Baseball Park (up to 20 MG/year) as part of the City's Recycled Water Program, which was approved by the California Department of Public Health (CDPH) in 2006. The recycled water for industrial cooling is delivered to TID for use at the Walnut Energy Center, a 250 megawatt (MW) natural gas power plant located in Turlock.

The City of Turlock currently treats approximately 3,400 MG of wastewater annually (West Yost, 2016b). At present, the City discharges recycled water that is not used to the San Joaquin River via the Harding Drain, a man-made agricultural drain. The City plans to build a pipeline as part of the NVRRWP that will bypass Harding Drain to allow for recycled water delivery to DPWD, who provides irrigation water to about 11,000 acres of farmland in western Stanislaus County. The NVRRWP Feasibility Study estimated that the City would have 14,100 AFY of recycled water available to DPWD in 2018 (RMC, 2013). The City will continue to use recycled water in its service area. The City of Turlock is currently designing its portion of the NVRRWP and anticipates starting construction in early 2018. Recycled water produced by the City will be delivered to the DMC and ultimately to DPWD customers in 2018.

City of Ceres

The City of Ceres does not currently produce or deliver recycled water, but in recent years, it has evaluated the potential to develop recycled water to offset potable water use and assist with wastewater disposal. Presently, the City collects and treats wastewater for customers within city boundaries, except the northwest portion of the city. The City manages collection in the northwest portion of the city, but currently exports about 1.3 mgd of wastewater to the City of Modesto's trunk sewer system. The City also exports a significant portion of its treated wastewater from its WWTP to the City of Turlock's WQCF. The wastewater Ceres sends to Modesto and Turlock's WWTPs will contribute to the flows available for the NVRRWP and associated recycled water use in the DPWD service area.

The City of Ceres WWTP has been at its existing location since before 1970, and treats 3.1 mgd of wastewater on average. No treated wastewater is discharged to a surface water body; instead, treated effluent is either discharged into on-site ponds for evaporation and incidental groundwater recharge (up to 2.5 mgd) or exported to the Cities of Turlock or Modesto (up to 1 mgd to each location). Wastewater treatment and disposal at the City's WWTP is regulated by Waste Discharge Requirements (WDRs) Order No. 93-237.

The City's wastewater flow projections exceed currently available disposal capacity, so the City has explored disposal options. Tertiary treatment and water recycling is currently not being considered due to significantly higher costs than other disposal options resulting from required upgrades. (Areas that could potentially use recycled water in the City's service area have been identified, but it was determined not to be cost effective to add tertiary treatment and install dual piping.) Other disposal options include increased exports to the City of Turlock and the City of Modesto, both of which will be explored further. The City of Ceres is in the process of buying another 1 mgd of capacity of Turlock's WQCF in order to export up to 2 mgd of its wastewater flows. The CVRWQCB is reluctant to add another discharger to the San Joaquin River. Under current RWQCB policy, regionalization is preferred whenever feasible. Regionalizing the Cities of Modesto and Turlock wastewater treatment facilities would provide greater economies of scale than the City of Ceres constructing its own treatment and/or disposal facilities (West Yost, 2011a).

City of Hughson

The City of Hughson operates the Hughson WWTP located adjacent to the Tuolumne River, north of the city. Most of the flows to the WWTP come from residential users except for a creamery owned by the Dairy Farmers of America (DFA) which is permitted specific flows and wastewater characteristics. The City is approximately 70% built out within the City limits, with agricultural land use dominating the areas surrounding the City boundary. The City's original WWTP was constructed in 1947 by the Hughson Sanitary District. The City took over the function of the Sanitary District in 1972, and in 1983, constructed the existing WWTP which began operation in 1986. Over the years, the WWTP has had a number of improvements, at times necessitated by violations issued by the RWQCB and operational issues. In 2003, the City's Hatch Road Pump Station broke down, and the RWQCB issued a Notice of Violation calling for improvements. More wastewater treatment capacity was required, so an interim upgrade project was designed and constructed in 2005 and 2006. The WWTP Interim Upgrades Project added two treatment ponds, a pump station and other peripherals. In 2007, the City prepared its *Wastewater Treatment Plant Master Plan* to develop an approach to upgrade the WWTP, and upgrades were completed in 2012 (Benziger, 2012). With this upgrade, plant capacity was increased from 1 mgd to 1.9 mgd (Quad Knopft, 2007). The existing treatment processes at the WWTP include screening, grit removal, denitrification, extended aeration, secondary clarification, and chlorine disinfection, and the effluent is discharged to 10 evaporation and percolation ponds.

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

City of Waterford

The City of Waterford owns and operates its own WWTP with a biological treatment system, and owns its sewer system. In 2015, the WWTP treated an average of 0.5 mgd (Shoreline, 2016).

However, the plant does not have sufficient capacity for the expected flow at build-out (3 mgd), and the City has been evaluating options for addressing this issue over the long term.

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

City of Riverbank

The City of Riverbank owns and operates its own wastewater collection and treatment system. The City's WWTP is located north of Riverbank, across the Stanislaus River, and borders the north side of Jacob Myers Park. The WWTP treats an average of 1.6 mgd.

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

City of Oakdale

The City of Oakdale owns and operates its own sewage collection system and WWTP. The City's WWTP is designed to treat up to 2.4 mgd of domestic and industrial wastewater. The facility uses two aerated lagoons for primary treatment. Effluent from the lagoons flow by gravity to a single secondary clarifier, and treated effluent is discharged to one of 11 evaporation/percolation ponds. At present, the City is looking to upgrade its WWTP to add a second secondary clarifier, a new disinfection facility, and a new or expanded biosolids treatment facility.

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

2.1.5 Stormwater and Flooding

Stormwater Management

Stanislaus County & Regional Stormwater Management

Flood management consists of flood prevention, response, and recovery, generally provided by flood control infrastructure, O&M of that infrastructure, non-structural flood control such as land use decisions that do not place assets in areas with a high probability of flooding, and by providing financial assistance, counseling, and assistance after flood events (ESA, 2013). Storm drainage systems are used to reduce the chance of flooding and to meet regulatory requirements regarding stormwater runoff. A Stormwater Management Plan (SWMP) was prepared for Stanislaus County in 2004, and a Storm Water Resource Plan is currently being prepared by the County. As an operator of a Small Municipal Separate Storm Sewer Systems (MS4) that serves urbanized areas, the County filed a Notice of Intent to participate in the SWRCB General Permit for these types of systems. To comply with State and Federal requirements, also referred to as Phase II Stormwater Requirements, designated MS4s must develop a plan to implement measures to control stormwater quality, develop a 5-year plan for implementation and an associated budget. The 2004 SWMP for the County covers the County's unincorporated communities, including Empire, Keyes, Salida, Crow's Landing, Denair, Diablo Grande, Del Rio, Grayson, Hickman, Knight's Ferry, La Grange, Sunset Oaks Estates, Valley Home and Westley, as well as the industrial area known as Beard Tract between Modesto and Empire.

SB 985, passed in 2014, requires the development of a stormwater resource plan in order for agencies to be eligible for grant funding for stormwater and dry weather runoff capture projects (Water Code § 10562 (c)(2)(B)). In order to comply with SB 985, the County and other agencies are developing the Stanislaus Multi-Regional Storm Water Resource Plan (SWRP). The County was awarded a $500,000 Proposition 1 grant to fund creation of the SWRP, which is expected to be published in 2018. The plan identifies and prioritizes multi-benefit stormwater resource projects to improve regional water supply resilience and aid in the adaptation of infrastructure to climate change. Many of the same agencies that participate in the ESRWMP are involved with the creation of the SWRP (including the Cities of Modesto, Ceres, and Turlock) and the project submittal process for the two planning efforts have been coordinated such that stormwater projects can be identified for inclusion in both plans. Production of the SWRP was underway at the same time as the 2017 IRWMP Update. Therefore, information from the SWRP has been incorporated to the extent possible through coordination with the County and other SWRP participants. Upon completion and adoption, the SWRP will be incorporated into the East Stanislaus IRWMP by reference.

The Cities of Modesto, Turlock, Ceres, Hughson, Oakdale, Patterson, and Riverbank are also subject to Phase II Stormwater Requirements. Ceres, Oakdale, Patterson, and Riverbank prepared a joint-Stormwater Management Program in 2003. The Cities of Modesto, Turlock, and Hughson have each prepared individual stormwater-related plans as described below.

In most rural parts of Stanislaus County, stormwater runoff is handled by field percolation or through roadside ditches which then drain to Dry Creek, Tuolumne River, Stanislaus River, or San Joaquin River. While the majority of agricultural lands on the valley floor do not require drainage, there are some lands in the rolling hills to the east which generate runoff. For example, runoff from Mustang Creek and Sand Creek drain to the TID canal system, and runoff from McDonald Creek eventually drains to Turlock Lake where flows are routed through the TID canal system to the river.

There are few storm drain facilities constructed in rural areas. The Beard Tract covers about 5,000 acres and the streets have curb/gutter storm drains that discharge to Tuolumne River. Unincorporated communities in the County typically have constructed storm drain facilities that are owned, operated, and maintained by the County (Stanislaus County, 2004). Some rural systems pump stormwater to the TID canal system which is used to convey runoff to the river system.

City of Modesto Stormwater Planning

In 2008, the City of Modesto prepared a draft *Storm Drainage Master Plan* (SDMP) to identify major storm drainage infrastructure improvements that are needed or would be needed in the future. The City also prepared a Stormwater Management Plan in August 2009 to comply with Phase II requirements. Historically, the City has used a rockwell system, a positive storm drainage system, or no system. The City's Public Works Department operates and maintains 77 miles of storm drain lines, 20 pump stations, 24 drainage basins, and about 11,000 rockwells. The rockwells are used to percolate stormwater runoff into the ground, but these can lead to groundwater quality concerns. In addition to potentially impacting water quality, rockwells are expensive to maintain and overall, the City's system is deficient in its ability to drain stormwater runoff and minimize localized flooding in many areas. In some areas of the City, a positive storm drainage conveyance system is used; this system discharges to the Tuolumne River, Dry Creek, detention basins, and irrigation facilities owned and operated by MID and TID. Some of these systems are in need of retrofit and repair to properly serve the areas (Stantec, 2008). In the areas of the City of Modesto where there is no permanent storm drain system, the City uses the sanitary sewer to drain stormwater runoff and reduce flooding. Sewer cross-connections are also used in other areas where rockwells are ineffective. There is a total of 60 storm drain cross-connections, most of which are located in the downtown area. These can cause a dramatic increase in Peak Wet Weather Flow at the City's WWTP, so the City is working to remove the cross-connections from the wastewater collection system (Carollo, 2016).

City of Turlock Stormwater Planning

In order for the City of Turlock to comply with the Waste Discharge Requirements for Stormwater Discharges from MS4s it prepared a Storm Water Management Plan in 2003. The City also prepared a more recent Storm Water Master Plan in 2013. Turlock owns and operates its own stormwater system that includes 133 miles of gravity storm lines, 40 stormwater pump stations and associated force mains, and 45 detention/retention basins (Carollo, 2013). Stormwater runoff is transferred through storm pipes to a storm basin where it either percolates to the groundwater basin or is pumped to a larger storm basin or canal. Stormwater runoff that reaches the larger storm basin percolates to and recharges the groundwater basin. If excess stormwater is pumped to a canal, it is discharged to the San Joaquin River. In some cases, stormwater inlets directly connect to the sanitary sewer system. To protect water quality, the City of Turlock implements Best Management Practices (BMPs) as required by its MS4 permit (Turlock, 2003). Additionally, the City of Turlock implemented an environmental stewardship program called “Go Green” that has a stormwater pollution prevention component in it, and is also heavily related to water conservation (City of Turlock, 2011). Currently, most areas of the existing storm drainage system have sufficient capacity to accommodate 10- and 50-year design storms, although some areas lack necessary capacity (usually in areas where large interceptors are needed to convey flows from large tributary areas) (Carollo, 2013).

City of Hughson Stormwater Planning

The City of Hughson provides positive storm drainage for its service area; the system includes pipelines, four stormwater pump stations, rockwells, and detention and retention basins. Stormwater is discharged to TID via three discharge points to its irrigation canal, and the Ceres Main Canal. Currently, stormwater is discharged from the detention basins to the TID canal once a significant portion of the detention basins are filled. Most of the stormwater runoff in the City goes through storm basins, while some is discharged directly to the canal. In 2007, the City of Hughson completed a *Storm Drainage Master Plan* to help plan, develop, and finance the storm drainage system facilities. The report recommended a number of improvements to the existing system including upsizing many of the pipelines, constructing new pipelines, and constructing a new basin. Overall, the City’s storm drainage system is in good condition. The City maintains, cleans and repairs lift stations and pipelines as needed. Some areas within the City have localized flooding problems due to the lack of positive drainage facilities; City crews typically eliminate any storm inlet plugging and street flooding/ponding within a half-day. During a major storm in 1997 (a 170-year storm event) the most significant issue was the high inflow of stormwater runoff into the sanitary sewer system which then caused problems at the WWTP (Carollo, 2007b).

City of Waterford Stormwater Planning

Waterford’s existing storm drainage system consists of storm sewers and pump stations that discharge runoff primarily into the Tuolumne River and the main MID lateral canal (Waterford, 2007). Waterford has prepared a SDMP that identifies where major arterial lines will connect the City’s different storm drainage systems. This will also reduce dependence on the Tuolumne River, Dry Creek, and MID Canal.

Cities of Ceres, Oakdale, Patterson, and Riverbank Stormwater Planning

In 2003, the Cities of Ceres, Oakdale, Patterson, and Riverbank adopted a MOU to jointly apply for permit compliance. They prepared a Stormwater Management Program that described their positive storm drainage services they provide to their communities. The City of Ceres stormwater system includes 33 detention/retention basins, about 100 rockwells, 33 stormwater pump stations, pipelines, and 27 discharge points to receiving streams and canals. Stormwater is discharged to detention basins for percolation, to TID canals, or the Tuolumne River. Oakdale has 22 detention/retention basins, 8 stormwater pump stations, about 200 rockwells, pipelines, and 9 discharge points to streams and canals. Stormwater is disposed of by percolation, and/or discharged to the Stanislaus River and OID canal. Some of the stormwater is discharged directly to the river, while some enters a stormwater basin prior to discharge. Patterson (located in the Westside-San Joaquin IRWM Region) has 14 detention/retention basins, 5 stormwater pump stations, pipelines, and multiple discharge points to Salado Creek, Patterson Irrigation District canals, and San Joaquin River. There is a portion of Stanislaus County development that discharges to Black Gulch, a tributary to Salado Creek above Patterson's service area. Runoff from the developed County area impacts stream hydrology in Salado Creek through Patterson. Storm drainage master plans were prepared in 1992 and 2001 to address the flooding along Salado Creek and Black Gulch. The study recommended $20 million of improvements to the storm drainage system be constructed. Some of the improvements have been constructed while other improvements have not as they require cooperation from other agencies such as the USACE. In the past, Patterson's WWTP received infiltration from stormwater runoff during storms, but the City has been eliminating infiltration through infrastructure improvements. Riverbank's storm drainage system consists of pipelines, 6 detention/retention basins, about 100 rockwells, 7 pump stations, and 8 discharge points to Stanislaus River and the MID Main Canal. The Cities of Ceres, Oakdale, Patterson, and Riverbank have a few stormwater quality incidents each year. Dumping of chemicals into storm drains may occur and a few illegal connections of house sewers to storm drains were found, but eliminated. The cities do not conduct routine stormwater quality monitoring and new storm drainage infrastructure will be constructed by developers as the City grows (Tulloch, 2003).

Flooding

During storms, there is occasional flooding in Stanislaus County because of a combination of factors: high groundwater elevations, low percolation soils, and topography (Stanislaus County, 2004). The flood management system in the San Joaquin Valley includes reservoirs to regulate snowmelt from elevations greater than 5,000 feet, bypasses at lower elevations, and levees that line major rivers. Typically, snowmelt floods are more frequent in the San Joaquin Valley than rain floods, but rain floods do occur and generally have higher peak flows than snowmelt floods. The following table shows the discharge-frequency relationships for some of the rivers and creeks in the East Stanislaus Region as described by the Federal Emergency Management Agency (FEMA) (ESA, 2013).

Table 2-4: Discharge Frequency Relationships for Rivers

		Peak Discharges (cubic feet per second [cfs])			
Location	**Drainage Area (square miles)**	**10-year**	**50-year**	**100-year**	**500-year**
Tuolumne River at Modesto	1,884	10,500	32,000	70,000	154,000
Tuolumne River at Waterford	1,640	9,000	10,000	42,000	225,000
Stanislaus River at Oakdale	1,020	7,600	8,000	8,000	41,300
Dry Creek at Modesto	192.3	4,730	9,300	11,800	18,100

Source: ESA, 2014

The San Joaquin River, upstream of the Tuolumne River and down to the Merced River confluence, has a design capacity of 45,000 cfs, but a current capacity estimated to be 22,000 cfs to 35,000 cfs. Downstream of Tuolumne River to Stanislaus River, the design capacity of the San Joaquin River is 46,000 cfs, while the current capacity is only 25,000 cfs. The lowest reaches of Stanislaus River have a design capacity of 12,000 cfs, but its current capacity is 23,000 cfs. The lowest 0.6 miles of the Tuolumne River have a design capacity of 15,000 cfs; the current capacity is not estimated, but landowners along the river report flood damages when flows exceed 8,200 cfs.

In 1983, four levees broke in the San Joaquin River Basin. One of the levees that broke was within the Mid-San Joaquin River Region, an area generally described as the floodplain corridor extending along the mainstem San Joaquin River, from its confluence with the Merced River to its confluence with the Stanislaus River, and the lower reaches of the Merced, Tuolumne and Stanislaus Rivers that are within the State Plan of Flood Control. This levee break occurred on March 5th of 1983 along the left bank of the San Joaquin River, just downstream of its confluence with the Tuolumne River and along the SJRNWR. The break resulted in the inundation of 500 acres, causing $12 million of losses in agricultural damages in Stanislaus County. In 1986, there were a series of storms from February 11th to the 19th in which several precipitation records were set. Precipitation in a 300-mile-wide band from San Francisco to Sacramento to Lake Tahoe ranged from 100 to 200% of normal. While this caused flooding and damage, there were no damages sustained in Stanislaus County (ESA, 2013). Some older areas of Stanislaus County have problems with flooding during storms that exceed ½-inch per hour due to inadequate drainage.

During the 170-year storm of 1997, the County experienced flooding in some areas surrounding Tuolumne River due to the release of excess water from Don Pedro Dam and Reservoir into the Tuolumne River channel. The second wettest December on record in the Sierra Nevada occurred in 1997 which contributed to the flooding. Additionally, there were three tropical storms that hit Northern California on December 29, 30, and 31, 1996. Within three days, more than 30 inches of rain fell in the upper watersheds of the Sierra Nevada. Record flows were a result in the Sacramento and San Joaquin River Basins. In mid-December, a cold storm brought snow to the Sierra Nevada foothills which melted during the three warm storms at the end of December. Approximately 15% of the total runoff volume was from the snowmelt. Millerton Lake and Don Pedro Reservoir both exceeded their design capacity. Flooding occurred along the Merced River Tuolumne River, and San

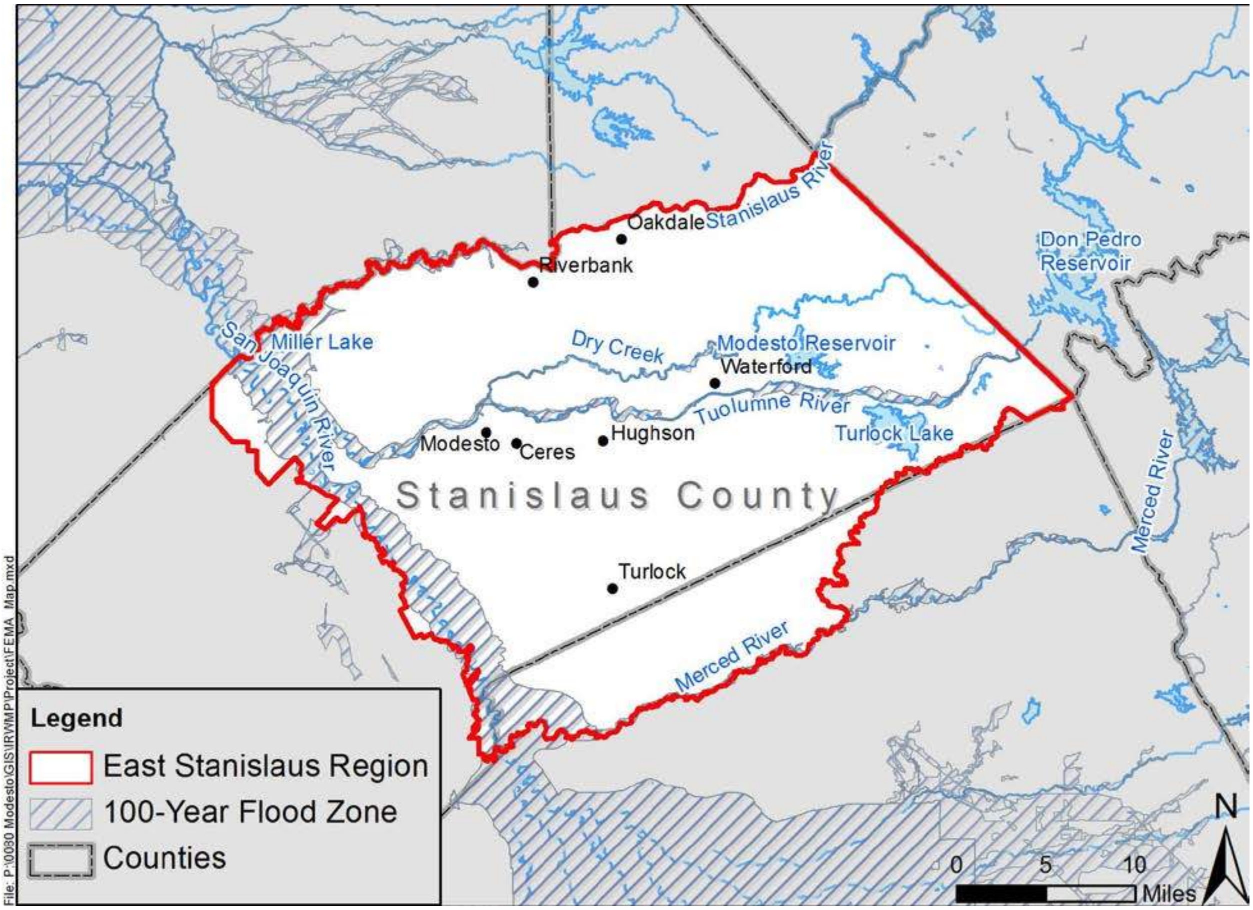
Joaquin River. Areas within Modesto, Ripon, Waterford, and La Grange were inundated. Multiple levees failed on the San Joaquin River, or were breached, leading to further flooding in nearby areas. Flooding did not occur in the Cities of Patterson, Newman or Turlock. Then in 1998, during 35 days of above average rainfall, upland areas of Stanislaus County experienced sheet flooding in a number of new subdivisions near saturated rural areas (Stanislaus County, 2004). Some low-lying areas of the lower reaches of the Tuolumne River and some near the confluence with Dry Creek are subject to occasional flooding.

Modesto experiences local urban flooding in various areas of the City, almost all of which utilize rockwells for stormwater management. The City has generally mapped these areas according to call responses and visual inspections and plans to further define boundaries based on topographical elevation references and storm event intensity. In the most recent storm season of 2016-17, the City experienced above average rainfall, as did most of the State. This resulted in flooding of local streets, as well as commercial parking areas. Flooding occurred mainly in areas where there are ineffective rockwell systems, but also in some gravity system areas that were overwhelmed due to intensity and/or debris.

Storm events in March 2017 resulted in increased releases from Don Pedro Reservoir. These releases, though carefully measured to reduce significant flooding in the Modesto area (generally from Santa Fe Avenue bridge to Carpenter Road bridge), did result in some flooding of low lying areas. Specifically, the mobile home parks located at 9th Street Bridge on the south side of the Tuolumne River were flooded and evacuation by residents was required. Unlike the 1997 event, Modesto's Sutter WWTP was not impacted as levees were able to withstand the elevated river flows. However, these higher flows did saturate the west bank east of the Sutter Treatment Plant where the City's major River Sewer Trunk is located. This contributed to the major breach of an aged section of pipe, causing flood waters to enter the sewer system and overwhelm the treatment plant. As a result, the Jennings Treatment Plant storage pond capacity could not keep up with the sustained increase in flow and Modesto had to discharge untreated secondary water into the San Joaquin River.

FEMA delineates 100-year floodplains for FEMA Flood Insurance Rate Maps (FIRMs). A majority of the San Joaquin River's 100-year flood plain (in this stretch of the San Joaquin River) is within the East Stanislaus Region, but overall, little of the Region is described as being within a 100-year floodplain (Figure 2-6). FEMA prepared the approximate floodplain mapping, but did not conduct detailed floodplain analysis. The City of Modesto performed detailed floodplain analyses to map the 100-year floodplain. According to the 2017 update of the *Stanislaus County Multi-Hazard Mitigation Plan*, an estimated 7,400 people live within the 100-year floodplain of the San Joaquin River within Stanislaus County. The estimated total property value, including private property, in that same area is approximately $690 million (Stanislaus County, 2017). Flood hazards in the region are areas that are naturally flood-prone, along major rivers, and potentially near levees that are in poor condition. The cities of Modesto, Newman, Patterson and the communities of Westley and Grayson are exposed to flood risk during large runoff events. Flooding occurs in Modesto at the confluence of the Tuolumne River and Dry Creek during intense storms and especially when releases from Don Pedro reservoir are high. Agricultural areas along the San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are also exposed to flood risk, as well as lands managed to preserve habitat along the San Joaquin, Tuolumne, and Stanislaus Rivers (ESA, 2013). Some development in the region is planned within the 100-year floodplain, but development will be restricted by the City's floodplain zoning ordinance. If areas within the 100-year floodplain are to be developed, properties are usually constructed on fill (Stantec, 2008).

Figure 2-6: 100-Year Flood Plain Maps for Water Bodies within the East Stanislaus Region



The East Stanislaus Region, as part of its IRWM planning process, participated in the development of a Regional Flood Management Plan (RFMP) for the Mid-San Joaquin Region to identify potential projects that may improve flood management. The Mid-San Joaquin River RFMP was completed in November 2014 and was one of six regional RFMPs prepared in the Central Valley. As part of FloodSAFE California, DWR initiated a comprehensive Statewide Flood Management Planning Program to assess flood risks statewide and inform development of the State's flood management policies and investment decisions over the next 10 to 15 years. DWR prepared the Central Valley Flood Protection Plan (CVFPP) in June 2012, which called for DWR to work with local flood management agencies to prepare detailed RFMPs that, at a minimum, identify and articulate the following:

- Describe flood management challenges and deficiencies at the regional level including O&M practices, levee and channel inspection, and emergency response plans.
- Propose potential solutions/projects identified by local public agencies and interest groups for the region, projects' costs, and prioritization of the solutions/projects enhanced O&M, emergency response, and floodplain management.
- Propose financial strategies that identify benefits of the projects and sources of the funding for implementation of the projects.

Six RFMPs were completed by 2015, including the Mid-San Joaquin River RFMP, which falls within the East Stanislaus Region. The management actions identified in the six RFMPs were then evaluated and incorporated into the 2017 update of the CVFPP as appropriate. Selected management actions fed into a refined State Systemwide Investment Approach portfolio, which provides a road map for Central Valley flood risk management.

The Mid-San Joaquin River Region planning area lies within the East Stanislaus IRWM Region, along its western boundary. Because flood concerns related to the San Joaquin River and its tributaries extend beyond the specific area, the geographic extent of the Mid-San Joaquin Region (the area covered in the Mid-San Joaquin River RFMP) is the Reclamation Districts (RDs) identified in the Draft Regional Atlas, as well as the Cities of Modesto, Ceres, Turlock, Patterson, and Newman; the communities of Grayson, West Stanislaus, and El Solyo; DWPD; MID; OID; Newman Drainage District; and all the areas between the Merced/San Joaquin River confluence and the Stanislaus/San Joaquin River confluence with a nexus to flood management.

The Mid-San Joaquin River RFMP was prepared with the purpose of developing a practical, flood-safe vision for the Mid-San Joaquin Region. The RFMP aims to improve flood risk management, promote ecosystem functions, and promote multi-benefit projects. The current flood management system in the area relies on aging levees, which have capacity to pass a 25- to 50-year flood event. Through an 18-month stakeholder input process, 37 projects were identified as having the potential to reduce flood hazards and provide other benefits to the planning area. Fourteen projects were identified as "highest priority." Some of these projects are also included in the East Stanislaus IRWMP, discussed further in Chapter 7. Overall, the RFMP has emphasized the need for improved emergency response in the Region, especially in terms of inter-agency coordination and among community members. The stakeholder involvement process began to address this issue by increasing flood literacy for those living in the planning area. The RFMP also addresses the financial capacity of the region to carry out the projects. The total cost for all projects identified within the Mid-San Joaquin River Region planning area is $340 million. The RFMP determined that funding sources from within this region would be inadequate to meet even the cost-share requirements of state and federal funding sources. Therefore, funding is a central challenge to project implementation. Nevertheless, the RFMP projects that by 2040, some projects will be completed, and land use changes in some areas will reduce flood risk (ESA, 2014).

2.1.6 Natural Resources

The East Stanislaus Region, as with most of California, is rich with natural resources. Most land in Stanislaus County has been cultivated, and very limited mineral resources were found within its boundary. In the early 1900's, some quicksilver, manganese, and magnesite were found, as well as silica, sand and clays. Gravel from the Stanislaus River near Oakdale was used for roads. In La Grange, mining for gold was successful (Perazzo, 2011).

Stanislaus County is primarily agricultural, but does contain some urban areas. Until approximately 1960, most of the County's population lived on farms. In the early 1990's, when Stanislaus County prepared its General Plan, the population of the nine incorporated cities was nearly three times that of the unincorporated area of the County. In its General Plan, the County applies agriculture land use to areas suitable for open space and recreational use.

Regional parks are valuable in preserving natural resources, such as river and riparian areas. River corridors and floodplains are some of the most ecologically valuable areas in the landscape, especially in an area like the Central Valley of California that has an arid climate. The rivers and floodplains are important for fish species, including anadromous species such as salmon and steelhead, and also provide wintering areas for migratory birds on the Pacific Flyway. The San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are characterized as Critical Habitat for steelhead trout, as designated by the (USFWS). Other Critical Habitats in the Region include those for the vernal pool tadpole shrimp and vernal pool fairy shrimp. Riparian and wetland sensitive species within the San Joaquin River and the lower reaches of the Merced, Tuolumne, and Stanislaus Rivers include Delta button-celery, valley elderberry longhorn beetle, riparian woodrat, riparian brush rabbit, wading bird rookeries, least Bell's vireo, tricolored blackbirds, Swainson's hawk, pallid bat, and western red bat (ICF 2016).

The Stanislaus River National Wildlife Refuge covers nearly 8,000 acres. Approximately three-quarters of this area was specifically acquired to allow floodwater to temporarily move out onto the floodplain, which is now home to flood-compatible land use. Extensive riparian vegetation is present within the Wildlife Area and there are small swaths of riparian vegetation along the San Joaquin River from the confluence with the Merced River to the confluence with the Stanislaus River. Similarly, the Dos Rios Ranch is a 1,600-acre area managed by the Tuolumne River Trust and River Partners. Located at the confluence of the Tuolumne and the San Joaquin Rivers, Dos Rios Ranch provides six miles of river frontage and is managed for habitat and attenuation of flood flows (ESA, 2013).

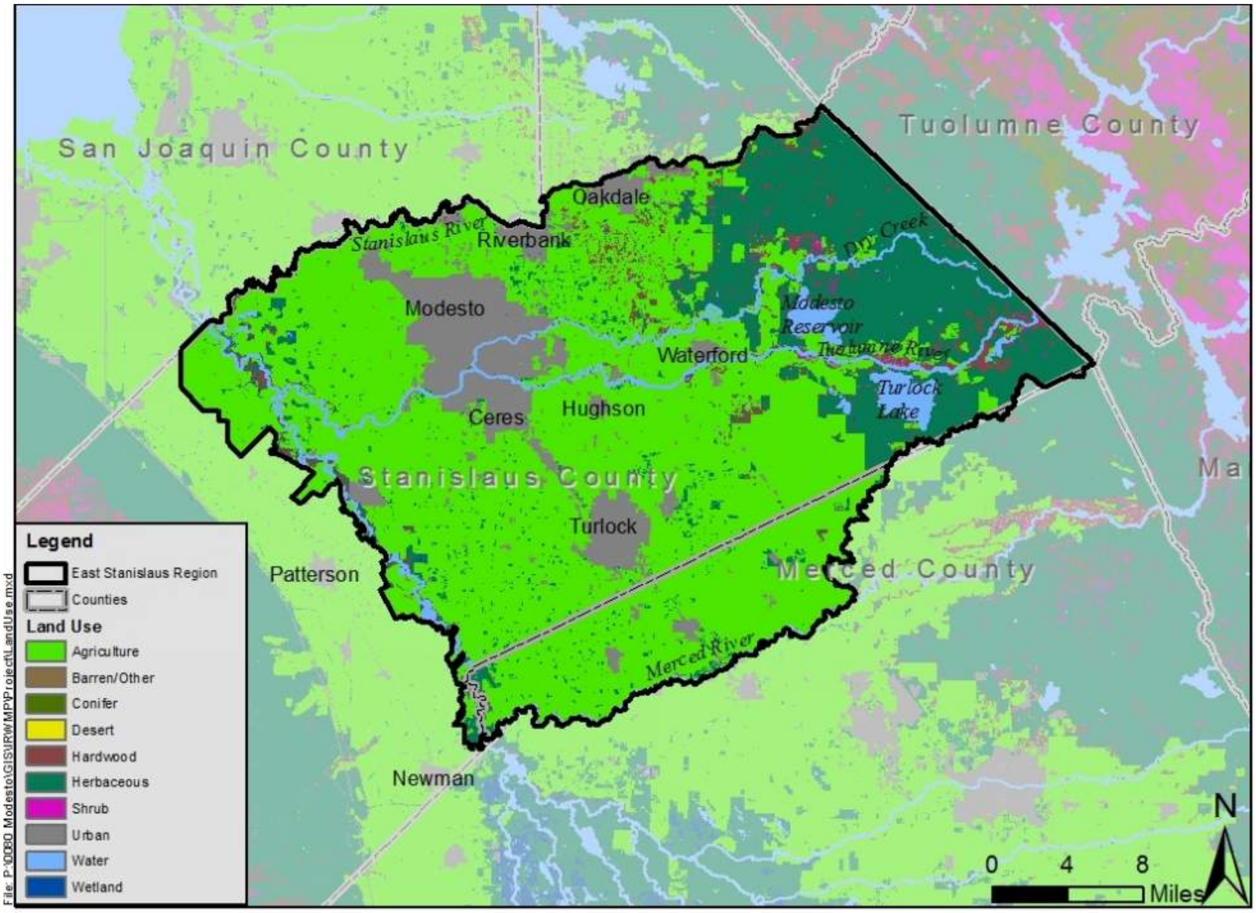
2.1.7 Social and Cultural Composition

As previously noted, the East Stanislaus IRWM Region encompasses most of Stanislaus County and a portion of Merced County. Based on the 2016 Census estimate data, Stanislaus County had a 2016 population of 541,560, an increase of 5% from 2010. As of 2015 (the latest year for which demographic estimates were available) the County's population is approximately 78% white, approximately 43% of which are of Hispanic or Latino origin. Asians provide the next largest demographic population, composing approximately 7% of the county's population. Native Americans compose approximately 1% of the county's population. Merced County is smaller than Stanislaus County (with a total population of 268,672 in 2016, a 5% increase from 2010); however, its population demographics are similar. As of 2015, approximately 61% of Merced County's population is white, though unlike Stanislaus County, approximately 56% of this population is of Hispanic or Latino origin. Approximately 7.5% of the county's population is Asian, while Native Americans compose approximately 0.7% of the county's population.

The cities within the East Stanislaus Region had all been experiencing extremely rapid growth within the last decade, with some slowing of the growth rate following the most recent economic downturn in 2008. As previously noted, Stanislaus and Merced Counties both had population increases of approximately 5% between 2010 and 2016, consistent with the 5% growth rate for the State as a whole over the same time period. Cities in the Region also experienced population growth during this timeframe. Modesto's population increased by 6%, Turlock's population increased by 23%, Waterford's population grew by 22%, and Ceres experienced a population increase of 31%. Hughson had the greatest percentage increase of 66%, from 3,980 people in 2000 to 6,640 people in 2010.

Agriculture is the primary industry in the East Stanislaus Region, except in urban centers (city limits). The region includes all or portions of five irrigation districts, providing water to over 300,000 acres. Figure 2-7 shows land uses in the East Stanislaus Region.

Figure 2-7: Land Use in the East Stanislaus Region



Disadvantaged Communities

The East Stanislaus Region is also home to many disadvantaged communities whose involvement in the IRWM process is essential. A Disadvantaged Community (DAC), according to the State of California (CWC, Section 79505.5(a)), is a community with a Median Household Income (MHI) less than 80 percent of the California statewide MHI. DWR compiled the U.S. Census Bureau's American Community Survey (ACS) data for the period of 2010 to 2014. Based on this data, a community with an MHI of $49,191 or less is considered a DAC. Figure 2-8 identifies the DACs in the Region based on U.S. Census ACS data. These data are available at three different geography levels: Census Designated Places, census block groups, and census tracts. DAC areas from each of the three geography types were combined to determine all the DAC area in the Region. Table 2-5 lists Census Designated Places in the Region that qualify as DACs, along with their associated MHIs. Of the Region's partner agencies, Modesto, Ceres, and Waterford are Census Designated Places that qualify as DACs. While Turlock and Hughson Census Designated Places are not DACs themselves, significant portions of each city are disadvantaged or severely disadvantaged. DACs comprise 53% of the Region by geographic area, and 74% of the Region by population. Severely disadvantaged communities (SDAC), those with MHIs less than 60% of the California Statewide MHI, exist in the Region as well. Figure 2-9 differentiates between DACs and SDACs, and SDACs are denoted in bold in Table 2-5. Involvement and participation by representatives of these communities during the East Stanislaus IRWM planning process was solicited and encouraged to help understand the issues confronted by DACs and to better address the needs of minority and/or low-income communities.

Figure 2-8: DACs Located in the East Stanislaus Region

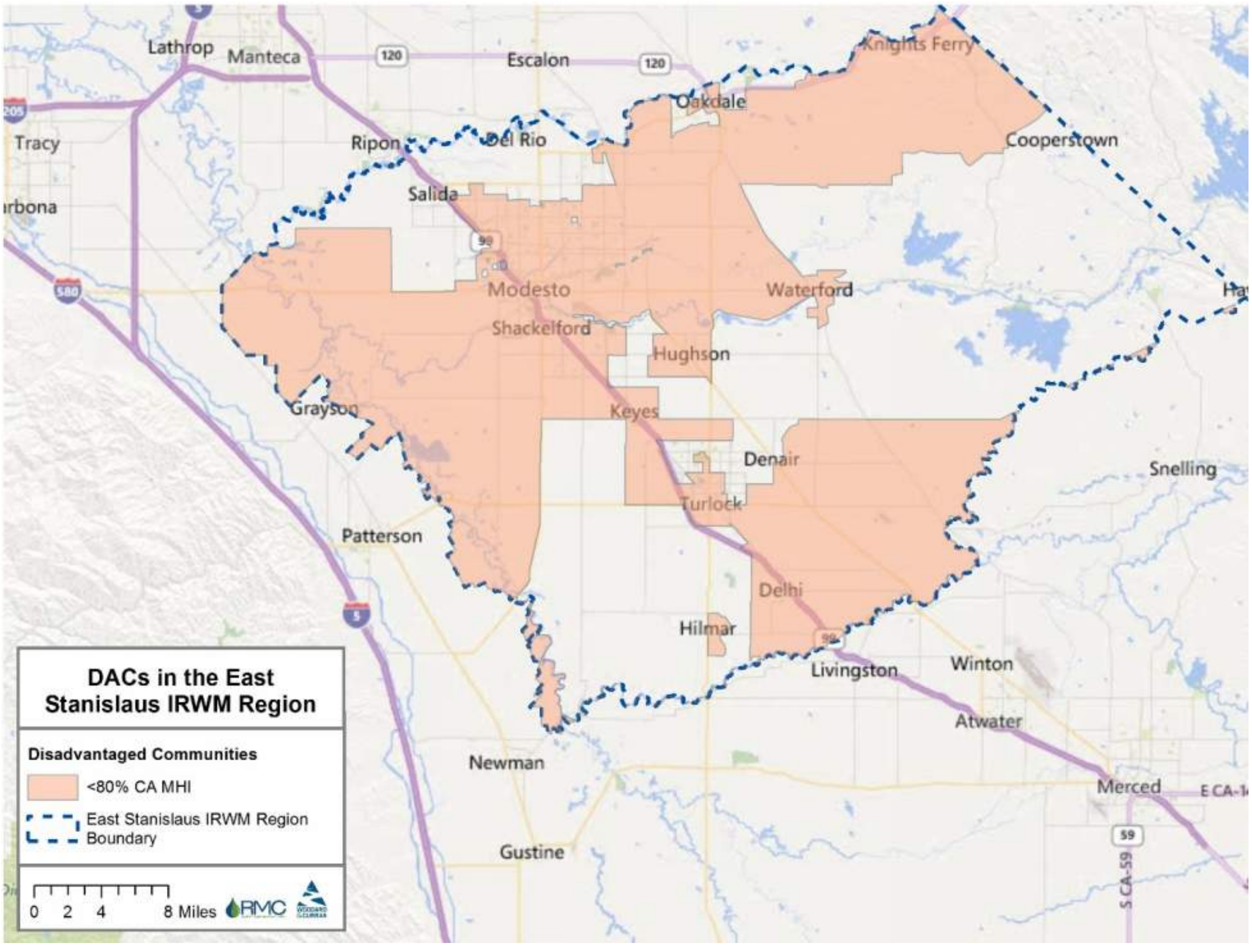


Figure 2-9: DACs and SDACs in the East Stanislaus Region

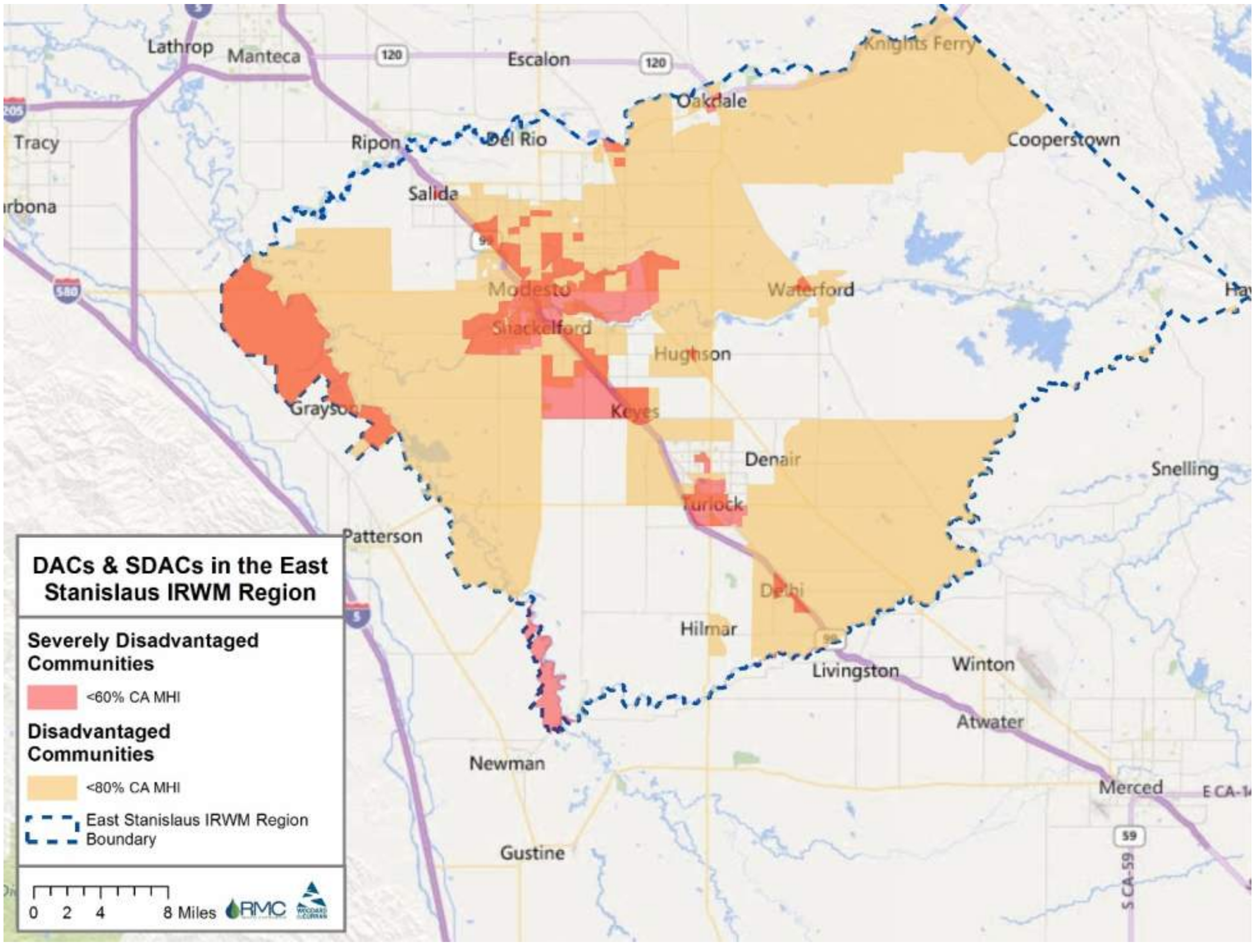


Table 2-5: DAC and SDAC Census Designated Places in the East Stanislaus Region

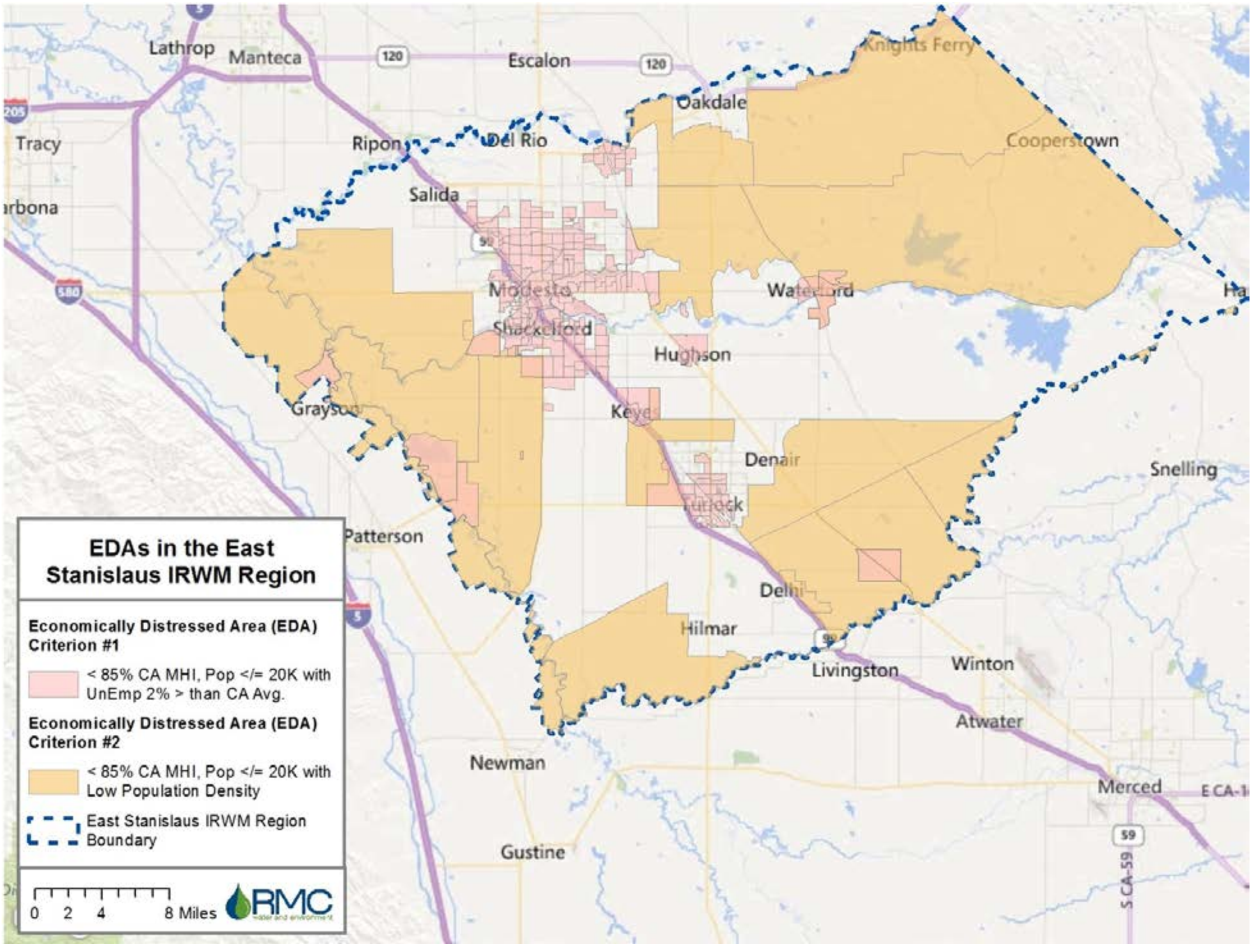
Census Designated Place[1]	MHI
Airport	**$21,607**
Ballico	$41,250
Bret Harte	**$28,279**
Bystrom	**$25,543**
Ceres	$46,132
Cowan	$37,656
Delhi	$46,224
Empire	**$31,446**
Grayson	**$28,068**
Hickman	$48,000
Keyes	$37,421
Modesto	$47,607
Monterey Park Tract[2]	$43,750
Parklawn	$42,105
Riverdale Park	**$26,838**
Waterford	$44,660
West Modesto	**$27,297**

[1] Data source: U.S. Census ACS data from 2010 to 2014, provided by DWR (http://www.water.ca.gov/irwm/grants/resources_dac.cfm).
[2] Data was obtained from the Stanislaus County Disadvantaged Unincorporated Communities Report. MHI data is from the 2010 census, and percent of CA MHI is calculated based on the 2010 Statewide MHI.
Bold rows indicate severely disadvantaged communities (less than 60% of CA Statewide MHI).

Economically Distressed Areas

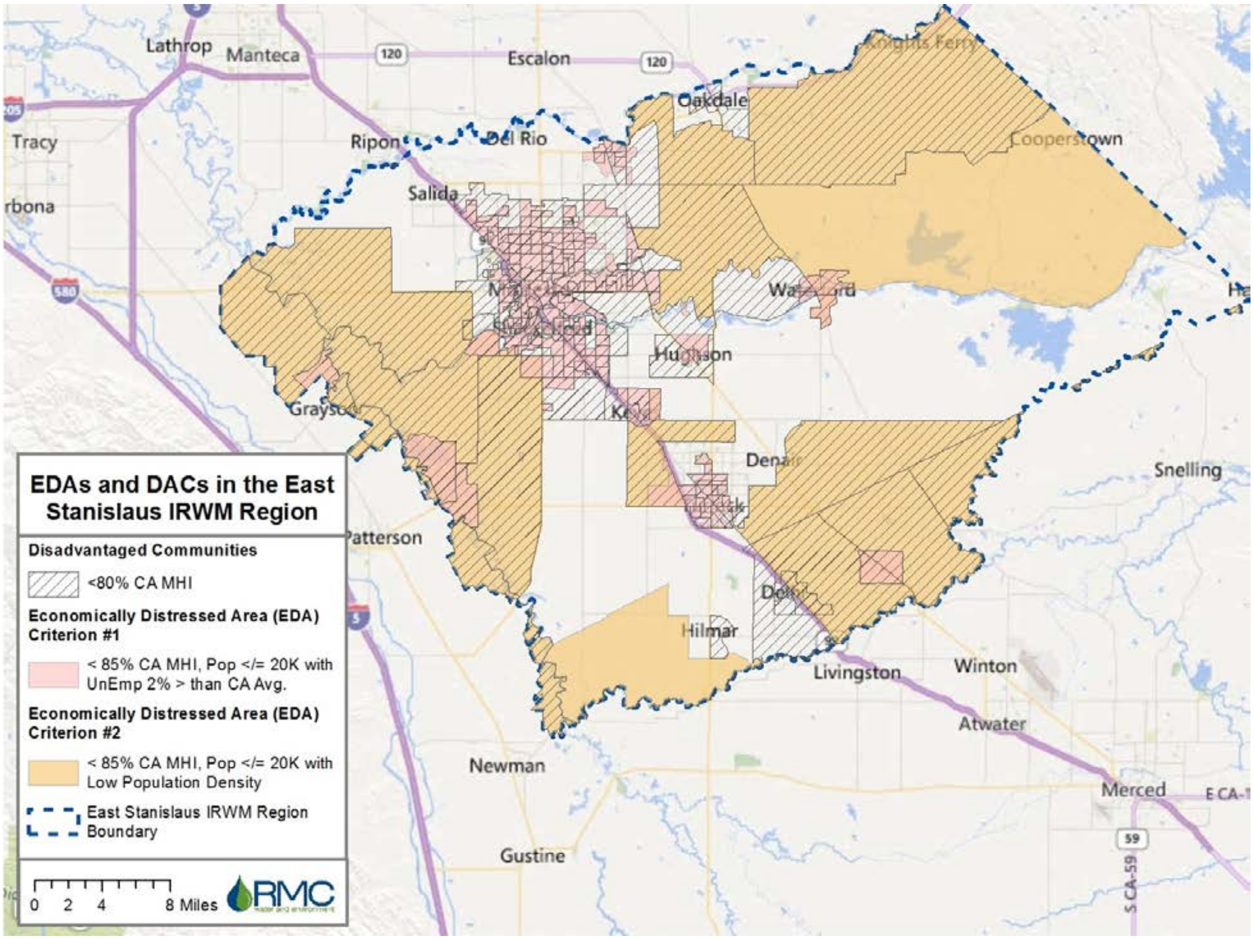
In addition to DACs, the East Stanislaus Region also contains areas that may be experiencing economic hardship, but do not fit the definition of a DAC. In an effort to capture these areas in the IRWM planning process, DWR has included a designation for Economically Distressed Areas (EDAs) in the 2016 Prop 1 IRWM Guidelines. An EDA is classified as a community with an annual MHI less than 85% of the California statewide MHI and that meets other criteria. An EDA must also have population of less than 20,000 people, and must either have an unemployment rate greater than 2% above the statewide average, or a low population density. Figure 2-10 shows the EDAs in the East Stanislaus Region. Approximately 52% of residents in the East Stanislaus Region live in EDAs (262,538 residents out of 502,340 total).

Figure 2-10. Economically Distressed Areas in the East Stanislaus Region



Together, EDAs and DACs cover much of the East Stanislaus Region, as shown in Figure 2-11. Approximately 69% of the Region includes DACs/EDAs by geographic area and 76% of the population in the Region live in communities classified as DACs or EDAs.

Figure 2-11. EDAs and DACs in the East Stanislaus IRWM Region



Native American Tribal Communities

As of January 2016, there were no federally-recognized Native American tribes in the East Stanislaus IRWM Region. This determination was made using spatial data of Indian lands provided by the Bureau of Indian Affairs (BIA), Pacific Region. No parcels of Indian land exist within the East Stanislaus IRWM Region. Subsequent communication with BIA staff indicated that no new tribal lands have been added in the IRWM Region since January 2016.

2.2 Water Resource Status

2.2.1 Water Supplies and Demands

The Cities of Modesto, Turlock, and Ceres have each prepared a 2015 Urban Water Management Plan (UWMP) as required by the Urban Water Management Planning Act. The City of Hughson is not considered an urban water supplier (as they deliver less than 3,000 AFY and have fewer than 3,000 connections) and therefore is not required to prepare an UWMP. The City of Waterford began delivering water to Waterford and Hickman in mid-2015, but did not prepare an UWMP as they currently have less than 3,000 customers and deliver less than 3,000 AFY (Shoreline, 2016), Stanislaus County did not prepare an UWMP as the County is not an urban water supplier.

The 2015 UWMPs prepared were updates to each city's 2010 UWMP and were prepared in compliance with the Urban Water Management Planning Act, which was originally established by Assembly Bill (AB) 797 in 1983. The law requires water suppliers who provide water to more than 3,000 customers or supply more than 3,000 AFY to prepare and adopt an UWMP every five years. In 2009, SB x7-7, also referred to as the Water Conservation Act of 2009, was passed which required each urban water supplier to include in the 2010 UWMP per capita water use targets to be met by 2015 and 2020. The statewide objective of SB x7-7 is to reduce per capita water use by the year 2020 by 20%. The cities each met their 2015 SB x7-7 targets and thus, the water demand projections each city developed for inclusion in its UWMP assume the 2020 urban water use targets will be met as well. Water supplies and demands for each city are described in the following sections. This section includes the demand information/projections that are currently available. Some water demands, such as the agricultural demands, are not currently publicly available and therefore are not included in this description.

It is worth noting that reducing dependence on the Delta is not applicable to the East Stanislaus IRWM Region; while upstream of the Delta, it does not rely on the Delta for water supplies.

City of Modesto

The City of Modesto is the largest retail water supplier in Stanislaus County and has been providing potable water service to its urban area since 1895 through the acquisition/purchase of multiple water companies. Until 1995, the sole water supply source was groundwater from the Modesto and Turlock Groundwater Subbasins.

In the early 1990s, the City of Modesto, MID, and the former Del Este Water Company formed a partnership to use a portion of MID's surface water supplies for municipal uses, resulting in the Modesto Domestic Water Project (MDWP). The MDWP includes a 30 mgd surface water treatment plant plus storage and delivery facilities. The surface water treatment plant, referred to as the Modesto Regional Water Treatment Plant (MRWTP), and the associated facilities were completed in January 1995 and the City started delivery of treated surface water in addition to groundwater. In July 1995, the City of Modesto acquired the Del Este Water Company.

The City of Modesto's service area includes one large contiguous area and several outlying, non-contiguous areas. The service area is shown in Figure 2-12. The contiguous portion of the service area consists of the City's current sphere of influence (SOI), Salida, North Ceres and some unincorporated Stanislaus County "islands." The non-contiguous portion of the service area includes Grayson, Del Rio, a part of north Ceres, and portions of Turlock.

Approximately 260,000 people within the service area receive water services from the City of Modesto. Historically, the City has been among the fastest growing areas in the State of California. Beginning in 2007, growth began slowing at a significant rate due to the economic downturn. Between 2010 and 2015, the City's growth rate was equal to about 0.6% per year. Some reduction in the service area population has occurred because Waterford and Hickman are no longer part of the City's service area. The 2015 Modesto UWMP assumes a growth rate of 1.3% in the majority of the service area, with an estimated population of 309,555 in 2030, much lower than the 375,000 that was predicted in 2010 (due to the higher growth rate assumed in 2010). Projected water demand is presented in Table 2-6.

Table 2-6: City of Modesto Projected Water Demand, AFY

2015 (actual)	2020	2025	2030	2035	2040
47,459	69,464	74,902	80,340	85,778	91,216

Source: West Yost, 2016a. Table 4-4.

As previously noted, the City of Modesto relies on conjunctive use to meet demands with its water supplies from two sources – groundwater and treated Tuolumne River surface water that is purchased wholesale from MID. Groundwater and surface water will continue to be the primary sources of water for the City, and although the City is pursuing recycled water, it would be to provide a more reliable and cost-effective water supply for agricultural use rather than to act as a potable water offset. The MRWTP provides water to municipal customers within the City of Modesto city limits north of the Tuolumne River, including the communities of Salida and Empire, while the customers south of Tuolumne River in the TID service area are served by groundwater from both north and south of the river.

In 2015, the City of Modesto pumped 32,058 AF, with groundwater constituting 67% of the City's total water supply. In the future, groundwater pumping is expected to be reduced with the expansion of surface water supplies due to the implementation of the MRWTP Phase 2, which was completed in 2016. Prior to 2010, the City of Modesto had 33,602 AFY in available treated surface water supplies from MID. In 2010, the City purchased 30,647 AFY of additional surface water from MID. Phase 2 of the MRWTP was completed in June 2016; with this project, available treated surface water from MID increased to 67,204 AFY, adding to the City of Modesto's water supply and replacing some groundwater pumping. Anticipated future water supplies are shown in Table 2-7.

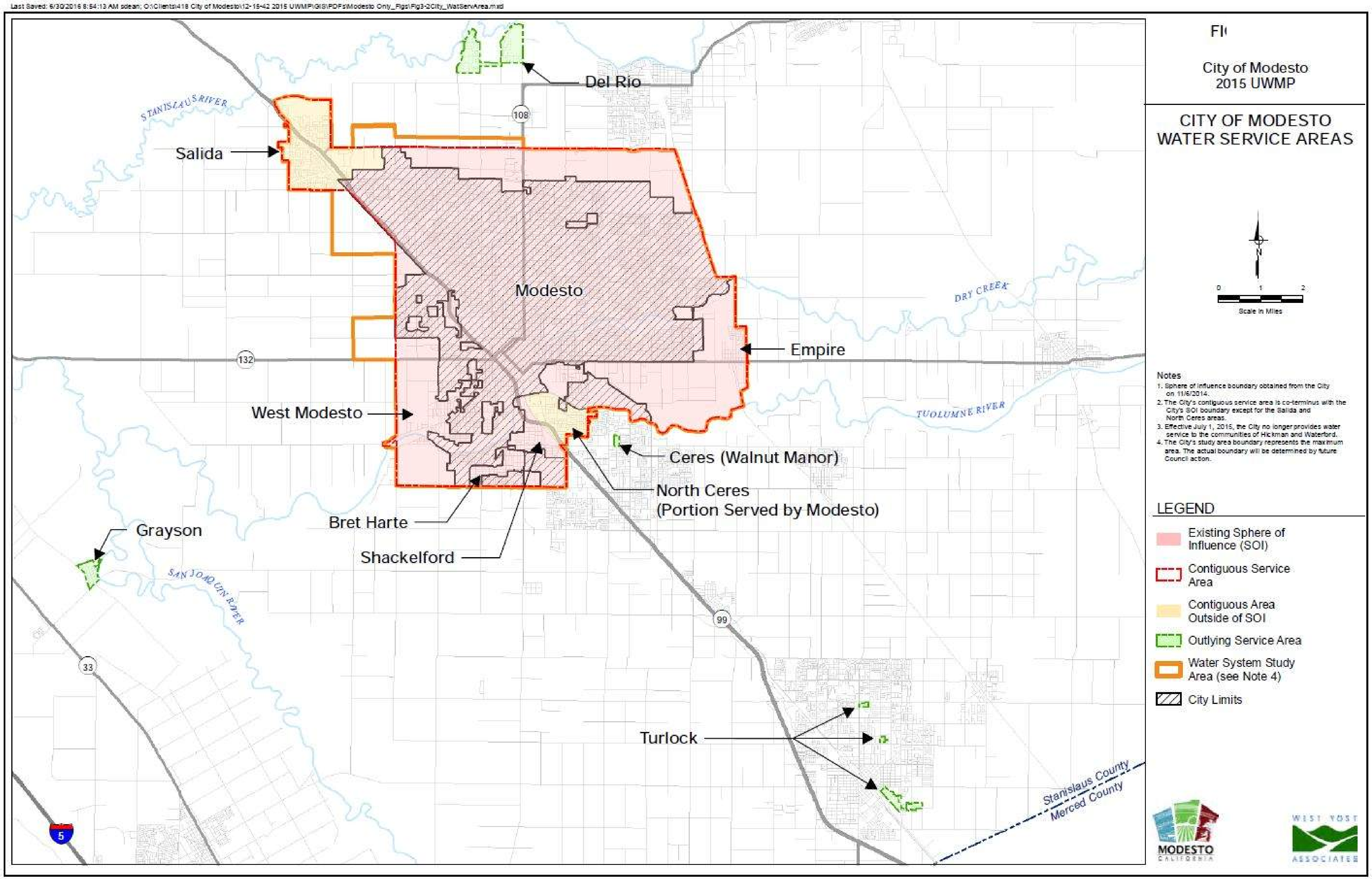
Table 2-7: City of Modesto Current and Future Water Supplies, AFY

Supply	2015 (actual)	2020 [a]	2025	2030	2035	2040
Surface Water (Purchased from MID)	15,401	44,800	48,533	52,267	56,000	59,733
Groundwater	32,058	24,664	26,369	28,073	29,778	31,483
Total	47,459	69,464	74,902	80,340	85,778	91,216

Source: West Yost, 2016a. Table 6-20.
Footnotes:
a. As of June 2016, when the MRWTP Phase 2 was completed, an additional 33,602 AFY of surface water supplies will be available to the City.

The City of Modesto has adequate water supplies to meet projected water demands through 2040 during all hydrologic conditions. Other water supply options (such as desalination) for the City of Modesto are not necessary nor are they economical (West Yost, 2016a).

Figure 2-12: City of Modesto Water Service Area



Source: West Yost, 2016a.

Modesto Irrigation District

In 1887, MID was formed as the second irrigation district in California (after TID), and predominantly provides agricultural irrigation water from the Tuolumne River and the underlying groundwater basin. Surface water is diverted from the Tuolumne River at La Grange Dam, constructed in 1893 to divert water to MID north of the river and to TID south of the river. Don Pedro Reservoir (located just two miles east of the East Stanislaus Region) is the District's primary water storage facility, while Modesto Reservoir is a small holding reservoir. The MID service area is shown in Figure 2-13.

MID is primarily an agricultural water supplier and provides irrigation water to 57,000 acres, typically between mid-March and late October each year. MID can also serve approximately 9,000 acres of additional lands based on customer demands. This water is used for dairy, chickens, turkeys, cattle, almonds, grapes, walnuts, tomatoes and peaches. In summary, MID serves approximately 3,100 irrigation accounts with an average of 20 acres per account. As previously noted, MID also provides treated surface water to the City of Modesto for domestic delivery, but it does not directly serve any domestic water users. In 1992, when MID, the City of Modesto, and the former Del Este Water Company formed a partnership, the agencies signed the *Treatment and Delivery Agreement Among the Modesto Irrigation District, City of Modesto, and Del Este Water Company* which controlled the delivery of domestic treated water from MID to the City of Modesto. This agreement obligated MID to deliver up to 33,602 AFY (30 mgd) to the City of Modesto each year (May 1st through April 30th), during normal years. The agreement contains a formula to determine reductions of water supplies during dry years. In September 2005, the SWRCB approved a long-term transfer of 67,204 AFY of water from MID to the City of Modesto through the year 2054. In October 2005, the original 1992 agreement was amended to include the second phase of the MRWTP (an additional 30 mgd) (West Yost, 2011b).

MID distributes a combination of Tuolumne River water and groundwater via a network of storage facilities, canals, pipelines, pumps, drainage facilities and control structures. The District operates approximately 93 groundwater wells with a combined pumping capacity of approximately 250 cfs (Provost & Pritchard, 2015). MID, in conjunction with TID, also operates the New Don Pedro Reservoir with a maximum storage capacity of 2,030,000 AF. Together, the irrigation districts are responsible for maintaining regulated fish flows in the Tuolumne River to comply with FERC licensing requirements. MID's median annual diversion from 2003 to 2012 was 294,000 AF (Provost & Pritchard, 2015). Of that amount, approximately 32,900 AF is diverted to the MRWTP for treatment and delivery to the City of Modesto (Provost & Pritchard, 2015).

The MID on-farm water delivery system was originally designed to deliver irrigation water by gravity, with very large flows (10-20 cfs) on a predetermined rotation (typically every 10-20 days). However, as irrigators have converted their on-farm application practices from flood to pressurized systems, the requests for irrigation water have shifted from rotation to arranged-demand (Provost & Pritchard, 2015). MID has an irrigation water allocation policy which established the allocation and cost of water to landowners. Factors affecting water allocation include land within the service area, reservoir storage, riparian rights, water year type, amount of land owned, and predicted runoff (MID, 2012). MID uses a variety of devices and methods to measure water within its delivery system (including orifices, propeller meters, weirs, flumes, venture meters and pumps), and it has a water rate schedule based on budget requirements and board policy. MID's water rates are an increasing block rate (tiered) pricing structure, with a fixed charge based on acreage and block rates for users who exceed the base amount of allocated water. Prior to 2015 the block rate structure was established annually; however, beginning in 2015, the same block rates will be used for multiple years in a row (Provost & Pritchard, 2015).

As the developed areas of the City of Modesto and other communities within the MID service area expand, irrigated land types are shifting from annual to permanent crops or are being replaced by urban land uses. This continuing shift in land uses drives projected changes in water use. MID delivered 30,034 AF of treated water to the City of Modesto in 2009 (MID, 2012). Modesto's 2015 UWMP projects that this supply will increase gradually, with 44,800 AF of projected deliveries in 2020, and 59,700 AF by 2040 (West Yost, 2016a). By 2050, the City projects water demands to reach 67,200 AFY (West Yost, 2017). Future changes in agricultural water use will be driven by changes in cropping, irrigation practices, climate change and fluctuations in Tuolumne River hydrology. Although the irrigated area within the MID service area is expected to remain relatively stable, changes in the availability of surface water will continue to include the annual allocation of water (Provost & Pritchard, 2015).

