

EXECUTIVE SUMMARY

ES.1 2014 IRWMP Update

The 2014 Eastern San Joaquin Integrated Regional Water Management Plan (IRWMP) is an update and expansion of the 2007 IRWMP prepared for the Eastern San Joaquin Region.¹ There has been significant progress toward implementing the goal of improving the sustainability and reliability of water supplies in the Region, but the process is ongoing and as yet incomplete. The Plan update complies with the most recent DWR guidelines and adds additional considerations including examination of climate change impacts, inter-regional cooperation, and expanded analysis of stormwater and floodwater management.

ES.2 Regional Water Management Agency



Water agencies in the Eastern San Joaquin Region are challenged to provide adequate water supplies and effectively provide groundwater management which transcends their individual powers and authorities. The Eastern San Joaquin County Groundwater Basin Authority² (GBA) recognizes that a regional consensus-based approach to water resources planning and water management increases the chance of successfully meeting these challenges.

Since its formation as a Joint Powers Authority in 2001, the GBA has employed the consensus-based approach in its goal to develop "...locally supported conjunctive use projects that improve water supply reliability in San Joaquin County... and provide benefits to project participants as a whole. Collaboration among the GBA member agencies has strengthened the potential for broad public support, as well as the ability to leverage local, state, and federal funds. The GBA membership has expanded since 2007 and is listed in Table ES-1.

The GBA is the regional water management group responsible for the development and implementation of the 2014 Eastern San Joaquin IRWMP Update. The GBA, together with San Joaquin County, is a Department of Water Resources Conjunctive Water Management Branch partner.

Table ES-1 Member Agencies, Eastern San Joaquin County Groundwater Basin Authority

City of Stockton
California Water Service Company
City of Lodi
Woodbridge Irrigation District
North San Joaquin Water Conservation District
Central San Joaquin Water Conservation District
Stockton East Water District
Central Delta Water Agency
South Delta Water Agency
San Joaquin County Flood Control and Water Conservation District
South San Joaquin Irrigation District
San Joaquin Farm Bureau Federation*

* Associate Member

¹ Northeastern San Joaquin County Groundwater Banking Authority, July 2007, "Eastern San Joaquin Integrated Regional Water Management Plan"

² Formerly the Northeastern San Joaquin County Groundwater Banking Authority. The GBA was renamed in October 2013 to better reflect its activities and goals.



ES.3 IRWMP Purpose, Objective and Planning Process

The purpose of this IRWMP is to define and integrate key water management strategies to establish the protocols and course of action for implementation of the Eastern San Joaquin Integrated Conjunctive Use Program (ICU Program). The ICU Program will implement a comprehensive, prioritized set of projects and actions that when implemented will meet adopted Basin Management Objectives and provide regional benefits to area stakeholders.

The objective adopted for both the 2007 IRWMP and the 2014 Update is stated as follows:

It is the Objective of the GBA to ensure the long-term sustainability of water resources in the San Joaquin Region while:

- *Equitably distributing benefits and costs;*
- *Minimizing adverse impacts to agriculture, communities, and the environment;*
- *Maximizing efficiency and beneficial use of supplies; and,*
- *Protecting and enhancing water rights and supplies.*

The IRWMP Update process began in late 2012, five years after adoption of the 2007 IRWM Plan. The Update is funded through an Integrated Regional Water Management Planning Grant from DWR. The 2014 Plan meets DWR's revised 2009 IRWM requirements for addressing climate change, stormwater and flood management, expanded outreach to identify and address the water needs of disadvantaged communities, and other topics.

ES.4 Regional Planning Area

For the purposes of this IRWMP, the Eastern San Joaquin Region is defined as that portion of the San Joaquin region which overlies the Eastern San Joaquin and Cosumnes Sub-Basins and coincides with the adopted Groundwater Management Area (GMA). The Regional Planning Area and the overlying agencies are depicted in Figure ES-1. To ensure that every parcel in the Regional Planning Area is represented, all unorganized areas are included in and represented by the San Joaquin County Flood Control and Water Conservation District.



The map displays the Eastern San Joaquin County Groundwater Management Area, divided into 15 numbered regions. Each region is color-coded and patterned to represent different water districts or agencies. The regions are: 1 (Woodbridge Irrigation District, dark green with dots), 2 (City of Lodi, light green with dots), 3 (North San Joaquin Water Conservation District, yellow with dots), 4 (City of Stockton, red with dots), 5 (Stockton East Water District, orange with dots), 6 (Central San Joaquin Water Conservation District, light green with dots), 7 (City of Lathrop, pink with dots), 8 (City of Manteca, light green with dots), 9 (South San Joaquin Irrigation District, yellow with dots), 10 (Oakdale Irrigation District, light green with dots), 11 (City of Escalon, light green with dots), 12 (City of Ripon, light green with dots), 13 (Central Delta Water Agency, blue with dots), 14 (South Delta Water Agency, pink with dots), and 15 (San Joaquin County Flood Control and Water Conservation District, yellow with dots). The map also shows major highways (Interstates 5, 99, 205, 580, State Routes 4, 12, 26, 88, 120) and a scale bar from 0 to 10 miles. A legend at the bottom identifies the numbered regions and the groundwater management area.

1 WOODBRIDGE IRRIGATION DISTRICT	11 CITY OF ESCALON
2 CITY OF LODI	12 CITY OF RIPON
3 NORTH SAN JOAQUIN WATER CONSERVATION DISTRICT	13 CENTRAL DELTA WATER AGENCY
4 CITY OF STOCKTON	14 SOUTH DELTA WATER AGENCY
5 STOCKTON EAST WATER DISTRICT	15 SAN JOAQUIN COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
6 CENTRAL SAN JOAQUIN WATER CONSERVATION DISTRICT	
7 CITY OF LATHROP	
8 CITY OF MANTECA	
9 SOUTH SAN JOAQUIN IRRIGATION DISTRICT	
10 OAKDALE IRRIGATION DISTRICT	

Legend:
 [Patterned Box] EASTERN SAN JOAQUIN COUNTY GROUNDWATER MANAGEMENT AREA

Scale: 0 2.5 5 10 Miles

Compass Rose: N, S, E, W

ES.5 Regional Integration Concepts

The focus of the Eastern San Joaquin IRWM Plan is the conjunctive water management needs of eastern San Joaquin County; however, the need to coordinate and cooperate internally and externally is undeniable and absolutely necessary for the success of the IRWMP. Water projects will always affect, in some manner, an upstream or downstream agency. Projects proposed by the GBA are no different. To facilitate coordination and cooperation, the GBA proposes the following conceptual framework for intra-regional and inter-regional collaboration.

- Intra-regional coordination refers to collaboration within the boundaries of the Regional Planning Area. The following concepts are promoted by the GBA to help stakeholders understand how their actions affect areas adjacent to them and throughout the Region.
- The GBA has defined a Regional Integration Area as that portion of the state that may influence, provide guidance to or contribute to the IRWMP. A Potential Solution Area (mostly upstream or upgradient) may provide water resource solutions to problems addressed in the IRWMP; and a Potential Benefits Area as those areas that may benefit from the development of the Eastern San Joaquin Basin Integrated Conjunctive Use Program. Because of its geographic proximity to the Delta, groundwater banking projects have the potential to benefit almost any hydrologically connected part of the state.
- The GBA has been working with the adjacent Mokelumne/Amador/Calaveras Region since 2005 as part of the Mokelumne Forum Process, and is currently working with that Region to develop the Mokelumne Watershed Interregional Sustainability Evaluation (MokeWISE) process.

ES.6 Disadvantaged Community Outreach

Disadvantaged Community (DAC) outreach was initially addressed as part of the 2007 IRWMP. The DAC outreach effort was redoubled in this update of the IRWMP to better identify and address the needs of the DACs in the Region. An outreach plan was developed to guide DAC engagement and is now structured so that it can be continued for the life of the IRWM Plan. The State defines a disadvantaged community as one where the median household income is below 80 percent of the statewide median, or about \$48,700 per year. A DAC project is any project that meets the water-related needs of one or more DACs and has support of the DAC members.

