2012 AGRICULTURAL WATER MANAGEMENT PLAN

prepared by

DAVIDS ENGINEERING, INC
www.de-water.com

December 2012

South San Joaquin Irrigation District

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Prepared in Accordance with

the Water Conservation Act of 2009

(Senate Bill x7-7)

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PREFACE

This Agricultural Water Management Plan (AWMP or Plan) has been prepared by South San Joaquin Irrigation District (SSJID or District) in accordance with the requirements of the Water Conservation Act of 2009, also known as Senate Bill x7-7 (SBx7-7). SBx7-7 modifies Division 6 of the California Water Code (CWC or Code), adding Part 2.55 (commencing with §10608) and replacing Part 2.8 (commencing with §10800). In particular, SBx7-7 requires all agricultural water suppliers greater than 25,000 acres in size to prepare and adopt an AWMP as set forth in the CWC and the California Code of Regulations (CCR) on or before December 31, 2012. The Plan must be updated by December 31, 2015 and then every 5 years thereafter (§10820 (a)). Additionally, the CWC requires suppliers to implement certain efficient water management practices (EWMPs).

To develop and adopt this Plan by the December 31, 2012 deadline, the District initiated preparations in June 2012, developed a project schedule and engaged technical consultants to assist with preparing the Plan. Working backwards from the December 31 deadline, the District scheduled Plan adoption by the Board of Directors at its second meeting in November (November 27). This was the latest schedule possible that would allow time to revise the Plan, if needed, in response to public comment. To allow approximately two weeks for public review of the Plan prior to the public hearing and adoption of the Plan in late November, the final draft of the Plan had to be complete by early-November. To ensure the draft Plan was complete by early-November, all Plan sections were drafted in September and October. In contrast to this schedule, versions of the draft revised DWR Guidebook to Assist Agricultural Water Suppliers to Prepare a 2012 Agricultural Water Management Plan (Guidebook) were not released until September 10, 2012 and October 8, 2012 with the final version scheduled for release sometime in October. Thus, the Guidebook was not released in sufficient time to serve as a reference for preparation of this 2012 AWMP. The main resources used to develop this Plan were the CWC itself, the relevant sections of the CCR, and the January 12, 2012 version of the Guidebook. The final revised Guidebook may be referenced during preparation of the 2015 Plan.

RESOLUTION OF ADOPTION

SOUTH SAN JOAQUIN IRRIGATION DISTRICT
RESOLUTION 12-18-W
ADOPTION OF AGRICULTURAL WATER MANAGEMENT PLAN

WHEREAS, the Agricultural Water Management Planning Act (Act) , codified in section 10800 et seq., of the Water Code (CWC) , requires all agricultural water suppliers greater than 25,000 acres in size to prepare and adopt an Agricultural Water Management Plan (AWMP or Plan); and

WHEREAS, South San Joaquin Irrigation District (District) has prepared a Plan which satisfies the requirements of Section 10826 of the CWC and the regulations implementing the Plan adopted by the Department of Water Resources (DWR's Regulations); and

WHEREAS, the District published notice in a newspaper of general circulation for two consecutive weeks and notified each of the three cities and the County of San Joaquin, of the availability of the Plan and of the time and place for a public hearing to be held on the Plan at the November 27, 2012 meeting of the District's Board of Directors; and

WHEREAS, the District held a public hearing at the November 27, 2012 meeting of the District's Board of Directors and no public comments were made; and

WHEREAS, Section 10820 of the CWC requires that the Plan be adopted on or before December 31, 2012; and

WHEREAS, the Plan shall be updated on December 31, 2015 and on or before December 31 every five years thereafter; and

NOW, THEREFORE BE IT RESOLVED AND ORDERED, by the Board of Directors of the South San Joaquin Irrigation District as follows:

The 2012 Agricultural Water Management Plan is hereby adopted and ordered filed with the District;

The Water Conservation Coordinator is hereby authorized and directed within 30 days to distribute copies of the Plan to the California Department of Water Resources and the other entities described in Section 10843 of the CWC and to cause the Plan to be posted on the District's website in accordance with Section 10844 of the CWC;

The General Manager is hereby authorized and directed to take appropriate action to implement the Agricultural Water Management Plan in accordance with the Act and DWR's Regulations, as such may be modified from time to time;

PASSED AND ADOPTED on this 11th day of December, 2012 by the following roll call vote:

Ayes:	HOLBROOK HOLMES KAMPER KUIL
Noes:	ROOS
Absent:	NONE

ATTEST: Jeff Shields

Jeff Shields, General Manager

CROSS-REFERENCE TO REQUIREMENTS OF SBX7-7

California Water Code, Division 6, Part 2.55. Sustainable Water Use and Demand Reduction

Chapter 4. Agricultural Water Suppliers				
Division	Subdivision	Paragraph	Code Language	Applicable AWMP Section(s)
10608.48	(a)		On or before July 31, 2012, an agricultural water supplier shall implement efficient water management practices pursuant to subdivisions (b) and (c).	**7**
	(b)		Agricultural water suppliers shall implement all of the following critical efficient management practices:	(see below)
		(1)	Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2)	**3.8, 7.2**
		(2)	Adopt a pricing structure for water customers based at least in part on quantity delivered.	**3.9, 7.2**
	(c)		Agricultural water suppliers shall implement additional efficient management practices, including, but not limited to, practices to accomplish all of the following, if the measures are locally cost effective and technically feasible:	(see below)
		(1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	**7.3**
		(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	**7.3**
		(3)	Facilitate the financing of capital improvements for on-farm irrigation systems.	**7.3**
		(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at the farm level. (B) Conjunctive use of groundwater. (C) Appropriate increase of groundwater recharge. (D) Reduction in problem drainage. (E) Improved management of environmental resources. (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	**3.9, 7.3**
		(5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage.	**3.4, 7.3**

		(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits.	**3.7, 7.3**
		(7)	Construct and operate supplier spill and tailwater recovery systems.	**3.4, 7.3**
		(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area.	**4.3, 5, 7.3**
		(9)	Automate canal control structures.	**3.4, 7.3**
		(10)	Facilitate or promote customer pump testing and evaluation.	**7.3**
		(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.	**7.3**
		(12)	Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following: (A) On-farm irrigation and drainage system evaluations. (B) Normal year and real-time irrigation scheduling and crop evapotranspiration information. (C) Surface water, groundwater, and drainage water quantity and quality data. (D) Agricultural water management educational programs and materials for farmers, staff, and the public.	**7.3**
		(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	**7.3**
		(14)	Evaluate and improve the efficiencies of the supplier’s pumps.	**7.3**
10608.48	(d)		Agricultural water suppliers shall include in the agricultural water management plans required pursuant to Part 2.8 (commencing with Section 10800) a report on which efficient water management practices have been implemented and are planned to be implemented, an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future. If an agricultural water supplier determines that an efficient water management practice is not locally cost effective or technically feasible, the supplier shall submit information documenting that determination.	**7.5**

California Water Code, Division 6, Part 2.8. Agricultural Water Management Planning

Chapter 3. Agricultural Water Management Plans				
Article 1. General Provisions				
Division	Subdivision	Paragraph	Code Language	Applicable AWMP Section(s)
10820	(a)		An agricultural water supplier shall prepare and adopt an agricultural water management plan in the manner set forth in this chapter on or before December 31, 2012, and shall update that plan on December 31, 2015, and on or before December 31 every five years thereafter.	**2**
10821	(a)		An agricultural water supplier required to prepare a plan pursuant to this part shall notify each city or county within which the supplier provides water supplies that the agricultural water supplier will be preparing the plan or reviewing the plan and considering amendments or changes to the plan. The agricultural water supplier may consult with, and obtain comments from, each city or county that receives notice pursuant to this subdivision.	**2**
	(b)		The amendments to, or changes in, the plan shall be adopted and submitted in the manner set forth in Article 3 (commencing with Section 10840).	**2**
Article 2. Contents of Plans				
Division	Subdivision	Paragraph	Code Language	Applicable AWMP Section(s)
10826			An agricultural water management plan shall be adopted in accordance with this chapter. The plan shall do all of the following:	(see below)
	(a)		Describe the agricultural water supplier and the service area, including all of the following:	(see below)
		(1)	Size of the service area.	**3.3**
		(2)	Location of the service area and its water management facilities.	**3.3, 3.4**
		(3)	Terrain and soils.	**3.5**
		(4)	Climate.	**3.6**
		(5)	Operating rules and regulations.	**3.7**
		(6)	Water delivery measurements or calculations.	**3.8**
		(7)	Water rate schedules and billing.	**3.9**
		(8)	Water shortage allocation policies.	**3.10**

10826	(b)		Describe the quantity and quality of water resources of the agricultural water supplier, including all of the following:	(see below)
		(1)	Surface water supply.	**4.2**
		(2)	Groundwater supply.	**4.3**
		(3)	Other water supplies.	**4.4**
		(4)	Source water quality monitoring practices.	**4.5**
		(5)	Water uses within the agricultural water supplier's service area, including all of the following: (A) Agricultural. (B) Environmental. (C) Recreational. (D) Municipal and industrial. (E) Groundwater recharge. (F) Transfers and exchanges. (G) Other water uses.	**5**
		(6)	Drainage from the water supplier's service area.	**5**
10826	(b)	(7)	Water accounting, including all of the following: (A) Quantifying the water supplier's water supplies. (B) Tabulating water uses. (C) Overall water budget.	**5**
		(8)	Water supply reliability.	**1.1, 4.2, 5.8**
	(c)		Include an analysis, based on available information, of the effect of climate change on future water supplies.	**6**
	(d)		Describe previous water management activities.	**1, 2, 3, 4, 7**
	(e)		Include in the plan the water use efficiency information required pursuant to Section 10608.48.	**7**

Article 3. Adoption and Implementation of Plans

Division	Subdivision	Paragraph	Code Language	Applicable AWMP Section(s)
10841			Prior to adopting a plan, the agricultural water supplier shall make the proposed plan available for public inspection, and shall hold a public hearing on the plan. Prior to the hearing, notice of the time and place of hearing shall be published within the jurisdiction of the publicly owned agricultural water supplier pursuant to Section 6066 of the Government Code. A privately owned agricultural water supplier shall provide an equivalent notice within its service area and shall provide a reasonably equivalent opportunity that would otherwise be afforded through a public hearing process for interested parties to provide input on the plan. After the hearing, the plan shall be adopted as prepared or as modified during or after the hearing.	**2**

10842			An agricultural water supplier shall implement the plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan, as determined by the governing body of the agricultural water supplier.	**7**
10843	(a)		An agricultural water supplier shall submit to the entities identified in subdivision (b) a copy of its plan no later than 30 days after the adoption of the plan. Copies of amendments or changes to the plans shall be submitted to the entities identified in subdivision (b) within 30 days after the adoption of the amendments or changes.	**2**
	(b)		An agricultural water supplier shall submit a copy of its plan and amendments or changes to the plan to each of the following entities:	(see below)
		(1)	The department.	**2**
		(2)	Any city, county, or city and county within which the agricultural water supplier provides water supplies.	**2**
		(3)	Any groundwater management entity within which jurisdiction the agricultural water supplier extracts or provides water supplies.	**2**
		(4)	Any urban water supplier within which jurisdiction the agricultural water supplier provides water supplies.	**2**
		(5)	Any city or county library within which jurisdiction the agricultural water supplier provides water supplies.	**2**
		(6)	The California State Library.	**2**
		(7)	Any local agency formation commission serving a county within which the agricultural water supplier provides water supplies.	**2**
10844	(a)		Not later than 30 days after the date of adopting its plan, the agricultural water supplier shall make the plan available for public review on the agricultural water supplier's Internet Web site.	**2**
	(b)		An agricultural water supplier that does not have an Internet Web site shall submit to the department, not later than 30 days after the date of adopting its plan, a copy of the adopted plan in an electronic format. The department shall make the plan available for public review on the department's Internet Web site.	**2**

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TABLES

FIGURES

ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

ADFM	acoustic Doppler flow meter
af	Acre-Feet
af/ac	Acre-Feet per Acre
af/ac-yr	Acre-Feet per Acre per Year
APN	Assessor's Parcel Number
AWMP	Agricultural Water Management Plan
BMO	Basin Management Objective
BO	Biological Opinion
CCR	California Code of Regulations
CCUF	Crop Consumptive Use Fraction
CDM	Camp, Dresser, & McKee
cfs	Cubic Feet per Second
CIMIS	California Irrigation Management Information System
CIP	Cast In Place
CNRA	California Natural Resources Agency
CSJWCD	Central San Joaquin Water Conservation District
CVP	Central Valley Project
CWC	California Water Code
DF	Delivery Fraction
DM	Division Manager
DWR	California Department of Water Resources
EC	Electrical Conductivity
EQIP	Environmental Quality Incentives Program
ET	Evapotranspiration
ET_{aw}	Crop Evapotranspiration of Applied Water
ETc	Crop Evapotranspiration
ET_o	Reference Evapotranspiration
ET_{pr}	Crop Evapotranspiration of Precipitation
EWMP	Efficient Water Management Practice
FWUA	Friant Water Users Authority
gpm	Gallons per Minute
ILRP	Irrigated Lands Regulatory Program
in	Inches
k_c	Crop Coefficient
LAFCO	Local Agency Formation Commission
LMSC	Lower Main Supply Canal
MDC	Main Distributary Canal
MGD	million gallons per day
mi/hr	Miles per Hour
MID	Modesto Irrigation District
MSC	Main Supply Canal
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OID	Oakdale Irrigation District
PAT	Program Administration Tool
PG&E	Pacific Gas and Electric
Program	On-Farm Water Conservation Program or Pilot Delivery Measurement Assessment Program
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
RWQCB	Regional Water Quality Control Board

SBx7-7	Senate Bill x7-7, Water Conservation Act of 2009
SCADA	Supervisory Control and Data Acquisition
SCWSP	South County Water Supply Program
SDWA	South Delta Water Agency
SEWD	Stockton East Water District
SIDE	System Improvements for Distribution Efficiency
SJCFCWD	San Joaquin County Flood Control and Water Conservation District
SLDMWA	San Luis-Delta Mendota Water Agency
SOI	Sphere of Influence
SSJID	South San Joaquin Irrigation District
SWSF	Surface Water Supply Fraction
TAF	Thousands of Acre-Feet
TDS	Total Dissolved Solids
TID	Turlock Irrigation District
TP	TruePoint
UMSC	Upper Main Supply Canal
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
VAMP	Vernalis Adaptive Management Program
VFD	Variable Frequency Drive
WMF	Water Management Fraction
WTP	Water Treatment Plant
WUE	Water Use Efficiency

EXECUTIVE SUMMARY

INTRODUCTION

This Agricultural Water Management Plan (AWMP or Plan) has been prepared by the South San Joaquin Irrigation District (SSJID or District) to describe the District's agricultural water management activities in accordance with Senate Bill x7-7 (SBx7-7), also referred to as the Water Conservation Act of 2009. Preparation of the AWMP includes a detailed evaluation of the District's water management operations as they relate to the implementation of mandatory and other locally cost-effective efficient water management practices (EWMPs).

Water for irrigation is foundational to supporting agriculture, the economic engine of San Joaquin County. In 2011, over $2.2 billion in agricultural commodities were produced in the County, providing a total economic impact of over $13 billion[1]. Key strategies employed by SSJID to support overall water management objectives are the conjunctive management of surface and groundwater supplies and water conservation.

Development of the AWMP represents a substantial effort by SSJID to evaluate its water management, including the development of detailed water balances spanning the period from 1994 to 2008 for the four primary water accounting centers:

1. Upper Main Supply Canal (UMSC) and Woodward Reservoir
2. Lower Main Supply Canal (LMSC) and Main Distributary Canal (MDC)
3. Irrigated Lands and District Laterals
4. Drainage System

The AWMP consists of an introduction to SSJID, its history, and previous water management activities; a review of the public participation process to prepare and adopt this AWMP; a detailed description of the District's physical setting, formation, organization, operations, and facilities; an inventory of water supplies and uses, a discussion of potential impacts of climate change and adaptation strategies, and an evaluation of the implementation of EWMPs and corresponding WUE improvements.

WATER MANAGEMENT OBJECTIVES AND ACTIONS

The District's primary water management objective is to maintain a reliable, affordable, high quality water supply for agriculture and other uses. To that end, SSJID has conducted and participated in numerous local and regional water management projects and initiatives, in addition to the day-to-day operation and maintenance of the District's supply and distribution

[1] San Joaquin County Agricultural Commissioner's 2011 Crop Report. The estimated total economic value of $13 billion is based on the agricultural commissioner's estimated economic multiplier of 6.

system to meet irrigation, domestic, and M&I water demands while also generating hydropower. Actions of note initiated or completed in the last ten years include the following:

- Development and implementation of the System Improvements for Distribution Efficiency (SIDE) project in 2003, resulting increased flexibility for system operations and deliveries in the surrounding area;
- Development of the South County Water Supply Program (SCWSP) through a collaborative and cooperative effort between SSJID, Manteca, Escalon, Lathrop and Tracy to provide treated surface water to supplement the City's existing groundwater supply through the construction of the Nick C. DeGroot Water Treatment Plant (WTP), including a 35-mile concrete-lined steel supply pipeline to supply Manteca, Lathrop and Tracy. From 2005 to 2010, the WTP delivered a combined average of 15,700 af annually. The opportunity to provide supplemental water to municipalities was made possible through SSJID's extensive conservation and water management efforts in the 1980's and 90's that resulted in significant reductions in spillage and increased system efficiency. These improvements increased flexibility and reliability in the delivery of water for irrigation;
- Development of a 15 year water balance for 1994 to 2008 in 2009, providing a benchmark of recent historical water use within the District to allow for assessment of current water management and planning and evaluation of future improvements;
- Preparation of a Joint Canal hazard study and completion of tunnel improvements on the Joint Canal and Upper Main Supply Canal between 2005 and 2010 totaling approximately $5 million;
- Development and implementation of a Flow Measurement Plan in 2010, including phased measurement improvements at boundary outflows, delivery measurement accuracy assessment, and pilot testing of delivery measurement alternatives;
- Acceleration of capital improvement projects from 2008 through 2010 to create local jobs and to take advantage of reduced construction costs;
- Installation and implementation of TruePoint water ordering software in 2009 to improve accounting of individual customer deliveries and support volumetric water charges.
- In 2011, the District licensed its own Federal Communications Commission (FCC) frequency and built eight (8) microwave towers to support the enhancement of its Supervisory Control and Data Acquisition (SCADA) system.
- Development and implementation of SSJID's On-Farm Water Conservation Program in 2011, providing direct incentives to SSJID irrigators to utilize available surface water supplies while implementing water conservation practices;
- Division 9 Project Completion in 2012, resulting in the availability of pressurized water for irrigators with arranged demand and online ordering, also reducing reliability on groundwater of lesser quality.

IMPLEMENTATION OF EFFICIENT WATER MANAGEMENT PRACTICES

SBx7-7 lists sixteen EWMPs aimed at promoting efficient water management. According to SBx7-7, two of these are "critical" or mandatory, and the remaining fourteen "conditional" EWMPs are to be implemented if technically feasible and locally cost effective. Of the fourteen conditional EWMPs, SSJID is implementing all of those that are technically feasible at locally cost effective levels and will continue to evaluate and implement additional actions for EWMPs that most effectively support the District's water management objectives. The EWMPs, along with past and future implementation activities by SSJID are described in Table ES-1.

CONCLUSION

Development of this AWMP has provided SSJID with an opportunity to evaluate and describe its ongoing water management activities and to evaluate how these actions support the District's water management objectives, described above, as well as water use efficiency improvements from the State's perspective. As demonstrated in the Plan, SSJID is a local leader in water management and is committed to the ongoing evaluation and implementation of water management practices that meet water management objectives. In the future, SSJID will continue efforts to effectively manage available surface water and groundwater supplies.

Table ES-1. Summary of EWMP Implementation Status

Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
Critical (Mandatory) Efficient Water Management Practices				
10608.48.b(1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	SSJID has evaluated and tested options for delivery measurement capable of meeting the requirements of new regulations. SSJID has developed a customer delivery measurement plan including corrective actions for compliance with CCR 23 §597 that is included as Attachment A of this AWMP.	
10608.48.b(2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented	SSJID adopted a pricing structure based in part on volume delivered on July 31, 2012. The new pricing structure includes a $3 per af charge to begin in 2014 in addition to the current $24 per acre flat rate charge. SSJID's Division 9 project charges a one-time fee to connect to the system and $30 per af for the first 3 af/ac $40 per af thereafter.	
Additional (Conditional) Efficient Water Management Practices				
10608.48.c(1)	Facilitate alternative land use for lands with exception-ally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	"Lands with exceptionally high water duties or whose irrigation contributes to significant problems" are not known to exist within the SSJID service area. District Rule #10 in the rules and regulations governing the distribution of water within SSJID prohibit the wasteful use of water through the "...flood[ing] of certain portions of the land to an unreasonable depth or amount...". Additionally, facilitation of alternative land use is beyond SSJID's jurisdiction; however, SSJID assists customers in implementing on-farm conservation measures, as described below.	
10608.48.c(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils	Not Technically Feasible	1. No available recycled water exists within the District service area that is not already beneficially used. 2. Manteca currently uses recycled water for irrigation of city parks and landscaping.	1. Consider requests from all qualifying permitted dischargers for additional use of recycled water.
10608.48.c(3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented	1. Cost sharing for irrigation improvements and services through On-Farm Conservation Program in 2011 and 2012. 2. Total financing of over $1 million in 2011 with 110 different landowners participating and continued financing of over $1 million during 2012.	1. SSJID will continue the On-Farm Conservation Program as long as it remains economically possible.
10608.48.c(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented	1. SSJID's volumetric charge promotes more efficient water use at the farm level and discourages excessive drainage (goals A and D). 2. Current pricing maintains low rates for surface water relative to groundwater pumping to promote conservation of groundwater through in lieu and direct recharge (goals B and C). 3. Division 9 project incentivizes more efficient irrigation systems and increases groundwater recharge in lieu and direct recharge (goals A through D). 4. Conservation Program increases use of surface water and efficient irrigation practices by encouraging growers who aren't District members to join to become eligible for incentives (goals A through D).	1. The District will review and assess its volumetric charge over time to ensure that identified water management objectives are being achieved.

Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	1. Main Canal is unlined but provides beneficial groundwater recharge through seepage. 2. Maintain 312 miles of pipeline. 3. Maintain 38 miles of lined channel. 4. Maintain 18 miles of unlined channel. 5. Scheduled maintenance and/or replacement of infrastructure. 6. Constructed Van Groningen Reservoir in 1992. 7. Constructed 5-acre SIDE reservoir and cross-lateral intertie pipeline in 2003. 8. Constructed 7-acre East Basin regulating reservoir as part of Division 9 project completed in 2012.	1. Connection of additional growers to Division 9 project. 2. Potential future construction of 7-acre West Basin reservoir within Division 9 based on determination of overall project benefit. 3. Reconstruction and concrete lining of approximately 4,000 feet of the Main Canal in the 2013 and 2014 offseasons to prevent erosion. 4. SSJID continues to look for opportunities to expand their system capabilities and increase delivery flexibility through improvements.
10608.48.c(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented	1. Ongoing efforts to facilitate high frequency, low volume deliveries to pump customers using pressurized irrigation systems. 2. Division 9 project completed in 2012 provides pressurized water on an arranged demand basis to 90 customers irrigating 3,800 acres while also enhancing delivery service for remaining surface irrigators. 3. On-Farm Conservation Program helps improve District-grower coordination. 4. Construction of regulating reservoirs and intertie pipelines to increase flexibility and steadiness, especially to growers near the lower ends of the system.	1. Continue efforts to facilitate flexible delivery service to pressurized irrigation system through operational and infrastructure improvements. 2. Expansion of pressurized pipeline system in Division 9. 3. Evaluate continued funding of On-Farm Conservation Program on a year-to-year basis. 4. Evaluate and implement additional locally cost-effective actions to improve flexibility
10608.48.c(7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented	1. SCADA at all drop structures along the MDC provides real-time control to prevent spillage. 2. The Van Groningen Reservoir provides for collection and storage of spillage and re-regulation. 3. The East Basin Reservoir in Division 9 captures spillage from Divisions 7 and 8. 4. Campbell Drain (Division 2) collects operational spillage and tailwater and conveys it into the "B" lateral in Division 3 for reuse. 5. Where tailwater drains do not exist, growers may channel tailwater back into District pipelines for redistribution. 6. Intertie pipeline construction for redistribution of excess. 7. Accept tailwater at 36 locations along the upper portions of the MSC and MDC, including spillage and tailwater outflows from OID	1. Continued and expanded monitoring at spill sites to reduce spillage and develop representative data. 2. Continue to look for opportunities to expand tailwater and spillage prevention and recovery capabilities.

Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented	1. Encourage use of available surface water supplies in lieu of groundwater through construction of pressurized irrigation systems. 2. Provide surface water at a lower cost than that of pumping groundwater. 3. Utilize 28 groundwater wells to augment surface water supplies and control shallow groundwater levels. 4. Constructed Division 9 project to provide pressurized surface water for irrigation to 90 customers through 19 miles of pipelines serving 3,800 acres.	1. SSJID anticipates refining conjunctive management by further evaluating the underlying groundwater system through update of their groundwater management plan and/or other activities.
10608.48.c(9)	Automate canal control structures	Being Implemented	1. Automation of all 24 lateral headings and all control structures on the MSC and MDC to improve customer service while reducing system losses. 2. Automation of the SIDE reservoir to maintain steady water supply to three adjacent laterals. 3. Implementation of an extensive SCADA system to provide communication, monitoring, and control of automated sites, including remote on/off control of 28 groundwater wells. 4. Automation of 19 miles of pipelines and deliveries to 90 customers farming 3,800 acres in Division 9.	1. SSJID will continue to evaluate opportunities for additional automation to increase delivery flexibility and steadiness and to reduce operational spillage.
10608.48.c(10)	Facilitate or promote customer pump testing and evaluation	Being Implemented	1. SSJID facilitates and promotes customer pump testing and evaluation by providing links on its website to programs that provide these services, such as offered by PG&E (http://www.pumpefficiency.org/).	1. Consider cost sharing for pump efficiency testing as part of its On-farm Water Conservation Program.
10608.48.c(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	1. SSJID added a permanent, full time water conservation coordinator in 2011.	1. Continue to employ a full time water conservation coordinator.
10608.48.c(12)	Provide for the availability of water management services to water users.	Being Implemented	1. SSJID provides for the availability of water management services through scientific irrigation scheduling and soil moisture monitoring conservation measures, for example, as part of its On-Farm Water Conservation Program. 2. Additionally, SSJID provides links to CIMIS and other water management information on its website and produces a periodic irrigation newsletter. 3. Historical water use data is available to growers in the Division 9 project.	1. Continue current activities. 2. Provide regular water usage information as part of implementing volumetric billing.
10608.48.c(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented	1. SSJID actively evaluates the effect of supplier (Reclamation) and Tri-Dam Project policies and operational practices and seeks policy changes to alleviate water supply constraints.	1. Continue current activities.
10608.48.c(14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented	1. Periodic evaluation and improvements of pumps by performing periodic pump efficiency tests to identify cost effective energy and/or water conservation improvements. 2. Replaced four of the 28 GW remediation pumps in the last 4 years 3. Maintain 7 pumps at the East Basin Reservoir and 5 at the SIDE Reservoir.	1. Continue testing and periodic refurbishment or replacement of pumps and motors. 2. Add any new pumps to the existing testing program.

1. INTRODUCTION

This Agricultural Water Management Plan (AWMP or Plan) has been prepared by the South San Joaquin Irrigation District (SSJID or District) to describe the District's agricultural water management activities. This section provides a description of the District's rich history of regional water management over more than 100 years, a description of legislative requirements related to the contents of the Plan, and a summary of previous water management activities. The District's primary water management objective is to maintain a reliable, affordable, high quality water supply for agriculture and other uses. Water for irrigation is foundational to supporting agriculture, the economic engine of San Joaquin County. In 2011, over $2.2 billion in agricultural commodities were produced in the County, providing a total economic impact of over $13 billion[2]. Key strategies employed by SSJID to support overall water management objectives are the conjunctive management of surface and groundwater supplies and water conservation.

Section 2 describes the process of preparing the Plan, including public outreach efforts. Section 3 provides a detailed background describing SSJID, its facilities, and the irrigation service area. Section 4 provides an inventory of SSJID's water supplies, which is followed in Section 5 with presentation of detailed water balances for the 1994 to 2008 period. Water balances are presented for four primary accounting centers as follows:

- Upper Main Supply Canal and Woodward Reservoir
- Lower Main Supply Canal and Main Distributary Canal
- Irrigated Lands and District Laterals
- Drainage System

Potential climate change effects on weather and hydrology, impacts on water supplies, and adaptation strategies are discussed in Section 6. Section 7 describes SSJID's implementation of Efficient Water Management Practices (EWMPs) and includes an evaluation of EWMP implementation relative to SSJID's water management objectives and Water Use Efficiency (WUE) improvements in general.

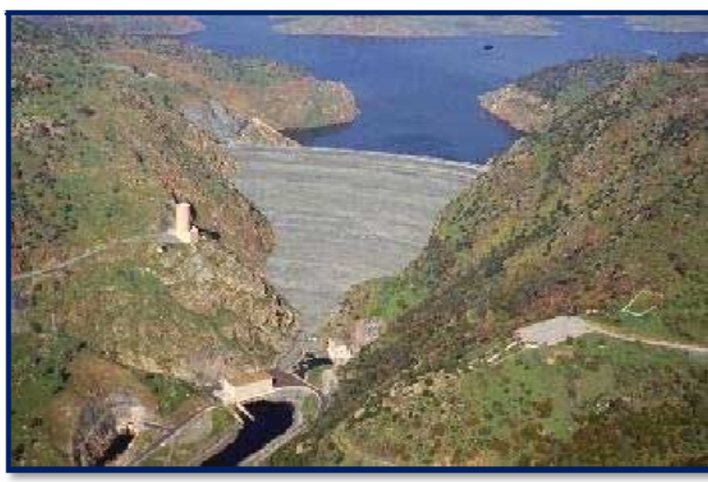

Figure 1-1. New Melones Dam

[2] San Joaquin County Agricultural Commissioner's 2011 Crop Report. The estimated total economic value of $13 billion is based on the agricultural commissioner's estimated economic multiplier of 6.

This AWMP has been prepared in accordance with the requirements of the Water Conservation Act of 2009 (SBx7-7), which modifies Division 6 of the California Water Code (CWC), adding Part 2.55 (commencing with §10608) and replacing Part 2.8 (commencing with §10800).

1.1 SSJID HISTORY

SSJID was formed in 1909 and in 1910 purchased half interest in certain Stanislaus River water rights and facilities from two existing water companies. SSJID's sister district, the Oakdale Irrigation District (OID) held the options on the rights and deeded half to SSJID through mutual agreement. Thereafter, the districts initiated expansion of their shared storage and respective distribution systems. OID and SSJID hold pre-1914 water rights for diversion of 1,816.6 cfs from the Stanislaus River at Goodwin Dam. Construction of New Melones Reservoir and Dam (completed in 1979, Figure 1-1) replaced the original Melones Dam, and operation was transferred to USBR, impacting the ability of the districts to store and divert water despite their senior water rights. In 1988 SSJID and OID entered into an operational agreement with USBR recognizing and protecting the rights of the districts. This agreement sets season limits on the quantity and timing of diversions by SSJID. The agreement provides the districts with the first 600,000 acre-feet (af) of inflow to New Melones annually as a first priority with special provisions in dry years, representing one of the most abundant and reliable water supplies in California.

With this secure and abundant water supply and revenues from power generation SSJID has accomplished infrastructure improvements and maintained the District's facilities over the last 100 years. Leadership and action by the Board of Directors and staff have maintained the integrity of the District's operational philosophy of providing high quality water for irrigation at affordable prices and have proactively sought physical and operational improvements to enhance irrigation service. SSJID is embarking on efforts to plan for the actions necessary to maintain and continue to enhance service while protecting local water supplies for generations to come.

Over the long history of irrigation in SSJID, cropping patterns have shifted from forage and feed crops grown to support dairy and livestock operations in the region to permanent orchard and vine crops. Although permanent crops, particularly almonds, represent approximately 72% of the irrigated acreage within SSJID, a variety of other crops continue to be grown. Double-cropped winter grains and corn represent approximately 9% of the irrigated acreage, and pasture represents 7%. Other crops include alfalfa, rice, berries, melons, tomatoes and clover. The SSJID distribution system infrastructure and operating policies evolved primarily to satisfy the needs of orchard crops, and are still generally adequate to meet those needs. However, improved water delivery strategies are needed to satisfy the evolving irrigation needs of orchards and other specialty crops, particularly as they transition from surface irrigation to pressurized irrigation (microirrigation and sprinklers).

The SSJID Board and management recognize that continued assessment and update of the District's policies, procedures and facilities is needed. As a result, SSJID has initiated and completed several foundational efforts to support long term infrastructure planning. These efforts include the following:

- Hydraulic Study and Design of Improvements for the Main Canal in 1986, resulting in automation of the Main Supply Canal and the Main Distributary Canal;
- Water Management and Conservation Report in 1989, providing information on the sources, uses and disposition of surface and groundwater in the District along with current and planned conservation measures;
- Inland Surface Water Plan in 1992, describing the SSJID surface water system;
- Groundwater Management Plan in 1994, prepared in accordance with the California Water Code as amended by Assembly Bill 3030 (AB3030);
- Development and implementation of the System Improvements for Distribution Efficiency (SIDE) project in 2003, resulting increased flexibility for system operations and deliveries in the surrounding area;
- Development of the South County Water Supply Program (SCWSP) through a collaborative and cooperative effort between SSJID, Manteca, Escalon, Lathrop and Tracy to provide treated surface water to supplement the City's existing groundwater supply through the construction of the Nick C. DeGroot Water Treatment Plant (WTP), including a 35-mile concrete-lined steel supply pipeline to supply Manteca, Lathrop and Tracy. From 2005 to 2010, the WTP delivered a combined average of 15,700 af annually. The opportunity to provide supplemental water to municipalities was made .possible through SSJID's extensive conservation and water management efforts in the 1980's and 90's that resulted in significant reductions in spillage and increased system efficiency. These improvements increased flexibility and reliability in the delivery of water for irrigation;
- Development of a 15 year water balance for 1994 to 2008 in 2009, providing a benchmark of recent historical water use within the District to allow for assessment of current water management and planning and evaluation of future improvements;
- Preparation of a Joint Canal hazard study and completion of tunnel improvements on the Joint Canal and Upper Main Supply Canal between 2005 and 2010 totaling approximately $5 million;
- Development and implementation of a Flow Measurement Plan in 2010, including phased measurement improvements at boundary outflows, delivery measurement accuracy assessment, and pilot testing of delivery measurement alternatives;
- Acceleration of capital improvement projects from 2008 through 2010 to create local jobs and to take advantage of reduced construction costs;
- Installation and implementation of TruePoint water ordering software in 2009 to improve accounting of individual customer deliveries and support volumetric water charges.

- In 2011, the District licensed its own Federal Communications Commission (FCC) frequency and built eight (8) microwave towers to support the enhancement of its Supervisory Control and Data Acquisition (SCADA) system.
- Development and implementation of SSJID's On-Farm Water Conservation Program in 2011, providing direct incentives to SSJID irrigators to utilize available surface water supplies while implementing water conservation practices;
- Division 9 Project Completion in 2012, resulting in the availability of pressurized water for irrigators with arranged demand and online ordering, also reducing reliability on groundwater of lesser quality.

Additionally, the District has completed several projects related to Woodward reservoir, including hydrologic, capacity, and dam safety studies as well as various improvements to reduce reservoir losses.

1.2 REQUIREMENTS OF SBX7-7

The Water Conservation Bill of 2009 (SBx7-7 or Bill) amends the California Water Code (CWC) Division 6 with regards to agricultural and urban water management by adding Part 2.55 (commencing with §10608) and replacing Part 2.8 (commencing with §10800). In particular, SBx7-7 requires all agricultural water suppliers to prepare and adopt an AWMP as set forth in the Bill on or before December 31, 2012. The plan must be updated by December 31, 2015 and then every 5 years thereafter (§10820 (a)).

Additionally, the Bill requires suppliers to implement certain efficient water management practices (EWMPs). Specifically, under §10608.48 of the CWC, all agricultural water suppliers are required to implement the following "critical" (i.e., mandatory) EWMPs:

(1) Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of §531.10.
(2) Adopt a pricing structure for water customers based at least in part on quantity delivered.

Further, suppliers are required to implement the following "additional" (i.e., conditional) EWMPs, if they are locally cost effective and technically feasible:

(1) Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.
(2) Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.
(3) Facilitate financing of capital improvements for on-farm irrigation systems.
(4) Implement an incentive pricing structure that promotes one or more of the following goals:
    (A) More efficient water use at the farm level.

   (B) Conjunctive use of groundwater.
   (C) Appropriate increase of groundwater recharge.
   (D) Reduction in problem drainage.
   (E) Improved management of environmental resources.
   (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.
(5) Expand or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce spillage.
(6) Increase flexibility in water ordering by, and delivery to, water customers within operational limits.
(7) Construct and operate supplier spill and tailwater recovery systems.
(8) Increase planned conjunctive use of surface water and groundwater within the supplier service area.
(9) Automate canal structures.
(10) Facilitate or promote customer pump testing and evaluation.
(11) Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.
(12) Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following:
   (A) On-farm irrigation and drainage system evaluations.
   (B) Normal year and real-time irrigation scheduling and crop evapotranspiration information.
   (C) Surface water, groundwater, and drainage water quantity and quality data.
   (D) Agricultural water management educational programs and materials for farmers, staff, and the public.
(13) Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.
(14) Evaluate and improve the efficiencies of the supplier's pumps.

Agricultural water suppliers not in compliance with the Bill are not eligible for state water grants or loans.

A compliance checklist has been prepared that provides cross reference of Sections in this AWMP to applicable sections in the CWC to ensure compliance. This is included as Attachment A.

1.3 PREVIOUS WATER MANAGEMENT ACTIVITIES

SSJID is involved in a variety of other water management activities at local, regional, and state levels. These activities include the following:

- **San Joaquin County & Delta Water Quality Coalition (www.sjdeltawatershed.org).** The District is a member of the San Joaquin County and Delta Water Quality Coalition under the Irrigated Lands Regulatory Program of the State Water Resources Control Board. The San Joaquin County & Delta Water Quality Coalition was established to help irrigated agriculture meet the requirements of the California Regional Water Quality Control Board's (RWQCB) Irrigated Lands Regulatory Program (ILRP) in San Joaquin County, Calaveras County and Contra Costa County. Under the ILRP that was originally adopted in July of 2003, farmers and ranchers that irrigate their land and have runoff from that irrigation or rainfall must belong to a coalition or apply for an individual discharge permit from the Regional Board directly. Prior to joining the coalition in 2010, SSJID filed as an individual discharger under the program and collected its own water quality information beginning in 2004.
- **Tri-Dam Project and Power Authority (www.tridamproject.com).** The Tri-Dam Project is a partnership between SSJID and OID that developed and now operates and maintains two reservoirs above New Melones Lake and one reservoir below the Lake on the Stanislaus River. The reservoirs are operated for irrigation water supply and power generation, as well as for recreation and water sports. Tri-Dam Power Authority is a joint powers authority of SSJID and OID that owns and operates the Sand Bar power generation plant above New Melones Lake.
- **Save the Stan (savethestan.com).** Save the Stan is a public education program of SSJID and OID. The purpose of the program is to inform the public about the NOAA Biological Opinion (BO) for the protection of Central Valley steelhead from the operations of New Melones Reservoir.
- **San Joaquin Tributaries Authority (calsmartwater.org).** The San Joaquin Tributaries Authority is a coalition of SSJID with Merced Irrigation District, Modesto Irrigation district, Oakdale Irrigation District, Turlock Irrigation District, and the City and County of San Francisco with the mission of promoting sound, environmentally responsible solutions to water supply management within a framework that recognizes the historic rights of its member agencies and the concerns of ratepayers.

The District has not previously prepared an AWMP. However, SSJID prepared a Water Management/Conservation Information Report in 1989 in accordance with the Agricultural Water Management Planning Act of 1986, Assembly Bill 1658, Part 2.8 added (commencing with Section 10800) to Division 6 of the California Water Code. Various other water management activities are listed and described in Section 1.1.

2. PLAN PREPARATION

2.1 AWMP PREPARATION

As described previously, this AWMP has been prepared in accordance with SBx7-7.