City of Turlock

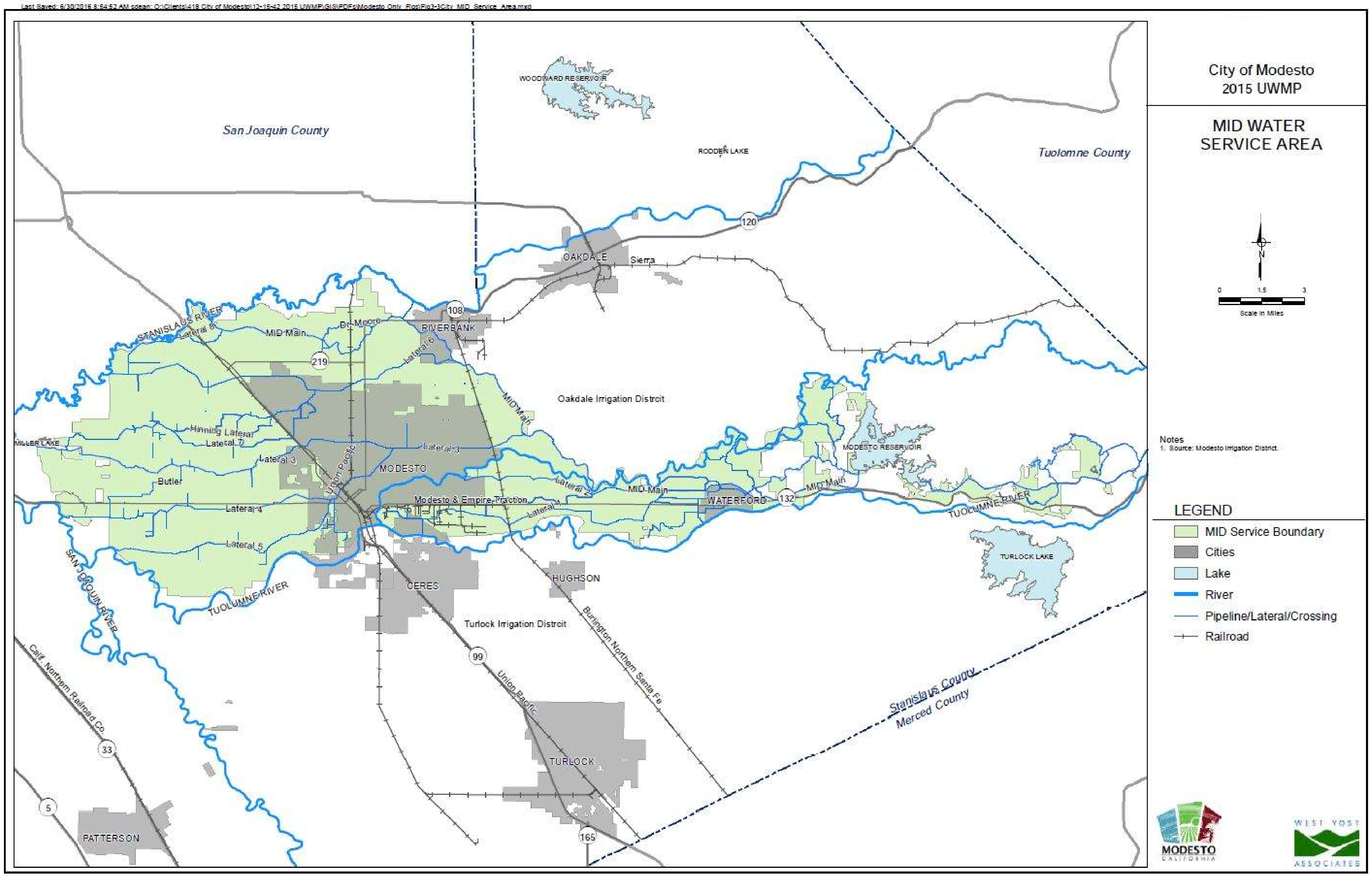
The City of Turlock is the second largest city in Stanislaus County, situated midway between Modesto (to the northwest) and Merced (to the southeast). The City of Turlock's population has grown steadily from 13,992 in 1970 to 71,043 in 2015. The City provides water to its service area through about 18,500 service connections. Turlock began installing water meters in 2007, and meter-based (i.e. volumetric) billing for all water users began on January 1, 2011. With the installation of water meters and volumetric billing, the recent drought, and the education/outreach efforts the City has implemented, there has been a significant reduction in water use. The City of Turlock's peak water use occurred in 2007 at 25,652 AF; in 2015 water use decreased to 17,416 AF.

The City of Turlock overlies the Turlock Groundwater Subbasin, a subbasin of the San Joaquin Valley Groundwater Basin. DWR's Bulletin 118 estimated a 160,000 AF increase of groundwater overdraft in this subbasin from 1990 to 1995, but from 1994 to 2000, groundwater water levels in the Turlock Subbasin rose about seven feet. The rising groundwater levels suggested that the groundwater basin had started to recover, but again, beginning in 2000, groundwater production increased, reaching its peak in 2007 when 8.359 billion gallons were pumped. Combined with below average rainfall, increased agricultural pumping and urbanization, groundwater pumping for urban water has adversely impacted groundwater levels. Conservation efforts and increased rainfall have helped the groundwater basin to begin recovering once again. The groundwater basin is not currently on the list of critically overdrafted basins (DWR, 2016b).

Groundwater is an unreliable water supply source for the City of Turlock in the long-term because the quantity that can be pumped depends on the amount available in the groundwater basin, the ability of the City's wells to pump, and pumping by other users. There is a significant cone of depression about five miles east of Turlock due to agricultural pumping; but even so, overdraft conditions have not occurred under the City of Turlock.

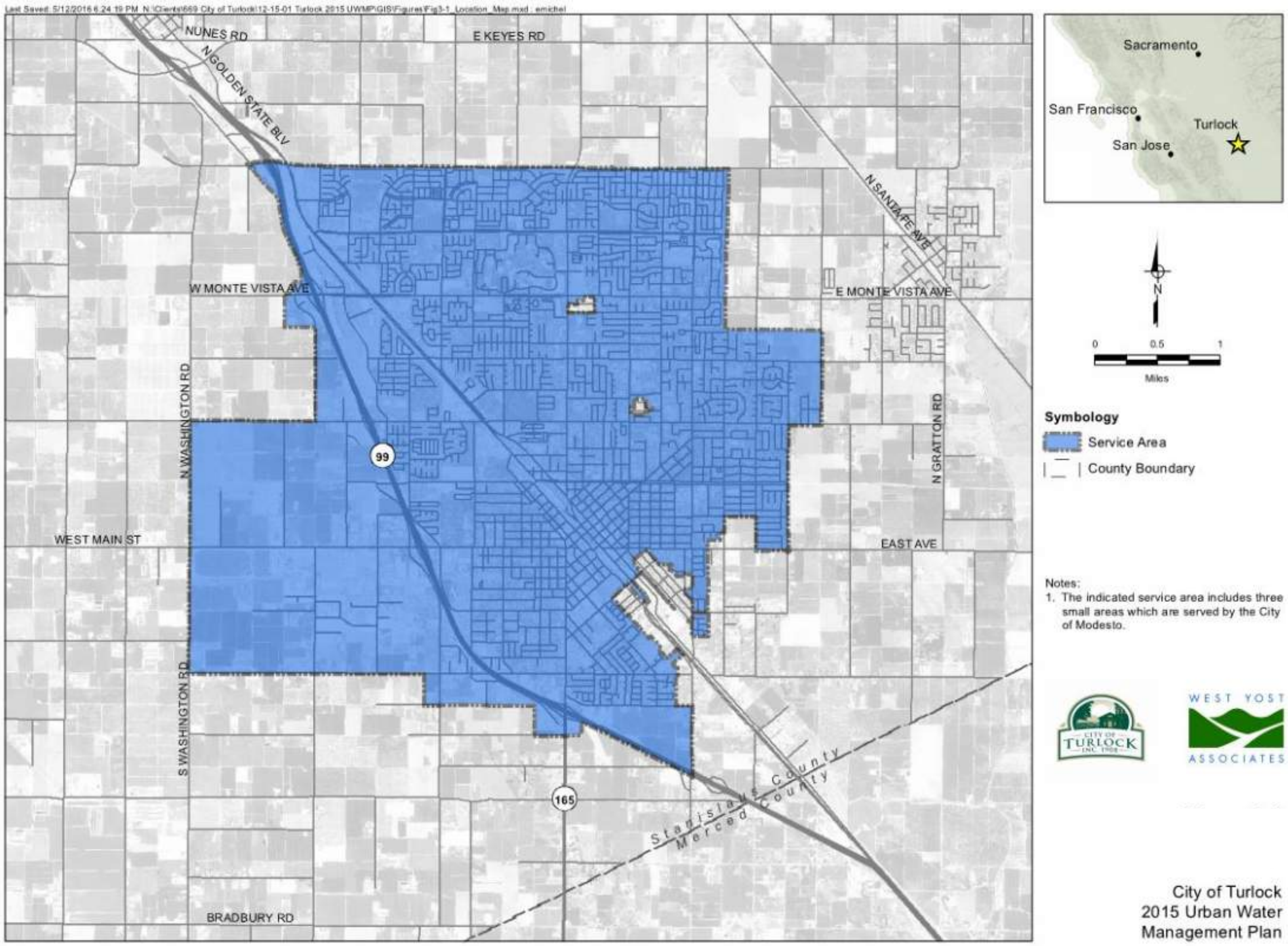
The City of Turlock's sole water supply is groundwater, and it anticipates meeting all water demands in its service area in the next five years with groundwater and supplementing supplies (recycled and non-potable water) as needed. As previously discussed, the City's wastewater treatment facility was upgraded to tertiary treatment in 2006, and the City is permitted to use the recycled water for industrial cooling and landscape irrigation at Pedretti Baseball Park. Water extracted from the shallow groundwater aquifer typically does not meet drinking water standards, but it can be used for landscape irrigation. Also, the City uses excess runoff from residential watering to supply irrigation water to Summerfaire Park. Potable water from the groundwater basin can support annual production of up to 8 billion gallons per year.

Figure 2-13: MID Service Area



Source: West Yost, 2016a.

Figure 2-14: City of Turlock Water Service Area



Source: West Yost, 2016b.

A population growth rate of 2.15% was used to estimate future water demand in the City of Turlock's service area in its 2015 UWMP. The demand projections are based on the preferred land use plan outlined in the Draft *2030 City of Turlock General Plan Update*. Table 2-8 presents current and projected future water demands for the City of Turlock.

Table 2-8: City of Turlock Water Demand, AFY [a]

2015 (actual)	2020	2025	2030	2035	2040
17,416	25,969	28,829	32,015	35,556	39,497

Source: West Yost, 2016b. Tables 4-5 and 4-5.
Footnotes:
a. Does not include recycled water Turlock delivers to TID for industrial cooling or recycled water used for irrigation.

As a member of the SWRA, the City of Turlock has entered into a water sales agreement with TID for delivery of 16,802 AFY of TID surface water to the City. TID has acknowledged that this volume of water is available and, for planning purposes, it expected to be available in 2020. Therefore, current and future water supplies for the City of Turlock are shown in Table 2-9.

Table 2-9: Current and Projected Water Supplies, AFY

Water Supply Source	2015	2020	2025	2030	2035	2040
Water Purchased from TID [a]	0	16,802	16,802	16,802	16,802	16,802
Groundwater	17,416	9,167	12,027	15,212	18,754	22,694
Recycled Water	1,105	1,501	1,900	2,296	2,296	2,296
Total	18,521	27,470	30,729	34,310	37,852	41,792

Source: West Yost, 2016b. Tables 6-10 and 6-11.
Footnotes:
a. Assumes the TID's surface water treatment plant (the RSWSP) will be operational in 2020.

Turlock Irrigation District

TID was established in 1887 as the first publicly owned irrigation district in the State. Organized under the Wright Act, the District operates under provisions of the CWC as a special district. At present, TID covers a service area of 197,261 gross acres, with 157,800 acres that can currently be irrigated with surface water (TID, 2015). TID services over 4,900 irrigation customers, with irrigation water used to grow alfalfa, almonds, beans, corn, grapes, grain, oats, peaches, sweet potatoes and walnuts. The Tuolumne River is the District's primary source of water. Water for irrigation and hydroelectric power generation is kept at Don Pedro Reservoir, about 50 miles east of the Turlock (approximately two miles east of the East Stanislaus Region regional boundary).

The TID irrigation service area is generally bounded on the north by the Tuolumne River, on the south by the Merced River, and on the west by the San Joaquin River. The communities of Turlock, Ceres, Keyes, Denair, Hughson, Delhi, South Modesto, Hickman, and Hilmar are within the boundaries of the TID irrigation service area. As previously noted, the Tuolumne River is the principal water supply for TID, although the irrigation district does supplement surface water supplies with drainage wells and rented wells and jointly operates New Don Pedro Reservoir with MID. Rented wells are private or Improvement District wells that are rented by TID to supplement irrigation supplies, especially in dry years (TID, 2015).

In addition to La Grange Dam (the District's diversion dam) and Don Pedro Reservoir (its storage reservoir), TID owns and maintains more than 250 miles of canals and laterals, about 90% of which are concrete-lined to curb seepage and erosion. TID typically delivers irrigation water between mid-March and mid-October of each year. Customers irrigate their lands through a variety of means, including flood irrigation, drip and micro systems.

TID works cooperatively with other local agencies to promote the long-term sustainability of its water supplies. TID actively manages its groundwater supplies conjunctively with its surface water supplies, and participates in local groundwater management and planning. The irrigation district has a long-standing program of groundwater level monitoring and cooperates with other state and local entities to monitor the larger Turlock Subbasin area. TID is a member of the Turlock Groundwater Basin Association (TGBA) and has adopted a Groundwater Management Plan.

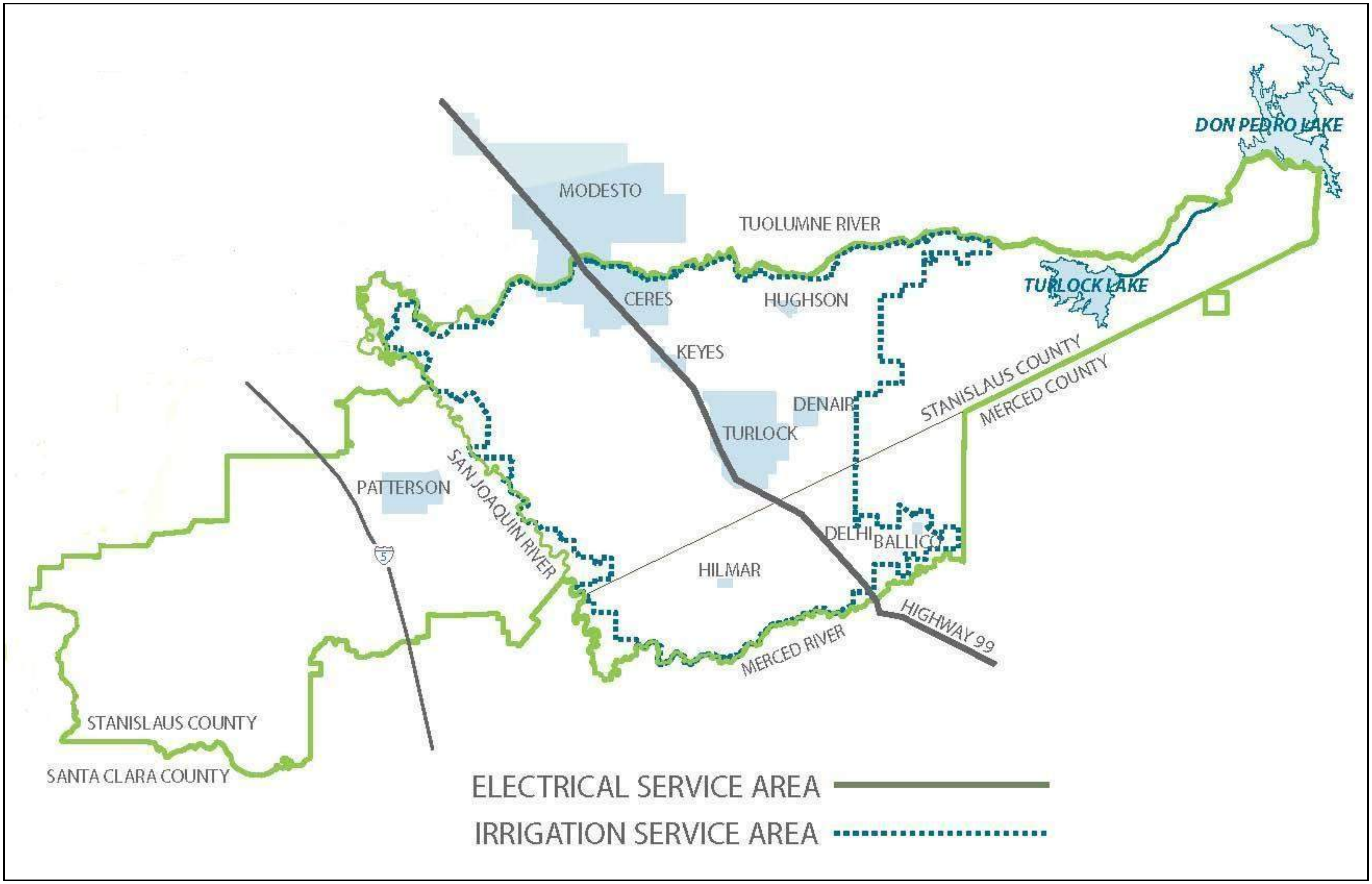
In 1996, TID was one of the first to develop an Agricultural Water Management Plan (AWMP) as a member of the Agricultural Water Management Council (AWMC), a non-profit organization consisting of water suppliers, public agencies, and members of the farming, academic and environmental communities. In compliance with new laws regarding Agricultural Water Management Planning, TID adopted an updated AWMP at the end of 2012 and remains committed to developing and implementing sound planning practices through its AWMP and to continue support agricultural irrigation efficiency.

TID uses a restricted arranged demand system of water ordering and delivery. Water deliveries are measured by a combination of Supervisory Control and Data Acquisition (SCADA), pressure transducers, sidegates, velocity meters, and electrical usage data. The TID Board of Directors establishes baseline water allotments each year, depending on projected runoff and including the possibility of the occurrence of consecutive dry years, carryover storage, flows required to be delivered to the lower Tuolumne River, and the availability of rented pumps. In addition, in 2012 the TID Board of Directors adopted a new volumetric pricing structure which utilizes a four-tiered increasing block rate structure combined with a fixed charge (TID, 2015).

Over the years, several local community water systems, including those in Hughson, Ceres, Turlock and the southern portion of Modesto, have studied the possibility of using TID surface water from the Tuolumne River to supplement urban groundwater supplies. While such a project would be within current irrigation boundaries, it would result in resumed water service to those areas (TID, 2015). With the implementation of the RSWSP, Turlock and Ceres will begin receiving water from TID.

From 2010 to 2014, total TID water supply averaged about 604,000 AF, approximately 75% from surface water, 22% from groundwater and 3% from other supplies such as subsurface drainage, tailwater, spill recovery, and recycled wastewater (TID, 2015).

Figure 2-15: TID Service Area



City of Ceres

The City of Ceres provides water to almost all residential, commercial, industrial and institutional (CII) users, and governmental water users within its city limits. The City of Ceres water service area is concurrent with the city limits, except in the northwest portion of the city where the City of Modesto serves water to approximately 1,200 customers. The City of Ceres also serves some customers outside its city limit, but within its primary SOI. The City's water service area is shown in Figure 2-16.

Since 1992, the City of Ceres has been installing water meters on all new residential units. In 2012, the City completed installation of meters on pre-1992 residential connection, multi-family housing, and CII users, and established rates for volumetric billing. Additionally, the City installed an Advanced Metering Infrastructure (AMI) system which includes fixed infrastructure to collect meter information. A metered rate structure was implemented to encourage conservation of water. The City of Ceres' future water demands are driven by compliance with SBx7-7 and the associated urban water use reductions. The City's projected water demands are presented in Table 2-10.

Table 2-10: City of Ceres Projected Water Demands, AFY

2015 (actual)	2020	2025	2030	2035
6,460	10,756	13,015	15,262	18,432

Source: City of Ceres, 2016a. Table 4-5.

The City of Ceres' sole water supply source is groundwater pumped from the Turlock Subbasin. Since 1980, the City of Ceres' groundwater production has increased from 3,300 AFY to approximately 10,000 AFY by the mid-2000's. Groundwater production since 2010 has remained near 8,000 AFY. Anticipated future water supplies are presented in Table 2-11. Non-potable groundwater is also pumped from shallow wells and used to irrigate several parks within the City. The non-potable water that is pumped is not included in the groundwater estimates in Table 2-11.

The City of Ceres is a member of the Stanislaus Regional Water Authority (SRWA) and is working with TID to implement the Regional Surface Water Supply Project (RSWSP) and supplement its current water supply with surface water. The City of Ceres future water supplies, shown below, assume the RSWSP is completed in 2020 and will supply the City with an additional 5 mgd.

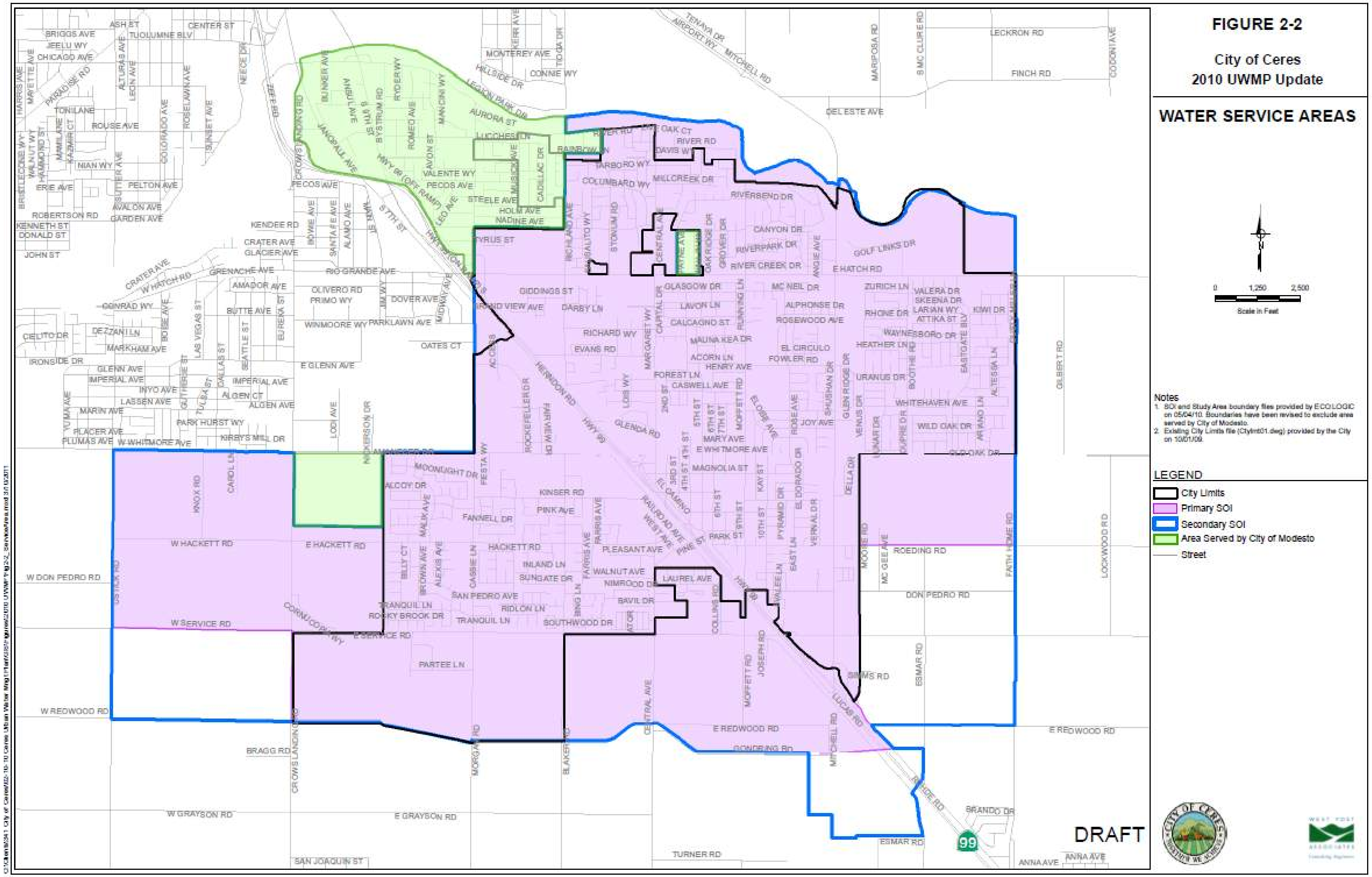
Table 2-11: City of Ceres Future Water Supplies, AFY

Supply Source	2015 (actual)	2020	2025	2030	2035
Groundwater [a]	6,632	5,156	7,414	9,661	12,831
TID Surface Water [b]	0	5,601	5,601	5,601	5,601
Total	6,632	10,756	13,015	15,262	18,432

Source: City of Ceres, 2016a. Table 6-10 and 6-11.
Footnotes:

a. Groundwater quantity calculated by subtracting future water demand from surface water supply amount.
b. The RSWSP is anticipated to be operational by 2020. 5,600 AFY will be provided to the City of Ceres.

Figure 2-16: City of Ceres Water Service Area



Source: West Yost, 2011a.

The City of Ceres' sole source of water supply is groundwater which is vulnerable to climatic variability and water quality issues. The primary sources of groundwater recharge in the Turlock Subbasin are infiltration from the Tuolumne River and incidental recharge from applied irrigation water. Drought conditions can reduce groundwater recharge and during a multi-year drought, groundwater levels can decline. By diversifying the City's water supply portfolio and adding a second source of water, surface water from the RSWSP, overall water supply reliability will increase. The addition of surface water to the City's supply portfolio will help protect the groundwater basin from overdraft and water quality degradation. Surface water is expected to be even more vulnerable to climatic variations than groundwater, so the City of Ceres' water supply projections presented in Table 2-11 assume groundwater will continue to be the primary source of water (Ceres, 2016a).

City of Hughson

The City of Hughson provides potable water services to residential and CII customers in its service area. Currently, the sole water supply source for the City is groundwater extracted from the Turlock Subbasin using three groundwater wells. The City's existing water distribution system and water facilities are shown in Figure 2-17. Water is distributed to its customers through 20 miles of pressurized pipe. The City's three wells each have a minimum capacity of 1,000 gpm, up to a maximum of 1,200 gpm. The combined well capacity is 5.0 mgd, which is adequate to meet estimated future water demands under most scenarios. In January 2007, the City of Hughson prepared a *Water System Master Plan* (Carollo, 2007a) with the purpose of effectively planning for future growth and identified Capital Improvement Program (CIP).

The annual water production in 2016 for the City of Hughson service area was 398 MG or 1.0 mgd. This equates to an average daily per capita water use of about 155 gallons per capita per day (gpcd) (J. French, email communication, June 30, 2017). The City of Hughson's future water demands are shown below in Table 2-12. These demands are estimated based on the general plan land use and applied water demand factors. The City's updated General Plan was adopted in December 2005 and defines the City's land use plan at build out. Population is expected to increase from 7,100 (in 2016) to 11,000 (at build out in 2025), equating to an annual increase of 6.1%.

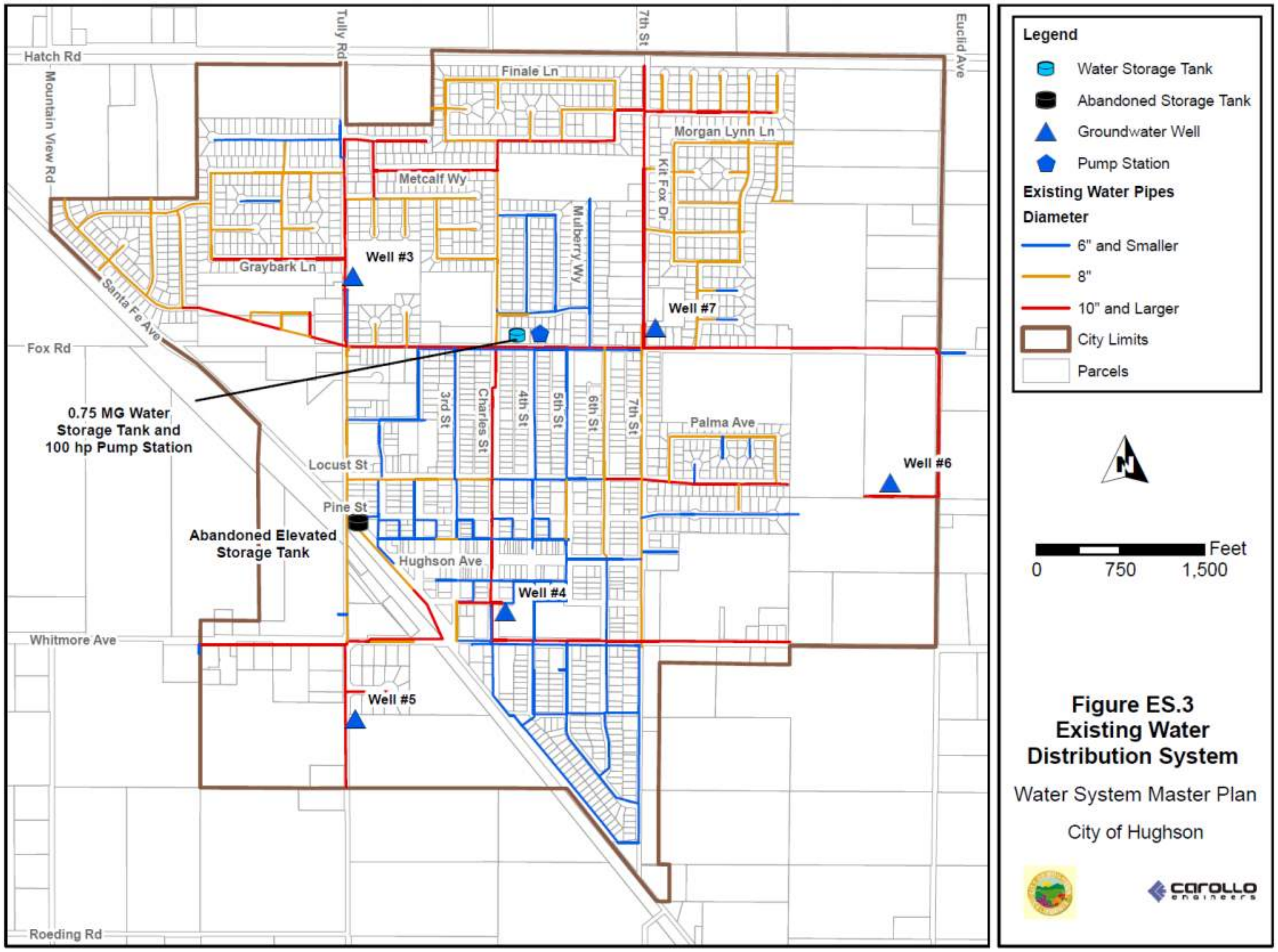
The City of Hughson executed a Funding Agreement with the SWRCB in May 2017 for the Well No. 7 Replacement Project. The project will include the re-drilling of an existing (currently offline) well and construction of a new well. These two wells will be connected to a central arsenic treatment facility and 1.0 MG storage/blending tank. This project will provide adequate water for future growth and ensure redundancy in the City's water system.

Table 2-12: City of Hughson Water Demand, AFY

2010	2015	2020	2025	2030
2,466	1,232	1,680	2,240	2,800

Source: J. French, email communication, June 30, 2017.

Figure 2-17: City of Hughson Water Service Area and Facilities



Note: Well #5 and Well #7 are no longer in use. Source: Carollo, 2007a

City of Waterford

The City of Waterford is located due east of Modesto, immediately north of the Tuolumne River. Waterford serves three separate areas: River Pointe, Waterford, and Hickman (Figure 2-18). The Waterford and Hickman systems were previously owned by the City of Modesto; in 2015, they were acquired by Waterford. The three water systems are hydraulically independent, and all solely dependent on groundwater.

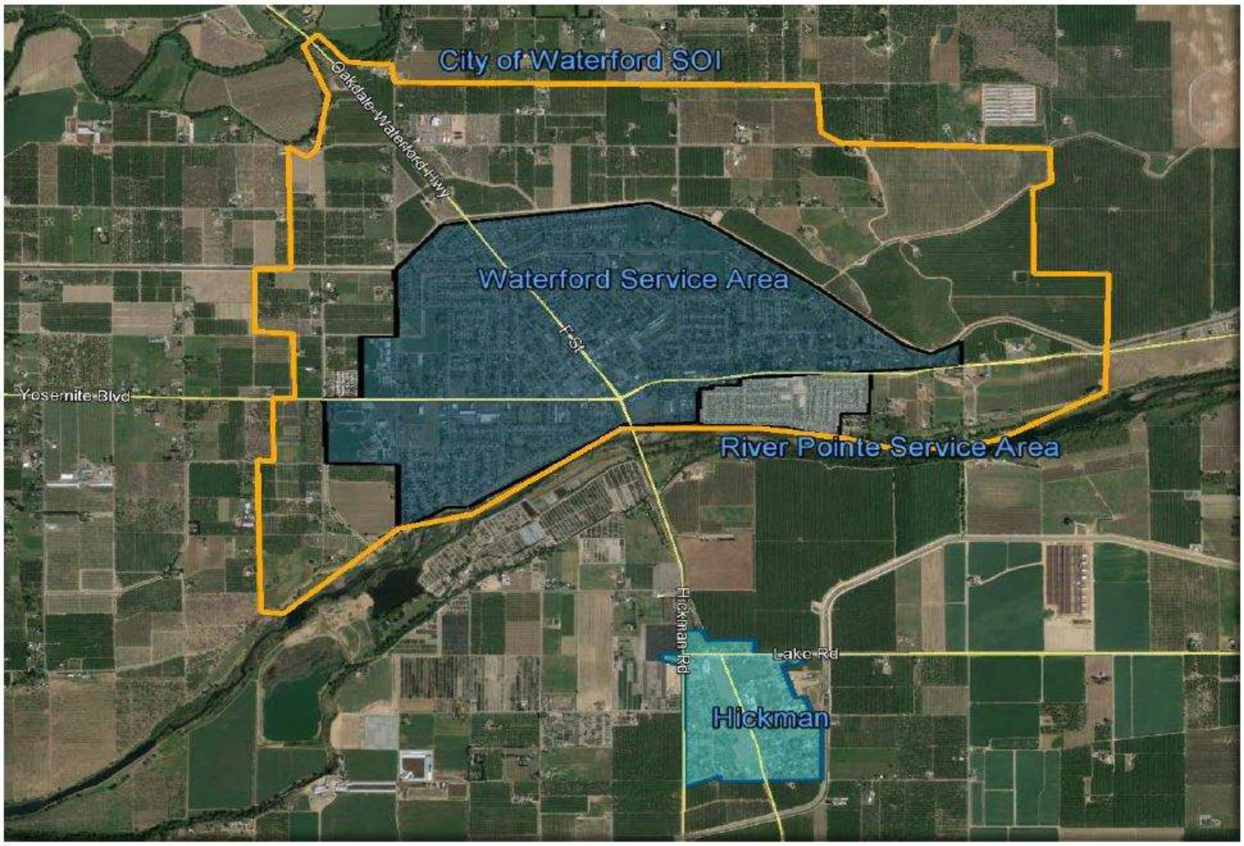
The River Pointe service area encompasses a new development with approximately 330 connections. The system includes two wells, a manganese removal facility, two 100,000-gallon storage tanks, and booster pumps. The water production capacity currently exceeds the demands of the service area (Shoreline, 2016).

The Waterford service area system provides water for residential and commercial use. It is supplied by six wells and approximately 17 miles of distribution pipelines. In total, the system serves approximately 2,260 connections. Comprehensive water meter installation was completed in the area in 2014. The Waterford system currently has no storage, and comprises a single pressure zone (Shoreline, 2016).

The Hickman water system is geographically separated from the Waterford and River Pointe systems and lies south of the Tuolumne River. The system includes less than 200 service connections, with 11 of these being commercial (Shoreline, 2016). The system is fed by two wells with a total production capacity of 600 gpm. One of the two wells (Well 272) cannot meet peak system demands on its own. Additionally, the system is currently unable to provide adequate fire suppression flow even with both wells in operation (Shoreline, 2016).

The average demand for Waterford (including all three systems) was calculated to be 1,412 AFY (Shoreline, 2016). In 2070, this demand is predicted to rise to approximately 4,500 AFY (Shoreline, 2016). Historically, average water use in Waterford has been 210 gpcd. Although Waterford is not yet required to prepare a UWMP, they anticipate preparing UWMPs in the future as growth occurs in the area. Therefore Waterford's 2016 Water Master Plan included selection of a target demand factor for compliance with SB x7-7. Based on SB x7-7 calculation methods, Waterford's target would be set at approximately 165 gpcd; however, Waterford projects an average day demand of only 145 gpcd in the future – well below the target

Figure 2-18. City of Waterford Water Service Area



City of Riverbank

The City of Riverbank is located approximately halfway between Modesto and Oakdale, adjacent to and south of the Stanislaus River. The City provides potable water to residential, commercial, and institutional users within the City limits. The City also provides water to several residential locations and complexes outside of the city limits, but within its SOI. Figure 2-19 shows the city limits, SOI, General Plan boundary, and water system components.

Water is pumped from ten city wells and distributed through 44 miles of pipeline. The total production capacity of the existing groundwater wells is approximately 10,800 gpm, with approximately 3,800 AF pumped in 2015 (Kjeldsen, Sinnock, & Neudeck, Inc., 2016). Riverbank is situated above the Modesto Groundwater Subbasin. Groundwater pumping from the basin averaged roughly 4,200 AFY.

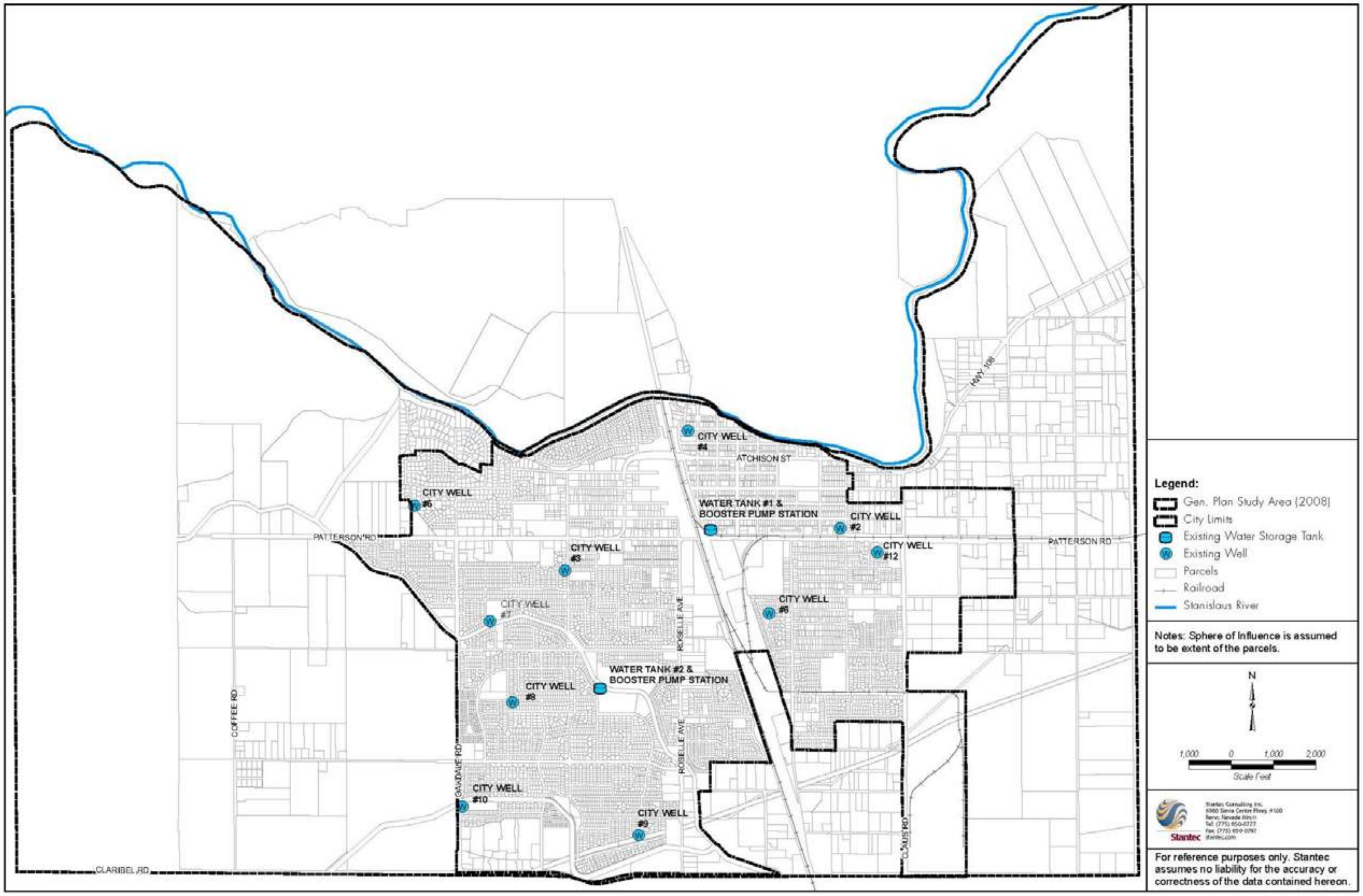
Water demand in Riverbank for 2015 was 147 gpcd, which met the Sbx7-7 targeted reduction for Riverbank. Projected citywide demands are shown in Table 2-13. Demands were estimated using a linear growth projection consistent with historical population growth. Residential usage represents approximately 90% of the total usage, with the remaining 10% falling into CII and other use categories. Population in Riverbank is expected to increase to approximately 31,000 by 2035, a 31% increase from 2015.

Table 2-13: City of Riverbank Water Demand, AFY

2015	2020	2025	2030	2035
3,878	4,165	4,475	4,786	5,096

Source: (Kjeldsen, Sinnock, & Neudeck, Inc., 2016)

Figure 2-19: City of Riverbank Existing Water Supply Facilities



Oakdale Irrigation District

OID is located in Stanislaus and San Joaquin Counties, on the eastern side of the region. Approximately three-fifths of OID's service area lies south of the Stanislaus River and overlies the Modesto Groundwater Subbasin; this area is within the East Stanislaus IRWM Region. The remaining two-fifths of the service area lies north of the Stanislaus River, overlying the Eastern San Joaquin Groundwater Subbasin.

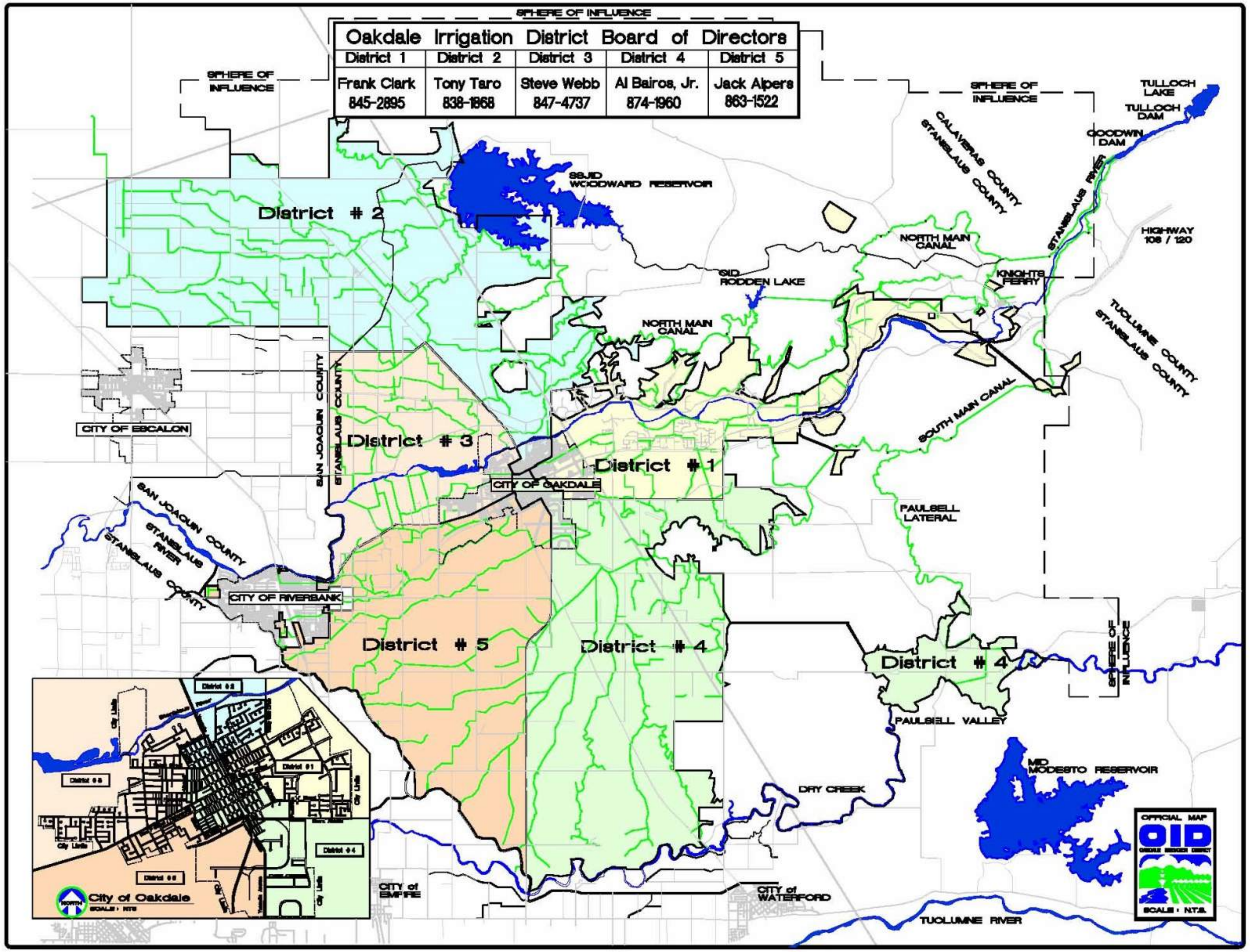
OID was formed in 1909 and, in 1910, purchased Stanislaus River water rights and facilities from two existing water companies. Together with the SSJID, OID holds pre-1914 water rights for diversion of 1,817.7 cfs from the Stanislaus River at Goodwin Dam (Davids Engineering, 2015). In addition to Goodwin Dam, OID and SSJID also share a joint main canal, extending four miles from Goodwin Dam to the Joint Diversion Works. This canal carries 28% OID water and 72% SSJID water. OID's facilities also include main canals on each side of the river (the North Main Canal and the South Main Canal), plus approximately 250 miles of lateral and sublateral ditches.

Historically, OID shared Melones Reservoir (a storage reservoir) with SSJID, plus 25 deep wells used to augment water supply as needed. The Tri-Dam Project (jointly owned with SSJID and PG&E) was subsequently added. This project consists of three reservoirs with a combined storage capacity of 230,400 AF, plus combined power generation facilities capable of producing 81,000 KW of power. An additional 93,000 KW of generation capacity is provided by the Sand Bar Hydroelectric Powerhouse.

In 1979, New Melones Dam was completed, providing a reservoir capacity of 2.4 million AF and effectively submerging the original Melones project. New Melones Dam was constructed by the USACE and transferred to the USBR; the dam and reservoir were subsequently incorporated into the Central Valley Project (CVP). Following completion, OID and SSJID entered into an operational agreement with the USBR allowing the District to divert a combined supply of 600,000 AF of water annually, subject to availability (Davids Engineering, 2012). Releases from New Melones Dam are now the principal source of water for OID, along with groundwater from 25 operating wells. These wells have a maximum annual production capacity of approximately 38,000 AF, but actual pumping has historically been much lower, ranging from 1,500 to 18,300 AF between 2005 and 2014 (Davids Engineering, 2015). OID also operates 42 drainage and several reclamation pumps, used to discharge around 13,000 AFY. OID actively participates in groundwater management activities in the groundwater basins it overlies.

OID's service area currently encompasses approximately 81,000 acres of land supporting four major crop groups (irrigated pasture, oats/corn (double crop), rice, fruits/nuts) plus several rural communities (including the Cities of Oakdale and Riverbank, located within OID's service area). In addition, OID has short-term water transfers with the California American Water Company (Stockton District), and provides water to two rural water areas outside of the City of Oakdale. Water diverted from the Stanislaus River into the District's canals is measured by gauging stations operated by the Tri-Dam Authority. Releases from the canals to laterals are measured by various means, including pressure transducers, ultrasonic water level sensors, weir sticks, measuring tapes, Clausen rules and stilling wells with staff gauges. OID's water rates are determined by Board of Directors and include both a fixed rate (per acre), and a volumetric charge component (per acre-foot) (Davids Engineering, 2015).

Figure 2-20: Oakdale Irrigation District Service Area and Facilities



Eastside Water District

Eastside Water District (EWD) was formed in 1985 to address water needs in the area and encompasses approximately 61,000 acres in Merced and Stanislaus Counties. Most of the land within the District is agricultural and is irrigated with groundwater from the Turlock Groundwater Subbasin; the landowners within the District pump on the order of 160,000 AFY. The District does not supply groundwater, and the only other source of supply is a limited amount of surface water from purchases in wet years from the Turlock and Merced Irrigation District's canals lying adjacent to District and from riparian water rights along the Tuolumne and Merced Rivers. Groundwater within District appears to be declining at about two feet per year, creating an average annual deficit of about 80,000 AF. The District participates in local groundwater management along with other users of the underlying Turlock Subbasin, and is actively working towards rectifying the basin overdrafts.

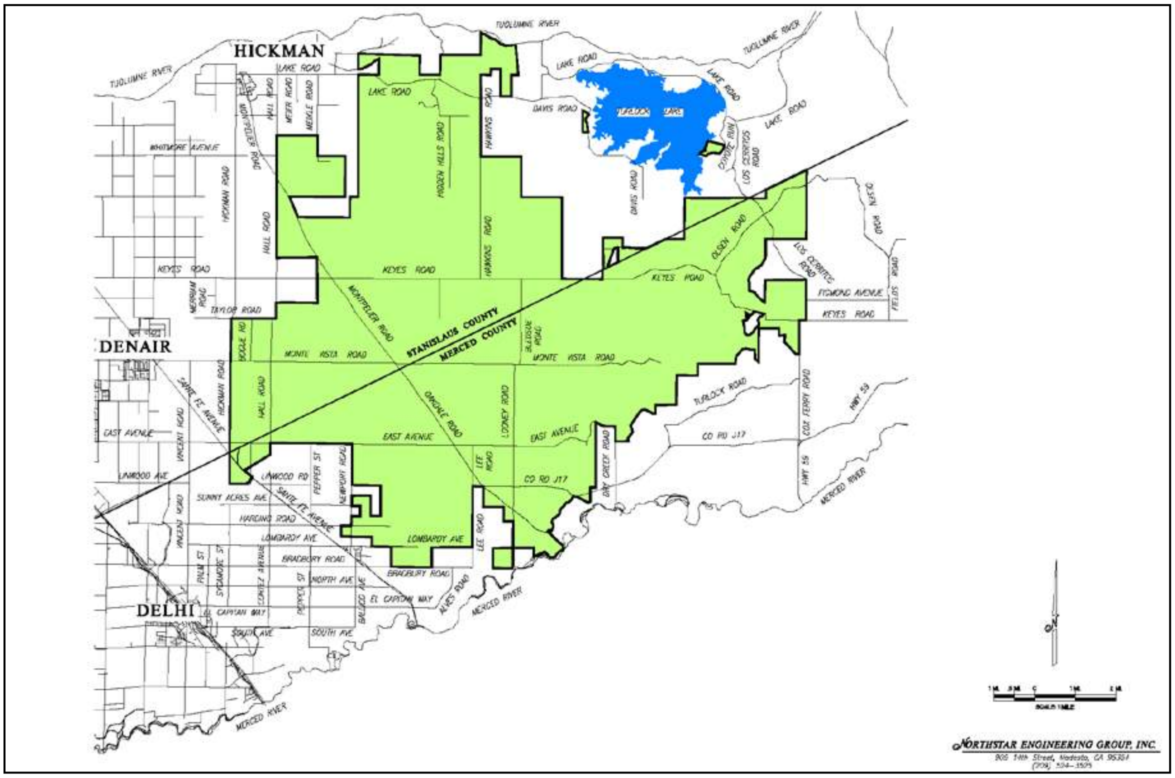
In 2014, a Managed Aquifer Recharge (MAR) study was completed and recommended specific areas within and outside of the District boundaries to conduct groundwater recharge operations using diffused surface water (surface water that never makes it to a natural waterway). The facilities proposed for construction (recharge basins, dry-wells, and infrastructure to deliver surface water for irrigation) would also be used to recharge other surface water supplies secured by the District through other water rights or contracts.

In 2015, the District conducted a Prop 218 Election to raise capital and operating funds to build and operate facilities described in the 2014 MAR study. These capital and operating per-acre charges will allow the District to build and operate groundwater recharge facilities intended to stop the continual overdraft of the aquifer.

By 2017 and 2022, the District and other agencies located over the aquifer are required to be in a groundwater sustainability agency and adopt a groundwater sustainability plan, respectively, in compliance with SGMA. The proposed EWD Diffused Surface Water Projects will allow the District to achieve this compliance. The funding established in 2015 provides the funds necessary to build the projects and to comply with the SGMA.

EWD is currently engaged in complying with California Statewide Groundwater Elevation Monitoring (CASGEM) Program (SB7X-6) to carry out the State mandate to monitor groundwater levels throughout the state in cooperation with TID. The District will continue to carry out that responsibility for all lands within the District, including newly annexed territory. An annexation of an additional 9,000 acres is expected in 2017.

Figure 2-21: Eastside Water District



Demands and Supplies Outside Established Public Service Areas

There are areas within the East Stanislaus Region that are located outside the service areas of the afore-mentioned public water agencies. These areas are dependent primarily on groundwater for their water supplies. Some small communities in the Region get drinking water from smaller water providers, including Denair CSD, Keyes CSD, Monterey Park Tract CSD, Riverdale Park Tract CSD, and Stanislaus County Housing Authority. Outside these localized areas, privately-owned properties are managed by the individual property owner who also determines the water supply use, irrigation method, cropping patterns, and other issues related to their land. Unless a permit is acquired to install a building or well, modifications on the land are not part of a larger land use planning process. Privately-owned irrigation supply wells and domestic wells have been installed throughout the Modesto and Turlock Groundwater Subbasins to provide water for irrigation and supplies to rural homes and businesses. In addition to areas located outside of the local water agency boundaries that are using groundwater, there are also areas that have had significant conversions from non-irrigated lands to irrigated lands, further increasing reliance upon groundwater (TGBA, 2008).

Possible Future Changes to Water Supplies

In September of 2016, the SWRCB issued its *Draft Revised Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality*. In this document, the SWRCB evaluated potential impacts from proposed amendments to the 2006 *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (2006 Bay-Delta Plan). The amendments would establish:

- New flow objectives on the Lower San Joaquin River and its three eastside tributaries, the Tuolumne, Stanislaus and Merced Rivers (all of which are located within the East Stanislaus IRWM Region), for the protection of fish and wildlife beneficial uses; and
- New water quality (salinity) objectives for the protection of agricultural beneficial uses in the southern portion of the Delta.

The San Joaquin River flow proposal would establish February through June flow requirements of 35% of unimpaired flow for the three salmon-bearing tributaries. (Unimpaired flow is the flow that would occur if all runoff from the watershed remained in the river, without storage in reservoirs or diversions.) Achieving this proposal would require increased flows of 21% and 20% in the Tuolumne and Merced Rivers, respectively, with the increased flows resulting from decreases in diversions of 132,000 AFY from the Tuolumne River and 67,000 AFY from the Merced River. Loss of these diversions would significantly impact water supplies in the East Stanislaus Region. The proposed amendments are currently under consideration.

In late 2016, USFWS released a final plan authorizing the expansion of the SJRNWR. As described in the Final Environmental Assessment, the proposed expansion would add up to 10,738 acres of land to the Refuge. This expansion may require additional water to establish and maintain riparian habitats; site-specific impacts of restoration projects would be evaluated in separate National Environmental Policy Act (NEPA) analyses conducted at a later date.

SGMA may also result in changes to the water supplies in the region. Neither the Modesto nor Turlock Groundwater Subbasins are critically overdrafted (though the Delta-Mendota Subbasin is), but groundwater management is a primary concern in the Region, both in terms of quality and supply. The intent of SGMA is for groundwater to be managed sustainably in California's groundwater basins; therefore, SGMA implementation should result in well-managed groundwater basins over the long term. As Groundwater Sustainability Plans (GSPs) begin to be developed, the Region-specific impacts of SGMA on available water supplies will become clearer. Additionally, the Stanislaus County Groundwater Ordinance (Stanislaus County Code 9.37), structured based on SGMA, addresses sustainable groundwater management and export of groundwater from the County. The Ordinance codifies requirements, prohibitions, and exemptions that assure sustainable groundwater extraction from new wells.

Eastside Water District, TID, MID, the cities of Modesto, Turlock, Waterford, and Hughson, and other regional partners, as members of Groundwater Sustainability Agencies (GSAs), are poised to develop and construct projects to conjunctively manage surface and ground water supplies in an effort to show sustainability in for both the Modesto and Turlock Groundwater Subbasins. The subbasin-specific GSPs, due to DWR by January 21, 2022 are expected to include conjunctive management plans as part of their respective sustainability toolboxes.

Climate change is also likely to impact water supplies in the future. Likely future conditions include longer and more frequent droughts, warmer temperatures, a longer growing season, and shift in the magnitude and timing of snowmelt. The effects on the Region's water supply are likely to be substantial. Impacts such as degraded water quality, increased demand, and reduced water supply will require proactive management and problem-solving to address. Climate change is discussed in more detail in Section 2.3 and Chapter 3 of this IRWMP.

2.2.2 Water Quality

Water quality within a watershed can be affected by a mix of point and nonpoint source discharges, and groundwater and surface water interactions. Water quality can affect water supplies for the East

Stanislaus Region and overall water supply reliability. Much of the Region relies predominantly on groundwater and/or surface water. In California, the SWRCB and the RWQCBs are responsible for contributing to the development of a Strategic Plan for water resource protection. In December 2002, the CVRWQCB prepared a Watershed Management Initiative (WMI) chapter for its watersheds to integrate surface and groundwater regulatory programs. It was then revised in October 2004. The CVRWQCB divided its region into the Sacramento River Basin, the San Joaquin River Basin, and the Tulare Lake Basin (CVRWQCB, 2004). As previously described in Section 2.1.3, the East Stanislaus Region is within the San Joaquin Basin which is then further divided into the Merced, Tuolumne, and Stanislaus River watersheds.

Each RWQCB is also required to prepare a Basin Plan (also referred to as a Water Quality Control Plan) to be used as a basis for regulatory actions to protect water quality. The Basin Plans describe beneficial uses, identify water quality objectives, and define an implementation program consisting of actions to be taken to meet those objectives. Region 5, the Central Valley Region, has two Basin Plans, one for Tulare Lake Basin and one for the Sacramento and San Joaquin River Basins. The latter Basin Plan is pertinent to the East Stanislaus Region and was originally adopted in 1975, then updated and revised in 1984, 1989, 1994, 1998, 2011, 2015, and 2016 (CVRWQCB, 2016).

Beneficial uses of water resources as identified in the Basin Plan are critical in water quality management. The existing and potential beneficial uses of the surface waters within the East Stanislaus Region include:

- Municipal and Domestic Supply
- Cold Freshwater Habitat
- Migration of Aquatic Organisms
- Spawning, Reproduction, and/or Early Development
- Hydropower Generation
- Recreation
- Freshwater habitat
- Wildlife Habitat
- Agricultural Supply

Beneficial uses of groundwater identified in the Basin Plan for groundwater in groundwater basins underlying the East Stanislaus Region include:

- Municipal and Domestic Supply
- Agricultural Supply
- Industrial Service Supply (e.g. cooling water supply)
- Industrial Process Supply (CVRWQCB, 2011)

Surface Water Quality

Pesticides have been found within the San Joaquin River at concentrations that are toxic to sensitive aquatic organisms. Two multi-year studies were conducted; one study in the early 1990's found a 43-mile reach of the San Joaquin River, between the confluence of the Merced and Stanislaus River, to be toxic about half of the time to invertebrate components of the U.S. Environmental Protection Agency (USEPA) three species test. This portion of the river is within the East Stanislaus Region as the Stanislaus River coincides with the northern regional boundary and the Merced River coincides with the southern regional boundary. The toxicity in the river was caused by pesticides, specifically diazinon and chlorpyrifos, in storm and irrigation runoff from crops. A year later, follow-up testing was conducted that found that water in the San Joaquin River was toxic to invertebrate species about 6% of the time. As with the first study, diazinon and chlorpyrifos in winter storm runoff from crops and summer irrigation return flows were identified as the primary source of the toxins. Urban runoff has also been identified as a significant source in and around the City of Modesto. The SWRCB has also found elevated levels of Group A Pesticides in fish in the Tuolumne, Merced, and Stanislaus Rivers and the main stem of the San Joaquin River. Group A Pesticides include chlordane, toxaphene, endosulfan, and other pesticides, many of which are no longer used or are heavily regulated. These chemicals tend to bind to sediment and move into water systems as sediment moves off site (CVRWQCB, 2004). The San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are on the Clean Water Act 303(d) list for Group A pesticides and various other constituents.

Water quality objectives were identified in the Basin Plan for inland surface waters and groundwater in the San Joaquin Basin. Examples of these objectives are as follows:

- Bacteria – In waters designated for contact recreation, the fecal coliform concentration shall not exceed a geometric mean of 200/100 milliliter (mL) from five samples over a 30-day period, nor shall more than 10% of the total number of samples taken during the 30-day period exceed 400/100 mL.
- Chemical Constituents – Water shall not contain chemical constituents in concentrations that adversely affect beneficial uses. For domestic and municipal water supply, the concentrations of chemical constituents must not be in excess of the maximum contaminant levels (MCLs) specified in the California Code of Regulations, and state and federal drinking water regulations.
- Color – Water shall be free of discoloration that adversely affects beneficial uses.
- Floating Materials, Oil and Grease – Water shall not contain floating materials, oils, greases, waxes or other materials that cause nuisance or affect beneficial uses.

Other water quality objectives were identified in the categories of biostimulatory substances, dissolved oxygen, mercury, methylmercury, pH, pesticides, radioactivity, salinity, sediment, settleable material, suspended material, tastes and odors, temperature, toxicity, and turbidity. A more comprehensive description of the water quality objectives is included in the Basin Plan. (CVRWQCB, 2011).

The SWRCB is also in the process of updating the *Water Quality Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary* (Bay-Delta Plan). The Bay-Delta Plan was developed in 2006 to protect water quality in the region and includes water quality objectives to protect municipal and industrial (M&I), agricultural, and fish and wildlife beneficial uses. The Delta Stewardship Council (DSC), as part of the Bay-Delta Plan, directed the SWRCB to adopt and implement updated flow objectives for the Delta to achieve the coequal goals of ecosystem protection and a reliable water supply by June 2, 2014. To implement this policy, the Bay-Delta Plan is being updated by the SWRCB through a phased process. As part of Phase 1, a draft Substitute Environmental Document (SED) was prepared in December 2012 in support of potential changes to San Joaquin River flow and southern Delta water quality objectives and an implementation program to be included in the Bay-Delta Plan. A revised draft was issued in 2016, and will be updated to a final draft before going to the SWRCB for approval. The SED proposes to balance the use of water for fishery protection against competing uses of water such as municipal, agricultural, and hydropower. Amendments to the 2006 Bay-Delta Plan will establish the following:

- **Flow Objectives** – New flow objectives on the Lower San Joaquin River (LSJR) and its three eastside tributaries (the Stanislaus, Tuolumne and Merced Rivers) for the protection of fish and wildlife beneficial uses.
- **Water Quality Objectives –** New water quality (salinity) objectives for the protection of agricultural beneficial uses in the southern portion of the Delta.
- **Implementation Program –** An implementation program to achieve those objectives

The amendments have the potential to impact the East Stanislaus Region, predominantly through reduced diversions from the Tuolumne River. As the SED and amendments progress forward, the East Stanislaus Region will track the flow objectives and water quality objectives that may be relevant to the region, and will plan response actions needed to adjust regional water use.

Groundwater Quality

Groundwater quality in the Region is variable and has been impacted by overlying land uses in many locations. The Basin Plan identified water quality objectives for groundwater in the San Joaquin River Basin, over which the East Stanislaus Region lies. Objectives for bacteria, chemical constituents, tastes and odors, toxicity, and radioactivity are defined in the Basin Plan for groundwater. Extracted groundwater from both the Modesto and Turlock Subbasins has contained concentrations of multiple constituents in excess of drinking water regulatory requirements, including arsenic, uranium, PCE, TCE, DBCP and nitrate. As a result, many of the Region's groundwater wells have been taken out of service (for example, the City of Modesto has had 21 wells removed from service in recent years due to groundwater quality impacts) and several DACs within Stanislaus County have been identified as having small community water systems with known violations of the arsenic and/or nitrate drinking water standards (CDPH, 2013).

> As required by AB1249 (Proposition 1 IRWM Guidelines, page 30), if the region has areas of nitrate, arsenic, perchlorate or hexavalent chromium, the plan must describe location, extent, impacts of contamination, actions undertaken to address the contamination and description of any additional actions needed to address the contamination.

High salinity, nitrates, iron, manganese, boron, arsenic, radionuclides, bacteria, pesticides, trichloroethylene and other trace organics have been detected in groundwater in the Turlock Subbasin. Between 1998 and 2008, the City of Turlock had to discontinue use of four wells due to contamination (TGBA, 2008). Two of the well closures were a result of nitrate contamination, which is a major threat to wells in the City of Turlock. Arsenic has also been a problem for some wells. Some of the contaminants found in the groundwater occur naturally while others have been introduced by manmade sources, such as industrial solvents, septic tanks, pesticides and herbicides. The City of Ceres has also had water quality concerns related to specific contaminants in the groundwater. These contaminants include many of the same that concern the Cities of Turlock and Modesto (such as nitrate, uranium, arsenic, and manganese). Nearly all of the City of Ceres' active wells are impacted by a combination of inorganic contaminants. Wellhead treatment and blending are used to reduce levels of contaminants and in the future, the City of Ceres may replace older wells and/or install new wells and in such a way that the need for wellhead treatment is minimized (Ceres, 2016a).

In the Region as a whole, nitrate is a persistent issue. In the City of Modesto, 12 wells draw from the Turlock Subbasin. Of these 12, two are inactive due to high nitrate concentrations, and five require blending before water can be distributed (West Yost, 2016b). In its Water Master Plan, the City of Modesto evaluated treatment options to maintain capacity and quality, including early detection monitoring, wellhead treatment, and well rehabilitation. The City of Modesto expects to move forward with selecting a course of action based on site-specific characteristics. Nitrate levels in the City of Turlock, which also pumps from the Turlock Subbasin, have been well below the Primary MCL of 10 parts per million (ppm) (nitrate as N), averaging 5.8 ppm in 2014. However, the City of Turlock has closed several wells in recent years due to nitrate levels exceeding the MCL (West Yost, 2016b). Many other parts of the region have experienced issues with nitrate levels at or near the MCL, including Ceres, Keyes, Delhi, Hilmar, and Denair (TGBA, 2008). The high nitrate concentrations in the Turlock Subbasin are present throughout the Subbasin, rather than existing only in localized areas. However, in the Modesto Subbasin, a former sewage effluent disposal area under southwestern Modesto has been noted as exceeding the MCL (Bookman-Edmonston, 2005).

Wells in the Region have also been removed from service due to arsenic concentrations. In the City of Turlock, several wells have been removed from active status. According to the City's 2014 Annual Water Quality Report, arsenic concentrations were 9.3 parts per billion (ppb), near the Primary MCL of 10 ppb. Some wells in the City of Modesto have also been removed from service, due to arsenic as well as the nitrate issues discussed previously (West Yost, 2016a). The City of Ceres has one well which is being treated for arsenic and manganese, where arsenic concentrations of 14 ppb are observed before treatment and reduced to approximately 5 ppb after treatment (Ceres, 2016a). As of the writing of the 2008 *Turlock Groundwater Basin Groundwater Management Plan*, the City of Hughson was experiencing high arsenic levels (approximately 11 ppb), and was undertaking studies to determine treatment options for meeting the MCL. At the time, Keyes also sometimes exceeded the MCL, and was investigating treatment options and alternative water supply options (TGBA, 2008). Arsenic concentrations in Waterford, Oakdale, and Riverbank are generally low (2-4 ppb) (Bookman-Edmonston, 2005).

Hexavalent chromium is also present in the Region, but does not exceed the MCL of 10 ppb. According to the City of Turlock's 2015 Water Quality Report, hexavalent chromium observations ranged from 2 to 8 ppb. The City of Modesto's 2016 Water Quality Report noted a concentration range of 0 to 4 ppb of hexavalent chromium.

Groundwater Management Plans (GWMPs) have been prepared for both the Modesto and Turlock Subbasins. The *Integrated Regional Groundwater Management Plan for the Modesto Subbasin* was prepared in 1994 by six agencies forming the Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA). The final draft of the Modesto Subbasin GWMP was completed in June 2005 and was adopted by all member agencies. The *Turlock Groundwater Basin Groundwater Management Plan* was drafted in 2008 by the TGBA. Similarly, this plan was adopted by the member agencies comprising the TGBA. Both GWMPs outlined methods for groundwater monitoring both for groundwater levels and groundwater quality. Local cities and small community water systems conduct water quality monitoring using drinking water supply wells. The data collected are then made available to the public in each municipal water supplier's Consumer Confidence Report (CCR). The Division of Drinking Water (DDW) (formerly part of CDPH and currently part of the SWRCB) regulates the type of monitoring and frequency of data collection to ensure the water meets required standards.

During development of the Turlock Groundwater Basin GWMP, the TGBA developed the required Basin Management Objectives (BMOs), one of which is monitoring groundwater extraction to reduce the potential for land subsidence, indicating how important it is for the TGBA to monitor groundwater levels. Other groundwater monitoring is conducted by other agencies. For example, DWR has a network of wells throughout the valley that are used to monitor groundwater level on an annual or semi-annual basis. Local agencies have a similar program to monitor groundwater levels at local supply wells. The Stanislaus County Department of Environmental Resources (DER) also monitors water quality very closely. There are 61 contamination sites within the Stanislaus County portion of the Turlock Subbasin; the County monitors groundwater quality at these sites quarterly. Most of the water quality data collected from the contaminated sites can be viewed on the SWRCB Geotracker-GAMA website, http://geotracker.waterboards.ca.gov. The TBGA has also participated in the Groundwater Ambient Monitoring and Assessment (GAMA) Program study, conducted by U.S. Geological Survey (USGS), SWRCB, CDPH, DWR, and Lawrence Livermore National Laboratory. The GAMA study has yielded baseline water quality conditions and has allowed for early detection of contamination (TGBA, 2008).