Goals and objectives were established for the engagement of DAC representatives, and strategies developed to identify governmental and non-governmental organizations to help identify needs and possible remedial projects or actions. The GBA team acted as intermediaries between the organizations and possible implementing water agencies. A series of public meetings was held to both provide and receive information, and a request for projects solicitation was sent to a broad range of community and governmental organizations. This process revealed several previously unidentified issues such as localized flooding, poor quality well water, and mercury levels in locally caught fish.

Several DAC projects were identified and carried forward into the evaluation phase of this IRWMP. The Disadvantaged Community outreach process is documented in Chapter 5 of this document.



ES.7 Land and Water Use

San Joaquin County's population totals 690,000 and ranks the fifteenth largest in the State. Its annualized growth is from 2000 to 2010 was 1.9 percent. Annualized growth through 2035 is estimated at 1.6 percent, which will increase population by nearly 50 percent to over one million. The attraction of affordable housing combined with the higher wages of the Bay Area will continue to be a driver in population growth. Accommodating planned growth in San Joaquin County is a huge challenge for land use entities throughout the Regional Planning Area.

For the purposes of this IRWMP, the current planning level is assumed to be 2010 for urban and water use while future conditions assume a 2035 planning horizon. The IRWMP assumes that urban growth will occur as either infill or entirely within spheres of influence delineated in the latest General Plan revision. To account for the loss of agricultural production, it is assumed that existing agricultural irrigation within the spheres of influence will be entirely replaced with urban uses by 2035. Agricultural water demands are expected to decrease throughout the Regional Planning Area as urban development continues. Growth of irrigated agriculture on marginal lands (primarily in the easternmost portion of the County) has been estimated. Table ES-2 summarizes the estimated and projected urban and agricultural water demands for the Regional Planning Area.

Table ES-2 Estimated and Projected Water Demands for the Regional Planning Area (acre-feet per year)

Water Use Sector	2010 Estimated Water Demand	2035 Projected Water Demand	Demand Change
Urban	154,566	236,500	+81,934
Agricultural	1,051,855	984,516	-67,339
Total	1,206,421	1,221,016	+14,595

ES.8 Groundwater Level Trends

Beginning in 1850 the development of groundwater for agriculture expanded rapidly. Within the Central Valley one hundred years ago, irrigated agriculture has grown from less than 1 million acres to an estimated 7 to 8 million acres at present. In average years almost 870,000 acre-feet of groundwater is pumped per year from the Regional Planning Area. In Bulletin 118-80, DWR designated the Eastern San Joaquin Basin as "critically overdrafted".

Figure ES-2 illustrates groundwater level changes from Fall 1992 to Fall 2012. The map clearly shows the significant groundwater level recovery in the central and western areas that have gained new surface water supplies. Groundwater gradients in the vicinity of Stockton are about 0.15% eastward towards the central cone of depression. Degradation of water quality due to saline migration threatens the long-term sustainability of underlying basin. Salt laden groundwater is unusable for either urban drinking water needs or for irrigating crops. The saline migration problem is not well understood. Limited



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studies and monitoring have produced postulates as to the sources and extent of the saline front. Groundwater modeling, performed prior to significant pumping reductions enabled by Stockton's use of the Delta Water Supply Project, estimates that inflow from the west is estimated at 42,000 acre-feet per year and is considered an undesirable source of lateral inflow due to elevated chloride levels.

ES.9 Integrated Regional Water Management Plan Framework

The Eastern San Joaquin Region IRWMP Framework can be described as a reflection of the values and needs of the community. The IRWMP Framework utilizes a nested tier system that begins with a Problem and Mission statement and then drills down through refining steps leading to specific evaluation and prioritization criteria by which the solution, the ICU Program, is measured and is ultimately implemented. Items in each lower tier directly relate to and support the concepts at each higher level.

ES.10 Basin Operations Criteria

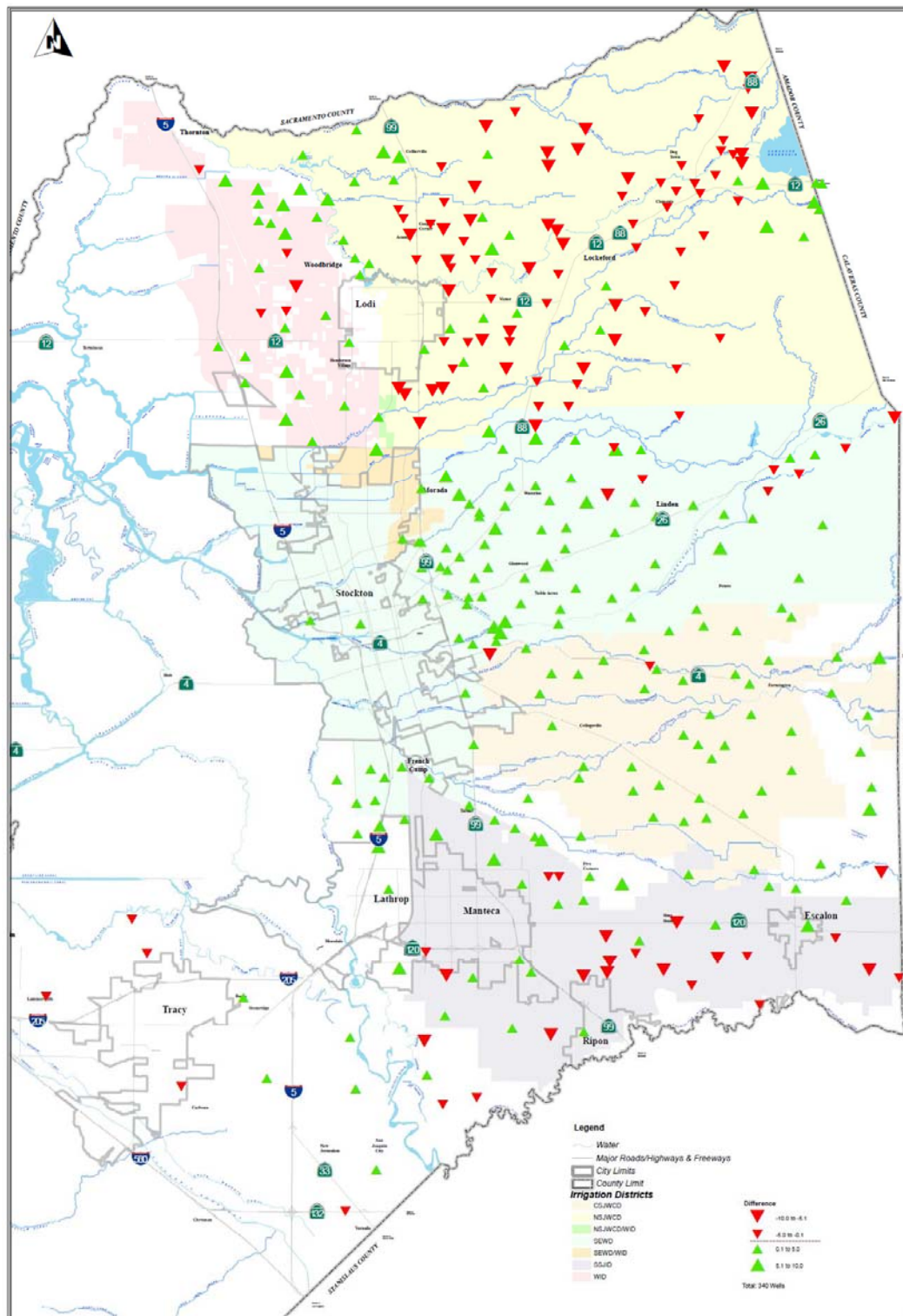
Essentially, Basin Operations Criteria are a quantitative management framework proposed to monitor and predict changes in basin conditions and gauge ICU Program operations within the Regional Planning Area. Within each of these areas, specific groundwater measurement criteria have been proposed based on historic groundwater levels as defined by the following:

- **Pre-1960 Elevation** – the Eastern San Joaquin Groundwater Basin contour measured in 1960 is considered as the top elevation in the basin management framework. It was assumed that this elevation was established prior to significant growth groundwater use during the past 54 years.
- **Fall 1986 Elevation** - the Eastern San Joaquin Groundwater Basin contour measured in 1986 is proposed as the criterion for normal conjunctive use operations in the Basin. If ICU Program projects can be developed to re-establish this elevation, there is general agreement that the basin is in good health. The Fall 1986 level was the highest groundwater elevation in the over-drafted portion of the basin in the past 30 years.
- **Fall 1992 Elevation** – the Eastern San Joaquin Groundwater Basin contour measured in 1992 is proposed as the basin management framework baseline. Groundwater fell to its lowest recorded elevation in 1992 following a significant drought period and it is considered undesirable to drop below this level.
- **Basin Reserve** – a quantifiable portion of the groundwater management area between the 1986 and 1992 contours that is dedicated as a water resource reserve to be utilized under dry year or drought conditions.
- **Basin Terminal Pool** - that portion of the groundwater management framework below the 1992 historic groundwater contour.