2.2 PUBLIC PARTICIPATION

Public participation in the development of this Plan included:

- Notification of the County of San Joaquin, the City of Manteca, the City of Ripon, and the City of Escalon of SSJID's intent to prepare an AWMP on November 9, 2012;
- Publication in the Manteca Bulletin on November 13, 2012 and November 20, 2012 of the time and place of a hearing to review the draft Plan;
- Posting of the draft Plan on the District's web page on November 13, 2012, including instructions for reviewers to submit comments;
- Posting of the draft AWMP for public review on November 13, 2012;
- Review of the publicly noticed presentation of the draft Plan at a regularly scheduled Board of Directors meeting on November 27, 2012;
- Adoption of the final AWMP at a regularly scheduled Board of Directors meeting on December 11, 2012; and
- Provision of copies of the adopted AWMP to the following parties within 30 days of adoption:
  - Cities of Manteca, Ripon, and Escalon
  - County of San Joaquin
  - San Joaquin County Library
  - Local Agency Formation Commission (LAFCO) of San Joaquin County
  - California Department of Water Resources
  - California State Library

The public is invited to attend all Board meetings with time reserved on each agenda for public comments. The Board members are accessible to the public. The District has a web site (www.ssjid.com) where the agendas of all Board meetings are published along with the most recent Board minutes, newsletters and other important information. Comments can be submitted via e-mail.

The District distributes a newsletter periodically to publicize important issues. The District maintains an open exchange of information with local newspapers and issues press releases on matters of importance to the public. The District also relies on its Division Managers (DMs) to keep customers informed of the latest water management information.

2.3 REGIONAL COORDINATION

The District coordinates operation of the Tri-Dam Project cooperatively with OID and coordinates with neighboring agencies, as appropriate; however, SSJID does not plan to develop a regional AWMP at this time due to differences in the institutional, physical, and operational characteristics of each district.

3. BACKGROUND AND DESCRIPTION OF SERVICE AREA

3.1 FORMATION

SSJID was organized in 1909 under the California Irrigation District Act – originally called the "Wright Act" – which provided for the organization of irrigation districts, for the acquisition or construction of irrigation facilities, and for the distribution of water for irrigation purposes. The Wright Act was approved March 31, 1897, (Statutes 1897, p. 254 et seq.).

The ditch system that later gave birth to SSJID and OID was developed by miners in 1855 as means to divert water from just above the current location of Goodwin Dam for mining and domestic water supply in areas around Knights Ferry (Marvin 2006). The San Joaquin County Water Company later acquired the diversion rights and the existing "Knights Ferry Ditch" and made efforts to expand the ditch system to the west for irrigation. Foreclosure prompted the sale of the rights to a local landowner named Abraham Schell in 1856. In 1888, Mr. Schell relinquished ownership to the newly formed San Joaquin Land and Water Company who, as early as 1864, had planned to extend the ditches and build a county-wide distribution system that would supply both water and power. Construction and funding for the enterprise proved to be difficult. With approximately $170,000 already spent on construction, tensions amongst the Company prompted the stockholders to relinquish ownership to H.W. Cowell and his partner, N.S. Harrold who both owned the Stanislaus and San Joaquin Water Company. Being large landowners, Cowell and Harrold were self-interested in developing a reliable water supply for irrigation and other uses and had the necessary capital to undertake the massive project of tunnel, ditch, dike, and flume construction.

Between 1888 and 1905 the ditch system was extended southwesterly towards modern-day Lathrop, in part by way of Lone Tree Creek, and northerly through Little Johns Creek toward Farmington and irrigated approximately 6,000 acres in what is now SSJID as well as small landholdings near Oakdale (Greene 1895). Although there were many important figures in the system development, much of the system's expansion and eventual success can be traced back to Mr. Charles Tulloch.

In the early 1860's the Tulloch Family, who owned a flour mill in Knights Ferry, acquired the upper portions of the original Knights Ferry Ditch to power their mill and constructed a new diversion dam just below the existing Tulloch Dam. Charles Tulloch was an early member of the San Joaquin Land and Water Company and saw the great potential in controlling the water supply for irrigation and electrical generation. With the ownership of the Knights Ferry Ditch, Mr. Tulloch built the first hydroelectric powerhouse on the Stanislaus River and incorporated the Stanislaus Water and Power Company to supply power to Knights Ferry, Oakdale, and rural Modesto. In 1899, Mr. Tulloch and three other prominent local businessmen and landowners organized the Stanislaus Water Company and purchased the entire Knights Ferry Ditch, including all water rights and partially completed facilities, from the financially troubled

Stanislaus and San Joaquin Water Company at auction for $27,300. The Company expanded the ditch length to reach near Lathrop, increased its capacity, and installed improved concrete infrastructure. Under the Tulloch Family interests, the ditch system continued to supply irrigation and domestic water services under the South San Joaquin Canal and Irrigation Company and the Consolidated Stanislaus Water and Power Company.

The limited capacity of the "Tulloch Ditch" was not enough to supply the growing demand, and landowners were not willing to fund the construction of a larger system if the water rights were privately held. In March of 1909, local landowners Joshua Cowell, F.A. West and P.E. Lunstrom petitioned the San Joaquin County Board of Supervisors to form the South San Joaquin Irrigation District under the Wright Act and to authorize a bond issue of $1,875,000 to purchase the Tulloch Ditch and to start the construction of new, larger infrastructure to supply the roughly 70,000 acres that the District would encompass. An election was held on May 11, 1909 and voters overwhelmingly supported formation of the District (396 to 67) and elected the first Board of Directors (German 1942).

After the task of legal formation was complete, the Board of Directors adopted a plan for constructing the necessary canals and works and acquiring the necessary property and rights to carry out the provisions of the act under which it was created. Additional bond issues were called for by the Board during the initial construction of the system and again during the first few years of operation. The Board also had the power to levy taxes and land assessments within the service area to pay for expenses and to repay the bonds.

A more detailed description of the history of the development of the District's surface water supply is provided in Section 4: Inventory of Water Supplies.

3.2 DISTRICT ORGANIZATION

The District is organized into five divisions with each division being represented by a director who is elected for a four-year term by the landowners residing within the division. Elections are held every two years so that terms are staggered and only two or three of the directors' seats are subject to election at any one time. The Board of Directors elects a Board President to run the meetings and a Vice-President to serve if the Board President is unavailable. The Board President serves for a two-year term. The five Directors of the SSJID also serve as board members on the "Joint Board of Directors" for the Tri-Dam Project and as commissioners of the Tri-Dam Power Authority Board together with the OID board of directors.

The General Manager is appointed by the directors and is principal administrative officer of the District, additionally serving as Secretary to the Board of Directors. The Finance and Administration Manger, Engineering Department Manager, Utility Systems Director, Operations and Water Superintendent, and Water Treatment Plant Manager report to the General Manager. Currently, there are 89 full-time District employees with six employees in Administration, four employees in Accounting, six employees in Engineering, 29 in Water Operations, 23 in Operations and Maintenance and 18 that operate the water treatment plant[3] . An organizational chart of the District is provided in Figure 3-1.

[3] Number of employees from 2012 SSJID Organization Chart.

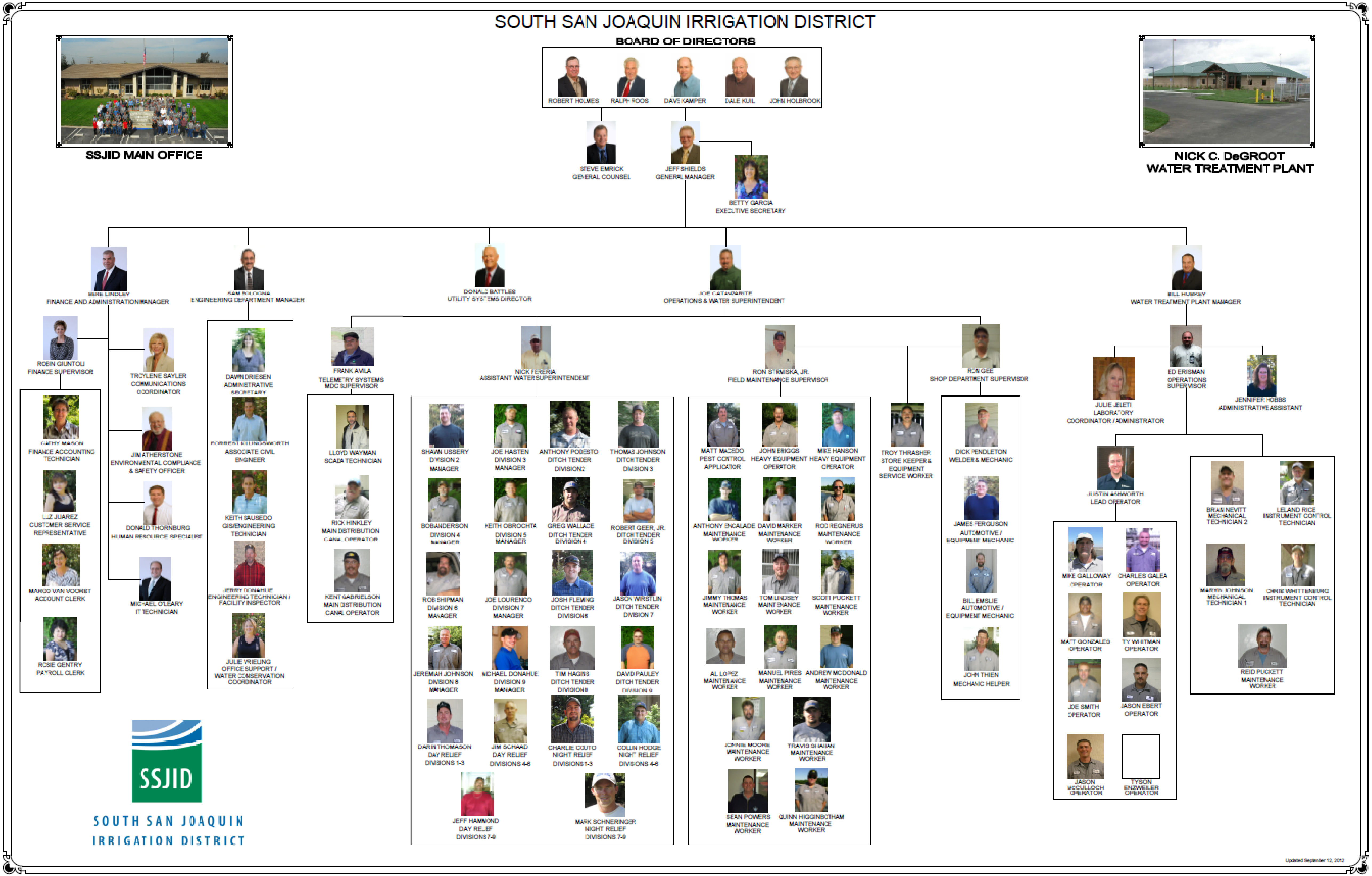

Figure 3-1. SSJID Organizational Chart

3.3 SIZE AND LOCATION OF SERVICE AREA

The District is located in the northeastern portion of the San Joaquin Valley, approximately 15 miles southeast of Stockton and 11 miles north of Modesto, encompassing the cities of Manteca, Escalon and Ripon (Figure 3-2). All irrigated lands are located north of the Stanislaus River in southeastern San Joaquin County. Woodward Reservoir, approximately 6.5 miles of the Lower Main Supply Canal, and 10.5 miles of the Upper Main Supply Canal are located in Calaveras County. The remaining 2.5 miles of the Joint Supply Canal (to Goodwin Diversion) are located in Tuolumne County. Modesto Irrigation District (MID) lies to the south, OID lies to the east, the South Delta Water Agency lies to the west, and the Central San Joaquin Water Conservation District (CSJWCD) and Stockton East Water District (SEWD) lie to the north.

The District encompasses approximately 72,000 acres, of which approximately 55,000 acres were irrigated in 2008, the last year for which the SSJID water balance was updated.

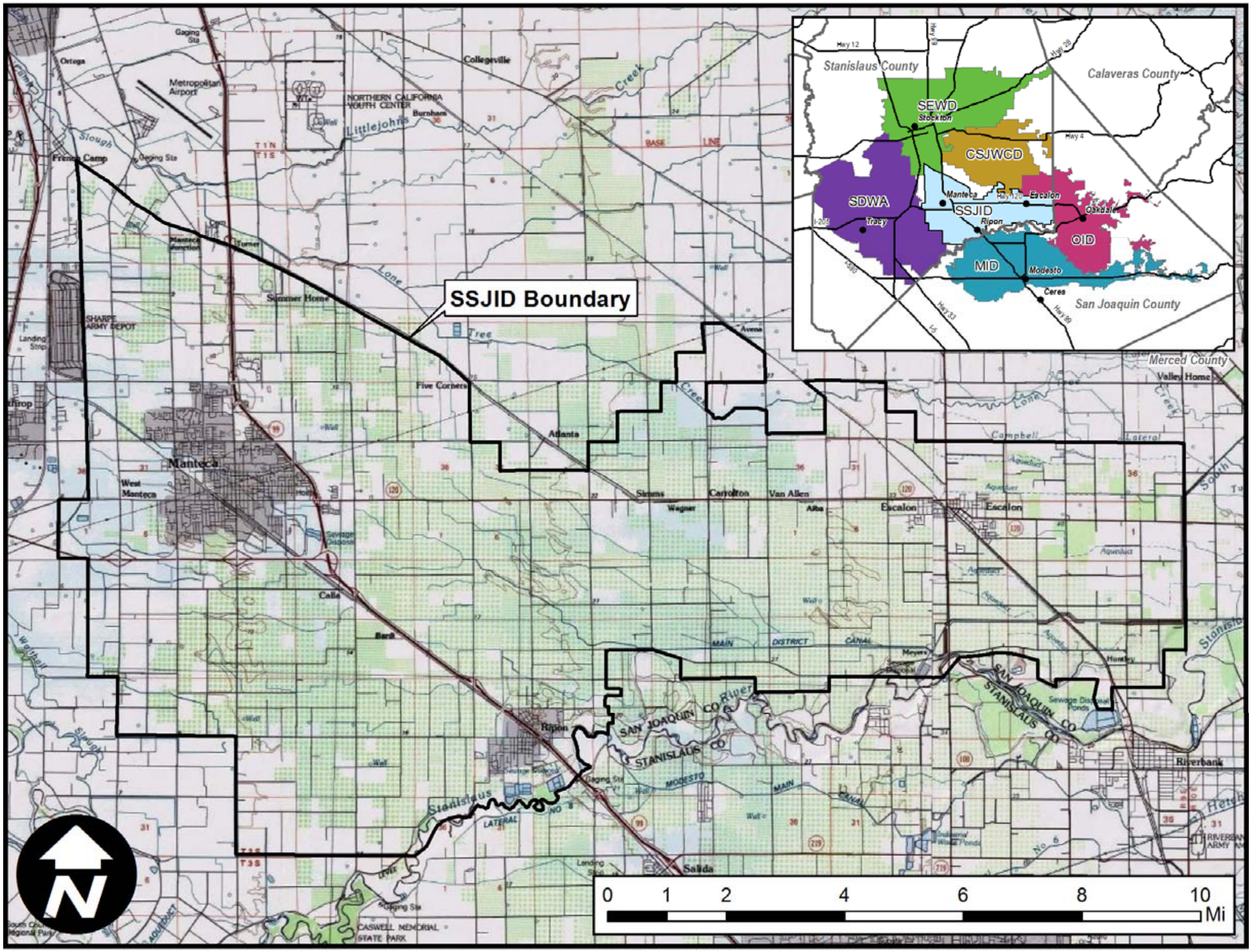

Figure 3-2. SSJID Location Map

3.4 SSJID DISTRIBUTION SYSTEM

SSJID diverts water from the Stanislaus River at Goodwin Dam into the Joint Main Canal on the north side of the River. The Joint Main Canal was constructed and is owned and operated by SSJID and OID with 72 percent of the capacity intended for SSJID and 28 percent intended for OID. OID also has a second diversion channel on the south side of the River. Approximately 3.5 miles downstream of Goodwin Dam, the Joint Main Canal bifurcates into OID's North Main Canal and SSJID's Upper Main Supply Canal (UMSC, Figure 3-3). The UMSC is the sole conveyance serving Woodward Reservoir, all of SSJID's irrigated area, and the Nick C. DeGroot water treatment plant (dedicated in 2005 and currently serves the cities of Manteca, Tracy, and Lathrop). After the split with the OID's North Main Canal, the UMSC continues westward, traveling through 11 tunnels and siphons for approximately 10 miles. The largest of these siphons, Hilts' Sag, was originally a 2,200-foot long wooden flume structure that bridged a natural gap at a maximum height of 68 feet from the ground and also crossed OID's North Canal. A fire in 1917 and mud slide in the early 1920's damaged the wooden truss and flume, temporarily delaying service (German 1942). Shortly thereafter the flume was replaced with a precast concrete structure that stood until 1993 when it was replaced with an underground siphon for earthquake safety concerns.

Figure 3-3. SSJID Upper Main Supply Canal

The UMSC terminates at Woodward Reservoir (Figure 3-4). The District constructed the 36,000 acre-foot Walter J. Woodward Reservoir in 1916 to provide much needed storage and regulation of diversions and as a safeguard against drought. Today, the reservoir continues to serve these purposes and has been a key feature allowing delivery flexibility and enhancing SSJID's water conservation capabilities.

Figure 3-4. Woodward Reservoir

Controlled discharges from the reservoir are channeled in the Lower Main Supply Canal (LMSC) which travels first westward for two miles and then south for an additional two miles before turning southwest and traveling 2.2 miles to the headings of laterals A, B, and

B15 and the first of 14 automated check structures (locally referred to as "drop structures"). At this point the canal enters the irrigation service area and the LMSC becomes the Main Distribution Canal (MDC), travelling south for 2.2 miles and creating the eastern-most boundary of the District. The MDC supplies four more lateral headings before turning west for the final 10 mile stretch and supplying the remaining 17 lateral headings. The MDC is capable of handling flow rates up to 900 cfs.

Water is delivered to 1,400 landowners and 3,500 parcels through more than 1,500 delivery points served by approximately 350 miles of laterals off of the main canals. Originally, the entire lateral system consisted of open, unlined ditches. Over time, selected laterals and lateral reaches have either been concrete lined or placed in low-head, cast-in-place (CIP) concrete or PVC pipelines. To reduce maintenance requirements, erosion, and seepage losses below Woodward Reservoir, many canals and ditches in the distribution system were lined with concrete in the 1920's with funding from a $550,000 bond measure passed in 1923. In the 1960's a low interest loan obtained through the USBR's P.L. 984 program allowed the replacement of 210 miles of open channel with buried concrete pipe. The majority of replacement pipe was cast-in-place (C.I.P). Additionally, related standpipes and water control structures were replaced to enhance operability and conserve additional water. The pipeline system is considered an "open" system meaning that it has open control and junction boxes that minimize pressurization of the line.

At the present time, approximately 312 miles of the District's laterals are pipelines and 38 miles are open, concrete-lined ditches. The only unlined open channel is the 18-mile length of the MDC. Although seepage from the unlined MDC generates beneficial groundwater recharge, concerns over embankment erosion have prompted the scheduling of the construction of approximately 4,000 feet of concrete lining between drop structures 1 and 3 for the 2012 and 2013 off-season maintenance periods.

The main canal and lateral distribution system remains upstream controlled as originally constructed, although completion of the Van Groningen Regulating Reservoir in 1992 near the terminus of the MDC; the Northwest Reservoir, constructed in 2003 on the R Lateral as part of the System Improvements for Distribution Efficiency (SIDE) Project; the complete automation of the Main Distributary Canal; and the East Basin (part of the 2012 Division 9 Project) enable flow changes to be made more readily than before. The reservoirs are operated to increase delivery flexibility to water users while also reducing operational spillage by reducing mismatches in diversion and delivery volumes. Additionally, the reservoirs provide for steadier flow to downstream laterals, improving the steadiness of farm deliveries and allowing efficiency improvements on-farm, including installation of pressurized irrigation systems that utilize surface water. Reservoir storage fluctuates daily with the objective of operating within the middle one third of the capacity. To achieve the highest operational benefit from the reservoirs SSJID installed six Rubicon Water FlumeGates® (Figure 3-5) and four AquaSystems2000

LOPAC® gates that can be set to maintain a specific passing flow rate or to maintain constant upstream water level. The automated gates were installed at select lateral headings to help propagate flow changes and excess water to the SIDE and East Basin reservoirs and to improve delivery service. The technologically advanced gates are designed to integrate seamlessly into the District's SCADA system and provide real-time monitoring and remote control.

Figure 3-5. Flume Gates at Lateral Heading

After years of faithful service, the MDC and its structures underwent a major overhaul that started in 1986 and was largely completed by 1989. SSJID has continued its commitment to MDC modernization as demand changes and new technologies emerge. Old concrete and wooden grade board structures were replaced with state-of-the-art concrete structures fitted with new electrically-operated gates allowing automation and monitoring of the upstream water level through a supervisory control and data acquisition (SCADA) system. MDC check structures were replaced with dropleaf overshot gates, and lateral headings were replaced with undershot sluice gates. The simultaneous addition of physical and operational tools has provided system operators with real-time monitoring of operational pools, water travel times, and lateral delivery flow rate that has reduced tailend spillage and increased the quality of delivery service.

Four subsequent SCADA upgrades and projects were completed from 1999 through 2003 including remote control and improved flow measurement at all 27 lateral headings to better control irrigation deliveries, to reduce spillage, and to simplify operations. Automated upstream water level control in the MDC near the lateral headings maintains constant upstream head pressure on lateral heading gates and, assuming downstream conditions are not changing, makes positioning undershot gates at the lateral headings and direct deliveries from the MDC a function of the desired flow rate. A SCADA base station and master control center was constructed in 1996 near the Van Groningen Reservoir to house the control computers and MDC/SCADA operation staff (Figure 3-6). The control center serves as the central hub for monitoring, control, communications, and operational coordination. In recent years SSJID expanded the SCADA system to include 18 newly constructed flow measurement devices in boundary drains. Detailed, real-time records of system inflows and outflows is an invaluable resource in furthering SSJID's water management goals and enabling irrigation performance improvement. In 2011, In the District licensed its FCC frequency and built eight (8) microwave towers to enhance the SCADA system.

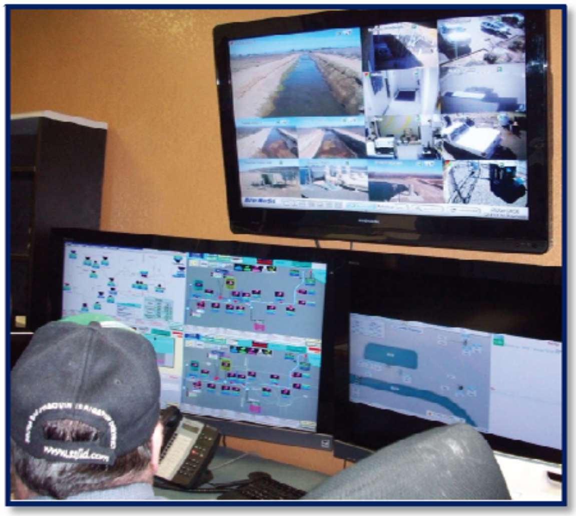

Figure 3-6. SCADA Control Center

With precise control of system inflows, SSJID has concentrated recent efforts more heavily on the lateral distribution system. Most notable is the Division 9 Surface Water Supply Project initiated in 2008 and completed in time for the 2012 irrigation season. The project is the first pressurized pipeline network as part of the District's distribution system and incorporates state-of-the-art technologies and water management features. The project provides pressurized surface water to a portion of the District west of Ripon (Division 9) that has a high frequency of permanent crops and micro irrigation systems but was predominately irrigating using groundwater. The project alleviated concerns of saline groundwater being used for irrigation and increased direct and in-lieu groundwater recharge thus helping to prevent overdraft of the underlying aquifer. The system includes a regulating reservoir, termed the East Basin (Figure 3-7); a pumping plant with seven pumps; 19 miles of pipeline that serves 90 customers and 3,800 acres; automatic flow control valves and magnetic flow meters at each turnout; soil moisture sensors in growers' fields; and online water ordering. At the pump station, variable frequency drive (VFD) pump controllers allow precise flow rates to be provided without wasting energy. The pumps pressurize water from the East Basin, providing 50 to 60 pounds per square inch (psi) at the turnouts, eliminating the need for booster pumps to operate pressurized irrigation systems. SSJID plans to expand the Division 9 project, including the construction of a second reservoir to be called the West Basin.

The pressurized network provides obvious benefits, especially with the growing number of pressurized irrigation systems, and the District will evaluate whether it is feasible to construct other networks in the future. Originally, the distribution system was designed to provide irrigation water to growers using graded border, graded furrow, and level basin surface irrigation methods. As such, delivery structures to individual fields commonly consist of large valves spaced evenly on a pipeline running along the head of the field (Figure 3-8). In many cases, the valves are installed directly in the SSJID lateral pipeline. A downstream control structure or "check box" allows the Division Manager to deliver all or a portion of the flow out of the upstream irrigation valves. Where the

Figure 3-7. Division 9 East Basin

field heading is not aligned with the lateral pipeline, an orifice gate in a check box is typically used to deliver to a private pipeline that serves the field. In this configuration, surface irrigators typically apply irrigation water directly to their field via irrigation valves installed in the private pipeline, while pump irrigators use a concrete sump box to provide limited storage to help compensate for mismatches between the delivery flow and the pump flow. The system has been successfully adapted to provide service to pump deliveries, mainly through off-lateral sumps, but does have restrictions and has required the continual evolution of the District's delivery and flow measurement policies and practices. Measurement of deliveries is described in detail in Section 3.8.

Figure 3-8. Surface Irrigation Valves

The District maintains 60 miles of dedicated drainage ways of which 23 miles are buried pipelines, and the remainder are unlined or lined open ditches. There is only one main drain entering the District, Lone Tree Creek. Drainage generally flows westerly to the San Joaquin River or northerly to Lone Tree Creek. Any southerly drainage flows into the Stanislaus River. The French Camp Outlet Canal (FCOC) runs south to north along the District's western boundary and is the main collector of drainage flows (figure 3-9). SSJID often redirects drain water back into the distribution system to augment water supply and to improve service through increased flexibility. Two emergency spill sites exist on the MDC near Ripon and Escalon that discharge to the Stanislaus River, if needed. In the past these spills have served as operational balancing tools on occasion when OID tailwater entered the system, but more recently the construction of regulating reservoirs, increased automation, and expanded control has limited the need for these spills. The FCOC is used, in addition to the Escalon Spillway, to make releases for maintenance of in-stream flows in coordination with USBR.

In addition to providing drainage to agricultural lands, SSJID has entered into contractual agreements with the cities of Manteca and Escalon to discharge urban storm run-off to the drains both by gravity flow into the open ditches and via drainage pumps that discharge into SSJID distribution pipelines or canals. Urban expansion has left some SSJID conveyance facilities running unused though developments and under neighborhoods. These facilities are decommissioned by SSJID or relinquished to the city for stormwater use. An example is the Tb lateral that runs through the western portion of Manteca and used almost exclusively by the City to collect runoff.

SSJID owns and operates 28 groundwater production wells predominately located in the western half of the District. The wells are operated for control of the high groundwater table that exists in this portion of District and to provide supplemental water supply.

Figure 3-9. French Camp Outlet Canal

In addition to providing water for irrigation, SSJID also provides treated surface water to the cities of Manteca, Lathrop and Tracy for domestic use. Phase I of the Nick C. DeGroot Water Treatment Plant (WTP) was completed in 2005 just below the Woodward Reservoir Dam and receives water directly from the lower Main Supply Canal (Figure 3-10). Water allotments for each city were established for Phase I and for Phase II. Phase II of the project will extend service to Escalon. Ripon currently receives raw untreated surface water from SSJID and is negotiating for treated water service.

Figure 3-10. Nick C. DeGroot Water Treatment Plant and Robert O. Schulz Solar Farm

The WTP is part of the larger South County Water Supply Project which includes the pipeline distribution system. Domestic water outtakes are measured by an electromagnetic flow meter. The sale of surface water for domestic uses was made possible because of the loss of agricultural land to urbanization and through SSJID's investment in system improvements (described in preceding sections) which resulted in water conservation. Because of these improvements irrigation deliveries are not affected by the additional water demands of the WTP, and agreements with the Cities are such that domestic deliveries receive the same percentage of allocation reductions during drought years.

SSJID completed the Robert O. Schulz Solar Farm at the WTP in 2008. The solar project, including nearly 7,000 photovoltaic panels installed on 14 acres of land offsets the power used to operate the WTP, reducing electrical costs by approximately $400,000 per year.

A map of the District's water management facilities is provided in Figure 3-11 on the following page.

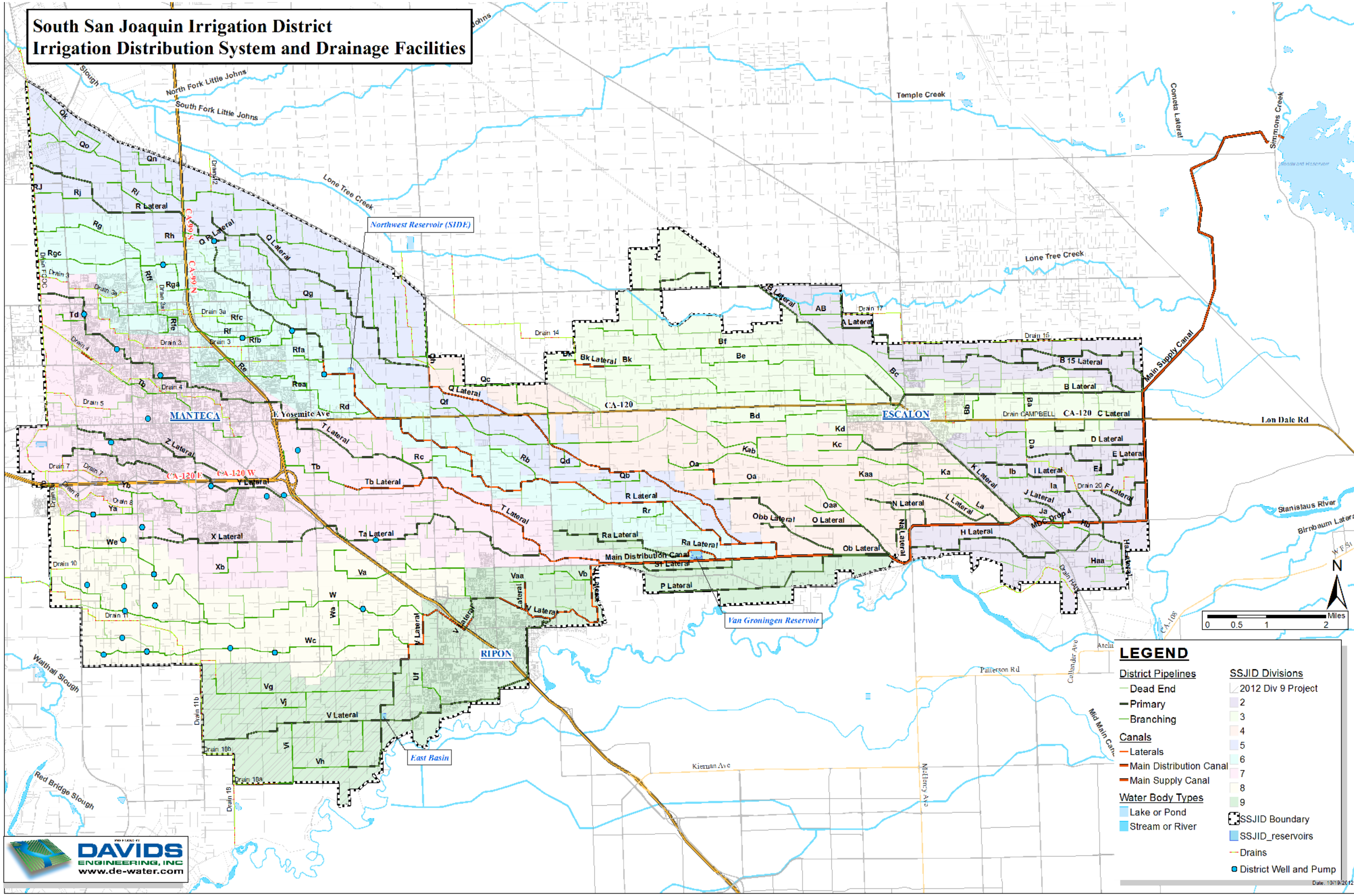

Figure 3-11. South San Joaquin Irrigation District Irrigation and Drainage Facilities

The District is currently divided into eight operational divisions. The divisions operate under the supervision of the Assistant Water Superintendent, who reports to the Operations and Water Superintendent. Within divisions, actual field operations are executed by Division Managers (DMs) (Figure 3-12). SSJID currently employs a total of 22 DMs, including eight to cover the regular day shift, three for relief day shift, eight to cover the regular night shift, and three for the relief night shift.

Based on the District's TruePoint electronic delivery tracking data for 2011 (described in greater detail below), division size ranges between 4,786 acres and 6,075 acres and averages 5,300 acres. The number of parcels per division ranges between 183 and 394 and averages 260. The average parcel size ranges between 15 and 27 acres and averages about 21 acres. The divisions have been delineated to achieve uniform division of workloads among DMs. To the extent possible, divisions are organized so that DMs have control of their water from the main lateral heading to the tail of their respective laterals. There are cases, however, where water is passed through one division to the next, rather than being delivered directly from the Main Canal. In these cases, the upstream DM provides a steady flow rate to the downstream DM according to the daily operations plan.

Figure 3-12. SSJID Division Manager Measuring Flow

SSJID has historically delivered water on a rotational basis. The distribution system and operating procedures are designed around a 10 day average rotation[4]. The season begins typically in mid-March to early April and continues until early to mid October. The rotation frequency may vary slightly by division based on crop types, irrigation methods or user requests. DM's may operate two separate rotation frequencies to cater to specific needs.

Historically, DMs have used "rotation sheets" to organize water deliveries. One rotation sheet is prepared for each lateral (or rotational unit), with the customers listed on the sheet in the order in which they will receive water. This order is referred to as the delivery "run". Important information about each customer is also provided on the sheet, including the customer's name, address, phone number, customer name and phone number, crop type, assessor's parcel number, irrigated acreage, number of hours to receive irrigation water, and delivery flow rate. As part of the modernization process, SSJID transitioned to TruePoint data collection software program in 2010 to digitally record delivery flow rate and start and stop times (duration) on laptop computers mounted in the DM's pickup

[4] Rotations of 14 or 20 days are provided by some DMs in some divisions as warranted based on customer needs.

trucks. The data is downloaded to a central computer at the main office once per day. The TruePoint water ordering and tracking system is discussed further in Section 3.8.

Each division has a cellular phone that is used to notify customers of when they will receive irrigation water and to whom to pass the water when their turn is complete, if applicable. The cellular phones are passed back and forth between the day shift and night shift DMs so that customers have only one number to call per division, any time of the day or night. Customers typically call to request schedule changes or to report unusual conditions such as delivery interruption. Prior to the start of a rotation, the DM calls each customer in the rotation to see if they would like water. Users can confirm their order or pass until the next rotation. The rotation schedule is adjusted accordingly. Permanent crops are often irrigated throughout the irrigation season while irrigation for field crops, alfalfa, etc. may begin later based on crop-specific water needs.

Each DM is responsible for determining how much water their division will need on at least a daily basis and requesting that amount from the control room operators. Typically the required flow rate is predetermined due to the nature of a rotational delivery system or is limited by the lateral capacity. However, the control room schedules two times during the day that flow rate changes can be made at the lateral headings off of the MDC and prefers that the DMs make their requests accordingly; however, automated gates and remote control allow changes to be made more frequently during the height of the season based on changes in customer demand. Communication between DMs and with headquarters is facilitated by a two-way radio system and cell phones.

The control room operators total the division requests, calculate the change from the current flow rate and initiate changes in diversions at Woodward Reservoir. The releases from Woodward Reservoir and many of the lateral headings off the MDC are remotely controlled through the District's SCADA system by staff in the control room. Based on the DM's request, and accounting for travel time from the dam, the control room will remotely adjust the lateral heading to deliver the requested flow rate at the requested time. Gates not on the MDC are typically adjusted by the DMs. The DMs may also cooperatively transfer water between divisions to manage their rotations, if water is available. For example, if one division is cutting 10 cubic feet per second (cfs) and the adjoining division is adding 10 cfs, the water can be transferred between the two, thereby avoiding routing two flow changes along the main canal.

At the 10-day rotation interval, the DM will begin a "run" either at the top end or bottom end of the division and deliver a "head" of water from one delivery point to the next, based on an established schedule, the capacity of the lateral, and the quantity ordered from the control room. The standard flood head is 25 cfs. Each delivery point receives the water for a predetermined duration that is established, in part, by the acreage and crop type served, although some flexibility in the delivery duration does exist to accommodate changes in the required delivery duration over the course of the irrigation season. SSJID laterals are typically sized to convey one, two or three heads for rotational delivery to growers. With multiple heads available in a lateral the DM has ability to deliver to multiple delivery points at the same time and to allow alternative rotation schedules along the length of the lateral and/or its sub branches. The full head of water is delivered to a single owner at 77 percent of the delivery locations. When more than one owner is served by a delivery location, the full head is either split between customers or passed (rotated) from parcel to parcel by customers with the delivery duration varying according to parcel size and other factors.

To better meet the needs of specialty crops and high-frequency, long duration, low flow rate irrigation systems, such as microirrigation and sprinklers, SSJID DM’s consider and attempt to accommodate delivery requests from growers desiring to irrigate outside of their scheduled rotation. Ultimately, requests are considered and approved at the discretion of the DM and vary from division to division based on operational constraints. Delivery start times are arranged, and shutoff times are scheduled at the same time that the water order is placed. Shutoff times may be modified by the irrigator in coordination with the DM , subject to the capacity and operational constraints of the distribution system. Divisions with high concentrations of pressurized irrigation systems are often able to provide arranged-demand delivery. Division Managers may also schedule two separate rotations within the same lateral pipeline; one for flood irrigators (25 cfs) and one for micro irrigators (typically 2 to 6 cfs, often referred to as a “pump head”). Often times this is not possible, and the DM delivers a pump head to micro- or sprinkler-irrigators and delivers the remaining partial head to a user who may flood irrigate. This requires additional coordination and effort by the DM. In some cases, particularly in the upper reaches, laterals are able to convey two flood heads (50 cfs).

As the amount of pressurized irrigation has increased, it has become increasingly difficult to provide the desired flexibility to sprinkler- and micro-irrigators while maintaining existing levels of service to surface irrigators without system modernization. In response, SSJID has and continues to modernize its distribution system and update operational procedures to provide flexibility and equity to its customers. Conjunctive use of water through installation of private groundwater wells and operation of SSJID wells is common in SSJID. Advantages of private wells to growers include complete flexibility in providing water for frost protection, chemigation, and fertigation, and to better align irrigations with crop water demands, field activities and harvest.

Woodward Reservoir is a key component of the ability to offer flexible service. The Reservoir is operated to maintain a specific downstream flow rate. SSJID operators coordinate with the Tri-Dam project personnel to adjust Goodwin diversions as needed to maintain target storage amounts. If demand increases, and an increase in releases at the Reservoir is required, the Superintendent checks whether the change can be made within the operational limits described below. Unless constrained by operational limits, the Superintendent requests the operator at the

Tri-Dam Project to divert the additional water. Because the reservoir is located nearly 15 miles closer to the irrigated lands than the river diversion, it serves as a re-regulation point that can be called upon for flexible changes in service that are not possible at the river diversion. It provides buffer storage to absorb excess diversions and provides localized supply for increases in MDC flows, improving service levels, minimizing spillage, and minimizing operational changes at Goodwin Dam.

Per the District's Rules and Regulations, growers are required to notify the District of their planned water needs (crop(s), acreage, etc) between January 1st and June 1st of each year they plan to irrigate so that the superintendent can develop a crop report and water usage records can be updated or developed.

Current daily use is determined from flow measurement sensors or rated gates at each of the lateral headings and relayed back to the Control Room using telemetry. All this information is tracked using the SCADA system and reports generated by the Control Room. Monitoring devices installed along the MDC within the Divisions and at spill sites allow the Control Room to regulate daily water use and provide DM's with helpful management information.

3.5 TERRAIN AND SOILS

The topography and soils within the District are typical of the San Joaquin Valley floor. Land surface is gently sloped westerly with elevations that vary from 150 feet in the east near Escalon to about 50 feet near Manteca with a relatively constant land slope. Surface water drainage generally flows southwesterly towards the San Joaquin River.

Historical flooding of the region's major rivers left layers of sediments and silts in the San Joaquin Valley floor, creating a unique soil profile that is well suited to implementation of irrigated agriculture, particularly for deep rooted tree crops such as walnuts and almonds. Soils in SSJID are typically deep and well drained with soil textures ranging from fine silts and sands in lower areas to medium in the low alluvial fan and terrace areas, with deposits of coarse-grained sands and gravels. SSJID does not contain expansive soils, and the erosion hazard rating is slight, indicating that erosion is unlikely under ordinary climatic conditions (NRCS 2007).

3.6 CLIMATE

The climate statistics presented in this section are based on the California Irrigation Management Information Station at Manteca (#70), established in 1987. This station was also used for the water balance analysis presented in Section 5.