In the Modesto Subbasin, groundwater levels have been measured in about 230 wells by DWR and others. USGS has also partnered with member agencies of STRGBA to monitor 17 wells in the area for the National Water Quality Assessment Program.

Future actions to manage groundwater quality and contamination will be taken under SGMA. Three new GSAs are being created in the Region: the STRGBA will function as a single GSA for the Modesto Subbasin, while the West Turlock Subbasin GSA (including TID, the cities of Turlock, Ceres, Hughson, and Modesto, water suppliers for the unincorporated towns of Denair, Delhi, and Hilmar, and Stanislaus and Merced Counties) and the East Turlock Subbasin GSA (including Eastside Water District, Ballico-Cortez Water District, Merced County, and Stanislaus County) will cover the Turlock Subbasin. These GSAs will be preparing GSPs by 2022 in order to address groundwater management issues within their boundaries. GSPs will address groundwater quality and contamination, including nitrate, arsenic, perchlorate, and hexavalent chromium, which were specifically added to IRWM planning under AB 1249.

Table 2-14: Monitoring by Member Agencies of Stanislaus and Tuolumne Rivers GBA

Member Agency	Total Number of Wells	No. of Wells Groundwater Levels are Measured	No. of Wells where Samples are Analyzed for Groundwater Quality
Modesto Irrigation District	104	96	104
Oakdale Irrigation District	17	17	
City of Modesto	102[a]		14
Ceres	4		
Walnut Manor	1		
Salida	7		
Del Rio	3		1
Waterford	7		
Hickman	2		1
City of Oakdale	7		
City of Riverbank	7		
Total	**221**	**113**	**135**

Source: Bookman-Edmonston, 2005. Table 5-1.

a. Total number of wells provided by City of Modesto staff (J. Alves, personal communication, November 13, 2017).

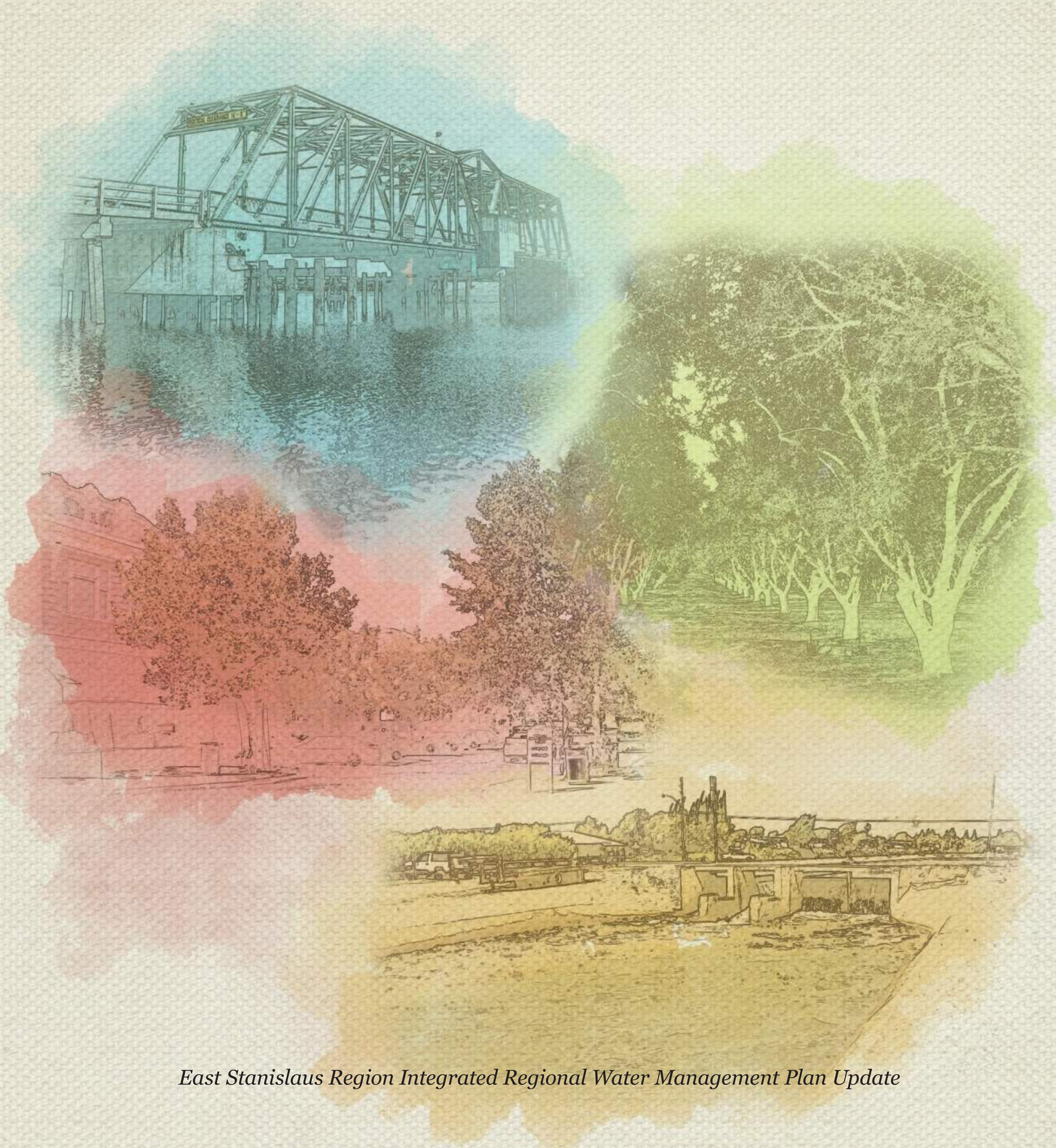
2.3 Climate Change Impacts

In order to adequately manage water supplies in the future, the Region must consider the impacts of climate change to its water supply. Several vulnerabilities exist for the region, as determined through the IRWMP vulnerability assessment. First, water demand is expected to increase across all sectors, including urban, agricultural, CII, and firefighting demand. Water supply and quality is expected to suffer due to more frequent droughts, reduced surface water availability, increased groundwater salinity, increased groundwater overdraft, decreased surface water quality, and increased cost of imported supplies. Flood management is another vulnerable area, as climate change brings the possibility of increased high flow events and shifts in the timing of snowmelt. The areas of inundation may increase as well. Ecosystems and habitats are vulnerable to degradation of surface water quality, including rising temperatures. Hydropower generators are expected to experience challenges as well, with a decrease in power generation capabilities coinciding with an increase in power demands. Lastly, the Region is vulnerable to increased frequency of wildfires and reduced snowpack.

The Region's water portfolio is relatively limited, with heavy dependence on surface water and groundwater. Surface water supplies are expected to be affected by increased temperatures, decreased precipitation, and earlier snowmelt. Climate change is predicted to result in frequent and severe droughts. Such events exacerbate water quality issues by causing low flows and increasing chance of wildfires. In the event of reduced surface water supplies, use of groundwater may increase, potentially resulting in groundwater overdraft and land subsidence. Additionally, several water providers in the Region rely on hydroelectric facilities, which will have reduced generation capacity if surface flows decrease.

Water providers within the Region are expecting increased irrigation demand due to temperature rise, increased evaporative losses from warmer temperatures, and a longer growing season. These impacts, and others, are addressed in further depth in Chapter 3, which includes the climate change vulnerability assessment for the Region.

Chapter 3



East Stanislaus Region Integrated Regional Water Management Plan Update

Chapter 3 Climate Change

3.1 Introduction

> An IRWMP must address both adaptation to the effects of climate change and mitigation of GHG emissions, including the following:
>
> - A discussion of potential effects of climate change on the IRWM region, including vulnerabilities and potential adaptations to those vulnerabilities.
> - Consideration of changes in the amount, intensity, timing, quality, and variability of runoff and recharge, and address adaptation to these changes.
> - Consideration of the effects of sea level rise and identification of adaptation measures.
> - A list of prioritized vulnerabilities and determination of the feasibility of addressing these vulnerabilities.
> - A plan for further data gathering and analysis.
> - Consideration of GHG emissions when choosing between projects.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 43

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

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

3.2 Statewide Observation and Projections

Indications of climate change have been observed over the last several decades throughout California and are apparent in long-term historic analysis. Between 1895 and 2011, statewide average temperatures have increased by about 1.7°F, with the greatest warming in the Sierra Nevada (Moser et al., 2012). Although the State's weather has followed the expected pattern of a largely Mediterranean climate throughout the past century, no consistent trend in the overall amount of precipitation has been detected, except that a larger proportion of total precipitation is falling as rain instead of snow (Moser et al., 2012).

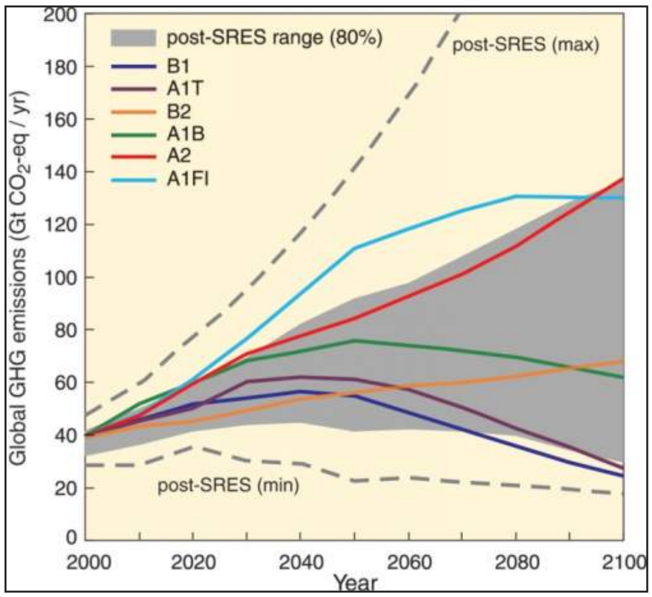
Multiple models have been developed and run to evaluate global and regional climate change impacts. General Circulation Models (GCMs, also referred to as Global Climate Models) have been used to simulate a range of potential future GHG emission scenarios, reflecting possible population increases and human behavioral patterns. The Intergovernmental Panel on Climate Change (IPCC) has established the A2 and B1 scenarios, which represent a middle range of possible emissions. The

A2 scenario is characterized by an increasing population, regionally-oriented economic development and independently operating, self-reliant nations. In the A2 scenario, economic growth is uneven, leading to a growing income gap between developed and developing parts of the world.

The B1 scenario assumes a more integrated and ecologically friendly future, and reflects a high level of environmental and social consciousness combined with global cooperation for sustainable development. This scenario is characterized by rapid economic growth and movement toward a service and information economy. It also assumes reductions in materials intensity and the introduction of clean and resource-efficient technologies combined with an emphasis on global solutions to economic, social and environmental stability.

Since the IPCC released these scenarios in 2000, the world has followed a “business as usual” emissions pathway (Figure 3-1). This most closely resembles the A2 scenario, although temperature changes over the next 30 to 40 years will be largely determined by past emissions.

Figure 3-1: IPCC Climate Change Scenarios



Source: IPCC 2007

3.2.1 Temperature and Precipitation Changes

While California’s average temperature has increased by 1.5°F in the last one hundred years, trends are not uniform across the state. The Central Valley has actually experienced a slight cooling trend in the summer, likely due to an increase in irrigation (CEC, 2008). Higher elevations have experienced the highest temperature increases (DWR, 2008). Many of the State’s rivers have seen increases in peak flows in the last 50 years (DWR, 2008).

GCMs project that in the first 30 years of the 21st century, overall summertime temperatures in California will increase by 1 to 2.3°F (CalEPA, 2013) and average temperatures will increase by 3 to 10.5°F by the end of this century (CalEPA, 2013). Increases in temperature are not likely to be felt uniformly across California. Models generally project that warming will be greater in California in the summer than in the winter (CalEPA, 20013) and inland areas will experience more extreme warming than coastal areas (CNRA, 2009). These non-uniform warming trends are among the reasons that regional approaches to addressing climate change are important.

While historical trends in precipitation do not show a statistically significant change in average precipitation over the last century (DWR, 2006), regional precipitation data show a trend of increasing annual precipitation in Northern California (DWR, 2006) and decreasing annual precipitation throughout Southern California over the last 30 years (DWR, 2008). A key change in precipitation patterns has been more winter precipitation falling as rain instead of snow (CNRA, 2012), leading to increased streamflow in the winter and decreased streamflow in the spring and summer, when water demands are the greatest. This increased runoff and streamflow variability could lead to increased risks of flooding, levee failure, saline water intrusion and flood- or drought-induced habitat destruction.

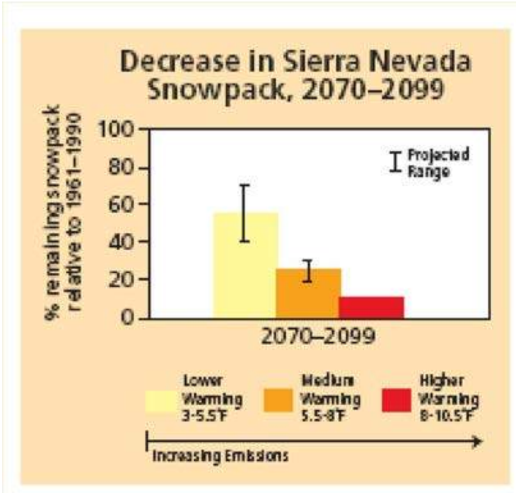
While temperature projections exhibit high levels of agreement across various models and emissions scenarios, projected changes in precipitation are uncertain, and therefore more varied. Taken together, downscaled GCM results show little, if any, change in average precipitation for California before 2050 (DWR, 2006), with a drying trend emerging after 2050 (USBR, 2011; CCSP, 2009). While little change in precipitation is projected by the GCMs as a group, individual GCM results are considerably varied. The models' inaccuracies leave uncertainty in the future projections regarding precipitation trends. Climate projections therefore imply an increase in the uncertainty of future precipitation conditions.

3.2.2 Sea Level Rise, Snowpack Reduction, and Extreme Events

In the last century, the California coast has seen a sea level rise of seven inches (DWR, 2008). The average April 1st snowpack in the Sierra Nevada region has decreased in the last half century (Howat and Tulaczyk, 2005; CCSP, 2008), and wildfires are becoming more frequent, longer, and more widespread (CCSP, 2008).

As the climate warms, the Sierra Nevada's snowpack (a primary storage mechanism for California's water supply) is anticipated to continue to shrink. Based on simulations conducted to date, Sierra Nevada snowpack is projected to shrink by 30% between 2070 and 2099, with drier, higher warming scenarios putting that number as high as 80% (Kahrl and Roland-Holst, 2008). Additionally, extreme events are expected to become more frequent, including wildfires, floods, droughts, and heat waves. In contrast, freezing spells are expected to decrease in frequency over most of California (CNRA, 2009). While GCM projections may indicate little, if any, change in average precipitation moving into the future, extreme precipitation events are expected to become more commonplace (CBO, 2009). The combination of drier and warmer weather compounds expected impacts on water supplies and ecosystems in the Southwestern United States (CCSP, 2009), with wildfires expected to continue to increase in both frequency and severity (CCSP, 2009).

Figure 3-2: Projected Snowpack Changes in the Sierra Nevada



Source: Hopmans et al. 2008

3.3 Legislative and Policy Context

In order to address currently-predicted climate change impacts to California's water resources, the DWR's IRWM Grant Program Guidelines require that IRWMPs describe, consider and address the effects of climate change on their region, and consider reducing GHG emissions when developing and implementing projects. Part of this process involves framing the IRWM analysis and response actions in the context of State legislation and policies that have been formed to address climate change. The following summarizes the legislation and policies that were considered as part of this IRWMP.

Executive Order (EO) S-3-05 (2005)

EO S-3-05, signed on June 1, 2005 by Governor Arnold Schwarzenegger, is a key piece of legislation that has laid the foundation for California's climate change policy. This legislation recognized California's vulnerabilities to the impacts of climate change, including vulnerabilities of water resources. EO S-3-05 established three GHG reduction targets for California:

- By 2010, reduce GHG emissions to 2000 California levels
- By 2020, reduce GHG emissions to 1990 California levels
- By 2050, reduce GHG emissions to 80 percent below 1990 California levels

In addition to establishing GHG reduction targets for California, EO S-3-05 required the head Secretary of the California Environmental Protection Agency (CalEPA) to establish the Climate Action Team (CAT) for State agencies to coordinate oversight of efforts to meet these targets. As laid out in the EO, the CAT submits biannual reports to the governor and State legislature describing progress made toward reaching the targets.

There are currently 10 sub-groups within CAT, one of which is the Water-Energy group (also known as WET-CAT). WET-CAT was tasked with coordinating the study of GHG effects on California's water supply system, including the development of GHG mitigation strategies for energy consumption related to water use. Since the adoption of the AB 32 Scoping Plan (see the following section), WET-CAT has been working on the implementation and analyses of five water-related measures identified in the Scoping Plan:

1. Water Use Efficiency
2. Recycled Water
3. Water Systems Efficiency
4. Stormwater Reuse
5. Renewable Development

AB 32: The California Global Warming Solutions Act of 2006 (2006)

AB 32, the California Global Warming Solutions Act of 2006, laid the foundation for California's response to climate change. In 2006, AB 32 was signed by Governor Schwarzenegger to codify the mid-term GHG reduction target established in EO S-3-05 (reduce GHG emissions to 1990 levels by 2020). AB 32 directed the California Air Resources Board (CARB) to develop discrete early actions to reduce GHG emissions by 2007, and to adopt regulations to implement early action measures by January 1, 2010.

Climate Change Scoping Plan (2008, 2014)

AB 32 required CARB to prepare a Scoping Plan to identify and achieve reductions in GHG emissions in California. The AB 32 Climate Change Scoping Plan, adopted by CARB in December 2008, recommends specific strategies for different business sectors, including water management, to achieve the 2020 GHG emissions limit. The first update to the Scoping Plan was approved by CARB in 2014. The 2014 update identified next steps for California to reduce GHG emissions beyond 2020 and reviewed the progress made to date. A second update is in progress as of summer 2017. The second update will build on the programs established in previous scoping plans, focusing on achieving the interim goal of reducing emissions 40% below 1990 levels by 2030.

SB 97 (2007)

SB 97 recognized the need to analyze GHG emissions as part of the California Environmental Quality Act (CEQA) process. SB 97 directed the Governor's Office of Planning and Research (OPR) to develop, and the Natural Resources Agency to adopt, amendments to the CEQA Guidelines to address the analysis and mitigation of GHG emissions. On December 31, 2009, the Natural Resources Agency adopted amendments to the CEQA Guidelines and sent them to the California Office of Administrative Law for approval and filing with the Secretary of State (http://www.resources.ca.gov/ceqa/guidelines/). The CEQA Guidelines are not prescriptive; rather they encourage lead agencies to consider many factors in performing a CEQA analysis, and maintain discretion with lead agencies to make their own determinations based on substantial evidence.

Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water (2008)

DWR, in collaboration with the SWRCB, other state agencies, and numerous stakeholders, initiated a number of projects to begin climate change adaptation planning for the water sector. In October 2008, DWR released the first state-level climate change adaptation strategy for water resources in the United States, and the first adaptation strategy for any sector in California. Entitled *Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water,* the report details how climate change is currently affecting the state's water supplies, and sets forth ten adaptation strategies to help avoid or reduce climate change impacts to water resources.

Central to these adaptation efforts will be the full implementation of IRWMPs, which address regionally-appropriate management practices that incorporate climate change adaptation. These plans will evaluate and provide a comprehensive, economical, and sustainable water use strategy at the watershed level for California.

EO S-13-08 (2008)

Given the potentially serious threat of sea level rise to California's water supply and coastal resources, and the subsequent impact it would have on our state's economy, population, and natural resources, Governor Schwarzenegger issued EO S-13-08 to enhance the state's management of climate impacts from sea level rise, increased temperatures, shifting precipitation, and extreme weather events. This order required the preparation of the first California Sea Level Rise Assessment Report (by the National Academy of Sciences) to inform the State as to how California should plan for future sea level rise; required all state agencies to consider a range of sea level rise scenarios for the years 2050 and 2100 in order to assess potential vulnerabilities of proposed projects and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise; and required the CAT to develop state strategies for climate adaptation, water adaptation, ocean and coastal resources adaptation, infrastructure adaptation, biodiversity adaptation, working landscapes adaptation, and public health adaptation.

California Climate Adaptation Strategy (2009)

In response to the passage of EO S-13-08, the Natural Resource Agency wrote the report entitled *2009 California Climate Adaptation Strategy* (CAS) to summarize the best-known science on climate change impacts in the state, to assess vulnerability, and to outline possible solutions that can be implemented within and across the state agencies to promote climate change resilience. The document outlined a set of guiding principles that were used in developing the strategy, and resulted in the preparation of 12 key recommendations as follows:

1. Appoint a Climate Adaptation Advisory Panel (CAAP) to assess the greatest risks to California from climate change and to recommend strategies to reduce those risks, building on the Climate Change Adaptation Strategy.
2. Implement the 20x2020 water use reductions and expand surface and groundwater storage; implement efforts to fix Delta water supply, quality and ecosystems; support agricultural water use efficiency; improve statewide water quality; improve Delta ecosystem conditions; and stabilize water supplies as developed in the Bay Delta Conservation Plan.
3. Consider project alternatives that avoid significant new development in areas that cannot be adequately protected from flooding, wildfire, and erosion due to climate change.
4. Prepare, as appropriate, agency-specific adaptation plans, guidance or criteria.
5. For all significant state projects, including infrastructure projects, consider the potential impacts of locating such projects in areas susceptible to hazards resulting from climate change.
6. The CAAP and other agencies will assess California's vulnerability to climate change, identify impacts to state assets, and promote climate adaptation/mitigation awareness through the Hazard Mitigation Web Portal and My Hazards Website, as well as other appropriate sites.
7. Identify key California land and aquatic habitats that could change significantly during this century due to climate change.
8. The CDPH will develop guidance for use by local health departments and other agencies to assess mitigation and adaptation strategies, which include impacts on vulnerable populations and communities, and assessment of cumulative health impacts.
9. Communities with General Plans and Local Coastal Plans should begin, when possible, to amend their plans to assess climate change impacts, identify areas most vulnerable to these impacts, and develop reasonable and rational risk reduction strategies using the CAS as guidance.
10. State firefighting agencies should begin immediately to include climate change impact information into fire program planning to inform future planning efforts.

11. State agencies should meet projected population growth and increased energy demand with greater energy conservation and an increased use of renewable energy.
12. New climate change impact research should be broadened and funded.

Safeguarding California: Reducing Climate Risk, An Update to the 2009 California Climate Adaptation Strategy (2014)

The California Natural Resources Agency prepared the *Safeguarding California Plan* as an update to, but not a replacement of, the 2009 California CAS. The *Plan* provides policy guidance for state decision makers, delineating climate risks in nine sectors in California and making recommendations within each sector. Within the water resources sector, the *Plan* lists the following actions needed to prepare for climate risks:

1. Vigorously prepare California for flooding
2. Support regional groundwater management for drought resiliency
3. Diversify local supplies and increase water use efficiency
4. Reduce Delta climate change vulnerability
5. Prepare California for hotter and dryer conditions and improve water storage capacity
6. Address water-related impacts of climate change on vulnerable and disadvantaged populations and cultural resources
7. Continue to mainstream climate considerations into water management
8. Utilize low impact development (LID) and other methods in State and regional stormwater permits to restore the natural hydrograph
9. Require closer collaboration and coordination of land use and water planning activities to ensure that each reinforces sustainable development that is resilient to climate changes
10. Protect and restore water resources for important ecosystems
11. Better understand climate risks to California water and develop tools to support efforts to prepare for climate risks

GHG Reporting Rule (2009)

While California has taken the lead in climate change policy and legislation, there have been several recent developments at the federal level affecting climate change legislation. On September 22, 2009, USEPA released the Mandatory Reporting of Greenhouse Gases Rule (74FR56260, Reporting Rule), which requires reporting of GHG data and other relevant information from large sources and suppliers in the United States. Starting in 2010, facility owners that emit 25,000 metric tons of GHGs or more per year are required to submit to the USEPA an annual GHG emissions report with detailed calculations of facility GHG emissions. These activities will dovetail with the AB 32 reporting requirements in California.

SB 375 (2008)

The Sustainable Communities and Climate Protection Act of 2008 (SB 375) was passed to enhance the State's ability to reach its AB 32 goals by promoting good planning with a goal of more sustainable communities. SB 375 required the CARB to develop regional GHG emission reduction targets for passenger vehicles and 2020 and 2035 GHG emission targets for each region covered by one of the State's 18 California's metropolitan planning organizations (MPOs). Each of the MPOs then prepares a sustainable communities strategy that demonstrates how the region will meet its GHG reduction target through integrated land use, housing and transportation planning. Once adopted, these sustainable communities strategies are incorporated into the region's federally enforceable regional transportation plan.

California Water Plan Update (DWR, 2013)

The California Water Plan (CWP) provides a collaborative planning framework for elected officials, agencies, tribes, water and resource managers, businesses, academics, stakeholders, and the public to develop findings and recommendations and make informed decisions for California's water future. The plan, updated every five years, presents the status and trends of California's water-dependent natural resources, water supplies, and agricultural, urban, and environmental water demands for a range of plausible future scenarios and evaluates different combinations of regional and statewide RMS to reduce water demand, increase water supply, reduce flood risk, improve water quality, and enhance environmental and resource stewardship. Last updated in 2013, the CWP Update provided statewide water balances for 13 water years (1998 through 2010), demonstrating the state's water demand and supply variability. The updated plan built on the framework and RMS outlined in the CWP Update 2009 promoting IRWM and improved statewide water and flood management systems. The CWP Update 2013 provided the following 17 objectives to help achieve the CWP goals:

1. Strengthen integrated regional water management
2. Use and reuse water more efficiently
3. Expand conjunctive management of multiple supplies
4. Protect and restore surface water and groundwater quality
5. Practice environmental stewardship
6. Improve flood management using an integrated water management approach
7. Manage the Delta to achieve the coequal goals for California
8. Prepare Prevention, Response and Recovery Plans
9. Reduce the carbon footprint of water systems and water uses
10. Improve data, analysis, and decision-support tools
11. Invest in water technology and science
12. Strengthen Tribal/State relations and natural resources management
13. Ensure equitable distribution of benefits
14. Protect and enhance public access to the State's waterways, lakes, and beaches
15. Strengthen alignment of land use planning and integrated water management
16. Strengthen alignment of government processes and tools
17. Improve integrated regional water management finance strategy and investments

The plan projects an uncertain future with respect to population, land use, irrigated crop area, environmental water and background water conservation, water demands, and climate variability. The CWP Update 2013 presents 30 RMS to provide a range of choices and building blocks in addressing future uncertainty. Finally, the CWP Update 2013 provides regional reports that summarize water conditions, provide a water balance summary, describe regional water quality, and describe water/flood planning and management on a hydrologic region basis. The regional summaries then provide a summary of challenges facing each of the hydrologic regions and provide future scenarios for the region.

Climate Ready Utilities (2010, 2015)

In the fall of 2009, the USEPA convened a Climate Ready Water Utilities (CRWU) Working Group under the National Drinking Water Advisory Council (NDWAC). This working group prepared a report that documented 11 findings and 12 recommendations relating to the development of a program enabling water and wastewater utilities to prepare long-range plans that account for climate change impacts. The report, delivered to USEPA in 2010, also included an adaptive response framework to guide climate readiness activities, and the identification of needed resources and possible incentives to support and encourage utility climate readiness. This report resulted in the preparation of the USEPA's Climate Ready Water Utilities Program and the development of tools and resources to support water and wastewater utilities in their planning. These tools and resources include:

- Climate Resilience Evaluation and Awareness Tool (CREAT) – a software tool to assist utility owners and operators in understanding potential climate change impacts and in assessing the related risks to their utilities.
- Climate Ready Water Utilities Toolbox – a searchable toolbox that contains resources that support all states of the decision process, from basic climate science through integration of mitigation and adaptation into long-term planning.
- Adaptation Strategies Guide – an interactive guide to assist utilities in gaining a better understanding of what climate-related impacts they may face in their region and what adaptation strategies can be used to prepare their system for those impacts.
- Climate Ready Water Utilities and Climate Ready Estuaries – USEPA initiative working to coordinate their efforts and support climate change risk assessment and adaptation planning.

In 2015, the USEPA released an update to the report, entitled *Adaptation Strategies Guide for Water Utilities*. The guide is intended to provide adaptation options for drinking water, wastewater, and stormwater utilities. Utilities can use the information in the guide to identify the most relevant challenges to their specific region, and to develop an adaptation plan.

National Water Program 2012 Strategy: Response to Climate Change (2012)

The USEPA prepared and released its *National Water Program 2012 Strategy: Response to Climate Change* to address climate change impacts on water resources and the USEPA's water programs. The report identifies core programmatic elements of the strategy in the form of programmatic visions, goals and strategic actions, with each long-term vision (or outcome) documented with an identified set of goals that reflect the same long-term timeframe as the vision and several strategic actions to be implemented in the next three to eight years to pursue the longer-term goals and visions. The report also includes ten guiding principles for implementing the strategy outlined in the vision, goals and strategic actions and recommendations for cross-cutting program support.

EO B-30-15 (2015)

In 2014, the IPCC released its Fifth Assessment Report, which identified limiting global warming to 2°C or less by 2050 as necessary to avoid potentially catastrophic climate change impacts. In response to this assessment Governor Edmund G. Brown, Jr., issued Executive Order B-30-15. This order established an interim GHG reduction goal (to be achieved prior to the established 2050 goal) of reducing GHG emissions to 40 percent below 1990 levels by 2030. This Executive Order also included guidance for state agencies regarding implementation and strategy.

3.4 Regional Climate Change Projections and Impacts

The East Stanislaus IRWM Region lies within the San Joaquin River Hydrologic Region and contains the Stanislaus, Tuolumne, Merced and San Joaquin Rivers and Dry Creek. The Stanislaus, Tuolumne and Merced Rivers are all tributaries to the San Joaquin River with the Tuolumne having the largest watershed in the San Joaquin River system (Epke et al., 2010). MID and TID operate one hydroelectric facility on the Tuolumne River (the Don Pedro Hydroelectric Project) with an online capacity of 203 MW. The New Don Pedro Reservoir has a capacity of 2.03 million AF. MID operates three hydroelectric facilities in the region with an online capacity of 108 MW, as well as two dams (New Exchequer Dam and McSwain Dam) with a total water storage capacity of over 1 million AF. There is hydroelectric generation on the North Fork of the Stanislaus River, however this facility is operated by Calaveras County Water District and is outside the East Stanislaus Region. New Melones Reservoir is the major water supply reservoir on the Stanislaus River with a capacity of 2.4 million AF.

3.4.1 Recent Regional Studies and Research

At present, all major tributaries to the San Joaquin River are being studied with respect to anticipated impacts from climate change. Studies currently underway include:

- Changes in snow cover patterns in the Sierra Nevada (University of Washington);
- The role of atmospheric rivers in extreme events in the Sierra Nevada (USGS);
- Impacts of climate changes on soil properties and habitats in the Sierra Nevada (University of California (UC) Merced and USGS); and
- Study of the effects of climate change on hydrology and stream temperatures in the Merced and Tuolumne River watersheds (Santa Clara University).

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

3.4.2 Climate Change Impacts on Surface Water

East Stanislaus Region Relation to Local Rivers

The East Stanislaus Region is bound on the north by the Stanislaus River and on the south by the Merced River. Dissecting the Region are Dry Creek and the Tuolumne River, and toward the western edge of the regional boundary is the San Joaquin River.

Multiple cities and agencies/districts in the Region rely on surface water from these rivers as part of their overall supply portfolio.

- The City of Modesto relies on Tuolumne River surface water purchased wholesale from MID.
- The RSWSP, which is anticipated to be operational by 2022 will expand reliance on the Tuolumne River as TID provides raw surface water from the Tuolumne River to SRWA to treat and deliver to the cities of Turlock and Ceres.
- MID and TID rely predominantly on their Tuolumne River water rights to provide irrigation to their customers as well as (currently for MID) potable water for retail providers.
- OID depends predominantly on their surface water rights on the Stanislaus River.
- Merced ID relies on water from the Merced River.
- Eastside Water District currently has only a temporary surface water right on Mustang Creek, which is tributary to TID's Main Canal. Managing a sustainable long-term supply of its groundwater supply requires the purchase of Turlock Subbasin replenishment water from agencies that possess such water (e.g., available surface water).

And just as importantly, all these rivers flow to the San Joaquin River and to the Delta, a resource that much of California relies on.

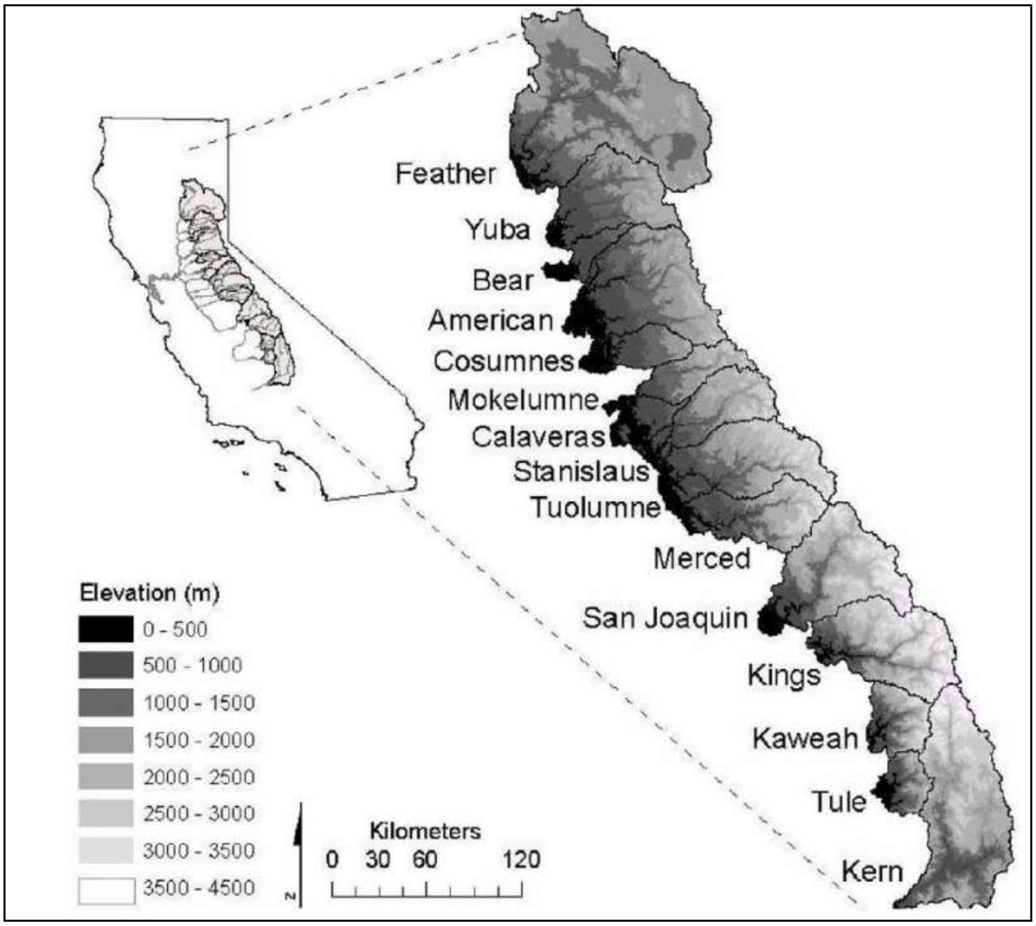
Potential Effects of Climate Change on the Rivers

A study was completed in mid-2010 to evaluate the potential impact of climate change on California's major rivers. As described in *Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada* (Null et al., 2010), the differential hydrologic responses of 15 west-slope Sierra Nevada watersheds in California to climate change were evaluated. The Stanislaus, Tuolumne, and Merced River Watersheds were three of the watersheds included in this analysis; Figure 3-3 shows the watersheds evaluated in the 2010 study.

The Sierra Nevada mountain range is a water source for much of California, including the East Stanislaus Region. Snowmelt from the mountains feeds the Stanislaus and Merced Rivers, as well as the Tuolumne River, one of the primary water supply sources for the region. The Water Evaluation and Planning System (WEAP21) model, developed by the non-profit Stockholm Environmental Institute, was used by the UC Davis, Center for Watershed Sciences to develop an unimpaired hydrologic model of the Sierra Nevada to explicitly simulate intra-basin hydrologic dynamics to better understand localized sensitivity to climate warming. The model is a climate-forced rainfall-runoff model that covers the area from the crest of the Sierra Nevada to the floor of the Central Valley. Incremental climate warming alternatives were developed with uniform increases in air temperature of 2°C, 4°C, and 6°C to evaluate impacts on regional water systems. During these evaluations, only air temperatures were increased while other variables remain the same. Due to uncertainty regarding the change of precipitation in the future due to climate change, historic hydrology was used with a modeled period of 1981 to 2001. The modeled period covers a wide range of climatic variability including the wettest year on record (at that time), the flood year of record and a prolonged drought, 1983, 1997, and 1988-1992, respectively.

The WEAP21 model was used to determine changes in mean annual flow (MAF), centroid timing (CT) and low-flow duration for each of the studied watersheds. The results concluded, in general, that the anticipated hydrologic changes from climate change to the watersheds on the western edge of the Sierra Nevada mountains are not uniform and therefore risks to water resources are not uniform and are watershed-specific.

Figure 3-3: West-Slope Sierra Nevada Watersheds



Source: Null et al., 2010.

The Sierra Nevada generally has a cool, wet season from November to April and a warm, dry season from May to October. The dry season has infrequent precipitation, except for high elevation thunderstorms, while the wet season is characterized as having precipitation fall as snow and rain, with the snowline at approximately 3,200 feet. During the wet season, precipitation averages 43 inches a year, but it can be highly dependent on elevation, latitude and local weather conditions. The average rainfall in the three watersheds within the East Stanislaus Region (Stanislaus, Tuolumne and Merced River watersheds), in addition to other physical characteristics of each watershed, is presented in Table 3-1. Water resource benefits (i.e. hydroelectric generation) for the watersheds are shown in Table 3-2.

Table 3-1: Physical Characteristics of Watersheds within Region

Watershed	Area (acres)	Mean Precipitation (inches/year)	Precipitation Range (in/year)	Elevation Range (ft.)
Stanislaus	578,227	45.6	25.5 – 66.2	692 – 11,546
Tuolumne	980,837	43.3	17.1 – 68.0	803 – 13,084
Merced	663,195	41.1	19.7 – 62.7	803 – 13,087

Source: Null et al., 2010. Table 1.

Table 3-2: Watersheds' Water Resource Benefits

Watershed	Hydropower Facilities	FERC Relicenses (next 40 years)	Total Water Storage Capacity (TAF)	No. of Dams (> 1TAF)	Wild and Scenic Rivers
Stanislaus	12	7	2,842	12	-
Tuolumne	6	1	2,717	9	134
Merced	3	2	1,042	2	197

Source: Null et al., 2010. Table 2.

MAF was the first parameter modeled using the WEAP21 model. MAF from the Sierra Nevada is vital to future water supply for the region, as well as to hydropower generation and aquatic ecosystems. Due to the increases in temperature and evapotranspiration (ET) associated with climate change, the overall trend in the watersheds modeled is a reduction of MAF as a result of increased air temperatures. Results of the modeling of the 15 watersheds indicated that for 2°C, 4°C, and 6°C temperature increases, MAF would be reduced by an average 3%, 6%, and 9%, respectively. A summary of the reduction in average annual flow for the three watersheds within the East Stanislaus Region due to the varied temperature increases modeled are presented in Table 3-3. Overall, watersheds in the northern portion of the Sierra Nevada had greater reductions in MAF than other regions of the Sierra Nevada. Reductions in MAF will impact water supplies for downstream urban, agricultural and environmental water uses.

Table 3-3: MAF by Climate Alternative and Watershed

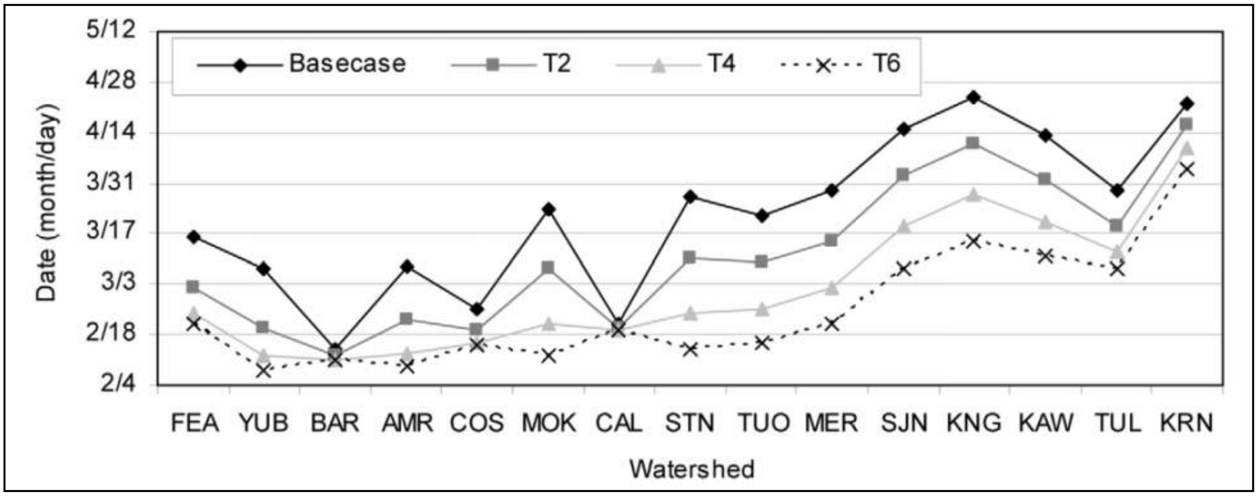
Watershed	Annual Average Flow (TAF)				% Reduction from Baseline		
	Baseline	2°C	4°C	6°C	2°C	4°C	6°C
Stanislaus	1,266	1,235	1,201	1,163	2.4%	5.1%	8.1%
Tuolumne	1,982	1,946	1,908	1,868	1.8%	3.7%	5.8%
Merced	1,093	1,031	1,031	1,003	3.0%	5.6%	8.2%

Source: Null et al., 2010. Table 5.
TAF – Thousand Acre-Feet

Runoff CT, the date at which the total annual runoff at the outlet of each watershed has passed, was also simulated for the 15 studied watersheds using the WEAP21. CT is mostly driven by snowmelt such that watersheds with lower elevations that do not reach the crest of the Sierra Nevada (e.g. Bear, Cosumnes, Calaveras Rivers) experience small changes in runoff CT as they receive less precipitation in the form of snow fall and therefore have less snowmelt. The watersheds with very high elevations (e.g. Kern River) maintain cooler air temperatures later in the year, so although there would be reduced snowfall as a result of climate warming (due to increased temperatures), the snowmelt continued late into the spring resulting in a minimal change to runoff CT.

The Stanislaus River had the greatest change in CT from the baseline conditions of all watersheds in the East Stanislaus IRWM Region. Under baseline conditions, CT was estimated to occur on March 27th, but under 2°C, 4°C, and 6°C temperature increases, timing was estimated to occur March 10th, February 24th, and February 14th, respectively (see Figure 3-4). The San Joaquin, Mokelumne, Kings, and Merced Rivers also had shifts in timing of about five to six weeks earlier in the year with a 6°C temperature increase. In general, for every 2°C increase in temperature, average CT occurred nearly two weeks earlier. The average timing for the Tuolumne River was about the same as the Stanislaus River. In summary, the Stanislaus, Tuolumne and Merced River watersheds may have significant changes in snowmelt and CT.

Figure 3-4: Average Centroid Timing by Watershed and Climate Scenario (north to south)

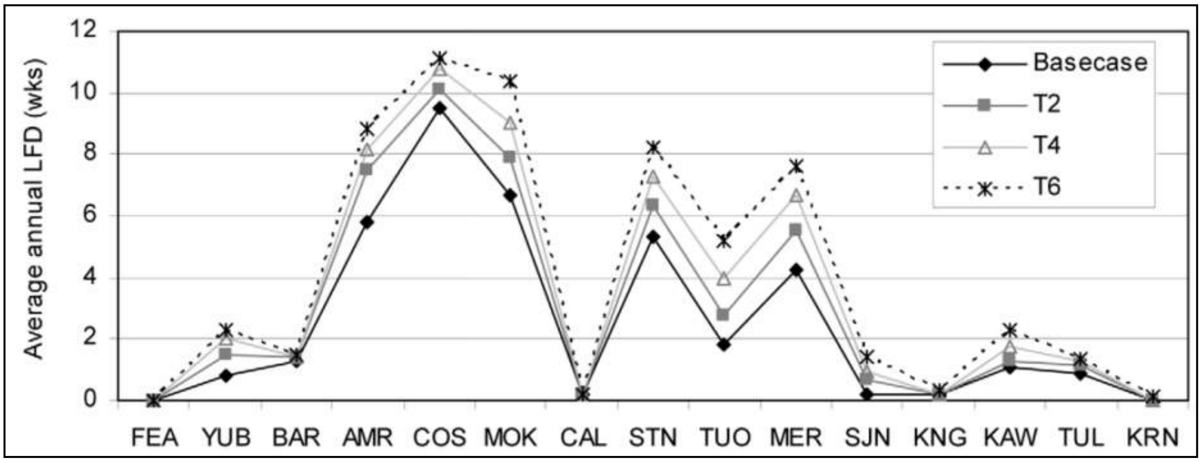


Source: Null et al., 2010 – Figure 6, page 8	FEA – Feather	MOK – Mokelumne	SJN – San Joaquin
Base case – baseline scenario	YUB – Yuba	CAL – Calaveras	KNG – Kings
T2 – 2°C temperature increase	BAR – Bear	STN – Stanislaus	KAW – Kaweah
T4 – 4°C temperature increase	AMR – American	TUO – Tuolumne	TUL – Tule
T6 – 6°C temperature increase	COS – Cosumnes	MER – Merced	KRN – Kern

The final parameter modeled for watersheds in the study using the WEAP21 was low flow duration (LFD), or the number of weeks with low flow conditions. Low flow weeks are when weekly discharge divided by total discharge for the water year is less than 1% of the total discharge for that water year. Also, in order to qualify as LFD, there must be at least three consecutive low flow weeks.

The Mokelumne, Tuolumne, American and Stanislaus River watersheds had the most significant changes in average LFDs from baseline conditions with each experiencing approximately one more week of LFD for each 2°C increase in temperature. The changes in average annual LFD for each watershed for the three temperature increases modeled are shown in Figure 3-5.

Figure 3-5: Average Annual LFD by Watershed and Climate Scenario (north to south)

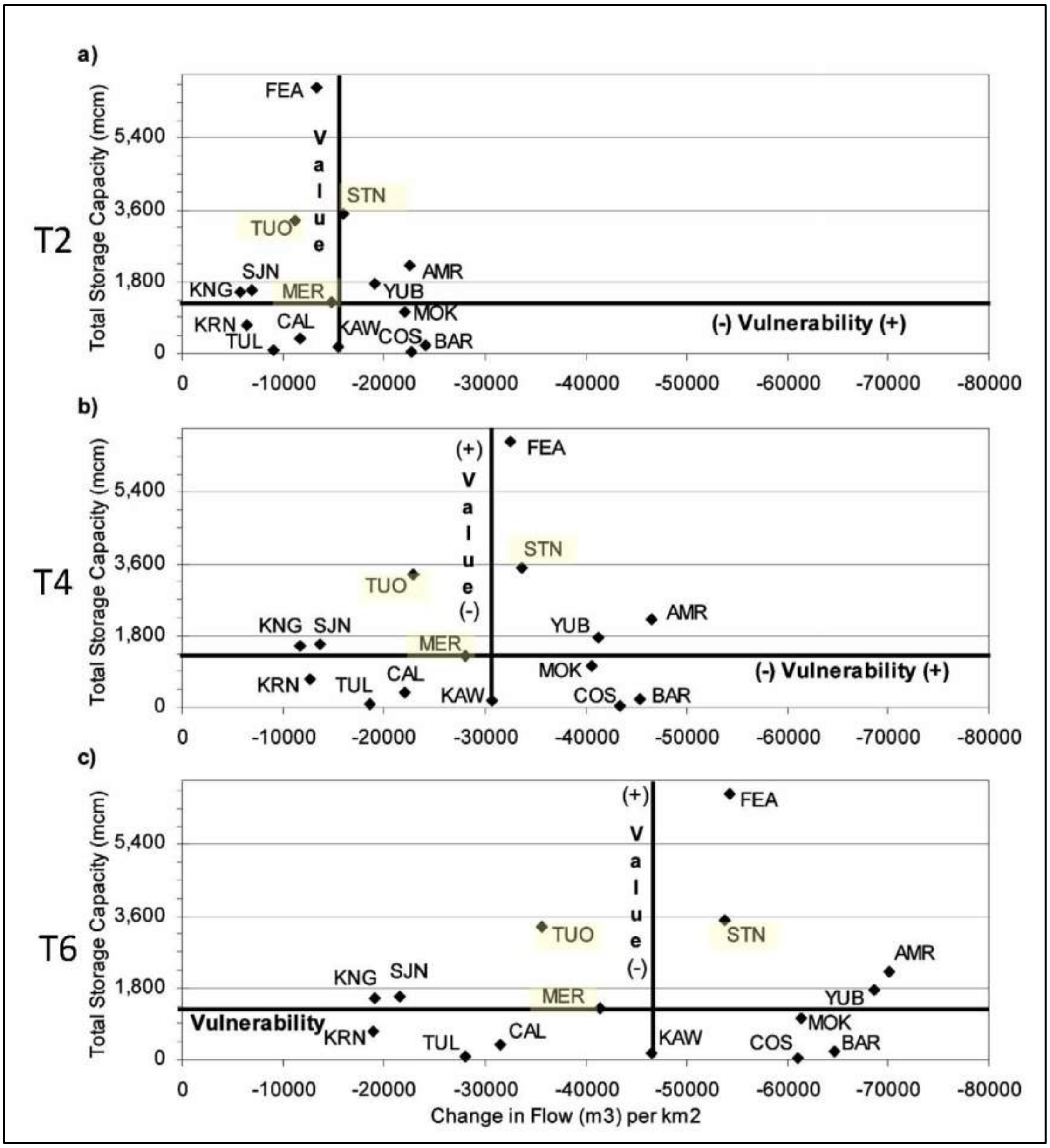


Source: Null et al., 2010 – Figure 6, page 8
Base case – baseline scenario
T2 – 2°C temperature increase
T4 – 4°C temperature increase
T6 – 6°C temperature increase

A number of comparisons were made in order to measure the intrinsic vulnerability of the 15 watersheds, which was defined in the study as the "… inherent ability of the system to cope with external, natural, and anthropogenic impacts that affect its state and character in space and time." Unimpaired change in MAF (per square kilometer) to total water storage, unimpaired change in CT to total hydropower capacity, and unimpaired change in LFD to mountain meadow area were the comparisons made for each watershed under the 2°C, 4°C, and 6°C climate warming scenarios, the results of which are presented in Figure 3-6, Figure 3-7, and Figure 3-8, respectively.

The watersheds on the right side of the graphs shown in Figure 3-6 had the greatest reduction in MAF, so were determined to be most vulnerable to climate warming. Value and vulnerability axes were placed on the median values for all of the watersheds so that half of the remaining watersheds had more water storage capacity and reduction in MAF. The watersheds that are in the top right quadrant are those that are valuable for water storage and most vulnerable to climate warming. As shown the figure below, the Stanislaus River watershed is one of three watersheds in the upper right quadrant (and therefore considered vulnerable to climate changes) since it has 2,282 TAF of total water storage and the model exhibited a significant reduction in MAF, which could likely affect irrigation and urban water storage as well as aquatic and riparian ecosystems.

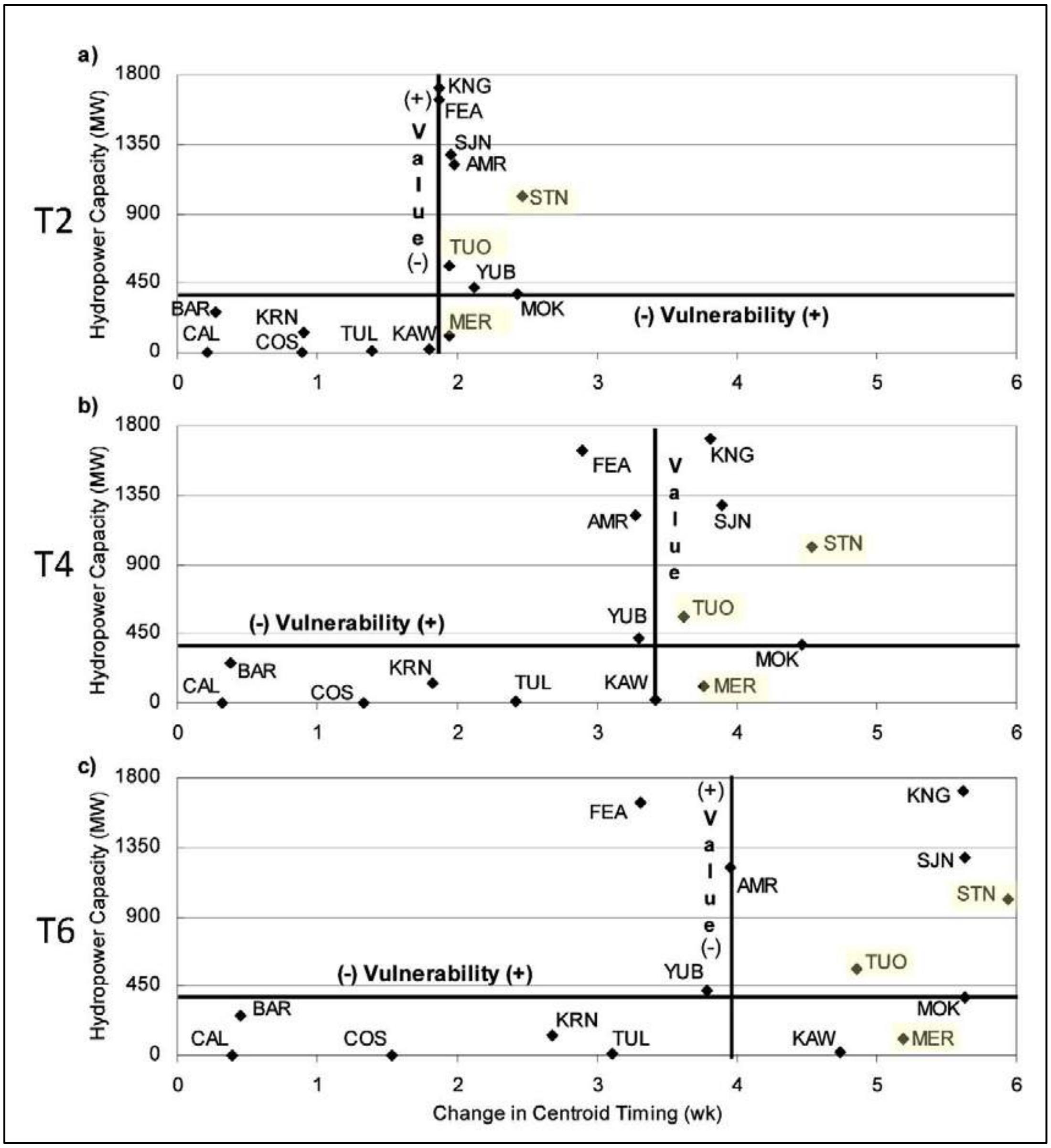
Figure 3-6: Relative Vulnerability Based on Total Water Storage and Change in MAF



Source: Null et al., 2010 – Figure 11, page 12
T2 – 2°C temperature increase
T4 – 4°C temperature increase
T6 – 6°C temperature increase

Changes to runoff CT were compared with hydropower capacity for each watershed, as shown in Figure 3-7. Watersheds that have a high hydropower capacity and may experience substantial changes in runoff timing with climate warming represent the more valuable and vulnerable watersheds. Therefore, similar to the MAF analysis, watersheds in the upper right quadrants of Figure 3-7 are those that are valuable for hydropower generation and have been found to be vulnerable to runoff timing changes associated with climate change. As seen below, the Tuolumne and Stanislaus River watersheds both generate a substantial amount of hydropower and simulations for these watersheds both exhibited significant changes in CT.

Figure 3-7: Relative Vulnerability Based on Total Available Hydropower and Change in CT

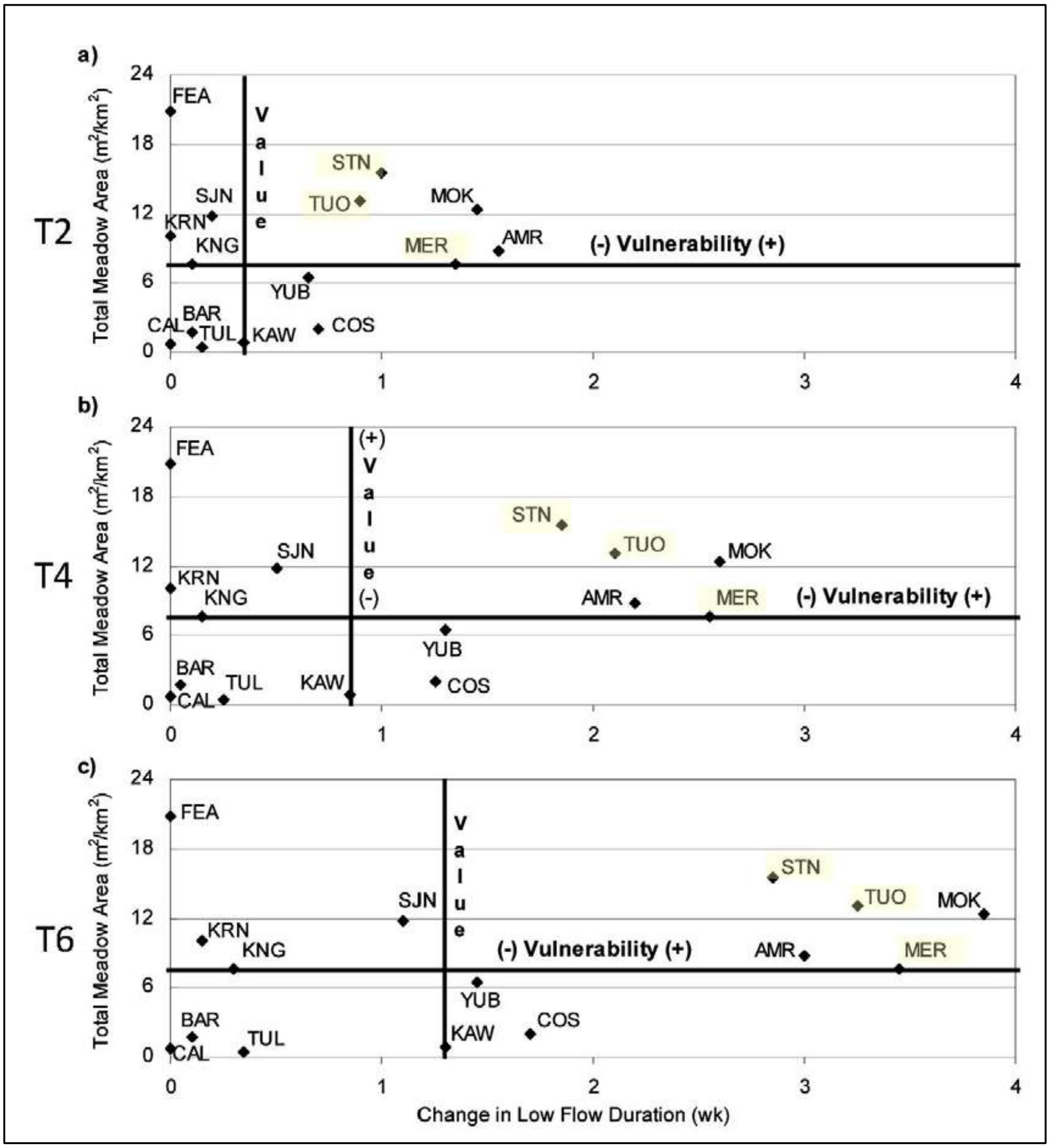


Source: Null et al., 2010 – Figure 12, page 13
T2 – 2°C temperature increase
T4 – 4°C temperature increase
T6 – 6°C temperature increase

LFD was compared to mountain meadow area, used as a representative for montane ecosystems, to evaluate the potential ecological impacts that may result from climate change. Meadows provide environmental and ecosystem benefits such as maintaining summer flow during dry periods, reducing flood in the winter, providing aquatic and riparian habitat, and improving downstream water quality. The study assumed that as LFD increases, groundwater reserves and soil moisture are depleted from meadows, reducing downstream benefits of meadows.

The results of the LFD analysis were graphed in a manner similar to those previously presented. As with the previous comparisons, the watersheds in the upper right quadrant are those that are valuable to ecosystem benefits (based on presence of mountain meadows) and which are also considered vulnerable to lengthened LFD as a result of the model simulations. The Stanislaus, Merced, and Tuolumne River watersheds are all present in the upper right quadrant of Figure 3-8.

Figure 3-8: Relative Vulnerability Based on Meadow Area Per Square Kilometer and Change in LFD



Source: Null et al., 2010 – Figure 13, page 14
T2 – 2°C temperature increase
T4 – 4°C temperature increase
T6 – 6°C temperature increase

3.4.4 Climate Change Impacts on Groundwater

East Stanislaus Region Relation to Groundwater Basins

The East Stanislaus Region is underlain by the Modesto and Turlock Subbasins of the San Joaquin Valley Groundwater Basin. Many of the cities and water agencies/districts in the East Stanislaus Region depend solely or partly on groundwater as part of their water supply. The City of Modesto relies on groundwater, along with surface water purchased wholesale from MID, for its supplies, while the Cities of Ceres, Hughson, Turlock, and Waterford currently rely solely on groundwater. TID, MID, and OID use groundwater to augment their surface water supplies, while other districts, such as the Eastside Water District and landowners within the District, and areas outside major water service areas rely heavily on groundwater to meet their demands.

Potential Effects of Climate Change on the Groundwater Basins

Climate change impacts include more frequent and more severe droughts in the future. The droughts will equate to less precipitation and less recharge of the groundwater basins. With the lack of diversified water supplies in the region, groundwater supplies may not be adequate to meet water demands, resulting in a greater likelihood of overdrafting the groundwater basins and ultimately impacting water quality in the Modesto and Turlock Subbasins. Users in the region rely mostly on groundwater with some surface water, which is to be expanded in the future with the completion of SRWA's surface water treatment plant (the RSWSP), but should more frequent droughts occur, the region's water supplies may not be drought resistant. All of the impacts within the watersheds to the surface waters in the region will lead to similar impacts to the groundwater basins. The conjunctive management of groundwater and surface water will be ever more important in the future and as climate change impacts are realized. In the near future, management of groundwater basins will be regulated under SGMA, with GSAs incorporating future climate conditions into their GSPs in order to achieve sustainability in the face of climate change impacts. GSPs will address climate change, at a minimum, by incorporating assumptions regarding precipitation and temperature into the future water balance analysis.

3.5 Regional Water Resource Vulnerabilities

Climate change is adding new uncertainties to existing challenges in water resources planning within the East Stanislaus IRWM planning region. There is not a widely-diversified water supply portfolio in the region. Water supplies are derived from multiple subbasins of the San Joaquin Valley Groundwater Basin (Modesto and Turlock Subbasins) and primarily from the Tuolumne River. Climate change will impact groundwater and surface water differently, but the Region's vulnerabilities are the same regardless of the source:

- Reduced surface water availability.
- Reduced water supply reliability as a result of reduced groundwater recharge and runoff.
- Potential increase in groundwater overdraft.
- Declining water quality.
- Loss of riparian habitat, wetlands and other sensitive natural communities.
- Reduced hydroelectric generation capacity.

The 2011 *Climate Change Handbook for Regional Water Planning* (DWR and USEPA) summarizes the effects of climate change on California. These effects include, among others:

1. Rising sea levels along the California coastline, including the Delta due to ocean expansion.

2. Extreme heat conditions, such as heat waves and high temperatures and associated increases in frequency and duration.
3. A reduction in the snowpack and stream flow from the Sierra Nevada, affecting water supplies.
4. An increase in the severity of winter storms, modifying peak stream flows and flooding.

These changes will occur concurrently with significant population increases. Population in California is expected to increase from 39 million to 51 million people by 2060 (DOF, 2017). Historically, cities within the East Stanislaus Region have seen extremely rapid growth, so it is expected that the region will see more population increases at a fast rate. For example, Stanislaus County population is projected to increase at a rate of 1.1% between 2016 and 2036, which is among the highest in the state during that time period (DOF, 2017).

Primary water users in the East Stanislaus IRWM region include urban users, agriculture, and the environment. Water supplies include both groundwater and surface water, with groundwater coming from the Modesto and Turlock Subbasins of the San Joaquin Valley Groundwater Basin and surface water being diverted primarily from the Tuolumne River. Declining Sierra Nevada snowpack, earlier runoff, and reduced spring and summer streamflows will likely affect surface water supplies and shift reliance to groundwater resources, which are already on the verge of being overdrafted in some places. This will, in turn, affect critical natural resource issues in the region, such as agricultural land conversion, population growth, air, water and soil quality concerns, and loss of habitat land.

Other anticipated regional impacts resulting from climate change (increased air temperatures and variable precipitation) include changes to water quality; increased flooding, wildfires and heat waves; and impacts to ecosystem health. Earlier springtime runoff will increase the risk of winter flooding as capturing earlier runoff to compensate for future reductions in snowpack would take up a large fraction of the available flood protection space, forcing a choice between winter flood prevention and maintaining water storage for summer and fall dry-period use. Under the 'business-as-usual' climate change scenario (A2), wildfires could increase by 100% or more by the end of the century (CNRA, 2009). Some of these impacts on water resources management are already being observed within the region. For example, a shift in the timing of runoff has occurred. Between 1901 and 2005, April-June runoff in the San Joaquin River System fell by 7% relative to total runoff (DWR, 2006).

The Region's vulnerabilities to climate change were identified using the vulnerability assessment contained in DWR's *Climate Change Handbook for Regional Water Planning* (USEPA and DWR, 2011). The vulnerability assessment checklist was completed for the 2013 IRWMP by Steering Committee (SC) members and other agency representatives. Vulnerabilities were then compiled for inclusion in the Plan. The vulnerability assessment checklist was reviewed and revised by the SC and Public Advisory Committee (PAC) for the 2017 IRWMP Update and used as the basis for identification and prioritization of the Region's vulnerabilities. The vulnerability assessment checklist is included in Appendix C. The identified vulnerabilities within the East Stanislaus Region are summarized in Table 3-4 and further described in the following sections.

Table 3-4: East Stanislaus Region Climate Change Vulnerabilities

Vulnerability	Description	Technical Feasibility	Financial Feasibility
Water Demand	Vulnerable to increased agricultural demands due to longer growing season, increased temperatures and evapotranspiration rates, and more frequent/severe droughts. Vulnerable to increased urban and commercial, industrial, and institutional (CII) demand due to increased outside temperatures.	Feasible to an extent. Demands can be reduced through agricultural, urban, and industrial efficiency measures. However, further reductions in demand would require greater changes in the Region, such as shifts to less water-intensive crop types. This type of demand is controlled by economic factors, and is outside the ability of the Region to control.	Varies. Efficiency and conservation strategies are inexpensive, while developing new sources of water would require a significant investment.
Water Supply and Quality	Vulnerable to decreased snowpack in the Sierra Nevada, shifts in timing of seasonal runoff, increased demands creating groundwater overdraft, degraded surface and groundwater quality resulting from lower flows, exaggerated overdraft conditions, a reduction of meadows which can provide contaminant reduction, and more frequent/severe droughts and storm events increasing turbidity in surface supplies.	Feasibility is generally high. Conjunctive management and recycled water expansion are technically feasible. Pollution prevention, groundwater remediation, habitat restoration, and additional treatment are all feasible ways to address water quality issues.	Projects addressing this vulnerability would generally be expensive. Strategies could require steps such as infrastructure expansion, additional treatment, or development of entirely new supplies.
Flood Management	More severe/flashier storm events and earlier springtime runoff leading to increased flooding, and a reduction of meadows which help reduce floods in the winter.	Feasible. Strategies such as habitat restoration in riparian areas, land use management, stormwater runoff management, LID, and levee improvements are technically feasible.	Varies. Including LID in planned construction would be relatively low cost. Levee improvements would be a significant investment.
Hydropower	Vulnerable to increased customer demand combined with changes in timing of seasonal runoff and flashier storm systems affecting reservoir storage.	Low feasibility. The Region would likely address hydropower vulnerabilities through multi-benefit projects whose primary benefits are water supply-related, such as optimization of storage operations.	Varies. Storage optimization may be relatively inexpensive, but improving reservoir storage would be costly.
Ecosystem and Habitat	Vulnerable to decreased snowpack, more frequent/severe droughts and wildfires, shift in seasonal runoff, increased low flow periods and increased water temperatures (degraded water quality).	Feasible. Habitat restoration projects are technically feasible, and will also likely be incorporated into other multi-benefit projects.	Relatively feasible. Ecosystem and habitat restoration projects would generally be less costly than infrastructure projects associated with other vulnerabilities.

3.5.1 Water Demand

Land use patterns in the East Stanislaus Region are dominated by agricultural uses, including animal confinement (dairy and poultry), grazing, forage, row crops, and nut and fruit trees, all of which rely heavily on water purveyors/districts and private groundwater and surface water supply sources. In general, irrigation water demand varies based on precipitation, and may or may not increase under future climate change conditions. Groundwater pumping is anticipated to increase as more irrigators and agricultural water users turn to groundwater to meet crop water requirements and farming needs (depending on surface water availability), and groundwater salinity increases with decreasing precipitation percolating to groundwater as a result of flashier and more variable precipitation events (Schoups et al., 2005). The effects of increased air temperatures on agriculture will include faster plant development, longer growing seasons, changes to reference ET and possible heat stress for some crops. In addition, fruit crops are more climate-sensitive than other crop types and may require additional water as the climate warms. Therefore, more water may be necessary to maintain yield and quality in future years of apricot or peach crops, for example, in the East Stanislaus Region.