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Figure ES-2 Groundwater Elevation Change Fall 1992 to Fall 2012 (feet MSL)

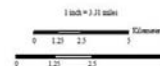


Differences in Groundwater Elevations Fall 2012 vs Fall 1992

San Joaquin County Public Works Water Resources

1810 East Hamilton Avenue, Stockton, CA 95205

This information is being provided based on the most current information available in the San Joaquin County Water Resources. The contents of this report are not to be used as a basis for any project or program. The information on this map is not intended to represent engineering, technical or project results.



Prepared by: Geomatrix Consultants, Inc.

ES.11 Summary of Alternatives from 2007 IRWMP

The 2007 IRWMP developed four composite Alternatives, each of which would allow recovery of groundwater levels with fluctuations around the 1986-1992 elevation bands described above. Each of the Alternatives would on average recharge 130,000 to 150,000 acre-feet per year, at a capital cost of \$600 million to \$900 million at a resulting unit cost of \$330 to \$460 per acre-foot. The 2007 IRWMP Alternatives are summarized in Table ES-3. These costs are significantly greater than the community's ability to pay, and significantly higher than current agricultural supplies. Urban uses are already supplied largely by surface water.

Table ES-3 Summary of Alternatives from 2007 IRWMP

	Total Net Recharge (KAF/yr)	Capital Cost (\$M)	O&M Cost (\$M/yr)	Annualized Cost (\$M/yr)	Unit Cost (\$/AF)
Alternative A	151	\$921	\$10.1	\$68.5	\$460
Alternative B	133	\$712	(\$1.7)	\$43.5	\$330
Alternative C	138	\$584	\$13.7	\$50.8	\$370
Alternative D	148	\$829	\$10.3	\$62.8	\$420

ES.12 Progress Since 2007 IRWMP

In January 1980, DWR issued Bulletin 118-80 which described the San Joaquin County Groundwater basin as “critically overdrafted.” Subsequent studies and technical reports verified the long-term decline in water levels. Public agencies within the County responded over the next several decades by emphasizing projects which would benefit the groundwater basin and potentially alleviate the overdraft. Approximately \$700 million has been spent by the various agencies implementing these projects, which collectively have developed 149,000 acre-feet of annual supply. If the use of all facilities and entitlements developed and obtained since 1980 were maximized, total additional surface water deliveries within the County since 1980 could potentially reach 309,000 acre-feet per year.

Three projects have begun operations since publication of the 2007 IRWMP.

ES.12.1 Stockton Delta Water Supply Project, Phase 1

The Stockton Delta Water Supply Project (DWSP) has added significant surface water treatment capacity to the region. In 1996, the City of Stockton filed a water right application with the SWRCB seeking to appropriate initially 33,600 acre-ft per year of water from the Delta, increasing to 125,900 acre-feet per year in 2050. The application specifies a place of use within the adopted City of Stockton General Plan boundary.

In 2003, the City of Stockton DWSP Feasibility Report, and certified its Environmental Impact Report in 2005. The water right was approved by the State in 2006 after a six-year-long feasibility study and

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environmental clearance effort. The facility was constructed at a cost of approximately \$220 million and became operational in 2012.

The DWSP consists of a new intake facility and pump station located at the southwestern tip of Empire Tract on the San Joaquin River, a raw water conveyance pipeline, a new water treatment plant along Lower Sacramento Road in north Stockton, and treated water pipelines.

The DWSP will not only replace declining and unreliable surface water supplies in the Region, but will also protect and restore groundwater resources by pumping less from the Region's groundwater basin. Reduction in pumping in Stockton has significantly reduced the groundwater gradient and its potential to induce migration of connate saline water.

ES.12.2 SEWD Water Treatment Plant Expansion to 60 MGD

The Stockton East Water District (SEWD) Joe Waidhofer Drinking Water Treatment Plant has been in operation since 1978. Treated surface water is delivered to the City of Stockton, Cal Water, and San Joaquin County. The Plant receives most of its water supply from New Melones and New Hogan reservoirs via pipelines. The plant has been expanded to serve up to 60 million gallons per day (mgd). Reduction of groundwater pumping within the City of Stockton has resulted in increased groundwater levels and reduced potential for migration of connate saline water.

ES.12.3 Lodi Water Treatment Plant and Transfer of WID Water Rights to Lodi and Stockton

The Lodi Surface Water Treatment Plant was dedicated in November 2012. This is Lodi's first surface water supply. The plant has the capacity to treat up to 10 million gallons per day of water from the Mokelumne River, and will meet about 35 percent of Lodi's current demand. The treatment plant uses a membrane treatment process, and cost \$36 million to construct. Water will be supplied from a transfer of 6,000 acre-feet per year from the Woodbridge Irrigation District (WID) approved in 2003.

In 2008 the City of Stockton and WID approved a water transfer agreement. Stockton will use the transfers to supplement its Delta water supplies. WID formerly supplied much of the agricultural land in north Stockton. The transfer agreement allows WID to provide urban water to areas that were once in agriculture. The 40-year agreement started in 2009, with an initial transfer of 6,500 acre-feet of Mokelumne River from March through July. The transfers will increase to a maximum of 13,000 acre-feet as more of the WID service area is developed. The agreement acknowledges the City of Lodi's transfer agreement with WID which gives Lodi the first right of refusal on any future water transfers.

ES.12.4 Completion of Freeport Element Study

The Phase I Feasibility Study of the Freeport Element of the American River Use Strategy was completed in 2011. Ten project configurations were studied for making use of San Joaquin County's 1990 water right filing on the South Fork American River, using available capacity in the Freeport Regional Water Project facilities that convey water through central San Joaquin County. Net groundwater recharge for the various alternatives would average from 15,000 to 68,000 acre-feet per year. Capital costs range from \$56 million to \$245 million, and unit costs range from \$150 to \$480 per acre-foot. An additional



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to-be-negotiated \$0 to \$200 per acre-foot would be paid to the Freeport Regional Water Project owners for use of the Freeport Project facilities, and would likely be determined by the benefits provided to the owners. Limited progress has been made in negotiating for use of the facilities.

ES.12.5 Phase 3 of the MORE Water Project

In 1990, the Mokelumne River Water and Power Authority (MRWPA) filed a water rights application for unappropriated wet year flows on the Mokelumne River. The effort initiated in 2005 to develop these rights is called the Mokelumne Regional Water (MORE Water) Project. In 2010 the Feasibility Analysis (Phase 3) was started which included an examination of Project alternatives in more detail in order to select a preferred alternative to carry forward into a project CEQA analysis. Tasks for Phase 3 included alternative screening, survey, geotechnical investigation, flood hydrology, environmental constraints analysis, engineering design, alternatives formulation, Mokelumne River operations simulations, alternatives analysis and evaluation, implementation planning, and feasibility study report. As a result of these studies, a number of technical issues with the key Duck Creek Reservoir were surfaced. These issues include poor foundation conditions, lack of on-site dam fill materials, and endangered species in the inundation area. These issues collectively will increase the cost to unaffordable levels, and it has been recommended to no longer pursue a reservoir on the Duck Creek site at this time. Alternatives using diversions on the lower Mokelumne River are still being pursued.