SSJID has a climate typical of the San Joaquin Valley with mild winters with moderate precipitation and warm, dry summers. Average daily maximum temperatures range from a low of about 56°F in December and January to a high of 90°F in July (Table 3-1). Mean daily minimum temperatures range from a low of 38°F in December to a high of about 58°F in July. Average annual reference evapotranspiration (ETo) is approximately 53 inches, ranging from a low of approximately one inch in December and January to a high of approximately eight inches in July. Approximately three quarters of the annual ETo occurs in the six-month period from April through September.

Average annual precipitation is 13.7 inches, with 11.2 inches, or approximately 80 percent, occurring in the five month period from November through March.

Even during the peak summer period, the average maximum relative humidity reaches approximately 86%, which is indicative of an irrigated area, and exceeds 95% between November and March. Minimum relative humidity ranges between approximately 35% during August and September and roughly 65 to 70 percent during the wet winter months.

Average wind speed is lowest in November (3.6 miles per hour) and highest in May and June (5.7 to 5.8 miles per hour).

There are no significant microclimates within the district that affect water management or operations.

Table 3-1. Mean Daily Weather Parameters by Month at Manteca CIMIS Station (1994 through 2008)

Month	Total ETo (in)	Total Precip. (in)	Daily Temperature (F)			Relative Humidity (%)			Average Wind Speed (mi/hr)
			Average	Min.	Max.	Average	Min.	Max.	
January	1.2	3.4	46.7	38.9	55.6	87.6	70.1	97.7	4.4
February	1.8	2.5	50.3	40.3	61.0	81.3	59.1	97.1	4.6
March	3.4	1.6	54.5	41.8	67.3	73.7	48.5	95.9	4.8
April	4.7	1.0	57.9	44.7	70.7	66.2	43.6	92.3	5.5
May	6.6	0.8	64.4	50.5	78.1	61.1	40.4	88.8	5.8
June	7.8	0.1	69.8	54.6	84.9	56.0	35.9	85.9	5.7
July	8.2	0.0	73.6	57.5	90.1	56.7	35.8	87.9	4.9
August	7.3	0.1	72.5	56.5	89.3	57.7	35.2	89.7	4.6
September	5.4	0.1	68.6	53.2	85.6	60.4	34.9	91.6	4.1
October	3.5	0.6	60.4	46.2	76.7	65.8	38.2	93.1	3.7
November	1.6	1.4	51.9	40.9	64.6	80.4	56.2	96.5	3.6
December	1.1	2.3	46.2	37.7	55.8	85.3	66.3	97.1	4.4
Annual	52.6	13.7	59.7	46.9	73.3	69.4	47.0	92.8	4.7

3.7 OPERATING RULES AND REGULATIONS

The District maintains Rules and Regulations for control of system facilities, employee conduct, apportionment of water, rotation of water, time limits, continuous use of water, deliveries, control, waste of water, access to land, breaks, use of rights-of-way, unlawful acts, and enforcement and modification of rules. The intention of the rules and regulations is summarized as follows:

> *"It is the desire and intention to carry on the business of the District in a businesslike and economical manner and to distribute the water equitably, and, as near as may be satisfactory to all water users. No two individuals have exactly the same requirements and while these individual requirements will be met as far as possible, yet there must be general rules and general practices to secure the greatest good to the greatest number." (SSJID 1919)*

The District "Rules and Regulations for Governing the Distribution of Water in the South San Joaquin Irrigation District" are currently being reviewed and revised to address changing conditions. The rules and regulations prescribe conditions that ensure distribution of irrigation water to users in an orderly, efficient and equitable manner; they are available to water users and the public in pamphlet form. The existing rules are attached to this report for convenient reference (Attachment B).

3.8 WATER DELIVERY MEASUREMENT AND CALCULATION

In recent years, SSJID has made substantial efforts to improve flow measurement to support efficient management of the District's water resources by increasing institutional knowledge of system operations to support ongoing operations and maintenance as well as future planning. Additionally, SSJID has prepared a plan to comply with the delivery measurement accuracy standards of §597 of Title 23 of the California Code of Regulations, effective July 11, 2012. The plan is included as Attachment A of this AWMP.

Figure 3-13. USGS Gaging Station

The general approach to improving water measurement within SSJID has been to focus efforts on the improved measurement of inflows and outflows at the District boundaries (where needed), and to progress inward with upstream to downstream priority. This approach enabled development of a District-wide water balance and increasingly allows for the development of balances for subdivisions of the District. In recent years, SSJID has installed several broad-crested weirs to enhance measurement in the main canals. Between 2012 and 2015, SSJID will focus measurement improvements on individual delivery locations.

Water diverted from the Stanislaus River into the Joint Main Canal is measured by stream gage stations operated and maintained by the Tri-Dam Authority to U.S. Geological Survey (USGS) standards (Figure 3-13). Releases to the MDC below Woodward Reservoir are controlled through a centralized, computer-based facility, and inflows and outflows are monitored by staff on a daily basis. A SonTek acoustic Doppler device was installed in a rated section below Woodward Dam (USGS Station 11300700) and provides accurate measurement of distribution system inflows. SSJID has engaged outside services to conduct periodic flow measurements and to refine the ratings of this and other gages.

Deliveries from the MDC to laterals are measured by various means, including rated orifice gates, weirs, flumes, and rated canal sections. Lateral inflows are remotely monitored from the control room via SCADA. Additionally, SSJID has installed six Rubicon Water FlumeGates® and four AquaSystems2000, Inc. LOPAC® automated flow control and measurement gates at selected lateral headings to help propagate flow changes and excess water to the SIDE and East Basin reservoirs and to provide accurate flow measurement.

DMs perform flow measurements at internal division points using weir sticks, measuring tapes, and stilling wells with staff gauges. Additionally, SonTek and ISCO acoustic Doppler flow meters (ADFM) have been selectively installed at critical division points, and flow rate is locally viewed on a digital screen and transmitted and recorded through the SCADA system. For rated gates, weirs, and rated sections water stage is measured by various means including pressure transducers, ultrasonic water level sensors, and stilling wells and floats.

Figure 3-14. Orchard Valve Installed on SSJID Pipeline

Farm deliveries are measured by rated gates or, in some cases, by determining the difference in flow between measurements points in the lateral upstream and downstream of the farm turnout. Direct measurement of deliveries to individual field is not technically feasible in some cases because multiple irrigation valves serving the field have been installed directly in the SSJID lateral pipeline (Figure 3-14). This tends to occur where the pipeline runs along the head of the field. The only technically feasible solution in these cases is to measure delivery volumes using a volume differential method. DM's use manufacturer stated pump capacities for reporting pump delivery flow rates or read in-line flow meters if present.

SSJID implemented TruePoint data management and report software in 2010 to better track water usage and to support reporting of aggregated water deliveries and volumetric billing. Each water delivery is represented by a separate data entry within the software that includes the DM's record of the delivery start and stop times. The DM also inputs the delivered flow rate. The delivery record also includes attributes such as: Assessor's parcel number (APN), rotation number, landowner name, crop, acres, lateral (i.e. delivery point) and irrigation method (e.g. flood, sprinkler, drip, micro). The TruePoint software calculates event duration, delivery volume, and applied water depth based on the DM's inputs (Figure 3-15).

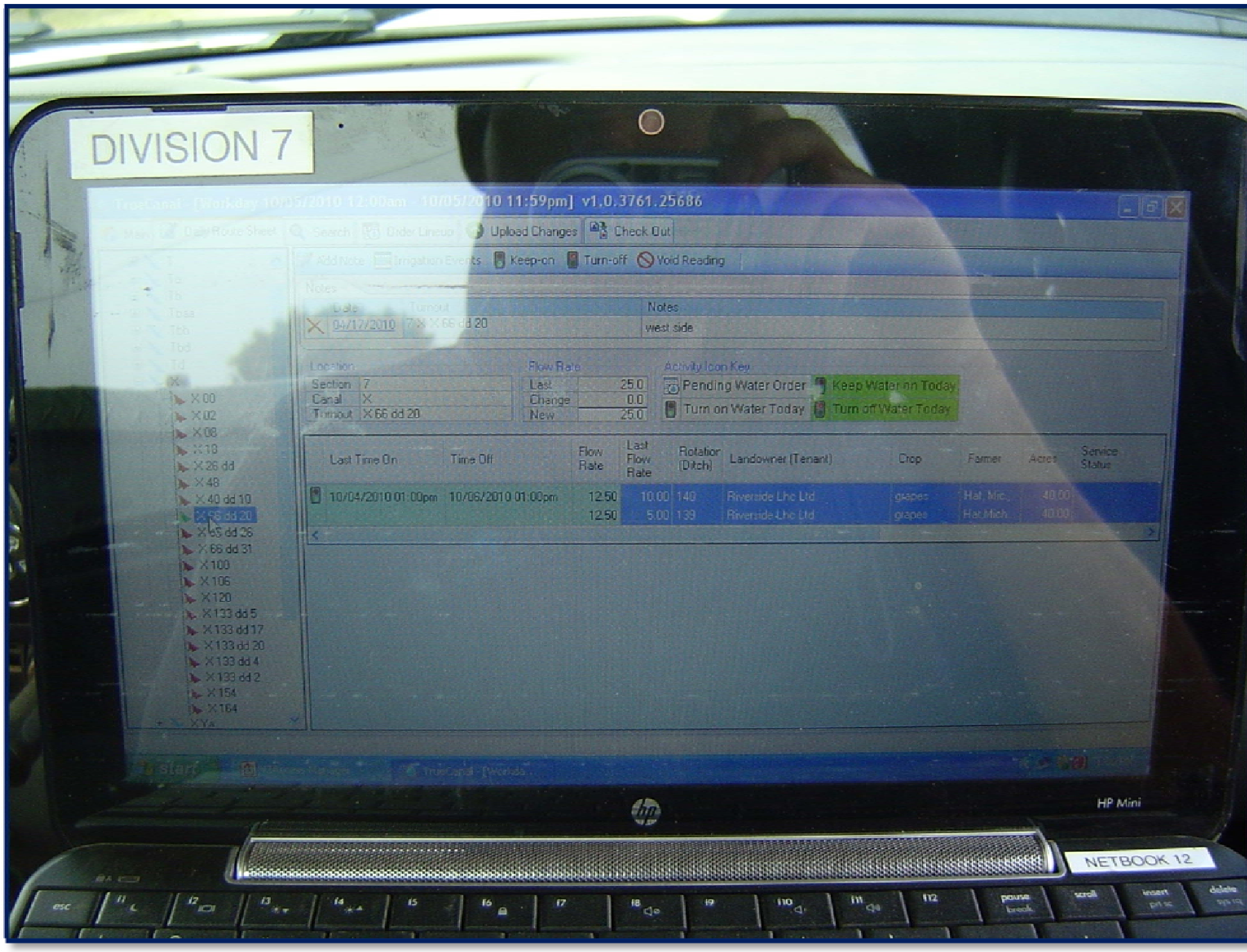

Figure 3-15. TruePoint Water Order Entry Screen

System spillage and on-farm tailwater are collected by a system of private and District drains that flow out of SSJID at numerous locations. Much of this drainage is used by downstream irrigators and what is not used contributes to stream flows in the Stanislaus River and the San Joaquin River either directly or through smaller tributary outflows. The largest of these outflows (Lone Tree Creek) runs along the northern border of the District. Lone Tree Creek inflow is measured using a level sensor to measure head over a grade board weir.

SSJID undertook and completed a systematic evaluation and ranking of boundary flow measurement sites in 2010 for the purpose of identifying potential improvements at each site and prioritizing the sites. Since that time, SSJID has established improved flow measurement and remote monitoring at four operational spillage sites and 14 drainage outflow sites. The drainage outflow sites represent approximately 75% of the total boundary outflows from SSJID. The district plans to continue to increase the number of operational spills and boundary outflow sites measured over time.

In response to the requirements of SBx7-7, SSJID engaged the professional services of an outside consultant in 2010 to perform a thorough analysis of existing delivery measurement within the District and to prepare a pilot measurement improvement program that would adapt the existing methods or adopt new methods for compliance with SBx7-7. Initial field testing and analysis suggested that few existing measurement methods would likely comply. A pilot delivery measurement improvement project was initiated on the Qk Lateral (Division 5) in 2012 to test the feasibility of installing acoustic Doppler flow meters (ADFMs) at strategic locations within the lateral pipeline to divide it into measurement reaches such that only one delivery is likely to occur within the reach at any given time, allowing the delivered flow rate to be measured by difference through subtraction of the flow rate at the downstream end of the reach from the flow rate at the upstream end of the reach.

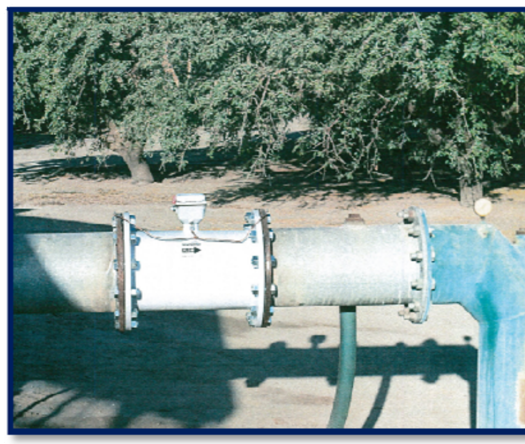

Figure 3-16. Magnetic Flow Meter

The nine-mile long Qk was segmented into two delivery reaches, and all reach inflows and outflows were bounded using five SonTek IQ ADFM’s and magnetic flow meters (Figure 3-16) installed on eight pump deliveries. Two sub branches (Qo and Qn) and one drain site (Drain 12) were included in the reach balance. Delivery volumes were calculated by combining delivery durations based on start and stop times recorded by the DM’s (recorded in TruePoint) and the flow rates calculated through difference. The Qk pilot project measures water deliveries to 69 customers who irrigate 1,853 acres. A result of the pilot project is that SSJID will expand the measurement approach to the remainder of the District service area that is not currently compliant with SBx7-7 and CCR 23 §597[5]. Additional information regarding delivery measurement improvements the pilot measurement project and corrective actions for the entirety of the District is included as Attachment A.

SSJID has incorporated improved delivery measurement into its On-Farm Water Conservation Program. Growers wishing to install a magnetic flow meter for their pump deliveries are eligible for a cost share of 80% of the purchase and installation cost, up to $4,500. Growers who install

[5] Magnetic flow meters were installed for fields in Division 9 as part of the Division 9 project.

drip or sprinkler irrigation systems as part of the program must also install a magnetic flow meter in order to be eligible for the cost share for the irrigation system. The on-farm water conservation program was implemented in 2011 and continued in 2012. The 2011 program resulted in the installation of 23 magnetic meters serving 1,005 acres. At the time of AWMP preparation, the 2012 program had resulted in the installation of 24 additional magnetic meters serving approximately 800 acres.

Implementation of the Division 9 pressurized surface water project included the installation of magnetic flow meters at all turnouts to support volumetric billing, track water usage, and provide growers with real time and historical data that can be used for planning and evaluation. Magnetic flow meters installed at each delivery location are tied into the telemetry system for remote monitoring and control. The installed magnetic meters in Division 9 and installed in the on-farm program comply with the accuracy standards of CCR 23 §597. Agricultural water measurement regulatory compliance is discussed further in Attachment A.

3.9 WATER RATE SCHEDULES AND BILLING

Historically, SSJID has billed for irrigation deliveries on a per-acre basis. The per-acre rate does not vary depending on the size of the parcel irrigated. Rates and payment due dates are established annually by the Board of Directors. The water rate for 2011 was $24 per acre with a $50 minimum charge. Typically, water charges for the coming season are billed annually in early November and may be paid in two installments in December and June. Water rates are kept low for affordability and to encourage the use of available surface water supplies in lieu of groundwater as part of SSJID's overall strategy of conjunctive management of surface water and groundwater supplies to maintain long term water supply.

In accordance with SBx7-7, SSJID has developed and adopted a new pricing structure based in part on the volume of water delivered. This pricing structure will ensure compliance with SBx7-7 and includes a $3 per af charge to begin in 2014 in addition to the current $24 per acre flat rate charge. In 2013, growers will be billed volumetrically, but the charge will be waived for the first year.

SSJID's Division 9 project currently is operated using a volumetric-based pricing structure. Water users are charged $30 per af for the first three acre-feet per acre and $40 per acre-foot thereafter[6]. All original Division 9 customers additionally paid a $2,500 one-time fee to connect to the pressurized system. The connection fee for new users of Division 9 is the District's actual connection cost.

SSJID also charges a groundwater recharge fee of $12 per acre for all parcels greater than 10 acres, subject to an Irrigation Service Abandonment Agreement with a minimum charge of $25.

[6] During 2012, the $40 per acre-foot charge was not applied. Rather, a flat rate of $30 per acre-foot was charged regardless of use.

3.10 WATER SHORTAGE ALLOCATION POLICIES AND CONTINGENCY PLAN

SSJID recognizes that there may be times when available surface water supplies are insufficient to meet the water demands of the crops grown. In response, the Board has developed and adopted a set of special rules to be implemented in case of a water supply emergency. The rules are intended to maintain equitable service even in the event of a water shortage. The rules were first developed and adopted by the Board in the spring of 1991. In the winter of 2012, the Board once again faced a possible water shortage. Based on the 1991 rules, the District's Agricultural Water Committee summarized a set of contingency options for Board consideration should the shortage be realized. The contingency plan and "special rules" are not permanent documents and may vary in specific provisions over time based on Board policies.

The surface water shortage contingency actions are summarized in eight measures that can be implemented by SSJID in the event of a shortage while still upholding its obligation to manage and deliver water in a reasonable and beneficial manner and its desire to provide equitable water delivery service. District operational alternatives summarized as follows:

- Reduce the maximum water surface elevation of Woodward Reservoir to minimize surface evaporation
- Extend the start date of the irrigation season
- Implement a variable water delivery rotation schedule
- Implement maximum time limits for flood irrigation
- Implement irrigation quantity limits for pressurized systems
- Implement alternative supply sources (e.g. lease private pumps, use District wells, or possibly drill additional wells)
- Allow for inter-parcel transfers/fallowing with a cut-off date for transfers. Those requesting transfers must apply before the start of the year's irrigation season.
- Enforce Tier 2[7] service agreement provisions

3.11 POLICIES ADDRESSING WASTEFUL USE OF WATER

SSJID actively prohibits the wasteful use of water, as described in Rule No. 10 in its Rules and Regulations which states:

> *"Persons wasting water on roads or vacant land, or land previously irrigated, either willfully, carelessly, or on account of defective ditches or inadequately prepared land, or who shall flood certain portions of the land to an unreasonable depth or amount in order*

[7] Customers who have filed a service abandonment agreement with the District in the past are considered Tier 2 customers if they petition the Board to amend the abandonment agreement and reinstate District service. Under the contingency plan the District has no obligation to provide water to Tier 2 customers during times of shortage. Newly annexed land is also subject to Tier 2 restrictions.

> *to properly irrigate other portions, will be refused the use of water until such conditions are remedied." [Rule no. 10, pg. 6, SSJID Rules and Regulations]*

Enforcement actions include withholding water for willful wasteful use. The District's policies regarding unauthorized uses of water and enforcement are described in detail in the Rules and Regulations (Attachment B).

4. INVENTORY OF WATER SUPPLIES

4.1 INTRODUCTION

The District has a highly reliable Stanislaus River surface water supply that serves as the primary supply source. In addition, both the District and private landowners have constructed groundwater production wells that serve primarily to supplement surface water supplies. Precipitation also provides additional soil moisture for agricultural purposes but, because of its unpredictability and limited quantity, is not considered a primary source. Surface water and groundwater supplies are discussed in the following sections.

4.2 SURFACE WATER SUPPLY

The Stanislaus River is the primary source of water supply for the District. The District's use of water is based on pre-1914 adjudicated and post-1914 appropriative rights that are shared with OID with the exception of rights applicable to Woodward Reservoir, which is solely owned by the District. "Pre-1914 water rights" are titled as such due to their establishment prior to the California Water Commission Act in 1914 and are only acquired by certain actions to protect the beneficial use of water prior to 1914. With these rights, SSJID and OID may change the place and/or purpose of use as long as it does not injure other users, is not being unreasonably used, or impacting public trust uses. A 1929 judgment from the San Joaquin County Superior Court adjudicated the districts' pre-1914 water rights and established a summary response for any future challenges of the water rights.

After the construction of New Melones Reservoir by the U. S. Bureau of Reclamation (USBR), the District entered into an agreement with the USBR on how water was to be allocated between the Districts and the USBR. Under the 1988 Agreement, the District's are entitled to receive the first 600,000 acre-feet per year and in years when inflow to New Melones is less than 600,000 acre-feet, are entitled to receive the actual inflow plus on-third of the difference between 600,000 and the actual inflow, as explained below. Water that is unused in any one year may be stored at New Melones in a "conservation account," up to a total of 200,000 acre-feet and can be used in certain water short years.

In 1858, Mr. Charles Tulloch, visionary and entrepreneur, built a small diversion dam immediately downstream of the current site of Tulloch Dam to distribute water to the Knights Ferry area. The system was extended down to the valley to serve 6,000 acres reaching as far downstream as Manteca (an area now served by SSJID) and a small area around Oakdale.

Wielding their newly authorized power from formation in 1909, the South San Joaquin Irrigation District entered into a deal with the OID, who had an option on the "Tulloch Rights", to equally split the purchase of the complete rights from the San Joaquin Canal and Irrigation Company and the Consolidated Stanislaus Water and Power Company for the sum of $650,000 on April 28th, 1910.

After purchasing the "Tulloch Rights", the districts abandoned the old miners' diversion dam and began construction of Goodwin Dam (Figure 4-1) in 1912. Goodwin Dam was completed in April of 1913 with a finished height of 80 feet above the bed of the Stanislaus River and a crest length of 500 feet. Main canals were constructed by both districts to deliver water to customers in the valley. A Joint Main Canal was constructed on the north side of the river to supply 850 cfs to SSJID and 260 cfs to OID with construction costs being in proportion to their respective diversion allotments. The two Districts separate at a bifurcation point approximately 3.6 miles from the Dam, with SSJID's diversion continuing to the west and OID's diversion channeled into Little John Creek.

Figure 4-1. Goodwin Dam

Severe water shortages in 1914-1915 prompted a meeting of landowners who approved the use of funds allocated in a 1913 bond issue specifically for construction of a reservoir. In 1916, the District completed construction of an earthen dam on the Main Supply Canal that stretched 3,400 feet long and 60 feet high and created the 36,000 acre-feet Woodward Reservoir to provide much needed storage and water regulation.

During dry years, the additional storage provided by Woodward afforded SSJID additional rotations as compared to neighboring Districts with little or no storage. However, expansion of irrigated acreage and changing crop patterns increased water demand, and in the early 1920's the Board and the farmers agreed to allocate funding for an additional reservoir, primarily for winter water storage. In 1925, the two districts began construction on Melones Reservoir with a storage capacity of 112,500 af. This dam was completed by the end of 1926, and each District was provided with 51,250 af of stored water. This was a post 1914 appropriation. At the time the water supply from Melones Reservoir was sufficient for the needs of SSJID, but increasing irrigated acreage and changes in cropping patterns, along with concern over deficiency in dry years, would prompt the Board of Directors to actively seek supplemental water. Some of this supplemental water was already supplied through the installation of groundwater wells by the District in the early 1920's to control high groundwater tables, primarily in the western portions of SSJID.

By the mid 1940's SSJID and OID were again searching for additional reservoir storage capacity to serve their constituents. In 1948, the Districts jointly formed the Tri-Dam organization and selected three reservoir sites to be collectively named the Tri-Dam Project. Donnells and Beardsley Reservoirs were constructed on the Middle Fork of the Stanislaus River with storage capacities of 64,500 and 97,500 af, respectively. Tulloch Reservoir was constructed above Goodwin Diversion Dam with a storage capacity to 68,400 af. The Tri-Dam facilities – including hydropower – became operational in 1957. Goodwin Diversion Dam was also raised 7 feet in 1955 to bring its total storage capacity to 500 af. Donnells and Beardsley Reservoirs have post-1914 rights to store water.

Prior to the construction of the New Melones Dam and Reservoir by the USBR, and as part of the condemnation of the (Old) Melones Reservoir, the joint districts entered into a 1972 Stipulation and Agreement, whereby the exercise of the joint districts' water rights was modified by an allocation agreement between the USBR and the districts for 654,000 af per year. In 1988, the joint districts renegotiated the 1972 Stipulation and Agreement with the USBR. In the 1988 Agreement, the districts receive a maximum of 600,000 af per year. Based on an even split of the available supply, this equates to 300,000 af that are available to both SSJID and OID each year. In reaching this Agreement, the joint districts agreed to relinquish 54,000 af per year of water in exchange for an obligation from the USBR to make up 33 percent of any deficiency below 600,000 af per year. In years when the inflow into New Melones Reservoir is less than 600,000 af, the District's available water supply under the 1988 Agreement is determined as set forth in Equation 4-1:

$$\text{Annual SSJID + OID Supply} = \text{Inflow} + [600{,}000 \text{ af} - (\text{inflow})] \times 0.33 \quad [4\text{-}1]$$

In 2005, SSJID's neighboring district, OID, commissioned the preparation of a comprehensive study of their water resources, delivery system, and operations. Part of the plan included determination of the probability that OID's available water supply under the 1988 Agreement will be less than 300,000 af (after splitting the total supply with SSJID) based on historical diversion and allocation records for the period from 1922 to 1998. Based on the analysis, it is estimated that SSJID will receive its full supply in 79 out of 100 years and will receive at least 249,000 af in 95 out of 100 years. The minimum supply SSJID will likely receive in any year is approximately 190,000 af. The exceedance probability of the SSJID Stanislaus River water supply is shown in Figure 4-2.

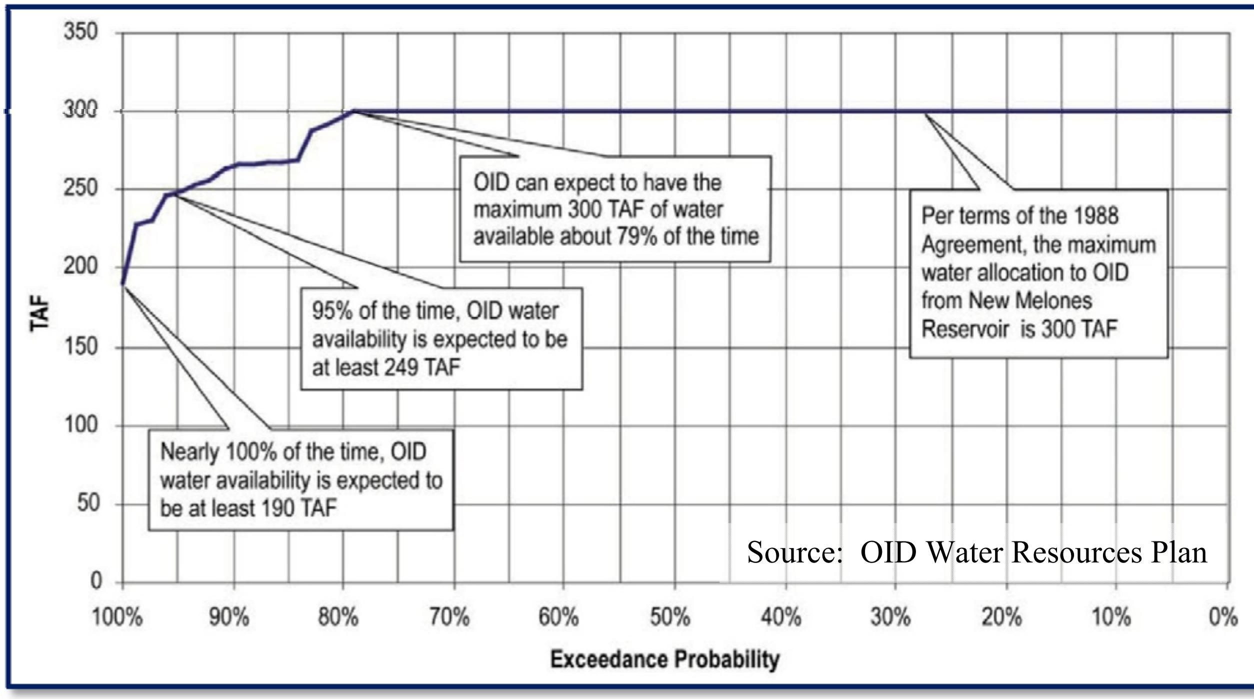

Figure 4-2. Exceedance Probability of OID (expected to be similar for SSJID) Stanislaus River Water Supply

4.3 GROUNDWATER SUPPLY

SSJID overlies the southern portion of the Eastern San Joaquin Subbasin (Basin 5-22.01 under California's Bulletin 118) of the San Joaquin Valley Groundwater Basin which is bounded by the Mokelumne River to the north, the Stanislaus River to the south, the San Joaquin River to the west and the Sierra Nevada foothills to the east.

The Eastern San Joaquin Subbasin underlies the urban areas of Manteca, Lathrop, and Stockton which utilize groundwater for a large portion of their drinking water supply (Figure 4-3). Historical pumping from urban, rural and agricultural wells has been above the safe yield of the underlying basin, resulting in significant net overdraft and, in areas close to the delta, saltwater intrusion.

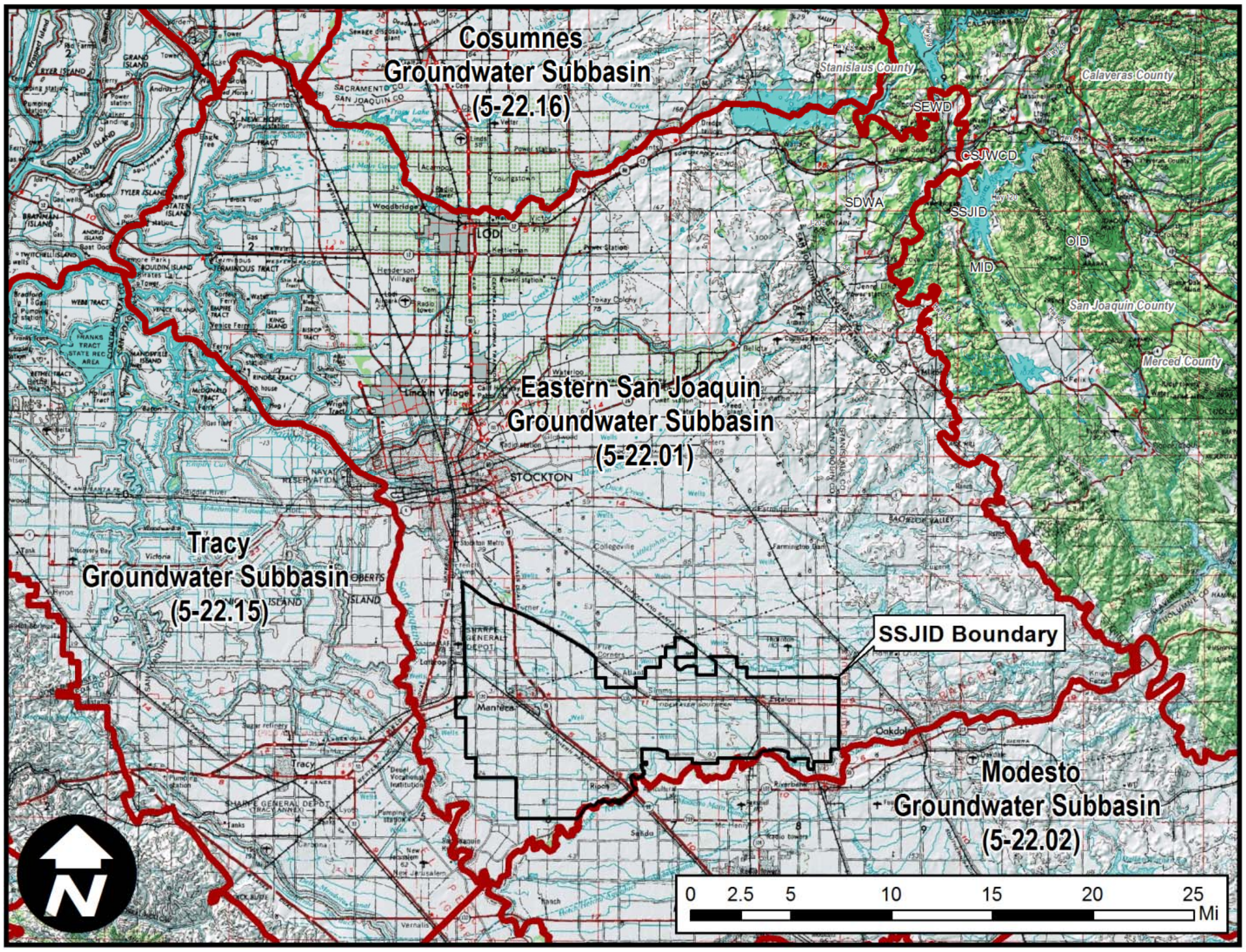

Figure 4-3. Eastern San Joaquin Groundwater Subbasin

The subbasin has an estimated overdraft of 70,000 acre-feet per year and groundwater levels that are dropping at an average rate of 1.7 feet per year (DWR 2006). Losses from SSJID, primarily deep percolation of applied surface water and seepage from District canals, serve as a source of beneficial recharge in the subbasin. Based on groundwater elevation contours that indicate groundwater flows northward away from SSJID, it is clear that this recharge provides regional as well as local benefits to groundwater pumpers. During the irrigation season recharge from seepage, deep percolation of applied water, and deep percolation is 97,000 acre-feet, on average, while District and private groundwater pumping is about 40,000 acre-feet. The conjunctive management of surface water and groundwater resources in the subbasin is an important consideration in evaluating the SSJID water balance and opportunities and potential impacts related to water conservation at the farm, district, and basin scales.

The subbasin formation is generally characterized by stream deposited sands, gravels, silts and clays. In the western portion of the District, localized layers of clay and silt result in zones of perched water (Kreinberg 1994). Four permeable water bearing formations are found to exist within the district's boundaries all at varying depths and thicknesses. Water for agricultural use is typically extracted from the first and second layers. These formations are formally known as the Alluvium and Modesto/Riverbank Formations, the Laguna Formation, and the Mehrten Formation and produce yields ranging from 650 – 1,500 gpm (DWR 2006). Irrigation and municipal well depths range from approximately 80 to 800 feet with an average depth of 350 feet.

To address the water supply needs of the urban areas of the District and the Region, SSJID contracted with neighboring cities to supply approximately 44,000 af per year of treated surface water from Woodward Reservoir to the cities of Escalon, Manteca, Lathrop and Tracy. The net benefit to the Basin is expected to be approximately 30,000 af per year (San Joaquin County 2004).

Figure 4-4. SSJID Groundwater Well

The District has twenty-eight deep wells located mainly in the southwestern portion of the service area and are operated to alleviate shallow groundwater conditions there (Figure 4-4). The water is discharged into laterals, mixed with surface water, and delivered to growers in the area. The pumps reduce shallow groundwater levels and provide increased water supply flexibility by allowing operators to access additional flow by turning on one or more pumps.

The pumps have a combined output of approximately 96 cfs and a maximum annual production capacity of approximately 37,800 af based on a 200-day irrigation season. Actual annual production ranges between approximately 5,300 and 6,400 af because the wells are not operated continuously. All deep well pumps are remotely monitored.

SSJID production wells are tested for pump efficiency on an annual basis or if a pump falls significantly below its design capacity. The need for replacement or rehabilitation of each well is periodically assessed, and improvement actions are prioritized to provide the greatest benefit relative to the cost.

4.4 OTHER WATER SUPPLIES

In addition to Stanislaus River water and groundwater supplies, the District is receptive to the reuse of municipal and industrial effluent[8] and accepts tailwater from irrigators who produce tailwater but do not have access to a drain.

SSJID captures boundary outflows from OID and individual irrigators in the MDC and MSC. Based on the water balance analysis, these inflows are approximately 15,000 af per year.

4.5 WATER QUALITY MONITORING

SSJID historically has performed monitoring of surface water and groundwater quality within its service area and the surrounding areas under a combination of District and regional water management activities. These activities are described in greater detail below.

4.5.1 Surface Water

Historically, SSJID has performed in-house water quality monitoring. In recent years, as a result of new state regulations, SSJID has begun representative monitoring. Specifically, monitoring has been performed in compliance with the Central Valley Regional Water Quality Control Board's Irrigated Lands Program –known as the Ag Waiver – through membership in the San Joaquin County and Delta Water Quality Coalition, which the District joined in March of 2011. Prior to joining the Coalition, SSJID monitored and reported drain water quality directly. Starting in 2004, SSJID measured electrical conductivity, dissolved oxygen, pH, temperature and turbidity in three different drains including: three locations in Drain 11 before its discharge to Walthall Slough, one location in Drain 12, and one location in Drain 14, both which drain to Lone Tree Creek. Additionally, the District monitored levels of potassium, phosphorus, total nitrogen, total organic carbon, and for traces of herbicides. In addition to the Ag Waiver, the District monitors for aquatic pesticides as required by the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for the Discharge of Aquatic Pesticide for Aquatic Weed Control in Waters of the United States.

Testing of inflow surface water quality is performed on a regular basis as part of the District's operation of the water treatment plant. The District's surface water supply is of excellent quality for irrigation.

4.5.2 Groundwater

The District monitors electrical conductivity for its 28 production wells using permanently installed sensors. All information is available real-time through the telemetry system.

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[8] There is currently no known source of M&I effluent within SSJID's service area that is not otherwise beneficially used.

In addition, annual monitoring of groundwater quality is performed in 26 wells throughout San Joaquin County, including SSJID, by the San Joaquin County Flood Control and Water Conservation District (SJCFCWD). Parameters measured include total dissolved solids (TDS), turbidity, chloride, and electrical conductivity (EC). SJCFCWCD produces semi-annual groundwater reports and is in the process of developing a web-based interactive tool to make historical groundwater information readily available in individuals and public entities, such as SSJID.

Groundwater pumped for irrigation in SSJID is generally of good quality.

5. WATER BALANCE

5.1 INTRODUCTION

This section describes the various uses of water within SSJID, followed by a detailed description of SSJID's water balances for key accounting centers within the District. For each accounting center, a detailed, multi-year water balance covering the period from 1994 to 2008 is presented. The water balance quantifies all significant inflows and outflows of water to and from the SSJID service area during the irrigation season. The irrigation season varies from year to year based on water needs, but approximately covers the period from March through October.

The water uses and water balances are discussed in relation to hydrologic conditions within SSJID, which vary from year to year. Key hydrologic drivers of water management in a given year include available surface water supply under the 1988 agreement with USBR, which is based on New Melones Reservoir inflows; precipitation within the SSJID service area; and atmospheric water demand.