If more water is required to maintain yield, and supplies are simultaneously reduced, the agricultural community may respond to these climate-induced changes primarily by increasing the acreage of land fallowing and retirement, augmenting crop water requirements by groundwater pumping, improving irrigation efficiency, and shifting to high-value and salt-tolerant crops (Hopmans et al., 2008). However, agricultural impacts resulting from climate changes are anticipated to be significant as Stanislaus County agricultural production had a value of around $4 billion in 2015 (Stanislaus County Agricultural Commissioner's Office, 2015). An example of potential impacts is on dairy production. Heat stress can have a variety of effects on livestock, including reduced milk production and reproduction in dairy cows (Valtorta, 2002). Based on modeling conducted by Hayhoe et al. and presented in their paper entitled *Emissions pathways, climate change and impacts on California* (Hayhoe et al., 2004), rising temperatures were found to reduce milk production by as much as 7 to 10% under the B1 scenario and by 11 to 22% under the A1 scenario.

With the exception of the City of Modesto, all urban users in the East Stanislaus Region depend solely on groundwater for their potable supplies. As noted above, climate change conditions may result in increased groundwater pumping by urban and agricultural water users, and on a smaller scale for landscape irrigation, putting greater stress on the underlying groundwater subbasins and increasing competition for limited supplies. Additionally, increased variability in precipitation events and higher temperatures are expected to reduce groundwater recharge by reducing the amount of snowpack recharge that may occur and by increasing ET (Dettinger and Earman, 2007). These factors will also result in greater competition for limited groundwater resources.

Other seasonal water uses, such as cooling demands, are also expected to increase as a result of climate change (DWR, 2008; CNRA, 2009). Identification of industrial cooling towers and similar facilities will help the region gain better understanding of the potential increases in seasonal demands.

In general, groundwater demands are highest during dry years, likely due to the shift to groundwater for supplies by urban, agricultural and landscape irrigation and urban users as surface water supplies decrease; these effects will be greater in regions heavily dependent on groundwater for water supply. The seasonal variability of water demand is projected to increase with climate change as droughts become more common and more severe (DWR, 2008).

3.5.2 Water Supply and Quality

The East Stanislaus IRWM Region's water supplies include groundwater, local surface water, and imported surface water from the CVP. In general, impacts on urban users will be a function of behavioral response of individuals and organizations as well as hydrology (Hayhoe et al., 2004). Additional water storage will be required to ensure water supply reliability. Without additional storage, it will be difficult to capture and retain the extra runoff for use after April 1st without reducing the amount of flood storage space left in reserve. Both the need for empty storage for flood protection and the need for carryover storage for drought protection reflect the uncertainty about future weather conditions and the level of regional risk aversion (Hayhoe et al., 2004).

Currently, approximately 75% of total water use statewide occurs between April and September when lawns and crops are being irrigated (Hayhoe et al., 2004). Decreased summertime flows will likely result in increased groundwater pumping (and potential overdraft conditions) due to increased groundwater use to offset surface water shortages. Additionally, rising temperatures are projected to increase the frequency of heat waves, which could also lead to increased water use and further exacerbate low flow conditions (Hayhoe et al., 2004).

Changes in water availability and timing will also affect the value of water rights statewide, as mid- and late-season natural stream flow water rights become less valuable and the value of rights to stored water (which has a higher degree of reliability) increase in value. Senior users without access to storage could face unprecedented shortages due to reduced summertime flows (Hayhoe et al., 2004). These same changes would also affect the level of hydropower generation on the Merced River (and other Rivers), especially in the summer, when hydropower generation is needed most to meet peak demand (Moser et al., 2012).

Finally, climate change impacts may affect water quality in a multitude of ways.

- Water quality can be impacted by both extreme increases and decreases in precipitation. Increases in storm event severity may result in increased turbidity in surface water supplies while decreases in summertime precipitation may leave contaminants more concentrated in streamflows (DWR, 2008).
- Higher water temperatures may exacerbate reservoir water quality issues associated with reduced dissolved oxygen levels and increased algal blooms (DWR, 2008).

Water quality concerns not only impact drinking water supplies, but also environmental uses and wastewater treatment processes. The altered assimilative capacity of receiving waters may increase treatment requirements, and collection systems could be inundated in flooding events. More prevalent wildfires could result in aerial deposition and runoff of pollutants (including sediment) into water bodies, impacting surface water quality. Declining Sierra Nevada snowpack, earlier runoff and reduced spring and summer stream flows will likely affect surface water supplies and shift reliance to groundwater resources, which are already overdrafted in many places.

Groundwater Supply and Quality

The East Stanislaus Region primarily overlies two groundwater subbasins within the San Joaquin Valley Groundwater Basin: the Modesto and Turlock Subbasins (though a very small portion of the Delta-Mendota Subbasin is within the western portion of the Region).

The Modesto Groundwater Subbasin is the primary source of water for many of the urban and private, rural domestic water systems overlying the groundwater basin. Groundwater levels in the subbasin decreased in the eastern and central Modesto area until the 1990s when a series of wet years occurred and the regional surface water treatment plant was completed, transferring a portion of Modesto's demand to surface water. In recent years, groundwater levels in the subbasin have recovered and generally remain steady in normal and wet years. Municipal (City of Modesto service area) and agricultural groundwater use (MID service area) in 2012 was estimated to be 46,000 AFY (Provost & Pritchard, 2015). This number is likely higher due to reliance on groundwater for supply in areas outside the public water system service area.

Groundwater quality in the Modesto Subbasin ranges from mostly good in the unconfined aquifer to poor in some areas of the confined aquifer (MID, 2012). Total Dissolved Solids (TDS) in groundwater in the eastern two-thirds of the basin is generally less than 500 mg/L, with a range from 90 mg/L to 700 mg/L. High TDS (2,000 mg/L) groundwater is present beneath the MID service area at a depth of about 400 feet in the west to about 800 feet in the east. This degraded water originates in marine sediments underlying the San Joaquin Valley. The shallowest high TDS groundwater (TDS greater than 1,000 mg/L) occurs around 120 feet below ground within a 5- to 6-mile zone parallel to the San Joaquin River (MID, 2012).

The Turlock Groundwater Subbasin is also the primary source of water from most of the urban and private, rural domestic water systems overlying the subbasin. Municipal groundwater use averaged approximately 41,000 AFY from 2008-2012 (TID, 2015) all of which was extracted from the confined aquifer. Rural and small private residential groundwater use is estimated at 5,500 AFY while TID groundwater extractions averaged 103,615 AFY from 2010-2014 (TID, 2015). Private pumping within TID is approximately 22,000 AFY (TGBA, 2008). Agricultural lands to the east of TID's irrigation service area rely entirely on groundwater for water supply. Farmers within Eastside and Ballico-Cortez Water Districts typically use an estimated 180,000 AFY of groundwater for irrigation (TGBA, 2008). Agricultural lands located along the river margins and east of Eastside and Ballico-Cortez Water Districts typically pump an estimated 115,000 AFY. However, similar to the Modesto Subbasin, the overall volume of groundwater extracted in a given year is likely higher than estimated pumpage due to reliance on groundwater for supply in areas outside the public water system service areas.

Historically, groundwater elevations have been relatively steady throughout the Turlock Subbasin, which relies on surface water supplies from the Tuolumne River for recharge. The subbasin has historically experienced seasonal fluctuations in groundwater levels and declines occurring during dry cycles, with groundwater levels rebounding in wetter years. Most recently, groundwater declines were observed in the eastern portion of the basin in the mid-2000's, but conservation efforts and rainfall have helped the basin to begin recovering, and the groundwater basin is not currently on the list of critically overdrafted basins (DWR, 2016b). However, changes in agricultural use (primarily conversion from annual to permanent crops) in the eastern portion of the Subbasin is leading to declining groundwater elevations in that area.

In terms of groundwater quality, shallow groundwater in the Turlock Subbasin does not meet drinking water standards due to the presence of constituents such as nitrate and arsenic. Additional treatment, blending, and well closures have all been used as strategies for addressing poor groundwater quality. Shallow groundwater is suitable for nonpotable uses, and groundwater from deeper aquifers is generally of high quality (TGBA, 2008).

For both the Modesto and Turlock Subbasins, variations in future precipitation and streamflow resulting from climate change impacts will influence how and when the groundwater subbasins are recharged in the East Stanislaus Region.

Surface Water Supply and Quality

The CVRWQCB compiled the 303(d) list of impaired water bodies within the Sacramento River and San Joaquin River Basins that suffer significant water quality impairments from a variety of pollutants and must be addressed through the development of Total Maximum Daily Loads (TMDLs). The Lower Stanislaus River, the Lower Tuolumne River (from Don Pedro Reservoir to the San Joaquin River), and the Lower Merced River (from McSwain Reservoir to the San Joaquin River) are included on this list. Irrigated agriculture has been identified as an anthropogenic source of pesticides, nitrate and sediment loading in surface water bodies. Additional sources of sediment loading include erosion, mining, and grazing, among others. Current climate change scenarios project lower stream flows and higher agricultural water use that would pose significant challenges in implementing the defined TMDLs and meeting water quality goals.

As the occurrence of wildfires increases, additional sediment would be deposited into water bodies, and turbidity would likely become more of a concern. Sediment and pollutants collected from upstream could be concentrated downstream, leading to water quality issues and the disturbance of critical habitats. In addition, earlier snowmelt and more intense precipitation events will likely increase turbidity in source waters. Shifts in the timing of runoff have already been observed; over the last one hundred years the fraction of total annual runoff occurring between April and July has decreased by 23% in the Sacramento Basin and by 19% in San Joaquin Basin (CEC, 2008). Increased flooding may lead to sewage overflows, resulting in higher pathogen loading in the source waters. Increased water temperatures and shallower reservoirs may result in more prevalent eutrophic conditions in storage reservoirs, increasing the frequency and locations of cyanobacterial blooms. These potential changes could result in challenges for surface water treatment plants and require additional monitoring to quantify changes in source water quality and better control of finished water quality (CUWA, 2007).

Imported Surface Water Supply

Imported supplies from the CVP are delivered to users in Stanislaus County through contracts with the USBR (Stene, 1994). Much of this water is delivered via the Delta-Mendota Canal to users outside the East Stanislaus IRWM Region though a small portion is utilized by OID, a CVP contractor that receives water through the New Melones Reservoir.

Due to delivery reductions by the USBR, the long-term average annual available CVP supply is estimated to be 53% of the contracted amount for agricultural usage and 83% of the contracted amount for M&I usage. On December 15, 2008, the USFWS released its final Biological Opinion on CVP and State Water Project (SWP) Operations Criteria and Plan (OCAP); the results of this study could also impact the long-term availability of CVP supplies.

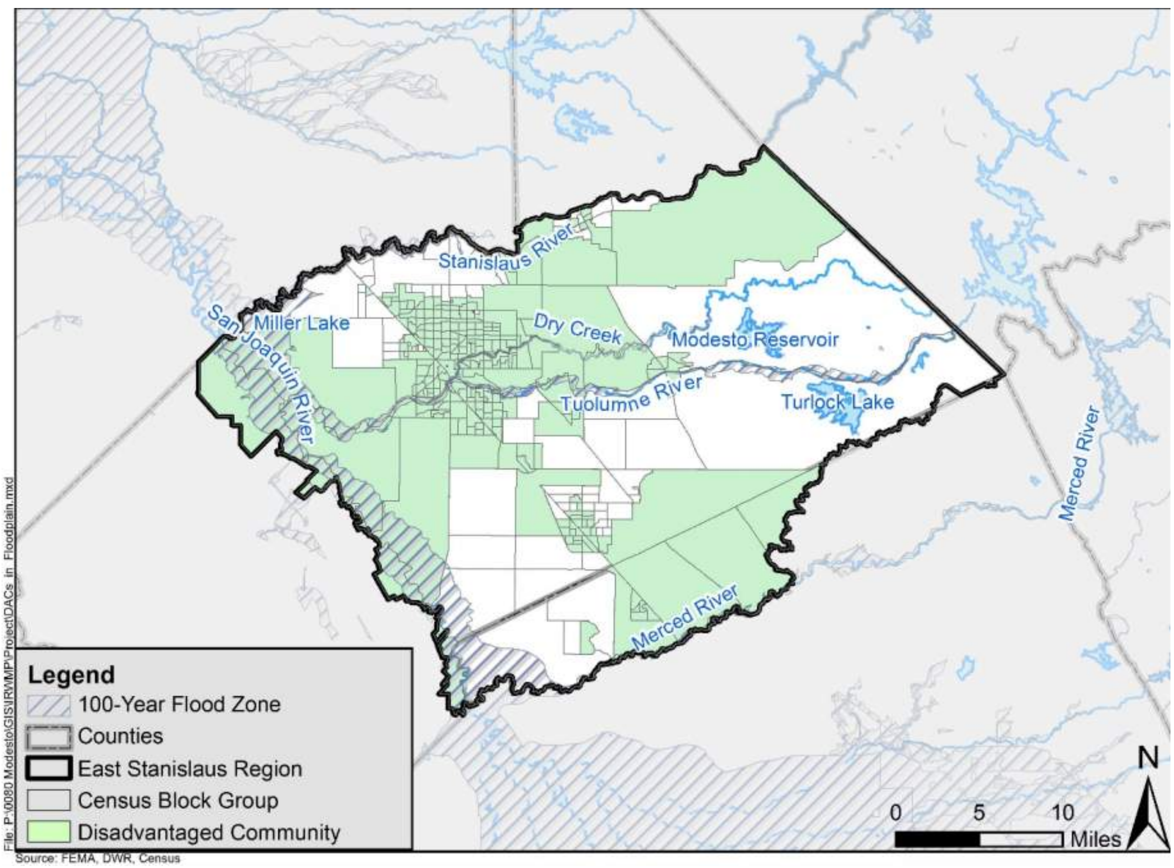
As a result of increased temperatures, DWR anticipates a 20% to 40% decrease in the State's snowpack by mid-century (DWR, 2008). This reduction in snowpack impacts the SWP, CVP and water systems that rely on the Colorado River. The SWP 2009 Delivery Reliability Report (DWR 2010c) indicates that Delta exports may be reduced by up to 25% by the end of the century.

3.5.3 Flood Management

Sea level rise is not a direct potential climate change impact to the East Stanislaus Region, but if sea level rise occurs, the salinity of the Delta may increase, impacting reservoir operations in the Region and resulting in the potential need for freshwater releases from tributaries of the Lower San Joaquin River, including the Stanislaus, Tuolumne and Merced Rivers. In addition to increased coastal flooding resulting from sea level rise, severity of non-coastal flooding will also increase in the future due to climate change. Extreme precipitation events will become more common, increasing the likelihood of extreme weather events and floods. Rising snowlines will also increase the surface area in watersheds receiving precipitation as rain instead of snow (DWR, 2008), thereby increasing storm-related runoff. Flooding has been a major problem throughout the history of Stanislaus County, particularly with the encroachment of urban growth into floodplains. Major floods have occurred in 1861, 1938, 1950, 1966 and 1969. Significant flooding also occurred in 1983 along the San Joaquin River, in isolated stretches of the Tuolumne River, and on smaller creeks such as Salado Creek (Stanislaus County, 2013). More recently, flooding occurred in the winter of 1997-1998 and in 2017 due to above average rainfall. These events could increase under anticipated future conditions.

In general, a majority of the San Joaquin River's 100-year floodplain (in this stretch of the San Joaquin River) is within the East Stanislaus Region, but overall, not much of the East Stanislaus Region is described as being within a FEMA designated 100-year floodplain. Low-lying DACs will be particularly vulnerable to flooding damages causing temporary and/or permanent displacement. Some of the DACs within the East Stanislaus Region lie within the 100-year floodplain as shown in Figure 3-9.

Figure 3-9: DACs within 100-year Floodplain

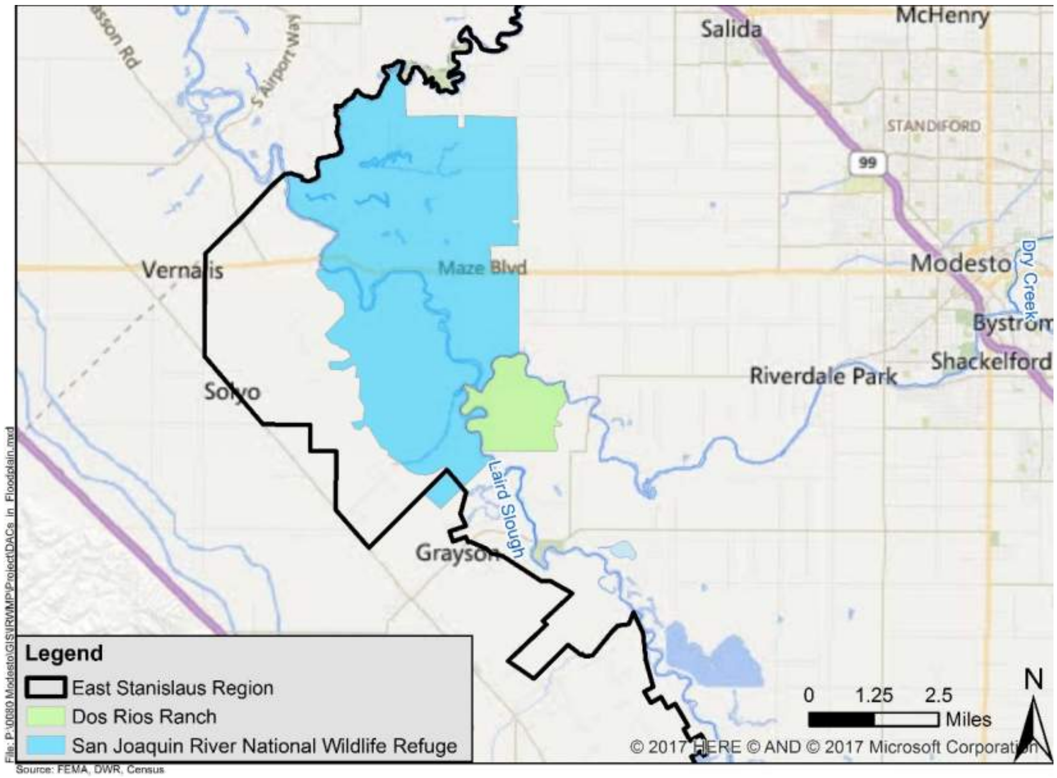


3.5.4 Ecosystem and Habitat

The SJRNWR is located in Stanislaus County at the juncture of the San Joaquin, Tuolumne and Stanislaus Rivers. The SJRNWR, the majority of which is located within the Region, encompasses over 7,000 acres of riparian woodlands, wetlands and grasslands that host a diversity of wildlife native to California's Central Valley and has played a major role in the recovery of the Aleutian cackling geese. Located adjacent to the Refuge and within the East Stanislaus Region is Dos Rios Ranch (Figure 3-10).

This historic property was acquired by the Tuolumne River Trust and River Partners, and is a collaborative restoration project headed by the two non-profits with other federal, state and local partners. Dos Rios Ranch consists of 1,600 acres of biologically rich floodplain, including three miles of riverfront on the San Joaquin River and three miles on the Tuolumne River. The habitats, and the species that inhabit them, are susceptible to heat waves, droughts, and flooding and may be in danger (CCSP, 2009).

Figure 3-10. San Joaquin River National Wildlife Refuge and Dos Rios Ranch



Climate change impacts on the environment within the East Stanislaus Region also include changes in vegetation distribution and increased ecosystem stress. Specifically, temperature-induced declines in alpine/subalpine forests are expected to occur, in addition to major shifts from evergreen conifer forests to mixed evergreen conifer forests and expansion of grasslands (Hayhoe et al., 2004). Increasing stress on ecosystems resulting from rising temperatures will reduce capacity to resist pest attacks while increasing pest survival rates, accelerating their development and allowing them to expand their range. For example, in the western United States, including the Stanislaus National Forest, large-scale tree mortality has occurred due to bark beetle outbreaks. Rising temperatures have reduced wintertime die-off of beetles, while drought and heat have made trees increasingly susceptible to these pests (Bentz et al., 2010). Increasing temperatures will also result in warmer freshwater temperatures which, along with changes in seasonal stream flows, are projected to cause sharp reductions in salmon populations and increased risks of extinction for some Central Valley subpopulations (Ackerman and Stanton, 2011).

Projected hotter and possibly drier future conditions will also increase the frequency and extent of wildfires, worsen pest outbreaks, and stress precarious sensitive populations. Wildfires will play a significant role in converting woodlands to grassland as decreases in moisture shift the competitive balance in favor of the more drought-tolerant grasses and increases in grass biomass provide more fine fuels to support more frequent fires. Increased wildfires also favor grasses, which re-establish more rapidly than slower growing woody life forms after burning (Hayhoe et al., 2004)

Finally, should there be decreases in precipitation, both surface water and groundwater quality could be affected. Warmer surface water would result in lower dissolved oxygen concentrations, which can directly impact aquatic and riparian habitats. Decreased precipitation and associated decreased groundwater percolation would result in increased dissolved concentrations of constituents in groundwater.

3.5.5 Hydropower

MID and TID have been generating and delivering wholesale electric power from the Don Pedro Hydroelectric Project since 1923, with TID as the majority owner and operating partner. The powerhouse can generate up to 203 MW of electrical power from its four generators. OID is a partner on the Tri-Dam Project, which manages the Tulloch, Beardsley and Donnells Reservoirs on the Stanislaus River. The combined storage capacity of the three reservoirs is 230,400 AF, with a combined power generation of 81 MW.

New Melones Reservoir on the Stanislaus River, New Don Pedro Reservoir on the Tuolumne River and New Exchequer Reservoir on the Merced River, along with their downstream reservoirs, are supplied primarily by snowmelt from the Sierra Nevada. Changing volumes of snowfall and snowpack in the Sierra Nevada and the changing seasonal melting patterns may require changes in dam operation. As the timing of snowmelt shifts in the spring, hydroelectric power generation may also shift to accommodate enhanced flood control operations. Additionally, increasing temperatures will also increase energy demands, especially during peak demand times (DWR, 2008). As previously described, the modeling completed as documented in the *Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada*, showed that runoff CT on the Merced River was 2 weeks, 4 weeks, and 6 weeks earlier given the respective 2°C, 4°C, and 6°C increases in air temperature, respectively. Change in seasonal runoff timing may affect electrical generation capabilities, flood protection, water storage and deliveries. Hydropower is often generated during high demand periods, which may be compromised if facilities are forced to spill due to higher magnitude flows or to accommodate early arrival of flows (Null, et. al., 2010) or if low river flows limit hydropower generation during high-demand summer months.

3.5.6 Other

Climate change will also affect the Region in other ways not previously described, including impacting recreation and tourism industries (and therefore the Region's economy). The Tuolumne River, along with the Merced River, are prominent waterways in Yosemite National Park, and communities downstream of the park rely on this industry as part of its economy. Stressed environments and increased wildfire will put these natural resources at risk and damage infrastructure such as roads and electrical transmission lines. Projections of decreased snowpack have the potential to affect the ski industry and reduce the economic contributions of travelers who currently pass through the region to access ski resorts.

3.5.7 Vulnerability Prioritization & Feasibility

The East Stanislaus Region's vulnerabilities to anticipated climate changes were prioritized based on discussions with the East Stanislaus IRWM SC and PAC, including considering regional understanding and sensitivities and identified regional goals and objectives. The prioritized vulnerabilities for the Region were as follows:

1. Water Supply/Water Quality

2. Water Demand
3. Flood Management

Secondary priorities included ecosystems and habitat as well as hydropower.

The rationale behind the prioritization acknowledges that, while the groundwater subbasins appear to be relatively stable, they could easily slip into overdraft conditions, and that additional water supply reductions could induce this condition. As water demands increase, any reductions in water supply or quality will be felt more severely within the Region. Similarly, flooding and flood management is a major issue for the portion of the Region adjacent to the San Joaquin River, and flashier river/stream systems is only going to worsen this condition, create new flooding conditions at other locations, and significantly impact hydropower operations (as would significant changes in river flows resulting from earlier springtime runoff and/or lower annual flows). Finally, while ecosystem and habitat issues are important, they derive from the other issues/vulnerabilities (e.g., water supply and quality, which is exacerbated by demand and flood issues), therefore ranking a lower vulnerability.

The feasibility of addressing the first priorities, water supply and water quality, is relatively high. The Region can adapt to water supply issues in a variety of ways. Increased use of conjunctive management, recycled water expansion, and pollution prevention can all help meet water supply needs. These adaptation strategies are already part of the Region's water management toolbox. For example, the NVRRWP is being implemented to expand recycled water use. Strategies for adapting to changes in water supply in the Region are technically feasible, and projects addressing this issue have been included in prior project solicitation processes in the Region. Given the proper funding, community support, and regional partnerships, it is feasible for the Region to adapt to water supply changes brought about by climate change. Water quality issues can be addressed through treatment, and through matching water sources with uses based on quality requirements. The Region can adapt to groundwater quality issues through treatment processes, which are demonstrated to be technically feasible and already in use in the Region. However, financial feasibility may present a greater issue, depending on the level of treatment required, the constituents being removed, and the intended use of the water. Water quality issues stemming from other sources, such as sedimentation in surface water, may need to be addressed in different ways. Ecosystem restoration, forest management, and flood management are all ways to adapt to impacts to declining water quality. As the Region continues to implement projects that fulfill the Regional Goals and Objectives related to water supply and quality, progress will be made in terms of climate change adaptation.

The second priority vulnerability is water demand. The Region's water demands are largely agricultural, and climate change is expected to lengthen the growing season and increase ET, resulting in greater water demand. Changes in instream flow requirements could exacerbate this increase in demand. Potential adaptations include increased water use efficiency (agricultural and urban), improved groundwater management, and water transfers. The Region's ability to enact these solutions varies. Increased water use efficiency can be achieved though regional and local actions, but also requires action from state agencies to ensure proper incentives and water rights security. Groundwater will be managed more sustainably as SGMA implementation continues, and the Region addresses this issue through participation in SGMA efforts. Water transfers already occur in the Region, and continued use of this strategy is feasible. The IRWM planning process encourages the type of regional cooperation that is essential for such transfers. Addressing climate-change driven water demand will likely require coordination beyond Regional boundaries, but the Region has the tools and relationships with neighboring IRWM regions available to address this issue.

Flood management was identified as the third priority. The Region can adapt to the threat of increased flooding through habitat restoration in riparian areas, land use management, stormwater runoff management, and LID. These are all proven strategies for alleviating flooding issues when applied correctly. Again, funding may prove to be the larger hurdle for implementing flood adaptation measures. The IRWMP plays an important role in reducing the financial barrier for such projects. In addition, Stanislaus County is in the process of preparing a *Regional Multi-Agency Storm Water Resource Plan*, which will identify projects that can provide flood adaptation in the face of climate change. These two planning efforts will provide the basis for implementation of flood management projects and outline feasible adaptation methods.

The secondary vulnerabilities were considered equally important to one another. Addressing the ecosystem and habitat vulnerabilities is considered generally feasible. Climate change impacts to ecosystems and habitat are anticipated to include changes in vegetation distribution, ecosystem stress, increased fire and flood occurrence, and decline in riparian habitat quality. A clear adaptation strategy to these impacts is through targeted habitat restoration projects. Additionally, ecosystem adaptations will likely be included as part of multi-benefit projects which aim to address flood control, water quality, or water supply. Therefore, it is feasible for the Region to address ecosystem adaptations through projects. Projects will vary in the amount of benefit they provide to the ecosystem and habitats.

The Region also generates hydropower, which is vulnerable to the effects of climate change. However, water management changes, such as optimization of storage operations, can also benefit hydropower operations. Generally, projects that support water supply are likely to support continued hydropower generation, either directly or indirectly, by increasing the flexibility of reservoir operations and reducing dependence on existing supplies. These types of multi-benefit projects provide methods for addressing potential reduction in hydropower generation capacity. While the Region does not control hydropower production, it is still feasible to address this vulnerability via projects submitted to the IRWMP.

3.6 Climate Change Adaptation and Mitigation

Global climate modeling carries a significant degree of uncertainty resulting from varying sensitivity to changes in atmospheric forcing (e.g. CO_2, aerosol compounds), unpredictable human responses, and incomplete knowledge about the underlying geophysical processes of global change. Even though current scenarios encompass the "best" and "worst" cases to the greatest degree possible based on current knowledge, significant uncertainty associated with future global GHG emission levels remains, especially as timescales approach the end of the century. The historical data for calibrating GCMs are not available worldwide, and are spatially biased towards developed nations.

Considering the great deal of uncertainty associated with climate change projections, a prudent approach to addressing climate change incorporates a combination of adaptation and mitigation strategies. Climate adaptation includes strategies (policies, programs or other actions) that bolster community resilience in the face of unavoidable climate impacts (CNRA and CEMA, 2012), where mitigation strategies include BMPs or other measures that are taken to reduce GHG emissions.

The Prop 1 IRWM Guidelines require consideration of the CWP resource RMS in identifying projects and water management approaches for the region. RMS are being considered in the East Stanislaus IRWM planning process to meet the region's objectives. Application of various RMS diversifies water management approaches, and many of the RMS apply to climate change adaptation and mitigation. Categories of applicable RMS include:

- Reduce Water Demand

- Improve Operational Efficiency and Transfers
- Increase Water Supply
- Improve Flood Management
- Improve Water Quality
- Practice Resource Stewardship
- People and Water
- Other Strategies

Within each RMS category listed above, a variety of specific RMS have been identified for the region. For example, reducing water demand can be accomplished through agricultural water use efficiency and/or urban water use efficiency. As described in the *Climate Change Handbook for Regional Planning* (CDM, 2011), not all of the RMS directly apply to climate change adaptation or mitigation, but are directed at overall system resiliency, which improves a system's resilience to the uncertain conditions climate change could bring.

3.6.1 Adaptation Strategies

Table 3-5 summarizes the ability of individual RMS to aid in climate change adaption.

The application of the RMS that are applicable within the East Stanislaus Region as climate change adaptation strategies are described fully in Chapter 6, Resource Management Strategies.

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

Resource Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Sea Level Rise	Water Quality Protection	Hydropower
Reduce Water Demand								
Agricultural Water Use Efficiency			✓		✓		✓	
Urban Water Use Efficiency			✓		✓		✓	
Improve Operational Efficiency and Transfers								
Conveyance-Delta*	✓	✓	✓	✓		✓	✓	
Conveyance-Regional/Local	✓	✓	✓	✓			✓	
System Reoperation		✓	✓	✓				✓
Water Transfers			✓	✓				
Increase Water Supply								
Conjunctive Management and Groundwater		✓	✓	✓			✓	
Desalination*			✓	✓				
Precipitation Enhancement*				✓				✓
Recycled Municipal Water			✓	✓				
Surface Storage-CALFED*	✓	✓	✓	✓			✓	✓
Surface Storage-Regional/Local	✓	✓	✓	✓			✓	✓
Improve Water Quality								
Drinking Water Treatment and Distribution			✓	✓			✓	

Resource Management Strategies	Habitat Protection	Flood Control	Water Supply Reliability	Additional Water Supply	Water Demand Reduction	Sea Level Rise	Water Quality Protection	Hydropower
Groundwater Remediation/Aquifer Remediation			✓	✓			✓	
Matching Water Quality to Use			✓	✓			✓	
Pollution Prevention	✓		✓				✓	
Salt and Salinity Management	✓		✓	✓			✓	
Urban Stormwater Runoff Management	✓	✓					✓	
Practice Resource Stewardship								
Agricultural Land Stewardship	✓	✓			✓		✓	
Ecosystem Restoration	✓	✓	✓			✓	✓	
Forest Management	✓	✓	✓				✓	
Land Use Planning and Management	✓	✓	✓			✓	✓	
Recharge Areas Protection		✓	✓	✓			✓	
Sediment Management	✓	✓	✓				✓	✓
Watershed Management	✓	✓	✓	✓		✓	✓	✓
People and Water								
Economic Incentives	✓	✓	✓	✓	✓	✓	✓	✓
Outreach and Engagement	✓	✓	✓	✓	✓	✓	✓	✓
Water and Culture	✓				✓		✓	
Water-Dependent Recreation	✓	✓	✓				✓	
Improve Flood Management								
Flood Management	✓	✓				✓	✓	✓
Other Strategies								
Crop Idling for Water Transfers*			✓	✓	✓			
Dewvaporation or Atmospheric Pressure Desalination*				✓				
Fog Collection*				✓				
Irrigated Land Retirement*			✓		✓			
Rainfed Agriculture*					✓			
Waterbag Transport/Storage Technology*	✓		✓	✓		✓	✓	

* RMS deemed inappropriate for the East Stanislaus IRWM Region at this time, as described in Chapter 6.

3.6.2 No Regret Strategies

'No Regret' adaptation strategies are those that make sense for current day conditions and the existing water management context, while also helping regions adapt to climate change and anticipated future conditions. The following table presents the No Regret adaptation strategies for the East Stanislaus Region. The region either is already implementing or planning to implement these strategies; strategies that the Region would not consider implementing in the future under any circumstances are not included in this table.

Table 3-6: No Regret Strategies in the East Stanislaus Region

Resource Management Strategies	No Regrets Strategy
Reduce Water Demand	
Agricultural Water Use Efficiency	✓
Urban Water Use Efficiency	✓
Improve Operational Efficiency and Transfers	
Conveyance-Delta	
Conveyance-Regional/Local	
System Reoperation	
Water Transfers/Sales	✓
Increase Water Supply	
Conjunctive Management and Groundwater	✓
Recycled Municipal Water	✓
Surface Storage-Regional/Local	
Improve Water Quality	
Drinking Water Treatment and Distribution	✓
Groundwater Remediation/Aquifer Remediation	✓
Matching Quality to Use	✓
Pollution Prevention	✓
Salt and Salinity Management	
Urban Runoff Management	✓
Practice Resource Stewardship	
Agricultural Lands Stewardship	✓
Ecosystem Restoration	✓
Forest Management	
Land Use Planning and Management	✓
Recharge Areas Protection	✓
Sediment Management	✓
Watershed Management	✓
Improve Flood Management	
Flood Management	✓
People and Water	
Economic Incentives	✓
Outreach and Engagement	✓
Water and Culture	
Water-Dependent Recreation	

3.6.3 Mitigation/GHG Reduction Strategies

The East Stanislaus Region recognizes the importance and value of mitigating climate change by reducing energy use and associated GHG emissions. Water distribution can require significant amounts of energy. In California, 19% of the state's electricity and 30% of its natural gas is used for water-related activities (DWR, 2010a). During the Region's Project Review Process, the East Stanislaus Region considers GHG emissions from the projects and ways to potentially mitigate climate change.

As described in Section 3.2, increasing GHG concentrations in the Earth's atmosphere contribute to warming trends and climate change impacts. Because the water industry is a significant contributor to GHG emissions and the overall increasing concentrations in the atmosphere, reducing GHGs generated in the conveyance, treatment, and distribution of water and wastewater represents a significant opportunity to help to achieve the GHG emission goals set by AB32 and reduce GHG emissions generated by water management.

The variation in temperature and precipitation projections from different emissions scenarios illustrates the importance of implementing mitigation measures now to address climate impacts already taking place. GHG emission reductions must be achieved through cooperation at global, national and regional levels to prevent or mitigate continued climate change impacts later in the century. Major components of climate change mitigation strategies include:

1. Improve Energy Efficiency
2. Reduce Emissions
3. Carbon Sequestration

Almost all RMS identified by the *2013 CWP Update* can potentially reduce GHG emissions and mitigate climate change impacts. A list of applicable mitigation strategies is included in Table 3-7.

GHG emissions and climate change mitigation was considered in the project prioritization methodology, described in Chapter 7 of this IRWMP. Project-related GHG emissions were evaluated on a qualitative basis, and the results used as a secondary sorting criteria in the project prioritization process. Chapter 7 describes this process in more detail.

The following briefly summarizes how the applicable RMS could contribute to climate change mitigation in the East Stanislaus Region.

- Reduce Water Demand – implementing water use efficiency measures will help save water and energy by reducing the volume of water treated and distributed (pumped) throughout regional water systems.
- Improve Operational Efficiency and Transfers – optimizing water system operations will maximize efficiency and potentially reduce energy use. Reducing system losses will also reduce emissions by reducing the volume of water treated and distributed (pumped) throughout regional water systems.
- Increase Water Supply – depending on the method used to increase water supply (e.g. desalination versus increased storage), there may be a net increase or decrease in GHG emissions. Increasing storage could have GHG emissions associated with construction, but relatively low operational emissions.
- Improve Water Quality – GHG emissions depend on the specific project implemented to improve water quality. Matching quality to use generally has lower emissions than using

potable water for non-potable uses. Additionally, protecting water sources from future water quality degradation may offset the future need for water treatment.

- Improve Flood Management – where flood management encourages vegetation growth (e.g. ecosystem or floodplain restoration), carbon sequestration may help reduce net carbon emissions.
- Practice Resource Stewardship – implementing ecosystem restoration or forest management, for example, can contribute to carbon sequestration and potentially reduce net emissions.
- Other Strategies – some of the strategies included under this RMS could reduce GHG emissions by conserving water (i.e., crop idling, irrigated land retirement), whereas others may be more energy-intensive and increase emissions (i.e., dewvaporation, fog collection, and waterbag transport, which were not considered feasible RMS for the East Stanislaus Region).

Table 3-7: Applicability of CWP Resource Management Strategies to GHG Mitigation

Resource Management Strategies	Greenhouse Gas Mitigation		
	Energy Efficiency	Emissions Reduction	Carbon Sequestration
Reduce Water Demand			
Agricultural Water Use Efficiency	✓	✓	
Urban Water Use Efficiency	✓	✓	
Improve Operational Efficiency and Transfers			
Conveyance-Regional/Local	✓	✓	
System Reoperation	✓	✓	
Water Transfers	*	*	
Increase Water Supply			
Conjunctive Management and Groundwater Storage	*	*	
Recycled Municipal Water	*	*	
Surface Storage-Regional/Local	*	✓	
Improve Water Quality			
Drinking Water Treatment and Distribution	✓	✓	
Groundwater Remediation/Aquifer Remediation	*	*	
Matching Quality to Use	*	*	
Pollution Prevention		✓	
Salt and Salinity Management		✓	
Urban Runoff Management	✓	✓	
Improve Flood Management			
Flood Management			✓
Practice Resource Stewardship			
Agricultural Lands Stewardship			✓
Ecosystem Restoration			✓
Forest Management			✓
Land Use Planning and Management	✓	✓	✓
Recharge Areas Protection			✓
Sediment Management	✓	✓	✓
Watershed Management	✓	✓	✓
People and Water			
Economic Incentives	✓	✓	
Outreach and Engagement	✓	✓	
Water and Culture	✓	✓	
Water-Dependent Recreation		✓	
Other Strategies			
Crop Idling for Water Transfers	✓	✓	
Irrigated Land Retirement	✓	✓	
Rainfed Agriculture	✓	✓	✓

Source: modified from CDM 2011
Key:
✓ indicates that in general this will provide a beneficial effect
* indicates that this may provide beneficial or adverse effects

3.7 Plan for Further Data Gathering

Identifying and implementing appropriate adaptation strategies requires data necessary to (1) understand the magnitude of climate change impacts and associated vulnerabilities, and (2) plan for strategy implementation in a timely manner. To aid in this understanding, the East Stanislaus Region has developed a data gathering and analysis approach to collect and assimilate data related to the prioritized climate change vulnerabilities and to facilitate future water resource management. A preliminary data collection plan is summarized in the table on the following pages. It represents a high-level overview of the types of data that may be collected, possible methods and frequency for data collection, and recommended responsible monitoring entities. In determining a final approach to data collection, the ESRWMP will need to determine how this preliminary plan aligns with existing monitoring programs and where new monitoring programs should be implemented. Additionally, as part of IRWM project implementation, numerous types of data will be collected to meet project performance and monitoring program requirements. These data will significantly contribute to the data collection described herein for further vulnerability assessment and will also need to be aligned with available resources and ongoing programs to minimize duplication of efforts.

Table 3-8: Preliminary Data Collection and Management Approach for Vulnerability Assessment

Vulnerability Indicators	Vulnerability Measurement Tools & Methods				Adaptation Goal(s)	Possible Near-Term Adaptation Actions
	Measure	Method	Frequency	Responsible Entity		
Vulnerability: Water Demand						
Increased urban demand	Water meter data	Flow meters	Monthly	Water agencies	- Minimize urban demand - Sufficient storage to meet unexpected needs	Participate in community planning and regional collaborations relating to climate change adaptation Develop programs to encourage installation of advanced irrigation equipment Develop water conservation and demand management programs through water metering and rebate programs Demand management through public education on conservation Establish a relationship with local power utility and work jointly on strategies to reduce seasonal or peak water and energy demand
	Groundwater use reporting (unmetered systems)	Individual reporting to basin management authority	Annual	Basin management group		
	Evaluation of meter records	Electronic data compilation	Every five years	ESRWMP		
Increased agricultural demand	Water meter data	Flow meters	Monthly	Water agencies & irrigation districts	- Minimize agricultural demand - Sufficient storage to meet unexpected needs	Participate in community planning and regional collaborations relating to climate change adaptation Reduce agricultural water demand by working with irrigators to install advanced irrigation equipment Develop water conservation and demand management programs through water metering and rebate programs Establish a relationship with local power utility and work jointly on strategies to reduce seasonal or peak water and energy demand Model agricultural water demand under future scenarios of climate change and projections of cropping types
	Groundwater use reporting (unmetered systems)	Individual reporting to basin management authority	Annual	Basin management group		
	Evaluation of meter records	Electronic data compilation	Every five years	ESRWMP		
Increased CII demand	Water meter data	Flow meters	Monthly	Water agencies	- Minimize CII demand - Sufficient storage to meet unexpected needs	Participate in community planning and regional collaborations relating to climate change adaptation Demand management through public education on conservation Develop water conservation and demand management programs through water metering and rebate programs Work with power companies to evaluate feasibility of using recycled water or alternative cooling methods to meet power plant needs Optimize operations by restricting some energy-intensive activities during the summer to times of reduced electricity demand and work with energy utility on off-peak pricing
	Groundwater use reporting (unmetered systems)	Individual reporting to basin management authority	Annual	Basin management group		
	Evaluation of meter records	Electronic data compilation	Every five years	ESRWMP		
Increased demand for firefighting (wild and other)	Public records compared with meter records; statistical analyses	Electronic data compilation	Every five years	ESRWMP	- Minimize likelihood of wildfires through land management - Plan and managed supplies to meet firefighting needs	Use fire models and develop fire management plans for water supply sources in fire-prone watersheds Practice fire management plans in watersheds
Vulnerability: Water Supply and Quality						

Vulnerability Indicators	Vulnerability Measurement Tools & Methods				Adaptation Goal(s)	Possible Near-Term Adaptation Actions
	Measure	Method	Frequency	Responsible Entity		
More frequent droughts	Historical data tracking with statistical analyses	Electronic data compilation	Every five years	ESRWMP	- Minimize urban, agricultural and CII demands - Sufficient storage to cover drought periods	Conduct climate change impacts and adaptation training for staff Participate in community planning and regional collaborations relating to climate change adaptation Expand current resources through developing regional water connections for sharing during shortages
Reduced surface water availability	Streamflow measurements	Stream gages or weirs	Continuously	DWR (California Data Exchange Center [CDEC]), U.S. Geological Survey, water agencies, irrigation districts	- Minimize urban, agricultural and CII demands - Sufficient storage to cover drought periods	Use hydrologic models to project runoff and incorporate model results in water supply planning Diversify water portfolio to include drought-proof supplies like recycled water Practice conjunctive use and construct or expand infrastructure to support such use Construct infrastructure for additional surface and/or ground water storage (i.e. recharge facilities) Increase water storage capacity (i.e. silt removal from reservoirs) Retrofit intakes to accommodate lower water levels in reservoir and decreased late season flow
	Water stage at dam sites	Water level gages	Continuously	Irrigation districts		
Increased groundwater salinity	Groundwater samples (Specific Conductance, TDS)	Laboratory and in-field analyses	As needed – quarterly, annually, or every few years	Water agencies, groundwater management organizations	- Track and mitigate groundwater quality impacts through basin management activities	Simulate climate change scenarios/projections in groundwater models
Increased groundwater overdraft	Groundwater elevations	Elevation monitoring data	Monthly or Seasonally	Water agencies, groundwater management organizations	- Track and mitigate groundwater overdraft through basin management activities	Simulate climate change scenarios/projections in groundwater models Diversify water portfolio to include drought-proof supplies like recycled water Practice conjunctive use and construct or expand infrastructure to support such use Construct infrastructure for additional surface and/or ground water storage (i.e. recharge facilities) Promote the use of LID techniques to encourage infiltration on the local level
Decreased surface water quality	Water quality parameters such as dissolved oxygen, total suspended solids, etc.	Laboratory and in-field analyses	Seasonally	Water agencies, resource conservation districts, volunteers	- Track and mitigate surface water quality impacts through watershed management activities	Manage reservoir water quality by investing in practices such as lake aeration Monitor surface water conditions, including water quality in receiving bodies Implement watershed practices to limit pollutant runoff to surface water Increase capacity for wastewater and storm water collection, treatment and discharge
	Ability of surface water treatment plants to treat diverted water	Number of violations	Annual	California Department of Public Health	- Maintain ability to treat surface water to drinking water standards	Develop models to understand potential water quality changes and costs of resultant changes in treatment Increase or modify treatment capabilities to address treatment needs of marginal water quality Implement or retrofit source control measures at treatment plants to deal with altered influent flow and quality

Vulnerability Indicators	Vulnerability Measurement Tools & Methods: Measure	Method	Frequency	Responsible Entity	Adaptation Goal(s)	Possible Near-Term Adaptation Actions
Increased cost of imported supplies (indicator of regional and statewide demand)	Average market value of one acre-foot of water	Market survey	Periodic, as needed	ESRWMP, water agencies, irrigation districts	- Minimize the need for imported water	
Vulnerability: Flood Management						
Increased frequency of high flow events / shift in timing of snowmelt	Streamflow measurements	Stream gage	Continuously	DWR (CDEC)	- Plan for sufficient flood storage space under a variety of hydrologic conditions	Increase water storage capacity (i.e. silt removal from reservoirs) Develop plans for reoperation of reservoirs Monitor flood events and drivers that may impact flood and water quality models Set aside land for future flood-proofing needs (e.g. berms, dikes) Use land use planning to limit development in the flood plain Implement or retrofit source control measures that address altered influent flow and quality at treatment plants Build flood barriers, flood control dams, levees and related structures Increase channel capacity along lower river stretches to eliminate constrictions and enable higher flows
Increased areas of inundation	Area flooded during storm events	Insurance reports	Annual	California Department of Insurance	- Plan for and minimize potential flood-related damage	Participate in community planning and regional collaborations relating to climate change adaptation Develop and implement emergency response plans to deal with natural disasters Implement strategies on site and in municipalities to reduce runoff and associated pollutant loads into waterways Integrate flood management and modeling into land use planning Conduct extreme precipitation events analysis with climate change to understand the risk of impacts to water and wastewater infrastructure Plan for alternative power supplies to support operations in case of loss of power Establish mutual aid agreements with neighboring utilities Identify and protect vulnerable facilities Use land use planning and zoning to limit development in flood plains Integrate climate change risks, including flooding, into capital improvement plans (CIPs) to build facility resilience against current and potential future risks Implement policies and procedures for post-flood repairs Monitor and inspect the integrity of existing infrastructure Set aside land for future flood-proofing needs (e.g. berms, dikes) Implement or retrofit source control measures that address altered influent flow and quality at treatment plants Build flood barriers, flood control dams, levees and related structures Relocate facilities to higher ground Study response of nearby wetlands to storm surge events
Vulnerability: Ecosystem and Habitat						

Vulnerability Indicators	Vulnerability Measurement Tools & Methods				Adaptation Goal(s)	Possible Near-Term Adaptation Actions
	Measure	Method	Frequency	Responsible Entity		
Impacted fisheries and other habitats	Fish count	Field studies	Seasonally	California Department of Fish and Game	- Track and mitigate fisheries impacts through watershed management activities	Monitor vegetation changes in watersheds
Degradation of surface water quality	Water quality parameters such as dissolved oxygen, total suspended solids, etc.	Laboratory and in-field analyses	Seasonally	Water agencies, resource conservation districts, volunteers	- Track and mitigate surface water quality impacts through watershed management activities	Develop models to understand potential water quality changes Monitor surface water conditions, including water quality in receiving bodies Implement watershed practices to limit pollutant runoff to surface water
Increased water temperatures	Water temperature	Thermometer	Monthly	Water agencies, resource conservation districts, volunteers	- Track and mitigate surface water quality impacts through watershed management activities	Develop models to understand potential water quality changes Monitor surface water conditions, including water quality in receiving bodies Reoperation of reservoir to use cold water pool to manage water temperatures
Vulnerability: Hydropower						
Decrease in power generation	Number of kilowatt hours produced	Data generation records	Annual	Modesto Irrigation District; Turlock Irrigation District Pacific Gas and Electric Company California Public Utilities Commission	- Reduce energy demand - Maximize hydroelectric generation	Develop plans for changing reservoir and hydropower operations Work with power companies to coordinate energy conservation programs (such as rebate programs) Establish a relationship with local power utility and work jointly on strategies to reduce seasonal or peak water and energy demand Work with power companies to evaluate feasibility of using recycled water or alternative cooling methods to meet power plant needs Optimize operations by restricting some energy-intensive activities during the summer to times of reduced electricity demand and work with energy utility on off-peak pricing
Increase in power demands	Number of kilowatt hours delivered	Data transmission and metering records	Monthly	Modesto Irrigation District; Turlock Irrigation District Pacific Gas and Electric Company California Public Utilities Commission	- Reduce energy demand	
Vulnerability: Other						
Increased frequency of wildfires	Historical data tracking with statistical analysis	Electronic data compilation	Annual	California Department of Forestry and Fire Protection	- Land management to minimize wildfire	Monitor current weather conditions Use fire models and develop fire management plans for water supply sources in fire-prone watersheds Practice fire management plans in watersheds

Vulnerability Indicators	Vulnerability Measurement Tools & Methods				Adaptation Goal(s)	Possible Near-Term Adaptation Actions
	Measure	Method	Frequency	Responsible Entity		
Reduced snowpack	Snowpack survey (depth of snowpack)	Snowpack measurements (depth and water content)	Seasonal	DWR	- Sufficient surface and/or ground water storage to replace lost snowpack storage	Monitoring current weather and hydrologic conditions Use hydrologic models to project snowpack and runoff, and incorporate results into planning Reoperate reservoirs according to predicted snowpack

Chapter 4

Chapter 4 East Stanislaus IRWM Governance, Coordination and Outreach

4.1 Governance

The Governance section of the IRWM Plan must:

- Name the RWMG responsible for development and implementation of the IRWMP.
- Define how the RWMG meets the definition of CWC §10539.
- Include a list of the RWMG and project proponents who adopted the Plan.
- Describe the governance structure and how it ensures the Plan will be updated and implemented beyond State grant programs.

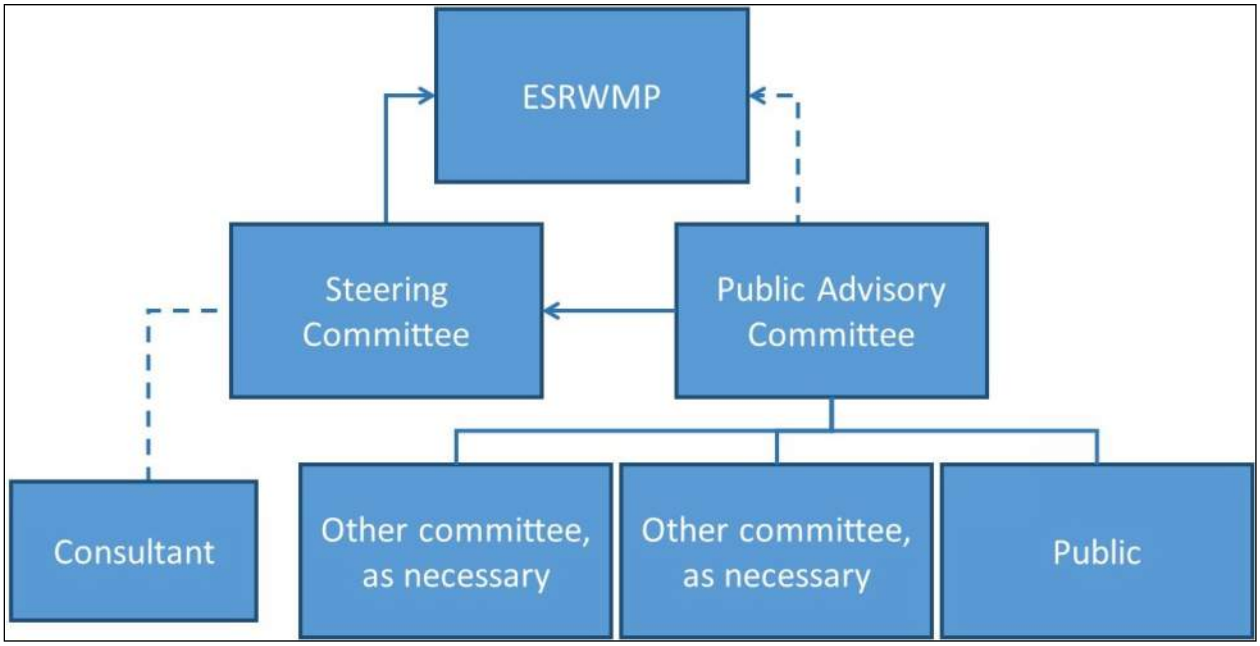
- *Proposition 1 IRWM Guidelines*, July 2016, Pages 37 to 38

The Governance Structure described in this document provides the basis for relationships within and procedures for governance of the East Stanislaus IRWM planning region. The governance structure helps facilitate sustained regional water management and the associated IRWM processes, both now and into the future. The East Stanislaus IRWM Region is inclusive and utilizes a collaborative, multi-stakeholder process that provides mechanisms to address water management issues and develop integrated multi-benefit regional solutions that incorporate environmental stewardship to implement future IRWMPs and projects. Regardless of a person's or entity's ability to contribute financially to the East Stanislaus IRWM planning process, the ESRWMP engages them through public outreach and stakeholder processes as described in Section 4.2.2, Public Forums, of this IRWMP.

4.1.1 Organization

The primary groups composing the East Stanislaus IRWM Region governance structure include the **East Stanislaus Regional Water Management Partnership (ESRWMP)**, the official Regional Water Management Group, plus the Steering Committee (SC), the Public Advisory Committee (PAC), and the general public. In the future, additional committees or sub-committees may be formed as the need arises. The governance structure for the East Stanislaus IRWM region is organized as shown in Figure 4-1.

Figure 4-1: East Stanislaus Region Governance Structure



Members of the ESRWMP are a mix of elected officials, board of director members, and other representatives from the six ESRWMP member agencies (Cities of Modesto, Hughson, Ceres, Turlock, and Waterford, and Stanislaus County). According to CWC §10539, a RWMG is a "group in which three or more local agencies, at least two of which have statutory authority over water supply or water management, as well as those other persons who may be necessary for the development and implementation of a plan that meets the requirements of CWC §10540 and §10541, participate by means of a JPA, MOU, or other written agreement, as appropriate, that is approved by the governing bodies of those local agencies." For the East Stanislaus IRWM region, all five city partner agencies have statutory authority over water supply or management in their respective jurisdictions. In 2011, the Cities of Modesto, Hughson, Ceres, and Turlock signed an MOU which formally created the ESRWMP. In July 2017, a revised MOU was adopted by the ESRWMP members to add the City of Waterford and Stanislaus County as ESRWMP members (Appendix A). One representative from each MOU signatory participates on the ESRWMP; each MOU signatory has also designated one alternate such that at every ESRWMP meeting, there will be a representative for each member. The ESRWMP representatives and alternates for each member agency are shown in Table 4-1. A more detailed description of the ESRWMP is included in Section 4.1.2, RWMG Composition.

Table 4-1: ESRWMP Representatives and Alternates

City	Category	Name	Contact Info
City of Modesto	Representative	Bill Zoslocki	bzoslocki@modestogov.com
	Alternate	Ted Brandvold	tbrandvold@modestogov.com
City of Turlock	Representative	Gary Soiseth	gsoiseth@turlock.ca.us
	Alternate	Amy Bublak	abublak@turlock.ca.us
City of Ceres	Representative	Chris Vierra	chris.vierra@ci.ceres.ca.us
	Alternate	Bret Durossette	bret.durossette@ci.ceres.ca.us
City of Hughson	Representative	Jeramy Young	jyoung@hughson.org
	Alternate	Mark Fontana	mfontana@hughson.org
City of Waterford	Representative	Mike Van Winkle	Mvanwinkle@cityofwaterford.org
	Alternate	Jose Aldaco	jaldaco@cityofwaterford.org
Stanislaus County	Representative	Vito Chiesa	chiesav@stancounty.com
	Alternate	Kristin Olson	olsonk@stancounty.com

The East Stanislaus IRWM region operates primarily on a consensus basis. The ESRWMP acts as the lead voice in the IRWMP development and implementation as there are multiple agencies, stakeholders, and members of the public involved in the process. The ESRWMP also acts as the ultimate decision maker in the rare case that the other supporting committees cannot come to a consensus. The ESRWMP facilitates communication, cooperation, and education between member agencies; facilitates implementation of the IRWMP and overall planning process; provides oversight to both the SC and PAC; finalizes the prioritization methodologies based on Committees' input; approves the screening and ranking of submitted projects; and ultimately determines the methodology for inclusion of projects in grant applications. ESRWMP meetings are held, as needed, at the discretion of the group. Each member agency is represented on the ESRWMP by one person and one alternate (generally someone from within the agency's management structure with decision-making authority). The ESRWMP meetings are open to the public, and the public may provide comment on agendized items.

The SC leads preparation and implementation of the IRWMP and future amendments and updates of the Plan (as described further in Chapter 9 of this plan), and generally manages the work. Representatives of the SC are generally those that are actively managing projects. Responsibilities of the SC include:

- Manage contracts, information/databases, reporting
- Manage IRWMP development and implementation
- Provide guidance to consultants and manage contracts
- Manage budgets and schedule
- Coordinate with the PAC

- Present unresolved issues/work tasks to the PAC
- Coordinate and implement the public outreach process
- Manage the East Stanislaus IRWMP website
- Ensure meetings are announced and posted in advance
- Coordinate distribution and posting of materials
- Convey Public Advisory Committee's recommendations to the ESRWMP
- Manage and formally submit IRWM-related grant applications

The SC representatives report back to the ESRWMP representatives throughout the planning process to brief them regarding specifics for plan implementation and to gain approval for the Plan's content. The governance structure allows for effective communication among the committees, ESRWMP, and consultant(s), as well as between the ESRWMP, SC, regional stakeholders and the public. Similar to the ESRWMP, each agency or organization participating on the SC is represented by one person and one alternate; current representatives are shown in Table 4-2. SC members may remain engaged in the East Stanislaus IRWM planning process for the length of their affiliation with their representative agency and as long as they remain active in their role (per the SC Roles and Responsibilities). Additional SC members may be added at any time, provided the existing SC members do not object and the proposed member agrees to follow the Roles and Responsibilities adopted by the SC (Appendix D). SC meetings are open to the general public and the SC directly engages the public as needed, such as when public input is solicited on project/planning deliverables. During the SC meetings, the public may provide comments on agendized and non-agendized items.

Table 4-2: Steering Committee Representatives and Alternates

City	Category	Name	Contact Info
City of Modesto	Representative	Jim Alves	jalves@modestogov.com
	Alternate	Miguel Alvarez	malvarez@modestogov.com
City of Turlock	Representative	Fallon Martin	famartin@turlock.ca.us
	Alternate	Garner Reynolds	greynolds@turlock.ca.us
City of Ceres	Representative	Mike Brinton	Michael.Brinton@ci.ceres.ca.us
	Alternate	Daryl Jordan	daryl.jordan@ci.ceres.ca.us
City of Hughson	Representative	Jaylen French	jfrench@hughson.org
	Alternate	Jaime Velazquez	jvelazquez@hughson.org
City of Waterford	Representative	Karen Morgan	kmorgan@cityofwaterford.org
	Alternate	Peni Basalusalu	pbasalusalu@cityofwaterford.org
Stanislaus County	Representative	Dhyan Gilton	Dgilton@stancounty.org
	Alternate	Walt Ward	wward@envres.org

The PAC is a stakeholder committee that provides input and recommendations to the ESRWMP and SC, and is comprised of governmental and non-governmental organizations (NGOs), environmental groups, community organizations, DACs, and other special interest groups and parties. The PAC is the first tier of decision making and provides recommendations for developing project prioritization methodologies to the SC, helps screen, integrate and rank projects, contributes to development of the methodology for inclusion of projects in grant applications, provides direct public communication and seeks public feedback and input, and conducts other actions as directed. When multiple individuals from a single organization are interested in participating on the PAC, the SC works with that organization to identify a single representative and an alternate, thereby providing equal representation by all interested parties. PAC members may remain engaged in the East Stanislaus IRWM planning process for the length of their affiliation with their representative agency and as long as they remain active in their role (per the PAC Roles and Responsibilities).

PAC meetings, as well as public meetings, are open to all stakeholders and the general public, and the application of a collaborative process helps to engage a balance of interest groups throughout the East Stanislaus Region. Any interested party is invited to participate in the PAC and/or participate during public comment periods and periodically during the planning process when public input is solicited. The meetings are meant to encourage discussion and collaboration among all parties.

Generally, anyone who wants to participate in the IRWM planning and implementation process can, at a minimum, participate in the PAC. A call for PAC participation was conducted through distribution of an outreach letter in June and July 2017 and was followed up by direct participation solicitation by ESRWMP member agencies. PAC meetings and the potential for participation in the East Stanislaus IRWMP Update were also announced in the Modesto Bee on June 19, 2017 and on the East Stanislaus IRWM planning website. Additional PAC members may be added at any time, provided the existing PAC members do not object and the proposed member agrees to follow the Roles and Responsibilities adopted by the PAC (Appendix D). Current members of the PAC are shown in Table 4-3.

Governance-related Documents:

Appendix A – *East Stanislaus Regional Water Management Partnership MOU*

Appendix B – *Adopting Resolutions*

Appendix D – *Steering Committee and Public Advisory Committee Roles & Responsibilities*

Appendix E – *Outreach and Communications Plan*

Table 4-3: Public Advisory Committee Representatives and Alternates

Name	Category	Affiliation	Contact Info
Patrick Koepele	Representative	Tuolumne River Trust	Patrick@tuolumne.org
Edgar Garibay	Alternate	Tuolumne River Trust	Edgar@tuolumne.org
Abigail Solis	Representative	Self-Help Enterprises	abigails@selfhelpenterprises.org
Kevin Kauffman	Representative	Eastside Water District	kauffmankevin@comcast.net
Al Rossini	Alternate	Eastside Water District	rossiniag@hughes.net

PAC meetings are open to the general public, who may provide comment on any meeting item, whether it is included on the meeting agenda or not. In fact, the Region has a large group of interested stakeholders who are unable to commit to the PAC meeting schedule but who participate in the process in an external manner (see Section 4.2.1, below, regarding stakeholders). The members on the stakeholder list are interested parties that receive updates of the IRWM planning process via email and are encouraged to provide comments electronically on draft East Stanislaus IRWMP-related documents. Subcommittees to the PAC can be formed, as necessary, to discuss specific water management activities/goals or to assume specific tasks as designated by the PAC. These subcommittees have the same procedures and policies as the PAC.

In general, the PAC and SC work on IRWMP development and implementation in a concurrent manner, with information passed between the two committees through key participant attendance at both committees and through participation on subcommittees. The PAC then conveys information to the ESRWMP through the SC for final decision, as needed. Members of the ESRWMP and SC can attend the PAC meetings as they wish. This structure helps to ensure the long-term implementation of the IRWM program by ensuring the continuing participation of members, clearly defining the anticipated roles and responsibilities of each participating member, and by allowing for modifications and adaptations to meet changing future conditions.

Since the adoption of the Region's first IRWMP in 2013, this governance structure has met the needs of the Region well. New member agencies have been added since the Region's initial formation, and in the future, it is possible that new member organizations and/or forums may be added to the governance structure. If an agency/entity/city would like to participate in some form of the Region's governance, the ESRWMP is first notified of their interest and the committee on which they would like to participate. The ESRWMP will then coordinate with the SC and/or PAC members for consideration and acceptance. Organization representatives may be added to the ESRWMP, but signing the Region's MOU is a mandatory requirement. Additional members may also be added to the SC and/or PAC, however existing SC/PAC members must approve the addition and the new PAC members must represent organizations not currently participating on the PAC. Signing the Region's MOU is not required for participation on the SC or PAC.

4.1.2 RWMG Composition

As previously noted, the official RWMG for the East Stanislaus IRWM Region is the ESRWMP, currently comprised of six member agencies: the Cities of Modesto, Ceres, Turlock, Hughson, and Waterford, and Stanislaus County. This Region, and its associated RWMG, were developed beginning in July 2010 to foster regional communication and cooperation and to cooperatively resolve potential water supply conflicts in the Region. Although there are other local agencies within the region that have statutory authority over water supply or water management and who have been invited to participate in the East Stanislaus IRWM planning process, some have shown interest while other agencies have chosen not to participate as part of the RWMG at this time or are still considering their level of participation. These agencies will continue to be encouraged to participate in the PAC or within the general public forum, at a minimum, and will be provided with meeting notices and other relevant information.

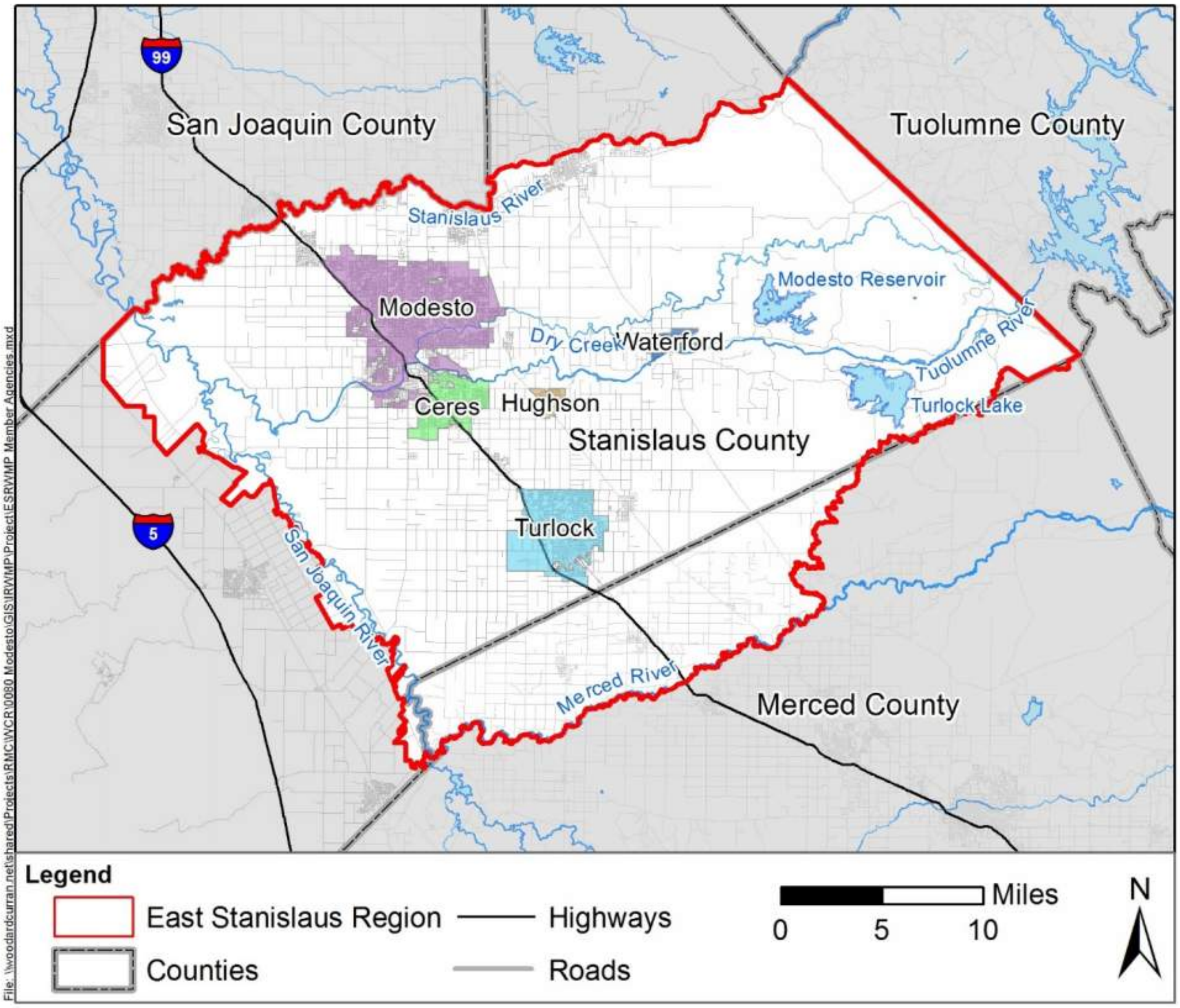
As it is currently structured, the RWMG member agencies cover various responsibilities within the Region. These are summarized in Table 4-4.

Table 4-4: Member Agencies' Water Management Responsibilities

Member Agency	Water Management Responsibility				
	Water Supply & Quality	Wastewater	Recycled Water	Stormwater/ Flood	Watershed/ Habitat
City of Modesto	✓	✓	✓	✓	✓
City of Ceres	✓	✓	✓	✓	✓
City of Turlock	✓	✓	✓	✓	✓
City of Hughson	✓	✓	✓	✓	✓
City of Waterford	✓	✓		✓	
Stanislaus County	✓			✓	✓

Each of the five cities is located within the East Stanislaus regional boundaries and manages multiple diverse aspects of water resources throughout the East Stanislaus Region. Further, each city is granted statutory authority to manage and deliver water within its purview under CWC § 1460. Stanislaus County is not a water purveyor, but is responsible for other diverse areas of water management, including water-related public health issues, well construction permitting, septic system permitting, and management of stormwater and flooding outside city jurisdictional areas. The member agencies' associated boundaries are shown in Figure 4-2.