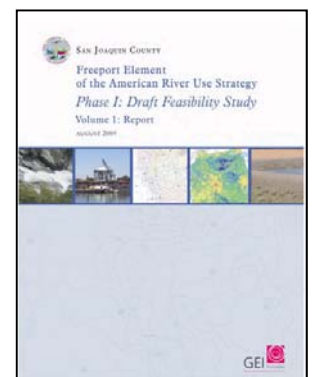
ES.13 Water Balance

Water use appears to have peaked and current use is about 75 percent of the 1976-1996 average. 2035 demands are expected to be approximately the same as current demands. The Eastern San Joaquin Groundwater Basin is not enclosed, but rather, is open on the north, west and south. Basin inflows and outflows are dynamic, and groundwater drawdown induces greater inflows across these political boundaries, and enhances stream seepage. Based on spring and fall data collected by the San Joaquin County Flood Control and Water Conservation District, it appears inflows and outflows have been in approximate balance over the last 20 years, and groundwater levels are approximately stable.

Of the 27 water level hydrographs in the Fall 2012 Groundwater Report two show consistently declining water surface elevations over time and two are increasing consistently over time. The water surface elevation in the remaining twenty-three wells has fluctuated but the hydrographs demonstrate that the water surface elevation has stabilized over the period of record, suggesting a balance in long-term supply and demand as demands have decreased and surface water supplies have become more available.

The demand for water in San Joaquin County appears to have peaked in the 1990s and is projected to continue to decline as more efficient urban and irrigation practices are adopted. Long-term groundwater elevations suggest water level recovery in some areas. Once rapid saline water migration appears to have slowed significantly.

Lower demand will require fewer projects and allow greater flexibility in selecting the most economic projects to implement. Redefining the range of acceptable water levels could further reduce the need



for new projects. Offsetting these factors is development of previously non-irrigated range land in the eastern margins of the County, and reduced groundwater recharge from more efficient irrigation operations.

ES.14 Stormwater and Flood Water Management

The SWRCB through its nine Regional Water Quality Control Boards (RWQCB) implements the Clean Water Act. As part of this program the RWQCB issues NPDES Industrial, Municipal and Construction Permits. Each Permit is aimed at eliminating pollutants to the Waters of the United States. Additionally new development or redevelopment pursuant to the Phase 1 and Phase 2 Municipal Permit must employ Low Impact Development (LID) measures. Such design approaches mimic the pre-development hydrology of a project site and minimize impacts to ground and surface water volume and quality, consistent with the goals of the IRWMP. LID improves evapotranspiration and groundwater recharge and reduces susceptibility to flooding. The EPA supports water management approaches that reduce the impact of built areas and promote the natural movement of water within an ecosystem or watershed. LID is considered a sustainable stormwater practice.

Flood water and stormwater management activities were coordinated with the San Joaquin Area Flood Control Agency (SJAFCA), a joint powers authority of the City of Stockton and the San Joaquin County Flood Control and Water Conservation District, as part of its efforts to update the Central Valley Flood Protection Plan (CVFPP). The U.S. Army Corps of Engineers is providing modeling support to the CVFPP effort.

In 2006, the California Department of Water Resources (DWR) launched FloodSAFE California—a multi-faceted program to improve public safety through integrated flood management. FloodSAFE California was funded by almost \$5 billion provided through Proposition 1E and Proposition 84 bond measures. Preparation of the Central Valley Flood Protection Plan (CVFPP) and the Statewide Flood Management Plan (SFMP) are two important components of the FloodSAFE initiative. The CVFPP was adopted in 2012.

As part of the 2017 CVFPP Update, DWR launched the Regional Flood Management Plan (RFMP) effort to assist local agencies to develop long-term regional flood management plans that address local needs, articulate local and regional flood management priorities, and establish the common vision of regional partners. DWR provides funding and resource support to help develop regional plans consistent with the CVFPP. SJAFCA is leading the effort to develop the RFMP for the Lower San Joaquin River/Delta South planning region.

The SJAFCA working group consists of representatives from flood management agencies, land use agencies, flood emergency responders, permitting agencies, and environmental and agricultural interests. The RFMP will present local agencies' perspectives of flood management with a prioritized list of projects that need to be implemented to reduce flood risks. The plan will also present an assessment of the proposed project costs and benefits, considering the projects' potential contributions to an integrated multi-benefit and basin-wide solution. This work is being developed concurrent with the IRWMP Update, and will be added as an addendum once it is available.



Chapter 11 describes the stormwater and flood water management projects identified through early 2014 as part of the RFMP process. Five stormwater or flood water management were defined well enough to be included in the IRWMP rating and ranking process.

ES.15 Climate Change

The Eastern San Joaquin Region receives surface water from the Delta and the Mokelumne, Calaveras, and Stanislaus river watersheds. Changes in streamflow resulting from climate change may impact the timing and availability of these supplies.

The USGS and Lawrence Livermore National Laboratory have used a variety of models to conduct studies on the effect of climate change for high (Scenario A1b), medium (Scenario A2) and low (Scenario B1) greenhouse gas emissions. Inflows to New Hogan Reservoir on the Calaveras River and Pardee Reservoir on the Mokelumne River may occur slightly earlier but overall volume is not expected to change significantly. Inflow to New Melones Reservoir on the Stanislaus River may occur significantly earlier with more runoff coming during winter months and less runoff in spring months.

Overall precipitation could increase for low emissions (Scenario B1), but could decline by up to 6 percent for the medium (Scenario A2) and high emissions (Scenario A1b) scenarios.

A variety of vulnerabilities have been identified for San Joaquin County for the various greenhouse gas emissions scenarios. The highest priority vulnerabilities include:

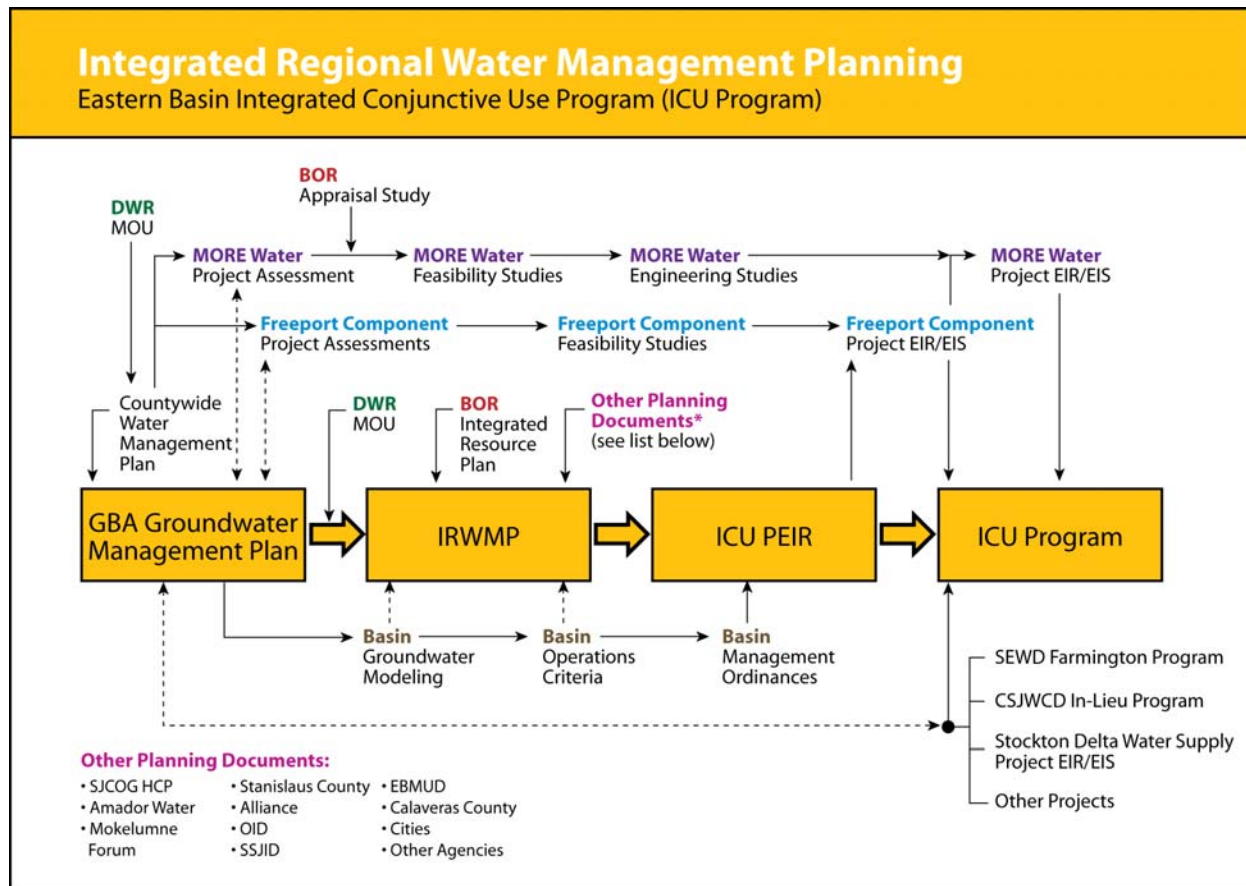
- Water storage reserves and management
- Water demand uncertainty due to hotter summers and lower rainfall
- Water quality and saline migration
- Flooding and water logging in areas of commercial agriculture
- Ecosystem and habitat loss
- Flooding due to sea level rise