5.2 WATER BALANCE OVERVIEW

The SSJID water balance includes four accounting centers. These include two separate accounting centers for the SSJID distribution system, the farmed lands served by SSJID, and the SSJID drainage system. A total of twenty-four individual flow paths are quantified as part of the water balance. A schematic of the water balance structure is provided in Figure 5-1. The accounting centers for SSJID are:

1. Upper Main Supply Canal (UMSC) and Woodward Reservoir
2. Lower Main Supply Canal (LMSC) and Main Distributary Canal (MDC)
3. Irrigated Lands and District Laterals
4. Drainage System

In general, flow paths are quantified on a monthly basis for the irrigation season (March – October). For each accounting center, all but one flow path is determined independently based on measured data or calculated estimates, and the remaining flow path is then calculated based on the principal of conservation of mass (Equation 5-1), which states that the difference between total inflows and outflows to an accounting center for a given period of time is equivalent to the change in stored water within that accounting center. Over the course of a year, it is assumed that the change in storage is zero (Equation 5-2).

$$\text{Inflows} - \text{Outflows} = \text{Change in Storage (monthly time step)} \qquad [5\text{-}1]$$

$$\text{Inflows} - \text{Outflows} = 0 \text{ (annual time step)} \qquad [5\text{-}2]$$

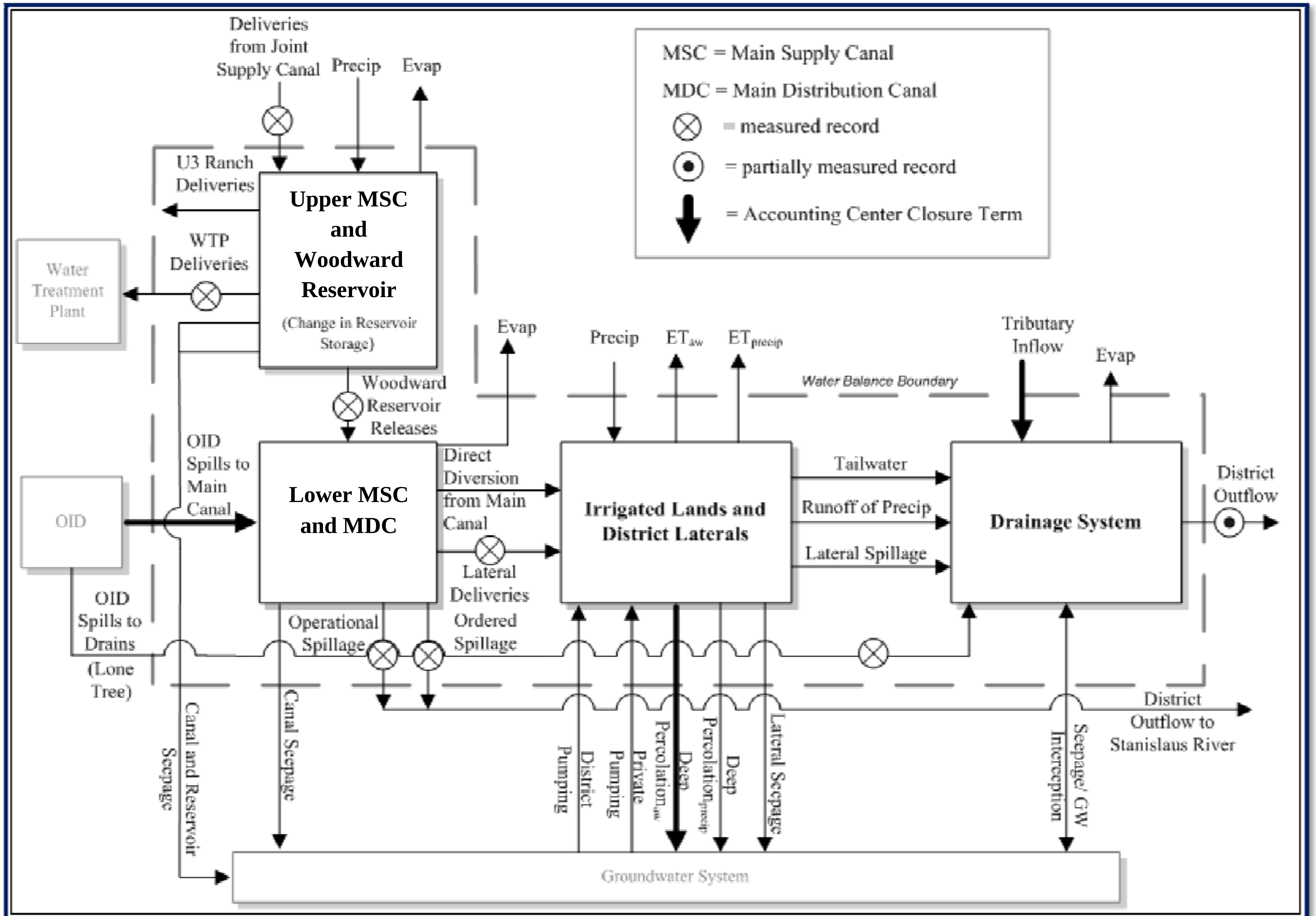


Figure 5-1. SSJID Water Balance Structure

The flow path that is calculated using Equation 5-2 is referred to as the “closure term” because the mass balance equation is solved or “closed” for the unknown quantity. The closure term is selected based on consideration of the availability of data or other information to support an independent estimate of each flow path as well as the volume of water representing the flow path relative to the size of other flow paths. Generally speaking, the largest, most uncertain flow path is selected as the closure term.

The primary outflow from SSJID is crop evapotranspiration (ET). Crop ET may be derived from applied irrigation water (ET_{aw}) or from precipitation (ET_{pr}). A monthly root zone water balance model was applied to partition total crop ET into ET_{aw} and ET_{pr}.

5.3 FLOW PATH ESTIMATION AND UNCERTAINTY

Individual flow paths were estimated based on direct measurements or based on calculations using measurements and other data. As described previously, those flow paths not estimated independently were calculated as the closure term of each accounting center.

For the UMSC and Woodward Reservoir accounting center, the closure term for 1994 through 2004 was the change in Woodward Reservoir storage and for 2005 through 2008 was reservoir seepage. Actual water level data from the reservoir for 2005 through 2008 were used to estimate the monthly change in reservoir storage and close on reservoir seepage. Average seepage coefficients from this time period were calculated and used to close on the change in reservoir storage from 1994 through 2004.

Drainage outflows from Oakdale Irrigation District discharge into the MDC canal at numerous locations, serving as a secondary water supply for the MDC. This inflow is unmeasured and is the closure term for the LMSC and MDC accounting center.

The irrigated lands and District laterals are combined into a single accounting center because reliable flow measurement from district laterals to irrigated lands is not available for the full period of study. For the irrigated lands and District laterals accounting center, deep percolation of applied water was calculated as the closure term. Deep percolation of applied water was selected because it is a relatively large flow path and nearly impossible to estimate otherwise.

For the SSJID drainage system accounting center, tributary inflows were calculated as the closure term. Other major flow paths of tailwater and operational spillage were estimated as a percentage of diversions and crop ET_{aw}, respectively. In the future, increased measurement of spillage and tailwater outflows will improve water balance estimates.

The results of the water balance for each flow path are reported with a high level of precision (nearest whole acre-foot) that implies a higher degree of accuracy in the values than is actually justified. While a detailed uncertainty analysis has not been conducted to assess potential error in the data and computed values, an estimated percent uncertainty (approximately equivalent to a 95% confidence interval) in each measured or calculated flow path has been estimated. Then, based on the relative magnitude of each flow path, the resulting uncertainty in each closure term can be estimated by assuming that errors in estimates are random (Clemmens and Burt 1997). Errors in estimates for individual flow paths may cancel each other out to some degree, but the net error due to uncertainty in the various estimated flow paths is ultimately expressed in the closure term.

Table 5-1 lists each flow path included in the water balance, indicating which accounting center(s) it belongs to, whether it is an inflow or an outflow, whether it was measured or estimated, the supporting data used to determine it, the 2008 flow volume, and the estimated confidence interval, expressed as a percent. As indicated, estimated confidence intervals vary by flow path from 5% to over 100% of the estimated value, with uncertainties generally being less for measured flow paths and greater for estimated flow paths. The estimated uncertainty of each closure term is provided, calculated based on the concept of propagation of random errors as described above.

The confidence intervals for the inflows and outflows from the UMSC and Woodward Reservoir ranged from five to six percent on the measured inflows and outflows, respectively (Table 5-1). The individual confidence intervals for each inflow and outflow were combined statistically, resulting in a confidence interval of plus or minus 60% on reservoir seepage, the closure term.

The confidence intervals for the inflows and outflows from the LMSC and MDC below Woodward Reservoir ranged from six to 50 percent on the measured and estimated flows, respectively (Table 5-1). The individual confidence intervals for each inflow and outflow were combined statistically, resulting in a confidence interval of plus or minus 812 percent on the inflows from OID, the closure term. The relatively small volume of OID inflows leads to a large percent uncertainty in the value. The main contributors to the uncertainty in the OID inflows are lateral deliveries (61 percent of the uncertainty), the Woodward Reservoir Release (21 percent of the uncertainty), and the reservoir and canal seepage (18 percent of the uncertainty). The remaining terms have a negligible effect on the accuracy of the OID spills.

The confidence intervals for the inflows and outflows from the SSJID laterals and irrigated lands ranged from 10 to 100 percent for the measured and estimated flows (Table 5-1). The individual confidence intervals for each inflow and outflow were combined statistically, resulting in a confidence interval of plus or minus 98 percent on the deep percolation of applied water, the closure term. Typically for water balances of irrigated lands, the confidence interval on deep percolation of applied water is in the range of 35 to over 100 percent.

Table 5-1. Water Balance Flow Paths, Supporting Data, and Estimated Uncertainty

		Flow Path	Data Source	2008 Volume, af	Confidence Interval	Confidence Interval Source
SSJID Main Supply Canal Above Woodward Reservoir	Inflows	Deliveries from Joint Main Canal	Measured--Rated Section	245,147	6%	
		Decrease in Reservoir Storage	Water levels and capacity-stage relation	0	100%	DE estimate.
		Precipitation	Manteca CIMIS	22	100%	Clemmens, A.J. and C.M. Burt, 1997
		Total	Computed	245,169	6%	Computed
	Outflows	Woodward Releases	Measured--Rated Section	189,752	6%	DE estimate.
		WTP Deliveries	KROHNE INFL meter - FIT-1320-1 & FIT-1320-2	10,792	5%	DE estimate.
		U3 Ranch Deliveries	One slide gate and one weir	4,473	100%	Computed based on estimated accuracy of measurement method used for spillage location.
		Reservoir Seepage	Closure Term	25,382	76%	DE estimate.
		Main Supply Canal Seepage	Estimate	432	50%	DE estimate.
		Increase in Reservoir Storage	Water levels and capacity-stage relation	7,147	100%	DE estimate.
		Evaporation	Estimate--surface area, K_c and ET_o	7,191	30%	Based on 20 percent estimate of K_c*ET_o process plus 10 percent allowance for surface area estimate.
		Total	Computed	245,169	6%	Computed.
		Delivered Fraction	Computed	87%	13%	Computed
SSJID Main Supply Canal Below Woodward Reservoir and Main Distributary Canal System	Inflows	Woodward Releases	Measured--Rated Section	189,752	6%	
		OID Spills	Closure	2,813	812%	Computed
		Total	Computed	192,565	10%	Computed
	Outflows	Lateral Deliveries	ISCO meters in pipes	170,294	10%	DE estimate.
		Direct Diversions from MDC	Estimated	1,300	50%	DE estimate.
		Ordered Spillage	One slide gate and one weir	277	9%	Computed based on estimated accuracy of measurement method used for spillage location.
		Operational Spillage	Long crested weir	0	9%	Computed based on estimated accuracy of measurement method used for spillage location.
		Seepage	Closure	20,152	50%	DE estimate.
		Evaporation	Estimate--surface area, K_c and ET_o	542	30%	Based on 20 percent estimate of K_c*ET_o process plus 10 percent allowance for surface area estimate.
		Total	Computed	192,565	10%	Computed.
		Delivered Fraction	Computed	89%	18%	Computed
SSJID Irrigated Lands	Inflows	Lateral Deliveries	***ISCO meters in pipes***	170,294	10%	Computed
		Precipitation	Manteca CIMIS	1,283	30%	Clemmens, A.J. and C.M. Burt, 1997
		Direct Diversions from Main Canal	Efficiency Estimate	1,300	50%	DE estimate.
		Precipitation removed from root zone storage	DE Root Zone Model	9,957	96%	Closure of the precipitation balance in the SSJID RootZone model.
		Private Pumping	Efficiency Estimate	45,260	50%	DE Estimate.
		Drainage Pumping	Power use	5,656	20%	Idaho Department of Water Resources study
		Total	Computed	233,750	13%	Computed
		Total applied water	Computed	222,510	13%	Computed
	Outflows	ET applied water	Irrigated area/crops/K_c/ET_o/monthly water balance	152,454	13%	Standard K_c*ET_o approach has been estimated to have confidence intervals in the range of 8 to 25 percent (Allen, et al., 2005). Estimate 13 percent given quality controlled CIMIS data and CIMIS K_c.
		Deep Percolation applied water	Closure of applied water	42,321	98%	Confidence Interval is less based on applied water balance.
		ET precipitation	Irrigated area/crops/K_c/ET_o/monthly water balance	10,214	13%	Standard K_c*ET_o approach has been estimated to have confidence intervals in the range of 8 to 25 percent (Allen, et al., 2005). Estimate 13 percent given quality controlled CIMIS data and CIMIS K_c.
		Deep Percolation precipitation	Closure of precipitation root zone water balance	769	161%	Computed
		Evaporation of precipitation	Estimate	128	30%	DE Estimate.
		Runoff of precipitation	Estimate	128	30%	DE Estimate.
		Precipitation added to root zone storage	DE Root Zone Model	0	96%	Closure of the precipitation balance in the SSJID RootZone model.
		Tailwater	Estimate	2,541	50%	DE estimate.
		Lateral seepage	Estimate	8,165	50%	DE estimate.
		Lateral spills	Closure	17,029	100%	DE estimate.
		Total	Computed	233,749	13%	Computed
		Irrigation Consumptive Use Coefficient (ICUC)	Computed	***70%***	**12%**	Computed

The general increase in flow volume confidence intervals (increase uncertainty) as the water flows from the distribution system accounting centers to the irrigated lands accounting center is typical of agricultural water suppliers. Increased uncertainty for the irrigated lands accounting center results chiefly from estimates of tailwater and deep percolation flow paths as these flows are difficult and expensive to accurately measure. Despite appreciable uncertainty in some flow path quantities, the water balance provides useful insights into SSJID's water management.

5.4 HYDROLOGIC YEAR TYPES IN SSJID

Development of a multi-year water balance allows for evaluation of water management impacts of surface water supply variability, precipitation variability, and other changes in the hydrology of SSJID and its surrounding area over time. Specifically, a multi-year water balance that includes both dry and wet years is essential to evaluate and plan for "planned conjunctive use of surface water and groundwater", an EWMP included in the CWC and discussed in Section 7. To support review and interpretation of water uses and overall water balance results over time, USBR surface water allocation, total water year precipitation[9], and total water year reference evapotranspiration (ET_o) are presented, and year types are assigned.

As discussed previously, SSJID has a reliable source of surface water supply under its 1988 agreement with USBR which is based on inflows into New Melones Reservoir. During the 1994 to 2008 period, a partial allocation was provided in 2000, 2006 and 2007, with full allocations in the remaining 12 years.

Reduced inflows into New Melones due to reduced precipitation in the watershed typically correspond to years with reduced precipitation and increased atmospheric water demand in the SSJID service area. Based on allotment, total water year precipitation, and irrigation season reference evapotranspiration, the years 1994 to 2008 have been assigned to wet or dry year types for purposes of discussion of water uses in SSJID over time and the corresponding water balances. These factors along with the year types by year are listed in Table 5-2. Seven years between 1994 and 2008 were assigned to wet year types, and eight years were assigned to dry year types. The wet years of 1995, 1996, 1998, 2000, 2004, 2005, and 2006 each had a full allotment and precipitation greater than the average of 13.6 inches. March to October ET_o was least for the wet years, averaging approximately 51 inches.

[9] Total water year precipitation refers to precipitation falling within SSJID during the period from October through September. Precipitation beginning around October at the end of the irrigation season in a given year runs off or accumulates in the soil during the fall to winter to early spring period and is available to support crop ET in the following irrigation season. Thus, for example, the period from October 2004 to September 2005 is referred to as the 2005 water year, and precipitation occurring between October 2004 and September 2005 is referred to as 2005 total water year precipitation.

Table 5-2. 1994 to 2008 SSJID Allotment, Water Year Precipitation, and Irrigation Season ETo, and Hydrologic Year Type

Year	Irrigation Start	Irrigation End	Number of Days	USBR Allotment	Precipita-tion, in	ET_o, in	Hydrologic Year Type
1994	3/8	10/14	220	Full	9.8	53.3	Dry
1995	4/3	10/27	207	Full	17.3	51.2	Wet
1996	3/24	10/23	213	Full	21.5	52.5	Wet
1997	3/8	10/15	221	Full	10.9	54.1	Dry
1998	3/16	10/29	227	Full	25.2	46.4	Wet
1999	3/15	10/27	226	Full	9.9	51.2	Dry
2000	3/20	10/19	213	Full	15.1	51.2	Wet
2001	3/17	10/18	215	Partial	14.4	55.8	Dry
2002	3/4	10/17	227	Full	9.5	53.3	Dry
2003	3/26	10/18	206	Full	9.5	52.6	Dry
2004	3/7	10/16	223	Full	14.5	54.2	Wet
2005	3/13	10/22	223	Full	17.4	51.1	Wet
2006	3/21	10/21	214	Full	15.0	50.7	Wet
2007	3/11	10/17	220	Partial	6.3	55.9	Dry
2008	3/9	10/16	221	Partial	8.6	55.4	Dry
Wet Year Average					18.0	51.0	
Dry Year Average					9.9	54.0	
Overall Average					13.7	52.6	

The dry years of 2001, 2007, and 2008 had a partial allotment, while 1994, 1997, 1999, 2002, and 2003 had full allotments. Each of the dry years had below normal precipitation, averaging approximately 10 inches. The dry years exhibited average ET_o of 54, three inches greater, on average, than wet years. In addition to having reduced surface water supplies in some years, dry years experience below normal precipitation and increased ET_o, resulting in increased crop irrigation requirements and corresponding irrigation demands. These increased demands are coupled with reduced surface water supply in partial allocation years.

In the future, updates of the water balance to include additional years with partial allocations will allow for increased understanding of the implications of partial allocations on SSJID's water resources and may support the identification and implementation of management actions to increase the reliability of surface water and groundwater supplies while maintaining or improving levels of service to the water users.

5.5 WATER USES

The District supplies irrigation water for agriculture as well as treated domestic drinking water for the cities of Manteca, Tracy and Lathrop; future plans also include supplying Escalon and Ripon. SSJID currently supplies raw untreated water to Ripon. The District constructed the

Nick C. DeGroot Water Treatment Plant in 2005 to treat surface water extracted from the MDC just below Woodward Reservoir. SSJID supplied approximately 16,800 acre-feet of treated water in 2008 (P&P 2011).

The District co-owns three reservoirs with OID that are managed by the Tri-Dam Project and Power Authority for water supply, power generation, recreation, and water sports. The Authority also owns and operates a separate hydro-power generation facility known as Sand Bar. All of these reservoirs lie outside of SSJID's service area. SSJID also owns the Frankenheimer and Woodward power generation facilities at the inlet and outtake of Woodward Reservoir, respectively. Turlock Irrigation District provided the financial capital for the installation of these sites in the early 1980's and operates and maintains the projects. Through the District's water conservation efforts, SSJID's water has been made available for environmental enhancement through water transfers and in-lieu groundwater recharge. These water uses are described in greater detail in the remainder of this section.

5.5.1 Agricultural

Agricultural irrigation is by far the dominant water use in SSJID (Figure 5-2). Total water required to meet the evapotranspiration need of the crops grown varied from about 152,000 to 186,000 acre-feet per water year during the period of analysis. An estimated 16,000 to 44,000 acre-feet of the demand was supplied by rainfall stored in the root zone with the remaining 108,000 to 158,000 acre-feet supplied by irrigation.

Figure 5-2. Young Almond Orchard in SSJID

Between 1994 and 2008, there was an average of 58,551 acres of irrigated crop land, including an average of 2,235 acres of fallow or idle lands. The dominant crop in SSJID is almonds, which was grown on an average of 32,928 acres while other permanent tree and vine crops were grown on an average of 9,355 acres. Annual and semi-permanent crops were grown on an average of 16,268 combined acres. Permanent crops in SSJID, including almonds, fruit trees, grapes and walnuts account for 72% of the total cropped area. Double-cropped oats-corn makes up approximately 9% of the irrigated acreage, and pasture makes up 7%. Other crops include alfalfa, rice, berries, melons, tomatoes and clover.

The acreage planted to permanent crops varied between 40,400 and 45,200 acres over the 15-year period as indicated in Table 5-3 and Figure 5-3. Permanent crops represent a firm base demand for District water. Pasture and alfalfa declined from a peak of about 8,300 acres in 1998 to a low of about 5,100 acres in 2008. Double-cropped corn-oats increased slightly from about 5,000 to about 6,000 acres.

Table 5-3. SSJID Crop Acreages, 1994 to 2008

Year	Permanent			Annual	Semi-Permanent	Total
	Almonds	Others	Subtotal			
1994	32,010	9,947	41,957	12,490	7,553	62,001
1995	31,807	10,116	41,923	11,226	8,018	61,167
1996	32,367	12,849	45,216	9,617	7,869	62,701
1997	30,784	9,995	40,779	11,072	7,555	59,406
1998	31,293	9,619	40,912	9,608	8,283	58,804
1999	33,658	9,774	43,432	9,457	6,426	59,315
2000	32,537	9,605	42,142	9,293	5,548	56,984
2001	33,504	9,109	42,614	9,354	6,160	58,128
2002	34,083	9,406	43,488	8,464	6,397	58,349
2003	33,986	8,892	42,878	8,772	6,376	58,025
2004	33,707	8,883	42,590	9,146	6,094	57,831
2005	33,799	8,471	42,270	8,931	6,141	57,342
2006	33,957	8,044	42,001	9,138	5,813	56,953
2007	33,773	7,883	41,656	9,023	5,590	56,269
2008	32,658	7,734	40,392	9,489	5,113	54,994
Average	32,928	9,355	42,283	9,672	6,596	58,551

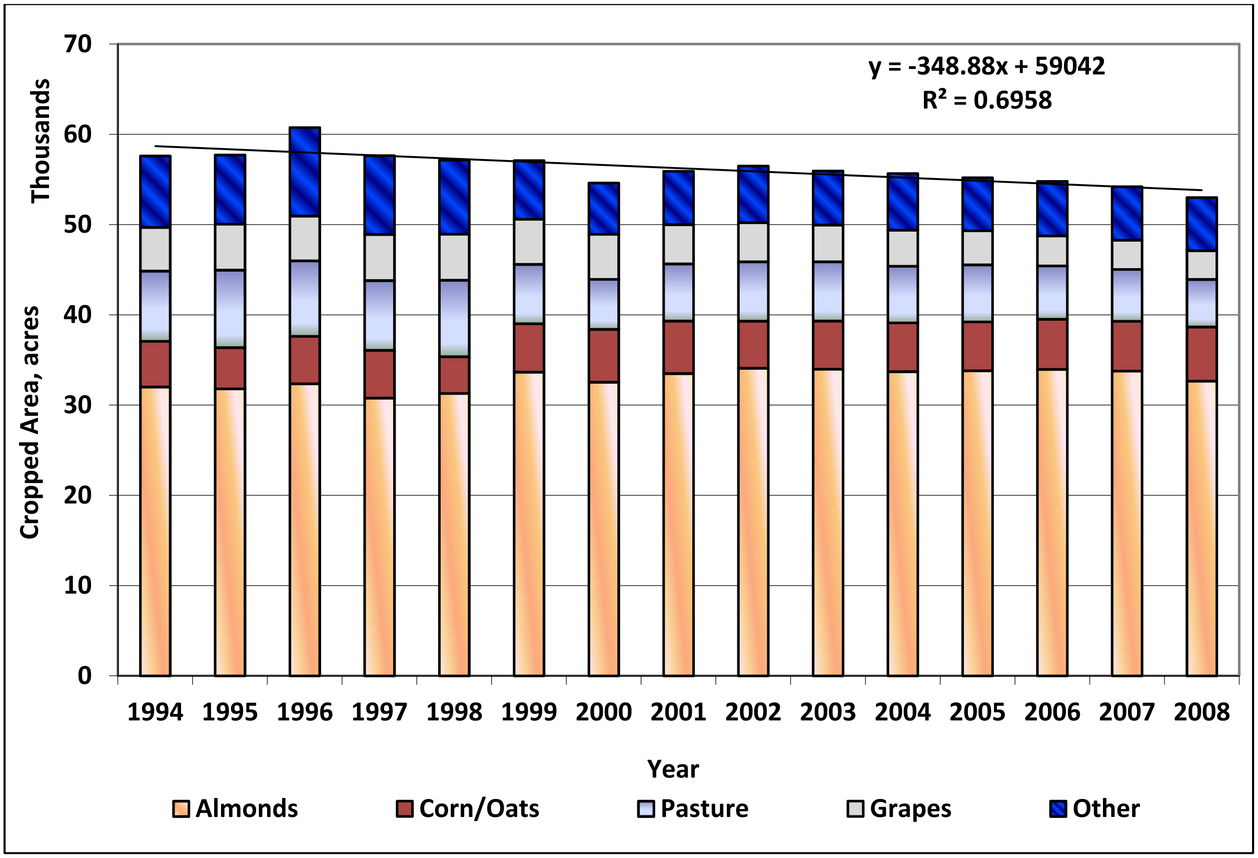


Figure 5-3. SSJID Cropping, 1994 to 2008

A root zone water balance simulation was run for each crop to estimate the portions of total ET supplied from applied water (ET_{aw}) and from precipitation (ET_{pr}). Unit ET values for each crop were multiplied by the corresponding cropped acres in each year to compute total water volumes consumed for agricultural purposes.

The consumptive use of water by crops in SSJID ranges from approximately 28 inches of total crop ET for vineyards to approximately 42 inches for pasture (Table 5-4)[10]. ET_{aw} ranges from approximately 22 inches to 36 inches for the cropped area. Average total crop ET for almonds, SSJID's primary crop, is 37 inches with approximately 31 inches derived from applied irrigation water. On average, total crop ET in SSJID is 37 inches, with approximately 31 inches derived from applied irrigation water. The remainder of the crop ET is derived from precipitation, as described previously.

[10] Crop ET values are presented in Table 5-4 on a calendar year basis to capture total ET_c, ET_{aw}, and ET_{pr} within SSJID. The vast majority of ET_c and ET_{aw} occur during the March to October irrigation season, with some residual ET occurring following cessation of irrigation in November, particularly on pasture and orchard ground. For the water balance results presented in Section 5.6, ET results correspond to the March through October irrigation season.

Table 5-4. Average Acreages and Annual Evapotranspiration Rates for SSJID Crops

Crop	Average Acres	Average Evapotranspiration (in)		
		ET_c	ET_{aw}	ET_{pr}
Almonds	32,928	37.2	31.3	5.9
Oats- Corn	5,315	31.9	26.7	5.3
Grapes	4,427	27.7	22.1	5.6
Pasture	4,170	42.1	32.9	9.2
Other	3,503	36.7	31.0	5.7
Alfalfa	2,425	42.1	35.9	6.2
Walnuts	1,963	41.3	33.7	7.5
Peaches	1,692	37.3	30.3	7.0
Totals	56,425	37.0	30.5	6.5

ET_c and ET_{aw} vary substantially between wet and dry years due to differences in overall evaporative demand and differences in the amount of accumulated rainy season precipitation available to support crop growth and offset crop irrigation requirements. For the 1994 to 2008 period, wet year ET_c averaged approximately 36 inches while dry year ET_c averaged nearly 38 inches. Wet year ET_{aw} averaged nearly 28 inches while dry year ET_{aw} averaged over 32 inches.

Additional information describing crop ET over time is included in Section 5.7. Total irrigation season crop ET varied between approximately 108,000 af and 158,000 af during the 1994 to 2008 period, with an average annual volume of 143,000 af. Approximately 122,000 af were derived from applied irrigation water (85%) and 21,000 af were derived from precipitation (15%).

Other uses of applied irrigation water include leaching of salts and frost protection for orchards and vineyards. Due to the low salinity of SSJID surface water, the required leaching fraction is small for the crops grown in the District and has not been estimated as part of this Plan. Additionally, water applied for frost protection is typically applied outside of the irrigation season and has not been estimated at this time.

5.5.2 Environmental

The District is a member of the San Joaquin River Group Authority along with Merced Irrigation District (Merced ID), Modesto Irrigation District (MID), Turlock Irrigation District (TID), Oakdale Irrigation District (OID), Friant Water Users Authority (FWUA), the San Joaquin River Exchange Contractors Water Authority (Exchange Contractors) and its member districts, and the Public Utilities Commission of the City and County of San Francisco. The San Joaquin River Agreement is a cooperative effort developed by urban, agricultural, environmental and governmental agencies to meet flow obligations at Vernalis on the San Joaquin River southeast of Tracy. Under the Agreement, the Vernalis Adaptive Management Plan (VAMP) was developed as an experimental adaptive management program designed to protect juvenile Chinook salmon during migration through the River while also evaluating the effects of flows on salmon survival. VAMP was initiated in 2000 and ended in 2011.

Under VAMP, SSJID and other member agencies were responsible for releasing supplemental water to provide spring (April – May) pulse flows to encourage outmigration of young fall run Chinook salmon. The required supplemental pulse flows varied from year to year depending on existing flow conditions in the River and previous year conditions.

In certain years, SSJID's VAMP obligation was made available to USBR at New Melones Reservoir to be used at the Bureau's discretion for authorized purposes. Typically USBR released the additional water during other times of the year or carried it over in storage to the following year and then released it. Objectives of releases of the additional water included various fish and wildlife benefits such as additional instream flows on the Stanislaus River during the months when fish are present, ramping of flow changes on the River following high flow periods, implementing pre-VAMP and post-VAMP ramping objectives during the spring flow period, water for fall attraction flows, temperature control in the lower Stanislaus River during the summer and fall periods, and/or storage in New Melones Reservoir for the purpose of using the additional water to augment flows in subsequent dry years.

The total volume of water provided by SSJID for pulse flows or to USBR for other environmental purposes on the Stanislaus and San Joaquin rivers from 2000 to 2010 is summarized in Table 5-5. As suggested by the table, the need for SSJID supplemental water to increase river flows is correlated to years with partial allotments due to reduced inflow into New Melones Reservoir. During the 2005 to 2011 period, the two years in which SSJID provided supplemental water were the partial allocation years of 2007 and 2008.

Table 5-5. Annual SSJID Supplemental Water under VAMP, 2000 to 2010[11]

Year	SSJID Supplemental Water (af)
2000	7,300
2001	7,365
2002	3,795
2003	5,039
2004	5,880
2005	-
2006	-
2007	2,185
2008	7,260
2009	-
2010	-
Average	3,529

5.5.3 Recreational

The District co-owns three reservoirs with OID that are managed by the Tri-Dam Project for water supply, power generation, recreation and water sports. These reservoirs include the Beardsley Reservoir and Donnells Reservoir (Figure 5-4) above New Melones Reservoir and Tulloch Reservoir below New Melones. All of the reservoirs lie outside of SSJID's service area.

Figure 5-4. Donnells Reservoir

Woodward Reservoir is owned by SSJID with the adjoining lands and water surface managed for recreational purposes by the Stanislaus County Parks and Recreation Department. The Woodward Regional Park offers established campsites and recreational activities including; hunting, fishing, boating and swimming.

Water stored in the reservoirs is not "used" for recreation, per se, as it is not consumed to support recreation activities. Rather, the storage of water in the reservoirs supports recreation activities.

[11] Based on San Joaquin River Group Authority annual technical reports from 2000 through 2010, available at www.sjrg.org/technicalreport/default.htm.

5.5.4 Municipal and Industrial

SSJID currently provides domestic water to several municipalities in southern San Joaquin County under the District's existing surface water rights. The South County Water Supply Program (SCWSP) was developed through a collaborative and cooperative effort of the SSJID, Manteca, Escalon, Lathrop and Tracy to provide treated surface water to supplement the City's existing groundwater supply. Funds provided by the supplied cities supported the construction of the Nick C. DeGroot Water Treatment Plant (WTP) just west of Woodward Reservoir Dam on Dodds Road. Phase I of the project included a 35-mile concrete-lined steel supply pipeline ending in the City of Tracy to supply Manteca, Lathrop and Tracy. Phase II will supply the city of Escalon and potentially the city of Ripon which currently purchases raw untreated water from SSJID and is negotiating a purchase of treated water in the near future. Escalon currently sells its water allotment to the City of Tracy (P&P, 2011). Contractual allotments for the supplied cities are listed in Table 5-6.

Table 5-6. SCWSP Phase I and II Allotments by City (acre-feet)

City	Phase I Allotment	Phase II Allotment
Escalon	2,015	2,799
Lathrop	8,007	11,791
Manteca	11,500	18,500
Tracy	10,000	10,000
Total	**31,552**	**43,090**

Source: Water Supply Development Agreements between the cities and SSJID

From its commissioning in 2005 to 2010 the WTP has delivered a combined average of 15,700af annually to the three cities currently under contract. Phase II will expand the sustained capacity of the system from 36 million gallons per day (MGD) to 57 MGD (P&P, 2011). Annual use is listed in Table 5-7. A map of the water systems and participating cities is provided in Figure 5-5.

Table 5-7. SCWSP Annual Water Usage by City (acre-feet)

City	2005	2006	2007	2008	2009	2010
Escalon	0	0	0	0	0	0
Lathrop	777	1,620	2,014	1,412	1,650	1,090
Manteca	2,861	6,666	6,344	6,817	6,970	5,745
Tracy	2,855	8,477	8,781	8,587	11,126	10,595
Total	6,493	16,763	17,139	16,816	19,746	17,430

Notes:
1 - These water deliveries do not represent all water demands in the Cities; each city also has additional sources of water.
2 - Escalon sold 2,015 AF/year to Tracy from 2006 to 2010. These values are shown under Tracy's water deliveries.

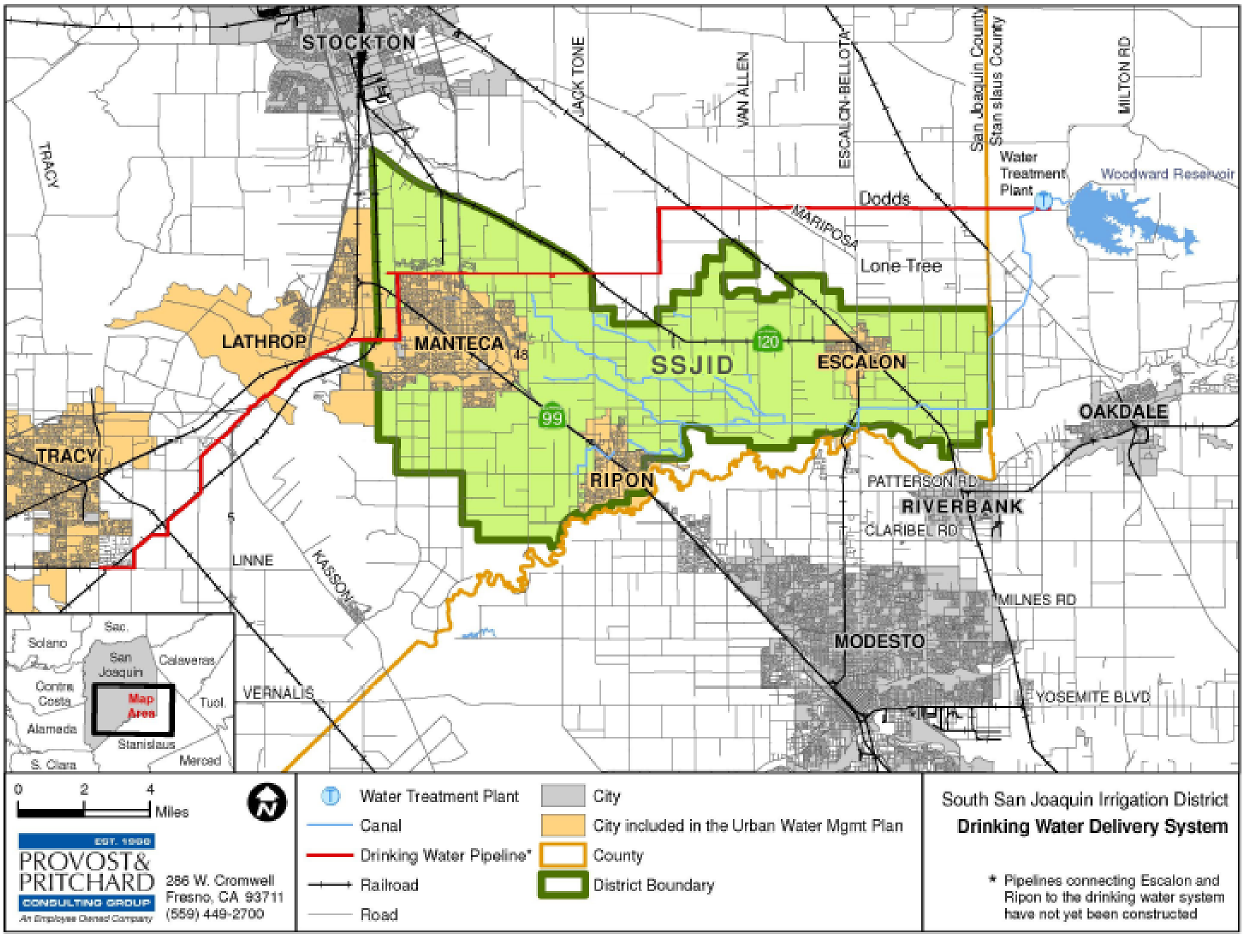


Figure 5-5. SCWSP Phase I Water System

Surface water is supplied to the WTP through an intake facility just below Woodward Reservoir and is filtered using state-of-the-art membrane filtration and mild chemical treatment technologies.

As discussed briefly in previous sections, the opportunity to provide supplemental water to municipalities was made possible through SSJID's extensive conservation and water management efforts in the 1980's and 90's that resulted in significant reductions in spillage and increased system efficiency. These improvements increased flexibility and reliability in the delivery of water for irrigation. Sale of conserved water generates revenues that can be used to further modernize and enhance the distribution system to the benefit of the District's customers. The SCWSP is an example of SSJID's active role in regional groundwater management and its commitment to maintaining local water supply reliability. The SCWSP also provides high quality drinking water to benefit local communities.

To offset the power used by the Water Treatment Plant and to maintain low water rates for both agricultural and municipal customers, SSJID constructed a seven-acre solar array utilizing thin-film solar modules mounted on frames instrumented to provide solar tracking—a first for the solar industry. The construction was initiated in two phases with the first featuring almost seven thousand 175-Watt crystalline modules with a maximum power production of 1.2 megawatts. Phase II was completed in March of 2009 and incorporated almost 6,000 additional 72.5 watt thin-film modules to bring the total production potential to almost 1.4 megawatts. Phase I of the solar field came on-line on May 15, 2008 and was dedicated as the Robert O. Schulz Solar Farm on July 18. The solar farm provides nearly all of the power used by the WTP.

5.5.5 Groundwater Recharge

Groundwater recharge that occurs within SSJID consists of seepage from SSJID canals and reservoirs and deep percolation of precipitation and applied irrigation water. Soil conditions conducive to direct artificial recharge do exist but are not cost effective for the District, and distributed recharge from canals and ditches provides an adequate means to maintain water levels in the East San Joaquin subbasin underlying SSJID to the benefit of SSJID water users, communities within SSJID, and surrounding areas that share the groundwater resource. Inflows to the groundwater system and pumping volumes for the 1994 to 2008 period are shown in Figure 5-6, along with the net annual volume of groundwater recharge.

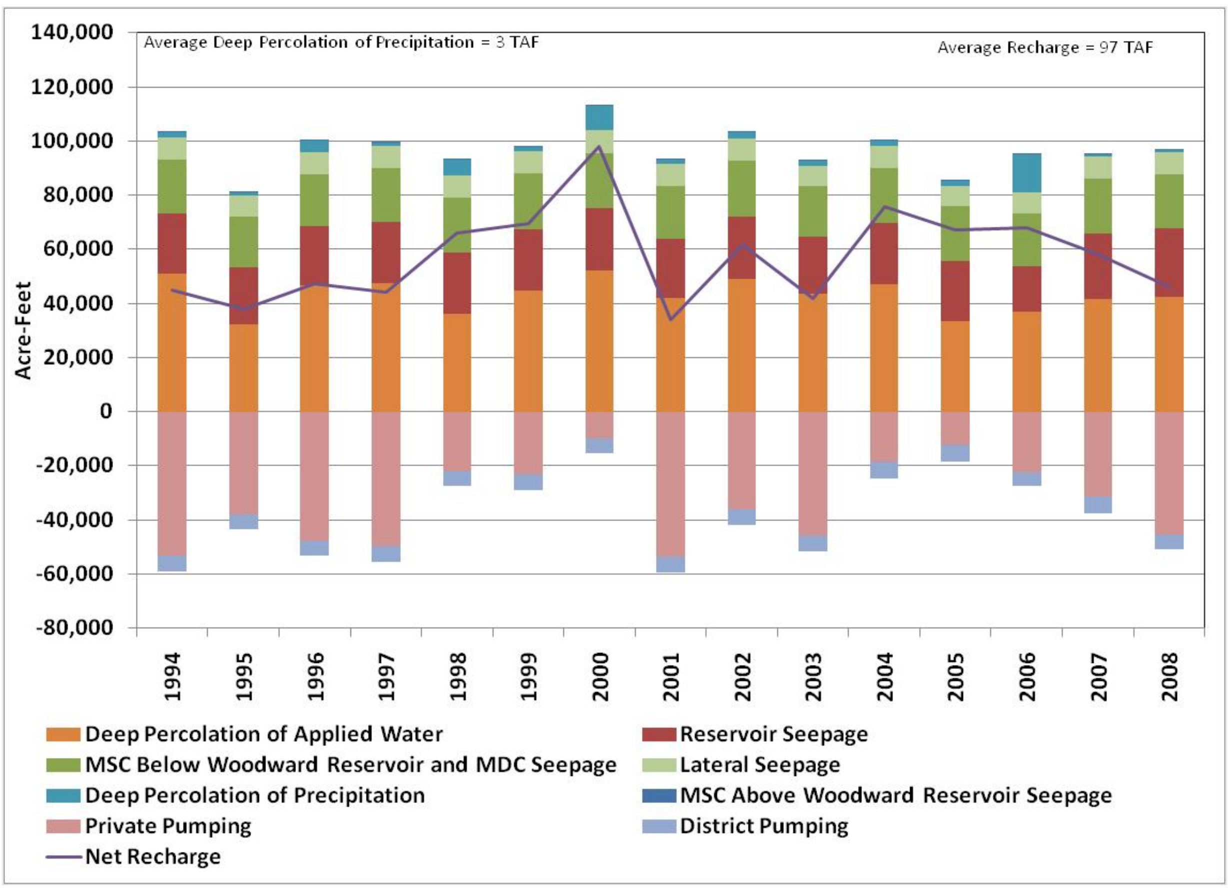


Figure 5-6. Groundwater System Inflows, Outflows, and Net Recharge, 1994 to 2008

Estimates of recharge were derived from the water balance analysis. Canal, reservoir and drain seepage were calculated based on soil characteristics along with estimated canal and drain wetted perimeters, overall lengths, and wetting frequency. Seepage from Woodward Reservoir was calculated as the closure term of the MSC above Woodward Reservoir and Woodward Reservoir water balance accounting center. Seepage and deep percolation volumes for 1994 to 2008 are provided in Table 5-8, along with total recharge expressed as a volume and as a depth of water relative to the cropped area in each year.