Figure 4-2: ESRWMP Member Agencies



The City of Modesto provides drinking water, wastewater services, and storm drain and sewer maintenance to the city and surrounding communities. The City of Modesto supplies water to the communities of Salida, Empire, Del Rio, Grayson, parts of the City of Turlock, a northern part of the City of Ceres, as well as other unincorporated County areas contiguous to the City of Modesto. Modesto pumps and delivers groundwater from 86 operating groundwater wells throughout its service area, and receives treated surface water through a long-term agreement with MID from Modesto Reservoir, which is operated by MID (West Yost, 2016a). Modesto also operates two wastewater treatment facilities; the Sutter Avenue Primary Treatment Plant and the Jennings Road Water Quality Control Plant, which was recently upgraded to provide tertiary treatment. There is potential for the City of Modesto to provide recycled water to users in the future. In order to evaluate this possibility, a feasibility study was completed in 2013, and Modesto is moving forward with a project to supply recycled water to the DPWD and other potential users in western Stanislaus County (West Yost, 2016a). The Cities of Turlock and Ceres are also involved in this effort, referred to as the

NVRRWP. Under the NVRRWP, up to 46,900 AFY of recycled water produced by the Cities of Modesto, Ceres, and Turlock would be delivered to DPWD and other potential users for agricultural irrigation.

Currently, groundwater is the only source of potable water for the City of Ceres. The Ceres Water Services Division maintains the City's 12 groundwater wells, two reservoirs providing a total of 4 MG of storage, and associated pipelines and pump stations (Ceres, 2016a). Ceres is a member of the SRWA, and as such has entered into a water sales agreement for delivery of 5 mgd of TID surface water, once online (Ceres, 2016a). This water will be delivered via the RSWSP, which is estimated to be operational in 2020. The RSWSP consists of a new Tuolumne River diversion, a 29 mgd water treatment plant, and downstream transmission mains that would divert, treat, and deliver surface water supplied from TID to the Authority for treatment and use, providing a conjunctive use strategy and reducing reliance on groundwater sources. Ceres also manages storm drainage services to handle internal storm runoff and flood protection. The City of Ceres Sanitary Services Division manages, operates and maintains the Ceres WWTP and wastewater collection system. One mgd of wastewater from the City of Ceres is sent to and treated at the City of Turlock's Regional Water Quality Control Facility; Ceres is in the process of increasing this export capacity to 2 mgd (Ceres, 2016a). Wastewater from Turlock's residents and commercial and industrial dischargers, as well as wastewater from Denair and Keyes Community Service Districts, is also treated at the Turlock Regional Water Quality Control Facility (RWQCF).

For water supplies, the City of Turlock currently relies solely on groundwater. Turlock serves a population of over 70,000 residents using 20 active groundwater wells and more than 250 miles of water distribution lines (West Yost, 2016b). The wells can produce approximately 45 mgd. The City is also a member of the SRWA, and has entered into a water sales agreement for 15 mgd of TID surface water (West Yost, 2016b). Turlock also provides recycled water for irrigation, and 2 mgd of recycled water is provided to TID for cooling purposes at its Walnut Energy Center (West Yost, 2016b). The Utility Maintenance Division of the City of Turlock provides safe and effective water, wastewater and storm distribution system and related services to its service area.

Similar to Ceres and Turlock, the City of Hughson manages the water, stormwater, and wastewater systems within its city boundaries, relying solely on groundwater for its raw water. The City's water system consists of five groundwater wells scattered through the City, pumping from the Turlock Groundwater Subbasin, and a distribution system with pipes ranging from 2- to 16-inches in diameter, as well as a storage tank with a capacity of 750,000 gallons.

The City of Waterford historically received its water from the City of Modesto. However, as of July 1, 2015, Waterford now owns and operates the water systems for both Waterford and the community of Hickman. The City maintains three separate hydraulically-independent service areas: River Pointe, Waterford, and Hickman. The River Pointe system has two wells, a treatment facility for manganese removal, two 100,000-gallon storage tanks, and booster pumps (Shoreline, 2016). The Waterford system also relies solely on groundwater, and has six wells (Shoreline, 2016). Wells and distribution pipelines are of various types and ages, with some in need of replacement. Waterford's system currently has no storage. The Hickman system has two wells with a combined production capacity of 600 gpm and serves approximately 430 residents (Shoreline, 2016).

Stanislaus County provides stormwater and flood protection services and environmental health services for areas outside city jurisdictions. The County oversees water supplies to areas outside of city jurisdictional areas. It also issues well construction and destruction permits through the Environmental Resources Department, and is responsible for coordinating for the Sustainable Groundwater Management Act (SGMA) in areas outside of other jurisdictional boundaries. The county regulates sanitary-related issues (such as permitting septic systems) and other water-related public health issues. The County DER and Public Works Department manage stormwater runoff and flooding within County jurisdiction.

As previously described in Section 4.1.1, Organization, the ESRWMP member agencies signed an updated MOU in 2017 committing to the purpose of coordinating water resources planning efforts and developing an IRWMP for the East Stanislaus Region. The MOU outlines the overall goals of the IRWM planning effort, the roles each agency has as an ESRWMP member, as well as indicating that they are expected to adopt the completed IRWMP. Any stakeholder entity that chooses to accept or adopt the East Stanislaus IRWMP will be asked to demonstrate support and commitment to implementation of the IRWMP once the plan is finalized.

4.1.3 Decision Making

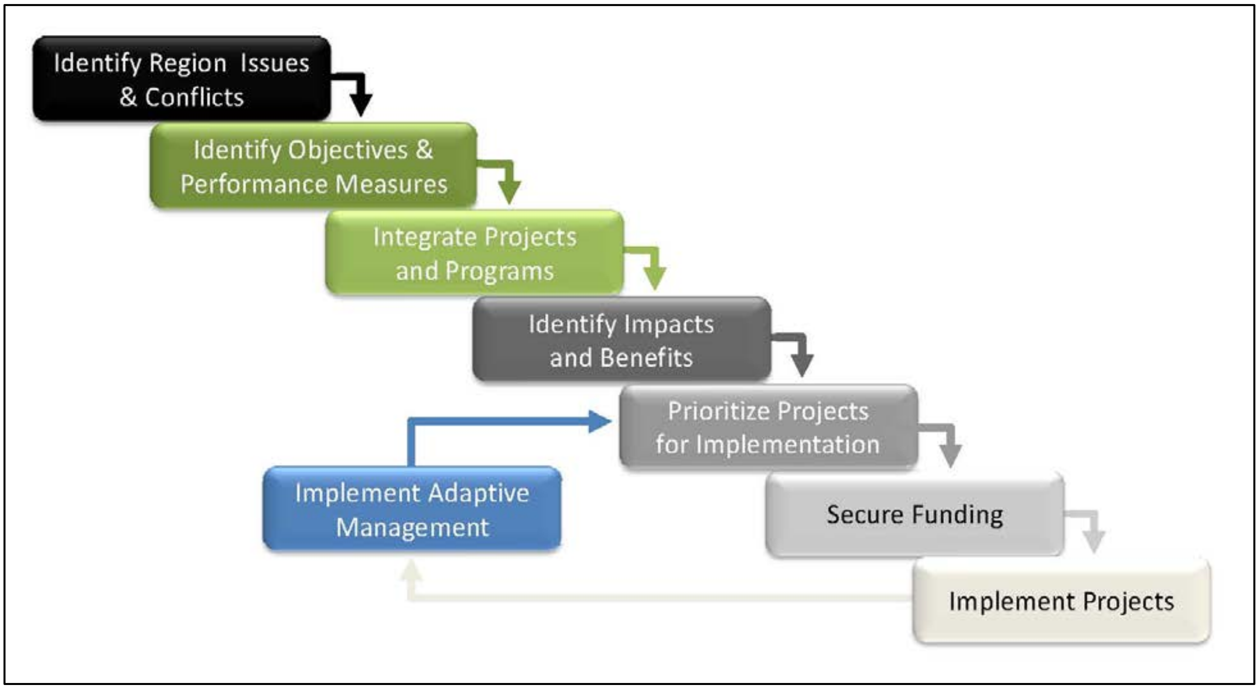
Decisions within the East Stanislaus Region are made using a consensus-based approach. The ESRWMP has developed a protocol for decision-making processes as described herein. Any decision being made by the ESRWMP is done so based on a vote; each member representative in the ESRWMP holds one vote and all actions require a simple majority vote. Regional decision-making and management processes may be revised as necessary, if agreed upon by the ESRWMP. Methods to establish IRWMP goals and objectives, prioritize projects, implement the IRWMP, and revise and update the IRWMP in the future are discussed in other sections of this plan. Each is briefly summarized here:

- **Establish IRWMP Goals & Objectives.** Issues and Conflicts within the East Stanislaus Region were first identified and presented to DWR in East Stanislaus' RAP application in April 2011. The SC and PAC jointly developed goals and objectives based on the identified Regional issues and conflicts which were included in the 2013 IRWMP. During this 2017 IRWMP Update, the SC and PAC revisited the previously identified goals and objectives and made revisions and additions based on current day conditions and issues; these are discussed in Chapter 4 of this IRWMP.
- **Prioritize Projects.** A prioritization process was developed for ranking submitted projects based on the degree to which they meet the IRWMP goals & objectives, in addition to any other parameters the ESRWMP and committees decide upon (e.g. IRWM Program Preferences). The process developed for this project prioritization is documented in Chapter 7of this IRWMP.
- **Implement the IRWMP.** The SC leads the effort in ensuring the IRWMP is implemented. Based on the MOU signed by each ESRWMP member agency, it is the personnel and financial resources of each member that facilitated the development and implementation of this IRWMP. The IRWMP will be implemented through the implementation of a series of short-term projects and long-term projects and programs.
- **Revise and Update the IRWMP.** The East Stanislaus IRWMP is a planning tool, and will require updates in response to emerging water management challenges and new project needs, and to ensure that the IRWMP appropriately addresses the East Stanislaus Region's evolving needs. Similar to the implementation of the Plan, the SC leads the effort to update and revise this Plan, as necessary, while the ESRWMP provides the staff and financial support, as necessary to achieve this goal. This structure helps ensure the long-term sustainability of the East Stanislaus IRWMP and continual implementation of the Plan into the future. Chapter 9 of this document describes the process by which the East Stanislaus IRWMP is managed and updated.

As described above and shown in Figure 4-3 below, the East Stanislaus Region developed a specific, but flexible, method for decision making and a general framework for developing and implementing the IRWMP. The Region began by identifying specific goals and objectives to meet the identified water management issues and conflicts within the Region. These goals and objectives formed the basis for identifying and integrating the Plan's projects, prioritizing those projects, and completing an IRWMP.

All decisions required for preparation of the IRWMP, including development of the goals and objectives, identification, integration and prioritization of projects, and development of the IRWMP, were completed in a collaborative manner. Initial decisions/initiative development were formulated at the SC and PAC level (in a collaborative manner), and were then brought to the ESRWMP for acceptance. The decision-making process and overall governance structure of the East Stanislaus Region thus facilitates the development of a single, collaborative water management portfolio prioritized based on meeting the regional goals and objectives.

Figure 4-3: ESRWMP Development Process



As described in Chapter 4 of this IRWMP, conflicts and issues within the Region were identified and discussed and agreed upon by the ESRWMP, SC and PAC. These regional conflicts and issues include:

- Water supply reliability for both agricultural and urban users;
- Localized flooding and stormwater quality issues;
- Groundwater overdraft and contamination; and
- Management and protection of surface water resources as both water supplies and recreation.

In the past, the agencies in the area have worked together to develop solutions to the issues facing the Region. For example, recent studies have shown that part of the Turlock Groundwater Basin may be in an overdraft condition requiring even closer collaboration and planning for the Basin. The TGBA member agencies (which include TID; Merced Irrigation District; the Cities of Ceres, Turlock, Modesto and Hughson; Hilmar and Delhi County Water Districts; the community services districts of Keyes, Denair, and Ballico; the Eastside and Ballico-Cortez Water Districts; and the Counties of Merced and Stanislaus), have coordinated on issues related to the groundwater basin since the mid-1990's. The TGBA conducted additional studies, updated the GWMP, and developed projects to aid the recovery of the groundwater basin. With the passage of SGMA, agencies in the Region have begun the process of forming GSAs. Two GSAs were formed in the Region, based on groundwater subbasin boundaries. The East Turlock Subbasin GSA includes MID, Eastside Water District, Ballico-Cortez Water District, Merced County, and Stanislaus County, with the City of Turlock as an associated member. The West Turlock Subbasin GSA consists of TID, the Cities of Turlock, Ceres, Hughson, and Modesto, Delhi County Water District, Denair Community Services District, Merced County and Stanislaus County, with the City of Waterford, Stevinson Water District, and Keyes Community Services District as associated members. These agencies will work together to prepare GSPs, which will outline management solutions to groundwater overdraft in each subbasin. As evidenced by interagency coordination on groundwater issues, the agencies involved in the East Stanislaus IRWM Region have a history of successfully working together, and this is reflected in the way the ESRWMP operates. By forming the ESRWMP on a voluntary basis and building commitment through development of shared goals and objectives, the East Stanislaus IRWM effort will be sustained through the ongoing efforts to meet those goals and objectives.

In addition to the ESRWMP and its committees, general stakeholders, disadvantaged and tribal communities, the public at large, and adjacent IRWM regions also have a role in the East Stanislaus IRWM planning process. The Region has established an outreach process by which many of these stakeholders have been, and will continue to be, contacted, and their concerns and ideas solicited and considered for inclusion in this plan. This process is described in Section 4.2 of this IRWMP. Further, the ESRWMP has coordinated with several adjacent IRWM regions to facilitate coordination of solutions to inter-regional issues and to advance inter-regional projects. For example, ESRWMP members coordinated with the adjacent Westside-San Joaquin Region to secure IRWM grant funding for and further progress the NVRRWP. The NVRRWP is a recycled water project being implemented by the cities of Modesto, Turlock, Ceres, and DPWD. Delivery of recycled water produced by the cities is expected to be delivered to DPWD in 2018 for agricultural irrigation. The East Stanislaus Region is also currently coordinating with the other IRWM Regions in the San Joaquin Funding Area to prepare and submit a DAC Involvement Grant Proposal with the intent of securing approximately $3.1 million for additional DAC outreach and completing DAC-focused planning activities. The ESRWMP will ensure the neighboring IRWM regions are invited to participate in its IRWMP update process and will endeavor to identify inter-regional projects and programs that can maximize benefits and beneficiaries for all regions involved. The East Stanislaus Region will strive to be inclusive rather than exclusive, not only within the Region but with neighboring IRWM Regions as the ESRWMP recognizes the effectiveness of developing integrated projects and programs to create multi-benefit opportunities.

4.2 Stakeholder Involvement and Outreach

An IRWMP must contain:

- A public process to provide outreach and opportunities to participate in IRWMP development and implementation to appropriate local agencies / stakeholders.
- A process used to identify, inform, invite and involve stakeholder groups in the planning process including mechanisms and processes to facilitate stakeholder involvement and communication during IRWMP development / implementation.
- A description of how the RWMG will endeavor to involve DACs and Native American tribal communities.
- A description of the decision-making process including IRWM committees, roles, or positions that stakeholders can occupy and how a stakeholder can participate without contributing financially.
- A description of how stakeholders are necessary to address objectives and RMS of the IRWMP and how they are involved.
- A discussion of collaborative processes that engage a balance of interest groups regardless of their ability to contribute financially.

- *Proposition 1 IRWM Guidelines*, July 2016, Pages 41 and 42

The East Stanislaus Region understands the importance of engaging stakeholders and the general public throughout the water management planning and IRWM process. In October 2011, the SC finalized a Stakeholder Outreach and Communications Plan to specify the identified methodology and approach to ensure the timely dissemination of information associated with preparation and implementation of the East Stanislaus IRWMP to the general public and stakeholders. The Outreach Plan includes identification of goals and objectives specific to public outreach, discussion of targeted outreach to DACs, and methods for inter-regional coordination. The intent of the Stakeholder Outreach and Communications Plan is to create a collaborative process and engage a balance of interest groups throughout the East Stanislaus Region. Any interested party is invited to participate in the planning process but it is important for stakeholders to participate in all aspects of Plan preparation, from developing the Region description to identifying goals and objectives to identifying projects and appropriate RMS and programs to be implemented. Stakeholder input is vital to understanding the variety of interest parties' value in the Plan objectives and the Resource Management Strategies applied. Gaining a variety of differing opinions creates conversation and collaboration in all aspects of the IRWM planning process. The Outreach Plan is included as Appendix E. DACs were identified in the East Stanislaus Region through a Geographic Information System (GIS) analysis as discussed in Chapter 2; no state- or federally-recognized tribal communities were identified within the Region.

In order to engage stakeholders, including DACs, the East Stanislaus Region conducts various meetings that are open to the public. The SC provides notice of all meeting types by posting the agenda, notices, and minutes on the East Stanislaus IRWM planning website, as well as posting on a public announcement board and direct mailings and/or emails to members on the stakeholder contact list. The SC ensures all meeting notices are posted with ample time for the public to participate. Additionally, the SC has issued notices in local newspapers. For example, public notices (in English) announcing the two public workshops in August and December 2017 were featured in the *Turlock Journal, Modesto Bee, Waterford Times,* and *Ceres Courier*. The same notices, but in Spanish, were published in the *Vida en el Valle*, a newspaper focused on the Latino community of the central San Joaquin Valley that is published weekly in five cities, including Modesto. The notices and associated flyers were also printed and placed in local libraries and city offices. Other notices published in newspapers were to announce the Notice of Intent to update the IRWMP and Notice of Intent to adopt the IRWMP. Copies of these notices and publications are included in Appendix F.

The governance structure developed for the East Stanislaus Region allows for the flow of information between committees and groups in the region. As with any agency or organization, there are overlaps and methods for communicating from the staff level to management level and above. The ESRWMP is generally comprised of management level staff at the Cities of Modesto, Turlock, Ceres, Hughson, and Waterford, and Stanislaus County; the SC includes staff level members from the cities and County; and the PAC is made of volunteering stakeholders from other cities and agencies (including NGOs). The governance structure is set-up so that members of the SC can attend PAC meetings and relay information to members of the ESRWMP regarding information and communication from the SC and PAC. Members of the SC often attend PAC meetings. Additionally, PAC members and general public can attend open ESRWMP meetings to provide comments and actively participate in development and implementation of the East Stanislaus IRWMP.

4.2.1 Stakeholders

In August 2017 the ESRWMP conducted a public workshop to announce the update of the IRWMP with a primary purpose of the public meeting to provide an early opportunity for stakeholders interested in participating in the planning process to do so and to become aware of the overall project, its associated schedule, and the ways that public input and participation would be sought throughout the update process. At this meeting, contact information of all meeting attendees was compiled and the Stakeholder Contact List was updated. The Stakeholder Contact List is continually updated as new persons, entities, and organizations express interest in the IRWM planning process. The most recent version of this stakeholder list is included in Appendix G. Materials from the meeting including the PowerPoint presentation, handouts, and sign-in sheets are included in Appendix H.

In addition to providing general information about the IRWM planning process at the initial public meeting, a call for applications for participation in the PAC was conducted in which stakeholders who wanted to become a member of the PAC could voice their interest in doing so, understanding that they will attend regularly scheduled meetings and are committing to a designated person or alternate in attendance. The PAC serves as one venue for conveying stakeholder input, comments, interests and ideas to the planning process. Potential PAC members were identified with the input of the SC and using the Stakeholder Contact List to notify stakeholders of the opportunity to participate via email.

In addition to the August 2017 public meeting, a public meeting occurred in December 2017 to present the public draft of the IRWMP and its contents. <Additional information about this meeting will be added after it occurs>

The public outreach process for the East Stanislaus Region provides stakeholders with two general options for involvement: (1) general public participation at the ESRWMP, SC, and PAC meetings and public meetings, and (2) involvement through participation in the PAC. This format ensures both a balanced and diverse collection of stakeholders due to the flexibility in the level of commitment and involvement for those interested.

The following methods are used to not only disseminate information to stakeholders, disadvantaged and tribal communities and the general public, but also can be used by them to provide input, ask questions, and participate in the planning process and IRWMP development process:

- ESRWMP, SC, and PAC meetings
- Public meetings
- East Stanislaus IRWM planning website
- OPTI online data management system
- Handouts, advertisements, and emails

The East Stanislaus IRWM website allows for an even and effective exchange of information between the ESRWMP, regional stakeholders and the public, while the newsletters and handouts ensures information access for all. The Region will also use OPTI, a web-based project tool, to review projects submitted as part of the IRWMP update. The ESRWMP can use OPTI to review and update project information, and any interested party is able to view project summaries through the OPTI web portal. OPTI allows for open and transparent project development, review, and prioritization process in a user-friendly manner that supports the collaborative process. The ESRWMP recognizes the significance of stakeholder input and therefore provides these various avenues for participation. Public input is further described in greater detail in Section 4.2, Stakeholder Involvement and Outreach.

As previously noted, there are other local agencies within the Region with statutory authority over water supply and/or water management; these agencies have been invited to participate in the IRWM planning and implementation process, but some have declined at this time. Many of the local agencies have a history working with the member agencies; for example, the City of Modesto and the MID have a water supply relationship (wholesaler-retailer) and have prepared joint UWMPs in the past due to the overlap in water resources management and shared water resources. The ESRWMP cooperates with these other agencies and districts through various planning processes and implementation of projects, and will continue to do so into the future.

The Stakeholder Contact List has been compiled to identify stakeholders throughout the Region in categories including water agencies/districts, irrigation districts, DACs, and environmental groups. Those actively participating are indicated in the Stakeholder Contact List in in Appendix G. Some of the stakeholders that are currently not participating have been contacted directly via email, and outreach calls have been made to DAC contacts. The Stakeholder Contact List includes contact information for most of the identified stakeholders, and the ESRWMP has reached out repeatedly to stakeholders in order to notify them of the IRWMP update, project solicitation, and public workshops.

4.2.2 Public Forums

Public forums have been used by the East Stanislaus Region since its conception. In 2011, formation of the East Stanislaus RWMG and development of the Region was announced at a public workshop. More recently, the update of the East Stanislaus IRWMP was announced to the public through a workshop on August 15, 2017. The primary purpose of the workshop was to announce the update of the IRWMP and to inform stakeholders about the project solicitation and submission process. Additional public involvement continues throughout the development of the East Stanislaus IRWMP update and through implementation of the Plan, as described herein. These efforts have helped the region provide balanced access and opportunities for participation in regional planning.

In order to make the public both aware of and a part of the regional water management planning and IRWM planning efforts within the Region, various methods have been applied to reach a varied audience. Public meetings have been conducted to introduce the IRWM process and, as needed, to update the public at key junctures in the regional water management process, allowing for public input. As discussed in the governance structure section, the ESRWMP conducts meetings for themselves, the SC, and the PAC. The public is allowed and encouraged to attend SC and PAC meetings and provide comments on both agendized and non-agendized items. The public is also welcome to attend open sessions of ESRWMP meetings to provide comments on agendized items only (similar to the way City Council meetings are conducted). The SC provides notice of all meeting types by posting the agenda, notices, and minutes on the East Stanislaus IRWM planning website (found at www.eaststanirwm.org), as well as posting on a public announcement boards and direct mailings to a mailing list of interested stakeholders. The SC ensures the meeting notices are posted with ample time for the public to participate in the meetings. Additionally, as documents are developed and public review is solicited, copies are placed in public libraries for public access and on the Region's website.

The Region's website is an integral mechanism for ensuring public awareness of the East Stanislaus IRWM update process. The website allows the ESRWMP to disseminate information to a wide audience. The website is updated on a bi-monthly basis, at a minimum, to maintain current meeting information and past project updates, press releases, meeting materials and other items of interest. The website domain is hosted by the City of Modesto, and each ESRWMP member agency has a link to the East Stanislaus IRWMP website on its respective agency-specific website. The website also allows for stakeholders to enter comments and questions, and provides contact information should they want to speak to an East Stanislaus Region representative. The website acts as a forum for the ESRWMP and stakeholders to exchange information throughout the IRWM planning process.

There are multiple ways for the public to gain access to the ESRWMP and IRWM process. The ESRWMP makes information available to the general public, including the status of the IRWM process and upcoming decisions to be made, through the handouts and website. If a member of the general public or a stakeholder has questions and comments, they are directed to a designated contact, Jim Alves at the City of Modesto (the designated ESIRWMP representative); his contact information is provided in Table 4-5.

Table 4-5: Contact Information

	City of Modesto
Point of Contact	Jim Alves
Title	Associate Civil Engineer
Mailing Address	1010 10th Street Modesto, CA 95354
Phone Number	209-571-5557
Email Address	jalves@modesto.gov

The public can provide input to the ESRWMP by attending the meetings, calling the provided contact, or emailing the contact with comments and questions. The designated contact discusses the questions and comments received with the SC, who takes the public input into consideration and responds to each call or email, as appropriate. If the ESRWMP receives public comment directly, the group evaluates the issues raised, and provides the comments/input to the SC to consider and respond to as appropriate.

In order to address the diversity of water management issues, geographical representation and stakeholder interests within the East Stanislaus Region, the ESRWMP has identified, and directly invited, key parties to participate in meetings and committees.

4.2.3 Outreach to Disadvantaged Communities

As described in Section 2.1.7, a DAC, according to the State of California (CA Water Code, Section 79505.5(a)), is a community with a MHI less than 80 percent of the California statewide MHI. DWR compiled the U.S. Census Bureau's ACS data for the period of 2010 to 2014. Based on this data, a community with an MHI of $49,191 or less is considered a DAC. Of the Region's partner agencies, Modesto, Ceres, and Waterford are Census Designated Places (CDPs) that qualify as DACs. While the Turlock and Hughson CDPs are not DACs themselves, portions of each city are disadvantaged or severely disadvantaged communities (SDACs). Additional CDPs that qualify as DACs or SDACs within the East Stanislaus Region, are the communities of Airport Ballico, Bret Harte, Bystrom, Cowan, Delhi, Empire, Grayson, Hickman, Keyes, Monterey Park Tract, Parklawn, Riverdale Park, Rouse, and West Modesto. Involvement and participation by representatives of these communities during the East Stanislaus IRWM planning process was solicited and encouraged to help understand the issues confronted by DACs and better address the needs of minority and/or low-income communities. DACs were first identified through a GIS analysis and then confirmed by SC members who actively work with many of these communities. Phone calls were made to identified DAC representatives in July 2017 to inform them about the East Stanislaus IRWMP Update and encourage participation in the IRWM planning process. During these calls, DAC representatives were presented with multiple options for participation in the IRWM Planning process, including PAC membership, public workshop attendance, PAC or SC meeting attendance, and project submission. DAC representatives were also given the option for a face-to-face meeting to further discuss methods of involvement. A second round of DAC calls were made during the project solicitation period in order to remind DAC representatives of the opportunity to submit projects to the IRWMP. DAC representatives were reached from the communities of Keyes, Airport, Grayson, and Monterey Park Tract. Objectives of specific outreach to DACs include:

- Solicit involvement by individual representatives from DACs within the East Stanislaus Region and encourage participation by those representatives as members of the PAC.
- For DACs which do not have designated community representatives on the PAC, encourage other PAC members to specifically advocate and represent the interests of those DACs which may lie within a PAC member's jurisdiction or area of special interest.
- Inform representatives and residents of DACs via flyers and newspaper notices about opportunities to get involved with the East Stanislaus IRWM planning process and participate in development, integration, and prioritization of projects.
- Notify potential representatives of DACs of the opportunity to submit a project to the IRWMP; provide details on eligible projects and the submission process.

Outreach to DACs is also being completed as part of the IRWM DAC Involvement grant proposal process in conjunction with other IRWM Regions in the San Joaquin Funding Area. DWR has made a minimum of $3.1 million available to the San Joaquin Funding Area for the purpose of ensuring involvement of DACs, EDAs, or underrepresented communities in IRWM planning efforts. Projects funded through the DAC Involvement grants will serve to increase understanding of water management needs of DACs and develop strategies and long-term solutions to address those needs.

4.2.4 Outreach to Economically Distressed Areas

In addition to DACs, the East Stanislaus Region also contains areas that may be experiencing economic hardship, but do not fit the definition of a DAC. In an effort to capture these areas in the IRWM planning process, DWR has included a designation for EDAs in the 2016 Prop 1 IRWM Guidelines. An EDA is classified as a community with an annual MHI less than 85% of the California statewide MHI. An EDA must also have population of less than 20,000 people, and must either have an unemployment rate greater than 2% above the statewide average, or a low population density. Approximately 52% of residents in the East Stanislaus Region live in EDAs (262,538 residents out of 502,340 total). Focused outreach was conducted to identify EDA representatives, and encourage them to participate in the IRWM planning process. The ESRWMP recognizes that, like DACs, EDAs often have limited resources to attend regular meetings. Therefore, the ESRWMP will work to reduce the obstacles to accessing planning discussions; strategies include conducting meetings outside business hours, holding meetings via conference call, and accepting formal or informal project ideas. The goal is for EDAs to have the opportunity to choose the level of participation that meets their needs and interests, and to encourage the long-term participation of EDAs.

4.2.5 Outreach to Native Americans

As of January 2016, there were no federally recognized Native American tribes in the East Stanislaus IRWM Region. This determination was made using spatial data of Indian lands provided by the Bureau of Indian Affairs (BIA), Pacific Region. No parcels of Indian land exist within the East Stanislaus IRWM Region. Subsequent communication with BIA staff indicated that no new tribal lands have been added in the IRWM Region since January 2016.

In 2014, AB 52 was passed, adding new requirements regarding Tribal cultural resources (Public Resource Code §21080.3.1). This law requires lead agencies under CEQA to consider project effects on Tribal cultural resources, and to conduct consultation with California Native American Tribes. CEQA documents must comply with this requirement, and documents relevant to the East Stanislaus Region served as a resource for the IRWM planning process. It is important to note that the East Stanislaus IRWMP itself is exempt from CEQA pursuant to CEQA Guidelines Section 15262 because the plan is a study that identifies potential projects, programs, and policies for possible future actions; and Sections 15306, 15307, and 15308 because the plan consists of basic data and information collection and includes possible actions, subject to future adoption and approval, which would protect natural resources and the environment.

4.3 Coordination with Other/Neighboring IRWM Regions

The East Stanislaus IRWM Region borders the Eastern San Joaquin, Merced, Tuolumne-Stanislaus and Westside-San Joaquin IRWM Regions. The Region's boundaries were identified to fill the void in IRWM coverage in this part of California, as well as to balance the need for boundaries based on natural watershed, groundwater basins and political and jurisdictional boundaries. All adjacent IRWM regions participated in either the 2009 or 2011 RAP and all have been approved. The regions adjacent to the East Stanislaus Region are described herein.

Eastern San Joaquin Region: The Eastern San Joaquin Region shares its southern border with the northern border of the East Stanislaus region. This border is marked by the Stanislaus River and the interface of the Modesto and Eastern San Joaquin Groundwater Subbasins. There is no overlap between these two regions.

> This Coordination Plan Standards includes:
>
> - Identification of a process to coordinate water management projects and activities of participating local agencies & stakeholders to avoid conflicts and take advantage of efficiencies.
> - Identification of other neighboring IRWM efforts and the way cooperation/ coordination will be accomplished.
> - A discussion of any ongoing water management conflicts with adjacent IRWM efforts.
> - Identification of areas where a State agency or other agencies may be able to assist in communication, cooperation or implementation of IRWMP components, processes, or projects, or where State or federal regulatory decisions are required before implementing the projects.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 42

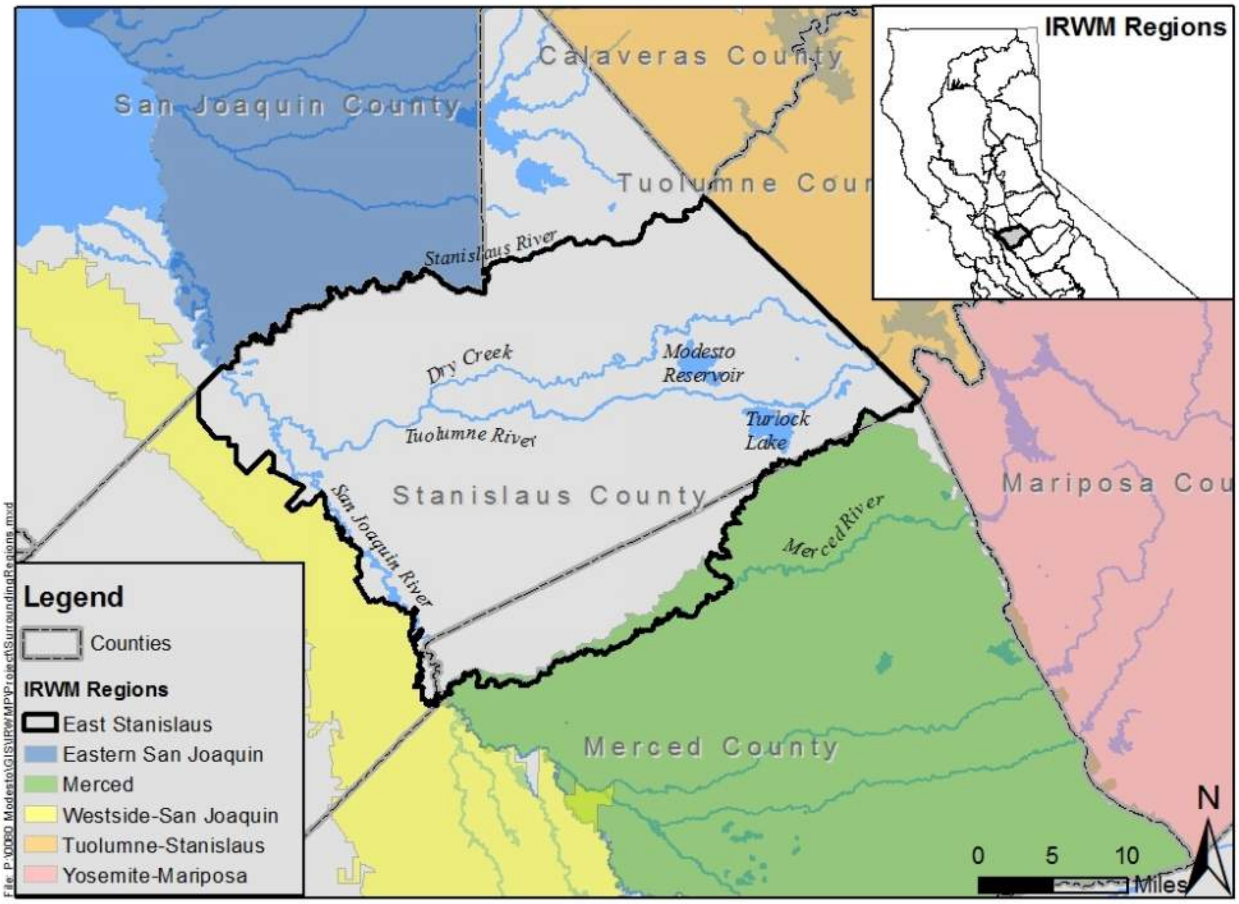
Merced Region: The Merced IRWM Region includes the eastern portion of the San Joaquin Valley within Merced County and was revised in the 2011 RAP process. The Merced Region defined its northern border as the Merced River watershed boundary while the East Stanislaus Region's southern boundary is defined as the Merced River, TID boundary, and the Turlock Groundwater Subbasin. Due to the differences in boundary delineations, a slight overlap exists between the Merced IRWM Region and East Stanislaus Region. There is an understanding between the East Stanislaus and Merced Regions that cooperation and coordination may be required in the overlap area.

Tuolumne-Stanislaus Region: The Tuolumne-Stanislaus Region's western border is defined as the Tuolumne County line. The interface between the Tuolumne-Stanislaus and East Stanislaus Regions is the border of Stanislaus and Tuolumne Counties. There is no overlap between these two regions.

Westside-San Joaquin: The Westside-San Joaquin Region's eastern boundary is adjacent to the East Stanislaus Region's western boundary. This boundary was defined by the Westside-San Joaquin Region using the San Joaquin River; however, the boundary does not strictly follow the river. The western boundary of the East Stanislaus Region simply follows the boundary as defined by the Westside-San Joaquin Region, such that there is no overlap.

As shown in Figure 4-4, the East Stanislaus Region shares borders with the Eastern San Joaquin Region, the Westside-San Joaquin Region, the Merced Region, and the Tuolumne-Stanislaus Region, and is adjacent to the Yosemite-Mariposa Region. When the East Stanislaus regional boundaries were being developed in 2010, the Yosemite-Mariposa Region (formerly the Central California Region) overlapped with the Merced Region and shared boundaries with the East Stanislaus Region. Because of the major overlap the Yosemite-Mariposa and Merced Regions were only conditionally approved by DWR. The Yosemite-Mariposa boundaries were modified during the 2010 RAP to eliminate its overlap with the Merced Region, while the Merced regional boundaries remained unchanged. The East Stanislaus therefore has a small overlap with the Merced Region, but avoids overlaps with all other surrounding IRWM regions.

Figure 4-4: Surrounding IRWM Regions



As previously noted, the East Stanislaus Region was developed to fill in an obvious void in IRWM coverage in the Central Valley. When determining the boundaries for the Region, however, natural water boundaries were also important so that the Region would make sense from a watershed and water use perspective, given the region's use of surface water as part of its supply and distinct features. This criterion resulted in a triangular area in the north-eastern portion of Stanislaus County being left uncovered by the East Stanislaus Region. This area is not in the Modesto Groundwater Subbasin, which was used to determine the northern boundary, and its surface water drains into the Eastern San Joaquin Region. This area overlies the Eastern San Joaquin Groundwater Basin, an area mostly covered by the Eastern San Joaquin IRWM Region. Additionally, Tuolumne River water is the primary surface water source in the East Stanislaus IRWM Region, whereas Stanislaus River surface water is the primary surface water source for the northeastern triangular portion of the County (which is outside the East Stanislaus IRWM Region).

The East Stanislaus Region has been coordinating with surrounding regions. The ESRWMP has an ongoing relationship with members of the Westside-San Joaquin IRWM Region in which members of the ESRWMP have attended meetings with the Westside-San Joaquin Region and participated in the planning process (and vice versa). Additionally, the Tuolumne-Stanislaus and the East Stanislaus Regions have established an interim coordination and communication protocol The Prop 1 IRWM DAC Involvement Program, administered by DWR, provides funding to the IRWM Funding Areas to ensure the involvement of DACs, EDAs, or underrepresented communities in IRWM planning efforts. The ESRWMP is currently working with the other regions in the San Joaquin Funding Area to develop a DAC Involvement proposal and funding program. The ESRWMP plans to discuss water management strategies that have or will be employed by each of the neighboring IRWM Regions to identify other opportunities for inter-regional collaboration and to optimize management strategies.

4.4 Coordination with State/Federal Agencies

The governance structure allows for any interested party to participate in the East Stanislaus IRWM planning process including members from State and federal agencies in the same manner as any other regional stakeholder. The other opportunity for the East Stanislaus Region to interface with State and federal agencies is through funding secured from State and federal agencies, as well as during permit acquisition for specific projects in the IRWMP and preparation of environmental documentation. When funding is secured from a State or federal agency to implement projects included in the IRWMP, on-going coordination is required during project implementation and after. For example, the East Stanislaus Region secured $5,005,829 in 2015 from the IRWM implementation grant solicitation to implement the NVRRWP and the Modesto Area 2 Stormwater to Sanitary Sewer Cross-Connection Removal Project. The City of Modesto, the grantee, executed a grant agreement with DWR and conducting ongoing coordination with the state through submittal of deliverables and progress reports as the two projects are implemented. Similarly, projects that are implemented will require certain State and federal approvals including various permits and/or environmental approvals. Projects will be compliant with CEQA and NEPA, as necessary. Completion of CEQA/NEPA documentation would require coordination with various State and federal agencies.

At present, the East Stanislaus Region is coordinating directly with DWR. This coordination is occurring through both the IRWM process and the DAC Involvement Grant Proposal. In addition, Stanislaus County is coordinating directly with DWR and local GSAs on compliance with SGMA for the Turlock, Modesto, Eastern San Joaquin, and Delta-Mendota groundwater subbasins. Stanislaus County is also coordinating with the SWRCB on a Storm Water Resources Plan (SWRP). The ESRWMP will be coordinating closely with the County during the creation of the SWRP, as this plan will be incorporated by reference into the IRWM update.

4.5 Coordination with Regional and Local Agencies

Coordination with regional and local agencies occurs through several avenues. First, through stakeholder outreach, as discussed in Section 4.2. Any local or regional agency may participate in the IRWM process through membership on the PAC, or by joining the ESRWMP. Agencies may also make their voices heard at public workshops or by providing comments on the Public Draft IRWMP. As agencies in the region conduct individual planning efforts, such as UWMPs or AWMPs, these efforts may be incorporated into the IRWMP in order to provide up-to-date characterization of the Region. Many agencies that engage in these types of planning efforts are already participants of the ESRWMP; therefore, communication between individual agencies and the ESRWMP is key. Coordination with regional and local agencies also occurs in the context of project submission and pursuit of funding. Any combination of regional and local agencies may work in conjunction to define and propose projects for inclusion in the IRWMP. For example, the NVRRWP is an interagency effort between the Cities of Modesto and Turlock and DPWD. In order to apply for funding, agencies may coordinate further to apply for grants, administer funds, and complete projects. Agencies in the region have a history of coordination, as evidenced by groups such as the STRGBA and the TGBA.

Chapter 5

East Stanislaus Region Integrated Regional Water Management Plan Update

Chapter 5 Vision, Goals, and Objectives

In order for the East Stanislaus Region to effectively manage its water resources, it first identified the regional water resources-related conflicts and issues to be resolved through this IRWMP. The Region then developed a shared vision, outlining what the future of water management will look like for the region. The Region then identified steps, or goals, to meet this vision. These goals define what exactly the Region would like to achieve in meeting its vision. Finally, objectives were defined for each goal. Each objective was framed to be specific, measurable and attainable. Once achieved, these objectives will move the region forward towards achieving its goals, and ultimately, its vision (Figure 5-1). This IRWMP represents the pathway that the East Stanislaus Region will follow to achieve its objectives, goals and vision.

This section reviews the conflicts/issues that the Region faces; it also discusses the goals and objectives which form a basis for addressing these conflicts/issues.

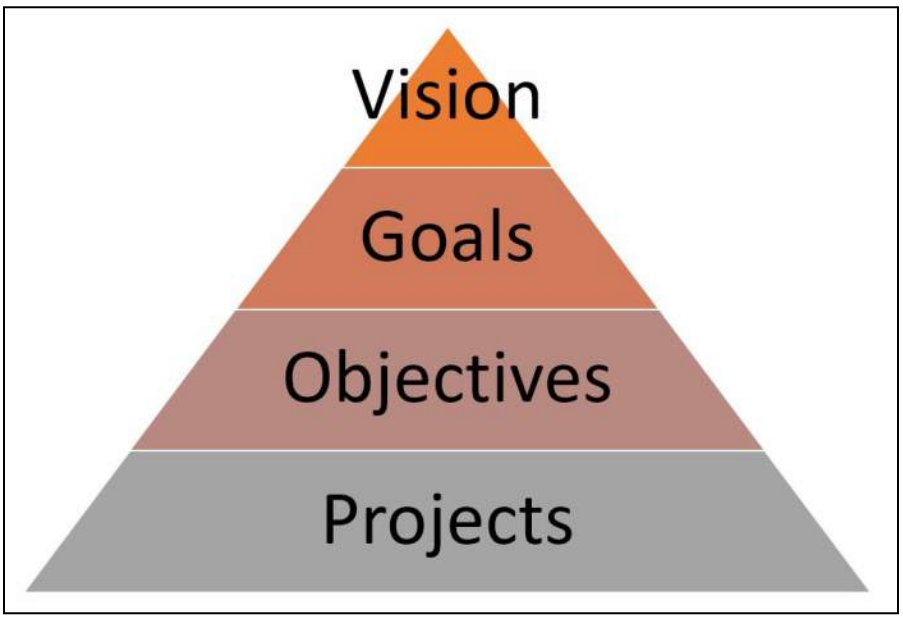
The IRWM Plan must clearly present plan objectives and describe the process used to develop the objectives. Plan objectives must address major water-related issues and conflicts within the region. In addition, objectives must be measurable by some practical means so achievement of objectives can be monitored.

The objectives may be prioritized for the region. The IRWM Plan must contain an explanation of the prioritization or reason the objectives were not prioritized.

The objectives must address climate change adaption and mitigation.

- *Proposition 1 IRWM Guidelines*, July 2016, Page 38

Figure 5-1: Relationship between Vision, Goals, and Objectives



5.1 Regional Conflicts and Issues

The initial regional conflicts identified for the 2013 IRWMP, as well as the goals and objectives described in Section 5.3, were brainstormed and discussed at several SC and PAC meetings held in 2011. These conflicts were revisited and revised during SC and PAC meetings in June and July 2017.

The primary water resources-related issues and conflicts identified within the East Stanislaus Region include:

- Water supply reliability
- Drinking water quality
- Water quality protection
- Groundwater overdraft, contamination, and recharge
- Protection and enhancement of aquatic, riparian, and watershed resources
- Water-related needs for DACs
- Flood protection
- Recycled water use
- Water conservation
- Aging infrastructure
- Climate change

These shared conflicts and interests within the East Stanislaus Region led to cooperatively-developed regional goals and objectives.

5.2 Region's Vision for Water Resources Management

After reviewing the identified conflicts and issues, the Region established a vision to act as a guiding principal throughout the IRWM planning process and establish what future regional water management will achieve.

The East Stanislaus region's vision for IRWM planning is to:

> *Integrate projects to provide multiple benefits, resolve identified issues and conflicts, and meet the regional goals and objectives to achieve water reliability and sustainability and flood protection while protecting and enhancing the environment and regional economies and culture.*

5.3 Region Goals & Objectives

5.3.1 Goals and Objectives

Identifying the Region's issues and conflicts allowed the SC and PAC to develop goals that, if achieved, would help resolve the issues in the Region and achieve its vision. Through application of the governance structure, as described in Section 4.1, and using a collaborative process to reach consensus, the SC and PAC met to discuss the region's conflicts and issues and developed objectives related to the conflicts. Information provided and discussed during this process included recent data regarding groundwater elevations, experiences in managing groundwater quality and publicly available information and opinions as published in local newspapers and websites. For example, the committees identified drinking water quality, water quality protection, and groundwater overdraft and contamination as issues in the region. To address these, a water quality-focused goal was developed – *Protect and improve water quality for beneficial uses consistent with regional interests and the Regional Water Quality Control Board (RWQCB) Basin Plan in cooperation with local, state, and federal agencies, and regional stakeholders.* Then, for the identified goal, a number of measurable objectives were developed (again, via consensus) that would enable the region to determine if the goal is being achieved. Goals were identified in the categories of Water Supply, Flood Protection, Water Quality, Environmental Protection and Enhancement, Regional Communication and Cooperation, and Economic and Social Responsibility.

Water Supply Goals and Objectives

Goal:

Protect existing water supplies and water rights, and improve regional water supply reliability.

Objectives:

- Provide a variety of water supply sources, including recycled water, to meet all current and future demands (urban, agricultural and the environment) under various hydrologic conditions.
- Promote the use of groundwater storage and conjunctive use options to reduce groundwater overdraft.
- Protect existing water rights, including permitted diversions and extractions.
- Implement water conservation plans for both urban and agricultural uses.
- Support monitoring and research to improve understanding of water supplies and needs.
- Address intra- and inter-regional conveyance infrastructure needs.
- Address changes in runoff and recharge due to climate change, including amount, intensity, timing, and variability.

Flood Protection Goals and Objectives

Goal:

Ensure flood protection strategies are developed and implemented through a collaborative process, utilizing both local and watershed-wide approaches designed to maximize opportunities for comprehensive water resource management that meet multiple objectives.

Objectives:

- Develop outlines of regional projects and plans necessary to protect infrastructure from flooding and erosion from the 100-year event.
- Work with stakeholders to preserve existing flood attenuation by implementing land management strategies throughout the watershed.
- Develop approaches for adaptive management that minimize maintenance requirements and protect water quality and availability while preserving and enhancing ecologic and stream functions, including addressing adaptation to changes in timing and intensity of runoff due to climate change, as appropriate.
- Provide community benefits beyond flood protection, such as public access, open space, recreation, agricultural preservation, and economic development.
- Protect, restore, and enhance the natural ecological, geomorphic, and hydrologic functions and processes of rivers, creeks, streams and their floodplains.
- Address changes in timing and intensity of runoff due to climate change.

- Increase and improve the quantity, diversity, and connectivity of riparian, wetland, floodplain, aquatic, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands.
- Identify opportunities and incentives for expanding or increasing use of floodway corridors.

Water Quality Goals and Objectives

Goal:

Protect and improve water quality for beneficial uses consistent with regional interests and the RWQCB Basin Plan in cooperation with local, state and federal agencies and regional stakeholders.

Objectives:

- Meet or exceed all applicable water quality regulatory standards, including drinking water standards.
- Deliver agricultural water to meet water quality guidelines established by stakeholders.
- Aid in meeting Total Maximum Daily Loads (TMDLs) established, or to be established, for the Tuolumne, Stanislaus, Merced, and San Joaquin River watersheds.
- Protect surface waters and groundwater basins from contamination and threat of contamination.
- Manage existing land uses while preserving or enhancing environmental habitats.
- Minimize impacts from storm water through implementation of Best Management Practices, Low Impact Development or other similar projects.
- Promote programs and projects to reduce the quantity and improve the quality of urban and agricultural runoff.
- Promote and support regional monitoring to further understanding of water quality issues.

Environmental Protection and Enhancement Goals and Objectives

Goal:

Protect the environmental resources of the Stanislaus, Tuolumne, Merced and San Joaquin River watersheds by identifying, promoting and implementing opportunities to assess, restore and enhance natural resources of these watersheds.

Objectives:

- Identify and incorporate (where possible and reasonable) opportunities to assess, protect, enhance, and/or restore natural resources when developing water management strategies.
- Minimize adverse effects on biological and cultural resources, including riparian habitats, habitats supporting sensitive plant or animal species, and archaeological sites when implementing strategies and projects.
- Identify opportunities for open spaces, trails and parks along creeks and other recreational projects in the watershed to be incorporated with water supply, water quality, or flood protection projects.
- Contribute to the long-term sustainability of agricultural, commercial, industrial, and urban land uses and activities within the basin.

- Identify opportunities to protect, enhance, or restore habitat to support all watersheds in the Region in conjunction with water supply, water quality, or flood protection projects.
- Support projects to understand, protect, improve and restore the region's ecological resources.
- Promote the recovery and stability of regionally present native species and populations.

Regional Communication and Cooperation Goals and Objectives

Goal:

Implement and promote this IRWMP through regional communication, cooperation, and education.

Objectives:

- Develop a forum for consensus decision-making and IRWMP implementation by regional entities.
- Build relationships with State and Federal regulatory agencies and other water forums and agencies to facilitate permitting of water-related projects and ensure continued consistency with state water plans.
- Facilitate dialogues between regional and inter-regional entities to reduce inconsistencies and conflicts in water management and to maximize benefits from water-related projects.
- Maintain avenues of communication with the general public and offering opportunities to provide feedback on the IRWM and water-related projects through the regional websites and other public forums.
- Identify opportunities for public education about water supply, water quality, flood management, and environmental protection.
- Implement focused outreach to DACs and EDAs relative to opportunities for water supply, water quality, flood management, and environmental protection projects.

Economic and Social Responsibility Goals and Objectives

Goal:

Promote development and implementation of projects, programs and policies that are socially impartial and economically sound.

Objectives:

- Support the participation of disadvantaged communities and economically distressed areas in the development, implementation, monitoring and long-term maintenance of water resource projects.
- Develop cost-effective multi-benefit projects.
- Consider disproportionate community impacts to ensure environmental justice.
- Maximize economies of scale and governmental efficiencies.
- Protect cultural resources.
- Reduce energy use and associated GHG emissions and/or use renewable resources where appropriate.
- Adopt carbon sequestration strategies where appropriate.

5.3.2 Prioritizing Objectives

The regional IRWM planning participants chose to prioritize the Region's goals, and therefore the associated objectives, for use in project prioritization. The planning participants felt that by prioritizing the Region's goals and objectives, along with the Statewide priorities and other relevant factors, that the resulting ranking of projects would help to identify those projects that, when implemented, would have the greatest impact in addressing the identified conflicts and issues and would best help the Region achieve its vision for regional water resource management. The participants chose to use a weighting schema to prioritize the projects, allowing for flexibility in future changes to the prioritized objectives as regional water resources issues change. Table 5-1 summarizes the measurements for each objective.

Table 5-1: Measures for Regional Goals and Objectives

Goal/Objective	Possible Measure(s)
Water Supply	
Provide a variety of water supply sources to meet all current and future demands (urban, agricultural, and the environment) under various hydrologic conditions	Acre-feet of water supply by water type; Percent demand met in any given year; Comparison of projected demand to existing water supplies
Promote the use of groundwater storage and conjunctive use options to reduce groundwater overdraft	Number of local conjunctive use programs; Acre-feet of water stored (directly and/or in-lieu); groundwater elevations
Protect existing water rights, including permitted diversions and extractions	Acre-feet of water delivered compared to perfected water rights
Implement water conservation plans for both urban and agricultural uses	Number of Demand Management Measures (DMMs) implemented regionally; Acre-feet of conserved water annually; 2015 and 2020 per capita water use rates
Support monitoring and research to improve understanding of water supplies and needs	Ongoing and new monitoring programs; Regional demand estimates
Address intra-and inter-regional conveyance infrastructure needs	Acre-feet of water lost through leakage; Percent demand met
Address changes in runoff and recharge due to climate change, including amount, intensity, timing, and variability.	Volume of water infiltrated or detained.
Flood Protection	
Develop outlines of regional projects and plans necessary to protect infrastructure from flooding and erosion from the 100-year event	Project list from Mid-San Joaquin River Regional Flood Management Plan (RFMP); Incorporate RFMP project list into IRWMP project list
Work with stakeholders to preserve existing flood attenuation by implementing land management strategies throughout the watershed	Coordinate with RFMP effort

Develop approaches for adaptive management that minimize maintenance requirements and protect water quality and availability while preserving and enhancing ecologic and stream functions, including addressing adaptation to changes in timing and intensity of runoff due to climate change, as appropriate.	Coordinate with RFMP to ensure adaptive management element; Incorporate RFMP elements into IRWMP Update
Provide community benefits beyond flood protection, such as public access, open space, recreation, agricultural preservation, and economic development	Number of multi-benefit projects identified and/or implemented providing flood protection and other benefits
Protect, restore, and enhance the natural ecological, geomorphic, and hydrologic functions and processes of rivers, creeks, streams and their floodplains	Number of acres of riparian habitat/floodplain restored or protected
Address changes in timing and intensity of runoff due to climate change	Volume of water infiltrated or detained.
Increase and improve the quantity, diversity, and connectivity of riparian, wetland, floodplain, aquatic, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands	Acres of habitat created or restored
Identify opportunities and incentives for expanding or increasing use of floodway corridors	Funding opportunities available
Water Quality	
Meet or exceed all applicable water quality regulatory standards, including drinking water standards	Basin Plan Water Quality Objectives (narrative and numerical); water quality
Deliver agricultural water to meet water quality guidelines established by stakeholders	Water quality monitoring data
Aid in meeting TMDLs established, or to be established, for the Tuolumne, Stanislaus, Merced, and San Joaquin River watersheds	Constituent concentrations (for specific TMDLs)
Protect surface waters and groundwater basins from contamination and threat of contamination	Surface and groundwater water quality monitoring data
Manage existing land uses while preserving or enhancing environmental habitats	Number of acres of habitat protected/maintained
Minimize impacts from storm water through implementation of BMPs, LID and other similar projects	Number of projects implemented incorporating storm water BMPs, LID or the like

Promote programs and projects to reduce the quantity and improve the quality of urban and agricultural runoff	Storm water monitoring data
Promote and support regional monitoring to further understanding of water quality issues	Participation in state and federal monitoring programs such as CASGEM; monitoring data
Environmental Protection and Enhancement	
Identify and incorporate (where possible and reasonable) opportunities to assess, protect, enhance, and/or restore natural resources when developing water management strategies	Number of acres of habitat restored, enhanced or protected
Minimize adverse effects of biological and cultural resources, including riparian habitats, habitats supporting sensitive plant or animal species, and archaeological sites when implementing strategies and projects	Measurement and monitoring of biological and cultural resources before and after project development
Identify opportunities for open spaces, trails and parks, and other recreational projects in the watershed to be incorporated with water supply, water quality or flood protection projects	Number of multi-benefit projects on IRWMP list that incorporate open space, trails, parks or other recreational benefits
Contribute to the long-term sustainability of agricultural, commercial, industrial and urban land uses and activity in the basin	Number of acres of each land use type in the Region
Identify opportunities to protect, enhance, or restore habitat to support all watersheds in the Region in conjunction with water supply, water quality, or flood protection projects	Number of multi-benefit projects on IRWMP list that include the protection, enhancement, or restoration of watershed habitats
Support projects to understand, protect, improve and restore the region's ecological resources	Number of multi-benefit projects on IRWMP list that include the protection, improvement, or restoration of ecological resources
Promote the recovery and stability of regionally present native species and populations	Acres of habitat preserved or restored
Regional Communication and Cooperation	
Develop a forum for consensus decision-making and IRWMP implementation by regional entities	Develop and implement governance structure that is based on consensus decision-making; Develop protocols for committee decision-making based on consensus

Build relationships with State and Federal regulatory agencies and other water forums and agencies to facilitate permitting of water-related projects and ensure continued consistency with state water plans	Invite State and Federal regulatory agency representatives to participate in IRWM regional governance; Participate in and/or coordinate with, either formally or informally, with State and Federal regulatory agencies and other water forums
Facilitate dialogues between regional and inter-regional entities to reduce inconsistencies in water management strategies and to maximize benefits from water-related projects	Communicate directly with adjacent IRWM regions; Participate in opportunities for dialogues with other IRWM regions
Maintain avenues of communication with the general public and offer opportunities to provide feedback on the IRWM and water-related projects through the regional websites and other public forums	Develop and maintain IRWM website; Provide notice of and conduct public workshops and meetings;
Identify opportunities for public education about water supply, water quality, flood management, and environmental protection	Number of multi-benefit projects on IRWMP list that include public education components
Implement focused outreach to DACs and EDAs relative to opportunities for water supply, water quality, flood management, and environmental protection projects	Number of DAC community members contacted; number of meeting attendees
Economic and Social Responsibility	
Support the participation of disadvantaged communities (DACs) and economically distressed areas (EDAs) in the development, implementation, monitoring and long-term maintenance of water resource projects	Provide direct outreach to DACs; Provide contextual and technical support to DACs as funding permits
Develop cost-effective multi-benefit projects	Number of multi-benefit projects on IRWMP list; Evaluation of costs and benefits of projects on IRWMP list
Consider disproportionate community impacts to ensure environmental justice	Geographical distribution of projects on IRWMP list relative to DAC locations
Maximize economies of scale and governmental efficiencies	Number of projects on IRWMP list with multiple project proponents; Evaluation of costs and benefits of projects on IRWMP list
Protect cultural resources	Measurement and monitoring of cultural resources before and after project development

Reduce energy use and associated GHG emissions and/or use renewable resources where appropriate	Number of projects on IRWMP that include energy-reduction or renewable energy components
Adopt carbon sequestration strategies where appropriate	Pounds of carbon sequestered

During development of the project prioritization process, described in detail in Chapter 7, the SC and PAC applied weighting factors to the scoring criteria which included the categories of Regional Objectives, Statewide Priorities, Other Strategies, and Feasibility. With the Region's vision in mind, the Regional Objectives collectively account for half of the total weight, as achieving the region's goals and objectives are at the forefront of successful IRWM planning. Of that, the goals were then weighted individually (or prioritized). The committees agreed that water supply and water quality are major issues that need to be addressed, as demonstrated by each category accounting for 15% of a project's score. The remaining regional objectives – flood protection, environmental protection and enhancement, and regional communication and cooperation each received a 5% weight.

The remainder of a project's score is determined by the Statewide Priorities it addresses and other project attributes (i.e. readiness to proceed) and feasibility. These aspects of the score are not explicitly included in the Region's Goals and Objectives, so they are not discussed in detail here. Chapter 7 includes a full list of scoring criteria and weights in Table 7-1.

5.4 Relation to Statewide Priorities

A Program Preference identified by DWR in the 2016 IRWM Guidelines is to address ten statewide priorities, which are listed below and briefly described. The statewide priorities are as follows:

- Make Conservation a California Way of Life
  - Promote increased conservation and efficiency, including encouraging innovative systems, creating funding opportunities, and promoting local urban conservation ordinances and programs.
- Increase Regional Self-Reliance and Integrated Water Management Across All Levels of Government
  - Ensure water security at the local level. This includes regional synergy and multiple benefits projects. This priority also covers the support of funding for integrated planning projects.
- Achieve the Co-Equal Goals for the Delta
  - Support the co-equal goals for the Delta: to provide a more reliable water supply, and to protect, restore, and enhance the Delta ecosystem. This action is directed toward State and federal agencies, although local and regional projects will also receive consideration for addressing this priority.
- Protect and Restore Important Ecosystems
  - Continue to protect and restore ecosystems and their functions, including support of fish and wildlife populations and water quality improvement. This includes water for wetlands and waterfowl, improved fish passage, and enhancement of flows.
- Manage and Prepare for Dry Periods
  - Manage resources effectively to reduce impacts of shortages and reduce costs of state response actions.
- Expand Water Storage Capacity and Improve Groundwater Management
  - Increase water storage, provide essential data, increase groundwater recharge, and reduce contamination.
- Provide Safe Water for All Communities

- Provide funding assistance to vulnerable communities, including consideration for projects that address contamination by nitrate, arsenic, or other specific constituents.

- Increase Flood Protection
  - Improve interagency coordination, including collaborative planning, better flood response coordination, and improved access to emergency funds.
- Increase Operational and Regulatory Efficiency
  - This action is directed toward State and federal agencies; however, consideration will be afforded to eligible local or regional projects that also support increased operational efficiency of the SWP or CVP.
- Identify Sustainable and Integrated Financing Opportunities
  - This action is directed toward State and federal agencies.

The goals and objectives identified for the East Stanislaus Region align with DWR's Statewide Priorities. All Statewide Priorities have been included in the Region's project prioritization process, and therefore all would be achieved by IRWM projects that contribute to the Region's objectives. The Regional Objectives' relation to the Statewide Priorities is shown in Table 5-2.

Achieving this IRWMP's objectives, when integrated with the Statewide Priorities and Resource Management Strategies (RMS), will result in a multi-benefit solution meeting the Region's needs, as well as the State's priorities and preferences. RMS are discussed in detail in Chapter 6, Resource Management Strategies. However, the RMS' relationships to the regional objectives is provided in Table 5-3.

Table 5-2: East Stanislaus Regional Objectives' Relation to Statewide Priorities

		Statewide Priority[1]									
Goal	Objective	Make Conservation a CA Way of Life	Increase Regional Self-Reliance and Integrated Water Mgmt Across All Levels of Govt	Achieve Co-Equal Goals for the Delta	Protect and Restore Important Ecosystems	Manage and Prepare for Dry Periods	Expand Water Storage Capacity and Improve Groundwater Mgmt	Provide Safe Water for All Communities	Increase Flood Protection	Increase Operational and Regulatory Efficiency	Identify Sustainable and Integrated Financing Opportunities
Water Supply - Protect existing water supplies and water rights, and improve regional water supply reliability	Provide a variety of water supply sources, including recycled water, to meet all current and future demands (urban, agricultural and the environment) under various hydrologic conditions.		✓		✓	✓		✓			
	Promote the use of groundwater storage and conjunctive use options to reduce groundwater overdraft.		✓			✓	✓	✓			
	Protect existing water rights, including permitted diversions and extractions.					✓					
	Implement water conservation plans for both urban and agricultural uses.	✓	✓			✓					
	Support monitoring and research to improve understanding of water supplies and needs.	✓							✓		
	Address intra- and inter-regional conveyance infrastructure needs.		✓			✓			✓		
	Address changes in runoff and recharge due to climate change, including amount, intensity, timing, and variability.					✓			✓		
Flood Protection - Ensure flood protection strategies are developed and implemented through a collaborative process, utilizing both local and watershed-wide approaches designed to maximize opportunities for comprehensive water resource management that meet multiple objectives.	Develop outlines of regional projects and plans necessary to protect infrastructure from flooding and erosion from the 100-year event.		✓						✓		
	Work with stakeholders to preserve existing flood attenuation by implementing land management strategies throughout the watershed.		✓						✓		
	Develop approaches for adaptive management that minimizes maintenance requirements and protects water quality and availability while preserving and enhancing ecologic and stream functions, as appropriate.				✓				✓		
	Provide community benefits beyond flood protection, such as public access, open space, recreation, agricultural preservation, and economic development.								✓		
	Protect, restore, and enhance the natural ecological, geomorphic, and hydrologic functions and processes of rivers, creeks, streams and their floodplains.				✓				✓		
	Address changes in timing and intensity of runoff due to climate change.								✓		
	Increase and improve the quantity, diversity, and connectivity of riparian, wetland, floodplain, aquatic, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands.				✓						
	Identify opportunities and incentives for expanding or increasing use of floodway corridors.				✓				✓		
Water Quality - Protect and improve water quality for beneficial uses consistent with regional interests and the RWQCB Basin Plan in cooperation with local, state and federal agencies and regional stakeholders	Meet or exceed all applicable water quality regulatory standards, including drinking water standards.							✓			
	Deliver agricultural water to meet water quality guidelines established by stakeholders.							✓			
	Aid in meeting Total Maximum Daily Loads established, or to be established, for the Tuolumne Stanislaus, Merced, and San Joaquin River watersheds.				✓			✓			
	Protect surface waters and groundwater basins from contamination and threat of contamination.				✓		✓	✓			
	Manage existing land uses while preserving or enhancing environmental habitats.				✓						

		Statewide Priority[1]									
Goal	Objective	Make Conservation a CA Way of Life	Increase Regional Self-Reliance and Integrated Water Mgmt Across All Levels of Govt	Achieve Co-Equal Goals for the Delta	Protect and Restore Important Ecosystems	Manage and Prepare for Dry Periods	Expand Water Storage Capacity and Improve Groundwater Mgmt	Provide Safe Water for All Communities	Increase Flood Protection	Increase Operational and Regulatory Efficiency	Identify Sustainable and Integrated Financing Opportunities
	Minimize impacts from storm water through implementation of Best Management Practices, Low Impact Development or other similar projects.				✓				✓		
	Promote programs and projects to reduce the quantity and improve the quality of urban and agricultural runoff.				✓						
	Promote and support regional monitoring to further understanding of water quality issues.							✓			
Environmental Protection and Enhancement - Protect the environmental resources of the Stanislaus, Tuolumne, Merced and San Joaquin River watersheds by identifying, promoting and implementing opportunities to assess, restore and enhance natural resources of these watersheds	Identify and incorporate (where possible and reasonable) opportunities to assess, protect, enhance, and/or restore natural resources when developing water management strategies.				✓						
	Minimize adverse effects on biological and cultural resources, including riparian habitats, habitats supporting sensitive plant or animal species, and archaeological sites when implementing strategies and projects.				✓						
	Identify opportunities for open spaces, trails and parks along creeks and other recreational projects in the watershed to be incorporated with water supply, water quality, or flood protection projects.					✓			✓		
	Contribute to the long-term sustainability of agricultural, commercial, industrial, and urban land uses and activities within the basin.	✓				✓					
	Identify opportunities to protect, enhance, or restore habitat to the support all watersheds in the Region in conjunction with water supply, water quality, or flood protection projects.					✓			✓		
	Support projects to understand, protect, improve and restore the region's ecological resources.				✓						
	Promote the recovery and stability of regionally present native species and populations.				✓						
Regional Communication and Cooperation - Implement and promote this IRWMP through regional communication, cooperation, and education	Develop a forum for consensus decision-making and IRWMP implementation by regional entities.		✓			✓			✓		
	Build relationships with State and Federal regulatory agencies and other water forums and agencies to facilitate permitting of water-related projects and ensure continued consistency with state water plans.					✓			✓		
	Facilitate dialogues between regional and inter-regional entities to reduce inconsistencies and conflicts in water management and to maximize benefits from water-related projects.					✓			✓		
	Maintain avenues of communication with the general public and offering opportunities to provide feedback on the IRWM and water-related projects through the regional websites and other public forums.	✓				✓			✓		
	Identify opportunities for public education about water supply, water quality, flood management, and environmental protection.	✓			✓	✓			✓		
	Implement focused outreach to DACs and EDAs relative to opportunities for water supply, water quality, flood management, and environmental protection projects.	✓			✓			✓	✓		
Economic and Social Responsibility - Promote development and implementation of projects, programs and policies that are socially impartial and economically sound	Support the participation of disadvantaged communities and economically distressed areas in the development, implementation, monitoring and long-term maintenance of water resource projects.	✓						✓			
	Develop cost-effective multi-benefit projects.		✓		✓	✓			✓		
	Consider disproportionate community impacts to ensure environmental justice.					✓		✓			
	Maximize economies of scale and governmental efficiencies.		✓								

Goal	Objective	Statewide Priority[1]									
		Make Conservation a CA Way of Life	Increase Regional Self-Reliance and Integrated Water Mgmt Across All Levels of Govt	Achieve Co-Equal Goals for the Delta	Protect and Restore Important Ecosystems	Manage and Prepare for Dry Periods	Expand Water Storage Capacity and Improve Groundwater Mgmt	Provide Safe Water for All Communities	Increase Flood Protection	Increase Operational and Regulatory Efficiency	Identify Sustainable and Integrated Financing Opportunities
	Protect cultural resources.							✓			
	Reduce energy use and/or use of renewable resources where appropriate.		✓								

[1]Gray columns indicate Statewide Priorities that are directed at State agencies, the legislature, and/or federal agencies, rather than individual Regions and/or agencies.