ES.16 Integrated Conjunctive Use Program

The Eastern San Joaquin IRWMP will define and implement the Integrated Conjunctive Use Program (ICU Program), which is a comprehensive, prioritized suite of projects and actions described in the IRWMP to ensure the reliability and sustainability of water resources in the eastern San Joaquin County Region. All on-going and proposed projects, programs, and studies proposed for the region have been aggregated, integrated, and evaluated on an equal basis, to funnel these regional efforts into a prioritized implementation plan, as illustrated schematically in Figure ES-3.

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Figure ES-3 Integrated Conjunctive Use Program Schematic



The ICU Program is a broad-based program to integrate and coordinate water resource management over a large region encompassing all or parts of the watersheds of the Mokelumne, Calaveras, and Stanislaus rivers and Littlejohns Creek. The plan is designed to be expandable to integrate with entire watersheds and adjacent areas such as the American River and upper Mokelumne River in the future. As such, a set of measurable, performance-based evaluation criteria have been developed that will be applicable to potential future planning and management in a broader region. The purpose of establishing these criteria *a priori* will support implementation of projects and programs that best meet the region's objectives rather than a small constituency, and identify opportunities for regional collaboration and leadership.

The Regional Planning Area is a study in contrasts:

- The area encompasses water districts with and without adequate surface water supplies.
- Some areas have groundwater elevations very close to pre-development levels, and other areas have groundwater levels that have continued to drop for decades.
- The area's highly productive though depleted aquifers sit astride the Sacramento-San Joaquin Delta, the switching yard for the majority of California's water supplies.

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- A major conveyance facility traverses the area carrying Mokelumne River water to the Bay Area. A second such facility conveying Sacramento River water was completed in 2011. However, these conveyances are not paired with storage adequate to meet Bay Area needs.

These contrasting conditions provide substantial opportunities for mutually-beneficial integrated programs that capture surplus supplies from areas with adequate supplies, and use them to replenish depleted aquifers to be used in times of drought. Areas external to the Regional Planning Area may pay significant portions of the Plan implementation costs to obtain access to stored water in dry years.

Because the Eastern San Joaquin County Basin is part of a regional aquifer system, shared both internally and externally of the GBA boundaries, integrated regional solutions are essential to solve key regional issues while avoiding or minimizing conflict. No one solution will fully address the underlying issues facing the area. An integrated mix of water management strategies (conservation, reclamation, new supplies, transfers, stormwater capture, groundwater banking and management are all expected to be part of the solution mix.

Chapter 9 presents an overview of the alternatives development and evaluation processes, including identification of water management strategies, supply sources, and projects;

Chapter 10 describes potential water supply projects to be evaluated in detail.

Chapter 11 describes stormwater and flood water management projects.

Chapter 12 describes development of evaluation and prioritization criteria and application of these criteria to rate, rank, and prioritize alternatives.

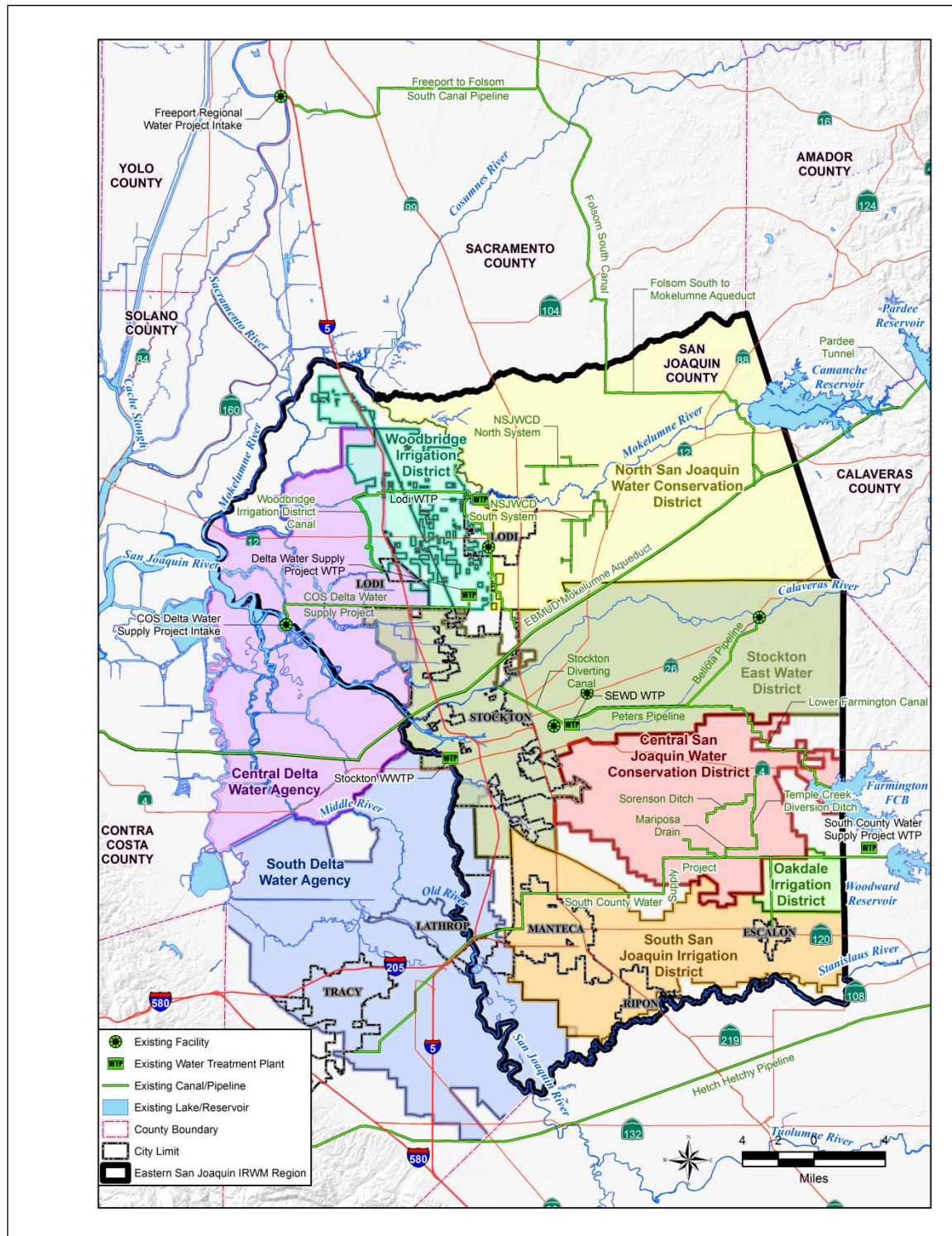
Major water related infrastructure is depicted in the Integrated Conjunctive Use Program infrastructure map presented as Figure ES-4. The map illustrates existing and proposed reservoirs, waterways, conveyance systems, irrigation systems, treatment plants, and recharge areas.