Table 5-8. SSJID Total Groundwater Recharge, 1994 to 2008

Year	USBR Allotment	Hydrologic Year Type	Canal and Reservoir Seepage (af)	Drain Seepage (af)	Deep Percolation (af)	Total Recharge (af)	Total Recharge (af/ac)
1994	Full	Dry	50,864	0	52,825	103,689	1.8
1995	Full	Wet	47,819	0	33,697	81,516	1.4
1996	Full	Wet	49,238	0	51,169	100,407	1.7
1997	Full	Dry	51,029	0	48,687	99,716	1.7
1998	Full	Wet	51,569	0	42,014	93,583	1.6
1999	Full	Dry	51,985	0	46,357	98,342	1.7
2000	Full	Wet	51,993	0	61,640	113,633	2.1
2001	Partial	Dry	49,702	0	43,910	93,612	1.7
2002	Full	Dry	52,449	0	51,184	103,633	1.8
2003	Full	Dry	47,601	0	45,666	93,267	1.7
2004	Full	Wet	51,550	0	48,863	100,413	1.8
2005	Full	Wet	50,584	0	35,074	85,658	1.6
2006	Full	Wet	44,488	0	50,904	95,392	1.7
2007	Partial	Dry	53,130	0	42,405	95,535	1.8
2008	Partial	Dry	54,130	0	43,090	97,220	1.8
Wet Year Average			49,606	0	46,194	95,800	1.7
Dry Year Average			51,361	0	46,766	98,127	1.8
Overall Average			50,542	0	46,499	97,041	1.7

Total recharge between 1994 and 2008 ranged from approximately 82,000 af to 114,000 af per year, or from 1.4 af to 2.1 af per cropped acre per year. On average, total recharge was estimated to be approximately 97,000 af per year (1.7 af/ac-yr), with approximately 52% of recharge originating from canal seepage and 48% of recharge originating from deep percolation of applied water. Seepage from drains was assumed negligible in the water balance.

Total recharge is greater in dry years due to two primary factors. First, the irrigation season tends to begin earlier in dry years, resulting in an increased number of days during which seepage in the distribution and drainage systems occurs. Second, increased crop irrigation requirements in dry years result in increased applied irrigation water and corresponding increased deep percolation of applied water not consumed by the crops. Total wet year deep percolation averaged approximately 46,000 af between 1994 and 2008, while total dry year deep percolation averaged 47,000 af.

Groundwater recharge net of well pumping[12] was calculated by subtracting estimated SSJID and private pumping volumes from total recharge volumes. Net recharge estimates for the analysis period are provided in Table 5-9.

Table 5-9. SSJID Net Groundwater Recharge, 1994 to 2008

Year	USBR Allotment	Hydrologic Year Type	Total Recharge (af)	Groundwater Pumping (af)	Net Recharge (af)	Net Recharge (af/ac)
1994	Full	Dry	103,689	58,905	44,784	0.8
1995	Full	Wet	81,516	43,455	38,061	0.7
1996	Full	Wet	100,407	53,267	47,140	0.8
1997	Full	Dry	99,716	55,667	44,049	0.8
1998	Full	Wet	93,583	27,603	65,980	1.2
1999	Full	Dry	98,342	28,973	69,369	1.2
2000	Full	Wet	113,633	15,419	98,214	1.8
2001	Partial	Dry	93,612	59,486	34,126	0.6
2002	Full	Dry	103,633	41,818	61,815	1.1
2003	Full	Dry	93,267	51,443	41,824	0.8
2004	Full	Wet	100,413	24,708	75,705	1.4
2005	Full	Wet	85,658	18,279	67,379	1.2
2006	Full	Wet	95,392	27,447	67,945	1.2
2007	Partial	Dry	95,535	37,390	58,145	1.1
2008	Partial	Dry	97,220	50,916	46,304	0.9
Wet Year Average			95,800	30,025	65,775	1.2
Dry Year Average			98,127	48,075	50,052	0.9
Overall Average			97,041	39,652	57,389	1.0

During the irrigation season, recharge from seepage, deep percolation of applied water, and deep percolation is 97,000 acre-feet, on average, while District and private groundwater pumping is about 40,000 acre-feet. Thus, the net effect of District and landowner operations is recharge of about 57,000 acre-feet each year. During the water balance analysis period, net recharge varied

[12] Total groundwater pumping includes SSJID and private pumping for irrigation.

from a low of 34,000 acre-feet (0.6 af/ac) in 2001 to a high of about 98,000 acre-feet (1.8 af/ac) in 2000.

Despite greater total recharge occurring in dry years as discussed previously, net groundwater recharge tends to be greater in wet, full allocation years due to increased groundwater pumping in dry years to supplement decreased surface water supplies and to satisfy increased crop irrigation requirements. Net recharge was relatively large in 2000, primarily due to the abundance of surface water, which resulted in reduced groundwater pumping and additional seepage and deep percolation of applied surface water, as compared to other years. Net wet year groundwater recharge averaged approximately 66,000 af between 1994 and 2008, while net dry year recharge averaged approximately 50,000 af.

5.5.6 Transfers and Exchanges

Voluntary transfers of water provide a source of funding for improvements to the SSJID distribution system. SSJID has participated in several water transfers in the past, and continues to seek opportunities for mutually beneficial transfer agreements with water users outside of the District. Parties to whom SSJID has transferred water include Stockton-East Water District (SEWD), VAMP, USBR, Central San Joaquin Water Conservation District (CSJWCD), San Luis-Delta Mendota Water Agency (SLDMWA), and South Delta Water Agency (SDWA).

In 1997, SSJID entered a 10-year contract with SEWD to provide a maximum of 15,000 ac-feet (adjusted based on annual inflows to New Melones) of surface water annually primarily for municipal and industrial use by the City of Stockton and the Lincoln Village and Colonial Heights Maintenance Districts. Deliveries commenced in 2000 and ended in 2010.

Figure 5-7. Chinook Salmon Smolt

The VAMP and USBR transfers were primarily for environmental uses, such as to encourage outmigration of fall run Chinook salmon smolt (Figure 5-7), as described previously in Section 5.2.2. In addition to environmental uses, transfers to USBR are integrated into the Central Valley Project (CVP) operations, enabling USBR to meet contractual water supply obligations more reliably and to comply with Delta outflow and water quality requirements.

From 1994 to 2011, SSJID transferred a total of 404,000 af, or about 22,500 af per year, on average (Table 5-10).

Table 5-10. SSJID Water Transfers, 1997 to 2011

	Transfer Recipient						
Year	SEWD	VAMP	CSJWCD	USBR	SLDMWA	SDWA	Total
1994	0	0	0	32,777	0	0	32,777
1997	0	0	0	40,000	0	0	40,000
1998	0	0	0	25,000	0	0	25,000
1999	0	0	0	25,000	0	0	25,000
2000	15,000	0	0	0	0	0	15,000
2001	23,750	7,365	0	0	0	0	31,115
2002	15,000	3,795	20,000	0	0	0	38,795
2003	15,000	5,039	15,000	0	0	0	35,039
2004	15,147	3,834	10,000	0	0	0	28,981
2005	15,117	0	0	0	0	0	15,117
2006	15,298	0	0	0	0	0	15,298
2007	15,820	0	0	10,000	0	0	25,820
2008	18,200	7,260	1,600	0	0	0	27,060
2009	20,000	0	0	0	25,000	0	45,000
2010	4,089	0	0	0	0	0	4,089
2011	0	0	0	0	0	130	130
Totals	172,421	27,293	46,600	132,777	25,000	130	404,221

5.5.7 Other Water Uses

Other incidental uses of water within SSJID may include watering of roads for dust abatement, agricultural spraying, and stock watering by SSJID water users. The volume of water used for such purposes is small relative to other uses and has not been quantified as part of this AWMP.

5.6 DRAINAGE

5.6.1 SSJID Boundary Outflows

As previously discussed, SSJID undertook and completed a systematic evaluation and ranking of boundary flow measurement sites in 2010 for the purpose of identifying potential improvements needed at each site and prioritizing the sites. Since that time, SSJID has established improved flow measurement and remote monitoring at four operational spillage sites and 14 drainage outflow sites. The drainage outflow sites represent approximately 75 to 80 percent of the total boundary outflows from SSJID. The district plans to continue to increase the number of operational spills and boundary outflow sites measured over time.

The increased monitoring and measurement of drainage flows have allowed SSJID to better evaluate potential projects to reduce or recover boundary outflows for reuse within SSJID, effectively increasing the District's available surface water supply.

Estimated total boundary outflows from SSJID for 2003 to 2008 are summarized in Table 5-11. Total boundary outflows for the irrigation season ranged from approximately 31,000 af to 59,000 af, with an average of 38,000 af. Drainage outflow estimates were not available prior to 2003 and are thus not included in the water balance.

Based on the period from 2003 to 2008, boundary outflows do not vary substantially, on average, between wet and dry years. This is likely due in part to contrasting changes in inflows to and outflows from the district drainage system that vary depending on the hydrologic characteristics of a given year. These flow path changes are summarized qualitatively in Table 5-12.

Table 5-11. Estimated SSJID Boundary Outflows, 1994 to 2008

Year	USBR Allotment	Hydrologic Year Type	Seasonal Drainwater Outflow (af)
1994	Full	Dry	N/A
1995	Full	Wet	N/A
1996	Full	Wet	N/A
1997	Full	Dry	N/A
1998	Full	Wet	N/A
1999	Full	Dry	N/A
2000	Full	Wet	N/A
2001	Partial	Dry	N/A
2002	Full	Dry	N/A
2003	Full	Dry	42,188
2004	Full	Wet	49,109
2005	Full	Wet	71,264
2006	Full	Wet	79,890
2007	Partial	Dry	66,864
2008	Partial	Dry	54,036
Wet Year Average			66,754
Dry Year Average			36,351
Overall Average			48,323

Table 5-12. General Effects of Hydrologic Year Type on SSJID Drainage System Inflows

Drainage System Flowpath	Wet Year Effect	Dry Year Effect	Notes
Lateral Spillage (Inflow)	Little or No Change	Little or No Change	Operational spillage does not appear strongly related to hydrologic year type based on currently available data. Longer irrigation seasons during dry years likely offset spillage reduction from more careful operation of the distribution system.
Tributary Inflows	More	Less	Greater precipitation tends to occur during the irrigation season of wet years, resulting in increased tributary inflows.
Farm Tailwater (Inflow)	Little or No Change	Little or No Change	Tailwater production is limited in SSJID due to the predominance of level-basin irrigation and ongoing conversion to pressurized irrigation.
Runoff of Precipitation and Direct Precipitation (Inflow)	More	Less	Greater precipitation tends to occur during the irrigation season of wet years, resulting in increased runoff or precipitation and direct precipitation in the drains.

The quality of SSJID drainwater is discussed in Section 4.

5.7 WATER ACCOUNTING (SUMMARY OF WATER BALANCE RESULTS)

The SSJID water balance structure was shown previously in Figure 5-1. The water balance was prepared for four accounting centers: (1) Main Supply Canal, including Woodward Reservoir; (2) Main Supply Canal below Woodward Reservoir and the Main Distribution Canal; (3) SSJID Irrigated lands and District Laterals; and (4) SSJID drainage system. Additionally, the water balance can be summarized for the SSJID service area as a whole ("District Water Balance Boundary" shown in Figure 5-1). An accounting center representing the groundwater system is also included in Figure 5-1 to account for exchanges between the vadose zone and the aquifers underlying SSJID; however, a complete balance for the underlying aquifer is not calculated because not all subsurface inflows and outflows have been estimated. Tabulated water balance results for each accounting center are provided in Tables 5-13, 5-14, 5-15, and 5-16.

The water balance is presented on an annual time step for the irrigation season (approximately March through October). Underlying the annual time step is a more detailed water balance in which all flow paths are determined on a monthly time step. The winter months are excluded because the non-irrigation season water balance is influenced by unmeasured intercepted stormwater, and the information provided does not pertain to SSJID water management activities.

Table 5-13. Upper MSC and Woodward Reservoir Irrigation Season Water Balance

		Inflow (af)		Outflows (af)							Performance Indicators	
Water Year	Hydro-logic Year Type	Diversions from Joint Supply Canal	Precipi-tation	U3 Ranch Deliveries[1]	WTP Deliveries	Wood-ward Reservoir Releases	Evapo-ration	Canal Seepage	Reser-voir Seepage	Change in Reservoir Storage (af)	Delivery Fraction[2]	Water Manage-ment Fraction[3]
1994	Dry	219,529	385	4,495	0	184,124	6,959	434	22,240	1,662	0.87	0.97
1995	Wet	208,856	252	3,687	0	179,940	6,411	356	20,932	-2,218	0.87	0.97
1996	Wet	224,489	370	4,211	0	191,758	6,745	406	21,536	203	0.87	0.97
1997	Dry	223,607	160	3,840	0	208,192	7,001	371	22,341	-17,977	0.87	0.97
1998	Wet	200,590	1,137	4,713	0	169,260	6,074	455	22,542	-1,317	0.86	0.98
1999	Dry	229,031	268	4,298	0	205,204	6,735	415	22,743	-10,096	0.87	0.97
2000	Wet	215,929	602	4,385	0	204,997	6,662	423	22,743	-22,680	0.86	0.97
2001	Dry	211,282	206	4,276	0	176,579	7,219	413	21,737	1,265	0.86	0.97
2002	Dry	247,050	330	4,385	0	204,594	7,021	423	22,944	8,012	0.88	0.97
2003	Dry	200,875	235	3,796	0	177,874	6,590	366	20,831	-8,348	0.86	0.97
2004	Wet	257,865	337	4,516	0	195,423	7,274	436	22,542	28,011	0.88	0.97
2005	Wet	204,210	817	3,949	706	172,222	6,667	381	22,330	-1,230	0.86	0.97
2006	Wet	215,449	788	3,971	9,087	170,826	6,425	383	16,681	8,864	0.89	0.97
2007	Dry	240,140	222	4,407	10,168	185,026	7,125	425	24,515	8,694	0.87	0.97
2008	Dry	245,147	22	4,473	10,792	189,752	7,191	432	25,381	7,147	0.87	0.97
Minimum		200,590	22	3,687	0	169,260	6,074	356	16,681	-22,680	0.86	0.97
Maximum		257,865	1,137	4,713	10,792	208,192	7,274	455	25,381	28,011	0.89	0.98
Wet Year Average		218,198	615	4,205	1,399	183,489	6,608	405.71	21,329	1,376	0.87	0.97
Dry Year Average		227,083	229	4,246	2,620	191,418	6,980	409.88	22,842	-1,205	0.87	0.97
Overall Average		222,937	409	4,227	2,050	187,718	6,807	408	22,136	-1	0.87	0.97

[1]U3 Ranch Deliveries estimated as 11 cfs (24 hour) delivery when the flow in the Main Supply Canal is greater than 100 cfs based on operations reports provided by the District

[2](U3 Ranch Deliveries + WTP Deliveries + Woodward Releases) / Diversions from Joint Supply Canal

[3](U3 Ranch Deliveries+WTP Deliveries+Woodward Releases+Canal Seepage+Reservoir Seepage)/(Diversions from Joint Supply Canal - Change in Reservoir Storage)

Table 5-14. Lower MSC and MDC Irrigation Season Water Balance

Water Year	Hydro-logic Year Type	Irri-gation Season Num-ber of Days	Inflows (af)			Outflows (af)						Performance Indicators	
			Wood-ward Reservoir Releases	OID Spills to Main Canal (Closure)	Total Supply	Lateral Deliveries	Ordered Spillage	Opera-tional Spillage	Evapo-ration	Canal Seepage	Direct Diversions from Main Canal	Deli-very Frac-tion[1]	Water Manage-ment Fraction[2]
1994	Dry	220	184,124	24,812	208,936	167,293	19,464	467	525	20,062	1,126	0.90	0.997
1995	Wet	207	179,940	16,667	196,606	155,720	20,430	0	483	18,881	1,091	0.90	0.998
1996	Wet	213	191,758	15,485	207,243	164,612	21,610	0	509	19,426	1,087	0.90	0.998
1997	Dry	221	208,192	13,007	221,199	174,626	24,665	0	528	20,152	1,228	0.91	0.998
1998	Wet	227	169,260	10,560	179,820	139,509	18,661	0	458	20,334	858	0.88	0.997
1999	Dry	226	205,204	3,720	208,924	186,769	0	0	508	20,515	1,131	0.90	0.998
2000	Wet	226	204,997	11,169	216,166	194,097	0	0	502	20,515	1,051	0.90	0.998
2001	Dry	215	176,579	11,744	188,322	166,891	0	0	544	19,608	1,279	0.89	0.997
2002	Dry	227	204,594	4,860	209,453	186,910	99	0	529	20,697	1,218	0.90	0.997
2003	Dry	206	177,874	9,205	187,078	164,796	1,803	0	497	18,791	1,192	0.90	0.997
2004	Wet	223	195,423	37,484	232,907	200,341	10,479	0	549	20,334	1,204	0.91	0.998
2005	Wet	223	172,222	21,937	194,159	171,989	260	0	503	20,334	1,074	0.89	0.997
2006	Wet	214	170,826	21,534	192,360	160,958	10,358	0	485	19,517	1,043	0.90	0.997
2007	Dry	220	185,026	23,575	208,601	185,642	1,081	0	537	20,062	1,279	0.90	0.997
2008	Dry	221	189,752	2,813	192,565	170,294	277	0	542	20,152	1,300	0.89	0.997
Minimum		206	169,260	2,813	179,820	139,509	0	0	458	18,791	858	0.88	0.997
Maximum		227	208,192	37,484	232,907	200,341	24,665	467	549	20,697	1,300	0.91	0.998
Wet Year Average		219	183,489	19,262	202,752	169,604	11,685	0	498	19,906	1,058	0.90	0.998
Dry Year Average		220	191,418	11,717	203,135	175,403	5,924	58	526	20,005	1,219	0.90	0.997
Overall Average		219	187,718	15,238	202,956	172,696	8,612	31	513	19,959	1,144	0.90	0.997

[1](Lateral Deliveries + Direct Diversions from Main Canal + Ordered Spillage) / (Total Supply)

[1](Lateral Deliveries + Direct Diversions from Main Canal + Ordered Spillage + Operational Spillage + Canal Seepage) / (Total Supply)

Table 5-15. SSJID Irrigated Lands and District Laterals Irrigation Season Water Balance

			Applied Water Balance											Precipitation Balance					
			Inflows (af)				Outflows (af)					Performance Indicators		Inflows (af)	Outflows (af)				
Water Year	Hydro-logic Year Type	Irriga-tion Season Number of Days	Lateral Deliv-eries	Direct Diversions from Main Canal	District Pumping	Private Pumping	Evapotran-spiration	Tail-water	Lateral Spillage	Lateral Seepage	Deep Perco-lation of Applied Water	Surface Water Supply Fraction (SWSF)[1]	Crop Consumptive Use Fraction (CCUF)[2]	Precipi-tation	Deep Perco-lation	Evapo-ration	Evapotran-spiration	Runoff	Change in Storage (af)
1994	Dry	220	167,293	1,126	5,822	53,083	148,965	2,483	16,729	8,128	51,019	0.74	0.66	14,674	1,805	1,467	23,984	1,467	-14,049
1995	Wet	207	155,720	1,091	5,612	37,843	142,338	2,372	15,572	7,650	32,334	0.78	0.71	9,328	1,364	933	15,958	933	-9,860
1996	Wet	213	164,612	1,087	5,707	47,560	145,327	2,422	16,461	7,870	46,886	0.76	0.66	31,194	4,284	3,119	33,232	3,119	-12,560
1997	Dry	221	174,626	1,228	5,831	49,836	155,624	2,594	17,463	8,165	47,675	0.76	0.67	5,743	1,011	574	13,429	574	-9,845
1998	Wet	227	139,509	858	5,708	21,895	107,631	1,794	13,951	8,238	36,356	0.84	0.64	42,290	5,657	4,229	38,128	4,229	-9,953
1999	Dry	226	186,769	1,131	5,831	23,142	142,831	2,381	18,677	8,312	44,672	0.87	0.66	10,999	1,684	1,100	18,592	1,100	-11,477
2000	Wet	226	194,097	1,051	5,678	9,741	128,480	2,141	19,410	8,312	52,224	0.93	0.61	45,435	9,320	4,543	28,780	4,543	-1,751
2001	Dry	215	166,891	1,279	5,749	53,737	158,259	2,638	16,689	7,944	42,126	0.74	0.70	14,838	1,784	1,484	15,633	1,484	-5,547
2002	Dry	227	186,910	1,218	5,895	35,923	151,276	2,521	18,691	8,385	49,073	0.82	0.66	11,644	2,110	1,164	16,349	1,164	-9,143
2003	Dry	206	164,796	1,192	5,641	45,802	147,179	2,453	16,480	7,613	43,706	0.76	0.68	13,992	1,960	1,399	18,431	1,399	-9,197
2004	Wet	223	200,341	1,204	6,306	18,402	148,246	2,471	20,034	8,238	47,264	0.89	0.66	18,225	1,598	1,822	21,198	1,822	-8,215
2005	Wet	223	171,989	1,074	5,974	12,305	131,085	2,185	17,199	7,539	33,334	0.90	0.69	12,685	1,741	1,268	19,897	1,268	-11,489
2006	Wet	214	160,958	1,043	5,239	22,208	126,424	2,107	16,096	7,907	36,914	0.86	0.67	40,210	13,990	4,021	28,129	4,021	-9,951
2007	Dry	220	185,642	1,279	6,024	31,366	153,546	2,559	18,564	8,128	41,514	0.83	0.68	7,754	891	775	11,840	775	-6,527
2008	Dry	221	170,294	1,300	5,656	45,260	152,454	2,541	17,029	8,165	42,321	0.77	0.69	1,283	769	128	10,214	128	-9,956
Minimum		206	139,509	858	5,239	9,741	107,631	1,794	13,951	7,539	32,334	0.74	0.61	1,283	769	128	10,214	128	-14,049
Maximum		227	200,341	1,300	6,306	53,737	158,259	2,638	20,034	8,385	52,224	0.93	0.71	45,435	13,990	4,543	38,128	4,543	-1,751
Wet Year Average		219	169,604	1,058	5,746	24,279	132,790	2,213	16,960	7,965	40,759	0.85	0.66	28,481	5,422	2,848	26,475	2,848	-9,111
Dry Year Average		220	175,403	1,219	5,806	42,269	151,267	2,521	17,540	8,105	45,263	0.79	0.68	10,116	1,502	1,011	16,059	1,011	-9,468
Overall Average		219	172,696	1,144	5,778	33,874	142,644	2,377	17,270	8,040	43,161	0.82	0.67	18,686	3,331	1,868	20,920	1,868	-9,301

[1](Lateral Deliveries + Direct Diversions from Main Canal) / Sum of Inflows

[2]Evapotranspiration of Applied Water / Sum of Inflows

Table 5-16. SSJID Drainage System Irrigation Season Water Balance

			Inflows (af)					Outflows (af)			
Year	Hydro-logic Year Type	Irrigation Season Number of Days	Tail-water	Runoff of Precip-itation	Lateral Spillage	Tributary Inflow	Spills to Drains	Seepage/ GW Interception	Evapo-ration	District Outflow (measured)	District Outflow (unmeasured)
2003	Dry	206	2,453	1,399	16,480	19,010	2,846	0	0	31,250	10,938
2004	Wet	223	2,471	1,822	20,034	18,582	6,199	0	0	36,377	12,732
2005	Wet	223	2,185	1,268	17,199	40,393	10,218	0	0	52,788	18,476
2006	Wet	214	2,107	4,021	16,096	46,629	11,037	0	0	59,178	20,712
2007	Dry	220	2,559	775	18,564	31,255	13,711	0	0	49,529	17,335
2008	Dry	221	2,541	128	17,029	30,246	4,092	0	0	40,027	14,009
Minimum		206	2,107	128	16,096	18,582	2,846	0	0	31,250	10,938
Maximum		223	2,559	4,021	20,034	46,629	13,711	0	0	59,178	20,712
Wet Year Average		220	2,254	2,370	17,776	35,201	9,151	0	0	49,448	17,307
Dry Year Average		216	2,518	767	17,358	26,837	6,883	0	0	40,269	14,094
Overall Average		218	2,386	1,569	17,567	31,019	8,017	0	0	44,858	15,700

5.7.1 Upper Main Supply Canal and Woodward Reservoir

Over the1994 to 2008 water balance period, the District distribution system had total inflows from Goodwin Dam ranging from 201,000 af to 258,000 af for the irrigation season with a wet year average of 218,000 af and a dry year average of 227,000 af. The overall average for the fifteen year period was 223,000 af. Diversions are greater in dry years due to the fact that less precipitation is available to support crop water demands in SSJID and evaporative demands tend to be greater. As a result, additional irrigation deliveries are needed to maintain crop production.

Water diverted at Goodwin is delivered to the U3 Ranch, lost as seepage in the upper MSC, or stored in Woodward Reservoir. Water entering the Reservoir is used to provide municipal supply to the WTP, released to satisfy downstream demand, or lost to evaporation and seepage from the reservoir. U3 Ranch deliveries are relatively steady, ranging from 3,700 to 4,700 af between 1994 and 2008 with an annual average delivery of 4,200 af. Canal seepage in the upper MSC is on the order of 400 af per year. WTP deliveries which began in 2005, were originally 700 af per year but quickly increased to more than 10,000 af per year by 2008. Releases to meet downstream irrigation demands ranged from 169,000 af to 208,000 af with a wet year average of 183,000 af and a dry year average of 191,000 af. The overall average during the period of analysis was 188,000 af. Irrigation demands are greater in dry years due to a longer irrigation season, less available stored precipitation in the root zone, and generally greater atmospheric water demand (i.e., ET_o). Reservoir seepage is approximately 22,000 af per year, and losses to evaporation are approximately 6,800 af per year.

Comparing total deliveries to meet demands to total water supply, a Delivery Fraction (DF) may be calculated to provide an indicator of distribution system performance. The DF is calculated on an annual (i.e., irrigation season) basis by dividing total deliveries to meet various objectives by total supply. The DF for the Upper MSC and Woodward Reservoir ranged from 0.86 to 0.89 between 1994 and 2008. The wet year, dry year, and overall average DF were 0.87, indicating that approximately 13% of water diverted at Goodwin is lost to seepage and evaporation. Seepage losses provide beneficial groundwater recharge and are recoverable within the basin. Losses to evaporation are irrecoverable.

Comparing total deliveries and recoverable losses to total water supply, a Water Management Fraction (WMF) may be calculated to provide an indicator of overall distribution system performance. The WMF for the upper MSC and Woodward Reservoir ranged from 0.97 to 0.98 between 1994 and 2008. The wet year, dry year, and overall average WMF were 0.97, indicating that approximately 3% of water is lost irrecoverably to canal and reservoir evaporation.

Changes in reservoir storage over the 1994 to 2008 period ranged from a decrease in storage of 23,000 af in 2000 to an increase in storage of 28,000 af in 2004. Over time, the average change in storage is essentially zero. Changes in storage in Woodward Reservoir between wet and dry years are similar, as the reservoir is operated essentially as a regulating reservoir rather than a water supply reservoir.

5.7.2 Lower Main Supply Canal and Main Distributary Canal

Over the1994 to 2008 water balance period, Woodward Reservoir releases ranged from 169,000 af to 208,000 af with a wet year average of 183,000 af and a dry year average of 191,000 af. The overall average during the period of analysis was 188,000 af. Irrigation demands are greater in dry years due to a longer irrigation season, less available stored precipitation in the root zone, and generally greater atmospheric water demand (i.e., ET_o).

Water released from Woodward is complemented by inflows from OID to the MSC. These inflows ranged between approximately 3,000 and 37,000 af per year during the analysis period with a wet year average of 19,000 af, a dry year average of 12,000 af, and an overall average of 15,000 af. The dry year average is likely less than the wet year average due to increased efforts by OID and its customers to reduce spillage and tailwater outflows, respectively, in dry years. A result of the additional inflows from OID is that there were between 180,000 and 233,000 af of total surface water available to meet irrigation demands within SSJID between 1994 and 2008 with wet year, dry year, and overall averages of 203,000 af. The similarity in total supply across years reflects SSJID's operation of the system to maximize the use of inflows from OID, effectively reusing the OID boundary outflows.

Deliveries from the MDC include lateral deliveries, direct deliveries from the MDC, and ordered spillage[13]. Lateral deliveries ranged from 140,000 to 200,000 af during the period of analysis with a wet year average of 170,000 af, a dry year average of 175,000 af, and an overall average of 173,000 af. Ordered spillage ranged from zero to 25,000 af with a wet year average of 12,000 af, a dry year average of 5,000 af, and an overall average of 9,000 af. Direct deliveries from the MDC average approximately 1,000 af per year.

Losses from the MSC below Woodward and the MDC include canal seepage, evaporation, and operational spillage. Seepage ranged from 19,000 to 21,000 af between 1994 and 2008 with an average in wet years, dry years, and overall of 20,000 af. Evaporation is approximately 500 af per year. Unintentional operational spillage is essentially zero due to complete automation of the MSC below Woodward and the MDC.

The DF for the lower MSC and MDC ranged from 0.88 to 0.91 between 1994 and 2008. The wet year, dry year, and overall averages DF were 0.90, indicating that approximately 10% of water released from Woodward is lost to seepage, evaporation, and unintentional spill. Seepage losses provide beneficial groundwater recharge and are recoverable within the basin. Spillage

[13] Ordered spillage includes water routed through the distribution system to spill points as part of water transfers and deliveries for environmental enhancement in downstream waterways.

losses are likewise recoverable by downgradient water users. Losses to evaporation are irrecoverable.

The WMF for the lower MSC and MDC ranged from 0.997 to 0.998 between 1994 and 2008, indicating that approximately 0.3% of water released from Woodward is lost irrecoverably to canal evaporation in this portion of the distribution system.

5.7.3 Irrigated Lands and District Laterals

Water supplies for irrigation include lateral and direct deliveries from the MDC, SSJID groundwater pumping, and private groundwater pumping. Over the1994 to 2008 water balance period, lateral deliveries ranged from 140,000 to 200,000 af with a wet year average of 170,000 af, a dry year average of 175,000 af, and an overall average of 173,000 af. Direct deliveries from the MDC average approximately 1,000 af per year. SSJID groundwater pumping ranged from 5,200 to 6,300 af with a wet year average of 5,700 af, a dry year average of 5,800 af, and an overall average of 5,800 af. Private pumping ranged from 10,000 to 54,000 af per year with a wet year average of 24,000 af, a dry year average of 42,000 af, and an overall average of 34,000 af. Private pumping is greater in dry years due to increased crop water requirements resulting from a longer irrigation season, less storage of precipitation in the root zone, and increased atmospheric water demand (ET_o).

The Surface Water Supply Fraction (SWSF), calculated as the sum of lateral and direct deliveries divided by the total irrigation supply, provides a relative measure of the amount of total irrigation supply met from surface water sources. Between 1994 and 2008, the SWSF ranged from 0.74 to 0.93 with a wet year average of 0.85, a dry year average of 0.79, and an overall average of 0.82. The relatively greater portion of irrigation supply met by groundwater in dry years reflects the conjunctive management of available water supplies by SSJID irrigators.

The irrigation supply is lost from the lateral system as spillage, seepage, or evaporation; consumed by crops as evapotranspiration; or lost as deep percolation or tailwater. Between 1994 and 2008, lateral spillage ranged from 14,000 to 20,000 af with a wet year average of 17,000 af, a dry year average of 18,000 af, and an overall average of 17,000 af. Lateral seepage is approximately 8,000 af per year, and evaporation is estimated to be zero due to most of the lateral system consisting of pipelines. Crop evapotranspiration of applied irrigation water (ET_{aw}) ranged from 108,000 to 158,000 af with a wet year average of 134,000 af, a dry year average of 151,000 af, and an overall average of 143,000 af. As discussed previously, crop ET of applied water is greater in dry years due to increased crop water requirements resulting from a longer irrigation season, less storage of precipitation in the root zone, and increased atmospheric water demand (ET_o). Deep percolation of applied water ranged from 32,000 to 52,000 af per year with a wet year average of 41,000 af, a dry year average of 45,000 af, and an overall average of 43,000 af. Tailwater is approximately 2,000 af per year.

The objective of irrigation is to meet crop consumptive demand (ET_{aw}), along with any other agronomic on-farm water needs. Comparing ET_{aw} to total applied irrigation water, a Crop Consumptive Use Fraction (CCUF) may be calculated to provide an indicator of on-farm irrigation performance. The CCUF is calculated on an annual (i.e., irrigation season) basis by dividing total ET_{aw} by total applied irrigation water. For SSJID, the CCUF ranged from 0.61 to 0.71 between 1994 and 2008 with an average of 0.67. The CCUF has been similar in wet and dry years.

5.8 WATER SUPPLY RELIABILITY

SSJID requires a firm water supply to meet crop irrigation demand. The primary crops grown in SSJID consist of almonds and other permanent crops that are typically high-value crops that supply increasing regional, national, and international food demands. Other primary crops include forage and feed crops to sustain beef cattle and dairy herds in surrounding areas. These critical food supplies additionally require a firm water supply. SSJID's water supply is considered very reliable and was discussed in detail previously in Section 4.

6. CLIMATE CHANGE

6.1 INTRODUCTION

Climate change has the potential to directly impact SSJID's surface water supply and to indirectly impact groundwater supplies. SSJID is committed to adapting to climate change in a manner that protects the District's water resources for the maximum benefit of the local community while continuing to maintain a reliable, affordable, high quality water supply for agriculture. This section includes a discussion of the potential effects of climate change on SSJID and its water supply, followed by a description of the resulting potential impacts on water supply and quality and on water demand. Finally, actions currently underway or that could be implemented to help mitigate future impacts are identified.

6.2 POTENTIAL CLIMATE CHANGE EFFECTS

Several potential effects of climate change have been identified by the scientific community, including reduced winter snowpack, more variable and extreme weather conditions, shorter winters, and increased atmospheric water demand. Additionally, climate change could affect water quality through increased flooding and erosion; greater concentration of contaminants, if any, in the water supply; and warmer water which could lead to increased growth of algae and other aquatic plants. Rising sea level and increased flooding are also potential effects of climate change. SSJID does not serve a flood management role and is not located in the Sacramento-San Joaquin River Delta. As a result, this discussion of climate change focuses on climate change effects and impacts related to SSJID water supply and demand and does not discuss potential effects of rising sea level and increased flooding.

Some climate change impacts are suggested by available data describing unimpaired Stanislaus River flows from 1900 to 2011 at Goodwin Dam. Over the last 100 years, April to July unimpaired runoff as a percentage of total water year flows shows a decreasing trend (Figure 6-1), suggesting that more runoff is occurring during the winter period. Total water year runoff has not decreased substantially during this period; however recent projections reported by USBR suggest that total runoff could decrease over the next 100 years (USBR 2011), as shown in Figure 6-2. The figure shows the 5th percentile, median, and 95th percentile annual Stanislaus River runoff at New Melones Lake for 2010 to 2100 based on 112 separate hydrologic projections.

In addition to the shift of runoff from the spring to the winter period, temperatures in California have increased by approximately 1°F over the last century. All else equal, increased temperature will lead to increased crop evapotranspiration. These increases may be offset to some extent by reduced transpiration due to increased atmospheric carbon dioxide concentrations and changes in other factors that drive crop water demands, such as humidity, incoming solar radiation, and wind. An example of the potential increase in evaporative demand if temperature increases and other factors remain unchanged is shown in Figure 6-3. The figure was developed based on an analysis of monthly mean climate data from Davis, California assuming an increase in air temperature of 3°F, an increase in air temperature and dew point temperature of 3°F, and finally an increase in air temperature and dew point temperature coupled with an increase in canopy resistance.

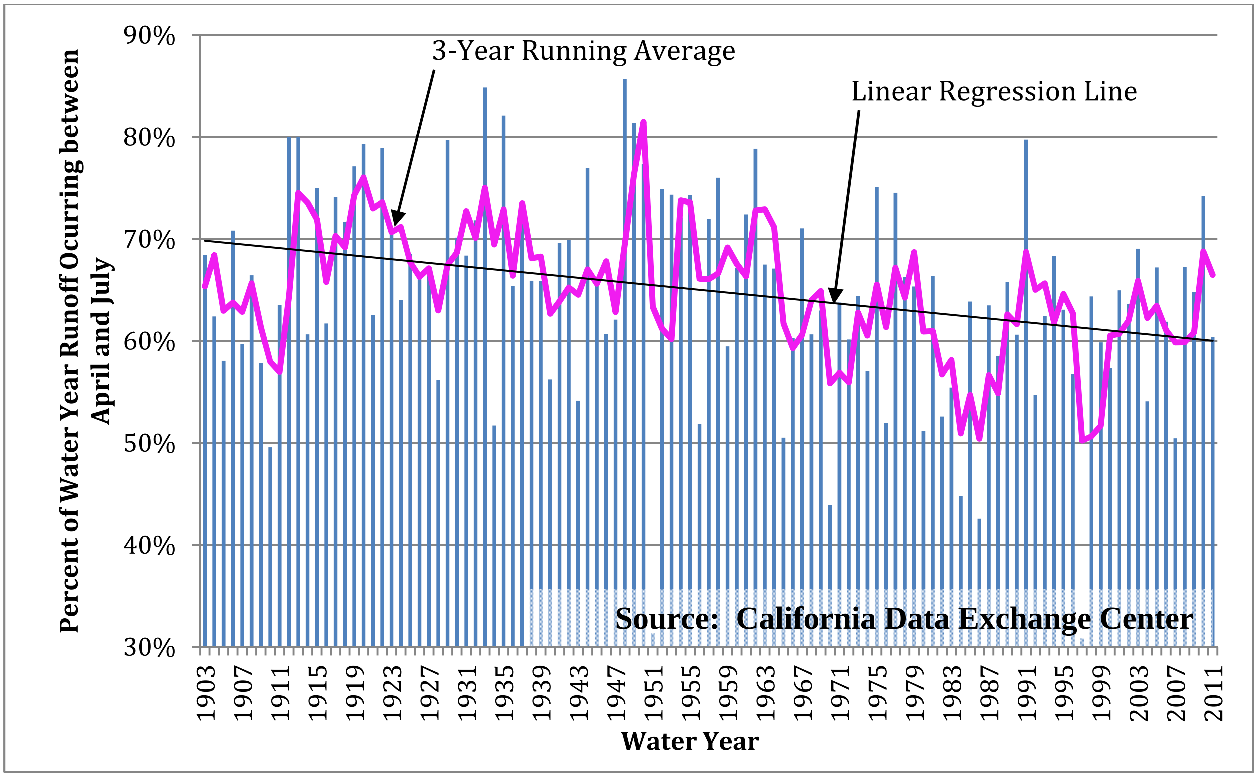


Figure 6-1. Annual April through July Unimpaired Runoff for Stanislaus River at Goodwin Dam

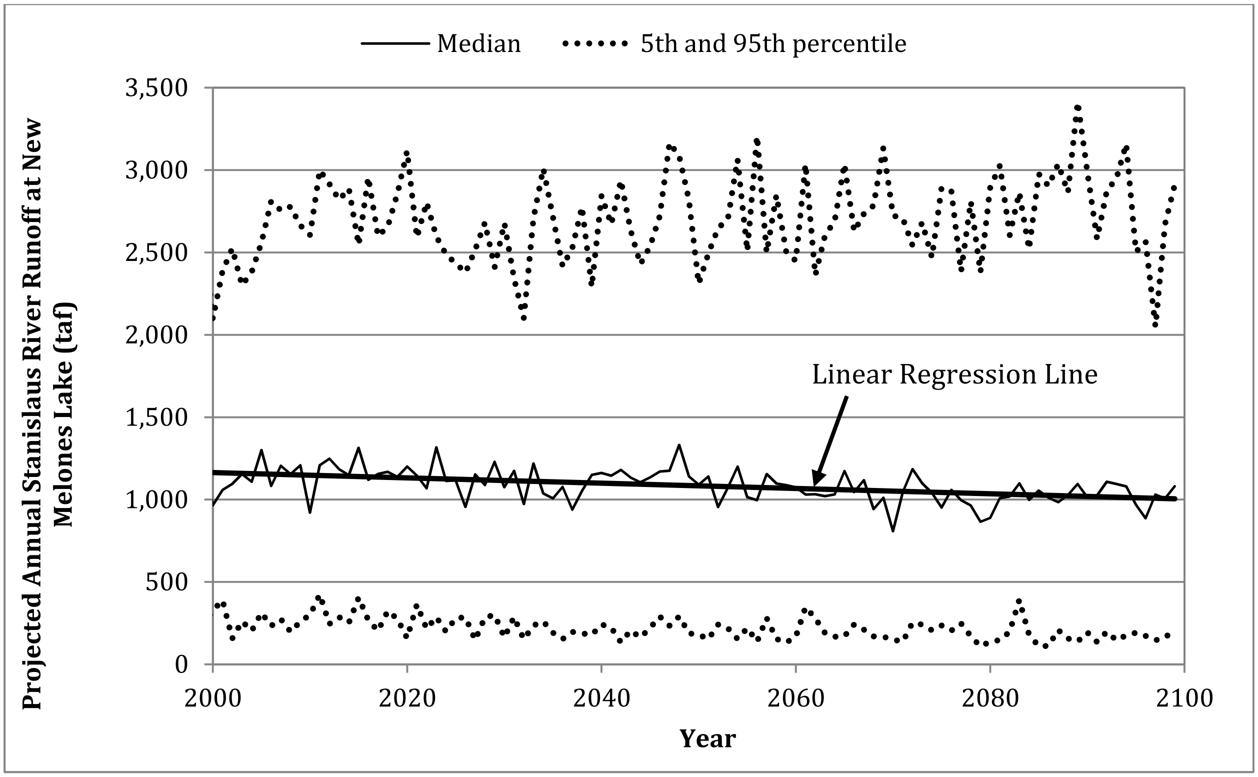
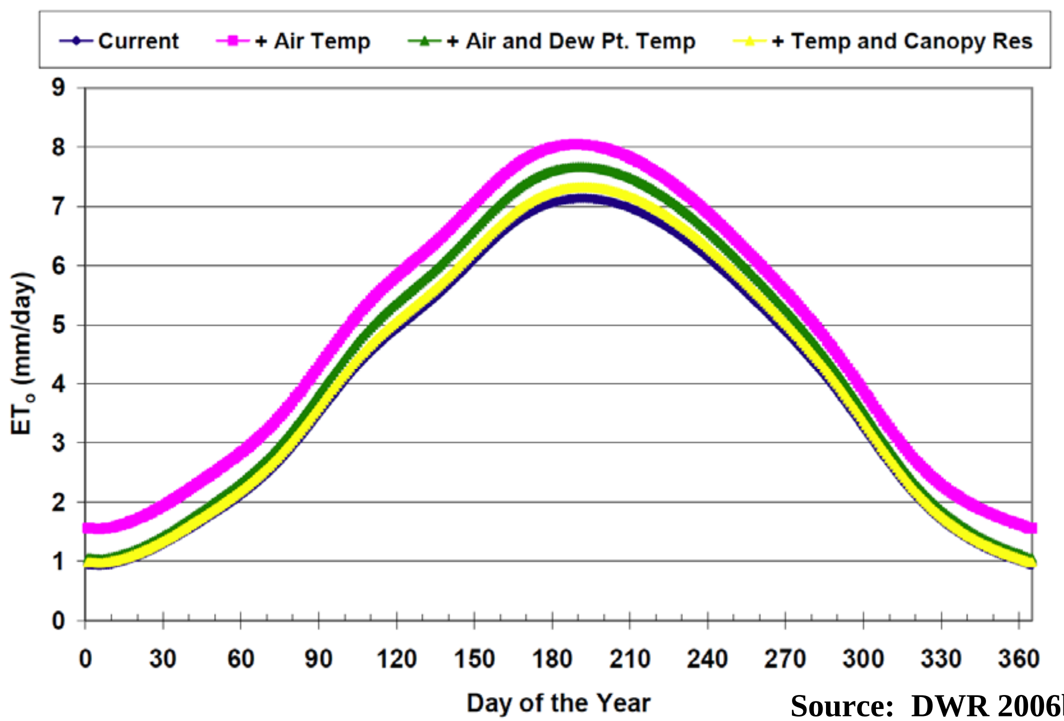


Figure 6-2. Annual Stanislaus River Runoff at New Melones Reservoir Based on 112 Hydrologic Projections (USBR 2011)



Source: DWR 2006b

Figure 6-3. Sensitivity of Reference Evapotranspiration to Hypothetical Changes in Climate (DWR 2006b)

6.3 POTENTIAL IMPACTS ON WATER SUPPLY AND QUALITY

The shift in runoff to the winter period has the potential to impact surface water supply in the future if sufficient storage is not available to retain winter runoff until it is needed to meet irrigation demands. SSJID's annual available supply under the 1988 Agreement is based on total annual inflows to New Melones Reservoir, so the timing of runoff will not affect SSJID's annual allotment.