Table 5-3: East Stanislaus Regional Objectives' Relation to RMS

Goal	Objective	Resource Management Strategies[1]																														
		Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Precipitation Enhancement	Sediment Management	Outreach and Engagement	Water and Culture	Watershed Management	Other Strategies
Water Supply - Protect existing water supplies and water rights, and improve regional water supply reliability	Provide a variety of water supply sources, including recycled water, to meet all current and future demands (urban, agricultural and the environment) under various hydrologic conditions.						✓						✓	✓		✓		✓	✓	✓		✓	✓	✓			✓					
	Promote the use of groundwater storage and conjunctive use options to reduce groundwater overdraft.					✓							✓	✓						✓			✓	✓					✓		✓	
	Protect existing water rights, including permitted diversions and extractions.				✓	✓	✓							✓				✓	✓			✓	✓		✓					✓		
	Implement water conservation plans for both urban and agricultural uses.	✓	✓							✓																				✓		
	Support monitoring and research to improve understanding of water supplies and needs.																				✓			✓	✓						✓	
	Address intra- and inter-regional conveyance infrastructure needs.	✓	✓		✓			✓											✓						✓							
	Address changes in runoff and recharge due to climate change, including amount, intensity, timing, and variability							✓						✓																	✓	

Goal	Objective	Resource Management Strategies[1]																														
		Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Precipitation Enhancement	Sediment Management	Outreach and Engagement	Water and Culture	Watershed Management	Other Strategies
Flood Protection - Ensure flood protection strategies are developed and implemented through a collaborative process, utilizing both local and watershed-wide approaches designed to maximize opportunities for comprehensive water resource management that meet multiple objectives	Develop outlines of regional projects and plans necessary to protect infrastructure from flooding and erosion from the 100-year event.							✓																	✓			✓			✓	
	Work with stakeholders to preserve existing flood attenuation by implementing land management strategies throughout the watershed.							✓			✓	✓									✓				✓				✓	✓	✓	
	Develop approaches for adaptive management that minimizes maintenance requirements and protects water quality and availability while preserving and enhancing ecologic and stream functions, as appropriate.							✓			✓														✓						✓	
	Provide community benefits beyond flood protection, such as public access, open space, recreation, agricultural preservation, and economic development.							✓	✓																	✓			✓		✓	
	Protect, restore, and enhance the natural ecological, geomorphic, and hydrologic functions and processes of rivers, creeks, streams and their floodplains							✓			✓														✓			✓			✓	
	Address changes in timing and intensity of runoff due to climate change							✓						✓																		

Goal	Objective	**Resource Management** Strategies[1]																														
		Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Precipitation Enhancement	Sediment Management	Outreach and Engagement	Water and Culture	Watershed Management	Other Strategies
	Increase and improve the quantity, diversity, and connectivity of riparian, wetland, floodplain, aquatic, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands.							✓		✓													✓					✓			✓	
	Identify opportunities and incentives for expanding or increasing use of floodway corridors.							✓			✓														✓			✓			✓	
Water Quality - Protect and improve water quality for beneficial uses consistent with regional interests and the RWQCB Basin Plan in cooperation with local, state and federal agencies and regional stakeholders	Meet or exceed all applicable water quality regulatory standards, including drinking water standards.												✓			✓			✓	✓		✓	✓	✓				✓				
	Deliver agricultural water to meet water quality guidelines established by stakeholders.	✓							✓							✓				✓		✓	✓	✓				✓	✓			
	Aid in meeting Total Maximum Daily Loads established, or to be established, for the Tuolumne, Stanislaus, Merced, and San Joaquin River watersheds.								✓	✓	✓									✓	✓		✓					✓				
	Protect surface waters and groundwater basins from contamination and threat of contamination.										✓	✓	✓							✓	✓	✓	✓	✓	✓			✓				
	Manage existing land uses while preserving or enhancing environmental habitats.								✓		✓	✓	✓								✓		✓		✓			✓		✓	✓	

	Objective	Resource Management Strategies[1]																														
Goal		Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Precipitation Enhancement	Sediment Management	Outreach and Engagement	Water and Culture	Watershed Management	Other Strategies
	Minimize impacts from storm water through implementation of Best Management Practices, Low Impact Development or other similar projects.							✓			✓	✓									✓		✓	✓	✓			✓			✓	
	Promote programs and projects to reduce the quantity and improve the quality of urban and agricultural runoff.	✓	✓						✓	✓											✓		✓		✓			✓			✓	
	Promote and support regional monitoring to further understanding of water quality issues.												✓										✓								✓	
Environmental Protection and Enhancement - Protect the environmental resources of the Stanislaus, Tuolumne, Merced and San Joaquin River watersheds by identifying, promoting and implementing opportunities to assess, restore and enhance natural resources of these watersheds	Identify and incorporate (where possible and reasonable) opportunities to assess, protect, enhance, and/or restore natural resources when developing water management strategies.							✓			✓	✓									✓							✓	✓		✓	
	Minimize adverse effects on biological and cultural resources, including riparian habitats, habitats supporting sensitive plant or animal species, and archaeological sites when implementing strategies and projects.										✓		✓								✓							✓			✓	
	Identify opportunities for open spaces, trails and parks along creeks and other recreational projects in the watershed to be incorporated with water supply, water quality, or flood protection projects.										✓										✓					✓					✓	

Goal	Objective	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Precipitation Enhancement	Sediment Management	Outreach and Engagement	Water and Culture	Watershed Management	Other Strategies
	Contribute to the long-term sustainability of agricultural, commercial, industrial, and urban land uses and activities within the basin.	✓	✓			✓		✓	✓					✓		✓		✓		✓	✓	✓	✓	✓	✓			✓			✓	
	Identify opportunities to protect, enhance, or restore habitat to the support all watersheds in the Region in conjunction with water supply, water quality, or flood protection projects.							✓			✓		✓								✓							✓			✓	
	Support projects to understand, protect, improve and restore the region's ecological resources.										✓										✓										✓	
	Promote the recovery and stability of regionally present native species and populations										✓	✓									✓											
Regional Communication and Cooperation - Implement and promote this IRWMP through regional communication, cooperation, and education	Develop a forum for consensus decision-making and IRWMP implementation by regional entities.																				✓			✓					✓	✓	✓	
	Build relationships with State and Federal regulatory agencies and other water forums and agencies to facilitate permitting of water-related projects and ensure continued consistency with state water plans.																				✓								✓		✓	

Goal	Objective	**Resource Management** Strategies[1]																														
		Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Precipitation Enhancement	Sediment Management	Outreach and Engagement	Water and Culture	Watershed Management	Other Strategies
	Facilitate dialogues between regional and inter-regional entities to reduce inconsistencies and conflicts in water management and to maximize benefits from water-related projects.																				✓								✓	✓		
	Maintain avenues of communication with the general public and offering opportunities to provide feedback on the IRWM and water-related projects through the regional websites and other public forums.																												✓	✓		
	Identify opportunities for public education about water supply, water quality, flood management, and environmental projection.								✓																				✓			
	Implement focused outreach to DACs and EDAs relative to opportunities for water supply, water quality, flood management, and environmental protection projects																												✓	✓		
Economic and Social Responsibility - Promote development and implementation of projects, programs and policies that are socially impartial and economically sound	Support the participation of disadvantaged communities and economically distressed areas in the development, implementation, monitoring and long-term maintenance of water resource projects.																												✓	✓		

Goal	Objective	Agricultural Water Use Efficiency	Urban Water Use Efficiency	Conveyance-Delta	Conveyance-Regional/local	System Reoperation	Water Transfers	Flood Management	Agricultural Lands Stewardship	Economic Incentives	Ecosystem Restoration	Forest Management	Recharge Area Protection	Conjunctive Mgmt /GW Storage	Desalination	Recycled Municipal Water	Surface Storage - CALFED	Surface Storage – Regional/local	Drinking Water Treatment & Distrib.	Groundwater/Aquifer Remediation	Land Use Planning & Management	Matching Quality to Use	Pollution Prevention	Salt and Salinity Management	Urban Runoff Management	Water-Dependent Recreation	Precipitation Enhancement	Sediment Management	Outreach and Engagement	Water and Culture	Watershed Management	Other Strategies
	Develop cost-effective multi-benefit projects.																				✓										✓	
	Consider disproportionate community impacts to ensure environmental justice.																												✓			
	Maximize economies of scale and governmental efficiencies.															✓																
	Protect cultural resources.																				✓									✓		
	Reduce energy use and associated GHG emissions and/or use of renewable resources where appropriate.															✓			✓			✓										
	Adopt carbon sequestration strategies where appropriate.							✓	✓		✓	✓																				

Resource Management Strategies[1]

[1]Gray columns indicate RMS that are not applicable to the Region. For in-depth discussion, see Chapter 6, Resource Management Strategies.

5.5 Relation to Regulatory Programs

The East Stanislaus Region falls under the purview of the USEPA Region 9, USFWS Southwest Region, the CVRWQCB, the San Joaquin District of DWR, CDPH, and CDFW, Central Region. Most water resources management activities fall under the oversight of one or more of these agencies. Examples of activities requiring coordination with these areas include preparation of this IRWMP (completed using the guidelines issued by DWR); water treatment plant operations and potable water distribution (conducted under the oversight of SWRCB Department of Drinking Water (DDW)); and discharges of treated wastewater to the San Joaquin River (CDFW and RWQCB). Direct and indirect regulatory agency participation has been sought by the East Stanislaus Region for participation on the SC or PAC; however, most region coordination with these State and Federal regulatory agencies is on a project-by-project basis.

5.6 Relation to Local Water Planning

Prior to the creation of the 2013 IRWMP, there were not any official IRWM planning efforts in the East Stanislaus Region, but entities within the East Stanislaus Region have worked together on various local water planning efforts and water projects over the years and have maintained an ongoing collaborative relationship through groundwater management groups, Directors' meetings, and other efforts. Some of the historical water-related planning efforts are project-based, while others are related to a broader discussion of water resources-related issues. The cities and agencies within the East Stanislaus Region have worked together in the past to develop solutions to the water management issues and conflicts they face, and the ESRWMP will continue doing so. This IRWMP provides an integrated venue under which these historical efforts can continue on a programmatic level. It is anticipated that project-specific coordination will continue independent of the IRWMP implementation, as needed, for development, construction and operation of projects required to meet the region's water resource management needs.

The IRWMP must document the local water planning documents on which it is based including:

- A list of local water plans used in the IRWM Plan.
- A discussion of how the IRWM Plan relates to planning documents and programs established by local agencies.
- A description of the dynamics between the IRWM Plan and local planning documents.
- A description of the consideration and incorporation of water management issues and climate change adaptation and mitigation strategies from local plans.
- Incorporation of the stormwater resource plan prepared under SB 985.

\- *Proposition 1 IRWM Guidelines*, July 2016, Page 41

Some of the historical local water planning efforts that have laid the foundation for the East Stanislaus IRWMP and future ESRWMP member agency coordination are described in the following sections. A list of local plans used in the development of the IRWMP is included in Chapter 8, Technical Analysis (see Table 8-1). Coordination among the ESRWMP on water management planning activities is discussed in more detail in Chapter 4. Information from other planning documents was sought and incorporated into this IRWMP, and it is anticipated that as the IRWM program progresses, programs and planning developed under the IRWM program will be shared with and incorporated into other local and regional planning documents. An example of this 'give and take' is the development of the 2014 Mid-San Joaquin River RFMP by RiverPartners and Stanislaus County. Flood-related information from the IRWMP was shared with the organization preparing the RFMP, and the ESRWMP incorporates planning and projects that resulted from this plan development into the East Stanislaus IRWMP. Additionally, as local plans are revised and updated in the future, they will be considered and incorporated into IRWMP updates (schedule of these updates is discussed in Section 9.4). Because many of the local planning efforts are conducted by many of the same entities participating in preparation of the East Stanislaus IRWMP, communication will be key. IRWM planning participants will relay relevant IRWM-related information back to their entities for consideration during individual planning efforts. Should inconsistencies between local plans and the IRWMP be identified, meetings will be scheduled to discuss details, reach a consensus, and ensure regional and local plans become consistent.

5.6.1 Groundwater Management Planning

The TGBA was created for cooperative groundwater management activities in the Turlock Groundwater Subbasin. Agencies in TGBA include the Turlock and Merced Irrigation Districts; the cities of Ceres, Turlock, Modesto and Hughson; the Hilmar and Delhi County Water Districts; the Keyes, Denair and Ballico Community Services Districts; the Eastside and Ballico-Cortez Water Districts; and Stanislaus and Merced Counties. Since the mid-1990s, the TGBA has coordinated as follows.

- Pursuant to State Law, the purpose of the TGBA is to coordinate groundwater management activities within the Turlock Groundwater Basin. The guiding document for the TGBA is the GWMP, prepared and adopted pursuant to state legislation (AB 3030) signed into law January 1, 1993. The first GWMP was adopted in 1997; it was updated and re-adopted in 2008 to reflect current conditions in the basin area. The TGBA will continue to coordinate in the future and update the GWMP, as necessary, in order to successfully coordinate groundwater management activities in the basin.
- A water balance study of the Turlock Subbasin was prepared in 2003 and updated in 2007 to estimate the inflows and outflows from the Subbasin between 1952 and 2006. Recent groundwater data indicate that the basin may no longer be in a state of equilibrium (that is, outflows have started to exceed inflows). While there is uncertainty about the causes, it is believed to be a combination of increased urbanization, recent dry years, and increased agricultural production (acreage) in the eastern hills (Turlock Lake area) which relies solely on groundwater for irrigation. The water balance study highlighted the importance of studying the issue in more detail and for member agencies to collaborate more closely on groundwater management issues within the entire subbasin.
- In response to the requirements of SB x7-6, the TGBA submitted an application to DWR to comply with requirements as a Cooperative Groundwater Monitoring Association. This has necessitated the formation of a SB x7-6 Committee to assist in coordinating compliance activities including, but not limited to: representing the TGBA at meetings regarding SBx7-6; development of draft submittals to DWR for TGBA's approval; and coordinating implementation of a monitoring program with DWR and local agencies.
- Submitted an application for, and was awarded in 2013, a Local Groundwater Assistance grant to study the geology of the far eastern side of the Turlock Subbasin, to update and refine the local groundwater model and the future needs study, and to identify additional monitoring locations in nearly planted areas to the east.
- The TGBA is coordinating with many regional agencies in order to achieve compliance with the Sustainable Groundwater Management Act (SGMA). Two Groundwater Sustainability

Agencies (GSAs) have been formed in the region, one encompassing the eastern portion of the Turlock Subbasin and one encompassing the western portion of the Subbasin. Following the establishment of these two entities, the TGBA is developing a process for working together with these agencies to develop a single GSP for the basin as a whole.

The Cities of Modesto, Oakdale, Waterford and Riverbank, MID, OID, and Stanislaus County are members of the STRGBA which was formed in 1994. The purpose of the association is to manage the groundwater resources within the Modesto Groundwater Subbasin. The STRGBA developed and adopted an *Integrated Regional Groundwater Management Plan* (IRGMP) in 2005 pursuant to state legislation SB1938. The STRGBA worked with the USGS to develop a numerical groundwater model for the Modesto Groundwater Basin (USGS, 2015). This effort characterized the basin and provided modeling capabilities for various groundwater scenarios. To comply with SBx7-6 State legislation requiring groundwater monitoring, passed in 2009, the STRGBA submitted an application to the DWR stating its intent as a Cooperative Groundwater Monitoring Association to submit a groundwater monitoring program for the Modesto sub-basin.

The STRGBA also received a $250,000 grant under the AB303 legislation to develop a Well Field Optimization Program. Phase 1 of this program is to develop and implement the first of the nine IRGMP management actions; more specifically, to operate wells to meet water supply demands, lower pumping power costs and prioritize well usage, maintain groundwater levels to satisfy BMOs, manage quality of discharge water and, increase effectiveness of shallow groundwater management. This study was completed in June 2007. Phase 2 expands the program to include aspects specific to urban purveyors of groundwater, but with similar goals of facilities inventory and maintaining groundwater levels to satisfy BMOs. More recently, the STRGBA submitted an application for, and was awarded in 2013, a Local Groundwater Assistance grant to study the Modesto Subbasin. This effort consisted of a groundwater characterization and recharge study, completed in 2016, which identified areas for potential groundwater recharge and to developed conceptual ideas for possible groundwater augmentation projects to support basin-wide conjunctive use.

The STRGBA has also been coordinating with the State on SGMA compliance. As of May 2017, the STRGBA is presumed to be the exclusive GSA for the Modesto Subbasin. Following this determination, the STRGBA will begin working toward completion of a GSP for the Subbasin.

5.6.2 Groundwater Elevation Monitoring/CASGEM

SB x7-6 added provisions for groundwater monitoring to Division 6 of the CWC and authorized DWR to establish permanent, locally managed, groundwater elevation monitoring and reporting in all of California’s alluvial groundwater basins. To meet this legislative requirement, DWR developed the CASGEM program to establish a program of regular and systematic monitoring of groundwater elevations and to track seasonal and long-term trends in groundwater elevations statewide.

A core component of CASGEM is the identification of Monitoring Entities in each groundwater basin/subbasin. Monitoring Entities are responsible for coordinating the groundwater elevation monitoring and reporting for their jurisdictional area, with groundwater elevation monitoring beginning in the Fall of 2011, and elevation reporting to DWR by January 1, 2012. TGBA and STRGBA have respectively registered to become the Monitoring Entities for the Turlock and Modesto Subbasins of the San Joaquin Valley Groundwater Basin.

The CASGEM Groundwater Basin Prioritization is a statewide ranking of groundwater basin importance that includes evaluation of criteria such as reliance on groundwater and impacts on groundwater, including overdraft. Basin Prioritization allows DWR to focus resources on High and Medium priority basins first. Basin rankings were completed in 2015. The Modesto and Turlock

Subbasins are both ranked as High priority, reflecting the area's reliance on groundwater, high irrigated acreage, and impacts on groundwater.

5.6.3 Groundwater Quality Monitoring

In 2006, the SWRCB conducted an investigation in the Central Eastside study unit, overlying the Modesto and Turlock Subbasins, as part of the Statewide Basin Assessment Project of the GAMA Program. The GAMA program was developed in response to the Groundwater Quality Monitoring Act of 2001 and was conducted in coordination with the USGS and the Lawrence Livermore National Laboratory (LLNL). The one-time study was conducted to provide a spatially unbiased assessment of raw groundwater for comparing water quality. Data collected during the study is available online at the SWRCB's Geotracker GAMA website at http://www.waterboards.ca.gov/gama/geotracker_gama.shtml. This website currently integrates data from the SWRCB, the RWQCBs, CDPH, the California Department of Pesticide Regulation, DWR, USGS and LLNL.

At present, all water agencies and irrigation districts in the East Stanislaus Region rely partially or wholly on groundwater wells. Active municipal supply wells must be tested per SWRCB DDW regulations on an annual basis. Groundwater quality is reported by water agencies annually to the public as part of their consumer confidence reporting and to CDPH as part of their permit requirements. Further, CASGEM requires some basic water quality testing and reporting in the wells that are monitored as part of the CASGEM program. Finally, the Irrigated Lands Regulatory Program and the Dairy Program are also monitoring groundwater quality in the region. The Irrigated Lands Regulatory Program began in 2003 to prevent agricultural runoff from impairing surface waters. Under the program waste discharge requirements were developed to protect both surface and groundwater. Waste discharge requirements for the Eastern San Joaquin River Watershed, which encompasses the Region, were adopted by the CVRWQCB in December 2012; with revisions occurring in 2013, 2014, and 2015. Additionally, as part of this program, if there are two or more exceedances of the same pollutant at the same site within a three-year period, management plans must be prepared and implemented. The Irrigated Lands Regulatory Program provides public access to monitoring reports, management plans, and water quality data collected since 2004. Data collected under the program can be accessed through the California Data Exchange Network (CEDEN). The Dairy Program has a General Order for Existing Milk Cow Dairies requiring monitoring and reporting in the Central Valley Region. Monitoring of discharges of manure and/or process wastewater, stormwater, or tailwater from dairy production is required to minimize leaching of nutrients and salts to groundwater and nearby surface waters. This program requires dischargers submit annual reports to the Central Valley Water Board.

5.6.4 Salt & Nutrient Management Planning

As previously stated, the City of Modesto is a member of the Central Valley Salinity Coalition, a non-profit coalition of public agencies, businesses, associations, and other members, formed in July 2008 with the purpose of better managing salts in the Central Valley of California. The Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) program is being led by the Coalition to find solutions to the Central Valley salt problem, and in February 2010, the organization completed the *Salt and Nitrate Sources Pilot Implementation Study*. The purpose of the study was to develop a methodology and provide guidance for development of the Central Valley Salt and Nutrient Management Plan (SNMP), including methods for quantifying salt and nutrient (or nitrate) sources. The identified methods were pilot tested to evaluate their appropriateness and effectiveness. Following completion of the pilot study, the Coalition developed a *Framework for Salt/Nitrate Source Identification Studies*, which led to preparation of the Initial Conceptual Model (ICM). The ICM was the first phase of a three-phased effort to develop the technical and regulatory basis for the SNMP. The ICM consists of a conceptual level analysis of the water balance in the Central Valley and the associated salt and nutrient conditions. The result of the ICM was an assessment of the salt and nutrient conditions in the Central Valley. Phases 2 and 3 of the ICM consisted of refining the findings from Phase 1, delineating management zones, and developing the SNMP which includes preparation of a salt and nutrient program of implementation and completion of regulatory analyses to support adoption of the SNMP in the CVRWQCB's Basin Plan. The Final SNMP for Central Valley Water Board consideration was completed in December 2016; public comments were solicited beginning in January 2017 and the SNMP is currently under review. The Final SNMP is anticipated to be complete and adopted in summer 2018.

5.6.5 Water Planning Efforts

In addition to the development of agency-specific Water Master Plans, UWMPs, and AWMPs in the Region, agencies within the Region have coordinated on regional and joint-projects and programs. Some of these are described as follows:

- *Regional Surface Water Supply Project (RSWSP).* For the past several years, the Cities of Turlock and Ceres have been negotiating with TID to receive treated water from the Tuolumne River to supplement current potable water supplies. On September 27, 2011, a JPA was executed between the cities of Turlock and Ceres to establish the SRWA. The member agencies of the SRWA are all heavily or entirely dependent upon groundwater as their source of water supply and groundwater is a diminishing resource in the region. Each of the Participants is authorized to develop, obtain, and serve a M&I water supply, pursuant to California law. It is anticipated that the SRWA's RSWSP will result in a safe, dependable, economical and long-term M&I water supply system. The SRWA creates a forum and decision-making body to collectively discuss, develop and negotiate alternatives regarding the RSWSP. In July 2015, the final Water Sales Agreement for the transfer of water to the SWRA was approved by the TID Board of Directors. Water purchased from TID will be treated at an SWRA-owned and operated water treatment plant, which is currently in the design phase.
- *Modesto Regional Water Treatment Plant (MRWTP) Phases 1 & 2.* This is an ongoing effort between the City of Modesto and the MID to deliver treated Modesto Reservoir surface water to the City of Modesto and other adjacent communities adjacent for which Modesto owns and operates the water systems. In 1992, the City and MID entered into a Treatment and Delivery Agreement to construct Phase 1 of the MRWTP, consisting of fourteen miles of conveyance piping, two terminal reservoir tanks and pumping facilities for the delivery of 30 mgd of potable water. Since 1995, Modesto has been receiving these surface water deliveries. In 2005, the City and MID entered into an Amended and Restated Treatment and Delivery Agreement to construct Phase 2 of the MRWTP, which would increase treated surface water deliveries to 60 mgd. The Phase 2 project was completed in spring of 2016.

5.6.6 Wastewater and Recycled Water Planning Efforts

In addition to the development of agency-specific Wastewater Master Plans, regional coordination for wastewater-related efforts has been completed by entities within the Region, helping lay the foundation for IRWM planning in the Region. Examples of these efforts include:

- *Turlock Regional Water Quality Control Facility (RWQCF).* Turlock's RWQCF provides tertiary treatment of wastewater from the City of Turlock and the CSDs of Keyes and Denair. Furthermore, the Turlock RWQCF processes 1 mgd of wastewater from the City of Ceres (approximately 30% of Ceres' total flow); this wastewater is partially treated before being sent to Turlock. Ceres has purchased the rights to discharge an additional 1 mgd of wastewater to Turlock, and the pipeline from Ceres to Turlock has a total hydraulic capacity of 6.5 mgd to allow for further regionalization efforts. Operation of these facilities requires on-going communication and coordination.

- *Wastewater Regionalization.* In November 2010, Erler & Kalinowski, Inc. evaluated the feasibility of forming a regional system to provide wastewater services to the cities of Modesto, Ceres, and/or Turlock. The study area consisted of the Cities of Modesto, Ceres, and Turlock. The study identified and evaluated options for wastewater regionalization in the study area and evaluated the feasibility of these options on a technical, economic, and legal basis. The study found that there are significant operational efficiencies to be realized by combining wastewater treatment and disposal systems in the study area. Currently, cities in the Region are engaged with smaller regionalization efforts, such as the NVRRWP, and they will continue to coordinate on future wastewater regionalization opportunities.
- *North Valley Regional Recycled Water Program (NVRRWP).* This is a proposed recycled water project to deliver up to 30,930 AFY of tertiary-treated recycled water to the drought-impacted west side of Stanislaus County, primarily the DPWD and other potential users. The recycled water will be used for agricultural irrigation. This quantity of water would be available from the combined cities of Modesto, Turlock, and Ceres effluents and could irrigate 15,600 acres of land per year (at two AF per acre of applied water). An additional 15,682 AFY of recycled water will be made available as the City of Modesto expands its tertiary treatment capacity. At the above-described build-out scenario, a total of 46,900 AFY of recycled water would be available for unrestricted farmland irrigation. The City of Modesto has begun construction of its facilities and the City of Turlock anticipates beginning construction of its facilities in early-2018. Delivery of recycled water to DPWD will begin in 2018.

5.7 Relation to Local Flood Control and Storm Water Planning

There are existing flood management planning activities underway in the East Stanislaus Region that are contributing to development of the East Stanislaus IRWMP. Two significant efforts include the DWR's Regional Flood Management Planning Initiative's CVFPP, as well as the Mid-San Joaquin River RFMP. The goal of DWR's Regional Flood Management Planning Program is to build upon flood risk management information developed through, and contained in the CVFPP and to develop a long-term vision for "a flood safe region" through the use of detailed regional information and a collaborative local planning process. Integrated Flood Management is an approach to dealing with flood risk that recognizes the:

- interconnectedness of flood management actions within broader water resources management and land use planning,
- value of coordinating across geographic and agency boundaries,
- need to evaluate opportunities and potential impacts from a system perspective, and
- importance of environmental stewardship and sustainability.

The Mid-San Joaquin River Region will support DWR's FloodSAFE initiative through demonstration of integrated multi-benefit flood management projects, coordination with adjacent flood management planning regions, and develop a region-wide flood management solution. A RFMP was developed for the Mid-San Joaquin River Region by participating agencies including RD 2092 and

Stanislaus County. The East Stanislaus IRWMP participating entities were active participants in the development of this Flood Management Plan, providing close coordination and integration among the IRWMP and flood management in the Region. The purpose of the RFMP is to develop a practical, flood-safe vision for the Mid-San Joaquin Region. The RFMP aims to improve flood risk management, promote ecosystem functions, and promote multi-benefit projects. This plan was developed from March 2013 to December 2014 in order to identify and prioritize flood control projects in the region. The projects in this plan were considered by DWR in their 2017 Central Valley Flood Protection Plan (CVFPP) update, and will also be pursued at the local level. Through an 18-month stakeholder input process, 37 projects were identified as having the potential to reduce flood hazards and provide other benefits to the planning area. Projects varied widely, with some focusing on agricultural lands, and others designed for more developed areas.

Concurrently with the IRWMP Update, the Stanislaus Multi-Regional Storm Water Resources Plan (SWRP) was under development. Many of the same agencies that participate in the ESRWMP are involved with the creation of the SWRP, including the Cities of Modesto, Ceres, and Turlock, and Stanislaus County. The plan will identify and prioritize multi-benefit stormwater resource projects to improve regional water supply resilience and aid in the adaptation of infrastructure to climate change. The plan is expected be finalized in 2018.

Separately, the Cities of Modesto and Turlock, Stanislaus County, and the TID jointly fund, and work cooperatively on the operation of Gomes Lake, a flood control facility on the San Joaquin River. The Gomes Lake Pumping Plant is approximately 3.5 miles east of the San Joaquin River. The Gomes Lake Pumping Plant pumps backed up water over levees that were constructed in the 1950s and 1960s to prevent stormwater from draining into the San Joaquin River. The water is then discharged into the San Joaquin River (ESA, 2013).

5.8 Relation to Local Land Use Planning

Land use planning entities in the East Stanislaus Region consist of Stanislaus County, Merced County, the incorporated cities of Modesto, Turlock, Ceres, Hughson, Oakdale, Riverbank, Waterford, the Stanislaus Local Agency Formation Commission (LAFCo), and the Stanislaus Council of Governments (StanCOG). Stanislaus County LAFCo develops and updates spheres of influence for cities and districts, prepares Municipal Service Reviews (MSRs), and works cooperatively with public and private agencies and interests on growth, preservation and service delivery. StanCOG is the MPO for the Stanislaus Region as designated by the Federal government. It is a council of city and county governments comprised of the Cities of Ceres, Hughson, Modesto, Newman, Oakdale, Patterson, Riverbank, Turlock and Waterford and Stanislaus County. The water management entities within the Region include Stanislaus County, Merced County, the cities of Modesto, Turlock, Ceres, Hughson, Oakdale, Riverbank, Waterford, MID, TID, and OID, various CSDs, as well as the USACE and state entities. Many of the water management entities in the Region are also land use planning entities and therefore, coordinate internally. Indirect coordination is conducted through completion

> IRWM Plans must document:
> - Current relationship between local land use planning, regional water issues, and water management objectives.
> - Future plans to further a collaborative, proactive relationship between land use planners and water managers.
> - Collaboration with regional land use planning in order to manage multiple water demands throughout the state, adapt systems to climate change, and potentially offset climate change impacts.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 41

of master plans, General Plans, UWMPs, and other land use or water plans in which water managers can provide input regarding project or land use decisions that may impact water supply or water quality and vice versa.

The relationship between the cities and the irrigation districts in Stanislaus County is very good; however, it is recognized that coordination between water managers and land use entities could always be improved. It is the intent of the East Stanislaus IRWM planning process to strengthen coordination among all water and land use planning entities in the Region.

Stanislaus County, and the Cities of Ceres, Hughson, Modesto, Oakdale, Riverbank, Turlock, Waterford, as well as Newman and Patterson (both of which are just outside of the East Stanislaus Region), prepared and submitted a joint funding request to the California Strategic Growth Council for the Stanislaus County Regional Sustainability Toolbox. The Strategic Growth Council awarded one million dollars in grant funding for creation of the Toolbox, which was developed and finalized in 2015. The Toolbox included the development of multiple planning tools to achieve GHG reductions in the region, comprised of eleven components. For example, Water Efficient Landscape Guidelines and Standards were developed, as well as LID Standards and Specifications. Some of these components are related to land use planning and because many of the same entities were involved in development of the Toolbox, this was an opportunity to coordinate on water planning and land use planning efforts. It is recognized by participating agencies that there are opportunities for improved coordination among water planners and land use planners. Allowing for early water management input and coordination with those responsible for making land use decisions and implementing land use changes will improve not only land use planning, but also water resources planning.

Chapter 6

Chapter 6 Resource Management Strategies

> The IRWM Plan must document the range of Resource Management Strategies (RMS) considered to meet the IRWM objectives and identify which RMS were incorporated into the IRWM Plan.
>
> Additionally, the IRWM Plan must:
> - Demonstrate how climate change effects are factored into its RMS.
> - Address reducing energy consumption, especially the energy embedded in water use, and ultimately reducing GHG emissions.
> - Evaluate the ability of RMS to eliminate or minimize climate vulnerabilities
> - Evaluate RMS and other adaptation strategies and their ability to eliminate or minimize climate change vulnerabilities, especially those impacting water infrastructure systems.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 39

As described in the 2013 CWP Update, Resource Management Strategies (RMS) are a diverse set of strategies to meet water-related resource management needs of each IRWM region. The ESRWMP has considered all of these CWP RMS for inclusion in the East Stanislaus IRWMP and application in the Region; those that were deemed appropriate and applicable have been included as shown in Table 6-1. The RMS, their relevance to the Region, and the feasibility of achieving the regional objectives through RMS implementation are summarized in the following sections. Additionally, RMS are evaluated in terms of climate change, including how climate change effects are factored into each RMS, the ability of each RMS to reduce energy consumption and reduce GHG emissions, and the ability of each RMS to address climate change vulnerabilities.

A summary table describing the RMS' relationships to the regional objectives can be found in Chapter 5, Table 5-2.

A summary table describing the RMS' applicability to the climate change adaptation strategies listed in DWR's Climate Change Handbook for Regional Water Planning is included in Chapter 3, Climate Change, Table 3-5.

Table 6-1: RMS Incorporated into East Stanislaus IRWMP

RMS	Incorporated into IRWMP	RMS	Incorporated into IRWMP
Reduce Water Demand		**Improve Water Quality**	
Agricultural Water Use Efficiency	✓	Drinking Water Treatment and Distribution	✓
Urban Water Use Efficiency	✓	Groundwater Remediation / Aquifer Remediation	✓
Improve Operational Efficiency & Transfers		Matching Quality to Use	✓
Conveyance – Delta		Pollution Prevention	✓
Conveyance – Regional/Local	✓	Salt and Salinity Management	✓
System Reoperation	✓	Urban Runoff Management	✓
Water Transfers	✓	**Practice Resource Stewardship**	
Increase Water Supply		Agricultural Lands Stewardship	✓
Conjunctive Management and Groundwater Storage	✓	Ecosystem Restoration	✓
Desalination (Brackish and Seawater)		Forest Management	✓
Precipitation Enhancement	✓	Land Use Planning and Management	✓
Recycled Municipal Water	✓	Recharge Area Protection	✓
Surface Storage – CALFED		Sediment Management	✓
Surface Storage – Regional/Local	✓	Watershed Management	✓
Improve Flood Management		**People & Water**	
Flood Management	✓	Economic Incentives (Loans, Grants, & Water Pricing)	✓
Other Strategies		Outreach and Engagement	✓
Crop idling, dew vaporization, fog collection, irrigated land retirement, rainfed agriculture, and waterbag transport		Water and Culture	✓
		Water-Dependent Recreation	✓

6.1 RMS Identification

The Prop 1 IRWM Guidelines require consideration of the CWP RMS in identifying projects and water management approaches for the Region. RMS have been considered in the East Stanislaus IRWM planning process to meet the Region's objectives, as stated in Chapter 5. Application of various RMS diversifies water management approaches, and many of the RMS apply to climate change adaptation and mitigation. The 2013 CWP organizes the RMS into various categories including:

- Reduce Water Demand
- Improve Operational Efficiency and Transfers
- Increase Water Supply
- Improve Flood Management
- Improve Water Quality

- Practice Resource Stewardship
- People and Water
- Other Strategies

Within each RMS category listed above, a variety of specific RMS have been identified for the Region. For example, reducing water demand can be accomplished by applying the RMS: agricultural water use efficiency and/or urban water use efficiency. As described in the *Climate Change Handbook for Regional Planning* (CDM, 2011), not all of the RMS directly apply to climate change adaptation or mitigation, but are directed at overall system resiliency, which inherently addresses the uncertain conditions brought on by climate change. RMS will also help the Region meet its goals and objectives beyond climate change adaptation, including its goals of water supply, flood protection, water quality, environmental protection and enhancement, regional communication and cooperation, and economic and social responsibility.

6.2 RMS Descriptions

The application of the RMS that are applicable within the East Stanislaus Region are described in the following sections. RMS are discussed in terms of their applicability to the Region's goals and objectives, and are also evaluated as climate change adaptation strategies.

6.2.1 RMS Category: Reduce Water Demand

Reducing existing and future water demands can lessen pressure on water sources and help adapt to the potential climate change impacts of less precipitation, shifting of springtime snowmelt, and overall uncertainty of the availability of water supplies. The Reduce Water Demand RMS category includes both agricultural and urban water use efficiency. Opportunities for increased water conservation and water use efficiency measures for urban and agricultural water use are identified in multiple documents including the CWP Update, the Agricultural Efficient Water Management Practices (EWMPs), the California 20x2020 Water Conservation Plan (20x2020 Plan), and by the California Water Efficiency Partnership (formerly the California Urban Water Conservation Council). These recommendations could potentially be incorporated into the existing framework already developed by cities and water agencies within the East Stanislaus Region. Performance metrics that could be used to measure the effectiveness of Reduce Water Demand adaptation include average water demand reduction per year and peak water demand reduction per month (CDM, 2011).

Agricultural Water Use Efficiency

This strategy aims to reduce net agricultural water use, focusing on improvements in technology and management of water, where appropriate, both on-farm and at the irrigation district level. This RMS is highly applicable to the East Stanislaus Region and is already being implemented. A significant amount of water use in the Region is for agriculture, and agricultural water use efficiency could be further applied, as is reasonable and cost-effective, to contribute to water savings for the Region.

The East Stanislaus Region is already implementing many agricultural water use efficiency efforts. For example, MID has made continuous improvements to their irrigation control SCADA systems as part of their Capital Improvement Program over the past several years, providing new water management tools and improved operational efficiency of canals (Provost & Richard, 2015). MID and TID also recently prepared their 2015 AWMPs, in accordance with the Agricultural Water Management Planning Act in SBx7-7, and have begun implementing the EWMPs as identified in the AWMPs. The AWMC suggests several EWMPs that include infrastructure upgrades and operational improvements in order to reduce water demand and maintain productivity. While many of these

EWMPs may have already been implemented in the Region, there may be opportunities to further implementation of EWMPs such as:

- **Infrastructure Upgrade:** Evaporation loss from irrigation ditches and canals is a function of temperature and other climate variables. Depending on different emission scenarios, the operation of these facilities may be impacted by climate change, leading to increased water loss. One of the AWMC EWMPs is to convert irrigation canals and ditches to piping. This water conservation method prevents evaporative losses, which will only increase as temperatures rise. This approach could help the East Stanislaus Region adapt to climate change by expanding water supplies and making existing water supplies less vulnerable to climate change impacts. Canal lining is identified as a less capital-intensive method to reduce seepage into the ground, although it does not reduce water evaporation and does reduce groundwater recharge that occurs as a result of this seepage. Canal automation can increase water supply reliability and flexibility to deliver water at the time, quantity, and duration required by the grower, and can facilitate conversion to more efficient irrigation methods such as micro-irrigation.
- **Water Management:** Water suppliers and users must take advantage of new technologies and hardware to optimize management of water-related infrastructure. SCADA systems enable water managers to collect data to a centralized location and operate automated canals to achieve desired water levels, pressures or flow rate, and also increase the efficiency in reservoir operation. In addition, automated control will free water system operators from manual operation and allow them to plan, coordinate system operations, and potentially reduce costs. Such systems improve communications and provide for flexible water delivery, distribution, measurement, and accounting. On-farm practices can also be improved. Furrow, basin, and border irrigation methods have been improved to ensure that watering meets crop water requirements while limiting runoff and deep percolation. Using organic or plastic mulch can reduce non-essential evaporation of applied water. Advanced irrigation systems include GIS, GPS and satellite crop and soil moisture sensing systems and can all improve overall farm water management.

As previously noted, agricultural irrigation has been linked to groundwater recharge in the East Stanislaus Region; reductions in irrigation could result in a reduction in basin recharge. This linkage must be considered in the implementation of any management practice that may result in the reduction of agricultural irrigation.

In terms of climate change, the Region is expecting to see increased ET from crops (and thus higher crop water needs) in addition to a longer growing season. These impacts will increase water demand, which can be lessened through more efficient water use. It is important to note that as agricultural practices become more efficient, demand hardens. For this reason, further adaptation measures, such as increased water storage, may be necessary. The Region will evaluate additional strategies in order to anticipate this need. In terms of energy, greater water use efficiency is generally associated with reduced energy use and lower GHG emissions.

This RMS aligns with the Water Supply objective identified by the Region to implement water conservation plans for both urban and agricultural uses.

Urban Water Use Efficiency

Application of the Urban Water Use Efficiency RMS results in benefits to water supply through improvements in technology and human behavior to decrease both indoor and outdoor water use. Urban Water Use Efficiency applies to residential and CII water uses.

The 20x2020 Plan includes urban water conservation measures that can be employed to improve water use efficiency. According to the 20x2020 Plan, approximately one third of urban water use is dedicated to landscape irrigation; as such, the greatest potential for urban water use reduction is in reduced landscape irrigation. New landscapes could be designed to be efficient and suitable for the local climate, and existing high-water-using landscapes could be transformed into lower, more efficient alternatives. Weather-based irrigation is a cost-effective measure to improve landscape watering efficiency. Irrigation restrictions can limit landscape irrigation to two days per week or less, encouraging climate-appropriate landscapes and reducing over-irrigation. The 20x2020 Plan also recommends mandating the landscape irrigation BMPs and requiring water-efficient landscapes at all state-owned properties (DWR, 2010b).

Urban water suppliers in the Region are already working hard to implement urban demand reduction measures in order to comply with SBx7-7 per capita water use targets. All four agencies subject to SBx7-7 (Ceres, Modesto, Riverbank, and Turlock) met their 2015 daily per capita urban water use targets and are on track to meet their 2020 targets, as discussed in their respective UWMPs. As water demands are reduced, the power required within a system to delivery water to users is reduced, resulting in reduced GHG emissions. Water providers in the Region will continue to use this RMS in the future to manage water resources, contribute to drought preparedness, and reduce energy use and associated GHG emissions.

Climate change is expected to produce more frequent and severe droughts and alter the timing of runoff in the Region, potentially producing water shortages. Urban water use efficiency helps adapt to this impact by reducing demand. Water use efficiency also decreases energy use and GHG emissions that are associated with the water supply system and end uses at the residential and CII levels.

Similar to the Agricultural Water Use Efficiency RMS, application of this RMS would contribute to the Region's objective to implement water conservation plans for both urban and agricultural uses.

6.2.2 RMS Category: Improve Operational Efficiency and Transfers

This category includes four RMS: Conveyance – Delta, Conveyance – Regional / Local, System Reoperation, and Water Transfers. Improving operational efficiency of a water system can provide a buffer against changes in the amount, intensity, and timing of runoff expected under climate change.

Conveyance – Delta

Conveyance provides for the movement of water, and includes natural water courses such as streams, rivers, and groundwater aquifers, as well as constructed facilities such as ditches, canals, and pipelines. The Delta is composed of natural streams and sloughs, as well as artificial channels and constructed islands protected by levees that naturally convey water from the Sacramento and San Joaquin Rivers westward to the Pacific Ocean. Conveyance facilities within the Delta also pump water from the Delta into canals that move water southward to urban and agricultural users. Application of the Conveyance - Delta RMS can maintain or improve water supply reliability, protect water quality, provide water system operational flexibility, and improve the environment.

The East Stanislaus Region, while upstream of the Delta, is not in direct proximity to the Delta and would not utilize it for conveyance; therefore, this RMS is not applicable to the Region.

Conveyance – Regional/Local

Various regional and interregional conveyance facilities exist throughout California and within the East Stanislaus Region. Interregional conveyance facilities, such as the SWP and the federal CVP, move water throughout the State. Regional or local conveyance is when water is distributed to users from locally-developed sources, usually located within the same watershed or river system. Proper use of conveyance facilities can provide benefits to flood management, environmental uses, water quality, recreation, operational flexibility, and can be related to conjunctive use applications as well as urban and agricultural water use efficiency. This RMS would be implemented through the following practices:

- Improve existing conveyance systems, which could consist of improving aging infrastructure, increasing existing capacities, and adding new facilities.
- Upgrade distribution systems to improve efficiencies, improve water quality, and reduce energy demands.
- Construct new conveyance systems to replace or supplement existing systems.
- Maintain channel capacity.
- Add system interties to interconnect conveyance systems.

Water agencies and irrigation districts in the East Stanislaus Region rely on local conveyance every day and maintain their conveyance facilities to provide water supply reliability and flood control. These functions are increasingly crucial in the face of more severe droughts and floods that climate change is expected to produce. Regional and local conveyance improvements can also reduce the GHG emissions associated with conveyance by improving operational efficiency. The Region will continue to rely on this RMS in the future. It aligns with the Region's Water Supply objective to address conveyance infrastructure needs.

System Reoperation

System reoperation consists of modifying the existing procedures for operation and management of water systems, including reservoirs and conveyance facilities. Oftentimes, system reoperation occurs to address a specific issue, such as integration of operations between multiple reservoirs.

System reoperation is an RMS that can be applied in the East Stanislaus Region. It will likely become more common in the future as populations continue to grow and climate change impacts are realized. As described in Section 2.3, climate change could alter the amount of snowpack in the Sierra Nevada, the timing of snowmelt, and runoff patterns which could greatly impact existing operations of water systems in the East Stanislaus Region. System reoperation is one adaptive management strategy that the Region can employ to address climate change impacts. System reoperation can also serve to reduce energy use and GHG emissions by increasing overall efficiency.

Through changes in water supply system operations, the East Stanislaus Region may be able to adapt to less reliable water supplies and/or increased water demands by maintaining conveyance infrastructure, as well as adapting to climate change impacts on hydropower production, flooding, habitat, and water quality.

Water Transfers

The CWC defines a water transfer as a temporary or long-term change in the point of diversion, place of use, or purpose of use due to transfer or exchange of water rights. Transfers can be between water districts using, in general, one of the following methods to make water available for the transfer:

- Transfer water from storage that would be carried over to the next year.
- Transfer previously-banked groundwater by directly pumping and transferring that water or by pumping the banked groundwater for local use and transferring surface water that would have been used locally.
- Reduce existing consumptive use of water and transfer the excess.

- Reduce seepage from conveyance systems to make additional water available.

Water transfers can provide operational flexibility and can be linked to conjunctive management, groundwater banking, conveyance efficiency, agricultural and urban water use efficiency, and water quality improvement. Water transfers can increase resiliency to climate change by moving water where it is needed most and can also decrease GHG emissions through reduced conveyance and/or treatment energy. This RMS can be applied in the East Stanislaus IRWM Region and will be considered both now and in the future to meet demands.

The Region is currently investigating and implementing water transfers and interagency sales. Specifically, the City of Modesto and MID have an MOU formalizing sale of treated surface water to the City for use in lieu of groundwater. MID has also made agreements with private agricultural landowners to sell surplus surface water, when available, to replace groundwater withdrawals. Additionally, the Cities of Modesto and Turlock developed the NVRRWP to sell tertiary-treated recycled water to DPWD for use in lieu of surface water supplies from the CVP for irrigation, with deliveries expected to begin in 2018. This will help the Region adapt to climate change by providing additional climate resilient and drought-proof water supplies. As such, transfers and sales can improve supply reliability when other supplies are projected to have reduced reliability due to climate change impacts.

6.2.3 RMS Category: Increase Water Supply

As water demands increase due to longer growing seasons, higher temperatures, and longer growing seasons, and the future of existing water supplies sources becomes less certain with more frequent and longer droughts, and a change to the timing, amount, and quality of runoff from the Sierra Nevada, the East Stanislaus Region will need to enhance existing water supplies to meet demands. Increasing water supply can be accomplished through the application of multiple RMS including Conjunctive Management and Groundwater Storage, Desalination, Precipitation Enhancement, Recycled Municipal Water, Surface Storage – CALFED, and Surface Storage – Regional/Local.

Conjunctive Management and Groundwater Storage

Conjunctive management is the planned use of surface water and groundwater resources to maximize availability and reliability of water supplies. For conjunctive management to be successful, groundwater storage must be feasible. Groundwater aquifers may be "recharged" from natural hydrologic process or water may be introduced to the aquifer through active groundwater management. Water can then be withdrawn through wells or it can discharge naturally, contributing to streamflow.

Conjunctive management is already relied upon by water managers in the Region. For example, the TGBA developed and has been implementing the *Turlock Groundwater Basin Groundwater Management Plan*, which promotes conjunctive surface water and groundwater management to improve the long-term sustainability of the Turlock Groundwater Subbasin (TGBA, 2008). The STRGBA has also recommended groundwater management and conjunctive use as a strategy in its *Integrated Regional Groundwater Management Plan for the Modesto Subbasin* for ensuring the long-term sustainability of the Modesto Groundwater Subbasin (Bookman-Edmonston, 2005). Members of the ESRWMP are active members of both the TGBA and STRGBA, and as such, have recognized the potential benefits regional planning would create when considering surface water and groundwater management in the basin. In addition, with SGMA implementation, GSAs will be required to summarize conjunctive management practices in their GSPs. Stanislaus County also has a groundwater ordinance which supports parallel goals to SGMA. The East Stanislaus Region should continue to investigate conjunctive management to efficiently use both surface water and groundwater, improve groundwater quality, and adapt to climate change. Increased storage and conjunctive use may increase resilience to shifting runoff patterns, providing more storage for early runoff, reducing or eliminating the potential climate change impacts on flooding and hydropower production, and offsetting decreases in snowpack storage. This strategy is valuable as weather patterns change in frequency and timing and more extreme events occur.

Conjunctive management and groundwater storage can provide benefits similar to additional surface storage, including increased water management flexibility and groundwater overdraft reduction. There is the potential to bank imported water, flood flows, runoff, recycled water, and/or desalinated water for dry seasons in groundwater basins. This capability will be especially valuable due to the changes in runoff that are anticipated to occur with climate change. As climate change impacts the timing of runoff, conjunctive management will be increasingly important in order to ensure that the maximum amount of water storage is occurring in a given year, as appropriate, while also minimizing the potential for flooding. Use of groundwater banking can also improve quality of waterways and alleviate flood risk due to runoff. Groundwater storage provides an important complement to surface reservoirs, which may be overwhelmed by greater runoff intensity. This RMS also relates to the Surface Storage RMS in that if available surface storage is increased, opportunities for conjunctive management may also increase; more surface storage provides greater flexibility to transfer water to groundwater banks.

Conjunctive management functions as an adaptation strategy in the face of reduced recharge from reduced precipitation, working most effectively when surface water and groundwater are managed as a single source.

Desalination (Brackish and Sea Water)

Desalination consists of the removal of salt from water to allow for the water's beneficial use. The Desalination RMS has typically focused on treating seawater or brackish water (water that has salt levels exceeding those acceptable for domestic, municipal, and irrigation uses). Because the East Stanislaus Region is not a coastal region, desalinating seawater is not an option; however, for inland areas, groundwater desalting is technically feasible and could be used in the Region to address increasing groundwater salinities. Because desalination of brackish groundwater is expensive, energy intensive, and results in a waste brine that may be difficult to manage it will not be considered for the East Stanislaus Region at this time as an RMS in water management or as a climate change adaptation strategy.

Precipitation Enhancement

Cloud seeding, or precipitation enhancement, artificially stimulates clouds to precipitate by injecting artificial substances (usually silver iodide) into clouds that enable snowflakes and raindrops to form more easily. Precipitation enhancement has been performed in California since the early 1950s, with most of it occurring along the central and southern Sierra Nevada. A long-term precipitation enhancement project is planned for the North Fork of the Stanislaus River, sponsored by the Northern California Power Authority, with a primary goal of increasing hydroelectric power. According to the 2013 CWP Update, the cost of cloud seeding is typically less than $30 per acre-foot per year. In 2013, TID and MID entered the 25th year of their cloud seeding program. TID studies estimate that cloud seeding produces a 2% annual increase in total precipitation which translates to approximately 40,000 AFY (Cantatore, 2010). This is and will continue to be valuable in the future as climate change impacts occur. Municipal Recycled Water

One RMS commonly applied throughout California to increase available water supplies and meet current and future water demands is the use of Recycled Municipal Water, consisting of treating and reusing wastewater. The California Recycled Water Policy, developed by the SWRCB in 2009, includes a goal of substituting as much recycled water for potable water as possible by the year 2030.

Recycled water is a sustainable, climate resilient local water resource that could significantly help the East Stanislaus Region meet water management goals and objectives, and assist in meeting the seasonal water demands of agriculture. Water recycling also provides a local supply that generally uses less energy than other water supplies, helping to mitigate climate change impacts through associated GHG emissions. Recycled water could be used for agricultural and urban landscape irrigation in lieu of surface water and groundwater supplies.

The East Stanislaus Region recognizes the importance of maximizing use of recycled water, as demonstrated in its Water Supply objective to provide a variety of water supply sources, including recycled water, to meet all current and future demands under various hydrologic conditions, and plans to expand application in and around the Region.

In terms of climate change, recycled water can be an effective adaptation measure when it offsets potable water use. Recycled water is also reliable when hydrologic conditions may vary. Especially when combined with conjunctive management, water recycling can be an effective strategy. The energy involved in treating water to tertiary standards can be significant, and this impact needs to be weighed against other available sources. Depending on other supplies available, recycled water may represent a reduction in energy use, thus lowering GHG emissions.

Surface Storage – CALFED

DWR, the Bureau of Reclamation, and local water interests are investigating five potential reservoirs for surface water storage as part of the CALFED Record of Decision. These include the Shasta Lake Water Resources Investigation, North-of-the-Delta Offstream Storage, In-Delta Storage Project, Los Vaqueros Reservoir Expansion, and the Upper San Joaquin River Basin Storage Investigation. Because none would apply to the East Stanislaus Region, this RMS is not being considered for future application or incorporation into the IRWMP.

Surface Storage – Regional/Local

Relying on surface storage, which consists of reservoirs to collect water for later release and use, is often necessary throughout California. Surface storage can also be operated in conjunction with groundwater storage to create conjunctive use opportunities. Modesto Reservoir and Turlock Lake lie within the East Stanislaus Region and are used by MID and TID, respectively, for surface storage. Regional and local surface storage will continue to be used for water management in the East Stanislaus Region. The addition or expansion of reservoirs could be an option for increased water supplies in the future, if deemed necessary.

Developing a project to provide additional local surface storage is a possible adaptation strategy for climate change impacts on water supply and associated reliability. Storage provides a way of adjusting a water system to altered peak streamflow timing resulting from earlier snowpack melting. Additional storage capacity could also help the East Stanislaus Region adapt to the anticipated increased precipitation variability and associated increase in the amount and intensity of runoff. Increased surface storage could allow water managers to make real-time decisions that are not available otherwise. It could also facilitate water transfers between basins from upstream reservoirs to receiving regions that have additional storage for the transferred water. Added storage provides greater flexibility for capturing surface water runoff, managing supplies to meet seasonal water demands, helping manage floods from extreme storm events, and adapting to extreme weather conditions such as droughts.

Climate change is expected to impact surface storage because the timing and intensity of runoff from snowmelt is expected to change, while prolonged droughts are also expected to occur. Therefore, reservoirs may be necessary but vulnerable from a water supply perspective, as well as useful from a flood control perspective. The addition or expansion of reservoirs may result in high energy use for construction. The Region would need to weigh the costs and benefits of additional surface storage in terms of both water supply and energy use. Expanded surface storage could help the Region meet its Water Supply objectives.

6.2.4 RMS Category: Improve Water Quality

Improving drinking water treatment and distribution, groundwater remediation, matching water quality to use, pollution prevention, salt and salinity management, and urban runoff management, all RMS within the Improve Water Quality category, can help improve surface and ground water quality in the East Stanislaus Region. These strategies may help a region adapt to drinking water and ecosystem-related water quality impacts from climate change. They may also contribute to providing additional supplies; for example, stormwater capture and reuse would reduce pollution and also provide a seasonal source of irrigation water for urban landscaping or groundwater recharge. Similarly, improved treatment of wastewater effluent discharges will minimize the water treatment needs for downstream diversions.

Drinking Water Treatment and Distribution

Drinking water treatment and distribution is a key RMS to achieving the Region's Water Supply and Water Quality goals and objectives. Providing a high quality, reliable drinking water supply to users is the primary goal of public water systems. The water agencies in the East Stanislaus Region apply this RMS every day, and will continue doing so through maintenance of existing water treatment and distribution facilities and the addition of new facilities, as necessary to meet demands and required state and federal water quality standards.

Climate change impacts can pose challenges for surface water treatment plants in a number of ways, including increased monitoring and treatment flexibility necessary to quantify and treat for source water quality changes in order to maintain finished water quality. Continued growth statewide will result in increased stress on the limited water resources available for domestic, agricultural, and industrial uses. Improving water treatment technologies and matching quality to end use can provide the flexibility required to meet uncertain future conditions. Drinking water treatment will also be an important adaptation strategy to changes in surface water quality brought on by climate change. As both droughts and intense storm events become more frequent, the quality of runoff and surface water is expected to decline, resulting in additional treatment needs and energy expenditure. Treatment strategies will play a key role in adapting to these changes.

Groundwater/Aquifer Remediation

Groundwater in aquifers throughout the State has degraded water quality that prevents beneficial use. In some areas, groundwater quality is degraded by naturally occurring constituents while other areas, poor water quality is caused by a variety of human activities. In order to allow for use of the degraded groundwater as a drinking water supply, groundwater and/or aquifer remediation may be required. Groundwater remediation removes contaminants that affect the beneficial use of the groundwater and can consist of the following basic methods:

- Passive groundwater remediation: allowing contaminants to biologically or chemically degrade or disperse in-situ over time.
- Active groundwater remediation: treating contaminated groundwater in-situ or extracting contaminated groundwater and then treating it. When groundwater is extracted and treated, it is commonly referred to as a 'pump and treat system'. If groundwater is pumped, treated, and then delivered to users for potable, irrigation or industrial use, it is referred to as wellhead treatment.

Groundwater is a crucial water supply source in the Region, and groundwater/aquifer remediation is important for the Region's Water Supply and Water Quality goals and objectives. The East Stanislaus Region's groundwater quality is variable and has been impacted by overlying land uses and natural causes in many locations. Both the Modesto and Turlock Subbasins have been designated as high priority basins by DWR (based on factors including reliance on groundwater and impacts to groundwater quality), indicating that groundwater management is crucial in the Region. For this reason, treating the pumped groundwater prior to delivery (i.e. active groundwater remediation) is generally necessary. Groundwater monitoring for groundwater levels and quality is currently being conducted and will continue to be; if contaminants spread or groundwater quality worsens, or if water quality regulations are modified, additional groundwater and/or aquifer remediation could be required in the future.

In order to prevent further contamination of a groundwater aquifer, local government and agencies with land use responsibility should limit potentially contaminating activities in areas where recharge takes place (recharge zone protection) and work together with entities currently undergoing long-term groundwater remediation to develop a sustainable, long-term water supply for beneficial reuse. Recharge area protection also serves as an adaptation strategy for changes in runoff and recharge that will occur as a result of climate change. Recharge areas will become more valuable for flood attenuation as runoff occurs over a shorter period of time. In addition, recharge areas provide drought adaptation by facilitating groundwater storage.

Remediated groundwater can be a reliable supply source in the face of climate change. However, a balance must be maintained in order to prevent groundwater overdraft and further degradation of groundwater quality. Remediation can make new storage space available if the contaminants have been removed (passively or actively), which would provide additional opportunities for conjunctive management and increased water supply. As with other active treatment methods, pump and treat or wellhead treatment systems carry energy demand and GHG emission implications; however, groundwater remediation may represent an energy savings depending on the other available supply options.

Matching Water Quality to Use

Not all water uses require the same quality of water. High quality water can be used for potable water supplies while water of lower quality, such as recycled water or untreated groundwater, may be appropriate for uses other than drinking water. For example, the City of Modesto has repurposed some existing wells for non-potable water uses, such as construction water, thereby reducing demand for potable surface water supplies for those purposes. The East Stanislaus Region plans on expanding recycled water use, initiating storm water capture and reuse, and expanding the non-potable use of degraded aquifer supplies. By applying this RMS, the Region will match quality to use in other water resource applications both at present and in the future, and further its support to the Region's Water Quality-related objectives. This increases the Region's ability to adapt to climate change by increasing overall supply reliability and reducing demand for the highest-quality sources. Using the proper level of treatment can also reduce the overall energy expended to treat the water supply, which reduces GHG emissions, assisting in climate change mitigation.

Pollution Prevention

Pollution prevention is the protection of water quality at its source, oftentimes through land use management practices, to prevent sediment and pollutants from entering the source water. It can improve water quality for all beneficial uses, and also reduce the cost and energy use for other water management and treatment processes. This RMS would help meet the Water Quality, Water Supply, and Ecosystem Protection and Enhancement goals and objectives for the Region.

In recent years, as point sources of pollution have become regulated and controlled, "non-point source" (NPS) pollution has become a primary concern for water managers. NPS pollution is generated from land use activities associated with agricultural development, forestry practices, animal grazing, uncontrolled urban runoff from development activities, discharges from marinas and recreational boating activities, and other land uses that contribute pollution to adjacent surface and groundwater sources.

Pollution prevention and management of water quality impairments should incorporate a watershed approach. DWR recommends the following approach to reduce NPS pollution to existing surface and groundwater sources:

1. Establish drinking water source and wellhead protection programs to shield drinking water sources and groundwater recharge areas from contamination.
2. Identify communities that rely on groundwater contaminated by anthropogenic sources as their drinking water source and take appropriate regulatory or enforcement action against the responsible party.
3. Address improperly destroyed, abandoned, or sealed wells in these communities that may serve as potential pathways for contaminants to reach groundwater.

The Region has and will continue to apply this RMS. Protecting water supply sources will help to ensure the long-term sustainability of those supplies and help adapt to climate change as supply availability becomes more uncertain and the timing, amount, and quality of runoff changes.

Salt and Salinity Management

With the exception of freshly fallen snow, salt (or materials originating from dissolution or weathering of rocks and soil) is present in most natural water supplies because soluble salts in rocks and soil begin dissolving as soon as water reaches them. Recycled water applications can increase salinity, and while living organisms benefit from low levels of salt concentrations, salinity can become a problem when consumptive use and evaporation concentrates salts to levels that adversely impact beneficial uses.

Accumulation of salts in soil can impair crop productivity, making salinity management a critical concern for the Region's highly productive agricultural industry. Salinity management strategies establish or improve salinity management in the Region based on an understanding of salt loading and transport mechanisms. Several potential benefits of establishing or improving salt and salinity management include protecting water resources and improving water supplies, securing, maintaining, expanding, and recovering usable water supplies, and avoiding future significant costs of treating water supplies and remediating soils. Salt and salinity management strategies identified by the 2013 CWP include:

- Supporting regional management, and using existing programs such as the IRWM grant program to fund projects with salt and nutrient management components;
- Centralizing validated water quality and flow data to facilitate easier access and data sharing necessary for the success of basin-wide salinity management;
- Reviewing existing policies to address salt management needs and ensure consistency with long-term sustainability;
- Expanding coordinated monitoring and standardization, including collaborating with other interest groups to optimize resources and effectiveness; and
- Identifying environmentally acceptable and economically feasible methods for closing the loop on salt.

CV-SALTS, a collaborative effort initiated in 2006 by the Central Valley Salinity Coalition, was created to find a solution to the rising salt levels in the Central Valley that have the potential to impact drinking water quality and productive crops throughout the basin. It is the Salt and Nutrient Planning effort in the Central Valley region as indicated by the RWQCB. The City of Modesto has been participating in CV-SALTS and plans on continuing its membership. The Region continues managing salt and applying this RMS through participation in CV-SALTS, as well as other methods. The CV-SALTS effort prepared a Central Valley-wide SNMP which is currently under review by the RWQCB.

Salt management requires high energy inputs for treatment, and therefore this RMS is not expected to result in climate change mitigation. However, once saline water is treated, it can contribute to the overall supply reliability of the water system helping to adapt to climate change impacts. The SNMP, and other work by CV-SALTS, will identify specific salt and salinity challenges within the region and strategies to help adapt to climate change by mitigating potential salinity increases associated with climate change. The Salt and Salinity Management RMS will help achieve the Water Supply, Water Quality, and Environmental Protection and Enhancement goals and objectives identified for the East Stanislaus Region.

Urban Stormwater Runoff Management

Urbanization, through increased impervious surfaces, alters flow paths, water storage, pollutant levels, ET, groundwater percolation and recharge, surface runoff and many other natural processes. Urban Stormwater Runoff Management is the management of stormwater and dry weather runoff (e.g. excess landscape irrigation water flows to the storm drain) typically for flood control and pollution prevention. This RMS takes a watershed-focused approach to urban runoff management through the implementation of BMPs and LID in which the natural hydrologic cycle can be emulated and preserved. The BMPs are designed to reduce pollutant loading, reduce the volumes of runoff, and reduce velocities of urban runoff discharged to surface waters. LID creates site designs and applies BMPs that maintain the site’s pre-development runoff rates and volumes. The East Stanislaus Region currently manages urban runoff in the more traditional sense in which stormwater is collected and conveyed through storm drains and pipes, with portions of the Region also relying on rock wells. The Region will continue applying this RMS as it supports the Regional goals related to Water Quality, Flood Protection, and Environmental Protection. In the future, the Region intends to identify opportunities to apply a watershed approach of urban runoff management and to manage stormwater runoff through capture and reuse.

Urban stormwater runoff management, including LID, encompasses a broad range of activities to manage both stormwater and dry weather runoff. Stormwater capture and reuse projects can reduce the burden on WWTPs and potable water supplies, helping a region adjust to climate change impacts on water quality and water supply (CDM, 2011). For example, climate change is expected to cause higher-intensity storm events, which can create a greater volume of runoff. Therefore, strategies for managing greater stormwater volume of poorer quality are necessary. The East Stanislaus Region will continue to investigate and implement LID techniques and opportunities where appropriate and integrate urban runoff management with other RMS.

6.2.5 RMS Category: Improve Flood Management

This RMS category includes a single RMS, Flood Management.

Flood Management

Flood management is required and performed by the Region in response to storm events that typically occur during winter months. Increased frequency and severity of storm events will require the East Stanislaus Region to collaborate on and accelerate flood protection projects in order to adapt to increased flooding risks due to climate change. Flood management involves emergency planning, general planning activities, and policy changes. Improving flood management can help a region adapt to not only potential flooding, but many other climate change impacts, including ecosystem and water quality vulnerabilities. The Flood Management RMS would help achieve the Flood Protection goal identified by the Region, to ensure flood protection strategies are developed and implemented through a collaborative process, utilizing both local and watershed-wide approaches designed to maximize opportunities for comprehensive water resource management, and its associated objectives.

The East Stanislaus Region, as part of its IRWM planning process, participated in the development of a RFMP for the Mid-San Joaquin Region to identify potential projects that may improve flood management. The RFMP formulated feasible projects, assessed the performance of the projects, and developed a plan that reflects the vision of local entities in reducing flood risks in their region. The RFMP helps identify strategies to implement to contribute to this RMS and will aid the Region in adapting to climate change impacts. Strategies identified in the RFMP include the following: practice and promote integrated flood management; enhance and sustain ecosystems; expand water storage and conjunctive management of surface and groundwater resources; and identify and fund focused climate change impacts and adaptation research and analysis.

Improved flood management can play an important role in climate change adaptation. One of the chief impacts of climate change includes changes in runoff. Runoff is expected to occur earlier in the year over a shorter period of time, resulting in greater intensity and poorer quality of runoff. Climate change can also pose challenges due to prolonged droughts, which reduce runoff amount and quality. Both of these scenarios present challenges for managing runoff and groundwater recharge. Improved flood management can reduce the risk of flooding that comes with intense storm events. It can also facilitate groundwater storage, which can provide a buffer against drought. Flood management projects can also have positive impacts on water quality through strategies such as slowing flood flows and using biological components for treatment or sediment retention.

The Region could implement various approaches to flood management, including:

- Structural Improvement: Local flood jurisdictions can acquire property adjacent to levees or other structural facilities to facilitate the eventual removal or relocation of these structures, enhancing the potential for setback levees and floodplain restoration where feasible.
- Land Use Management: General plans should be updated to reflect increased future flood risks; these should be updated as hydrologic projections change. Local land use agencies should not allow new critical public facilities to be constructed within the 200-year floodplain.
- Disaster Preparedness, Response, and Recovery: Flood control districts and other relevant jurisdictions should analyze potential flood risks and make this information publicly available. Flood control districts should also incorporate the potential effects of climate change into planning for future flood events.

6.2.6 RMS Category: Practice Resource Stewardship

Resource stewardship includes overseeing and protecting land, wildlife, and water by way of conservation and preservation, coordination of compatible land uses, ecosystem management and restoration, watershed management, flood attenuation, water-dependent recreation, and public outreach, engagement, and cultural relationship to water. Restoring and preserving habitat and wetlands has multiple benefits, including promoting biodiversity and habitat enhancement, and improved flood management as the natural storage provided by riparian wetlands can serve as buffers that absorb peak flows and provide slow releases after storm events (DWR, 2008). Coordination of land uses can promote multi-faceted land stewardship by identifying and encouraging compatible land uses such as agriculture, natural resource management, open space and outdoor recreation. Because the scope of resource stewardship includes all resources, these strategies can help adapt to climate change impacts in various ways, depending on project-specific details (CDM, 2011).

Agricultural Land Stewardship

Agricultural land stewardship consists of conserving natural resources and protecting the environment while improving land for food, fiber and biofuels production, watershed function, soil, air, energy, plant and animal and other conservation purposes. It can help attenuate peak precipitation runoff, facilitate groundwater recharge, provide critical habitat, sequester carbon, and also maintain production of food and fiber. The economy of the East Stanislaus Region is distinguished by its large agricultural sector. Protection of these lands, and therefore implementation of this RMS is already underway and it will continue to be implemented in the future, helping meet the Region's Environmental Protection and Enhancement goal and objectives.

The Stanislaus County General Plan provides policies for the protection and management of agricultural lands, including policies to ensure that lands designed for agriculture are restricted to compatible uses such as natural resource management, open space, outdoor recreation and scenic beauty (Stanislaus County, 2015). DWR recommends counties adopt agricultural general plan elements and designate supportive agricultural districts that enhance agricultural land stewardship on high priority, productive agricultural lands. The focus of these districts should be on:

- Regulatory assistance through county agricultural ombudsmen;
- Local agricultural infrastructure investment, marketing assistance, and the development of agricultural lands stewardship practices and strategies in cooperation with local, State and federal agricultural conservation entities;
- Land protection instruments, such as the Williamson Act and agricultural conservation easements; and
- Engagement of resource organizations such as resource conservation districts, the American Farmland Trust, and Ag Futures Alliances (via Ag Innovations Network), and be integrated with IRWMPs and habitat conservation plans (HCPs) where appropriate.