Water supplies and associated water rights have been secured or have been applied for on most of the stream systems in the region. Water supply sources from the following stream systems were examined:

- Sacramento-San Joaquin Delta
- American River
- Mokelumne River
- Calaveras River
- Littlejohns Creek /Rock Creek
- Stanislaus River
- San Joaquin River

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Figure ES-4 Integrated Conjunctive Use Program Infrastructure Map



ES.16.1 Water Management Strategies

Through past planning efforts, the GBA, its member agencies, and other regional interests have developed numerous projects and programs that integrate multiple strategies and in turn provide multiple benefits to the community. The mission of the GBA is to promote regional collaboration in a consensus-building environment. The IRWM planning process is a continuum of this mission and is reflected in the projects and programs described in the ICU Program options discussion below.

This Plan has considered all of the resource management strategies identified in the California Water Plan. These strategies are grouped into seven management objective categories:

- Reduce Water Demand
- Improve Operational Efficiency and Transfers of Water
- Increase Water Supply
- Improve Water Quality
- Practice Resources Stewardship
- Improve Flood Management
- Other Resource Management Strategies

The strategies to be implemented in the IRWMP are displayed in Table ES-4. The GBA is the forum that fosters regional integration amongst member agencies and with other regional participants. The GBA will continue to interact with other agencies and groups throughout the region to increase the social, economic, and environmental viability of the Region and beyond. This integration of these strategies increases the potential for broad-based support by spreading benefits to multiple interests and agencies. Integration also produces synergistic effects and makes additional funding sources available.

Geographic realities and the success and expertise of GBA member entities are the principal reasons for focusing on these strategies. No one single project will meet the objectives of the IRWMP. An integrated combination of several projects, implemented over a wide geographic area will be necessary.

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Table ES-4 Resource Management Strategies

Management Objective	Resource Management Strategy	Included in IRWMP	Notes
Reduce Water Demand			
1	Agricultural Water Use Efficiency	Yes	
2	Urban Water Use Efficiency	Yes	
Improve Operational Efficiency and Transfers of Water			
3	Conveyance—Delta	Yes	
4	Conveyance—Regional/Local	Yes	
5	System Reoperation	Yes	
6	Water Transfers	Yes	
Increase Water Supply			
7	Conjunctive Management and Groundwater Storage	Yes	
8	Desalination	Considered	Not practical for region
9	Precipitation Enhancement	Considered	Not practical for region
10	Recycled Municipal Water	Yes	
11	Surface Storage—CALFED	Considered	
Improve Water Quality			
12	Surface Storage—Regional/Local	Yes	
13	Drinking Water Treatment and Distribution	Yes	
14	Groundwater Remediation/Aquifer Remediation	Yes	Saline barrier project
15	Matching Water Quality to Use	Yes	
16	Pollution Prevention	Yes	
17	Salt and Salinity Management	Yes	
18	Urban Runoff Management	Yes	
Practice Resource Stewardship			
19	Agricultural Lands Stewardship	Considered	Does not address Plan objectives
20	Economic Incentives (Loans, Grants, Water Pricing)	Yes	
21	Ecosystem Restoration	Yes	
22	Forest Management	No	Not applicable to Region
23	Land Use Planning and Management	Yes	
24	Recharge Area Protection	Yes	
25	Water-dependent Recreation	Yes	
26	Watershed Management	Yes	
Improve Flood Management			
27	Flood Risk Management	Yes	
Other Strategies			
28	Crop Idling for Water Transfers	Considered	
29	Dewvaporation or Atmospheric Pressure Desalination	No	Not practical for region
30	Fog Collection	No	Not practical for region
31	Irrigated Land Retirement	Yes	
32	Rain-fed Agriculture	Yes	Not practical for region
33	Waterbag Transport/Storage Technology	No	Not practical for region

Notes: Strategies identified in the 2009 California Water Plan Update (Bulletin 160-09)



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ES.16.2 Identification of Potential Projects

The following potential projects are described in Chapters 10 and 11 and are evaluated as part of the IRWM Plan:

Project Number	Carry Forward?	Project	Primary Management Objective	Resource Management Strategy	Quality of Information
1	Yes	Conservation at UWMP/AgWMP level	Reduce Water Demand	Water use efficiency	Fair
3	Yes	Water Efficiency Demonstration Garden (WEDG) Project	Reduce Water Demand	Water use efficiency	Fair
12	Yes	Water transfers from WID, OID, SSJID	Improve Operational Efficiency and Transfers	Transfers	Fair
13	Yes	Tracy Lakes Project	Increase Water Supply	Conjunctive Use/ Banking	Good
14	Yes	SEWD Water Supply Enhancement Project	Increase Water Supply	Conjunctive Use/ Banking	Fair
15	Yes	NSJWCD Surface Water Distribution System Rehab	Increase Water Supply	Conjunctive Use/ Banking	Fair
16	Yes	NSJWCD Surface Water Distribution System Lining	Increase Water Supply	Conjunctive Use/ Banking	Fair
17	Yes	NSJWCD South System Rehabilitation	Increase Water Supply	Conjunctive Use/ Banking	Fair
18	Yes	MORE Water Lower Mokelumne Diversion	Increase Water Supply	Conjunctive Use/ Banking	Good
19	Yes	Freeport Element/American River Alt G2 (Ponds)	Increase Water Supply	Conjunctive Use/ Banking	Good
20	Yes	Freeport Element/American River Alt R1b (Banking)	Increase Water Supply	Conjunctive Use/ Banking	Good
21	Yes	Micke Grove Park Recharge Ponds	Increase Water Supply	Conjunctive Use/ Banking	Fair
22	Yes	OID/SSJID to Stockton transfer renewal	Increase Water Supply	Conjunctive Use/ Banking	Good
23	Yes	Ripon Surface Water Pipeline and Pump Station Project	Increase Water Supply	Conjunctive Use/ Banking	Fair
24	Yes	SEWD Water Bank	Increase Water Supply	Conjunctive Use/ Banking	Fair
25	Yes	Regional Groundwater Banking	Increase Water Supply	Conjunctive Use/ Banking	Fair
26	Yes	Regional Groundwater Banking Recharge Pilot Project	Increase Water Supply	Conjunctive Use/ Banking	Fair
27	Yes	Regional Groundwater Banking Extraction Pilot Project	Increase Water Supply	Conjunctive Use/ Banking	Fair



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Project Number	Carry Forward?	Project	Primary Management Objective	Resource Management Strategy	Quality of Information
29	Yes	CSJWCD BN Intermodal ponds	Increase Water Supply	Conjunctive Use/ Banking	Fair
35	Yes	Lodi Non-Potable Surface Water Distribution System	Increase Water Supply	Recycled Municipal Water	Fair
38	Yes	Renewal of SEWD/CSJWCD CVP contracts	Increase Water Supply	Water Rights and Contracts	Good
39	Yes	NSJWCD Permit 10477 renewal (expired 2002)	Increase Water Supply	Water Rights and Contracts	Good
40	Yes	SJCo Environmental Health Mobile Home Park Drinking Water Supply	Improve Water Quality	Drinking Water Treatment and Distribution	Fair
43	Yes	Thornton Wastewater Treatment Improvements	Improve Water Quality	Wastewater Treatment	Fair
44	Yes	CSJWCD Surface Water Delivery (In-lieu Incentive) Program	Practice Resource Stewardship	Economic Incentives (Loans, Grants, Water Pricing)	Fair
47	Yes	Mormon Slough Bypass Channel and Restoration	Improve Flood Management	Floodwater management	Fair
69	Yes	SJCFCWCD Ardelle Avenue Stormwater Improvements	Improve Flood Management	Stormwater management	Fair
70	Yes	Smith Canal	Improve Flood Management	Stormwater management	Good
71	Yes	Wisconsin Avenue Pump Station	Improve Flood Management	Stormwater management	Good
72	Yes	Gill Creek and Woodbridge Road Flood Control	Improve Flood Management	Stormwater management	Poor

ES.16.2.1 Environmental Enhancements

Water and planning agencies in San Joaquin County are working to develop a number of water-related environmental enhancements. These include:

- San Joaquin County Habitat Conservation Plan (HCP).
- Lower Mokelumne River Stewardship Plan
- City of Stockton efforts to increase dissolved oxygen along the Deep Water Ship Channel on the San Joaquin River.
- Studies to characterize, remediate, and manage saline migration into County groundwater aquifers.