Reduced total inflows to New Melones Reservoir in the future would increase the probability that total inflows to the reservoir would be less than 600,000 af in a given year, resulting in supplies less than 300,000 af more often than predicted based on analysis of historical data.

Increased erosion and turbidity under climate change would likely not significantly affect the water quality of the Stanislaus River as it affects agricultural irrigation. Additionally, there are no known contaminants that could be concentrated to levels that would affect agricultural irrigation if spring runoff were to decrease, particularly due to the dilution of such contaminants in reservoirs upstream of SSJID. Increased water temperature could result in additional challenges to SSJID in controlling aquatic plants in its distribution system to maintain capacity, to the extent that the increase is great enough to result in substantially increased plant growth. Increased turbidity and algae growth, if substantial, could pose challenges to filtering SSJID canal water for microirrigation.

6.4 POTENTIAL IMPACTS ON WATER DEMAND

Increased temperature and changes to other climate factors could result in increased crop water demands, as discussed previously. Additionally, changes in precipitation timing and amounts could result in greater irrigation requirements to meet ET demands. Changes in the timing of crop planting, development, and harvest could also result in changes to the timing of irrigation demands during the year.

6.5 POTENTIAL STRATEGIES TO MITIGATE CLIMATE CHANGE IMPACTS

Although there is consensus that climate change is occurring, and the effects of climate change are being observed, the timing and magnitude of climate change impacts remains uncertain. SSJID will mitigate climate change impacts with this uncertainty in mind through an adaptive management approach in cooperation with other regional stakeholders, including municipalities within SSJID, neighboring irrigation districts, and USBR. Under adaptive management, key uncertainties will be identified (e.g., April – July runoff as a percentage of annual runoff, total runoff, average temperature, and reference evapotranspiration), and strategies will be developed to address the related climate change impacts. As the actual impacts occur, the strategies will be prioritized, modified as needed, and implemented.

Several strategies for agricultural water providers and other water resources entities to mitigate climate change impacts have been identified (DWR 2008, CDM 2011). These strategies include those included as part of the California Water Plan 2009 Update (DWR 2010a) as well as strategies identified as part of the California Climate Adaptation Strategy (CNRA 2009). Many of these strategies applicable to irrigation districts are already being implemented by SSJID in some form to meet local and regional water management objectives and will continue to serve the District well as climate change impacts occur.

Resource strategies that are being implemented or could be implemented by SSJID to adapt to climate change are summarized in Table 6-1.

Table 6-1. SSJID Position on Strategies to Mitigate Climate Change Impacts

Source	Strategy	Status
California Water Plan (DWR 2009)	Reduce water demand	SSJID is implementing all technically feasible EWMPs identified by SBx7-7 to achieve water use efficiency improvements in SSJID operations and to encourage on-farm improvements.
	Improve operational efficiency and transfers	As described above and elsewhere in this AWMP, SSJID is implementing improvements to increase operational efficiency within SSJID. Additionally, SSJID is an active participant in the TriDam Project and Authority as well as the San Joaquin Tributaries Authority and the San Joaquin River Group, which seek to maximize the efficiency of system operations at the regional scale.
	Increase water supply	SSJID may consider additional opportunities to increase available water supply, including consideration of opportunities to increase available groundwater supply to compensate for reduced April through July runoff.
	Improve water quality	SSJID will continue to monitor groundwater and surface water quality internally and through its participation in the San Joaquin and Delta Water Quality Coalition.
	Practice resource stewardship	SSJID intrinsically supports the stewardship of agricultural lands within and surrounding its service area through its irrigation operations and resulting groundwater recharge. Additionally, SSJID actively supports protection of ecosystems through its participation in VAMP and by sustaining riparian habitat coincident with its irrigation and drainage systems.
	Improve flood management	SSJID does not serve a formal flood management role, although its irrigation and drainage systems provide a passive system to collect and convey winter runoff. If runoff characteristics change substantially within SSJID in the future, modifications to the irrigation and/or drainage system to increase capacity or mitigate other impacts may be considered.
	Other strategies	Other strategies identified in the California Water Plan include crop idling, irrigated land retirement, and rainfed agriculture. Under severely reduced water supplies, SSJID could consider these strategies; however, it is anticipated that climate change impacts will be mitigated through the other strategies described.
California Climate Adaptation Strategy (CNRA 2009)	Aggressively increase water use efficiency	Described above under "Reduced water demand" and "Improve operational efficiency and transfers."
	Practice and promote integrated flood management	Described above under "Improve flood management."
	Enhance and sustain ecosystems	Described above under "Practice resource stewardship."
	Expand water storage and conjunctive management	Described above under "Increase water supply."
	Fix Delta water supply	Not directly applicable to SSJID; however, water transfers could be used to help meet Delta water supply objectives.
	Preserve, upgrade, and increase monitoring, data analysis, and management	Through implementation of SSJID's boundary flow measurement program, Division 9 water usage and soil moisture monitoring system, SCADA system and other SSJID water management activities, the amount of information and analysis available to support SSJID's water management continues to increase substantially.
	Plan for and adapt to sea level rise	Projections indicate that sea levels could rise by 2 to 5 feet by 2100. Direct impacts on SSJID are not anticipated, although SSJID could consider a role to help mitigate impacts to affected areas through water transfers or other means.

6.6 ADDITIONAL RESOURCES FOR WATER RESOURCES PLANNING FOR CLIMATE CHANGE

Much work has been done at State and regional levels to evaluate the effects and impacts of climate change and to develop strategies to manage available water resources effectively under climate change. The following resources provide additional information describing water resources planning for climate change:

- Progress on Incorporating Climate Change into Planning and Management of California's Water Resources. California Department of Water Resources Technical Memorandum. July 2006. (DWR 2006b)
- Climate Change and Water. Intergovernmental Panel on Climate Change. June 2008. (IPC 2008)
- Managing An Uncertain Future: Climate Change Adaptation Strategies for California's Water. California Department of Water Resources Report. October 2008. (DWR 2008)
- 2009 California Climate Change Adaptation Strategy. California Natural Resources Agency Report to the Governor. December 2009. (CNRA 2009)
- Climate Change and Water Resources Management: A Federal Perspective. U.S. Geological Survey. (USGS 2009)
- Managing an Uncertain Future. California Water Plan Update 2009. Volume 1, Chapter 5. March 2010. (DWR 2010a)
- Climate Change Characterization and Analysis in California Water Resources Planning Studies. California Department of Water Resources Final Report. December 2010. (DWR 2010b)
- Climate Change Handbook for Regional Water Planning. Prepared for U.S. Environmental Protection Agency and California Department of Water Resources by CDM. November 2011. (CDM 2011)
- Climate Action Plan—Phase 1: Greenhouse Gas Emissions Reduction Plan. California Department of Water Resources. May 2012. (DWR 2012a)
- Climate Change and Integrated Regional Water Management in California: A Preliminary Assessment of Regional Perspectives. Department of Environmental Science, Policy and Management. University of California at Berkeley. June 2012. (UCB 2012)

7. EFFICIENT WATER MANAGEMENT PRACTICES

7.1 INTRODUCTION

This section describes the actions that SSJID has taken and is planning to take to meet its water management objectives and improve water use efficiency. These actions are organized with respect to the Efficient Water Management Practices (EWMPs) described in California Water Code §10608.48 (listed previously in Section 1.2). The Code lists two types of EWMPs: those that are critical (i.e., mandatory) for all agricultural water suppliers subject to the Code and those that are mandatory if found to be technically feasible and locally cost effective (i.e., conditional).

Two EWMPs mandatory for all water suppliers are included in the Code. These include measurement of the volume of water delivered to customers with sufficient accuracy for aggregate reporting and adoption of a pricing structure based at least in part on the quantity delivered. SSJID is actively implementing the delivery measurement accuracy EWMP and has included a plan to comply with the agricultural water delivery measurement regulation CCR 23 §597 as described in Attachment A. SSJID is currently implementing volumetric pricing in its Division 9 Project – along with customer delivery measurement – and plans to implement volumetric pricing District-wide beginning with the 2013 irrigation season. On July 31, 2012, SSJID's Board of Directors adopted a pricing structure based in part on the volume of water delivered, including a $3 per af charge to begin in 2014 in addition to the current $24 per acre flat rate charge.

SSJID has been implementing and plans to continue implementing all additional EWMPs that are technically feasible and locally cost effective. Table 7-1 describes each EWMP and summarizes SSJID's implementation status.

Table 7-1. Summary of Additional EWMPs to be Implemented if Locally Cost Effective and Technically Feasible (Water Code Section 10608.48.c.)

Water Code Reference No.	EWMP Description	Implementation Status
Critical (i.e., Mandatory) Efficient Water Management Practices		
10608.48.b(1)	Measure the volume of water delivered to customers with sufficient accuracy.	Being Implemented
10608.48.b(2)	Adopt a pricing structure based at least in part on quantity delivered.	Being Implemented
Additional (i.e., Conditional) Efficient Water Management Practices		
10608.48.c(1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible
10608.48.c(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Not Technically Feasible
10608.48.c(3)	Facilitate financing of capital improvements for on-farm irrigation systems.	Being Implemented
10608.48.c(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented
10608.48.c(5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage.	Being Implemented
10608.48.c(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits.	Being Implemented
10608.48.c(7)	Construct and operate supplier spill and tailwater recovery systems.	Being Implemented

Water Code Reference No.	EWMP Description	Implementation Status
10608.48.c(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area.	Being Implemented
10608.48.c(9)	Automate canal control structures.	Being Implemented
10608.48.c(10)	Facilitate or promote customer pump testing and evaluation.	Being Implemented
10608.48.c(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented
10608.48.c(12)	Provide for the availability of water management services to water users.	Being Implemented
10608.48.c(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented
10608.48.c(14)	Evaluate and improve the efficiencies of the supplier’s pumps.	Being Implemented

7.2 MANDATORY EWMPS

7.2.1 Delivery Measurement Accuracy (10608.48.b(1))

As described previously in Section 3.8. SSJID is implementing this EWMP by measuring deliveries to customers in the Division 9 project area using magnetic flow meters, by subsidizing the installation of magnetic flow meters for pump deliveries elsewhere in the District as part of the On-Farm Water Conservation Program, and by implementing corrective actions for the remainder of the distribution system. The District's corrective action plan is included as Attachment A of this AWMP.

7.2.2 Volumetric Pricing (10608.48.b(2))

SSJID is implementing this EWMP by adopting revisions to its pricing structure on July 31, 2012 as described previously in Section 3.9.

In accordance with SBx7-7, SSJID has developed and adopted a new pricing structure based in part on the volume of water delivered. This pricing structure will ensure compliance with SBx7-7 and includes a $3 per af charge to begin in 2014 in addition to the current $24 per acre flat rate charge. In 2013, growers will be billed volumetrically, but the charge will be waived for the first year.

SSJID's Division 9 project currently is operated using a volumetric-based pricing structure. Water users are charged $30 per af for the first three acre-feet per acre and $40 per acre-foot thereafter. All original Division 9 customers additionally paid a $2,500 one-time fee to connect to the pressurized system. The connection fee for new users of Division 9 is the District's actual connection cost.

7.3 ADDITIONAL EWMPS

CWC §10608.48.c requires agricultural water suppliers to implement 14 additional EWMPs "if the measures are locally cost effective and technically feasible." Historically, SSJID has been active in implementing various water management improvements to support the District's water management objectives. These improvements include water conservation improvements that also increase system efficiency and improve customer delivery service. SSJID is implementing all additional EWMPs with the exception of two that are not technically feasible, as described in the following sections.

7.3.1 Alternative Land Use (10608.48.c(1))

The facilitate alternative land use EWMP is not technically feasible for SSJID because lands with exceptionally high water duties or whose irrigation contributes to significant problems (required conditions for considering this EWMP) are not found within the District boundaries. Furthermore, SSJID's rules and regulations prohibit wasteful use of water, preventing exceptional water duties or significant problems from occurring (see Section 3.10). Additionally, facilitation of alternative land use is beyond SSJID's jurisdiction; however, SSJID assists customers in implementing on-farm conservation measures, as described below.

7.3.2 Recycled Water Use (10608.48.c(2))

There is currently no known recycled water within the District service area that is not beneficially used. As a result, this EWMP is not technically feasible for SSJID. The largest city in the District, Manteca, has implemented a "Purple Pipe" recycling program that uses all recycled water for irrigation of city parks and landscaping. SSJID will evaluate all potential sources of recycled water as they become available as potential means to augment current water supplies.

7.3.3 Capital Improvements for On-Farm Irrigation Systems (10608.48.c(3))

SSJID is implementing this EWMP by providing cost shares for capital improvements for on-farm irrigation systems through its On-Farm Water Conservation Program initiated in 2011 and continued in 2012. SSJID cost shares totaled approximately $1.14 million in 2011, providing improvements to 149 different parcels representing 5,350 acres.

Conservation measures to be offered through the program were chosen in-part through a grower survey conducted in 2010 that gauged grower interest in a cost sharing program, identified which measures were the most attractive, and gained valuable information on irrigation methods and irrigation management within SSJID. The evaluation process resulted in the identification of six specific water conservation measures for inclusion in the Program for which the District defined probable and reasonable implementation costs and a cost share percentage (Table 7-2). In addition to the six specific measures, SSJID included a budget for grower-proposed measures, further increasing program flexibility.

Table 7-2. 2011 On-Farm Water Conservation Program Conservation Measures and Budget

Conservation Measure	District Share (% of Actual Cost)	Cost Share Budget	Max. per Grower
Delivery Measurement	80%	$ 190,000	NA (see below)
Sprinkler Conversion	50%	$ 168,044	$ 25,000
Drip Conversion	50%	$ 329,135	$ 25,000
Tailwater Recovery	50%	$ 178,040	$ 25,000
Irrigation Scheduling	75%	$ 49,500	$ 5,000
Moisture Monitoring	75%	$ 45,500	$ 5,000
Grower-Proposed Measures	50%	$ 179,781	$ 25,000
	Total	**$ 1,140,000**	
Maximum Combined Payment per Grower:			$ 50,000

In January of 2011 the District released the program description and application to its irrigation customers. The package described the enrollment and eligibility requirements and described the eligible conservation measures, grouped into three categories: physical improvements, management practices, and District services. The program was again conducted in 2012 and continued at a similar level of funding. As of November 2012, applications are being accepted for the 2013 program, again being continued at similar levels of funding. The enrollment package for 2012 is included as Attachment C of this AWMP. An evaluation of the 2011 program prepared in 2012 is included as Attachment D.

In the future, it is anticipated that SSJID will continue to evaluate annually whether to continue to facilitate financing or to provide funding directly for on farm capital improvements that are compatible with District water management objectives. The District currently actively plans and implements the program and evaluates additional conservation measures on a year-to-year basis. Other District actions facilitating on-farm capital improvements include active cooperation with SSJID water users and the NRCS to facilitate on-farm improvements through the NRCS EQIP program. The District often supplies technical assistance to facilitate these improvements.

The 2011 program is further summarized in Tables 7-3 and 7-4.

Table 7-3. General Statistics for 2011 On-Farm Water Conservation Program

Parcel Applications Received	Parcels Eligible	Parcels Selected	Measures Implemented	Parcels Receiving Cost Shares		Acres Receiving Cost Share	Total Implemen-tation Cost	Total SSJID Cost Share
				Total	% of Received			
143	141	140	167	140	98%	5354	$1,621,793	$700,795

Table 7-4. Cost Share Amounts by Conservation Measure

Conservation Measure	Parcels Receiving Cost Share	Acres	Implementation Cost			SSJID Cost Share				Grower Cost Share			
			Total	Average	$/acre	Total	Average	$/acre	% of Total	Total	Average	$/acre	% of Total
Delivery Measurement	27	1,005	$46,287	$1,714	$46	$39,388	$1,459	$39	85%	$6,899	$256	$7	15%
Sprinkler Conversion	7	272	$414,589	$59,227	$1,524	$125,571	$17,939	$462	30%	$289,018	$41,288	$1,063	70%
Drip Conversion	19	770	$601,993	$31,684	$782	$263,923	$13,891	$343	44%	$338,070	$17,793	$439	56%
Tailwater Recovery	3	228	$106,978	$35,659	$470	$41,871	$13,957	$184	39%	$65,107	$21,702	$286	61%
Irrigation Scheduling	23	909	$87,084	$3,786	$96	$49,500	$2,152	$54	57%	$37,584	$1,634	$41	43%
Moisture Monitoring	79	2,663	$54,380	$688	$20	$40,454	$512	$15	74%	$13,926	$176	$5	26%
Grower-Proposed	9	179	$310,482	$34,498	$1,736	$140,088	$15,565	$783	45%	$170,394	$18,933	$953	55%
Total			$1,621,793			$700,795				$920,998			

7.3.4 Incentive Pricing Structures (10608.48.c(4))

SSJID is implementing this EWMP by promoting conjunctive use of groundwater by setting water rates below the cost of groundwater pumping to promote the use of available surface water supplies (goals B and C). By maintaining low water rates for surface water relative to groundwater pumping, SSJID is promoting conservation of precious groundwater resources and reduction in overdraft of the subbasin through in lieu and direct recharge. In addition, the implementation of a volumetric charge per acre-foot delivered provides a modest incentive to increase water use efficiency at the farm level (goal A). The volumetric charge additionally discourages excessive drainage (goal D).

The District will review and assess its volumetric charge over time to ensure that identified water management objectives are being achieved. Additionally, SSJID's Division 9 project provides pressurized surface water to growers which incentivizes the installation of more efficient micro and sprinkler irrigation systems and increases groundwater recharge by encouraging growers who were pumping groundwater to now utilize the pressurized surface water. The cost share incentives offered through the District's On-Farm Conservation Program also encourage growers who have filed service abandonment agreements to rejoin the District to become eligible for incentives and utilize surface water in lieu of groundwater.

7.3.5 Lining or Piping of Distribution System and Construction of Regulating Reservoirs (10608.48.c(5))

SSJID is implementing this EWMP. The SSJID distribution system consists of 38 miles of lined canals and 312 miles of pipelines, with the exception of the 18 mile long Main Distribution Canal, which remains unlined to provide beneficial groundwater recharge through seepage. SSJID began lining earthen ditches and converting to pipelines in the 1960's when they replaced 210 miles of open, earthen ditches with buried pipelines.

SSJID maintains its distribution system on a continuous basis, including replacement of canal lining and pipelines as they reach the end of their useful life. SSJID has also installed multiple pipeline interties on dead end lateral pipelines to increase delivery flexibility and reduce losses, especially for pumped irrigation deliveries.

SSJID's preventative maintenance program has completed the next 6 years worth of identified maintenance activities in the last 2 years and is now ahead of schedule. Additionally, SSJID is proactively planning to line approximately 4,000ft of the MDC between Drops 1 and 3 during the winters of 2013 and 2014 to prevent embankment erosion and to increase capacity. From 2005 to 2011 (excluding the Division 9 Project), SSJID spent an average of $2.5 million dollars annually on system maintenance, rehabilitation, and enhancement.

In addition to concrete lining and pipeline conversion, the District has constructed three regulating reservoirs within its service area. In 1992 the Van Groningen Reservoir was constructed near the terminus of the MDC to provide 60 acre-feet of storage to capture excess canal inflows flows for re-regulation. The reservoir capacity was increased to 125 acre-feet in 2002. Due to the construction of the reservoir and automation of the MSC and MDC below Woodward Reservoir, SSJID has essentially eliminated spillage from the MDC.

In 2003, SSJID constructed the five-acre Northwest Regulating Reservoir and a cross-lateral intertie pipeline between the Q and R laterals as part of the System Improvements for Distribution Efficiency (SIDE) project in an effort to increase supply flexibility and absorb excess flows for redistribution and spillage reduction.

SSJID completed the construction of the Division 9 Project in 2012, providing pressurized surface water to 90 customers farming 3,800 acres through 19 miles of buried PVC pipeline. The project includes the seven-acre East Basin reservoir that buffers supply for the project and captures operational spillage from the V, U and W laterals for re-regulation and distribution. Future expansion of the pressurized system includes the possible addition of a second seven-acre West Basin regulating reservoir on the west side of Division 9. The Division 9 Project service area maintains the old low-head pipelines and open canals for flood irrigation deliveries and supplies pressurized water through the new PVC pipe network. This greatly increases flexibility and distribution efficiency both for micro- and sprinkler-irrigation and for surface irrigation.

7.3.6 Increased Water Ordering and Delivery Flexibility (10608.48.c(6))

The District is implementing this EWMP by maximizing the amount of flexibility in water ordering by, and delivery to, water customers within operational limits. In particular, SSJID works with customers on an ongoing basis to facilitate high frequency, low volume deliveries to pump customers using pressurized irrigation systems. The use of these systems has increased over time and is anticipated to continue to increase in the future.

The Division 9 project was completed in 2012 and provides pressurized water on an arranged demand basis to 90 customers irrigating 3,800 acres within SSJID's service area. Construction of the Division 9 project retains the original non-pressurized delivery infrastructure to supply flood irrigators. The dual system allows increased flexibility for both pressurized and flood irrigators by effectively increasing overall system capacity and providing a dual system that can cater to the distinct irrigation needs of the two different irrigation system types. Growers are able to order water through the Internet using personal computers or mobile devices and can check the status of water deliveries, past water orders, and delivery flow rates.

The On-Farm Conservation Program (initiated in 2011 and continuing in 2012 and 2013) strengthened communications between irrigation customers and SSJID and helped identify the potential for further operational improvements to provide even greater levels of delivery flexibility and steadiness.

Construction of the Northwest, Van Groningen, East Basin and future West Basin regulating reservoirs and intertie pipelines have greatly increased flexibility, especially to growers near the lower ends of the system that typically receive the largest fluctuations in delivery steadiness.

Installation of SCADA during the late 1980's and early 1990's at all MDC drop structures and all lateral headings along with automation of many of the MDC control and lateral delivery structures has increased accuracy of deliveries to laterals, reduced measurement and gate adjustment effort required by the DM's, and increased monitoring and data collection for quality control and planning purposes. MDC control, combined with SCADA installations at boundary outflow sites, has provided valuable information and control to increase water ordering and delivery flexibility while controlling operational spillage.

SSJID implemented TruePoint water ordering software in 2010 to allow DM's to better track and manage water orders and to create permanent and consistent records of water usage. The streamlined recording process increases water ordering efficiency and allows additional customer ordering flexibility.

In the future, SSJID will continue to evaluate and implement locally cost-effective actions to further increase the flexibility and steadiness of irrigation deliveries.

7.3.7 Supplier Spill and Tailwater Recovery Systems (10608.48.c(7))

SSJID is implementing this EWMP through the operation of regulating reservoirs to capture and prevent spillage, through monitoring of spillage and boundary outflows, and through automation of the MDC and lateral headings to prevent spillage.

The Van Groningen Reservoir provides for the collection and storage of spillage for re-regulation of MDC outflows along with implementation of SCADA monitoring and control at drop structures and lateral headings along the MDC. Automation of the MDC provides SSJID operators with the real-time water levels and water travel times needed to anticipate and eliminate operational spillage. The newly constructed East Basin in Division 9 was designed and is operated to capture spillage from nearby laterals. The collection and utilization of operational spillage also occurs between Divisions 2 and 3 where the Campbell Drain collects operational spillage and tailwater and conveys it into the "B" lateral in Division 3 for reuse.

In efforts to provide sufficient water to pump irrigators on deadend laterals, SSJID supplies the growers with slightly more water than required to prevent any occurrences of pump cavitation or pump shutdown due to low water levels. Pump irrigators are billed for this additional water and, in the case of deadend lines, typically discharge this excess water onto their fields, often becoming tailwater, or directly into drains. Installation of intertie pipelines on deadend laterals has eliminated this requirement, thus reducing spillage and tailwater.

Tailwater production within SSJID is generally limited due to the level basin irrigation practices typically employed for surface irrigation and the expanding use of pressurized irrigation systems. Where tailwater drains do not exist, and when determined that irrigation and agronomic practices do not jeopardize water quality, SSJID allows growers to channel tailwater back into District pipelines. SSJID is increasing its real time monitoring of operational spillage as part of its customer delivery measurement program and plans to evaluate additional opportunities to reduce spillage once more information becomes available District-wide. The upper portions of the lower MSC and MDC (upstream of Drop 3) have 36 spill locations that receive tailwater and operational spillage from surrounding fields (mainly pasture) and OID for redistribution.

SSJID continues to evaluate and implement locally cost-effective actions to further increase the prevention, recovery, and reuse of operational spillage and tailwater.

7.3.8 Increase Planned Conjunctive Use (10608.48.c(8))

The District is implementing increased planned conjunctive use by encouraging the use of available surface water supplies, when available, in lieu of groundwater by facilitating delivery service to customers using pressurized irrigation systems and by providing surface water at a lower cost than that of pumping groundwater. These actions conserve groundwater for pumping in years of limited surface water availability and by neighboring water users such as the cities of Manteca, Lathrop, Ripon, and Escalon.

SSJID also maintains 28 groundwater wells and pumps in the western portion of the District to control shallow groundwater levels and to provide a supplemental water supply during dry years. Additionally, SSJID recently completed its Division 9 project which provides pressurized surface water for irrigation to 90 customers through 19 miles of pipelines serving 3,800 acres. Many of the parcels within the Division 9 project that were previously irrigated exclusively with groundwater have connected to the pressurized surface water, providing for conjunctive use. In the future, SSJID anticipates refining conjunctive management of local surface water and groundwater supplies by further evaluating the underlying groundwater system through update of their groundwater management plan and other efforts. Deep percolation of applied SSJID surface water and seepage from SSJID canals and reservoirs are a critical source of groundwater recharge to maintain a sustainable groundwater supply for users within and surrounding SSJID.

7.3.9 Automate Canal Control Structures (10608.48.c(9))

SSJID is implementing this EWMP through the automation of all 24 of its lateral headings and all control structures on the MSC and MDC which improves customer service while reducing losses. The SIDE reservoir also is automated to maintain water supply to three of the adjacent laterals during deliveries. SSJID's extensive SCADA system provides communication and monitoring of all automated sites and also provides remote control of the 28 groundwater wells operated by the District. Additionally, the Division 9 project resulted in automation of 19 miles of pipelines and deliveries to 90 customers farming 3,800 acres. In the future, SSJID will continue to evaluate and implement opportunities for additional automation to increase delivery flexibility and steadiness while reducing operational spillage.

7.3.10 Facilitate Pump Testing (10608.48.c(10))

SSJID is implementing this EWMP. SSJID facilitates and promotes customer pump testing and evaluation by providing links on its website to programs that provide these services, such as offered by PG&E (http://www.pumpefficiency.org/). Additionally, SSJID will consider cost sharing for pump efficiency testing as part of its On-Farm Water Conservation Program.

7.3.11 Designate Water Conservation Coordinator (10608.48.c(11))

SSJID is implementing this EWMP by continuing to designate a designated Water Conservation Coordinator (to develop and implement the water management plan). SSJID added a permanent, full time water conservation coordinator in 2011.

7.3.12 Provide for Availability of Water Management Services (10608.48.c(12))

SSJID is implementing this EWMP by providing a link to CIMIS and other eater management resources to growers on the District's website (Figure 7-1). SSJID provides for the availability of water management services through its On-Farm Water Conservation Program, including scientific irrigation scheduling and soil moisture monitoring conservation measures, for example. Additionally, SSJID produces a newsletter periodically (Figure 7-2) and will continue to provide links to CIMIS and other water management information on its website. Historical water use data is available to growers in the Division 9 project through an internet-based portal. Water usage will be reported to all growers beginning in 2013 as part of implementing the District's volumetric water charge.

Figure 7-1. SSJID Website

7.3.13 Evaluate Supplier Policies to Allow More Flexible Deliveries and Storage (10608.48.c(13))

SSJID is implementing this EWMP through ongoing cooperation and discussion with USBR and other agencies that affect SSJID's flexibility in delivering and storing water. Although SSJID owns its own surface water rights, SSJID actively evaluates the effect of Reclamation and Tri-Dam Project policies and operational practices on District operations and seeks policy changes to alleviate water supply constraints. SSJID actively participates in initiatives that affect its water users including the process to implement the Water Conservation Act of 2009 (SBx7-7).

SSJID will continue to participate in local, regional, and statewide water management initiatives that affect the District's ability to store and deliver water to ensure that SSJID is able to meet irrigation and other demands with the degree of flexibility required to maintain and enhance efficient water management.

7.3.14 Evaluate and Improve Efficiencies of Supplier's Pumps (10608.48.c(14))

SSJID is implementing this EWMP by evaluating and improving the efficiency of its pumps by performing periodic pump efficiency tests to identify cost effective energy and/or water conservation improvements. SSJID has replaced four of its 28 groundwater wells in the last four years. In addition to the 28 groundwater wells, SSJID maintains seven pumps at the East Basin Reservoir and five pumps at the SIDE Reservoir.

SSJID Fall 2012 Irrigation Newsletter

October 2012

SSJID
SOUTH SAN JOAQUIN IRRIGATION DISTRICT

Points of Interest:

- End of Irrigation Season Details, page 1
- Volumetric Pricing to go into Effect in 2014, page 1
- How you can help us in our effort to save you 15% on your electric bill, page 2
- Construction Projects Ready to Go, page 3
- Keeping your pets safe while in the field, page 3

A special thank you goes to recently retired District employees:

Cheryl Burke, Executive Secretary. Betty Garcia has replaced Cheryl.

Ray Hellstrom, Engineering Technician. Keith Sausedo has replaced Ray.

Ray Simons, Shop Supervisor. Ron Gee was promoted into Ray's position.

Please join us in wishing them a relaxing and enjoyable retirement.

SSJID Programs and Growers Assist with Conservation During Dry Irrigation Season

The harvest season is nearing an end, signaling the conclusion of another successful water year for SSJID customers. At their meeting on September 25, the Board of Directors determined that the 2012 water season has come to an end on Thursday, October 18.

In a report to the Board, SSJID General Manager Jeff Shields said that the District will be ending a rather dry season with approximately 70,300 acre feet (AF) of conserved water into our conservation account with the Bureau of Reclamation. This deposit is critical, assisting with making water available to supplement the District's dry year supplies in the event that inflow into New Melones Reservoir drops below 600,000 AF in any given year. (SSJID and Oakdale Irrigation District have rights to the first 600,000 AF of inflow into New Melones.)

Part of this year's conserved water, approximately 4,700 AF, is the result of 2,000 AF of conservation gains made through the District's Division 9 Irrigation Enhancement Project, and an additional 2,700 AF from the On-Farm Water Conservation Program that the Board has implemented during the last two years. Although the District had its first ever January irrigation delivery, we were fortunate that rain came in March and April in the valley, reducing the amount of water needed for spring irrigation.

If you observe leaks or see any vents down throughout the winter, please call Water Operations Superintendent Joe Catanzarite at (209) 249-4634, or Field Maintenance Supervisor Ron Strmiska Jr. at (209) 249-4631, during regular business hours (Monday through Friday, 7:30AM-4:30PM).

The District thanks all of our growers for joining us in conserving water for our future!

How Volumetric Pricing Will Affect You
District Required to Implement New Rate Structure

On Tuesday, July 31, a public hearing was held at SSJID headquarters to discuss and vote on a new rate structure required by state law SBX7-7. After considering customer comments, the Board unanimously voted to hold the flat rate of $24 per acre and to adopt a $3 per-acre-foot water rate, but to suspend collection of the volumetric charge in 2013 in order to ensure accuracy of the meters that will be installed to track water usage by growers. The Board also decided not to adopt an annual rate increase based on the Consumer Price Index (CPI).

About 30 water customers were in attendance at the hearing, which was held to consider protests made by customers. In order to not adopt the new rate structure proposed by the District, 51% of parcel owners needed to submit a written protest. Each customer was given the information to do so when the public notice was sent out in June. Out of 3,038 notices, only 45 protest letters covering 85 parcels were received.

After the meeting was called to order, General Manager Jeff Shields reviewed a detailed outline regarding the new volumetric charges and water measurement requirements. He also discussed capital investments made to date related to volumetrically measuring water. Shields explained Prop 218 requirements and why compliance with SBX7-7 is mandatory. Following Shield's presentation, the podium was opened for public comment.

A majority of attendees shared the common concern of the proposed annual adjustable rate increase based on the CPI. Some

Continued on page 2

Figure 7-2. SSJID Newsletter

7.4 SUMMARY OF EWMP IMPLEMENTATION STATUS

SSJID has taken many actions throughout its history to promote efficient water management and continues to evaluate and implement additional measures to accomplish improved and more efficient water management, according to the District's water management objectives. For purposes of this AWMP, SSJID water management actions have been organized and are reported with respect to the Efficient Water Management Practices (EWMPs) listed in CWC §10608.48. A summary of the implementation status of each listed EWMP has been provided previously in Table 7-1. A summary of specific current and planned activities related to each EWMP is provided in Table 7-5.

Table 7-5. Summary of EWMP Implementation Status

Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
Critical (Mandatory) Efficient Water Management Practices				
10608.48.b(1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	SSJID has evaluated and tested options for delivery measurement capable of meeting the requirements of new regulations. SSJID has developed a customer delivery measurement plan including corrective actions for compliance with CCR 23 §597 that is included as Attachment A of this AWMP.	
10608.48.b(2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented	SSJID adopted a pricing structure based in part on volume delivered on July 31, 2012. The new pricing structure includes a $3 per af charge to begin in 2014 in addition to the current $24 per acre flat rate charge. SSJID's Division 9 project charges a one-time fee to connect to the system and $30 per af for the first 3 af/ac $40 per af thereafter.	
Additional (Conditional) Efficient Water Management Practices				
10608.48.c(1)	Facilitate alternative land use for lands with exception-ally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	"Lands with exceptionally high water duties or whose irrigation contributes to significant problems" are not known to exist within the SSJID service area. District Rule #10 in the rules and regulations governing the distribution of water within SSJID prohibit the wasteful use of water through the "...flood[ing] of certain portions of the land to an unreasonable depth or amount...". Additionally, facilitation of alternative land use is beyond SSJID's jurisdiction; however, SSJID assists customers in implementing on-farm conservation measures, as described below.	
10608.48.c(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils	Not Technically Feasible	1. No available recycled water exists within the District service area that is not already beneficially used. 2. Manteca currently uses recycled water for irrigation of city parks and landscaping.	1. Consider requests from all qualifying permitted dischargers for additional use of recycled water.
10608.48.c(3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented	1. Cost sharing for irrigation improvements and services through On-Farm Conservation Program in 2011 and 2012. 2. Total financing of over $1 million in 2011 with 110 different landowners participating and continued financing of over $1 million during 2012.	1. SSJID will continue the On-Farm Conservation Program as long as it remains economically possible.
10608.48.c(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented	1. SSJID's volumetric charge promotes more efficient water use at the farm level and discourages excessive drainage (goals A and D). 2. Current pricing maintains low rates for surface water relative to groundwater pumping to promote conservation of groundwater through in lieu and direct recharge (goals B and C). 3. Division 9 project incentivizes more efficient irrigation systems and increases groundwater recharge in lieu and direct recharge (goals A through D). 4. Conservation Program increases use of surface water and efficient irrigation practices by encouraging growers who aren't District members to join to become eligible for incentives (goals A through D).	1. The District will review and assess its volumetric charge over time to ensure that identified water management objectives are being achieved.

Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	1. Main Canal is unlined but provides beneficial groundwater recharge through seepage. 2. Maintain 312 miles of pipeline. 3. Maintain 38 miles of lined channel. 4. Maintain 18 miles of unlined channel. 5. Scheduled maintenance and/or replacement of infrastructure. 6. Constructed Van Groningen Reservoir in 1992. 7. Constructed 5-acre SIDE reservoir and cross-lateral intertie pipeline in 2003. 8. Constructed 7-acre East Basin regulating reservoir as part of Division 9 project completed in 2012.	1. Connection of additional growers to Division 9 project. 2. Potential future construction of 7-acre West Basin reservoir within Division 9 based on determination of overall project benefit. 3. Reconstruction and concrete lining of approximately 4,000 feet of the Main Canal in the 2013 and 2014 offseasons to prevent erosion. 4. SSJID continues to look for opportunities to expand their system capabilities and increase delivery flexibility through improvements.
10608.48.c(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented	1. Ongoing efforts to facilitate high frequency, low volume deliveries to pump customers using pressurized irrigation systems. 2. Division 9 project completed in 2012 provides pressurized water on an arranged demand basis to 90 customers irrigating 3,800 acres while also enhancing delivery service for remaining surface irrigators. 3. On-Farm Conservation Program helps improve District-grower coordination. 4. Construction of regulating reservoirs and intertie pipelines to increase flexibility and steadiness, especially to growers near the lower ends of the system.	1. Continue efforts to facilitate flexible delivery service to pressurized irrigation system through operational and infrastructure improvements. 2. Expansion of pressurized pipeline system in Division 9. 3. Evaluate continued funding of On-Farm Conservation Program on year-to-year basis. 4. Evaluate and implement additional locally cost-effective actions to improve flexibility
10608.48.c(7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented	1. SCADA at all drop structures along the MDC provides real-time control to prevent spillage. 2. The Van Groningen Reservoir provides for collection and storage of spillage and re-regulation. 3. The East Basin Reservoir in Division 9 captures spillage from Divisions 7 and 8. 4. Campbell Drain (Division 2) collects operational spillage and tailwater and conveys it into the "B" lateral in Division 3 for reuse. 5. Where tailwater drains do not exist, growers may channel tailwater back into District pipelines for redistribution. 6. Intertie pipeline construction for redistribution of excess. 7. Accept tailwater at 36 locations along the upper portions of the MSC and MDC, including spillage and tailwater outflows from OID	1. Continued and expanded monitoring at spill sites to reduce spillage and develop representative data. 2. Continue to look for opportunities to expand tailwater and spillage prevention and recovery capabilities.

Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented	1. Encourage use of available surface water supplies in lieu of groundwater through construction of pressurized irrigation systems. 2. Provide surface water at a lower cost than that of pumping groundwater. 3. Utilize 28 groundwater wells to augment surface water supplies and control shallow groundwater levels. 4. Constructed Division 9 project to provide pressurized surface water for irrigation to 90 customers through 19 miles of pipelines serving 3,800 acres.	1. SSJID anticipates refining conjunctive management by further evaluating the underlying groundwater system through update of their groundwater management plan and/or other activities.
10608.48.c(9)	Automate canal control structures	Being Implemented	1. Automation of all 24 lateral headings and all control structures on the MSC and MDC to improve customer service while reducing system losses. 2. Automation of the SIDE reservoir to maintain steady water supply to three adjacent laterals. 3. Implementation of an extensive SCADA system to provide communication, monitoring, and control of automated sites, including remote on/off control of 28 groundwater wells. 4. Automation of 19 miles of pipelines and deliveries to 90 customers farming 3,800 acres in Division 9.	1. SSJID will continue to evaluate opportunities for additional automation to increase delivery flexibility and steadiness and to reduce operational spillage.
10608.48.c(10)	Facilitate or promote customer pump testing and evaluation	Being Implemented	1. SSJID facilitates and promotes customer pump testing and evaluation by providing links on its website to programs that provide these services, such as offered by PG&E (http://www.pumpefficiency.org/).	1. Consider cost sharing for pump efficiency testing as part of its On-farm Water Conservation Program.
10608.48.c(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	1. SSJID added a permanent, full time water conservation coordinator in 2011.	1. Continue to employ a full time water conservation coordinator.
10608.48.c(12)	Provide for the availability of water management services to water users.	Being Implemented	1. SSJID provides for the availability of water management services through scientific irrigation scheduling and soil moisture monitoring conservation measures, for example, as part of its On-Farm Water Conservation Program. 2. Additionally, SSJID provides links to CIMIS and other water management information on its website and produces a periodic irrigation newsletter. 3. Historical water use data is available to growers in the Division 9 project.	1. Continue current activities. 2. Provide regular water usage information as part of implementing volumetric billing.
10608.48.c(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented	1. SSJID actively evaluates the effect of supplier (Reclamation) and Tri-Dam Project policies and operational practices and seeks policy changes to alleviate water supply constraints.	1. Continue current activities.
10608.48.c(14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented	1. Periodic evaluation and improvements of pumps by performing periodic pump efficiency tests to identify cost effective energy and/or water conservation improvements. 2. Replaced four of the 28 GW remediation pumps in the last 4 years 3. Maintain 7 pumps at the East Basin Reservoir and 5 at the SIDE Reservoir.	1. Continue testing and periodic refurbishment or replacement of pumps and motors. 2. Add any new pumps to the existing testing program.

7.5 EVALUATION OF WATER USE EFFICIENCY IMPROVEMENTS

CWC §10608.48(d) requires that AWMPs include:

> *… a report on which efficient water management practices have been implemented and are planned to be implemented, an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future.*

A description of which EWMPs have been implemented has been provided previously in Section 7. This section provides an evaluation of EWMP implementation and an estimate of water use efficiency (WUE) improvements that have occurred in the past and are expected to occur in the future.

The value of evaluating water use efficiency (WUE) improvements (and EWMP implementation in general) from SSJID's perspective is to identify what the benefits of EWMP implementation are and to identify those additional actions that hold the potential to advance SSJID's water management objectives. The District's primary water management objective is to maintain a reliable, affordable, high quality water supply for agriculture and other uses. To that end, SSJID has taken action to develop and maintain reliable surface water and groundwater supplies, to prevent or reduce losses from the distribution system in order to increase operational efficiency, to promote the efficient use of water at the farm level, and to meet changing environmental and other demands that affect the flexibility with which the District can deliver and store water.

First and foremost among the issues that must be considered in any evaluation of the benefits of EWMP implementation and resulting WUE improvements is how water management actions affect the water balance (Davenport and Hagan, 1982; Keller, et al., 1996; Burt, et al., 2008; Clemmens, et al., 2008; Canessa, et al., 2011). Accordingly, any evaluation of EWMP implementation and WUE improvements for SSJID must consider how water balance changes relate to the District's mission and water management objectives. For example, flows to deep percolation and seepage that could be considered losses in some settings are critical to maintain the long-term sustainability of the underlying groundwater basin. Reductions in these flows resulting from EWMP implementation could be considered WUE improvements at the farm or District scale, but have the consequential effect of diminishing recharge of the underlying groundwater system. Other flows that could be considered losses at the District or farm scale such as spillage and tailwater, respectively, are also recoverable. For example, spillage from the SSJID distribution system is available for beneficial use by downgradient water users. The only distribution system or on-farm losses that are not recoverable within SSJID, the underlying groundwater basin, or the San Joaquin River Basin as a whole are canal and reservoir water surface evaporation and evaporation from irrigation application. These components represent a small portion of SSJID's water supply. An implication of this is that very little "new" water can be made available through water conservation in SSJID.

An essential first step in evaluating EWMP implementation and water use efficiency improvements is a comprehensive, quantitative, multi-year water balance (see Section 5). The quantitative understanding of the water balance flow paths enables identification of targeted flow paths for WUE improvements, along with improved understanding of the beneficial impacts and consequential effects of EWMP implementation at varying spatial and temporal scales. The water balance enables evaluation of potential changes in flow path quantities and timing for any given change in water management.

Even where comprehensive, multi-year water balances have been developed, evaluating water balance impacts and WUE improvements is not a trivial task. Issues of spatial and temporal scale and relatively small changes in flow paths resulting from many water management improvements (relative to day to day and year to year variation in water diversions and use) coupled with inaccuracies inherent in even the best water measurement greatly complicate the evaluation of water balance impacts. The implications of recoverable and irrecoverable losses at varying scales complicate the evaluation of WUE improvements, and consequential, potentially unintended consequences must be considered (Burns et al. 2000, AWMC 2004).

As part of assembling this AWMP, SSJID has identified the targeted flow paths associated with implementation of each EWMP and the water management benefits of each EWMP, along with the potential consequential effects of implementation. A brief discussion of the benefits associated with implementation of each EWMP is provided, along with a brief discussion of consequential effects that must be considered. A summary of targeted flow paths, beneficial impacts, and consequential effects associated with implementation of each EWMP by SSJID is provided in Table 7-6.

Table 7-6. Summary of WUE Improvements by EWMP

Water Code Reference No.	EWMP	Implementation Status	Targeted Flow Path(s)	Benefits	Consequential Effects	Notes (See End of Table)
10608.48.b (1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	None	Supports Evaluation of EWMPs	Not Applicable	1
10608.48.b (2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented	Farm Deliveries, Tailwater, Deep Percolation of Applied Water, System Inflows, Drainage Outflows	Volumetric pricing could create a modest incentive to reduce on-farm deliveries, primarily through reduced tailwater and deep percolation. In aggregate, reduced deliveries result in decreased system inflows and corresponding reductions in drainage outflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system, potentially contributing to groundwater overdraft. Reduced drainage outflows from tailwater result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	Not Applicable	Not Applicable	Not Applicable	3
10608.48.c (2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Not Technically Feasible	System Inflows, Farm Deliveries	Not Applicable	Not Applicable	3
10608.48.c (3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented	Farm Deliveries, Tailwater, Deep Percolation of Applied Water, System Inflows, Drainage Outflows	SSJID funding of on-farm improvements could result in reductions in on-farm deliveries through reduced tailwater and deep percolation. In aggregate, reduced deliveries result in decreased system inflows and corresponding reductions in drainage outflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system, potentially contributing to groundwater overdraft. Reduced drainage outflows from tailwater result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented	Varies	Volumetric pricing will incentivize goals A and D, resulting in on-farm benefits as described for the volumetric pricing EWMP (10608.48.b(2)). Provision of surface water at lower rates than the cost of groundwater pumping incentivizes goals B and C and improves the reliability of regional water supplies.	Consequential effects of volumetric pricing are the same as described for the volumetric pricing EWMP (10608.48.b(2)).	2
10608.48.c (5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	System Inflows, Operational Spillage, Canal Seepage, Farm Deliveries, Tailwater, Deep Percolation of Applied Water, Drainage Outflows	SSJID regulating reservoirs allow for improved on-farm delivery steadiness and flexibility, potentially providing a modest reduction in on-farm deliveries due to reduced deep percolation and tailwater. Reservoirs allow operators to reduce operational spillage. Lining and pipeline conversion provide maintenance and operational benefits while also substantially reducing seepage in some areas. In aggregate, reduced recoverable losses at the farm and district scale result in decreased system inflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation and seepage result in reduced beneficial recharge of the underlying groundwater system, potentially contributing to groundwater overdraft. Reduced drainage outflows result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2

Water Code Reference No.	EWMP	Implementation Status	Targeted Flow Path(s)	Benefits	Consequential Effects	Notes (See End of Table)
10608.48.c (6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented	System Inflows, Operational Spillage, Farm Deliveries, Tailwater, Deep Percolation of Applied Water, Drainage Outflows	Changes in ordering and delivery practices, coupled with improvements to the SSJID distribution system and operation result in increased control for DMs and improved farm delivery steadiness and flexibility. Farm deliveries could be reduced due to reduced deep percolation and tailwater. System improvements result in greater operational efficiency and, potentially, reductions in spillage. In aggregate, reduced recoverable losses at the farm and district scale result in decreased system inflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system, potentially contributing to groundwater overdraft. Reduced drainage outflows result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented	System Inflows, Drainage Outflows	Current levels of tailwater interception and spillage recovery and prevention will continue to reduce drainage outflows from SSJID. As a result, reduced outflows result in decreased system inflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer.	Reduced drainage outflows result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	
10608.48.c (8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented	System Inflows, District Groundwater Pumping	Increased conjunctive management benefits SSJID by improving long-term water supply reliability through reliance primarily on surface water to minimize withdrawals from the groundwater system and provide beneficial groundwater recharge.	Not Significant	2
10608.48.c (9)	Automate canal control structures	Being Implemented	System Inflows, Operational Spillage, Farm Deliveries, Tailwater, Deep Percolation of Applied Water, Drainage Outflows	Automation of the SSJID distribution system results in increased control for system operators and improved farm delivery steadiness and flexibility. Farm deliveries could be reduced due to reduced deep percolation and tailwater. System improvements result in greater operational efficiency and, potentially, substantial reductions in spillage. In aggregate, reduced recoverable losses at the farm and district scale result in decreased system inflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system, potentially contributing to groundwater overdraft. Reduced drainage outflows result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (10)	Facilitate or promote customer pump testing and evaluation	Being Implemented	None	Improved pumping efficiency by SSJID's customers does not affect the SSJID water balance but results in decreased energy demand and reduced pumping costs for customers. There are no direct benefits to SSJID.	Not Significant	
10608.48.c (11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	Varies	See Comment	See Comment	4
10608.48.c (12)	Provide for the availability of water management services to water users.	Being Implemented	Farm Deliveries, Tailwater, Deep Percolation of Applied Water, System Inflows, Drainage Outflows	Farm water management support by SSJID could result in reductions in on-farm deliveries through reduced tailwater and deep percolation. In aggregate, reduced deliveries result in decreased system inflows and corresponding reductions in drainage outflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system, potentially contributing to groundwater overdraft. Reduced drainage outflows from tailwater result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented	System Inflows	Changes in the policies of agencies that affect SSJID's flexibility and storage in using its surface water supply could allow for limited improvements in system operation and reductions in system losses. Available water not diverted could allow for service area expansion (annexation) or be available for transfer.	Reduced drainage outflows from operational spillage could result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	

Water Code Reference No.	EWMP	Implementation Status	Targeted Flow Path(s)	Benefits	Consequential Effects	Notes (See End of Table)
10608.48.c (14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented	None	Improved pumping efficiency of SSJID's pumps and prioritizing repairs and replacement based on pump evaluations results in decreased energy demand and reduced pumping costs for SSJID and increases pump reliability. There are no direct impacts to water balance flow paths.	Not Significant	

Notes:

1. Although delivery measurement does not directly affect any flow paths, it will provide the basis for improved understanding of the overall water balance in the future.
2. SSJID works to balance tradeoffs between incentivizing on-farm water conservation and maintaining long-term surface water and groundwater reliability for the region.
3. Such conditions do not exist in SSJID. As a result, it is not technically feasible to implement this EWMP.
4. Implementation of the AWMP by SSJID's Water Conservation Coordinator/Water Operations Supervisor, General Manager, District Engineer, and other staff as appropriate is the mechanism by which all EWMPs are implemented and targeted benefits are realized.

WUE definitions vary. For purposes of evaluating WUE improvements associated with EWMP implementation by SSJID, specific WUE improvement categories or objectives, as described by CALFED and DWR (CALFED 2006, DWR 2012b), have been identified that correspond to each EWMP. Potential WUE improvements include reduction of irrecoverable losses, increased local supply, increased local flexibility, increased in-stream flow, improved water quality, and improved energy efficiency. Definitions for each of the WUE improvement categories have been developed and are provided in Table 7-7. Note that the WUE improvement categories are not mutually exclusive in many cases. For example, reductions in irrecoverable losses could be used to increase local supply. The applicability of each EWMP to each WUE improvement category based on SSJID's water management activities has been identified and is presented in Table 7-8.

Table 7-7. WUE Improvement Categories

Water Use Efficiency Improvement Category	Definition
Reduce Irrecoverable Losses	Reduce losses that cannot be recovered and used by the water supplier or downgradient users (e.g. evaporation and flows to salt sinks).
Increase Local Supply	Reduce losses and/or increase storage locally to increase supply available to meet demands, including both near-term (within an irrigation season) and long-term (over more than one year).
Increase Local Flexibility	Improve the supplier's ability to divert, pump, convey, control, and deliver available water supplies to meet customer demands.
Increase In-Stream Flow	Increase flow in natural waterways to benefit fisheries or meet other environmental objectives.
Improve Water Quality	Increase the quality of targeted water bodies (i.e. streams, lakes, or aquifers).
Improve Energy Efficiency	Increase the efficiency of water supplier or customer pumps.

Table 7-8. Applicability of EWMPs to WUE Improvement Categories.

Water Code Reference No.	EWMP	Implementation Status	Water Use Efficiency Improvement Category					
			Reduce Irrecoverable Losses	Increase Local Supply	Increase Local Flexibility	Increase In-Stream Flow[1]	Improve Water Quality[2]	Improve Energy Efficiency
10608.48.b (1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	No Direct WUE Improvements					
10608.48.b (2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented		✓				
10608.48.c (1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	Not Applicable to SSJID					
10608.48.c (2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Being Implemented		✓				
10608.48.c (3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented		✓				
10608.48.c (4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented		✓				
10608.48.c (5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	✓	✓	✓			
10608.48.c (6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented		✓	✓			
10608.48.c (7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented		✓				
10608.48.c (8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented		✓				
10608.48.c (9)	Automate canal control structures	Being Implemented		✓	✓			
10608.48.c (10)	Facilitate or promote customer pump testing and evaluation	Being Implemented						✓
10608.48.c (11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	The activities of the Water Conservation Coordinator and other SSJID staff to achieve WUE improvements through implementation of the EWMPs are described individually by EWMP.					
10608.48.c (12)	Provide for the availability of water management services to water users.	Being Implemented		✓				
10608.48.c (13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented		✓	✓			
10608.48.c (14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented						✓

1. Increased in-stream flow could be a direct or indirect benefit water transfers between willing buyers and SSJID. For example, an objective of the VAMP program was to increase San Joaquin River flows at certain times and by certain amounts to improve fish habitat.
2. While many EWMPS could result in improved water quality through reduced diversions, reduced deep percolation, or reduced tailwater outflow, the potential for improved water quality in stream flows in particular is very uncertain as it depends on coordination with USBR and others.

In order to more explicitly report an estimate of WUE improvements that have occurred since the last AWMP and an estimate of WUE improvements expected to occur five and ten years in the future, SSJID has estimated the qualitative magnitude (expressed as None, Limited, Modest, or Substantial in order of increasing relative magnitude) for the targeted flow paths associated with each EWMP relative to the applicable WUE improvement categories identified in Table 7-8. Past WUE improvements are estimated relative to no historical implementation. As SSJID has not previously prepared an AWMP, WUE improvements relative to the last AWMP are not evaluated. Future WUE improvements are estimated for five years in the future (2017) relative to 2012 and for ten years in the future (2022) relative to 2012. The result of this evaluation is provided in Table 7-9.

SSJID will continue to seek out and implement water management actions that meet its overall water management objectives and result in WUE improvements. SSJID staff regularly attend water management conferences and evaluate technological advances in the context of SSJID's water management objectives and regional setting. The continuing review of water management within SSJID, coupled with exploration of innovative opportunities to improve water management will result in future management improvements by SSJID and additional WUE improvements.

Table 7-9. Evaluation of Relative Magnitude of Past and Future WUE Improvements by EWMP.

Water Code Reference No.	EWMP	Implementation Status	Marginal WUE Improvements[1,2]			
			Past		Future	
			Relative to No Historical Implementation[3]	Since Last AWMP[4]	5 Years in Future[5]	10 Years in Future[5]
10608.48.b (1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	No Direct WUE Improvements			
10608.48.b (2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented	Limited	Not Applicable	Limited to Modest, Depending on Structure	
10608.48.c (1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	Not Applicable to SSJID			
10608.48.c (2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Not Technically Feasible	Not Applicable to SSJID			
10608.48.c (3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented	Substantial (Limited Reduction in Irrecoverable Losses)	Not Applicable	Substantial (Limited Reduction in Irrecoverable Losses)	Substantial (Limited Reduction in Irrecoverable Losses)
10608.48.c (4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented	Substantial (Goals B & C)	Not Applicable	Limited to Modest (Goals A and D), Depending on Structure	
10608.48.c (5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	Substantial (Limited Reduction in Irrecoverable Losses)	Not Applicable	Modest (Spillage Reduction from Reservoirs)	Modest (Spillage Reduction)
10608.48.c (6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented	Substantial	Not Applicable	Modest	Modest
10608.48.c (7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented	Substantial	Not Applicable	Limited to Substantial, Depending on Specific Actions	
10608.48.c (8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented	Substantial	Not Applicable	Limited to Modest, Depending on Specific Actions	
10608.48.c (9)	Automate canal control structures	Being Implemented	Substantial	Not Applicable	Modest	Modest
10608.48.c (10)	Facilitate or promote customer pump testing and evaluation	Being Implemented	Limited	Not Applicable	None to Modest, Depending on Customer Interest	
10608.48.c (11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	The activities of the Water Conservation Coordinator and other SSJID staff to achieve WUE improvements through implementation of the EWMPs are described individually by EWMP.			
10608.48.c (12)	Provide for the availability of water management services to water users.	Being Implemented	Substantial (Limited Reduction in Irrecoverable Losses)	Not Applicable	Substantial (Limited Reduction in Irrecoverable Losses)	Substantial (Limited Reduction in Irrecoverable Losses)
10608.48.c (13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented	Substantial	Not Applicable	None to Modest, Depending on Outcomes	
10608.48.c (14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented	Substantial	Not Applicable	Limited	Limited

1. As noted herein and throughout this analysis, reductions in losses that result in WUE improvements at the farm or district scale do not result in WUE improvements at the basin scale, except in the case of evaporation reduction. All losses to seepage, spillage, tailwater, and deep percolation are recoverable within SSJID or by downgradient water users within the basin.

2. In most cases, quantitative estimates of improvements are not available. Rather, qualitative estimates are provided as follows, in increasing relative magnitude: None, Limited, Modest, and Substantial.

3. WUE Improvements occurring in recent years relative to if they were not being implemented.

4. SSJID has not previously prepared an AWMP.

5. WUE Improvements expected in 2017 (five years in the future) and 2022 (ten years in the future), relative to level of implementation in recent years.

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9. SUPPLEMENTAL INFORMATION

The following attachments are included as part of this AWMP:

- Attachment A: Customer Delivery Measurement Compliance Documentation
- Attachment B: Rules and Regulations Governing the Distribution of Water in the South San Joaquin Irrigation District
- Attachment C: On-Farm Water Conservation Program Description, 2012
- Attachment D: Evaluation of 2011 On-Farm Water Conservation Program

Attachment A

Agricultural Water Measurement Corrective Action Plan
According to Requirements of the
California Code of Regulations
Title 23. Waters
Division 2. Department of Water Resources
Chapter 5.1. Water Conservation Act of 2009
Article 2. Agricultural Water Management

INTRODUCTION

The South San Joaquin Irrigation District (SSJID or District) recognizes the need for uniform standards and procedures for measuring and recording field water deliveries in order to: (1) provide cost-effective service to customers and (2) generate improved operational records for planning and analysis. Regulations requiring specified levels of delivery measurement accuracy were incorporated into the California Code of Regulations Title 23 Division 2 Chapter 5.1 Article 2 Section 597 (CCR 23 §597) in July 2012. Field investigations conducted over the last two years indicate that SSJID's existing measurement devices and methods are generally adequate for the aforementioned purposes, but that existing measurement devices at delivery points[14] (hereafter referred to as turnouts) are generally not capable of satisfying the new accuracy standards required by CCR 23 §597.

This document describes SSJID's plan to implement corrective actions over the next three years to comply with CCR 23 §597 by December 31, 2015, to the extent it is feasible to do so[15]. As implementation of the plan proceeds, SSJID will continually assess progress and adapt the plan as necessary to ensure that the corrective actions implemented will achieve timely compliance with the accuracy standards.

APPLICABILITY (CCR 23 §597.1)

Briefly summarized, CCR 23 §597 requires that on or before July 31, 2012 agricultural water suppliers that provide water to 25,000 irrigated acres or more measure the volume of water delivered to customers. Existing measurement devices must be certified to be accurate to within

[14] The "delivery point" is defined in CCR 23 §597 as "…the location at which the agricultural water supplier transfers control of delivered water to a customer or group of customers…." (CCR 23 §597.2(a)(6))
[15] See, for example, the section entitled "Multiple Valves."

±12 percent by volume (CCR 23 §597.3(a)(1)). New or replacement measurement devices must be certified to be accurate to within ±5 percent by volume in the laboratory if using a laboratory certification or ±10 percent by volume in the field if using a non-laboratory certification (CCR 23 §597.3(a)(2)). The regulation includes specific requirements for certifying and documenting accuracy for existing and new devices (CCR 23 §597.4). Additionally, the District is required to report certain information in its 2012 and subsequent Agricultural Water Management Plans (AWMP) (CCR 23 §597.4(e)). If existing measurement devices are not sufficiently accurate, the District must include in its 2012 AWMP a plan to for taking corrective action by December 31, 2015 to achieve compliance (CCR 23 §597.4(e)(4)). SSJID serves more than 25,000 acres and is therefore subject to these regulations.

EXISTING MEASUREMENT FACILITIES AND PRACTICES

In 2011, under its Pilot Delivery Measurement Assessment Program (Program), SSJID initiated a preliminary assessment of field turnouts with respect to their ability to achieve the then pending measurement accuracy standards. . The Program inventoried SSJID turnout infrastructure and assessed existing measurement practices through:

1. Field accompaniment and interviews with Division Managers (DMs), who manage water deliveries, and
2. Data collection at selected turnouts and locations in the conveyance system.

Understanding District conveyance systems and operational practices are critical to understanding existing measurement practices. The SSJID conveyance system consists of an unlined, open main canal serving 350 miles of laterals, of which 38 miles are open lined canals and 312 miles are cast in place concrete pipelines. Water deliveries to parcels typically occur on a rotational schedule with one delivery point taking the full flow of water (or "head") delivered at a given time. The standard basin-check flood head is 25 cubic feet per second (cfs). DMs manage the rotational delivery of water on each lateral in their division by scheduling deliveries and opening and closing water control gates according to the schedule. The full "head" of water (typically 25 cfs) is delivered to a single owner at 77 percent of the delivery points. When more than one owner is served by a delivery point, the full "head" is either split between the owners or passed (rotated) directly from one owner to the next without involving the DM. The delivery duration varies according to parcel size and other factors. SSJID laterals are generally sized to convey one head, although laterals serving large areas may be sized to convey two or even three "heads" to avoid excessive rotation intervals. Typically, multi-head laterals are segmented into reaches where one head is rotated among fields, with the upper lateral reaches passing one or two heads to lower reaches while rotating a head among fields within the reach.

District turnouts were grouped into three main types based on unique physical configurations pertaining to delivery volume measurement:

1. Pumps (Figure A-1) account for 282 (20 percent) of deliveries
2. Multiple valves (Figure A-2) account for 586 (42 percent) of deliveries
3. Orifice gates (Figure A-3) account for 524 (38 percent) of deliveries

A typical pipeline lateral includes all three types of turnouts interspersed along the lateral (Figure A-4) while a typical open canal lateral includes only orifice gates and pumps .

Figure A-1. Pump turnout on a District pipeline.

Figure A-2. Multiple valve turnout on a District pipeline.

Figure A-3. Orifice gate turnout in a concrete box on a District pipeline.

Flows into the laterals are controlled by maintaining pre-determined levels in the main canal at the location of the lateral head gate and setting the head gate opening to obtain the required flow. On laterals that convey only single heads, SSJID regards the lateral heading as the customer delivery point because the full flow is delivered to just one field at a time (Figure A-4). On laterals that convey multiple heads, the lateral headgates are operated as described above and additional measurement devices are placed between single head lateral reaches so that heads being passed through upper reaches to lower reaches can be measured. On such multiple head laterals, the downstream-most measurement device measures the flow to the lowest single head reach.

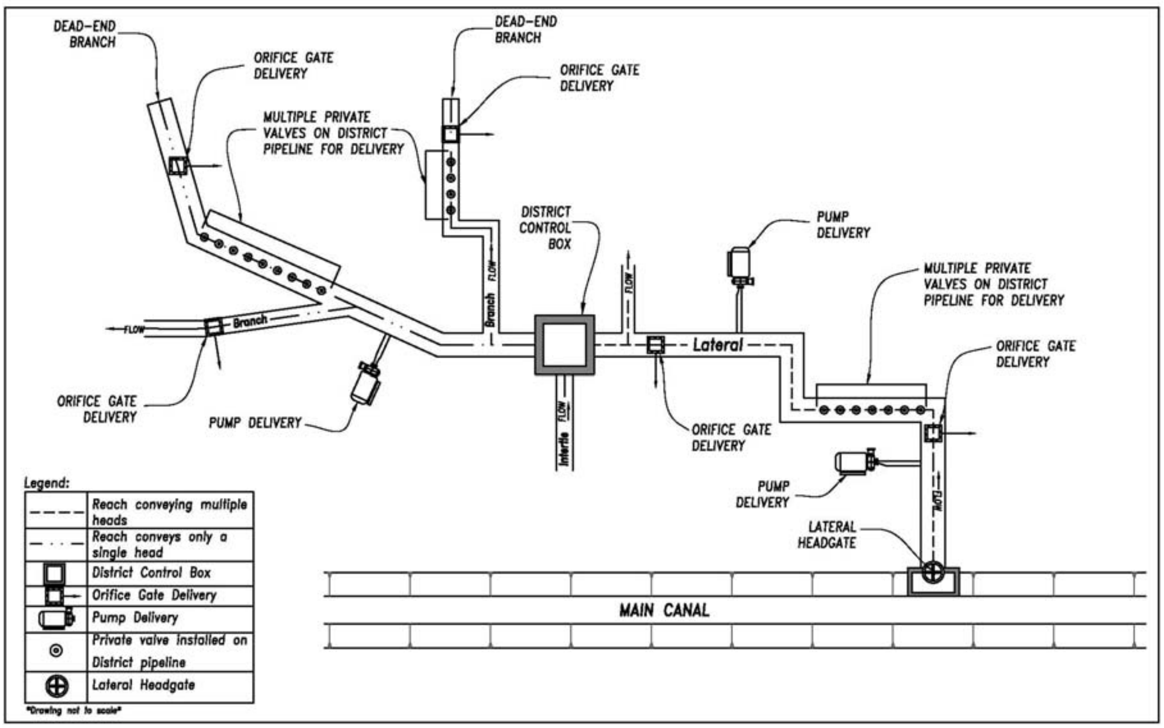

Figure A-4. Typical laterals conveying multiple and single heads with pump, multiple valve, and orifice gate turnouts.

EVALUATION OF DELIVERY MEASUREMENT DEVICES AND PRACTICES

Prior to the initial certification process (CCR 23 §597.4a), the District evaluated the applicability of three measurement devices at each of the three types of turnouts that exist in the District: pump, multiple valve, and orifice gate turnouts (Table A-1).

Table A-1. Applicability of Selected Measurement Devices at Different Types of Turnouts

Measurement Device	Turnout Type		
	Multiple Valve	Orifice Gate	Pump
Orifice Gate	Use existing orifice gate in center wall of District control box upstream and downstream of multiple valve delivery, or at spill in case of single head lateral that has a spill site.	Use existing farm delivery orifice gate. Requires continuous measurement of gate opening and upstream and downstream water levels. Downstream water level access tubes do not exist on all turnouts.	Not applicable in most situations observed.
Acoustic Doppler Meter	Install new acoustic Doppler meters in District pipelines at control boxes upstream and downstream of pipeline reaches from which just one delivery is made at a time, or at spill in case of single head lateral that has a spill site.	Install new acoustic Doppler meters in District pipelines at control boxes upstream and downstream of pipeline reaches from which just one delivery is made at a time, or at spill in case of single head lateral that has a spill site.	Not applicable in most situations observed.
Magnetic Meter	Not applicable.	Not applicable.	Install new permanent magnetic meter on existing pump discharge piping. May be possible to rate some pump deliveries with portable flow meter.

PUMPS

Magnetic flow meters (Figure A-5) have been installed at 54 turnouts serving about 2,400 acres in the District's Division 9 pilot project area[16]. The magnetic flow meters are laboratory certified to measure flows with ± 0.4 percent accuracy (Attachment A-1), exceeding the ±5 percent accuracy requirement for laboratory certified measurements (CCR 23 §597). In addition, through the District's ongoing on-farm conservation program and the pilot delivery measurement program, magnetic meters have been installed on 51 pump turnouts serving a combined 2,200 acres at various locations.

Pending installation of magnetic flow meters over the next three years, as specified in this corrective action plan, the remaining pump delivery volumes are determined by estimating pump flows based on the pump size and flow rate required by the irrigation system supplied with water. A small sample of measurements using magnetic flow meters and transit time strap on flow meters indicated that these estimated flows rarely meet the required 12% accuracy for existing devices. The District has elected to install magnetic flow meters at these pumps because they provide high measurement accuracy (better than 1% accuracy laboratory certified by the manufacturer) with minimal straight pipe length requirements[17], have minimal ongoing maintenance requirements and have been installed in both the Division 9 pilot project area and in the District On-Farm Conservation Program.

[16] The pilot project is to evaluate the feasibility of providing pressurized water delivery in areas of the District dominated by drip and micro-sprinkler application systems.
[17] Irrigation Training and Research Center. 2007. SeaMetrics Ag2000 Irrigation Magmeter Test Results and Summary. Technical Memorandum. Rev. 22 Novemeber 2007. California Polytechnic State University, San Luis Obispo, CA.

Figure A-5. Magnetic flow meter on delivery at Ra81.

MULTIPLE VALVES

No practical measurement device exists that can directly measure flow or volume through the multiple valve turnouts on District pipelines within the accuracy range required by the regulation[18]. However, two alternatives exist to measure the combined flow through all valves. For water delivered through multiple valve turnouts on a single head, dead end pipeline, measurement can be made at a single upstream point using either the orifice gate in the center wall of the District control boxes or an acoustic Doppler meter in the pipeline. System losses between the measurement point and delivery point are included in the measurement. Alternatively, for water delivered through multiple valve turnouts on multiple head reaches where one or more head is being passed through to a reach downstream, a volume differential[19] measurement approach is necessary to account for the water conveyed downstream of the multiple valve turnout. In this case also, any system losses between the measurement points are included in the measurement.

The existing orifice gates in the center wall of the District control boxes are typically operated either fully open (when passing water through) or fully closed (when water is being delivered at or just upstream of the control box) to keep the pressure on the pipelines below the pipeline

[18] Burt, C. and E Greer. 2012. SBx7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts. ITRC Report No. R 12-002. Irrigation Training & Research Center (ITRC). California Polytechnic State University. San Luis Obispo, CA.

[19] "Volume differential," as used throughout this report, refers to the method of determining the volume delivered as the difference between measured volumes upstream and downstream of the delivery point. The volume differential measurement method is a key component of the recommended SSJID delivery measurement plan due to the presence of multiple on-farm irrigation valves being installed on District conveyance pipelines.

design pressure. The fully open position often does not allow for measurement due to the absence of, or an extremely small, head drop across the gate. Thus, the acoustic Doppler meter in the pipeline is the selected device for measurement at the point of delivery.

ORIFICE GATES

The existing orifice gate turnouts are fully opened so the full head is delivered to minimize pressure on pipelines. This operating practice, common among Districts practicing a rotational delivery system and necessary to prevent damage to conveyance pipelines, results in "small differentials in water levels" (less than 0.1 feet). Data collected for the delivery Q606 (on lateral Q at station 606), illustrates the gate opening (labeled as "goodstem_in") and water level difference across the gate (labeled as "head_ft") that occur during normal operation (Figure A-6). This sample data demonstrates the typical operating practice of operating the orifice gate to be either fully open or fully closed, and, when fully open, the extremely small water level difference (0.1 foot) across the gate is evident. These conditions are not conducive to flow measurement because even small inaccuracies in water level measurement can lead to large inaccuracies in calculated head differential and, ultimately, flow rates and volumes. Thus, these orifice gate turnouts cannot be used to measure deliveries "due to small differentials in water levels" (**CCR 23 §597.3b1B**).

These orifice gate turnouts are interspersed among the pump and multiple valve turnouts on the laterals. An alternative is to measure at a single upstream point using an acoustic Doppler meter in the pipeline or canal as described previously for a multiple valve turnouts. As for the multiple valve turnouts, there are the two cases one for turnouts on a single head pipeline and a second case for turnouts on a multiple head pipeline, or canal. As with the multiple valve turnouts, the second case requires a volume differential measurement.

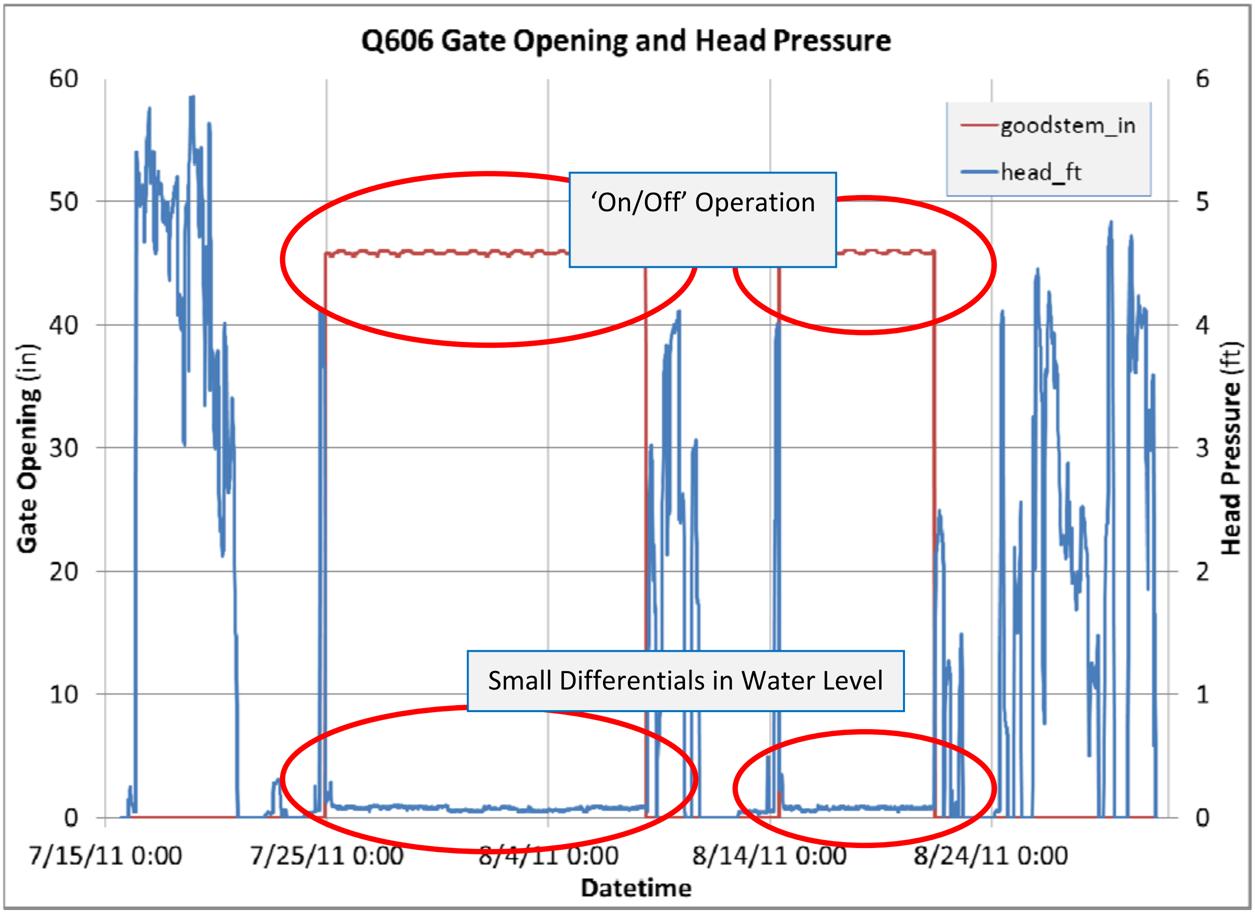

Figure A-6. Orifice gate water level differential measurements.

Three measurement devices were evaluated by the Program with respect to the three main turnout types at the District for improving delivery measurement accuracy to comply with **CCR 23 §597** (Table A-2). Figure A-7 shows a typical lateral with a reach conveying multiple heads and a reach conveying a single head segmented into measurement reaches with typical instrumentation.

Table A-2. South San Joaquin Irrigation District Farm Delivery Measurement Options by Delivery Type.

Measurement Device	Turnout Type		
	Multiple Valve	Orifice Gate	Pump
Orifice Gate	**NOT SELECTED.** Multiple valves cannot be measured directly and existing orifice gates (both in center wall of control boxes and to farms) cannot meet CWC § 597 accuracy requirements due to small level differentials. Additionally, numerous challenges involved with installing and maintaining necessary monitoring instruments make this option impractical.		Not applicable in most situations observed.
Acoustic Doppler Meters	**SELECTED.** Acoustic doppler meters meet CWC § 597 accuracy requirements. Install a network of these meters in District pipelines at strategically selected control boxes that isolate single farm deliveries under most operating conditions. Some deliveries would be measured directly (where only one delivery is made downstream); others indirectly (by differential measurement in cases where additional deliveries are being made downstream). Meter data will be combined with Division Manager records of delivery start and end times to calculate volumetric water deliveries to individual fields.		Not applicable in most situations observed.
Magnetic Meter	Not applicable.	Not applicable.	**SELECTED.** Only option that meets CWC § 597 accuracy requirements and is adaptable to existing on-farm pumps and piping installations.