This recommendation should be implemented over the long-term as the Stanislaus County General Plan is updated in the future (CDM, 2011).

The Agricultural Land Stewardship RMS promotes several climate change adaptations, including groundwater recharge, flood control, and wildlife refugia. This RMS relates to the Agricultural This RMS can also mitigate climate change through carbon sequestration. Responsible land stewardship can lead to increased water supply reliability through water conservation and quality improvements.

Ecosystem Restoration

The Ecosystem Restoration RMS aligns directly with the Environmental Protection and Enhancement goal and objectives for the Region. Ecosystem restoration for the purposes of this RMS includes the restoration of aquatic, riparian, and floodplain ecosystems as they are most directly affected by water and flood management activities. Restoration can be completed as stand-alone projects, or aspects of ecosystem restoration can be incorporated into water resources-related projects to create multi-benefit projects. This RMS is incorporated into the East Stanislaus IRWMP.

Climate change is predicted to further fragment and shrink California's ecosystems. Appropriate corrective actions should be designed to protect and/or expand and reconnect them, minimizing these effects. As water managers in the region identify adaptation strategies for water and flood management, they should consider strategies that will also benefit ecosystems as follows.

1. Establish large biological reserve areas that connect or reconnect habitat patches.
2. Promote multidisciplinary approaches to water and flood management.
3. Expand financial incentives for farmers to grow and manage habitat.
4. Improve instream flow needs (CDM, 2011).

Improved and enhanced aquatic and riparian habitats can provide significant water resource benefits through promoting groundwater recharge, protecting and improving water quality, and contributing to flood protection. Such projects also provide adaptation to changes in runoff (timing, intensity, quality) and recharge (amount, timing, quality) caused by climate change. Water filtration is an example of such a major ecosystem service, which could reduce treatment needs and associated GHG emissions.

Forest Management

The East Stanislaus Region's water supplies originate from high elevation forests in the Sierra Nevada. Forests in California are used for sustainable production of resources such as water, timber, native vegetation, fish, wildlife, livestock, and recreation opportunities. Forest management can directly impact water quantity and quality. This RMS focuses on forest management activities that improve availability and quality of water for downstream users. The Stanislaus National Forest lies roughly 15 miles east of the East Stanislaus Region. The ESRWMP can promote forest management practices that are in line with the Forest Management RMS in order to benefit the entire East Stanislaus Region and help contribute to the Water Supply, Water Quality, Flood Protection, and Environmental Protection and Enhancement goals and objectives.

Although the cities that comprise the East Stanislaus Region's RWMG do not have responsibility to manage the upland forested areas that drain to the Region, protection of those lands is important for ensuring high quality surface runoff supplies. Proper forest management would improve water quality, help reduce wildfires, and improve ecosystem and habitat within the Region. In well-managed forests, fire danger may be reduced, which decreases the likelihood of siltation in surface water bodies. Any RMS that improves water quality also reduces the energy use inherent in water treatment.

Land Use Planning and Management

The Land Use Planning and Management RMS focuses on integrating land use and water management to plan for housing and economic development needs while providing for efficient use of water, water quality, energy, and other resources. The way land is used (i.e. land use type) directly affects water supply and quality and flood management. This RMS relates to the Water Supply, Water Quality, Flood Protection, and Environmental Protection and Enhancement goals and objectives. The Region has, and will continue to, apply this RMS, integrating land use with water resource management, as described further in Section 5.6.

Recharge Area Protection

Recharge areas are locations where groundwater is replenished through percolation. Ideal natural recharge areas are those areas that allow for high quality water to percolate through sediments and rocks to the underlying groundwater basins. Protection of recharge areas consists of ensuring recharge areas continue to allow recharge, rather than being covered by urban infrastructure (impervious areas), and preventing pollutants from contaminating the groundwater that has recharged the area. This RMS is required in order to maintain groundwater quantity and quality. The East Stanislaus Region has, and will continue to, apply this RMS in order to achieve its Water Supply and Water Quality goals and objectives.

Groundwater recharge is an important adaptation to climate change because it increases water supply reliability and flexibility. In the face of changing hydrology, groundwater storage is a key component of the water supply and conjunctive use. It is vital that the Region maintain and enhance recharge areas. By protecting groundwater quality, necessary treatment may be reduced, resulting in reduced treatment needs and associated energy use and GHG emissions.

Sediment Management

Sediment Management is critical on both a watershed and regional scale. Sediments can be helpful in some areas, and harmful in others, depending on the surroundings and the type and quantity of sediment. Excess sediment can increase turbidity of surface water, physically alter habitat, and reduce the hydraulic capacity of channels. Due to the prevalence of agriculture in the East Stanislaus Region, sediment management is necessary in order to reduce soil loss and to maintain agricultural productivity. Agricultural BMPs are one method for reducing erosion. The East Stanislaus Region has been and will continue applying this RMS in relation to its Water Supply, Water Quality, and Environmental Protection and Enhancement Goals.

With the threat of increased erosion (due to both flooding and wildfires) as climate change occurs, proactive sediment management is essential for the Region's agriculture. Sedimentation in reservoirs can also pose water supply and quality issues. Mitigation of this issue can include sediment removal from the reservoir itself, but this carries high financial and energy costs. Other effective approaches to sediment management relate to ecosystem stewardship discussed in other RMS such as Agricultural Land Stewardship, Ecosystem Restoration, and Forest Management, which all promote healthy waterways.

Watershed Management

The Watershed Management RMS consists of creating and implementing plans, programs, and projects to restore and enhance watershed functions to meet the diverse needs of communities that depend on it. Using watersheds as organizing units for planning and implementing projects is made possible in the East Stanislaus Region by integrated regional water management planning. The Region's Regional Communication and Cooperation goals and objectives align with this RMS, which is incorporated into the East Stanislaus IRWMP.

A well-managed watershed can be more resilient to changes in climate and provide the ecosystem services that the Region depends on for its water supply. Considering watersheds as a whole allows managers to integrate all elements of ecosystem function and reduce the impact of climate change.

6.2.7 RMS Category: People and Water

This RMS category focuses on the relationship of residents with their water supply. All the RMS in this category play a role in advancing the goals of the Region, but not all are directly applicable as climate change adaptation strategies. However, these RMS can impact the way people use water and thus serve as tools for achieving regional goals such as reducing water consumption.

Economic Incentives (Loans, Grants, and Water Pricing)

Economic incentives can be provided to influence the amount and timing of water use, wastewater volume generated, and sources of water supplies. Economic incentives generally come in the form of financial assistance such as low interest loans and grants, water pricing (e.g. water rates), and rebates or free services. The most common water rate policy is for water suppliers to recover costs for planning, O&M, capital, and administration costs for water-related projects. All of the water suppliers in the East Stanislaus Region use rate structures to fund their capital, water enterprise, and general funds and some offer rebates to encourage the use of water conserving fixtures. Economic pricing can be used to encourage the continued use of surface water, rather than moving to groundwater when implementing advanced irrigation practices. Keeping surface water economically priced can also help to implement conjunctive use, and improve groundwater conditions. This RMS will continue to be relied upon to promote and implement EWMPs for both urban and agricultural uses, a Water Supply objective for the region, as well as continue to fund needed projects and offset costs for low-income and disadvantaged communities.

Economic incentives can indirectly provide climate change adaptation and/or mitigation by encouraging other RMS, such as LID, water transfers, or water use efficiency. Potential carbon markets in California would result in emission reduction incentives, creating additional responsibilities or opportunities for the Region.

Outreach and Engagement

This RMS relates to educating members of the public, obtaining their feedback, and engaging in collaborative exercises. Public education can also encourage engagement, participation, and changes in behavior that support multiple objectives in this plan. Positive outcomes of this RMS include improving water-wise behaviors, protecting water quality, educating youth early, and receiving policy input from the public, which creates buy-in. Outreach can also help reduce potential legal conflicts with projects. However, crafting effective outreach strategies is a difficult task that is outside the purview of many water managers. Engagement and outreach efforts need to recognize that a "one size fits all" approach may not be effective in reaching the public, and multiple messages may need to be shared at multiple times in order to have the most impact. Due to the prevalence of agriculture in the Region, community groups and individuals are generally interested in water supply and water-related projects. The Region used this RMS throughout the IRWMP update process, and intends to continue using public outreach and engagement in the future as a key part of project planning.

Water and Culture

This RMS focuses on the consideration of culture and cultural activities, specifically Native American culture, in making management decisions. This RMS serves to improve recognition and support of cultural diversity and heritage resources, understand perspectives that influence water conservation and water management approaches, and avoid conflict. While there are currently no federally recognized Native American tribal communities within the Region, the ESRWMP will consider Native American culture and cultural activities in their management efforts. The ESRWMP will also monitor the recognition of any tribal communities in the future.

Water-Dependent Recreation

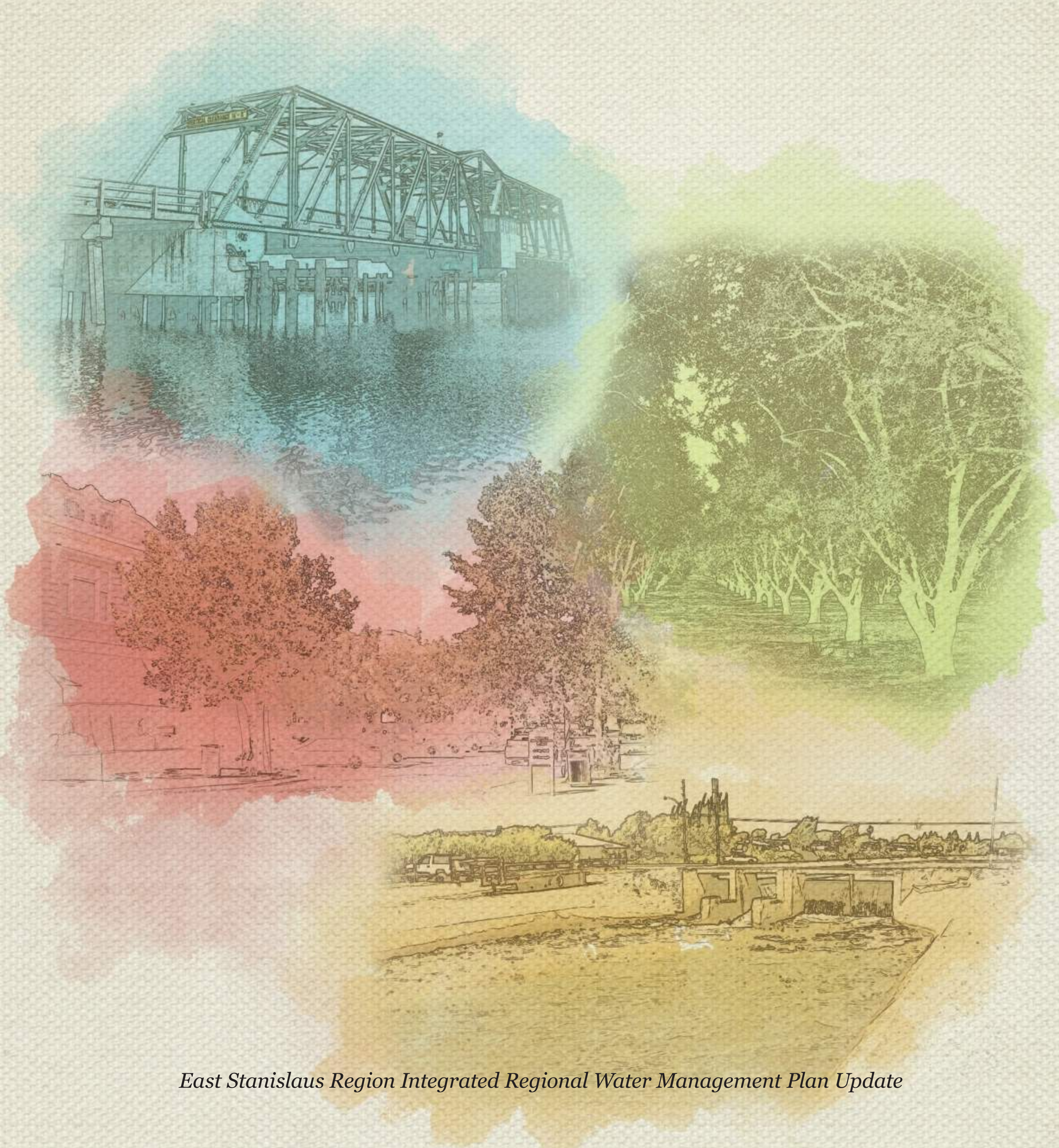
The East Stanislaus Region has many opportunities for water-dependent recreation such as fishing, swimming, waterfowl hunting and birding, boating, canoeing and kayaking. The upper reaches of the Tuolumne River are known for whitewater rapids for rafting. The lower reaches of the Tuolumne River, Modesto Reservoir, Don Pedro Reservoir, and Turlock Lake are recreation areas offering opportunities for boating, swimming, birding, and fishing. There are areas throughout the Region that allow for hiking, biking, picnicking, camping, and wildlife viewing; while these activities do not depend on water, they are enhanced by being near water. Water planners can incorporate water-dependent recreation opportunities as part of water projects. This RMS has been applied, and will continue to be, in order to help achieve the objective to identify opportunities for open spaces, trails, and parks along creeks and other recreational projects in the watershed to be incorporated with water supply, water quality, or flood protection projects.

In some cases, areas that support water-dependent recreation may be vulnerable to climate change impacts. For example, boating opportunities may diminish if reservoir levels drop. Therefore, the Region will need to consider the potential impacts of climate change on specific projects relating to this RMS.

6.2.8 RMS Category: Other Strategies

Other RMS such as crop idling, irrigated land retirement, fog collection, rainfed agriculture, dewvaporation, and waterbag transport are identified in the 2013 CWP. While some of the RMS are feasible (such as crop idling, irrigated land retirement and rainfed agriculture), they would be applied only in the most desperate of circumstances. Most likely, unless all other RMS have been exhausted, the East Stanislaus Region would not apply these strategies as they could have substantial economic impacts; as such, these strategies will not be considered further at this time.

Chapter 7



East Stanislaus Region Integrated Regional Water Management Plan Update

Chapter 7 Project Review Process

This chapter describes the Project Review Process which includes the process for submitting, reviewing, and selecting projects for inclusion in the IRWMP. Specifically, it discusses:

1. The process used to solicit projects for the IRWMP;
2. How the projects were reviewed for consistency with IRWMP objectives;
3. How the projects were evaluated with respects to integration; and
4. How the projects were prioritized.

The results of these activities are included in Appendix I of this plan.

Finally, this chapter also includes the potential impacts and benefits of implementing this IRWMP and the projects identified within it.

The IRWMP must contain a process or processes to select projects for inclusion in the IRWM Plan. The selection process must include the following components:

- Procedures for submitting a project to the RWMG.
- Procedures for review of projects considered for inclusion in to the IRWMP. These procedures must, at a minimum, consider the following factors:
  - o Plan objectives
  - o RMS
  - o Technical feasibility
  - o DACs & EJ considerations
  - o Project cost/financing
  - o Economic feasibility
  - o Project status
  - o Strategic considerations for IRWMP implementation
  - o Climate change & GHG emissions
  - o Plan adoption
  - o Reducing dependence on the Sacramento-San Joaquin Delta
- A list of the selected projects.

- *Proposition 1 IRWM Guidelines*, July 2016, Pages 39 & 40

7.1 Project Solicitation

Project solicitation is the process by which agencies, organizations, and/or members of the public can submit project concepts for inclusion in the IRWMP. To be considered inclusion in the IRWMP, projects must be described in sufficient detail to identify the need being met, infrastructure to be constructed and operated, tasks to be implemented, and the impacts and benefits of the project. However, the projects can be in any stage of development, from conceptual to final design. There are many benefits to submitting a project for inclusion in the IRWMP, including raising local awareness of the potential project and its associated benefits, identification of potential project improvements and/or integration, and positioning the project for potential State funding.

In order to facilitate project solicitation, a project information form, reviewed and approved by the SC and PAC, was prepared (see Appendix J for a copy of the form). This form served as the basis for developing OPTI, which is the web-based project submittal and management system that was used for project solicitation during development of the 2013 IRWMP. OPTI was updated and made available through the East Stanislaus IRWMP website (http://irwm.rmcwater.com/es). The OPTI system allows project information to be submitted, reviewed, organized, and regularly updated electronically by the ESRWMP and project proponents. Project proponents were also provided with the option to submit the project information form via hard copy or email if they elected not to use OPTI. Access to project summaries is available to all interested parties with the intention of improving IRWMP transparency. Anyone that chooses to can create an OPTI account, and log-in to view all project information. In addition, OPTI was further updated for 2017 in order to allow for submission of SWRP projects. New fields were added to OPTI so that SWRP project proponents could enter their project for inclusion in the IRWMP and/or SWRP through the same process, thereby maximizing efficiency between the IRWMP and SWRP and reducing complexity for project proponents.

A public meeting was held on August 15, 2017 to announce the project solicitation and to review OPTI and the ways the project proponents could submit projects. This meeting was formally noticed in the *Modesto Bee, Ceres Courier, Turlock Journal,* the *Waterford News*, and the *Vida en el Valle* (the local Spanish newspaper). English and Spanish versions of a public workshop flyer were also posted in the Modesto City Hall, Modesto Public Library, Waterford City Hall, Stanislaus County building elevators, Ceres City Hall, Ceres Community Center, and Ceres Library, electronic flyers were emailed to the Stakeholder Contract List and County personnel. At the workshop and in the OPTI instructions, project proponents were instructed to provide, at a minimum, basic information about their project, including a project description, contribution to IRWM objectives, water-related benefits, estimated costs, project status and details. It was established that projects could be submitted by anyone, and could have a single proponent or multiple proponents.

The project information form/OPTI (along with discussion at the public workshop) explained that projects submitted for consideration would be separated into three categories: Concept Projects, Preliminary Design Complete, and Ready-to-Proceed (RTP) Projects. RTP Projects consist of projects that are ready or close to being ready for implementation. They could be construction projects, research projects, or studies, but must be developed enough to have detailed budget and schedule information available and most planning, design and environmental documentation (if required) completed. Concept Projects are projects that are at a conceptual level and require additional project development before being implementation-ready. Preliminary Design Complete Projects are further developed than the Concept Projects, but may not yet ready for implementation. Concept Projects, Preliminary Design Complete projects, and RTP Projects can be included in the IRWMP, but Concept Projects would not be considered for inclusion in applications for funding through DWR's IRWM Grant Program.

The project solicitation period for the 2017 IRWMP Update was held from August 7, 2017 to September 29, 2017. During this solicitation period, 51 projects were submitted, of which 28 were Concept Projects and 23 were either Preliminary Design Complete Projects or RTP Projects (see Appendix I for a summary of projects submitted).

In order to facilitate review and organization of the project submittals, OPTI provides the option of printing or exporting a detailed list of all projects submitted. The ESRWMP used this project list in discussions regarding submitted projects with the SC members, PAC members and other stakeholders. OPTI is open at all times for receipt of new projects as well as for editing and revision of currently submitted projects. As new funding opportunities arise, the ESRWMP will issue a new "Call for Projects" with a deadline appropriate for that funding application. See Chapter 9, Plan Implementation, for more information regarding the frequency of project solicitation.

During the project solicitation process, project proponents are given the opportunity to provide information on a variety of topics in order to describe the project and encompass all project benefits. For example, proponents are able to fill out information on benefits to DACs, environmental justice (EJ) considerations, and contributions to plan objectives, RMS, and Statewide Priorities. In addition, several new components were identified in the 2016 Guidelines that are reflected the Region's project review process:

- *Project's contribution to climate change adaptation:* The OPTI project submittal form provides project proponents the opportunity to describe the project's ability to consider and/or address climate change in the region through adaptation (Appendix J). Additionally, the project review process considered adaptation to the regional climate change vulnerabilities using weighted scores. The Region identified water supply and water quality as the highest-priority climate vulnerabilities as described in Chapter 3. The project scoring system reflects this by assigning a 15% weight to each of the water supply and water quality goals, thereby providing an opportunity for projects to achieve higher scores by addressing these vulnerabilities. Further, addressing the changing characteristics of runoff and recharge due to climate change is addressed by specific objectives within the water supply and flood protection goals; this results in projects addressing climate adaptation to the changes in runoff and recharge to receive higher scores by supporting these objectives. As noted previously in the IRWMP, sea level rise impacts were not considered during project review due to the location of the region.

- *Contribution of project in reducing GHGs compared to project alternatives:* The OPTI project submittal form provides project proponents the opportunity to state whether the project considers the contribution of GHG emissions compared to project alternatives, as well as reduce energy consumption and/or GHG emissions. In addition, a GHG worksheet was developed and incorporated into the scoresheet (see Appendix I) which was used during the project review process in Step 2 (described in greater detail in Section 7.3.2) to assess a project's contribution to reducing GHG emissions as compared to project alternatives, its ability to reduce GHG emissions over the 20-year planning horizon, and its potential to reduce energy consumption and associated GHG emissions embedded in water use. Separate from the Region's project review process, but just as important, project-level CEQA analyses must also include comparison of GHG emissions between project alternatives.
- *Specific benefits to critical water issues for Native American Tribal communities:* OPTI provides proponents the opportunity to provide details regarding benefits to critical water supply or water quality issues for Native American tribal communities. It is important to note that there are no tribes in the region; however, it is possible an interregional project could result in benefits to a tribal community. In addition, should tribal communities be identified in the future, their critical water needs will be part of the project review process.

7.2 Project Review and Integration

To be considered for inclusion in the East Stanislaus IRWMP, a project was required to fulfill five minimum requirements:

- Be located at least partially within the East Stanislaus IRWM region;
- Meet at least one Regional objective;
- Fulfill at least one Resource Management Strategy;
- Fulfill at least one Statewide Priority; and
- Be technically feasible.

> The IRWMP must contain structure and processes that provide opportunities to develop and foster integration.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 39

All projects submitted during the project solicitation period met the minimum requirements. The projects were then evaluated for independent utility. The SC and PAC discussed potential opportunities for integration and/or enhancement. One project (Regional Surface Water Treatment Project) submitted by Hughson was removed from the list as it was viewed as duplicative to the SRWA Surface Water Supply Project, currently a project to be implemented by TID, Turlock, and Ceres. Hughson is interested in potential partnership in the future, which was discussed by parties involved. The SRWA Surface Water Supply Project description was later revised to reflect potential regional partnerships. In other instances, while projects were submitted with similar concepts and benefits, they were not integrated into one project due to differing project schedules, funding mechanisms, or implementing agencies; however, depending on schedule and funding availability, some projects could be integrated and/or combined in order to maximize benefits in the future. For example, the City of Modesto submitted the Grayson Water System Efficiency Improvements and the South Modesto Infrastructure Efficiency Improvements. Both projects involve replacing aging, leaky water mains to improve water system efficiency and reduce water loss. There is the potential to create a Water System Efficiency Improvements program that would target leaky mains in various communities; should the City wish to integrate the projects, it could do so in a future project solicitation.

7.3 Project Prioritization

During development of the 2013 IRWMP, the PAC developed a project prioritization process which was subsequently approved by the SC, in order to rank and compare the Preliminary Design Complete and RTP Projects. The project prioritization process was not conducted for Concept Projects. For the 2017 IRWMP Update, the SC and PAC discussed the prioritization method during the July 2017 meetings and agreed to keep the general prioritization process the same; however, weighting factors were revisited and revised to reflect the current needs and priorities of the Region as discussed in Section 7.3.1.

The project prioritization process implements a two-step approach. The first step considers regional goals and objectives, statewide priorities and other relevant factors such as relative benefit-cost (B/C) ratio and multiple benefits. The second step qualitatively considers the relative GHG emissions of the project. The following sections describe the approved two-step project prioritization process implemented for the most recent project solicitation period (August/September 2017) in more detail.

7.3.1 Project Prioritization Step 1 – Project Ranking with Respect to Regional Goals, Statewide Priorities and other Relevant Factors

The first step of project prioritization considered the projects relative to regional goals and objectives, Statewide Priorities and other relevant factors such as relative B/C ratio and multiple benefits. Specifically, the regional IRWM planning participants felt that the Region's goals, and therefore the associated objectives, should be the most influential factor in the project prioritization process in order to identify those projects that, when implemented, would best help the Region achieve its vision for regional water resource management. The SC and PAC also felt that achieving the Statewide Priorities, addressing other project aspects (such as readiness to proceed) and project feasibility also merited consideration in project ranking. A weighting scoring system was selected as the means of ensuring that the process results reflect the intent of the prioritization. The SC and PAC applied weighting factors to the scoring criteria which included the categories of Regional Objectives, Statewide Priorities, Other Strategies, and Feasibility. This weighting schema allows for flexibility for future changes to the prioritized objectives as regional water resources issues change over time. The SC and PAC revised the weights during the IRWMP update process with the final weights presented in Table 7-1.

With the Region's vision in mind, the Regional Objectives account for half of the total weight applied in the project scoring system. Within that half of the total weight, the goals were then weighted individually. The committees agreed that water supply and water quality are major issues that need to be addressed, as demonstrated by each category accounting for 15% of a project's score. Flood protection, environmental protection and enhancement, regional communication and cooperation, and economic and social responsibility each account for 5% of a project's score. The remaining 50%

of the scoring weights were then distributed amongst Statewide Priorities, worth 25% of the remaining weight, with other strategies and project feasibility accounting for 16% and 9% of the weights, respectively. The distributed weights were multiplied by a project score in each category, ranging from 0 to 5 based on its applicability to the project and the magnitude to which the project achieved each objective. A copy of the final project prioritization scoring sheet is included in Appendix I.

In developing scoring weights for the Statewide Priorities, the SC and PAC chose to assign greater weights to those priorities that best supported the 'more important' Regional goals of water supply and water quality. Similarly, the SC and PAC determined that other factors, not directly incorporated into either the Regional goals and objectives or Statewide Priorities, should be considered and weighted as part of the prioritization process. Other Strategies, as defined by the SC and PAC in the context of the project prioritization process, included direct benefits to DACs and tribal communities, schedule (i.e. readiness to proceed), whether a project was an inter-regional project and therefore taking advantage of a larger scale of benefits, and/or whether a project provided non-water related benefits such as new jobs in the Region. Finally, the feasibility of a project from the standpoint of costs and benefits was also considered an important factor. Projects were scored based on a relative benefit-cost analysis conducted on each project and based on the degree to which project financing was available.

The relative benefit-cost analysis was conducted on all non-Concept projects submitted for inclusion in the IRWM process. The analysis was a semi-numerical analysis designed to rank projects relative to their costs and benefits achieved given, in some cases, relatively gross data. In this analysis, project costs included capital costs, annual O&M costs (assuming 10% of capital costs when O&M costs were not supplied), and the cost of items to be replaced during the life of the project. Project life was assigned either given information provided by the project proponent or selected from a list of pre-defined life spans for various water infrastructure, as developed from a list of publicly-available resources. This list of infrastructure life spans is included in Appendix I. The present value cost of the project was then calculated in 2017 dollars, assuming a 6% discount factor, as follows:

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

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

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

where *i* is the discount factor.

Cost scores were then assigned a measure of 1 point if the project's present value cost was less than \$2 million, a measure of 2 points if the present value cost was between \$2 million and \$20 million, and a measure of 3 points if the present value cost was greater than \$20 million. Project benefits were similarly given rankings based on the number of objectives achieved. A project received a ranking of 3 points if it achieved greater than 8 objectives, a ranking of 2 points if it achieved between 4 and 8 objectives, and a ranking of 1 point if it achieved less than 4 objectives. Project scores for benefits and costs were then used to calculate a relative B/C ratio for each project. This relative B/C ratio serves as the score, and was entered into the appropriate line on the project prioritization scoring sheet. A summary of the relative B/C analyses conducted on the submitted projects is included in Appendix I.

The resulting percentages applied to the various project scoring criteria are summarized below (Table 7-1). Projects were subsequently ranked as high, medium or low priority based on their score resulting from application of this prioritization process.

Table 7-1: Project Prioritization Process Weights

Prioritization Factor	Weighting	Comments
Regional Objectives	**50%**	
Water Supply	15%	With the Region's vision in mind, the Regional Objectives account for half of the total weight. Within that half of the total weight, the goals were then weighted individually with greater importance placed on reaching the Region's water supply, flood protection, and water quality goals.
Flood Protection	5%	
Water Quality	15%	
Environmental Protection and Enhancement	5%	
Regional Communication and Cooperation	5%	
Economic and Social Responsibility	5%	
Statewide Priorities	**25%**	
Make Conservation a California Way of Life	3%	Achieving Statewide Priorities was considered an achievement only secondary to achieving the Region's goals and objectives. Statewide priorities that also support the Region's primary goals with respects to water supply, flood protection and water quality were given greater weights.
Increase Regional Self-Reliance and Integrated Water Management Across All Levels of Government	4%	
Achieve the Co-Equal Goals for the Delta	2%	
Protect and Restore Important Ecosystems	2%	
Manage and Prepare for Dry Periods	4%	
Expand Water Storage Capacity and Improve Groundwater Management	5%	
Provide Safe Water for All Communities	3%	
Increase Flood Protection	2%	
Increase Operational and Regulatory Efficiency	0%	
Identify Sustainable and Integrated Financing Opportunities	0%	
Other Strategies	**16%**	
Direct Benefit to DAC and/or Native American Communities	6%	Other Strategies were intended to reflect the criteria considered important in project prioritization but not covered/reflected in either
Schedule	6%	
Inter-Regional Project	2%	

Prioritization Factor	Weighting	Comments
Provide Non-Water Related Benefits	2%	Regional goals or objectives or Statewide Priorities.
Feasibility	**9%**	
Benefit-Cost Analysis	6%	The feasibility criteria focused on the cost-effectiveness of the projects (relative to the benefits achieved) and the financial 'security' of the project.
Financing/Economic Feasibility	3%	

7.3.2 Project Prioritization Step 2 – Qualitative Comparison of Project GHG Impacts

As directed by the Guidelines, GHG emissions were considered by the IRWM Region in development of the project solicitation and prioritization process. After discussions among the PAC and SC, the Region decided to include GHG impacts and emissions as a secondary criterion (or second step) in developing project rankings. As with the primary (Step 1) prioritization process, only non-Concept projects were evaluated in this Step 2 process.

While quantitative GHG emissions calculations can be required as part of a project-level CEQA analysis to evaluate a proposed project and its alternatives, due to project statuses, it was assumed that project-specific GHG evaluations were not available. Nor was it in the wherewithal of either the SC or PAC to prepare such calculations. Therefore, a qualitative comparative methodology was developed and applied to the projects. OPTI provided project proponents the opportunity to state whether the project considers the contribution of GHG emissions compared to project alternatives, as well as reduce energy consumption and/or GHG emissions. In addition, a GHG worksheet was developed and incorporated into the scoresheet (see Appendix I) which was used during the project review process to assess a project's contribution to reducing GHG emissions as compared to project alternatives, its ability to reduce GHG emissions over the 20-year planning horizon, and its potential to reduce energy consumption and associated GHG emissions embedded in water use.

A GHG emissions score sheet was developed by the SC and PAC for use in preparing this secondary evaluation (see Appendix I). Key to the application of this score sheet is the assumption that all projects would require construction and would therefore result in construction-related GHG emissions. Any project that did not require construction (e.g. a paper study) would receive a 'benefit' as a result of no construction. Projects impacts and benefits relative to GHG emissions were then evaluated based on a series of yes/no questions.

Within each prioritization category resulting from application of the Step 1 prioritization process, projects were ordered/ranked based on their relative impacts or mitigation/benefits (or neutrality). The resulting project prioritization therefore reflected the ability of the project to achieve the Region's goals and objectives, Statewide Priorities or important criteria, while providing a secondary prioritization based on GHG emissions, benefits and/or mitigations. It is worth noting that reducing dependence on the Delta is not included in the prioritization criteria because the East Stanislaus Region does not rely on the Delta for water supplies. Although the Region is not dependent on the Delta for water supplies, the Region's water management may impact the Delta in other ways. The impacts of projects on the Delta were evaluated under the Statewide Priority to "achieve the coequal goals for the Delta." These goals are to (1) provide a more reliable water supply for California, and (2) protect, restore, and enhance the Delta ecosystem.

7.3.3 Prioritization Application and Results

The project prioritization process described above was applied to the RTP and Preliminary Design Complete projects submitted for inclusion in the 2017 East Stanislaus IRWMP. Information used in evaluating the submitted projects against the prioritized criteria was provided via the project submittal process, as previously described. The results of the prioritization process, including the list of selected projects for inclusion in the Plan, are included in Appendix I. Prioritized projects are included in this IRWMP and also communicated to stakeholders and the public through OPTI and the East Stanislaus IRWM planning website (www.eaststanirwm.org/projects).

7.4 Impacts and Benefits

> The IRWMP must contain a discussion of potential impacts and benefits of Plan implementation. This discussion must include both impacts and benefits within the IRWM region, between regions, and those directly affecting DACs, EJ concerns, and Native American Tribal communities.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 40

The East Stanislaus IRWM partners and stakeholders recognize the importance of pursuing and integrating multiple RMS to achieve the greatest and most equitable benefit for the region. Through implementation of this IRWM Plan, regional and localized benefits will be realized and potential impacts addressed. This section provides an overview of potential benefits and impacts that may result from implementation of projects or programs included in the East Stanislaus IRWM Plan.

It should be noted that inclusion of a project in this IRWM Plan indicates that it passed the screening requirements outlined in Sections 7.2 and 7.3, but does not necessarily reflect endorsement by the SC or PAC. In addition, inclusion of a project in the IRWM Plan does not commit the ESRWMP, SC or PAC member(s), or the project proponent to implement the project. Implementation, if undertaken, is the responsibility of the project proponent. Prior to implementation and/or construction of any project included in this Plan, individual environmental review, compliance with CEQA, NEPA, and any other local, state and/or federal requirements as applicable, will be completed by the project proponents.

The potential impacts and benefits that implementing the projects included in the East Stanislaus IRWM Plan could achieve are shown in Table 7-2, and are described in more detail in the following sections. A table cross-referencing the submitted projects with the project types noted below is included in Appendix I. The table assumes the projects are located entirely within the East Stanislaus Region. Projects located entirely within the Region do have the potential to result in impacts or benefits outside the Region as well. For example, a new groundwater well (falling under the Groundwater Supply Development project type) could impact or benefit the groundwater basin in portions outside of the East Stanislaus IRWM regional boundary. Interregional projects (i.e., projects located in the East Stanislaus Region and one or more neighboring IRWM regions) would likely result in the same potential impacts and benefits listed in the “Within the East Stanislaus Region” column in all regions in which it is located. It’s important to note that these potential impacts and potential benefits are provided as generalities and actual impacts and benefits would depend on project specifics such as exact location, size, and the way in which it is operated.

Table 7-2: Potential Impacts and Benefits by Project Type

Project Type	Within the East Stanislaus Region		Outside the East Stanislaus Region	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Groundwater Projects				
Groundwater Supply Development	Water quality degradation Reduced groundwater availability and reliability	Increased groundwater storage / recharge Improved water supply reliability Improved water quality Reduced land subsidence and/or fissuring Local prosperity	Water quality degradation Reduced groundwater availability and reliability	Increased groundwater storage/recharge Improved water supply reliability Improved water quality Local prosperity
Conjunctive Use	Water quality degradation Reduced groundwater availability and reliability	Increased groundwater storage / recharge Improved water supply reliability Improved water quality Reduced land subsidence and/or fissuring Improved water management coordination Local prosperity	Water quality degradation Reduced groundwater availability and reliability	Increased groundwater storage/recharge Improved water supply reliability Improved water quality Reduced land subsidence and/or fissuring Improved water management coordination Local prosperity
Potable Water Supply Projects				
Conveyance Facilities	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability	None	None
Storage Facilities or Storage Operations	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water quality (through reduced groundwater pumping) Improved water supply reliability	None	Improved water quality (through reduced groundwater pumping)
Treatment Facilities	Energy consumption Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability Improved water quality Economic benefits	None	Improved water quality
Salinity Management	None	Improved water quality Long-term sustainability of water supplies Local prosperity	None	Improved water quality Long-term sustainability of water supplies Local prosperity
Conservation Projects				
Outreach and Education	Reduced discharges to Tuolumne, Stanislaus and Merced Rivers	Improved water supply reliability Public education and environmental awareness	Reduced discharges to Tuolumne, Stanislaus and Merced Rivers	Improved water supply reliability Public education and environmental awareness
Economic Incentives	Reduced discharges to Tuolumne, Stanislaus and Merced Rivers	Improved water supply reliability Avoided costs of imported water supply Avoided costs of water supply infrastructure Local prosperity	Reduced discharges to Tuolumne, Stanislaus and Merced Rivers	Improved water supply reliability Avoided costs of imported water supply Avoided costs of water supply infrastructure Local prosperity

Project Type	Within the East Stanislaus Region		Outside the East Stanislaus Region	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Wastewater Projects				
Conveyance Facilities	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability	None	None
Treatment Facilities	Energy consumption Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability Improved water quality Avoided costs of imported water supply Local prosperity	None	Improved water quality
Septic to Sewer Conversion	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water quality Local prosperity	None	None
Recycled/Non-Potable Water Projects				
Conveyance Facilities	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species Water quality degradation	Improved water supply reliability Increased nutrient levels for landscape irrigation Potable water offsets	None	Improved water supply reliability Potable water offsets
Treatment Facilities	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species	Improved water supply reliability Potable water offsets Improved water quality Local prosperity	None	Improved water supply reliability Potable water offsets Improved water quality
Salinity Management	None	Improved water quality Improved water supply reliability Local prosperity	None	Improved water quality Improved water supply reliability Local prosperity
Urban Runoff Management Projects				
Stormwater Capture and Reuse / Recharge	Water quality degradation	Increased groundwater storage / recharge Improved water supply reliability Reduced land subsidence and/or fissuring Avoided costs of imported water supply Local prosperity	Water quality degradation	Increased groundwater storage / recharge Improved water supply reliability Avoided costs of imported water supply Local prosperity
Diversion to Sewer	Disturbance of habitat and endangered species	Improved water quality Flood control enhancement Increased recycled water	None	None
Pollution Prevention	None	Improved water quality	None	Improved water quality
Flood Management Projects				
Storm Drains or Channels	Land use compatibility (rights-of-way) Disturbance of habitat and endangered species Increased sedimentation and erosion Economic impacts	Flood control enhancement Increased groundwater storage / recharge Avoided costs of flood damage Local prosperity	None	None

Project Type	Within the East Stanislaus Region		Outside the East Stanislaus Region	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Ecosystem Restoration and Protection Projects				
Land Conservation	Economic impacts	Improved water quality Flood control enhancement Habitat protection, restoration, and enhancement Open space preservation	None	None
Invasive Species Removal	Disturbance of habitat and endangered species Increased sedimentation and erosion	Improved water quality Flood control enhancement Habitat protection, restoration, and enhancement	None	None
Restoration / Revegetation	Disturbance of habitat and endangered species	Improved water quality Flood control enhancement Habitat protection, restoration and enhancement Reduced threat of wildfires	None	None
Water-Based Recreation Projects				
Reservoir Recreation	Water quality degradation	Enhanced recreation and public access Local prosperity	None	None
Parks, Access and Trails	Disturbance of habitat and endangered species Increased sedimentation and erosion	Enhanced recreation and public access Local prosperity	None	None
Data Collection/Management Project				
Data Collection and Management	None	Improved data accessibility and dissemination Public access to data Facilitation of projects	None	Improved data accessibility and dissemination Public access to data Facilitation of projects
Outreach Project				
Outreach	None	Improved intraregional coordination and communication Identification of collaboration opportunities Identification of potential project enhancements	None	Improved inter-regional coordination and communication Identification of collaboration opportunities Identification of potential project enhancements
Public Education	None	Increased public awareness and support of IRWM-related projects Improved consumer response to water resource management requests	None	Increased public awareness and support of IRWM-related projects Improved consumer response to water resource management requests
DAC Support	None	Improved accessibility to regional support for project design and implementation Identification and facilitation of projects that directly improve water supply reliability and water quality for DACs	None	Improved accessibility to regional support for project design and implementation Identification and facilitation of projects that directly improve water supply reliability and water quality for DACs

7.4.1 Plan Implementation Benefits and Impacts

Regional Impacts and Benefits

Implementation of the East Stanislaus IRWMP through implementation of projects included in the IRWMP Update will lead to numerous benefits including, at a minimum:

- **A more reliable and high-quality water supply.** Additional water supplies through the development of new potable supplies, as well as potable water offsets (e.g., recycled water), and conjunctive use lead to enhanced water supply reliability and assist with the improvement of water quality. Water quality projects ensure that existing water quality is sustained and protected. Reliable and high-quality water is directly linked to economic and environmental health and well-being.
- **Cost-effective and multi-beneficial projects.** Opportunities for multi-benefit projects, which can achieve a multitude of goals and objectives for several stakeholders rather than a single entity, provide increased value to stakeholders and the communities they serve. Integrated planning and collaboration can lead to multi-benefit projects that achieve cost savings through cost-sharing opportunities, economies of scale, resource sharing, and other mechanisms. Existing resources can be optimized, duplication of efforts avoided, and larger scale efforts developed to provide cost savings to all involved.
- **Shared experience and resources.** Completion of the East Stanislaus IRWM Plan and implementation of the IRWMP facilitates knowledge sharing and equips agencies to overcome future challenges by coordinating resources, more effectively meeting the needs of the region as a whole. In addition to direct quantitative benefits of Plan implementation (such as volume of new water supply or acres of habitat protected) indirect benefits are expected to result from avoiding the negative impacts of not implementing the projects.
- **Increased regional understanding.** Agencies and stakeholders are working together as a cohesive group to solve water resource problems in a consensus-based approach, resulting in a deeper understanding of the effects of each individual project on other agencies and stakeholders. This deeper understanding, in turn, reduces interagency conflicts that may prevent projects from gaining the necessary support for successful implementation.
- **Improved local understanding of water resources issues.** Through consistent and coordinated public outreach and education programs, local understanding of regional water resources issues, conflicts, and solutions will improve. Maintaining a consistent message will improve public understanding of water resource management issues and encourage the acceptance and understanding of integrated projects.

Potential impacts of implementation of the East Stanislaus IRWM Plan could include a variety of temporary construction-related impacts during project construction, including dust, noise, and traffic generation. Other impacts may include increased costs associated with financing projects. Additional impacts may be identified on a project-by-project basis during CEQA or NEPA analyses.

Conversely, should the East Stanislaus IRWMP not be implemented, the impacts to the region, water and wastewater agencies, and residents within it would be vast. The same issues the region is currently experiencing would not be resolved and while individual, localized planning efforts and projects would likely continue, they would not achieve the same magnitude and multitude of benefits delivered from regional planning and implementation.

Interregional Benefits and Impacts

Interregional projects, or projects that are within the East Stanislaus Region and one or more neighboring IRWM regions, stand to provide benefits that extend beyond regional boundaries. The projects included in this IRWMP benefit not only the local agencies and residents of the East Stanislaus Region, but multiple watersheds (Stanislaus, Tuolumne and Merced River watersheds), the Delta, and members of the public throughout California. Specific ways in which the projects contained in the East Stanislaus IRWM Plan provide benefits beyond the East Stanislaus region include the following:

- Reduced effluent discharges (and associated pollutant loadings) into the San Joaquin, Stanislaus, and Tuolumne Rivers due to increased recycled water use, promoting improved water quality in both rivers, as well as downstream in the Delta.
- Improved regional water supply and reliability for Stanislaus County, achieved through several water storage projects and well replacement projects, will reduce pressure on the Delta and on the Modesto and Turlock Groundwater Subbasins to serve the region in times of significant drought. Additional recycled water projects will also reduce the demand for potable water, potentially increasing downstream supplies.
- Conjunctive use projects will increase water supply reliability within the region, resulting in increased surface water supply availability in dry years and reduced pressure on the San Joaquin River as a water supply.

Most likely, project-dependent construction-related impacts would not impact other IRWM regions, as project and program facilities would be implemented within the East Stanislaus Region. These construction impacts would be temporary in nature and will result in predominantly local impacts, if any.

The East Stanislaus IRWM Plan also has the potential to benefit resources beyond local and regional water resources. Improved surface water quality will benefit local ecosystems. Enhanced tree cover, while viewed as a habitat enhancement, may also directly benefit regional air quality through the creation of microclimates and the filtering capacity provided by trees. By optimizing water supply operations and implementing conjunctive use, additional surface water supplies may be available for hydropower generation to benefit statewide energy resources and for the San Joaquin River Wildlife Refuge expansion. The impacts and/or benefits of projects in other IRWM regions on the East Stanislaus IRWM Region are not discussed here.

Benefits and Impacts to DACs and EJ-Related Concerns

While there are no federally recognized Native American tribal communities within the East Stanislaus Region, there are DACs, EDAs, and EJ-related concerns. Protection of the people and economy of these communities and correction of EJ concerns are priorities for the East Stanislaus IRWM Plan. EJ is addressed by ensuring that all stakeholders, regardless of financial contribution to the planning process, have access to the IRWM planning decision-making process and that minority and/or low-income populations do not bear disproportionately high and adverse human health or environmental impacts. Working on a regional basis aids in protecting the economy of the East Stanislaus Region and Stanislaus County, and minimizes direct monetary impacts felt by DACs in the region through the stabilization of water and wastewater utility rates. Implementation of the Region's flood control projects will protect the local communities from disastrous flood damage. Providing high quality, reliable water supplies helps to ensure safe drinking water for all communities. Regional coordination has been, and will continue to be, achieved through the noticing of public meetings, to be held as needed to address public and stakeholder concerns, conducting routine reviews to ensure that DACs are not being adversely affected by project and Plan implementation, and by using grant monies receive to help offset project implementation costs.

Impacts to DACs will be kept to a minimum, and ongoing coordination and public involvement will aid in minimizing possible impacts. Construction of project facilities will create short-term environmental impacts (noise, dust, traffic disruption) at neighboring communities. A preliminary analysis of the areas affected by construction of project facilities will ensure that these construction nuisance impacts will not be borne predominantly by any minority population or low-income group.

7.4.2 Project/Program Impacts and Benefits

The potential benefits and impacts summarized in Table 7-2 are described in more detail in the following sections. Additionally, the projects included in the East Stanislaus IRWMP, by project type, are summarized in the table included in Appendix I. For each project, potential benefits and impacts are assumed to be similar to those identified for the specified project type. During updates to the IRWMP, impacts and benefits of projects and Plan implementation will be reevaluated and assessed based on project performance and changes in water resource conditions in the region. In addition, detailed evaluation of potential environmental impacts is included in project-level CEQA analyses.

Benefits

Increased groundwater storage / recharge

The Modesto and Turlock Subbasins of the San Joaquin Valley Groundwater Basin underlie most of Stanislaus County. Use of groundwater for irrigation and municipal purposes has resulted in historical declines of available groundwater in previous years. In past years, both subbasins have experienced overdraft conditions, with groundwater depressions underlying the cities of Modesto and Turlock. A cone of depression has also formed on the eastern side of the Turlock Subbasin where groundwater is the only available water supply. Groundwater recharge could help improve the state of the subbasins and their long-term sustainability. Groundwater improvement programs may include projects to:

- Enhance conjunctive management and groundwater storage
- Aquifer storage and recovery
- Stormwater capture and recharge
- Construction of new and/or rehabilitation of spreading grounds/recharge basins
- Improvement to groundwater monitoring
- Hydrogeologic investigations and groundwater modeling

Improved water supply reliability

Improving water supply reliability in the East Stanislaus Region is a key objective of the Region's water supply goal. Projects that diversify the Region's water supply portfolio, create new supplies, improve efficiencies of existing supplies, or offset potable water supplies will improve the Region's water supply reliability. Projects that would achieve this benefit include:

- Water use efficiency and water management projects
- New water supply pipelines and/or rehabilitation/repair projects
- Water system tie-ins, interconnections, and diversion structures

- Water transfer projects
- Groundwater extraction and/or treatment projects
- Surface water diversion and treatment projects
- Water storage and treatment projects
- Upgrading wastewater treatment facilities to produce recycled water
- Water quality protection projects

Improved water quality

As described in Chapter 5, Vision, Goals, and Objectives, protecting and improving water quality for beneficial uses consistent with regional interests and the RWQCB Basin Plan is a key regional goal. Different types of projects contribute to different types of water quality improvements. For example, groundwater recharge projects can improve groundwater quality in the Modesto Groundwater Subbasin, while treatment improvement projects will improve potable water quality. Projects that improve water quality include, but are not limited to:

- Stormwater projects (e.g. stormwater capture and recharge or stormwater management to reduce volume of urban runoff discharged to surface waters)
- Upgrading WWTP
- Groundwater monitoring and assessment
- Conversion of septic systems to municipal sewers
- Conjunctive management and groundwater storage
- Sewer collection improvements
- Water treatment projects
- Ecosystem restoration and revegetation projects
- Land conservation
- Salinity management

Reduced land subsidence and/or fissuring

Land subsidence occurs when groundwater is excessively pumped from a groundwater basin; the clay layers in the aquifer settle and the ground surface in the area lowers. While subsidence has historically not been a concern in the Region, projects that reduce groundwater pumping or increase groundwater recharge will help reduce the potential for land subsidence and fissuring. These projects include:

- Enhanced conjunctive management and groundwater storage
- Stormwater capture and recharge
- Construction of new and/or rehabilitation of spreading grounds/recharge basins
- Improvement to groundwater monitoring
- Hydrogeologic investigations and groundwater modeling

Local prosperity

Local prosperity and economic benefits can be achieved by:

- Avoiding costs associated with new water supply infrastructure through the implementation of water management and water use efficiency projects
- Avoiding flood damage costs
- Avoiding impacts to the economy (e.g. businesses and agriculture) associated with water supply interruption
- Increased tourism with enhanced recreational opportunities and improved water quality and ecosystems
- Benefits to the regional economy associated with constructing and maintaining proposed IRWM projects

Additionally, as previously stated, working on a regional basis aids in protecting the economy of the East Stanislaus Region and minimizing direct monetary impacts felt by DACs in the region through the stabilization of water and wastewater utility rates. IRWM planning and collaboration can lead to multi-benefit projects that achieve cost savings through cost-sharing opportunities, economies of scale, resource sharing, and other mechanisms. Existing resources can be optimized, duplication of efforts avoided, and larger scale efforts developed to provide cost savings to all involved.

Long-term sustainability of water supplies

Some groundwater basins throughout California contain salts and nutrient levels exceeding water quality objectives established in Water Quality Control Plans (Basin Plans). The high salt and nutrients concentrations can be either natural or man-made. Salinity management is key to ensuring the long-term sustainability of groundwater supplies. Groundwater quality varies throughout the East Stanislaus Region. As new water supplies are developed, recycled water use increases, and groundwater recharge projects are implemented, the importance of salinity management and other water quality management programs will increase.

Public education and environmental awareness

Many water conservation, water quality protection, and water supply projects include public education and environmental awareness components, creating multi-benefit projects or programs. Public outreach programs and components can help promote and increase water efficient management practices, educate about habitat stewardship which can improve water resources, discourage illegal dumping of trash and litter in watercourses, and encourage appropriate water management practices, including appropriate collection and disposal of hazardous liquid wastes and pharmaceuticals.

Increased nutrient levels for landscape irrigation

Depending on the nutrients supplied by the recycled water available, increasing the use of recycled water for landscape irrigation through construction of additional conveyance facilities could significantly reduce the amount of fertilizer required for irrigated areas.

Potable water offsets

Potable water offsets can be achieved through stormwater capture and reuse and recycled water projects. New non-potable water supplies may be used for irrigation or other beneficial uses, helping to increase the Region's water supplies. Projects that would provide potable water offsets include:

- Recycled water treatment and conveyance projects
- Stormwater capture and reuse/recharge
- Conversion of septic systems to centralized sewer collection systems to increase the amount of recycled water available

Flood control enhancement

Flooding is a concern for some areas within the East Stanislaus IRWM Region, especially along the San Joaquin River and the lower Tuolumne River. Flooding can occur from heavy rainfall, rapid snow melt, saturated soils, or a combination of these conditions. In some cases, flooding is due to inadequate storm drainage systems, unable to handle heavy storms during winter and spring seasons, and from increasing development leading to increases in impervious surface areas and decreases in natural vegetative cover, which reduces the detention and attenuation characteristics of the overland areas. To reduce potential property and structure damage, and economic impacts, flood control enhancement may be provided by projects that:

- Capture and divert stormwater
- Improve levee systems (e.g. floodwalls or setback levees)
- Install pervious pavement
- Protection and manage floodplains
- Construct regional flood control infrastructure

Increased recycled water

By centralizing sewer collection systems in areas that may still be on septic systems, a greater volume of wastewater will be treated at existing and new wastewater treatment facilities, creating more recycled water for beneficial uses. Increasing the amount of recycled water available for farmland, landscape, golf course, and school irrigation, industrial uses, and other uses, will lead to other benefits such as potable water offsets and increased nutrient levels for landscape, as previously discussed.

Habitat protection, restoration, and enhancement

Projects that contribute to habitat protection and restoration have the ability to enhance the Region's ecosystems and protect threatened, endangered, and sensitive species. The following types of projects would provide this benefit:

- Land conservation
- Water quality protection projects that would result in surface water quality improvement
- Invasive species removal
- Restoration and enhancement of special aquatic features (e.g. wetlands, springs, bogs, riverine environments)

- Stormwater management and pollution prevention
- Debris cleanup and habitat restoration
- Meadow restoration
- Forest fuels reduction
- Road management activities to reduce runoff to streams

Reduced threat of wildfire

Wildfires threaten property, lives, and ecosystems, and can adversely impact flood management and cause soil erosion. Ecosystem protection and enhancement projects, such as forest restoration, fuels reduction, and habitat restoration, can help reduce the threat of wildfire. There is already evidence that wildfires are becoming more frequent, longer, and more widespread, and they are expected to increase in frequency and severity due to climate change (CDM, 2011).

Open space preservation

Open space preservation is a benefit that can be achieved through implementation of land conservation projects. Preserving open space contributes to other benefits such as environmental and recreational benefits, as well as stormwater control, reduced runoff, and flood management benefits.

Enhanced recreation and public access

Reservoirs, parks, wildlife refuges and the wilderness within the East Stanislaus Region are used by outdoor recreation enthusiasts throughout the year. Enhancing recreation and public access in the region will be achieved by projects that:

- Conserve and preserve open space and access to public land
- Remove and control invasive species
- Improve water quality
- Provide appropriate sanitation facilities at recreation sites
- Manage road activities to reduce runoff to streams
- Improve opportunities for public outreach and environmental education

Impacts

Implementation of the projects described in this plan may also have quantitative and/or qualitative impacts if the East Stanislaus IRWM Plan and/or its component projects are not managed or implemented properly. These impacts may include increased project costs to agencies and ratepayers, delayed construction and/or operation of planned facilities leading to delayed water supply and other benefits, negative impacts to surface water and/or groundwater quality, and increasingly limited operational flexibility, especially in times of drought, leading to increased water rationing and associated pressure on water users and the environment.

Project-specific environmental compliance processes will be completed by project proponents prior to project implementation. These processes will determine the significance of project-related impacts. Each project will comply with the CEQA and NEPA requirements, if applicable, prior to and throughout implementation.

Negative impacts that could be associated with the implementation of projects and programs included in this IRWM Plan are similar to those of other water infrastructure projects. In general, temporary, site-specific impacts related to construction and potential long-term impacts associated with project operation are anticipated. Short-term, site-specific construction impacts from implementing physical project facilities may include increased traffic and/or congestion; noise; and impacts to public services, utilities, and aesthetics. Other potential, longer-term impacts are described in more detail below.

Water quality degradation

Groundwater-related projects, such as projects that increase groundwater pumping or implement conjunctive use, could degrade water quality if not operated appropriately for the groundwater basin and conditions. In addition, projects that involve the implementation of potentially contaminating activities in groundwater recharge areas could result in negative impacts to groundwater quality. Surface water quality could be similarly impacted by projects that encourage recreation and/or intensive development by increasing loading of nutrients, bacteria, and other contaminants to adjacent surface water bodies, negatively impacting water quality for water supply and environmental needs.

Recreation-related projects also have the potential to increase erosion and sedimentation. Increased motor vehicle traffic and foot traffic can increase erosion and sedimentation to adjacent water bodies, negatively affecting water quality for water supply and the environment/habitat purposes. Water quality issues associated with increased erosion and sedimentation can be detrimental to aquatic communities. Additionally, storm drains and channel modifications that are implemented to manage flood flows can contribute to erosion and sedimentation. Projects that allow use of motorized watercraft may introduce organic contaminants to water bodies.

Reduced groundwater availability and reliability

There are groundwater quality issues in many areas within the Modesto and Turlock Groundwater Subbasins, both man-induced and naturally-occurring. Projects that impact water quality and/or yield could reduce overall groundwater availability and water supply reliability to users depending on the source. Increased groundwater pumping in the subbasins could create plume migration and/or create overdraft conditions, potentially degrading water quality and further decreasing overall reliability.

Land use compatibility (rights-of-way)

A potential impact of any project that includes construction of physical facilities is land use compatibility. The types of projects that could potentially have land use compatibility or rights-of-way issues include:

- Water conveyance facilities
- Storage tanks or reservoirs
- Treatment plants
- Wastewater collection
- Recycled water distribution facilities

Construction of new facilities outside of disturbed areas, such as roads, could result in impacts to otherwise undisturbed areas and may result in loss of open space and habitat.

Disturbance of habitat and endangered species

The East Stanislaus Region contains a large wildlife refuge in addition to many riparian habitats. These areas provide habitat for numerous species, including special-status species (i.e. endangered, threatened, sensitive, or candidate). Projects that involve facility construction have the ability to disturb surrounding habitat and endangered species, depending on the location, type of construction, and facilities. All projects implemented will comply with CEQA and NEPA, as applicable, and as part of the process, will identify and implement mitigation measures for potential environmental impacts to sensitive species and habitats, as necessary.

Energy consumption

The water sector plays a significant role in California's energy consumption. Implementing certain projects may increase energy use. Water and wastewater treatment and distribution projects that require significant amounts of power may result in increased energy consumption in the region. Increased energy consumption can increase GHG emissions, further exacerbating projected climate change impacts.

Reduced discharges to the Tuolumne, Stanislaus and Merced Rivers

Agricultural and urban water use efficiency projects and water recycling projects could reduce the quantity of water discharged to the Tuolumne, Stanislaus and Merced Rivers, effectively reducing streamflows and potentially impacting aquatic habitat.

Economic impacts

Implementation of certain projects may have associated long-term economic impacts to agencies and ratepayers. Project financing has historically provided a challenge in areas of the East Stanislaus Region. Even when grants and/or low-interest loans are available to subsidize project capital costs, agency rate revenues are sometimes insufficient to properly operate and maintain the project. Because funds available to implementing agencies are generally limited, it will be important to evaluate financing methods and avenues for potential projects prior to implementation such that potential economic impacts on ratepayers and agencies in the Region can be minimized.

Chapter 8

Chapter 8 Technical Analysis and Data Management

The Technical Analysis and Data Management section is intended to ensure the efficient and effective use of available data in developing and implementing the East Stanislaus IRWMP, as well as describe stakeholder access to data, and how that data generated by IRWM implementation activities can be integrated into existing State databases.

8.1 Technical Analysis

> The IRWMP must document the data and technical analyses used to develop the IRWMP.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 41

The East Stanislaus IRWMP has been developed using sound technical information, analyses, and methods. Information, documents, and studies were collected from various sources including the cities of Modesto, Turlock, Ceres, Waterford, and Hughson, the CVRWQCB, Stanislaus County, and DWR. Multiple local water planning and land use documents were reviewed and used to prepare the East Stanislaus IRWMP. These include UWMPs, Water Supply Master Plans (WSMPs), project Environmental Impact Reports/Environmental Impact Statements (EIRs/EISs), General Plans, and feasibility studies. Additionally, specialized studies, such as those evaluating the potential for future climate change in the Central Valley, were reviewed and used to prepare specific plan sections. Some of the key documents used in the East Stanislaus IRWM planning process are summarized in Table 8-1; these documents were reviewed and relevant information extracted as appropriate. All documents cited in the References section of this IRWMP were also reviewed and used in development of the East Stanislaus IRWMP.

Table 8-1: Key Documents Used to Prepare East Stanislaus IRWMP

Document	Year	Author	Results/Information Derived	Use in East Stanislaus IRWM Plan
Stanislaus Multi-Agency Storm Water Resource Plan	In progress	Woodard & Curran	Evaluation of stormwater projects in Stanislaus County.	Used to describe stormwater management practices and potential stormwater uses.
Modesto Water Master Plan	2017	West Yost Associates	Comparison of the City of Modesto's existing water supplies with projected water demands to determine if an overall system supply shortage will exist in the future.	Used to evaluate future water supply needs for the City of Modesto.
Oakdale Irrigation District 2015 Agricultural Water Management Plan	2016	Davids Engineering	Current and planned EWMPs implemented by OID.	Used to evaluate current EWMPs underway, additional practices that may conserve water, and incorporate opportunities into Resource Management Strategies and projects.

Document	Year	Author	Results/Information Derived	Use in East Stanislaus IRWM Plan
City of Ceres 2015 Urban Water Management Plan	2016	City of Ceres	Current and future water use, sources of supply and associated reliability, and existing and planned conservation measures for the City of Ceres.	Used to evaluate current water supply system and basis for future water supply needs.
City of Riverbank 2015 Urban Water Management Plan	2016	Kjeldsen, Sinnock, & Neudeck, Inc.	Current and future water use, sources of supply and associated reliability, and existing and planned conservation measures for the City of Riverbank.	Used to evaluate current water supply system and basis for future water supply needs.
City of Modesto 2015 Urban Water Management Plan	2016	West Yost Associates	Current and future water use, sources of supply and associated reliability, and existing and planned conservation measures for the City of Modesto.	Used to evaluate current water supply system and basis for future water supply needs.
City of Turlock 2016 Urban Water Management Plan	2016	West Yost Associates	Current and future water use, sources of supply and associated reliability, and existing and planned conservation measures for the City of Turlock.	Used to evaluate current water supply system and basis for future water supply needs.
City of Waterford Water Master Plan	2016	Stillwater Sciences	Current and future water demands, analysis of distribution system's ability to meet demands.	Used to describe current water supply system.
2016 Census Estimate Data	2016	U.S. Census Bureau	Population and basic information regarding residents, estimated annually.	Used to understand demographic of the East Stanislaus Region.
Modesto Irrigation District Agricultural Water Management Plan for 2015	2015	Provost & Richard	Current and planned EWMPs implemented by MID.	Used to evaluate current EWMPs underway, additional practices that may conserve water, and incorporate opportunities into Resource Management Strategies and projects.

Document	Year	Author	Results/Information Derived	Use in East Stanislaus IRWM Plan
Turlock Irrigation District 2015 Agricultural Water Management Plan	2015	Turlock Irrigation District	Current and planned EWMPs implemented by TID.	Used to evaluate current EWMPs underway, additional practices that may conserve water, and incorporate opportunities into Resource Management Strategies and projects.
Climate Ready Water Utilities Adaptation Strategies Guide for Water Utilities	2015	United States Environmental Protection Agency	Strategies to provide water and wastewater utilities with a basic understanding of how climate change can impact utility operations and missions, and examples of actions utilities can take (i.e. adaptive actions) to prepare for these impacts.	Used to evaluate climate change impacts in the East Stanislaus Region and development of adaptive management strategies.
DWR GIS data	2015	DWR	DWR-derived GIS data at the county, census block, census tract, and census designated place levels from the U.S. Census Bureau's American Community Survey. Included median household income information for 2010 through 2014, unemployment rates, and population.	Used to identify DACs and EDAs in the East Stanislaus IRWM region.
Regional Flood Management Plan for the Mid-San Joaquin River Region	2014	Environmental Science Associates	Potential flooding impacts and climate change impacts.	Used to understand flood management in the Region.
Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada	2010	Null, Sarah E., Joshua H. Viers, and Jeffery F. Mount	Potential climate change impacts on individual watersheds within the Sierra Nevada mountains of California (including Merced, Stanislaus, and Tuolumne River watersheds).	Used to assess climate change impacts anticipated in the East Stanislaus Region.

Document	Year	Author	Results/Information Derived	Use in East Stanislaus IRWM Plan
City of Modesto Municipal Stormwater Program, Stormwater Management Plan	2009	City of Modesto	Approach to addressing pollutants in stormwater discharges and monitoring program for assessing the health of local water bodies.	Used to understand current impacts to water bodies from stormwater discharges and need for future measures / projects to reduce impacts.
Turlock Groundwater Basin Groundwater Management Plan	2008	Turlock Groundwater Basin Association	Status of groundwater resources in the Turlock Groundwater Subbasin, its basin management objectives and the goal of ensuring a safe, reliable, cost-effective groundwater supply for the area and basin.	Used to evaluate current condition of the Turlock Groundwater Subbasin and measures, studies, or projects required in the future.
Modesto Draft Storm Drainage Master Plan	2008	Stantec	Storm drainage infrastructure improvements needed to effectively accommodate stormwater runoff under existing and future conditions within the City of Modesto's sphere of influence.	Used to evaluate current storm drainage in the City of Modesto and basis for future improvements.
Modesto Wastewater Collection and Treatment Systems Master Plan	2016	Carollo Engineers	Improvements to the City of Modesto's wastewater collection, treatment, and disposal facilities and operation with the goal of accommodating the wastewater service needs of the population and land uses as described in the City's General Plan.	Used to evaluate the City of Modesto's existing wastewater treatment system and basis for future improvements.
Hughson Water System Master Plan	2007	Carollo Engineers	Proposed improvements to mitigate existing capacity deficiencies and expansion improvements in Hughson's water system.	Used to assess Hughson's existing water system and basis for future improvements and projects.

Document	Year	Author	Results/Information Derived	Use in East Stanislaus IRWM Plan
Hughson Storm Drain Master Plan	2007	Carollo Engineers	Hydraulic modeling results of the Hughson storm drainage system and proposed improvements to enhance system reliability.	Used to understand Hughson's existing storm drainage system and basis for future needs.
City of Hughson Urban Water Management Plan	2006	Carollo Engineers	Current and future water use, sources of supply and associated reliability, and existing and planned conservation measures for the City of Hughson.	Used to evaluate current water supply system and basis for future water supply needs.
Oakdale Irrigation District Water Resources Plan	2005	CH2M Hill	Land use trends, existing water resources, and delivery operations for OID. Specific, prioritized recommendations for OID facility improvements that will comply with CEQA and accommodate available financial resources.	Used to evaluate OID's water resources, delivery system and operations, to determine how future changes in these areas will impact water supply and demand during the next two decades.
Integrated Regional Groundwater Management Plan for the Modesto Subbasin – Stanislaus and Tuolumne Rivers Groundwater Basin Association	2005	Bookman-Edmonston	Basin Management Objectives for the Modesto Subbasin, as well as groundwater management area objectives, and groundwater monitoring activities.	Used to assess condition of the Modesto Subbasin and potential impacts to Region since the area relies on groundwater for water needs.
City of Hughson Storm Water Management Program, Report of Waste Discharge	2004	Tulloch Engineering	Stormwater quality management activities proposed by the City of Hughson in compliance with the federal stormwater quality regulations.	Used to understand current impacts to water bodies from stormwater discharges and need for future measures / projects to reduce impacts.

Document	Year	Author	Results/Information Derived	Use in East Stanislaus IRWM Plan
Turlock Stormwater Management Plan	2003	City of Turlock	Stormwater management actions for the City of Turlock, Best Management Practices for six control measures, and the efforts the City will take to comply with all necessary requirements.	Used to understand current impacts to water bodies from stormwater discharges and need for future measures / projects to reduce impacts.
San Joaquin River Management Plan	1995	Advisory Council to DWR	Description of specific projects, studies, and acquisitions that will help revive the San Joaquin River system.	Used to describe issues relating to the San Joaquin River. The upcoming Mid-San Joaquin River Regional Flood Management Plan will be used to identify specific projects to be incorporated into later updates of this plan.
General Plans (Stanislaus County, Turlock, Modesto, Ceres, Hughson, Waterford, Riverbank, Oakdale)	Various	Various	Long-term visions for the County and cities (15 to 25 years in the future) with respect to land use and development.	Used to understand current and future demographic and cultural makeup of the East Stanislaus Region.

The technical information included in these plans and studies is ideal for use in developing the East Stanislaus IRWMP. While some of these documents are project-specific, others address water and/or land management issues on a local or regional basis. This allows for an understanding of regional issues shared by multiple entities in the Region, as well as more specific, localized issues, and potential solutions. Furthermore, these documents have been developed by the local and regional entities to address and plan for future growth and development, as well as anticipated changes in climate, economic conditions, and land use. They have been performed with a technical level of care that justifies their use in the IRWMP development.

Beyond the analyses required to prepare this IRWMP, no additional focused models or studies were performed in support of this IRWMP. Although several such studies have been identified as a result of the IRWMP preparation, a lack of funding has, to date, prevented their implementation. These focused studies include preparation of a regional water needs assessment and a comprehensive county island sewer connection study. These studies, once implemented, will help the ESRWMP fill identified data gaps in regional understanding, including projected future demands (on a regional level) and areas where sanitary practices may be contributing to groundwater contamination. A stormwater resources plan for Stanislaus County is currently under development, and will help the Region identify opportunities for integrating stormwater management with other regional water supply management. Project solicitation is occurring in late 2017 and the plan is expected to be completed in spring 2018. Furthermore, two other recent studies cover the IRWM region and have been incorporated by reference into the East Stanislaus IRWMP. These studies are the RFMP, which evaluated flood management risks in the region and proposed projects for addressing those risks, and CV-SALTS, a coalition of Central Valley stakeholders working to develop a workable, comprehensive plan to address salinity, including nitrates, throughout the region in a comprehensive, consistent, and sustainable manner. The results of the CV-SALTS effort (which is currently under review by the SWRCB) will include programs and management strategies to help manage salt and nutrient loadings to the Modesto and Turlock Groundwater Subbasins. Further, the STRGBA GSA, West Turlock Subbasin GSA, and East Turlock Subbasin GSA will all prepare GSPs in compliance with SGMA. These plans will include evaluation of groundwater resources and use in each subbasin. GSPs are intended to provide a path to achieving sustainable groundwater management. Future IRWMP updates will reflect these planning documents underway or to be prepared.