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- Efforts by cities and planning agencies to establish buffer lands or 'greenbelts' between cities and conservation easements on high value farmland.
- Active groundwater recharge to replenish regional water supplies and restore natural groundwater gradients to area streams and rivers.
- Installation of recycled water piping (purple pipe) in new and existing developments, and including such requirement in city general plans.
- Opportunistic habitat creation and enhancement as part of new projects, including in stream releases.
- Studies of fisheries, and providing enhancements such as state-of-the-art fish ladders and screens at Woodbridge Dam and NSJWCD intakes.
- Providing recreation opportunities at streams, lakes, and linear water features.
- Installing improved fish screens and fish passage facilities on older diversions and crossings along the Calaveras River and Mormon Slough (e.g. between New Hogan Reservoir and the San Joaquin River) as part of a new Aquatic Habitat Conservation Plan for the river.
- Education programs such as those planned for Micke Grove Regional Park.
- USGS/DWR/GBA Joint Saline Groundwater Monitoring and Migration Study.

ES.16.3 Development of Evaluation and Prioritization Criteria

To choose between potential alternatives, as part of the 2007 IRWMP the GBA developed methods to predict performance and assess impact with respect to the Objectives. To this end, a detailed integrated surface-groundwater model built on the DYNFLOW platform was used to perform a detailed assessment of the No Action and alternatives that could recharge an average of approximately 140,000 acre-feet per year.

The regional DYNFLOW screening model was used to compare expected performance of various combinations of projects and management alternatives for the GBA. The model provides a method to evaluate the response of the Region's water system in meeting future target demands for water considering various structural and management changes to the system. All modeled program alternatives, each designed to recharge approximately the same amount of water, performed acceptably. Though not updated for the 2014 IRWMP, the Basin is expected to perform similarly under current conditions.

Model operation was simulated at a fixed level of 2030 demand considering the variability of hydrology and imported supply the region will likely face. The historical time-series hydrology as presented in the Water Management Plan was used to approximate the likely hydrologic variability the region will face in the future. The results of the modeling provided a time series of outputs that can be evaluated in many different ways, as described in the Chapter 13 and detailed in the 2007 IRWMP.

ES.16.3.1 Evaluation Criteria (Performance Measures)

Performance measures were developed to allow the GBA to screen and select the best combinations of projects and management actions that address key water issues using a systems approach. The first step is the clear articulation of what the GBA wanted to accomplish. The intended accomplishments are



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specified in terms of the Objectives together with development of Performance Measures. Performance-based standards allow flexibility but focus on unbiased quantifiable results.

The Performance Measures are evaluation criteria which provide a methodology to compare the relative success of alternative solutions for producing the desired results. This leads directly to identifying projects, evaluation of those projects, and ultimately the selection the best projects to implement.

Articulation of Objectives was completed through the Groundwater Management Plan and Water Management Plan processes. The Objectives were adopted by the GBA as a representative statement of what should be accomplished through the process of IRWMP development.

The Performance Measures developed in the IRWMP process provide a set of indicators that can be used to help decide how effectively possible alternatives solutions provide the desired outcomes.

The adopted Performance Measures fall into the following six categories:

- Reliability and Sustainability
- Economics
- Compatibility
- Environmental Constraints
- Implementability

ES.16.3.2 Prioritization Criteria

The application of the Performance Measures provides an unranked list of project alternatives. Though it is possible that a single alternative could rank the highest for all Performance Measures, it was found that all alternatives received a mixed ranking (e.g. Alternative X provides the most high-quality water, but is twice as expensive as Alternative Y). For this portion of IRWMP development, Prioritization Criteria were developed to select the best projects or alternatives to develop. Adopted Prioritization Criteria are described below:

- **Need** - was assessed based on water level or water quality considerations in the area the supply will be used.
- **Feasibility** – was evaluated on the level of technical development of the project, whether institutions are in place to support project implementation, and whether there is opportunity to phase implementation versus commitment to the full sized project.
- **Readiness to Proceed** - was assessed based on whether water right permits are needed or have been obtained, the level of engineering that has been performed (e.g. conceptual, preliminary, or final design), whether the constituency providing funding has been identified or funding obtained, and whether environmental documentation and mitigations have been completed.
- **Public and Stakeholder Acceptance** - gauges public support or opposition to the proposed project, including support or opposition from agencies or parties outside of the project area.

ES-16.4 Definition of System and Characterization of Projects

A comprehensive list of projects and actions were developed through a series of stakeholder workshops over 18 months with the GBA Coordinating Committee. The sequence of workshops allowed GBA and



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stakeholders to work together efficiently to choose the most promising projects and management actions that can be successfully implemented by GBA member agencies.

Information for the various projects was developed in detail sufficient to reflect key differentiating characteristics. This information includes water quantity and availability, as well as cost, seasonality, and other measures that differentiate the projects and actions. Cost information for most projects is based on existing estimates and data from similarly constructed or bid projects. Where cost information was not available, estimates were made using basic unit cost formulas. Several stakeholder workshops with the GBA Coordinating Committee were used to confirm that these attributes correctly represent local and regional issues and potential solutions.

Groundwater banking is supported regionally and statewide as an alternative to constructing new on-stream reservoirs and desalinization plants. It is of paramount importance to the GBA that groundwater banking operations remain under local control, which was the primary reason for the development of Basin Operations Criteria for the Basin as discussed in Chapter 8. The selective timing of withdrawals from surface and groundwater sources can improve the reliability of both water quantity and quality. Such operation is referred to as “conjunctive use.” Conjunctive use of surface and groundwater consists of harmoniously combining the use of both water supplies in order to minimize the undesirable physical, environmental and economic effects of each solution and to optimize the balance of water demand and supply. Conjunctive use of surface water and groundwater sources take advantage of the variability of natural water supplies, manipulating water storage so that less water is wasted during wet seasons.

ES.16.5 Prioritized Project List

A prioritized list of projects was assembled to address the GBA objectives of improving water supply sustainability and reliability through:

- Improving water supply reliability;
- Providing multiple benefits;
- Protection and improvement of water quality;
- Providing financial incentives to promote regional integration and conjunctive management;
- Enhancing environmental stewardship;
- An inclusive, integrated planning process incorporating a wide range of planning processes including land use, flood control, and energy use;
- Scalable implementation;
- Unbiased performance and prioritization criteria; and,
- Monitoring protocols to gauge Plan success

Non-project strategies considered of key importance include maintenance of water rights and filings, and maximizing water transfers from within the Region. This includes:

- Renewal of transfers to Stockton from Oakdale Irrigation District and South San Joaquin Irrigation District (expire 2019);
- Renewal of NSJWCD Mokelumne River Permit 10477 (expired 2002); and,



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- Renewal of SEWD (75 kaf/yr) and CSJWCD (31 kaf/yr) interim Central Valley Project contracts (expire 2022).
- Continued and expanded evaluation of water transfers from Woodbridge Irrigation District, South San Joaquin Irrigation District, and Oakdale Irrigation District.

A series of GBA workshops were conducted over nine months to work through the alternatives development process and to identify the most promising projects and management actions. General observations on desirability, reliability, and performance were solicited from participants.

ES.16.6 Application of Evaluation Criteria

The analyses described above resulted in identification of 27 promising projects that best address the Objectives and underlying issues. Based on Performance Measures and the weighting factors used, 16 of these projects were rated “High” for implementation.

ES.16.7 Application of Prioritization Criteria

The prioritization criteria were next applied to all projects and management actions. No project or action is being discarded, but rather the projects that are more likely to be implemented are identified to focus implementation efforts. The overall ranking does not change significantly when the applied weighting criteria are individually altered. Approximating a timeline for additional project development, acquisition of water right permits, performing preliminary and final engineering, completing environmental documentation, obtaining financing, and construction produces possible implementation priorities displayed in Figure ES-5.

ES.17 Management Action Plan

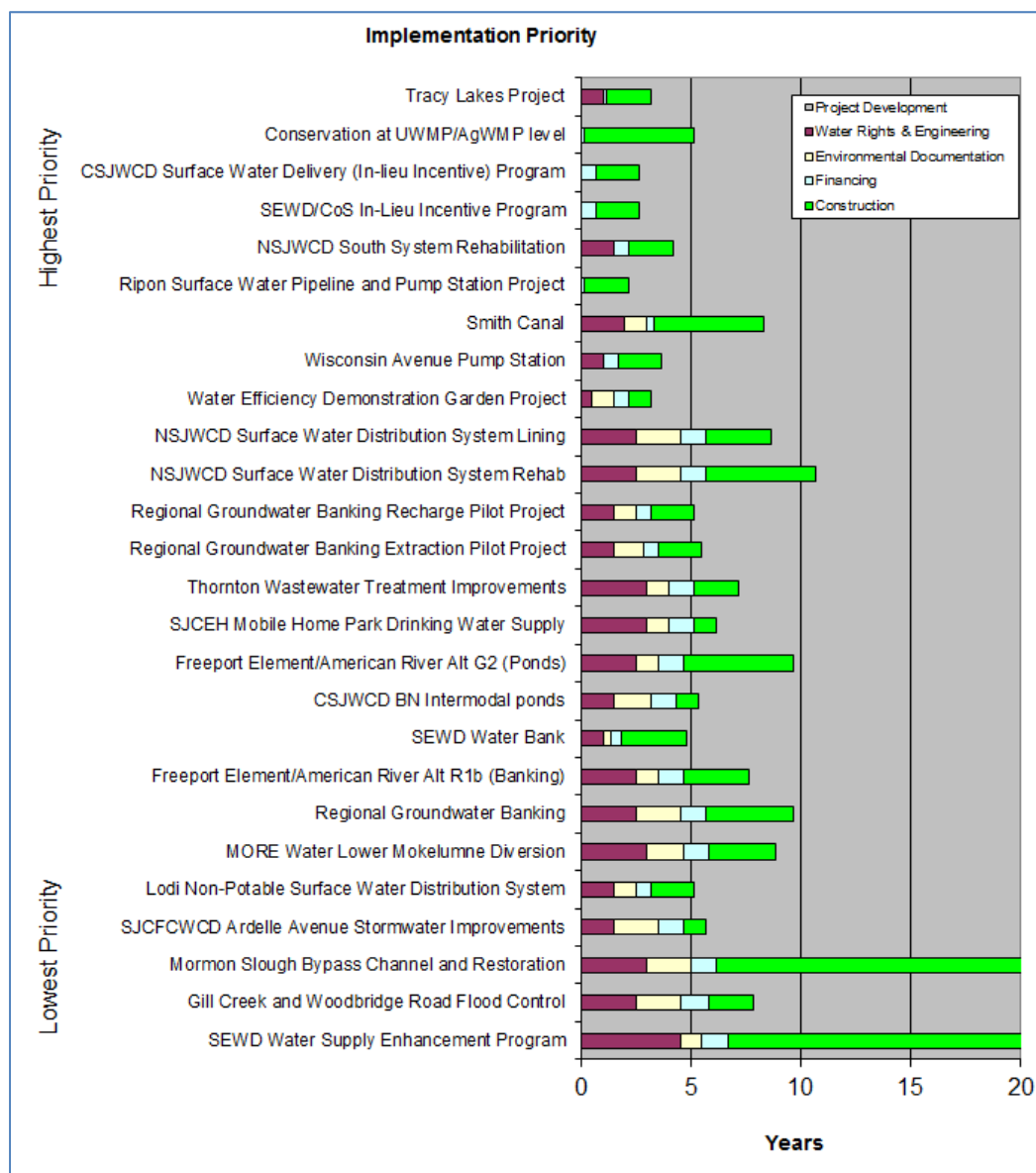
Chapter 16 details the actions to be taken to achieve the Basin Management Objectives. The GBA is committed to continued inter-agency coordination as IRWM Plan elements are put into action both independently and by implementing agencies.

Inter-agency coordination and collaboration during development of this Plan took place through the GBA Board, the GBA Coordinating Committee, the San Joaquin County Advisory Water Commission, the Mokelumne River Forum, and meetings with the Mokelumne WISE study group. Coordinating Committee members provided input and review on elements of the Plan including the Management Actions presented here. The GBA is committed to continued inter-agency coordination as Plan elements are put into action both independently and by implementing agencies.



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Figure ES-5 Potential Project Implementation Timeline



ES.17.1 Management Authority

The GBA is a Joint Powers Authority which is represented by individual agencies overlying the Basin with the common interest being the health of the underlying Basin. The GBA is a consensus-based forum in which projects can be developed by stakeholders in a manner that maximizes benefits to all involved parties and the region as a whole. Projects developed with input from the stakeholder group ensure consistency with the Plan. The GBA employs a mutual interest-based governance framework that creates a stakeholder group of common interests with the powers to undertake specific goals and objectives.

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The enabling act authorizes the GBA to perform planning and study activities in furtherance of acquiring water supplies and improving management of regional water resources. To fulfill this objective, the GBA currently performs the following:

- Preparation of the IRWMP and Groundwater Management Plan
- Assistance with the filing of water rights and assists member agencies to acquire and retain their rights and filings
- Conducting water monitoring programs and special studies throughout the Region, including CASGEM monitoring, and joint USGS/DWR/GBA groundwater investigation
- Preparation of applications for grant funding
- Acts as a clearinghouse for water resource data
- Represents GBA member interests in regional forums
- The GBA has prepared this Integrated Regional Water Management Plan to plan water supplies and use in the region through 2035

As discussed in this Plan, the management authority of the GBA is considerable in scope and geo-political extent. The GBA will continue to interact with other agencies and groups throughout the region to increase the social, economic, and environmental viability of the San Joaquin region and beyond. This integration of these strategies increases the potential for broad-based support by spreading benefits to multiple interests and agencies. Integration also produces synergistic effects and makes additional funding sources available.

ES.17.2 Management Actions

The 57 actions listed in Chapter 9 constitute the Groundwater Basin Authority's plan and pledge to implement the Integrated Regional Water Management Plan. Management Actions have been grouped into the following categories:

- **Monitoring** – Monitoring of water parameters such as water levels, water quality, import quantities, water budgets, etc., plus monitoring of population growth and development, effectiveness of water conservation measures, and land subsidence. Data management will be closely tied to this function.
- **Improved Basin Characterization** – Continued exploration, infiltration rate testing, aquifer characterization, modeling, improvements to understating of the water budget.
- **Continued Long-Term Planning** – Includes review of land use plans, additional water supply identification, and IRWM Plan updates.
- **Groundwater Protection** – This category could include recharge site management, identification and destruction of abandoned wells, hazardous material response, and protection of recharge areas.
- **Construction and Implementation** – Identification of implanting agencies for high priority projects, and coordinating with those agencies in putting them into service.
- **Governance** – Development of regional governance structures to acquire water supplies, manage the groundwater basin, and equitably distribute benefits and costs.



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- **Financing** – Implementing the IRWM Plan will require an array of financing mechanisms such as bonds, grants, or low interest loans. Some implementing agencies have available revenue streams for implementing projects, while others do not. Cost savings may be incurred through implantation of conservation and water reuse projects. In addition, cooperative funding agreements between the GBA and local, state, or federal agencies may also provide funding for IRWM Plan projects and management actions.
- **Public Participation/Community Outreach** – Continued coordination with the GBA Board and Coordinating Committee, the San Joaquin County Advisory Water Commission, as well as regional water managers and community groups including those representing disadvantaged communities.
- **Adaptation to Climate Change** – Changes to the Region’s climate may cause changes in the timing or magnitude of rainfall and surface water supplies, and may increase flood risk through higher intensity storms and sea level rise. The GBA will continue to analyze potential changes and adapt water management strategies to meet these challenges.