The projects included in the East Stanislaus IRWMP have also been found to be technically feasible based on similar projects, pilot studies, technical analyses, benefit analyses, cost estimating, modeling and simulation efforts and data assessments by the project proponents, local planners, and the IRWM planning participating entities. As the projects move closer to design and implementation, technical analyses will be conducted to confirm project feasibility and to provide any necessary feedback to modify the project's plan to improve its likelihood of success. The following table summarizes project-specific documentation that supports the technical feasibility of the East Stanislaus IRWMP RTP projects (including Preliminary Design Complete) and the associated technical feasibility of IRWMP implementation. Projects that were submitted to OPTI as "conceptual" were screened for feasibility but are not included in this table due to the limited project information currently available. These conceptual projects will be reevaluated for feasibility as they are further developed and progress from Conceptual to RTP during future project solicitations.

Table 8-2: East Stanislaus IRWMP Project Technical Feasibility

Project	Project Status	Technical Feasibility Justification
Ready to Proceed Projects		
Non-Potable Water System (Hughson)	Non-Potable Water Plan completed. Phase 1 implemented through conversion of Well No. 6 to non-potable use (December 2012).	The project is similar to existing facilities currently in operation and is therefore technically feasible.
DAC and Native American Outreach and Technical Assistance	Ready to proceed.	On-going outreach has been conducted as part of the East Stanislaus IRWM planning process. A more targeted approach will be taken with the implementation of this project. Sound technical assistance will be provided using common outreach techniques to contact DACs in the Region.
Regional Water Needs Assessment	Ready to proceed.	Project would develop a region-wide demand projection to increase the understanding and better management of local water supplies. Would build upon existing UWMPs and county population projections.

Project	Project Status	Technical Feasibility Justification
Dennett Dam Removal	A Basis of Design Report and engineering designs and specifications have been completed.	Design work has determined that the project is technically feasible.
Dos Rios Floodplain and Riparian Habitat Restoration	CEQA, permit acquisition, and design are complete. Construction is underway.	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Online Data Management System (DMS)	Ready to proceed.	The project would create a consolidated, web-based DMS and involve use of standard web database tools and would be technically feasible.
Tuolumne River Non-Motorized Boat Launch	Planning, design, and permitting have been completed.	Project is similar to existing facilities currently in operation and is therefore technically feasible.
South Modesto Infrastructure Efficiency Improvements	Planning is underway, with environmental documentation expected to be completed in 2018.	Project involves routine replacement of existing pipe infrastructure, and is therefore technically feasible.
East Stanislaus Watershed Outreach and Education	Ready to proceed.	The project is entirely an outreach and education project with some volunteer stewardship components. The project is technically feasible.
Rouse Lake Managed Aquifer Recharge (MAR) Project	Planning and design are in progress. EWD 2014 MAR Investigation Study, EWD 2017 NRCS Partnership Proposal completed to date.	Studies completed to date demonstrate technical feasibility.
Mustang Creek Managed Aquifer Recharge Project	Environmental documentation complete. EWD 2014 MAR Investigation Study, Project Design completed to date	Studies and design completed to date demonstrate technical feasibility.
F Street Storm Pond (Waterford)	Planning in progress.	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Tuolumne River Regional Park	Planning and environmental documentation completed, design and permitting in progress.	Project is similar to existing facilities and is therefore technically feasible.

Project	Project Status	Technical Feasibility Justification
Preliminary Design Complete		
SRWA Regional Surface Water Supply Project	CEQA and design underway.	The project is a collaboration between the cities of Turlock and Ceres under the Stanislaus Regional Water Authority JPA. Studies and CEQA documentation completed and on-going.
Regional Surface Water Treatment Plant Pipeline Turnout	Planning, feasibility study, and design have been completed.	Project is similar to existing facilities currently in operation and is therefore technically feasible.
North Valley Regional Recycled Water Program	Modesto currently constructing its portion of the project and expects completion in Spring 2018. Turlock is in final design for its portion of the project and plans to start construction in 2018.	Feasibility study and design documents detail the delivery of recycled water to DPWD customers from Modesto and Turlock. The EIR/EIS was completed and many permits have been acquired demonstrating technical feasibility.
Modesto Area 2 Stormwater to Sanitary Sewer Cross-Connection Removal Project	Phase 1 is complete, Phase 2 is in final design.	Phase 1 has been completed demonstrating technical feasibility. Complete design will confirm feasibility of Phase 2.
7th Street Low Impact Development (LID) Storm Drainage Improvements (Hughson)	Preliminary design completed; project is CEQA-exempt.	Project will be constructed using techniques developed by the City of Portland and the City of Seattle. Since both cities have working projects on the ground, this project is technically feasible.
Grayson Water System Efficiency Improvements	Planning and environmental documentation have been completed.	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Regional Surface Water Treatment Plant Pipeline Turnout (Hughson)	Hughson Water Master Plan completed (Carollo Engineers, 2007)	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Sutter Wastewater Treatment Plant Relocation Project	Planning and feasibility study completed.	Project is similar to existing facilities currently in operation and is therefore technically feasible.
Catherine Everett Park Cross Connection Elimination	Planning, feasibility study, and preliminary design report completed.	Similar projects have been implemented in Modesto; the project is technically feasible.
JM Pike Park Cross Connection Elimination	Planning, feasibility study, and preliminary design report completed.	Similar projects have been implemented in Modesto; the project is technically feasible.

Project	Project Status	Technical Feasibility Justification
Tuolumne River Regional Park - Carpenter Road/West Modesto Flood Management and Park Development	Planning completed.	Project is similar to existing facilities and is therefore technically feasible.

8.2 Data Management

> The IRWMP must describe the process of data collection, storage, and dissemination to IRWM participants, stakeholders, the public and the State.
>
> Data is technical information (e.g. designs, feasibility studies), and information gathered for a specific project in any phase of development including planning, design, construction, operation and monitoring.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 40

Data management is an important aspect to IRWM planning because the process encompasses multiple water and wastewater agency service areas, various watersheds, political areas, and groundwater basins, and provides the foundation on which water resource management and planning decisions are made. On a regional basis, this data management includes multiple data sources and a variety of methods for data collection, processing and management. Additionally, the IRWM planning process itself generates significant amounts of data related to the project review process and implementation of the IRWMP, such as project and Plan performance monitoring data. As such, development of a comprehensive data management system (DMS) is ideal to promote the efficient and effective use of data.

Data related to the East Stanislaus IRWMP includes project- and program-specific technical information, such as feasibility studies or design documents, and any data collected during project or program development, implementation, or operation or as a result of required monitoring efforts. Project-specific data is typically collected and maintained in DMS specific to the individual project proponent. Data that may be collected includes, but is not limited to:

- Groundwater elevations
- Groundwater quality data
- Groundwater pumping volumes
- Water demand
- Surface water diversions
- Location of sensitive species
- Stream flows and/or stages
- WWTP flow data
- Water quality data
- Weather data (precipitation, ET, temperature)
- Land use data
- Stormwater quantity and quality data

At present, the East Stanislaus Region will utilize existing, industry-standard data collection and management procedures for implementation of IRWMP-related projects. Modification to these procedures may occur as a result of the development of a region-wide DMS in order to ensure consistency with this new regional database once it is established. Typically, only data that is meant to be publicly available is uploaded to entities' websites and/or uploaded to Statewide databases. Projects implemented outside of the Region's IRWM Program will be encouraged to follow similar protocols to maximize usefulness and compatibility of data collected throughout the region, and to improve potential integration into statewide databases. The types of data to be collected and anticipated collection and storage procedures are presented in the sections below.

8.2.1 Data Needs within the Region

While there has been significant progress in the last decade in characterizing the Region's water supplies, demands, groundwater and surface water availabilities and quality, wastewater treatment and collection needs, and potential for recycled water use, there remain water resources-related data needs within the East Stanislaus Region. For the most part, these data needs center around the portions of Stanislaus County not found within urbanized areas (such as Modesto, Turlock, Ceres, Hughson, Waterford, Patterson and Oakdale), and are required to fill data gaps in knowledge necessary for the effective management of regional water supplies. Additional data needs include information regarding local hydrogeology and opportunities for groundwater banking, data pertaining to localized flooding and storm water management, and region-wide information to promote the reuse of storm water management.

Many of the data gaps identified as a result of this IRWMP are addressed through inclusion of a project in this IRWMP. For example, there are many areas in rural Stanislaus County that are not connected to municipal sewer systems and instead rely on stand-alone septic tanks/systems for wastewater disposal. These areas, referred to as County "islands", are often the same areas that rely on private groundwater wells for water supply. Septic systems are a key source of contamination to shallow groundwater aquifers and as such, pose a continuing source of groundwater quality problems for these rural communities and for the groundwater basins as a whole. Groundwater is a critical water supply for the East Stanislaus Region, and understanding and managing potential sources of contamination to the underlying groundwater basins is needed to sustain this important supply. The **Regional County Island Sewer Connection Study,** included in this Plan, would help identify County "islands" within the region that are on septic systems, determine potential groundwater impacts (current and future) from the septic systems, analyze the feasibility of connecting these areas to centralized or satellite collection and treatment systems, and perform an associated preliminary financial analysis of the most feasible and reasonable alternatives. The Study would build upon existing data and information gathered by the County and cities within the County. For example, the City of Modesto has identified all septic system areas within its sphere of influence and has begun coordinating with the County to connect some of these systems to its sewer collection and treatment system.

Other projects included in the Plan that would help fill data gaps include the following:

- **Regional Water Needs Assessment -** The purpose of this study is to complete a comprehensive assessment of current and future potable water demands within the entire East Stanislaus Region. This information is critical to managing water supplies under various hydrologic conditions to ensure water supply reliability and to prepare for droughts and potential climate change impacts. In essence, one must know the demands in order to be able to ensure the supply. UWMPs have been prepared by many entities within the Region (for example, by the Cities of Modesto, Turlock and Ceres), but not all areas and water users are included in the urban water management planning jurisdictions as required by the State (e.g. Hughson), and these areas are typically dependent on groundwater as their primary supply. This task will help fill the information gap and assess the current and future demands from those parts of the region where UWMPs are not required and, as needed, update the information where UWMPs are required so as to provide the region with essential information regarding projected future demands in order to effectively manage their water supplies to meet demands in a sustainable fashion. As water demands within the Region continue to increase and as groundwater quality continues to be a major factor threatening the sustainability of regional supplies, it is critical that a complete understanding of regional demands be prepared; that new, supplemental supply sources be identified, obtained, and integrated into the Region's water supply portfolio; and that effective programs be established to protect and sustain existing regional water supplies for all users, including the environment.

- **Dry Creek Watershed Detention Reconnaissance Study** – This study will determine potential options for reducing flood risks by detaining flood flows in the Dry Creek watershed, upstream of the City of Modesto. A Flood Hazard Assessment will be conducted in an Integrated Development Planning Study. The effort will involve the collection and review of generally available resource information, including reviewing the 1998 USACE reconnaissance study. The team will review available topographic, hydrologic and vegetation mapping as well as aerial and satellite imagery. These data will then describe the need for a flood hazard assessment. The flood hazard assessment will involve the preparation of a development strategy with the goal of identifying projects for high priority areas. This will be accomplished by utilizing historical flood data obtained through stream gauges and other flood documentation. The team will identify potential mitigation measures as well as determining acceptable risk within the Planning Study area.
- **Hydraulic and Channel Migration Studies -** Two regional studies are required to advance flood management planning within the Mid San Joaquin River Region's planning area. First, updated baseline hydraulic analyses of flood conditions on the mainstem of the San Joaquin River in the Mid SJR Region's planning area are needed to inform site-specific studies of flood hazards and better identify flood hazard mitigation opportunities. The analyses will include a range of flood events, such as the 2-, 10-, 25-, 100-, and 200-year events and will largely or entirely rely on available models and hydrology as developed for the CVFPP. A report on this study will provide a regional evaluation of the level of performance of the flood management facilities and produce a set of recommendations for improvements and a strategy for pursuing them. Second, as a counterpart to the hydraulic analyses, a channel migration study within the same area will also be conducted to identify under current (baseline) conditions approximately where, and by what degree, channel movement is anticipated to occur, creating challenges and opportunities for flood management. The results of the channel migration study will be used to inform the recommendations in the hydraulic study.

While other projects included in the East Stanislaus IRWMP are not studies or plans, many of them will have data collection as an aspect of project development and completion. Additionally, some of the projects are not yet ready for construction; some require preparation of plans, design documents, and other technical reports. The methods for collection and storage of these documents and their associated data are described in the following sections.

8.2.2 Data Collection and Storage

To date, data collection and storage is primarily managed on an individual basis by the members of the ESRWMP and local stakeholders. At present, each entity collects and manages data using its own protocols and methodologies. The city ESRWMP member agencies house data on their respective servers and use software such as Microsoft Excel, ArcGIS, SCADA, New World Systems, and

Wonderware. Some of the data collection completed by the ESRWMP member agencies is summarized in the following table.

Table 8-3: Data Collection for the City ESRWMP Member Agencies

Data Type	Frequency of Data Collection	Method for Data Collection
Turlock groundwater quality	Monthly	Well sampling
Turlock groundwater elevations	Monthly	Electronic water level indicator
Turlock water demand	Daily	Meter readings
Modesto groundwater quality	Monthly, quarterly	Well sampling
Modesto groundwater elevations	Monthly	Sounding cable
Modesto water demand	Daily, Monthly[1]	SCADA, meter readings
Ceres groundwater quality	Annual	Well sampling
Ceres groundwater elevations	Quarterly	Sounding cable
Ceres water demand	Monthly	Meter readings[2]
Hughson groundwater quality	Weekly, quarterly, annually	Well sampling
Hughson water demand	Daily	SCADA
Hughson wastewater treatment plan groundwater monitoring	Quarterly	Monitoring well sampling
Waterford groundwater quality	Monthly	Well sampling
Waterford groundwater elevations	Monthly	Sounding cable
Waterford water demand	Daily	SCADA, meter readings

[1] Water production data is collected daily and meter reading is conducted monthly.
[2] Ceres uses Smart Meters to capture real-time data.

The STRGBA also implemented the Well Field Optimization Project in order to improve understanding of the Modesto Subbasin groundwater system and its infrastructure, and to develop tools for optimizing operations of well fields in the subbasin in conjunction with surface water resources. Phases 1 and 2 of the project were partially funded by Local Groundwater Assistance grants from DWR. A key component of the project was an inventory of all the wells operated by the STRGBA member agencies (i.e. MID, OID, Stanislaus County and the cities of Modesto, Riverbank, and Oakdale) and development of a web-based DMS where well data can be accessed, queried, plotted and shared amongst the member agencies. The DMS is a Microsoft Access database with a customized interface and customized Decision Support System tool to automate the decision process for system operators in selecting wells to meet deliveries.

A regional DMS proposed by the ESRWMP and referred to as the **Online DMS** is also included in the East Stanislaus IRWMP as a project; implementation of this DMS is pending funding. The Online DMS would create a consolidated web-based data management system to facilitate the collection and analysis of various data types, monitoring and reporting, and provide stakeholder access to data. This data management system would be developed to facilitate the sharing of data with existing State databases and the DMS created as part of the Well Field Optimization Project. The East Stanislaus Online DMS would connect with the East Stanislaus IRWMP website, located at http://www.eaststanirwm.org/. Presently, data and documents specific to the East Stanislaus IRWM planning process are uploaded to the website and made available for public review (including proposed projects through the Region's OPTI project solicitation website). The ESRWMP is responsible for maintaining the website and documents available there. With SGMA implementation, GSAs will be required to develop DMSs. These systems could build on or coordinate with the existing IRWM DMS.

Stakeholders participating in the IRWM planning process and project proponents are responsible for collecting, storing, and maintaining project-specific data in the individual entity's existing DMS and are tasked with uploading necessary, publicly available data to applicable statewide databases, discussed in more detail in Section 8.2.3 Any required monitoring after project implementation will be implemented consistent with applicable standards and reported to the State. Each entity that uploads data to its DMS, the East Stanislaus IRWMP website, and/or applicable statewide databases performs quality assurance and quality control (QA/QC) measures to validate the data. These measures include third-party reviews of data collected, laboratory quality control measures such as blind duplicates and matrix spike samples, and model calibration and sensitivity analyses.

8.2.3 Data Dissemination

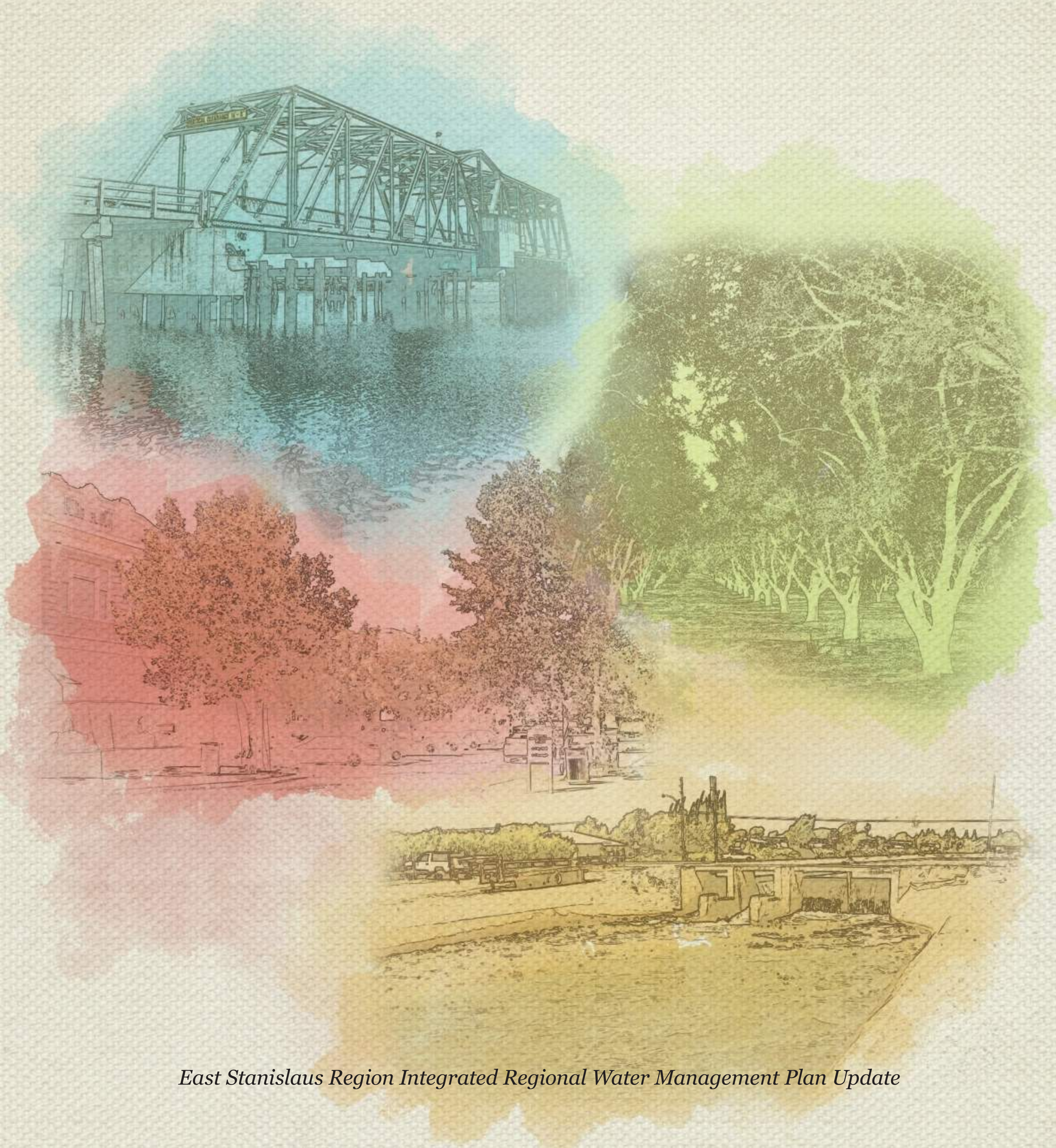
During preparation of the East Stanislaus IRWMP, data has been disseminated primarily via project-specific documentation and associated meetings, inter-agency collaboration on issues and projects of mutual interest, discussion at PAC, SC, and ESRWMP meetings, and through website postings on the East Stanislaus IRWM Region's website. Project proponents, PAC members, and IRWM planning participants are all jointly responsible for data dissemination. As previously mentioned, project-specific data is shared by and between participating agencies during project development and made available to the public at various milestones. Environmental documentation processes completed to comply with CEQA and NEPA have also allowed for dissemination of data developed for review by interested stakeholders and the public. These methods will continue to be employed.

As described previously, all data specific to the East Stanislaus IRWM planning process will be housed on the East Stanislaus IRWM website, OPTI, and/or maintained by implementing agencies. Project- and program-specific data will be housed on the project proponent's individual DMSs. Hard copies and CDs may be available to interested parties without internet access. Future East Stanislaus IRWMP updates will be distributed in a similar manner to that employed for this IRWMP.

As described in Section 9.3, Plan Performance and Monitoring, East Stanislaus IRWMP project proponents implementing projects funded by the IRWM Program will be required to prepare project-specific monitoring plans in compliance with the grant agreement and that adhere to the data collection techniques and procedures established by existing statewide programs. This will ensure compatibility of data among projects implemented through the IRWM Program, as well as compatibility with relevant statewide databases. Individual project proponents will be responsible for collecting data in accordance with the approved project-specific monitoring plan, which will clearly identify monitoring and analytical techniques and QA/QC procedures to be implemented, and will describe how those techniques are compatible with the requirements of appropriate statewide database(s). The individual project sponsor will be responsible for implementing and reviewing the data collection and QA/QC protocols to validate that data were collected in accordance with the QA/QC procedures required as part of the project monitoring program. In addition, project proponents will be responsible for reviewing the data for accuracy at the time of entry to the database to identify any errors. Once data collection and QA/QC has been completed in accordance with provisions of the approved project-specific monitoring plan, the project sponsor will submit the compatible data to the appropriate statewide database and provide the ESRWMP and/or grant administrator with confirmation that the data has been submitted to the appropriate statewide databases. Dissemination of data to statewide programs administered by the SWRCB, the California DWR, and other entities will support statewide data needs and allow for another method for public access. The current methods used to disseminate data to the State for programs such as CASGEM will continue in their present form, pending the development of a regional database and/or changes to the State's program necessitating changes to the data reporting and dissemination.

East Stanislaus IRWM planning participants have supported statewide data needs in the past through voluntary participation, and will continue to do so in the future by making collected data available to programs such as the Surface Water Ambient Monitoring Program (SWAMP), GAMA, and the California Environmental Information Catalog (CEIC) when appropriate and feasible. Data will also be disseminated to DWR for inclusion in its databases, such as the Water Data Library (WDL), which contains groundwater level and water quality data. Finally, stakeholders, agencies, and the public may request all publicly available IRWMP data (i.e., non-proprietary and non-confidential) from any of the MOU signatories for this IRWMP.

Chapter 9



East Stanislaus Region Integrated Regional Water Management Plan Update

Chapter 9 Plan Implementation

For the East Stanislaus IRWMP to be successful, projects included in the Plan must continue to move forward with planning, design, permitting, environmental documentation, construction and ultimately operation. Implementation of projects and programs included in the IRWMP will help the Region achieve its identified regional goals and objectives and will contribute to solutions to address issues and conflicts in the region. The process the East Stanislaus Region applies for IRWMP implementation is described in Section 9.1. Potential financing options for continued IRWMP development and implementation is summarized in Section 9.2.

9.1 Implementation Process

> The IRWMP must include a plan for implementation and financing of projects and the Plan itself. The financing discussion must, at a minimum, include the following:
>
> - List of possible funding sources for development and ongoing funding for the IRWMP.
> - List of funding mechanisms for projects that implement the IRWMP.
> - An explanation of the certainty and longevity of known or potential funding for the IRWMP and projects.
> - An explanation of how O&M costs for projects that implement the IRWMP would be covered and the certainty of funding.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 41

Implementing the East Stanislaus IRWMP consists of:

- Implementing projects and programs included in the IRWMP;
- Monitoring projects and programs included in the IRWMP that are implemented to ensure they are meeting their goals and objectives and contributing to the East Stanislaus regional objectives.
- Regularly evaluating the East Stanislaus IRWMP to determine if movement has been made in achieving the regional objectives, and modifying the IRWMP, as necessary, to ensure that Plan (and the projects it contains) are on track to achieve the overall Plan goals.

Implementation of the East Stanislaus IRWMP will be completed through cooperation among the participating entities, including the ESRWMP, the RWMG for the region, the SC, the PAC, project proponents, and stakeholders. In August 2011, the Cities of Ceres, Hughson, Turlock and Modesto signed a MOU for IRWM planning, forming the ESRWMP and agreeing to develop the East Stanislaus Region's first IRWMP. In June 2017, the City of Waterford and Stanislaus County joined the ESRWMP, and an amendment to the MOU was signed by all members. Upon completion and adoption of the updated East Stanislaus IRWMP, the ESRWMP will continue to coordinate implementation of the IRWMP and perform future IRWMP updates (as discussed in Section 9.4). Coordination with the project proponents will be necessary through the IRWM planning process, even after Plan adoption. While some of the projects included in the East Stanislaus IRWMP are projects to be implemented by the present ESRWMP member agencies, others are led by other entities and stakeholders such as the Tuolumne River Trust, River Partners, and Eastside Water District. Individual project proponents will move projects forward as funding and staff is available, and as appropriate. For example, some projects included in the East Stanislaus IRWMP are considered ready to proceed, that is, ready for construction, but do not have adequate funding to construct. Others are at the conceptual level and require additional planning, design, and project development prior to construction and implementation. Regardless of the project status, funding must be available in order to proceed with project development and implementation. Financing is discussed in more detail in the following sections.

Implementation of the East Stanislaus IRWMP also involves monitoring performance of the IRWM program as a whole. Regular assessment of IRWMP performance and updates is described in Section 9.4 below.

9.2 Financing Plan

Because the East Stanislaus IRWMP is a living document and will require implementation and updates in the future, and because there are projects included in the Plan that will be implemented to achieve the region's goals and objectives, a financing plan is necessary to help ensure funding sources are available to do so. Additionally, as projects are implemented, not only is funding necessary for capital costs, but also for ongoing O&M of the projects. The following sections discuss the potential funding sources that may be available for developing, maintaining, and updating the East Stanislaus IRWMP, the potential funding sources for projects that implement the IRWMP, and the certainty and longevity of the funding sources.

9.2.1 Funding for Development of IRWMP

The cost of developing and maintaining the first East Stanislaus IRWMP (completed in 2013) was borne by the local entities involved in the ESRWMP, which, at the time, included the Cities of Modesto, Turlock, Ceres, and Hughson. In 2016, the four ESRWMP member agencies prepared and submitted a Prop 1 IRWM planning grant application that was successful and resulted in an approximate $150,000 grant from DWR to update the 2013 IRWMP. Additionally, staff of the ESRWMP member agencies, SC, and PAC have contributed significant time and resources to completing and updating the IRWMP, coordinating and participating on the SC and PAC, and organizing stakeholder outreach efforts. The East Stanislaus Region is committed to developing, updating, and maintaining a useful and implementable IRWMP, which includes Plan performance monitoring and updates to the IRWMP in the future to help ensure that Plan implementation addresses the conflicts and issues currently present in the region.

Many of the same potential funding sources available to local entities involved in the East Stanislaus IRWMP may be used for developing and updating the IRWMP, implementing projects and programs (i.e. funding capital costs of projects included in the IRWMP), as well as funding project O&M costs. An overview of potential funding sources is provided in Table 9-1. The primary sources of funding for developing, maintaining, and updating the East Stanislaus IRWMP are the cities' General Funds (or Capital Improvement Funds), utility rates, or local, state, or federal grants. A brief overview of the ESRWMP member agencies' financial outlook is as follows:

- According to the City of Modesto's Comprehensive Annual Financial Report for the fiscal year ending June 30, 2016, the City's primary revenue sources are benefitting from an ongoing upturn in the economy, following the recession of the late 2000's and early 2010's (Modesto, 2016).
- The City of Turlock also expects to see improvements in the economy after the protracted economic downturn, with Turlock's General Fund revenues expected to increase (Turlock, 2016).
- The City of Ceres is experiencing slower recovery overall, but does expect an increase in revenues for fiscal year 2017 (Ceres, 2016b).

- The City of Hughson is benefitting from an improved housing market and increased sales tax revenue, resulting in a growth in the City's General Fund balance (Hughson, 2016).
- Waterford reported a decrease in its General Fund over the course of fiscal year 2016 (Waterford, 2016).
- Stanislaus County's CIP encompasses a 20-year planning horizon and currently identifies 129 capital improvement projects (including all project types). Funding from outside sources has been identified for a portion of the planned costs, with the County covering part of the remaining cost. The balance of capital improvement project costs, roughly $30 million, do not yet have a funding source identified (Stanislaus County, 2016). The unassigned balance of Stanislaus County's General Fund decreased in 2016 compared to 2015 (Stanislaus County, 2016).

In general, despite overall improvement in the local economy since the 2013 IRWMP, local entities are still struggling to fund major infrastructure projects without assistance of other funding avenues. SGMA compliance also presents added short- and long-term cost issues for many jurisdictions.

While funding for future IRWMP updates has not yet been secured by the ESRWMP member agencies, it is possible that funding will be available as the participating agencies and other regional stakeholders understand the critical nature of updating the IRWMP and addressing the region's changing issues and conflicts as conditions change, and will coordinate these updates with other required planning studies, such as the five-year UWMPs. IRWM grant funding may also be available for IRWMP updates, as it was for this 2017 Update, which will help to offset costs to the ESRWMP member agencies and their ratepayers.

Table 9-1: Potential Funding Sources Available for IRWMP Development, Project Implementation, and O&M Costs

Potential Funding Source	Description	Certainty / Longevity
Capacity Fees	• Used by water agencies as a means to achieve and maintain equity among its past, present and future customers. • Typically charged per connection, measured in equivalent dwelling units (EDUs). A single connection may encompass more than one EDU. In addition to the connection fee aspect of capacity fees, water agencies may also assess other fees (e.g., Commercial Acreage Fee [per acre] and Other Service Fee [per acre]).	Dependent upon rate structure adopted by project proponents and Proposition 218 process
User Fees	• Monthly user fees are assessed by some water agencies where an argument can be made that new facilities directly benefit existing customers. • In many cases, income from this monthly revenue source is used to pay debt service on debt financed assets.	Dependent upon rate structure adopted by project proponents and Proposition 218 process
User Rates	• User rates (also referred to as rate recovery) pay for O&M of a water agency or public utility's system. Within a water agency user rate, there is a fixed cost component that covers costs that do not vary with the amount of supplied water, such as labor and overhead expenses, and a variable cost component that covers costs that are based on the amount of pumping and applied chemicals to meet the water demands of the customers and vary with the amount of supplied water, such as the electrical and chemical costs. • A water agency customer pays a monthly fixed rate and a variable rate based on the metered usage. In cases in which billing is not based on a metered usage, a single monthly rate is assessed that combines the average of the fixed and variable rates.	Dependent upon rate structure adopted by project proponents and Proposition 218 process
General Funds	• General or capital improvement funds are monies that an agency sets aside to fund general operations and/or facility improvements, upgrades and, sometimes, development. These funds are usually part of their overall revenue stream and may or may not be project-specific. • The general fund budget is supported by revenues generated from a variety of taxes including sales tax, property tax, franchise fees, and a variety of permit fees.	Dependent upon annual budgets adopted by project proponents and participating agencies

Potential Funding Source	Description	Certainty / Longevity
Bonded Debt Service	• In cases in which a large facility is needed to support current services and future growth, revenue bonds are issued to pay for new capital. This allows for payment of the facility by bonded debt service at the time of construction with repayment of the debt service over a 20- to 30-year timeframe. • Preferred approach to paying for high cost facilities because it avoids the perceived over-collection of fees from past customers that go toward facilities that serve present and future customers. The downside to bonded debt is that it cannot be accomplished with capacity fees alone due to the variability and uncertainty of new development over time. A user rate is needed as a bond document covenant in the event that development fees are not adequate to make the required annual payment for the debt service.	Dependent upon bond market and existing debt of project proponents
Local, State, or Federal Grants	• Typically require local matching funds. The matching requirement shows a local commitment to promoting and completing the study, plan, or project. • Typically administered and contracted by a single agency within the region that works directly with the state or federal agency administering the grant. • Grants typically carry relatively high administration cost because extensive grant reporting may be required, and typically only a small portion of the grant may be used to cover grant administration. • Common grants available for water resources projects include, but are not limited to, IRWM grants from DWR, Title XVI Water Reclamation & Reuse/Water Infrastructure Improvements for the Nation (WIIN) grants from Reclamation, Water Recycling Funding Program (WRFP) grants from SWRCB, Water-Energy grants from DWR, and others.	Grant programs at the local, state, or federal levels are periodically available. Some projects have secured grants as shown in the table in Appendix I.
Low-interest loans	• Several funding agencies (e.g., SWRCB, California Infrastructure & Economic Development Bank) administer low-interest loans for implementation of water- and wastewater-related projects. Low-interest loans can save the implementing agency significant amounts of money by reducing interest payments as compared with traditional bonds. • SWRCB offers low-interest loans for water and wastewater / recycled water projects through its Drinking Water and Clean Water State Revolving Fund (SRF) loan programs, respectively. The interest rate is half of the most recent General Obligation (GO) Bond Rate at the time of the funding commitment. Over the last five years, the SRF loan interest rate has ranged from 1% to 2.2%. • The California Infrastructure and Economic Development Bank (I-Bank) administers the Infrastructure SRF loan program for financing implementation projects such as sewage collection and treatment, water treatment and distribution, and water supply projects.	Dependent upon the specific program and federal appropriations to each

9.2.2 Funding for Projects that Implement the IRWMP

Agencies within the Region have explored a variety of potential regional water resource planning and implementation funding vehicles including the SRF programs, USBR's Title XVI Water Reclamation and Reuse Program, and other State and Federal grant and loan programs, in addition to rate revenues, bond financing, assessments, and potential county and municipal revenue sources.

> The IRWMP must contain performance measures and monitoring methods to ensure the Plan Objectives are met.
>
> This Plan Performance and Monitoring section shall describe the method of evaluating and monitoring the RWMG's ability to meet the objectives and implement the projects in the IRWMP.
> The IRWMP Plan must contain policies and procedures that promote adaptive management, particularly in relation to effects of climate change.
>
> - *Proposition 1 IRWM Guidelines*, July 2016, Page 40

The East Stanislaus IRWMP is implemented through the Projects included in the IRWMP Estimated capital and O&M costs for these projects are shown in Appendix I, along with potential funding sources, exclusive of additional local, state or federal grant funding. It should be recognized that each implementing organization has a unique set of revenue and financing methods and sources.

Ongoing support and financing of the O&M of projects in this IRWMP are expected to be derived from many of the same sources that were identified to fund project implementation, as shown in Table 9-1. Support and financing will likely come primarily from local sources, including user rates, fees and assessments. Since regional projects and programs often involve multiple partner agencies, the range of local sources available is broadened. The details of financing these larger, multi-partner projects are typically worked out on a project-by-project basis. Large multi-purpose projects typically adhere to standard cost accounting and cost of service principles which are typically described and codified in the agreements for ownership. O&M of facilities is typically developed as part of a project financing package.

O&M costs of proposed implementation projects must be evaluated as the overall viability of a particular project effort is determined. Any project that is advanced for implementation consideration must include an analysis to determine the ability to operate and maintain the project and project benefits. The annual fiscal impact on user rates, and the willingness of ratepayers to accept any increased cost of service as may be required for project implementation must be included in this analysis. The need for water and the economic hardship impacts that would occur, should the new source not be available, may also be considered as part of the analysis.

9.3 Plan Performance and Monitoring

Plan performance and monitoring is vital in IRWM planning as it helps a region determine if implementation of its IRWMP is contributing to meeting its identified goals and objectives. Measuring the success of Plan implementation is directly related to IRWMP project implementation. Therefore, the monitoring required as part of the East Stanislaus IRWMP implementation will evaluate both project-specific performance in meeting project goals, in addition to how the cumulative benefits of those implemented projects are meeting the Region's goals and objectives. As environmental conditions in the Region change, particularly due to the effects of climate change, it will be critical for the IRWMP to adjust in response to these changes, and for the IRWMP to promote adaptive management in the Region.

As described in Section 8.2, individual project proponents implementing projects through the East Stanislaus IRWMP will be responsible for collecting data in accordance with approved project-specific monitoring plans and submitting data to appropriate statewide databases. These data will include the information necessary for monitoring project-specific performance. Projects that affect surface water quality shall include a monitoring component that allows the integration of data into the California Environmental Data Exchange Network (CEDEN). Similarly, groundwater-related projects must monitor and report groundwater elevation data, as required by CWC §10920 *et seq.* and may be required to monitor groundwater quality, depending on the project's nature.

Monitoring the East Stanislaus Plan performance will be based on the results of project-specific performance monitoring, and cumulatively will help ensure:

- The Region is making progress towards meeting the goals and objectives as specified in the IRWM Plan.
- Projects included in the East Stanislaus IRWMP are being implemented.
- Each project in the IRWM Plan is monitored to comply with all applicable rules, laws, and permit requirements.
- The Region and participating agencies apply adaptive management in water resources planning and project implementation.

Additionally, the 2016 IRWM IRWMP Guidelines indicate that plan performance address the plan's success in providing specific benefits to critical water issues for Native American Tribal communities. Currently no tribes have been identified in the Region; however, if tribes are identified in future Plan updates, plan performance criteria will be updated to include consideration of critical tribal water needs.

Project-specific monitoring plans will be prepared and implemented by the project proponents for projects that are funded through the IRWM grant program. The project proponent will also be responsible for all project-specific monitoring activities and for reporting the results of the monitoring program to the designated grant administrator. While projects that are not implemented through the East Stanislaus IRWMP will not be required to have project-specific monitoring completed, project proponents and participating entities will be encouraged to prepare and implement performance monitoring plans as part of their project implementation. Performance data for non-IRWMP projects will be collected and evaluated as made available.

In general, project-specific monitoring plans will include the following information:

- The project name and a brief description
- List of the project goals and objectives
- Identified targets to be achieved over the life of the project (e.g. reduce water loss from the tank by 8%)
- Description of what is being monitored for, in table format (see example below), including the location of monitoring, monitoring frequency, methods used to collect data, and procedure for data collection/storage
- Measures to remedy or react to problems encountered during monitoring. An example would be to coordinate with the Department of Fish and Wildlife if a species or its habitat is adversely impacted during construction or after implementation of a project.

Table 9-2: Example of Monitoring Table included in Project-Specific Monitoring Plan

Parameter	Location of Monitoring	Frequency	Monitoring Protocol / Methodology	Data Collection, Storage, and Dissemination Procedures
Surface water diversion	Water meter at San Joaquin River mile X	Weekly	Use meter data to monitor monthly surface water diversions	Store data on City existing DMS and submit groundwater level data to SWAMP
Groundwater recharge	Water meter on discharge pipe to percolation pond	Daily	Use meter data to monitor daily discharges to percolation ponds	Store data on City existing DMS
	Water levels (staff gauge) in percolation pond	Daily	Use gauge data to estimate weekly volume of percolated water	Store data on City existing DMS

Project-specific monitoring plans may be prepared at different stages of project development, but all will be prepared prior to the start of construction and will comply with the requirements included in the grant agreement. Each monitoring plan will specify monitoring protocols and methodologies to ensure consistency and accountability by the project proponent collecting the data and performing monitoring activities. Project proponents are responsible for preparing a project-specific monitoring plan and implementing the plan accordingly, and ensuring that the required reporting and data uploads (to DWR or the appropriate entity) occur. Project proponents must also retain records of implementation. Additionally, each project proponent will be responsible for demonstrating to DWR that the monitoring has occurred and that the anticipated benefits have occurred, if required by the grant agreement.

The monitoring plans will include monitoring schedules, dictating an estimated timeline of monitoring activities which the project proponent will use as a guideline to ensure a monitoring schedule is maintained. Prior to project implementation, the project proponent must be able to ensure that adequate funding will be available to complete the necessary project monitoring. Data collected and analyses performed as part of the performance monitoring plans will be reported as often as required based on the specific project, proponent, and funding agency requirements. Data and information collected as part of the project-specific monitoring plan will be summarized in a project-specific monitoring report, in table format, and submitted to the grant administrator for ultimate submittal to DWR. Necessary backup information will be attached to the report. An example of the monitoring report table is provided in Table 9-3. This will help ensure the projects meet the goals and objectives as originally conceived for the projects and the East Stanislaus IRWMP, and that project proponents report monitoring and benefits appropriately.

Where possible, ongoing data collection efforts will be relied upon, at a minimum, to provide necessary baselines to measure project and Plan success. In some cases, monitoring and data collection currently underway will be adequate for project performance monitoring. For example, with respect to surface water rights, an entity diverting surface water must submit data to SWRCB. The data is housed on eWRIMS – the Electronic Water Rights Information Management System. This data, which is already collected for certain water bodies, could help gauge effectiveness of a project meant to increase or decrease flows in a portion of a river. Similar to eWRIMS, SWRCB administers the GAMA program. Groundwater production wells are monitored by the well owners and volumes pumped are reported to CDPH, who puts that information on GAMA. Additionally, GAMA has data from DWR, USGS and the Department of Pesticide Regulation. The data that exists on GAMA could be used to develop baseline conditions of a groundwater basin and could potentially be relied upon to track conditions and measure project effectiveness.

Table 9-3: Example Project-Specific Monitoring Report

Project Name:	Insert name
Project Description:	Briefly describe the project
Identified Project Goals and Objectives:	Insert goals and objectives as identified in project specific monitoring plan
Project Targets:	List specific, measurable targets, as described in the project specific monitoring plan
Data Collected:	Describe the data collected (including collection location) and how often it was collected
Measurement tools and methods:	Describe the tools and methods used to collect data, as described in the project specific monitoring plan, and how that data is being managed and/or uploaded to existing databases
Goals and Objectives Results Summary:	Describe how the project is meeting its identified goals and objectives
Project Targets Results Summary:	Describe if the project is on track to meet its identified targets based on the data collected, including schedule and fiscal targets
Recommended Modifications or Adjustments	Describe any remedy or recommended actions that should be implemented (if any) to counter problems identified through implementation of the monitoring plan

As described in Section 8.2, project proponents will be responsible for collecting, storing, and maintaining project-specific data on the individual entity's existing DMS and are tasked with uploading necessary data to applicable statewide databases. Any required monitoring after project implementation will be collected consistent with applicable standards and reported to the State. Each entity that uploads data to its DMS and/or applicable statewide databases will perform QA/QC measures to validate the data. By making data available online through the various State websites and online DMSs, data transfer and sharing among the ESRWMP, participating entities, and interested parties (including local, State and federal agencies) is made possible.

Project proponents will use the information and data collected as part of the project-specific monitoring plans to conduct adaptive management; that is, information will be fed back to the individual project's management structure to adapt the project to better meet its overall objectives. Only by consistent monitoring and analysis of project performance feedback data can projects successfully achieve the objectives set for the project. Monitoring will also provide a clear reporting mechanism for the public, decision makers, and regional planners to determine the planned versus actual value of the project. Results from project-specific monitoring will also be used to improve the ESRWMP's ability to identify and implement future projects in the East Stanislaus IRWMP and identify revisions to the IRWMP itself. This adaptive management approach is particularly important in light of climate change; more effects of climate change will become apparent as time goes on and projects and plans will need to be adjusted to reflect changing conditions. In order to support this process, the project proponents implementing IRWM grant-funded projects will submit project-specific monitoring reports to the grant administrator (as mentioned above). During future IRWMP updates, the ESRWMP will evaluate how the projects implemented as part of the East Stanislaus IRWMP are not only addressing the identified project-specific goals and objectives, but how overall Plan implementation is contributing to the identified regional goals and objectives included in the most recent adopted IRWMP. If adequate progress is not being made in addressing the Plan objectives, the region may choose to implement other projects in the future or re-evaluate the projects currently in the Plan. This will help the region as it updates its project list, the IRWMP, and applies for grant funding.

9.3.1 Projects Implemented to Date

Since the initial IRWMP was adopted in 2013, a range of projects included in the Plan have been completed or are underway. These projects, listed in Table 9-4, collectively address every goal outlined in Chapter 5: water supply, water quality, flood protection, environmental protection and enhancement, regional communication and cooperation, and economic and social responsibility. By completing the projects listed in Table 9-4, all of the Region's goals and many of the Region's objectives have been addressed in the last four years.

Table 9-4. East Stanislaus IRWM Region 2013 IRWMP Project List

Project Name	Project Proponent	Status			Funded by IRWM Grant Program
		Not Yet Implemented	Underway	Complete	
Ready-to-Proceed Projects					
SRWA Regional Surface Water Supply Project	City of Modesto on behalf of the SRWA	✓			
Modesto Area 2 Stormwater to Sanitary Sewer Cross-Connection[1]	City of Modesto		✓		✓
Non-Potable Water System	City of Hughson	✓			
Integrated Stormwater Resources Management and Groundwater Augmentation Plan[2]	ESRWMP				
Dos Rios Floodplain and Riparian Habitat Restoration	Tuolumne River Trust	✓			
DAC & Native American Outreach and Technical Assistance	ESRWMP	✓			
Regional Water Needs Assessment	ESRWMP	✓			
Monterey Park Tract Community Safe Drinking Water Project	Monterey Park Tract Community Services District			✓	
Municipal Well No. 41	City of Turlock	✓			
Dennett Dam Removal	Tuolumne River Trust	✓			
Water Storage Reservoir NW	City of Turlock			✓	
Online Data Management System	ESRWMP	✓			
Regional County Island Sewer Connection Study	ESRWMP	✓			
Regional Surface Water Treatment Plan Pipeline Turnout	City of Hughson	✓			
Arsenic Mitigation Project	Keyes Community Services District			✓	
Water Well No. 9 and Arsenic Treatment Facility	City of Hughson		✓		
7th Street LID Storm Drainage Improvements	City of Hughson	✓			
Conceptual Projects					
Water Blending Facility	City of Hughson		✓		
North Valley Regional Recycled Water Program[3]	City of Turlock on behalf of NVRRWP Partners		✓		✓
Canal Drive Stormwater Trunk Line[4]	City of Turlock				
Northeast Storm Drainage Interceptor Project	City of Modesto	✓			
Water Well No. 10	City of Hughson		✓		
Water Well No. 11	City of Hughson	✓			
Well No. 5 Depth Extension	City of Hughson		✓		
Well No. 3 Depth Extension	City of Hughson	✓			
La Grange Floodplain Restoration and Spawning Gravel Augmentation	Tuolumne River Trust	✓			
Tuolumne River Trail Project	City of Waterford	✓			

Notes:

1. Phases 1 and 2 complete. Phases 3 and 4 to be completed.
2. Replaced with GSPs and Stanislaus County Multi-Agency SWRP.
3. Modesto portion under construction. Turlock portion to start construction in 2018.
4. Turlock removed project as road improvements were completed prior to execution

9.4 Plan Updates

The East Stanislaus IRWMP is meant to be a living document and will therefore periodically be updated to reflect changing conditions such as population growth and climate change, as well as project implementation in the Region. The Region's needs will undoubtedly change in the future, and as they do, regional objectives must be re-evaluated and new, applicable regional solutions identified. Plan implementation will be assessed as to its performance in achieving the identified regional objectives during IRWMP updates no less than every five years. The ESRWMP will update the East Stanislaus IRWMP when deemed appropriate; this could be when one or more of the following criteria are met:

- Five years since the last Plan adoption.
- DWR updates its IRWM Plan Guidelines and associated Plan Standards.
- DWR releases a Proposal Solicitation Package (PSP) for IRWM implementation grants.
- Project and plan monitoring have occurred leading to the identification of needed revisions to the East Stanislaus IRWMP or projects included in the Plan.

The next IRWMP update will likely new information regarding the SWRP and GSPs. The prioritized project list, contained in the appendices of this IRWMP, will be revised during Plan updates or more frequently, as needed. For example, the project list could be updated in response to an upcoming grant solicitation. The revised project list will be vetted by the ESRWMP among regional stakeholders following updating, and upon receiving consensus, will substitute the updated project list for the one currently contained herein. No formal plan adoption or re-adoption will be required for project list updating. Similarly, should administrative revisions be made to the IRWMP (e.g. based on DWR recommendations during completeness review), the Plan may not require re-adoption. Table 9-5 summarizes the long-term maintenance activities to be conducted for the East Stanislaus IRWMP; the frequencies identified for each activity are minimum frequencies.

Table 9-5: Summary of Long-Term East Stanislaus IRWMP Maintenance Activities

Activity	Frequency
ESRWMP Meetings (financing, regional water resources issues, other)	As needed
Project Solicitation, Review, Integration and Prioritization	As needed, no less than every 5 years
Plan and Project Monitoring and Performance	Annually
IRWM Plan Review and Update	As needed, no less than every 5 years
Outreach	Continuously

Chapter 10

East Stanislaus Region Integrated Regional Water Management Plan Update

Chapter 10 References

Ackerman, Frank and Elizabeth A. Stanton. 2011. The Last Drop: Climate Change and the Southwest Water Crisis. Stockholm Environmental Institute – U.S. Center. February.

Bentz, Barbara J., et al. September 2010. Climate Change and Bark Beetles of the Western United States and Canada: Direct and Indirect Effects. BioScience. 160(8): 602-613.

Benziger, Jeff. 2012. Hughson Can Grow with New Sewer Plant. Turlock Journal. May 8, 2012. Accessed at: http://www.turlockjournal.com/archives/14891/.

Bookman-Edmonston. 2005. Integrated Regional Groundwater Management Plan for the Modesto Subbasin – Stanislaus and Tuolumne Rivers Groundwater Basin Association. April 2005.

California Air Resources Board (CARB). 2008. Climate Change Scoping Plan: A Framework for change. December 2008.

CARB. 2011. Attachment D, Final Supplement to the AB 32 Scoping Plan Functional Equivalent Document. August 19.

California Climate Action Team (CAT), Water-Energy Sector Sub Group. 2009. Water-Energy Sector Summary, AB 32 Scoping Plan, GHG Emissions Reduction Strategies. March 4.

California Department of Finance (DOF). 2017. Department of Finance Releases New State Population Projections. Press release. March 8.

California Department of Fish and Wildlife (CDFW). 1995. Stanislaus River Basin and Calaveras River Water Use Program, Threatened and Endangered Species Report. Bay Delta and Special Water Projects Division. March.

California Department of Public Health (CDPH). 2013. Small Community Water Systems with Known Violations. January.

California Department of Water Resources (DWR). 2003. Bulletin 118 – Update 2003: San Joaquin Valley Groundwater Basin, Turlock Subbasin. Last updated January 20, 2006.

DWR. 2006. Progress on Incorporating Climate Change into Management of California's Water Resources. Technical Memorandum Report. Accessed April 24, 2011.

DWR. 2008. Managing an Uncertain Future: Climate Change Adaptation Strategies for California's Water. October.

DWR. 2010a. Proposition 84 & 1E Integrated Regional Water Management Guidelines. August.

DWR 2010b. 20x2020 Water Conservation Plan. February.

DWR. 2010c. State Water Project Delivery Reliability Report 2009.

DWR. 2012a. Draft Climate Action Plan. March.

DWR. 2012b. State Water Project Delivery Reliability Report 2011. June.

DWR. 2013. California Water Plan Update 2013 – Investing in Innovation and Infrastructure. DWR Bulletin 160-13.

DWR. 2016a. Proposition 1 Integrated Regional Water Management Grant Program Guidelines. July.

DWR. 2016b. Table of Critically Overdrafted Basins. January 2016. Accessed at: http://www.water.ca.gov/groundwater/sgm/pdfs/COD_BasinsTable.pdf

DWR. 2017. Central Valley Flood Protection Plan 2017 Update. August 2016.

California Energy Commission (CEC) Public Interest Energy Research Program (PIER). 2008. The Future Is Now: An Update on Climate Change Science, Impacts, and Response Options for California. Publication # CEC-500-2008-077.

California Environmental Protection Agency (CalEPA). 2013. Indicators of Climate Change in California. August 2013.

California Natural Resources Agency (CNRA) and the California Emergency Management Agency (CEMA). 2012. Draft California Climate Change Adaptation Policy Guide. April.

CNRA. 2014. Safeguarding California: Reducing Climate Risk. An update to the 2009 California Climate Adaptation Strategy. July.

CNRA. 2017. State & Federally Listed Endangered & Threatened Animals of California. April.

CNRA. 2009. 2009 California Climate Change Adaptation Strategy: A Report to the Governor of the State of California in Response to Executive Order S-13-2008. As viewed at http://www.climatechnage.ca.gov/adaptation/

California State Assembly. 2006. Assembly Bill No. 32 (Chapter 488).

California State Senate. 2007. Senate Bill No. 97 (Chapter 185).

California State Senate. 2008. Senate Bill No. 375 (Chapter 728).

California State Water Resources Control Board (SWRCB). 2012. Public Draft, Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality. December.

California Urban Water Agencies (CUWA). 2007. Climate Change and Urban Water Resources.

Camp Dresser McKee (CDM). 2011. Climate Change Handbook for Regional Water Planning. Prepared for the U.S. Environmental Protection Agency Region 9 and the California Department of Water Resources. November.

Cantatore, Alex. 2010. Pilots Brave Winter Storms in Cloud Seeding Program. Posted December 10, 2012. Accessed here http://www.turlockjournal.com/section/12/article/17895/ on April 10, 2013.

Capitol PFG. 2016. Sewer User Rate Study: Salida Sanitary District. March 10, 2016. Accessed at http://salidasanitary.net/SalidaSewerRateStudy.pdf.

Carollo Engineers. 2006. City of Hughson 2005 Urban Water Management Plan. November 2006.

Carollo Engineers. 2007a. City of Hughson Water System Master Plan. January 2007.

Carollo Engineers. 2007b. City of Hughson Storm Drainage System Master Plan. February 2007.

Carollo Engineers. 2007c. City of Hughson Sewer System Master Plan. June 2007.

Carollo Engineers. 2007d. City of Hughson Wastewater Treatment Plan Master Plan. June 2007.

Carollo Engineers. 2016. Final City of Modesto Wastewater Master Plan Update, Master Plan Report.

Carollo Engineers. 2007f. Final City of Modesto Wastewater Collection System Master Plan. March 2007.

Carollo. 2008. City of Modesto Wastewater Treatment Master Plan Supplement. September.

Carollo. 2016. City of Modesto Wastewater Treatment Master Plan.

Cayan, Dan, Mary Tyree, Mike Dettinger, Hugo Hidalgo, Tapash Das, Ed Maurer, Peter Bromirski, Nicholas Graham and Reinhard Flick. 2009. Climate Change Scenarios and Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment. CED-500-2009-014-F. California Climate Change Center. As viewed at www.energy.ca.gov/2009publications/CEC-500-2009-014/CEC-500-2009-014-D.pdf

Cayan, Dan. Amy Lynd Luers, Michael Hanemann, Guido Franco, Bart Croes. 2006. Scenarios of Climate Change in California: An Overview. California Energy Commission Publication CEC-500-2005-186-SF.

Central Valley Regional Water Quality Control Board (CVRWQCB). 2004. Watershed Management Initiative Chapter. December 1, 2002 with revision as of October 2004.

CVRWQCB. 2016. The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board, Central Valley Region, Fourth Edition, for the Sacramento River Basin and San Joaquin River Basin. Revised July 2016 (with Approved Amendments).

Ceres, City of. 2016a. City of Ceres 2015 Urban Water Management Plan. June 2016.

Ceres, City of. 2016b. Annual Financial Report for the Fiscal Year Ended June 30, 2016.

Chung, F., J. Anderson, S. Arora, M. Ejeta, J. Galef, T. Kadir, K. Kao, A. Olson, C. Quan, E. Reyes, M. Roos, S. Seneviratne, J. Wang, H. Yin. 2009. Using Future Climate Projections to Support Water Decision Making in California. California Energy Commission publication CEC-500-2009-52-F.

Congressional Budget Office (CBO). 2009. Potential Impacts of Climate Change in the United States. May.

Davids Engineering. 2012. Oakdale Irrigation District, Agricultural Water Management Plan, December 2012. December.

Davids Engineering. 2016. Oakdale Irrigation District, Agricultural Water Management Plan, December 2016. March.

Design, Community & Environment. 2005. Hughson General Plan. December 12, 2005.

Dettinger, Michael and Sam Earman. 2007. Western Ground Water and Climate change – Pivotal to Supply sustainability or Vulnerable in its Own Right? National Groundwater Association, Association of Groundwater Scientists and Engineers, Ground Water News & Views, Volume 4, No. 1. June.

Dyett & Bhatia. 2012. Turlock General Plan. September 2012.

Epke, Gerhard, Mandi Finger, Robert Lusardi, Naomi Marks, Jeffery Mount, Andrew Nichols, Sarah Null, Teejay O'Rear, Sabra Purdy, Anne Senter, and Joshua Viers. 2010. Confluence: A Natural and Human History of the Tuolumne River Watershed. Summer.

ESA. 2013. Mid San Joaquin River Regional Flood Management Plan, Administrative Draft. July 2013.

ESA. 2014. Regional Flood Management Plan for the Mid San Joaquin River Region. November 2014.

Galloway, Devin L. and Francis S. Riley. 1999. San Joaquin Valley, California - Largest human alteration of the Earth's surface. In Land Subsidence in the United States. U.S. Geological Survey Circular 1182, pp. 23-34, http://pubs.usgs.gov/circ/circ1182/, accessed Feb. 13, 2009.

Hayhoe, Katharine, et al. 2004. Emissions Pathways, Climate Change and Impacts on California. Published in the Proceedings of the National Academy of Sciences of the United States of America, Volume 101, Number 34. August 24. pp 12422-12427.

Hopmans, Jan, Gerrit Schoups, and Ed Maurer. 2008. Global Warming and its Impacts on Irrigated Agriculture in the San Joaquin Valley (SJV). As viewed at https://sunsite.berkeley.edu/WRCA/WRC/pdfs/GW26thHopmans.pdf. August 22.

Howatt, Ian M. and Slawek Tulaczyk. 2005. Climate sensitivity of spring snowpack in the Sierra Nevada. As seen in the Journal of Geophysical Research, Volume 110, F04021, 9 pp. December 8.

Howitt, Richard, Josué Medellin-Azuara, and Duncan MacEwan. 2009. Estimating the Economic Impacts of Agricultural Yield Related Changes for California. CED-500-2009-042-F. California Climate Change Center, as viewed at http://www.energy.ca.gov/2009publications/CED-500-2009-042/CED-500-2009-042-F.pdf

Hughson, City of. 2016. City of Hughson Annual Financial Report, Fiscal Year Ended June 30, 2016.

Hydrocomp, Inc. 2012. Sensitivity of Upper Tuolumne River Flow to Climate Change Scenarios. January.

ICF. 2012. Evaluation of San Joaquin River Flow and Southern Delta Water Quality Objectives and Implementation. December.

ICF. 2015. Stanislaus County Disadvantaged Unincorporated Communities Report. November 2015.

ICF. 2016. Stanislaus County General Plan and Airport Land Use Compatibility Plan Update Final Program Environmental Impact Report. July 2016.

ICF Jones & Stokes. 2009. 2010 Water System Engineer's Report Draft Program Environmental Impact Report, SCH # 2008092095. December 2009.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: Synthesis Report.

Kahrl, Fredrich and David Roland-Holst. 2008. California Climate Risk and Response. November.

Kjeldsen, Sinnock, & Neudeck, Inc. 2016. City of Riverbank 2015 Urban Water Management Plan. October 17, 2016.

Letter from Katy Sanchez, Program Analyst at the Native American Heritage Commission to Michael Cooke, Regulatory Affairs Manager of the City of Turlock, dated September 29, 2009 Regarding Proposed Turlock Regional Water Quality Control Facility Upgrade and Expansion.

Leung, L. Ruby, and William I. Jr. Gustafson. 2005. Potential Regional Climate Change and Implications to U.S. Air Quality. As published in the Geophysical Research Letters, 32:L16711.

Loáiciga, Hugo A. 2003. Climate Change and Groundwater. As published in the Annals of the Association of American Geographers. 93(1), pp 30-41.

Lobell, David B., Kimberly Nicholas Cahill, and Christopher B. Field. 2006. Weather-based yield forecasts developed for 12 California Crops. As published in California Agriculture, 60:4, pp211-15. As viewed at http://dx.doi.org/10.1007/s1-10584-006-9141-3

Lobell, David B., Kimberly Nicholas Cahill, and Christopher B. Field. 2007. Historical effects of temperature and precipitation on California Crop Yields. As published in Climate Change, 81:2, pp187-203. As viewed at http://www.escholarship.org/uc/item/3d53x9mc

Lundquist, Jessica D. and Daniel R. Cayan. 2002. Seasonal and Spatial Patters in Diurnal Cycles in Streamflow in the Western United States. As published in Journal of Hydrometeorology, by the American Meteorological Society, Volume 3, pp. 591-603. October.

Lundquist, Jessica D., Michael D. Dettinger, and Daniel R. Cayan. 2005. Snow-fed streamflow timing at different basin scales: Case study of the Tuolumne River above Hetch Hetchy, Yosemite, California. As published in Water Resources Research, Volume 41, July 7.

Merced River Watershed Portal. http://mercedriverwatershed.org/

Modesto, City of. 2008. Final Urban Area General Plan. October 14, 2008.

Modesto, City of. 2016. Comprehensive Annual Financial Report, FY 2015-2016.

West Yost. 2017. City of Modesto Water Master Plan.

Modesto Irrigation District (MID). 2012. Modesto Irrigation District Agricultural Water Management Plan for 2012. December.

Moser, Susanne, Julia Ekstrom and Guido Franco. 2012. Our Changing Climate 2012, Vulnerability & Adaptation to the Increasing Risks from Climate Change in California. A Summary Report on the Third Assessment from the California Climate Change Center. CEC-500-2012-007. July.

National Marine Fisheries Service. 2009. Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the District Population Segment of Central Valley Steelhead. October.

Null, Sarah E., Joshua H. Viers, and Jeffery F. Mount. 2010. Hydrologic Response and Watershed Sensitivity to Climate Warming in California's Sierra Nevada. April 1.

Perazzo, Peggy B. 2011. Stone Quarries and Beyond. Retrieved December 29, 2011 from http://quarriesandbeyond.org/states/ca/quarry_photo/ca-stanislaus_photos.html. Last updated 6/23/2011.

Provost & Pritchard. 2015. Agricultural Water Management Plan, 2015 Update, for the Modesto Irrigation District. December 2015.

Public Policy Institute of California. 2008. Adapting California's Water Management to Climate Change. November 2008.

Quad Knopf. 2007. Draft Environmental Impact Report for the Hughson Wastewater Treatment Plant, SCH # 2006122032. June 2007.

RMC Water and Environment. 2011. California Department of Water Resources Integrated Regional Water Management Program, East Stanislaus IRWM Region Acceptance Process. April 2011.

RMC Water and Environment. 2013. North Valley Regional Recycled Water Program Feasibility Study. December.

RRM Design Group. 2001. North Turlock Master Plan. October 2001.San Joaquin River Group Authority. 1999. San Joaquin River Agreement Final EIS/EIR. January 28.

Schlenker, Wolfram, W. Michael Hanemann, and A. C. Fisher. 2007. Water availability, degree days and the potential impact of climate change on irrigated agriculture in California. As viewed in Climate Change, 81:1, pp 19-38. As viewed at http://dx.doi.org/10.1007/s10584-005-9008-z

Schoups, G., E.P. Maurer and J.W. Hopmans. 2005. Climate change impacts on water demand and salinity in California's irrigated agriculture.

Schoups, Gerrit, Ed Maurer, and Jan Hopmans, et al. 2009. Climate Change Impacts on Subsurface Hydrology, Crop Production, Water Use and Salinity in the San Joaquin Valley, CA. As presented at the DWR-UC Workshop on Climate Change Impacts, January 26.

Shoreline Environmental Engineering. 2016. City of Waterford, Water Master Plan – Final Draft. September.

Stanislaus County. 2004. Storm Water Management Program for Stanislaus County, Report of Waste Discharge. Submitted February 23, 2004, revised May 18, 2004.

Stanislaus County. General Plan. As viewed at http://www.stancounty.com/planning/pl/general-plan.shtm on February 15, 2013.

Stanislaus County. 2015. Stanislaus County General Plan. Available at: http://www.stancounty.com/planning/pl/general-plan.shtm.

Stanislaus County. 2016. Comprehensive Annual Financial Report, County of Stanislaus, California, Fiscal Year Ended June 30, 2016.

Stanislaus County Agricultural Commissioner's Office. 2015. 2015 Annual Crop Report.

Stanislaus River Watershed Data. As viewed at http://hydra.ucdavis.edu/watershed/stanislaus in February 2013.

Stantec. 2008. City of Modesto 2008 Storm Drainage Master Plan, Draft. March 2008.

State Water Resources Control Board. 2012. Public Draft, Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality, Executive Summary. December.

Stene, Eric A. 1994. Delta Diversion, Central Valley Project.

Stillwater Sciences. 2008. The Merced River Alliance Project, Final Report, Volume II: Biological Monitoring and Assessment. September.

The H2O Group. 2012. City of Patterson 2010 Urban Water Management Plan. July.

Timothy J. Durbin, Inc. 2008. Assessment of Future Groundwater Impacts Due to Assumed Water-Use Changes Turlock Groundwater Basin, California. September 11.

Treidel, Holger, Jose Luis Martin-Bordes, and Jason J. Gurdak (ed.). 2012. Climate Change Effects on Groundwater Resources, A Global Synthesis of Findings and Recommendations. CRC Press.

Tulloch Engineering. 2004. Stormwater Management Program for the Cities of Ceres, Oakdale, Patterson, Riverbank, Report of Waste Discharge. March 10, 2003.

Turlock, City of. 2003. City of Turlock Water Resources Division, NPDES Phase II Storm Water Management Plan.

Turlock, City of. 2004. Northeast Turlock Master Plan. February 10, 2004.

Turlock, City of. 2011. City of Turlock 2010 Urban Water Management Plan, Public Draft. July 2011.Turlock, City of. 2016. City of Turlock Financial Reports for the Year Ended June 20, 2016.

Turlock Groundwater Basin Association (TGBA). 2008. Turlock Groundwater Basin Draft Groundwater Management Plan. January 17, 2008.

Turlock Irrigation District (TID). 2012. Turlock Irrigation District 2012 Agricultural Water Management Plan. December.

TID. 2015. Turlock Irrigation District 2015 Agricultural Water Management Plan. November 2015.

United States Bureau of Reclamation (USBR). 2011. SECURE Water Act Section 9503(c) – Reclamation Climate Change and Water, 2011. April.

United States Census Bureau, Population Division. 2017. Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2016. Accessed at https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

United States Climate Change Science Program (CCSP). 2008. Weather and Climate Extremes in a Changing Climate. Regions of Focus: North American, Hawaii, Caribbean and U.S. Pacific Islands. Synthesis and Assessment Product 3.3. June.

CCSP. 2009. Best Practice Approaches for Characterizing, Communicating, and Incorporating Scientific Uncertainty in Decision Making. Synthesis and Assessment Product 5.2. January.

United States Department of the Interior, Bureau of Indian Affairs. 2012. Tribal Leaders Directory. Fall 2012.

United States Department of the Interior, Bureau of Indian Affairs. 2013. Pacific Region – Tribes Served. Accessed here: http://www.bia.gov/WhoWeAre/RegionalOffices/Pacific/WeAre/Tribes/index.htm on January 14, 2013.

United States Environmental Protection Agency (USEPA). 2012a. Climate Ready Water Utilities Adaptation Strategies Guide for Water Utilities. EPA 817-K-11-003. January.

USEPA. 2012b. Planning for Sustainability, A Handbook for Water and Wastewater Utilities. EPA-832-R-12-001. February.

USEPA. 2012c. National Water Program 2012 Strategy: Response to Climate Change. December.

USEPA. 2015. Climate Ready Water Utilities Adaptation Strategies Guide for Water Utilities. EPA 817-K-15-001. February.

USEPA and DWR. 2011. Climate Change Handbook for Regional Water Planning. November.

United States Geological Survey (USGS), Office of Global Change. 2009. Effects of Climate Variability and Change on Groundwater Resources of the United States. Fact Sheet 2009-3074. September.

USGS. 2015. Hydrologic Model of the Modesto Region, California, 1960–2004. Scientific Investigations Report 2015–5045.

United States Global Change Research Program (USGCRP). 2009. Global Climate Change Impacts in the United States. June 2009.

University of California, Davis. 2012. Vulnerability and Adaptation to Climate Change in California Agriculture. A White Paper from the California Energy Commission's California Climate Change Center. CEC-500-2012-031. July.

Valtorta, Silvia. 2002. Animal production in a changing climate: impacts and mitigation. October. Water Utility Climate Alliance. 2010. Decision Support Planning Methods: Incorporating Climate Change Uncertainties into Water Planning. January 2010.Waterford, City of. 2007. Waterford Municipal Service Review. August 2007. Prepared for the Stanislaus Local Agency Formation Commission.

Waterford, City of. 2016. City of Waterford, California, Annual Financial Report for the Fiscal Year Ended June 30, 2016.

West Yost Associates. 2011a. City of Ceres 2010 Urban Water Management Plan Update, Draft. April 2011.

West Yost Associates. 2011b. City of Modesto and Modesto Irrigation District 2010 Joint Urban Water Management Plan. May 2011.

West Yost Associates. 2016a. City of Modesto 2015 Urban Water Management Plan. June 2016.

West Yost Associates. 2016b. City of Turlock 2015 Urban Water Management Plan. June 2016.

West Yost Associates. 2017. City of Modesto Water Master Plan.

Prepared by:

RMC water and environment

WOODARD & CURRAN

2175 N. California Blvd., Suite 315
Walnut Creek, CA 94596

925.627.4100

woodardcurran.com