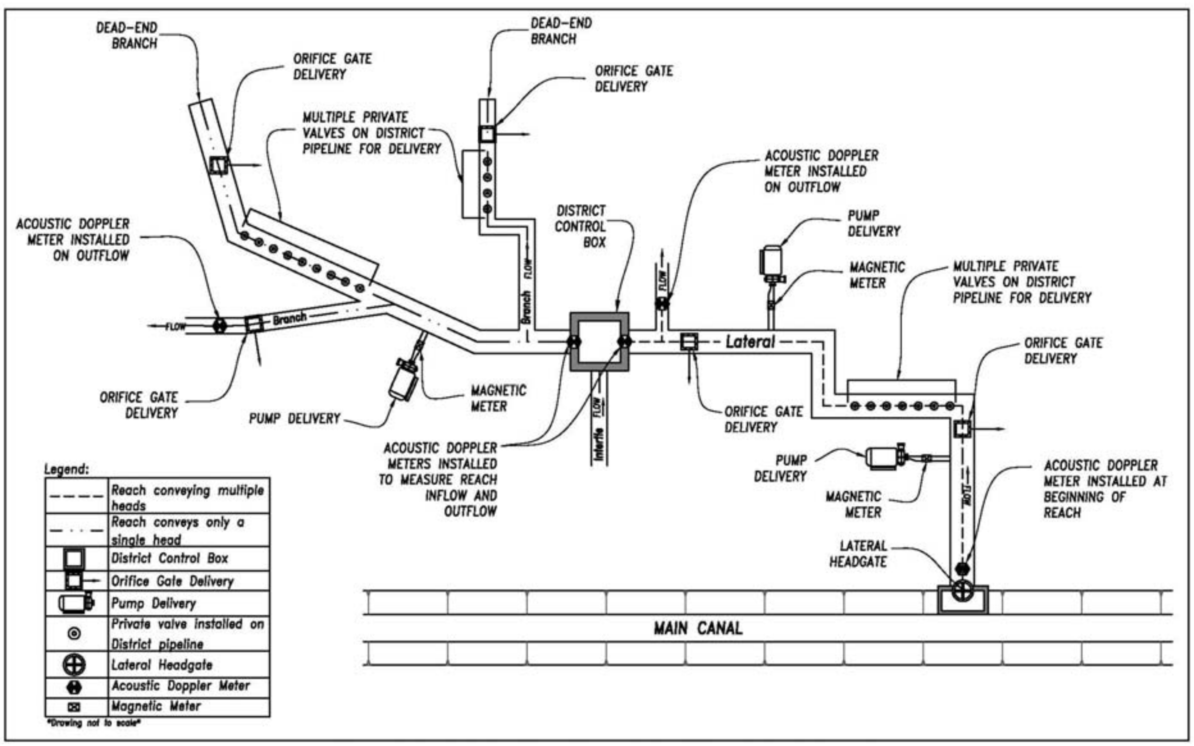

Figure A-7. Typical laterals conveying multiple and single heads with pump, multiple valve, and orifice gate turnouts and flow measurement network delivery measurement devices.

DELIVERY MEASUREMENT CORRECTIVE ACTION PLAN (CCR 23 §597.4(E)(4))

CORRECTIVE ACTION

Based on the results of the Program described in the preceding section, a corrective action plan has been formulated that relies predominantly on "volume differential measurement." This term, as used throughout this report, refers to the method of determining the volume of water delivered to customers as the difference between measured volumes upstream and downstream of customer delivery points (turnouts). A key factor necessitating volume differential measurement is the presence of multiple on-farm irrigation valves installed on District conveyance pipelines, as previously described.

The SSJID conveyance system was segmented into 52 delivery measurement reaches for volume differential measurement (Figure A-8). The reaches are whole laterals or portions of laterals where one head is typically rotated among the customers within the reach. On average, each measurement reach contains 18 flood turnouts (multiple valves or orifice gates), ranging from as few as two turnouts to as many as 53 (Table A-3). The reaches each serve an average of 37 parcels, ranging from five to 90 parcels per reach District-wide. In most cases, when multiple parcels are provided water through a single delivery point, the parcels have a single owner. The average reach has six pump turnouts. Six reaches have no pump turnouts, nine have more than 10 pump turnouts with one reach having 32 pump turnouts. As discussed previously, a magnetic flow meter will measure the flow and volume at each pump delivery. The average reach provides water deliveries to 753 acres using flood irrigation. The measurement reach with the smallest area of flood turnouts serves 75 acres while the largest serves an area of 2,134 acres.

The key practical consideration in the development of these delivery measurement reaches was to minimize the time that more than a one delivery, or head, was historically delivered in the reach. Thus, the operational changes required of the Division Managers to delivery only a single head from each measurement reach were minimized. Based on the 2011 irrigation season, more than one flood delivery was occurring during two percent of the time (Table A-3), or 4.5 out of 227 days. The maximum time more than one flood delivery was occurring was seven percent, or 15.9 out of 227 days. In 17 of the reaches, only one flood delivery was ever occurring at a given time.

SCHEDULE

CCR 23 §597.4(e)(4) requires an agricultural water supplier with existing water measurement devices out of compliance with **CCR 23 §597.3** to submit a schedule for taking corrective action in three years or less (i.e. prior to December 31, 2015). The delivery measurement plan consists of the following delivery measurement improvement tasks:

1. Install acoustic Doppler sensors at specified measurement locations.
2. Install magnetic flow meters at pump deliveries.
3. Include newly instrumented measurement reach in delivery volume calculation database.

SSJID has developed a three-year schedule to complete the three tasks necessary to complete the required corrective action (Figure A-9). SSJID plans to install all devices during the winter season when the system is de-watered. Device installation shall be scheduled so that all required instrumentation is installed to complete entire divisions.

Additionally, the District will consider adopting a policy prohibiting the installation of multiple valves serving a single parcel on all newly installed District pipelines and sections of pipelines. Instead, delivery structures must be installed that would permit measurement in compliance with applicable requirements.

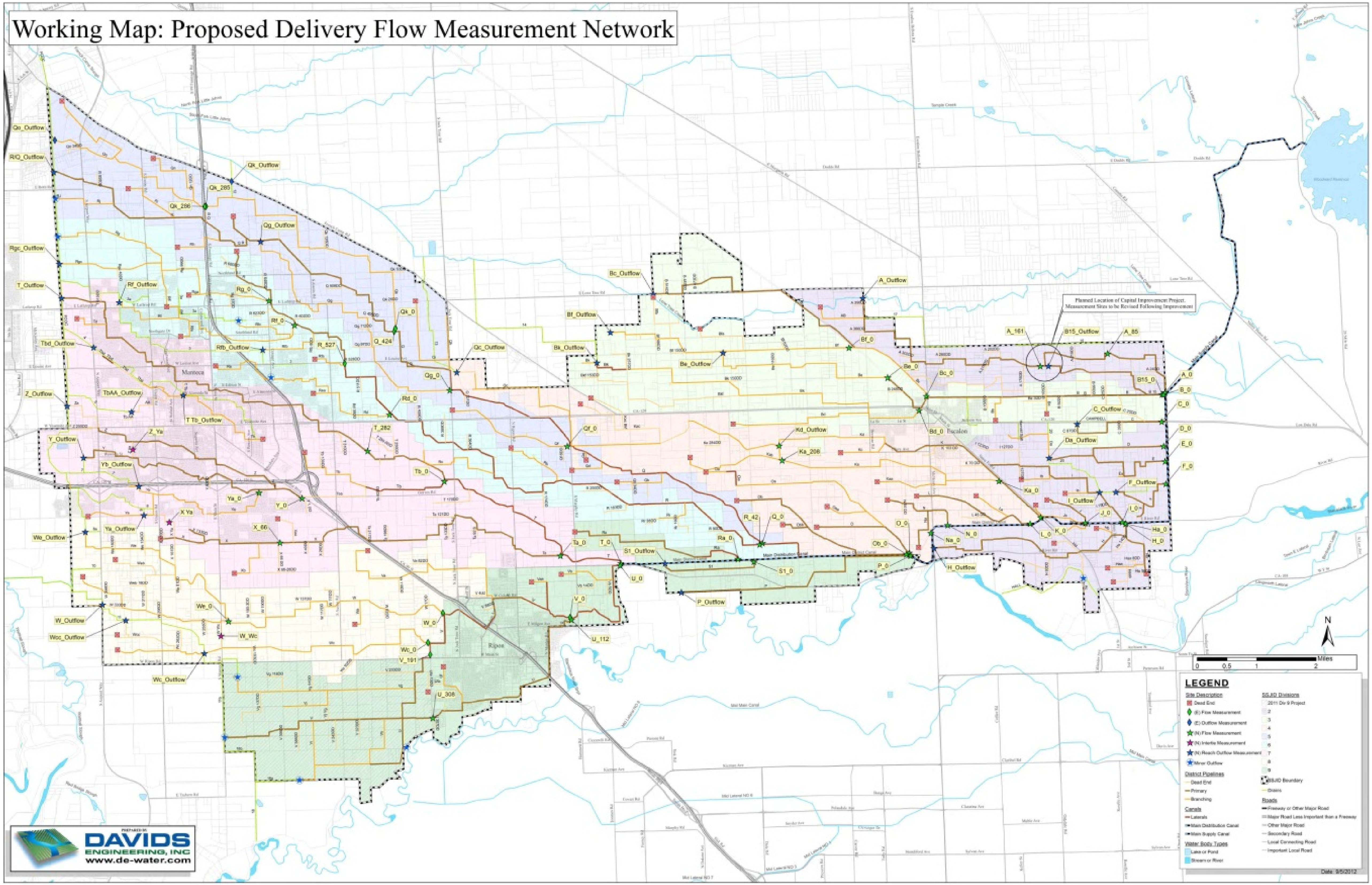

Figure A-8. SSJID delivery flow measurement network.

Table A-3. Summary of number of flood delivery turnouts, area and related information for delivery flow measurement reaches.

Summary Statistics	No. of Fields	No. of Flood Delivery Turnouts	Fields/Turnout	Number of flood turnouts serving multiple owners	Irrigated Area per Turnout, Acres	No. Pump Delivery Turnouts	Total Area Served by Flood Irrigation, acres	Total Time Between First and Last Irrigations in Reach, days	Total time flood deliveries were on, days	% of irrig season flood deliveries were on[1]	Total time more than one flood delivery was on, days	% of irrig season with more than one flood delivery on[1]	Total Flood Deliv Vol, AF
Min	5	2	1.0	0	15	0	75	162	5	2%	0	0%	145
Max	90	53	6.5	17	164	32	2134	227	113	50%	16	7%	5984
Mean	37	18	2.4	4	48	6	735	202	44	19%	5	2%	1861
Total	1936	939		215		293	38212						96747

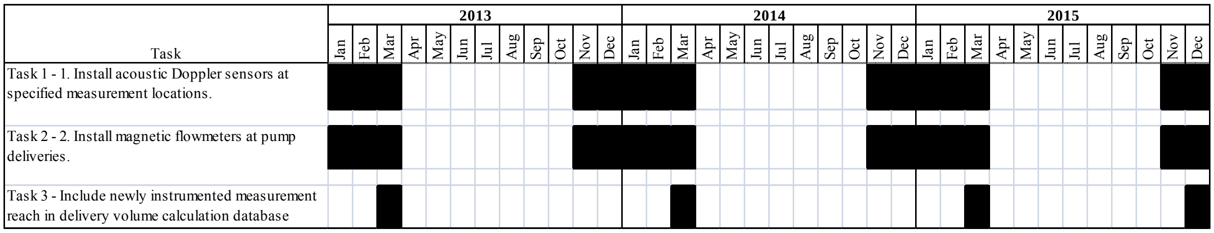

Figure A-9. Schedule for completing delivery measurement corrective action.

BUDGET

The total three year budget for delivery measurement corrective action plan to install SCADA-ready acoustic Doppler sites and SCADA-ready magnetic flow meters is $4.82 million dollars. The number of delivery points measured, planned acoustic Doppler measurement sites, and magnetic flow meters required together with the total estimated cost by division is provided in Table A-4. SSJID plans to complete Division 5 in 2013 as a final test of installation plans and procedures. The six divisions will be completed in 2014 and 2015. Current plans are to complete three divisions in 2014 and 2015, but these plans could be revised depending on the experience installing the delivery measurement network in Division 5 in 2013.

Table A-4. Estimated budget for delivery measurement corrective action plan.[1]

Estimated Year for Completion	Division	Delivery Points ("laterals")	Pump Deliveries	Area Flood Irrigated, Acres	Total Estimated Doppler Measurement Sites	Potential On-Farm Mag Meters	Existing Doppler Measurement Sites to be Retained	Existing SCADA Sites to be Retained	Total
2015	2	133	33	5355	15	33	0	0	$ 644,989
2015	3	168	44	5737	13	44	0	0	$ 732,841
2015	4	80	41	4126	9	41	0	1	$ 621,683
2013	5	173	37	6486	12	37	6	1	$ 552,519
2014	6	124	39	4968	8	39	1	1	$ 567,859
2014	7	144	46	5323	17	46	0	0	$ 828,073
2014	8	67	25	3539	8	25	2	0	$ 401,366
2014	9	50	28	2678	10	28	1	3	$ 470,291
	Totals=	939	293	38212	92	293	10	6	$4,820,000
	Min=	50	25	2678	8	25	0	0	$ 401,366
	Average=	117	37	4776	12	37	1	1	$ 602,452
	Max=	173	46	6486	17	46	6	3	$ 828,073

[1]Division 9 does not include the 3,100 acres included in the Division 9 pressurized system.

FINANCE PLAN

In July 2012, SSJID adopted a water pricing structure partially based on the quantity of water delivered as required by the California Water Code Section 10608.48. SSJID Resolution No. 12-12-B, Adopting Volumetric Charge states as one of the reasons the proposed volumetric charge is necessary:

> *"…additional costs will be incurred to operate and maintain the necessary new flow measurement facilities and to bill customers for the amount of water delivered, in order to comply with the new volumetric measurement and billing requirements."*

With funds at least partially provided by the new volumetric water charge, SSJID plans to include a budget line item in the 2013, 2014 and 2015 budgets to provide funds for the delivery measurement corrective action plan.

ATTACHMENT A-1

Flow Measurement
SITRANS F M

MAG 8000 for abstraction and distribution network applications (7ME6810)

4

Overview

Benefits

- Bury meters, IP 68
- Low cost of ownership
- Long-term stability
- Leak detection
- Low flow measurement

Technical specifications

Meter	
Accuracy	Standard calibration: ± 0.4% of rate ± 2 mm/s Extended calibration DN 50 ... DN 300 (2" ... 12"): ± 0.2 % of rate ± 2 mm/s
Media conductivity	Clean water > 20 µs/cm
Temperature	
Ambient	-20 ... +60 °C (-4 ... +140 °F)
Media	0 ... +70 °C (32 ... +158 °F)
Storage	-40 ... +70 °C (-22 ... +158 °F)
Enclosure rating	IP68/NEMA 6P; Cable glands mounted requires Sylgard potting kit to remain IP68/NEMA 6P, otherwise IP67/NEMA 4 is obtained; Factory-mounted cable provides IP68/NEMA 6P
Drinking water approvals	• NSF/ANSI Standard 61 (cold water) USA • WRAS (BS 6920 cold water) UK • ACS Listed France • DVGW W270 Germany • Belgaqua (B) • MCERTS (GB)
Custody transfer approval	• OIML R 49 approval
Conformity	• PED: 97/23EC • EMC: IEC/EN 61000-6-3, IEC/EN 61000-6-2
Sensor version	DN 25 ... 1200 (1" ... 48")

Measuring principle	Electromagnetic induction
Excitation frequency	
Basic version	
• Battery-powered	DN 25 ... 150 (1" ... 6"): 1/15 Hz DN 200 ... 600 (8" ... 24"): 1/30 Hz DN 700 ... 1200 (28" ... 48"): 1/60 Hz
• Mains-powered	DN 25 ... 150 (1" ... 6"): 6.25 Hz DN 200 ... 600 (8" ... 24"): 3.125 Hz DN 700 ... 1200 (28" ... 48"): 1.5625 Hz
Advanced version	
• Battery-powered	DN 25 ... 150 (1" ... 6"): 1/15 Hz (adjustable up to 6.25 Hz; reduced battery lifetime) DN 200 ... 600 (8" ... 24"): 1/30 Hz (adjustable up to 3.125 Hz; reduced battery lifetime) DN 700 ... 1200 (28" ... 48"): 1/60 Hz (adjustable up to 1.5625 Hz; reduced battery lifetime)
• Mains-powered	DN 25 ... 150 (1" ... 6"): 6.25 Hz DN 200 ... 600 (8" ... 24"): 3.125 Hz DN 700 ... 1200 (28" ... 48"): 1.5625 Hz
Flanges	
EN 1092-1 (DIN 2501)	DN 25 and DN 40 (1" and 1½"): PN 40 (580 psi) DN 50 ... 150 (2" ... 6"): PN 16 (232 psi) DN 200 ... 1200 (8" ... 48"): PN 10 or PN 16 (145 psi or 232 psi)
ANSI 16.5 Class 150 lb	1" ... 24": 20 bar (290 psi)
AWWA C-207	28" ... 48": PN 10 (145 psi)
AS 4087	DN 50 ... 1200 (2" ... 48"): PN 16 (232 psi)
Liner	EPDM
Electrode and grounding electrodes	Hastelloy C276
Grounding straps	Grounding straps are premounted from the factory on each side of the sensor.

ATTACHMENT B: RULES AND REGULATIONS GOVERNING THE DISTRIBUTION OF WATER IN SSJID

RULES AND REGULATIONS

Governing the Distribution of Water in the South San Joaquin Irrigation District

Adopted April 13, 1915
Amended May 20, 1919

TO THE TAXPAYERS AND WATER USERS OF THE SOUTH SAN JOAQUIN IRRIGATION DISTRICT

These Rules and Regulations have been adopted under the authority of the Irrigation Act (Section 15) and have been passed by three successive readings and by being published and have now become a part of the law governing this District, with all the force of county or municipal ordinances.

It is the desire and intention to carry on the business of the District in a businesslike and economical manner and to distribute the water equitably, and, as near as may be, satisfactory to all water users. No two individuals have exactly the same requirements and while these individual requirements will be met as far as possible, yet there must be general rules and general practices to secure the greatest good to the greatest number.

It is expected that it will be found necessary to modify these rules from time to time to meet the changing conditions in the District, and the Board of Directors will always have an open mind for suggestions for modifications from water users. It is also understood that employees of the District may use a certain amount of judgment and discretion in enforcing the rules when an avoidable injury to any water user may thereby be prevented without doing an injustice to other water users.

Employees must be courteous and considerate in their dealings with the public and must understand that it is their duty to serve as effectively as possible the interests of water users and taxpayers, who in turn, are requested to extend the same courteous consideration to employees that employees will be required to show to them.

Every person in the District should feel a personal responsibility in helping to keep down expenses. This can be done by avoiding doing any damage to canals and structures, by stopping small leaks, reporting weak places and breaks and by NOT taking out or putting in flash boards or raising or lowering gates except under direct supervision of a ditch-tender and by following his directions carefully when so doing, and also by not turning the water loose at night or at other times after promising the ditch tender to keep it.

1

The office of the District and its records are public. All records are open to the inspection and examination of any taxpayer upon request and without assigning a reason for the request. All officials and employees will cheerfully furnish any information or answer any questions asked concerning the affairs of the District. Taxpayers are requested to avail themselves of this source of information.

This booklet is available for free distribution.

BOARD OF DIRECTORS

Reprint including amendments by order of the Board of Directors.
Dated May 20, 1919

Reprinted by order of the Board of Directors.
Dated October 28, 1986

RULES AND REGULATIONS

Governing the Distribution of Water in the South San Joaquin Irrigation District.

No. 1 - Control of System:

The canals and works of the District and all takeouts, checks, pipelines, pumps and other structures and devices placed in District canals, laterals, and ditches are under the exclusive control and management of the Superintendent, appointed by the Board of Directors, and no other person, except his employees and assistants, shall have any right to interfere with said canals and works in any manner.

No. 2 - Employees:

The Superintendent shall employ, under authority and subject to confirmation by the Board of Directors, such ditchtenders and other assistants as may be necessary for the proper operation of the system and distribution of the water. Each ditchtender shall have charge of his respective section and shall be responsible to the Superintendent. From the ditchtender's decision an appeal may be made to the Superintendent. From the action of the Superintendent, appeal may be made to the Board of Directors.

No. 3 - Apportionment of Water:

The water will be apportioned to each distributing section by the Superintendent, and in cases of controversy or shortage in water the apportionment shall be made upon the basis of the acreage irrigated from each section.

No. 4 - Rotation of Water:

The water will be furnished in rotation to each irrigator except by agreement between adjoining owners satisfactory to the Superintendent. The method of distributing water in any section shall be under the discretion of the Superintendent, except that if the Superintendent begin at either upper or lower end he must continue the routine as started.

No. 5 - Time Limit:

Each irrigator, with a head of 15 second feet of water will be allowed not to exceed thirty minutes to irrigate an acre of land requiring flooding; and with a larger or smaller head of water, will be required to irrigate more or less land in proportion to the amount of water furnished. But for gardens, trees and vines water will be furnished on request whenever available and will be kept available continuously as far as possible. The time will start when the diverting gate in the District canal is opened, and water must be used night and day continuously until the time limit expires. The head of water or time limit for gardens, trees and vines will not be fixed unless required in time of shortage.

No. 6 - Continuous Use of Water:

Before water is turned into a private individual or party ditch the same shall be in condition satisfactory to the Superintendent, and the water shall be used continuously day and night, and all land upon which water is not used loses its right to water until the next regular irrigation for that ditch.

Properly checked land to be flooded on regular time limit. On unimproved land water may be used up to July 1st for furrow irrigation, providing flooding is not attempted to such an extent as to become a waste of water; waste of water in this instance shall immediately accrue when water commences to collect in low swales, runs upon roads or adjacent lands. A time limit of thirty minutes per acre shall be placed on each acre with a fifteen second foot head of water or a limit of one and one-half hours per acre for five second feet, and if applicant is not in position to handle five second feet of water a time of one and one-half hours to the acre shall be charged against stream of water that applicant is able to handle in the same manner as though he was in a position to receive and handle five second feet.

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No. 7 - Notice of Delivery:

Each irrigator will be notified at least 12 hours before water will be delivered to him and further notified of any change in time of delivery, and the irrigator who fails to use his allotment of water during an irrigation will not be entitled to any more water at any future irrigation than if he had used his full share at the time of allotment.

No. 8 - Control of Diverting Gates:

The District's employees alone will be allowed to open the diverting gates or pipelines, and they have full authority to close same as soon as the requisite amount of water for each irrigator has been discharged. When water user requests, or it is evident to District's employee that an extension of time is necessary to adequately irrigate a piece of land that is in all respects properly prepared, same shall be granted; provided, said extension does not materially interfere with schedule of other irrigators on same ditch or lateral, in which case said employee shall forthwith report to the Superintendent, and in case of his absence then to one of his assistants, who shall give final instructions for that particular irrigation.

No. 9 - Using Water Out of Turn:

Any person who uses the water out of his turn and without the permission of his ditchtender forfeits his right to water at the next regular irrigation and is also subject to criminal prosecution.

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No. 10 - Waste of Water:

Persons wasting water on roads or vacant land, or land previously irrigated, either willfully, carelessly, or on account of defective ditches or inadequately prepared land, or who shall flood certain portions of the land to an unreasonable depth or amount in order to properly irrigate other portions, will be refused the use of water until such conditions are remedied.

No. 11 - Access to Land:

The authorized agents of the District shall have free access at all times to lands irrigated from the canal system for the purpose of examining the canals and ditches and the flow of water therein.

No. 12 - In Case of Breaks:

When a break or succession of breaks occur under any distributing section, the person to whom the water is last given while the break is being repaired, will be allowed to finish before the water is taken from him, and shall not claim another irrigation for that run. When the breaks are repaired the water will be returned to its original rotation as nearly as possible.

No. 13 - Diverting Gates and Checks:

All diverting gates, pipe lines, and checks are under the control of the District. All pipe takeouts from District canals are subject to exclusive control by the District employees and District padlocks to lock such takeout gates must be installed at the expense of the irrigator.

No. 14 - Acreage of Crops:

Between January 1st and June 1st of each year the Superintendent will obtain from each user of water a signed statement of the kinds of crops and numbers of acres of each which he intends to irrigate. Such other information as may be desirable may be obtained on the same forms.

No. 15 - Use of Right of Way:

Trees, vines and alfalfa must not be planted on the banks of the District canals. Trees and vines interfere with repairs and cleaning, and alfalfa brings gophers into the banks. Permission will be granted to raise cultivated crops on the banks whenever it can be done without injuring the canals or interfering with the distribution of water.

No. 16 - Paralleling of District Ditches:

Where private service ditches are constructed closely paralleling District ditches, a full and complete bank must be constructed adjacent to and in addition to the bank of the District ditch so paralleled.

No. 17 - Liability of Irrigators:

Every consumer of water shall be responsible to the District for all damages caused by his willful neglect or careless acts, and upon his failure to repair such damage after notification by the ditchtender, such repairs shall be made at his expense by the District.

No. 18 - Unlawful Acts:

Attention is called to the fact that any person draining water upon or permitting water to drain upon a public highway is liable to fine and damages. Any interference with the canals or structures under the control of the District is a penal offense.

No. 19 - Building Diverting Gates and Structures:

No openings shall be made or structures placed in any District canal until an application in writing has been made to the Board and permission granted therefore, and without the special permission of the Superintendent. All structures in District canals must be constructed according to requirements of the District and must be maintained in a condition satisfactory to the Superintendent, and must not be changed without the permission of the Superintendent.

No. 20 - Obstructions in Right of Way:

No fences or other obstructions shall be placed across or upon or along any canal bank or right of way of any canal or ditch belonging to the District without the special permission of the Board of Directors. Whenever such special permission shall be granted it shall always be with the distinct understanding that proper openings or passage ways for teams shall be provided, and that such fence or obstruction must be removed whenever requested by the Superintendent.

No. 21 - Preparation of Land for Irrigation:

All parties wishing to prepare land for irrigation may obtain data covering elevations of available water service, proper point on lateral from which to obtain service, and elevation of land which may be watered without endangering the canals, from the engineering department of the District. Before new land may receive water service, same must be inspected by the engineering department, which shall judge as to the feasibility of serving such land. - Amended January 10, 1922.

No. 22 - Enforcement of Rules:

Refusal to comply with the requirements hereof, or transgression of any of the foregoing rules and regulations, or any interference with the discharge of the duties of any official, shall be sufficient cause for shutting off the water, and water will not again be furnished until full compliance has been made with all requirements herein set forth.

No. 23 - Abatement of Nuisance:

No rubbish, swill, garbage, manure or refuse, or dead animal, or animal matter from any barnyard, stable, dairy or hog pen shall be placed in or allowed to be emptied into any ditch or canal of The South San Joaquin Irrigation District, and the Superintendent and ditchtenders of said District are hereby instructed to see that this rule is strictly enforced. All persons found guilty of violating the above rule will be prosecuted for maintaining a nuisance.

No. 24 - Modification of Rules:

These rules may be modified temporarily to meet special conditions.

Section 592, Penal Code of the State of California: Water Ditches, etc., Penalty for Trespass or Interference With.

Every person who shall, without authority of the owner or managing agent, and with intent to defraud, take water from any canal, ditch, flume or reservoir used for the purpose of holding or conveying water for manufacturing, agricultural, mining, irrigating, or generation of power, or domestic use, or who shall without like authority, raise, lower or otherwise disturb any gate or other apparatus thereof, used for the control or measurement of water, or who shall empty or place, or cause to be emptied or placed, into any such canal, ditch, flume or reservoir any rubbish, filth or obstruction to the free flow of the water, is guilty of a misdemeanor.

Section 607, Penal Code of the State of California: Destroying or Injuring Bridges, Dams, Levees, Etc.

Every person who willfully and maliciously cuts, breaks, injures, or destroys any bridge, canal, flume, aqueduct, levee, embankment, reservoir, or other structure erected to create hydraulic power, or to drain or reclaim any overflowed tide or swamp land, or to store or conduct water for mining, manufacturing, reclamation, or agricultural purposes, or for the supply of the inhabitants of any city or town, or any embankment necessary to the same, or either of them, or willfully or maliciously makes, or causes to be made, any aperture in such dam, canal, flume, aqueduct, reservoir, embankment, levee or structure, with intent to injure or destroy the same; or draws up, cuts, or injures any piles fixed in the ground for the purpose of securing any sea bank or sea walls, or any dock, quay, jetty, lock or sea wall; or who, between the first day of October and the fifteenth day of April of each year, plows up or loosens the soil in the bed or on the sides of such natural watercourse or channel, without removing such soil within twenty four hours from such watercourse or channel; or who, between the fifteenth day of April and the first day of October of each year, shall plow up or loosen the soil in the bed or on the sides of such natural watercourse or channel, and shall not remove therefrom the soil so plowed up or loosened before the first day of October next thereafter, is guilty of a misdemeanor, and upon conviction, punishable by a fine not less than one hundred dollars and not exceeding one thousand dollars, or by imprisonment in the county jail not exceeding two years, or by both; provided, that nothing in this section shall be construed so as to in any manner prohibit any person from digging or removing soil from any such watercourse or channel for the purpose of mining.

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ATTACHMENT C: PROGRAM DESCRIPTION FOR 2012 ON-FARM WATER CONSERVATION PROGRAM

ON-FARM WATER CONSERVATION PROGRAM

2012 PROGRAM DESCRIPTION

SOUTH SAN JOAQUIN IRRIGATION DISTRICT

TABLE OF CONTENTS

BACKGROUND AND OBJECTIVES

In the early 1900's, the South San Joaquin Irrigation District's system was built for flood irrigation. Over the years, the practices of growers have changed as they work to conserve water and to improve crop yields with the installation of more efficient irrigation systems and implementation of advanced farming practices. In recognition of the farmers' efforts, and to comply with State law regarding agricultural water use, SSJID provides financial incentives to accelerate improvements to the existing distribution system, enhance farm irrigation practices and provide for measurement of water usage. The intent of this Program is to engage as many growers as possible.

SSJID has developed an on-farm water conservation program (Program) to promote and incentivize on-farm physical improvements, irrigation management practices and water measurement (together referred to as Conservation Measures) that promote water conservation. From a Program perspective, water conservation is defined as use of less water to accomplish the same purpose by encouraging the efficient use of District surface water to meet crop water requirements.

SSJID's goal is to ensure that water is being used efficiently and that it is being put to beneficial use. The District has implemented the on-farm water conservation program in order to work together to achieve the shared water management goals of the growers and the District. The Program also supports ongoing efforts to preserve existing water rights and to comply with current and emerging regulations.

This Program helps the District satisfy the new regulatory requirements of California Senate Bill SBx 7-7, which took effect January 1, 2010 and mandates measurement of individual farm deliveries and implementation of Efficient Water Management Practices (EWMPs) including both District and on-farm improvements. Additionally, it is anticipated that this Program will enhance the control of available surface water and groundwater supplies while promoting improved crop production within SSJID. This program, along with other initiatives the District is evaluating, will provide improved farm delivery measurement and support compliance with SBx 7-7.

A focused set of conservation measures have been included in the Program. In addition, a provision has been included for growers to propose other conservation measures they believe will result in improved water management on their fields, subject to District approval. In future years, additional conservation measures may be added based on experience with the Program.

Cost shares made available by the Program have been approved for the 2012growing season. This document provides a detailed description of the 2012 Program to be implemented in November 2011. Cost share offerings for implementation of conservation measures for 2013 will be the subject of future Board decision. For the 2012 Program, participants will be eligible for cost share payments for conservation measures implemented after the Program start date of Monday, November 7, 2011. Applications will be available and accepted on the start date.

ENROLLMENT PROCESS

SOLICITATION AND APPLICATION PROCESS

The program will be launched in November 2011 through a mailing to SSJID water users, an announcement on the SSJID web site, and through the SSJID Newsletter. Additionally, a brief press release will be made to local news outlets.

Growers are invited to submit applications for one or more fields (Appendix A). For each field, the grower will select one or more conservation measures for implementation from a pre-approved list. Additionally, growers may propose additional conservation measures of their choosing. Fields will be selected by the District for implementation individually from each application provided that they are complete, pass minimum eligibility requirements, and provided that funding is available, as described in the following sections. Additionally, for some conservation measures (conversion from flood to sprinkler or drip/micro irrigation and grower proposed conservation measures not included on the preapproved list) the application will be reviewed to ensure compatibility with the SSJID distribution system and operations. The District reserves the right to restrict the amount of participation by a particular grower or a particular field.

As mentioned above, each application must be complete to be considered for inclusion in the Program. A complete application will have all applicable portions of the application filled in and, in the case of grower-proposed conservation measures, complete applications will include sufficient documentation to support evaluation of the conservation measure by the District. Required documentation for grower-proposed conservation measures is described later in this Program Description under Grower Proposals.

For additional information, contact Program Manager Julie Vrieling at (209) 249-4675 or email jvrieling@ssjid.com.

ELIGIBILITY REQUIREMENTS

The following eligibility requirements apply to all fields applying to enter the Program.

- Minimum Field Size – The minimum field size for inclusion in the Program is 10 acres, based on the net irrigated acreage of the field. The 10-acre threshold is additionally the acreage above which the recharge fee applies to fields within the District.

  Growers with fields less than 10 acres in size may submit an application. The District will evaluate whether there is sufficient potential for water conservation to be achieved to warrant the administrative time required to include the field in the Program. Proposals to enroll fields less than 10 acres in size will be evaluated on a case by case basis.

- Current SSJID Water User – For a field to be eligible for the Program, it must be or become a current SSJID surface water user as a condition to approval of any funding. For physical improvements, the participant agrees to use SSJID surface water for a period of not less than 5 years.

- Water Charges Current – At the time of enrollment, all of the grower's SSJID water charges must be or become current.

- On-Farm Measurement – For fields entering the Program with pumped deliveries, the participant agrees to install a meter to measure farm deliveries, in accordance with the conservation measure Delivery Measurement for Pumped Deliveries, as described in this document, including any reconfiguration of the pump discharge needed to facilitate accurate measurement while maintaining the pump flow rate. The participant will agree to perform repairs, maintenance, or replacement of water measurement devices as needed to ensure accurate measurement into the future.

  The participant agrees to allow SSJID to periodically record flow rate and delivery amounts using the meter and, at the District's option, to perform repairs, maintenance, or replacement as needed to ensure accurate measurement into the future. Additionally, all participants agree to allow meters to be installed by the District on a case-by-case basis for flood deliveries, if the District determines that site conditions support accurate delivery measurement.

- Satisfactory Performance in Prior Programs – If applicable, applications may be denied due to less than satisfactory performance in prior District programs.

- Cost Share - The District's maximum share of cost will be a set percentage of the participant's implementation cost.

- Program Award/Modification – the District will review and select applications for participation in the Program based on its determination of which applications best meet the Program objectives. The District may modify the terms for participation in the Program at any time, but will not reduce its commitment applicable to a particular field after a participant has received notice of approval from the District.

SELECTION PROCESS

Fields will be considered on a first-come, first-served basis. An application will be considered approved when the District issues written notice of approval to the applicant at the address specified on the application. The terms of approval and the conditions for District payment will be stated in the notice. Fields will be considered for approval until available funds allocated to each conservation measure of the Program are fully committed for each year, based on the assumption that actual reimbursement costs for cost share payments, as described later in this document, will be the maximum allowable payment per field. If after actual payments are made remaining funds are available, additional fields will be considered in the order in which their applications were received.

In order to encourage adoption of a variety of conservation measures, a total budget will be allocated for each conservation measure, including grower-proposed measures and District-provided valve packing services, as described in the Budget Tracking section of this document.

Approved conservation measures must be completed within 1 calendar year of the date of approval to be considered eligible for cost share payments. Requests for reimbursement must be submitted to the District within the 1 year period. Conservation measures started prior to the approval date are not eligible for cost share payments.

CONSERVATION MEASURES

Conservation measures as described herein are classified as either physical improvements or management practices. Physical improvements include conservation measures involving substantial physical changes to a field. Management practices include collection of information and development of recommendations to aid in improved irrigation management to meet crop water needs.

All measures must be constructed or implemented according to Program standards prior to receiving reimbursement. For physical improvements, all measures must have been inspected and approved by SSJID staff prior to reimbursement. For management practices, payment will be made following the receipt of operational reports (soil moisture monitoring data and/or irrigation scheduling recommendations) under the provision that service provider will provide these data for the full irrigation season for which the field is enrolled in the Program. For both physical improvements and management practices, documentation of costs must be provided to the District's satisfaction prior to reimbursement.

As described in the Background and Overview section of this Program Description, for the 2012 Program, participants will be eligible for cost share payments for conservation measures implemented after the Program start date of November 7, 2011.

PHYSICAL IMPROVEMENTS

Delivery Measurement for Pumped Deliveries

Delivery measurement for pumped deliveries consists of installing a flow meter to measure SSJID water deliveries for existing or new pumped SSJID deliveries. In some cases, the existing pump discharge piping may need to be reconfigured to provide an adequate straight section of pipe without bends or other obstructions to allow for accurate flow measurement using a flow meter.

This conservation measure is applicable to any case in which SSJID water is delivered to a pump that pressurizes irrigation water for application via a sprinkler, drip, or micro system. Minimum standards for the measure are:

- Seametrics AG2000 Irrigation Magmeter, McCrometer Ultra Mag flow meter, or approved equal
  - Installed with at least 3 diameters of straight pipe upstream of meter and 2 diameters of straight pipe downstream of meter (see Figure 1)
  - Provided with continuous power supply
  - Equipped with telemetry hardware allowing integration to the District's Supervisory Control and Data Acquisition (SCADA) System
  - Equipped with an internal datalogger[20]
- The participant agrees to perform repairs, maintenance, or replacement of water measurement devices as needed to ensure accurate measurement into the future.
- The participant agrees to allow the District to record delivery flow rates and volumes periodically for the life of the meter and to allow the District, at its option, to perform any repair, maintenance, or replacement, as needed to ensure accurate measurement into the future.
- The land owner must sign an SSJID agricultural Meter Service Agreement (Appendix C) as part of implementation of this conservation measure.
- The participant agrees to allow the District, at its option, to install telemetry, including but not limited to a solar panel, mast, antenna and other necessary equipment to remotely monitor delivery flows using the flow meter.

[20] For the McCrometer Ultra Mag flow meter, an external datalogger is required and is subject to approval by SSJID.

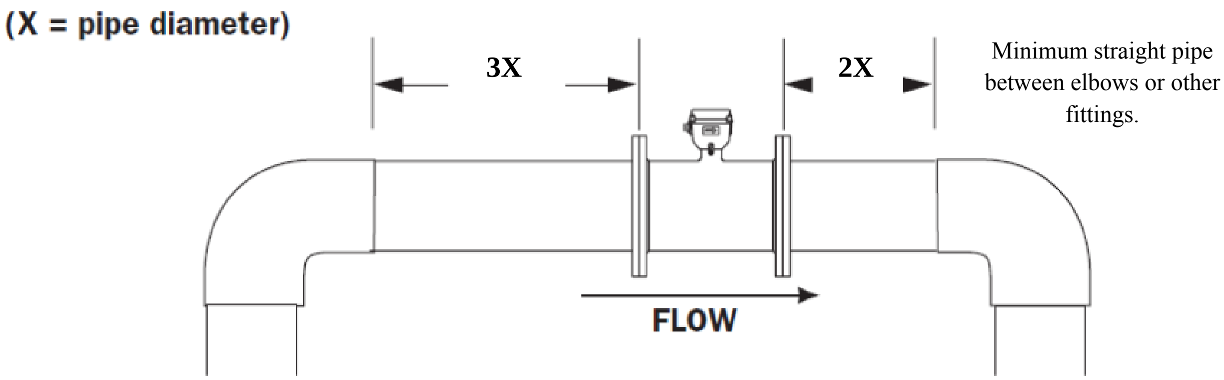


Figure 1. Example Magnetic Flow Meter Installation.

This measure will be included with any participating fields installing a sprinkler or drip irrigation system as described under the following conservation measure. All growers implementing this measure are required to agree to allow the District to read the flow meter periodically for purposes of delivery record keeping for the life of the device.

The estimated cost for planning purposes is $5,650 per location based on the estimated purchase and installation cost of a 12” mag meter, plus a contingency to allow for re-plumbing of pipe discharge to allow for adequate length of straight pipe to install the meter in some cases.

The District’s cost share for delivery measurement of pumped deliveries will be 80% of the actual cost, not to exceed $4,500.

Conversion from Flood to Sprinkler or Drip/Micro Irrigation

Conversion from flood to sprinkler or drip irrigation consists of installing a sprinkler, drip, or microspray irrigation system on an existing field that is currently flood irrigated. The conservation measure includes installation of the pump, filtration, mainlines, laterals, and emitters for the system. Adoption of this conservation measure additionally requires installation of an SSJID approved sump to allow for pumping of canal water along with adoption of the conservation measure Delivery Measurement for Pumped Deliveries, described previously.

Conversion from flood to sprinkler or drip irrigation is generally applicable throughout SSJID, except where delivery system physical and operational constraints limit the District’s ability to meet the delivery needs of sprinkler or drip/micro systems. Although the primary crops currently irrigated using sprinkler or drip irrigation are trees and vines, this conservation measure could also apply to the installation of a sprinkler system to irrigate pasture or field crops, for example. **Applications for conversion to sprinkler or drip/micro irrigation will be evaluated on a case by case basis to determine whether the District can continue to provide canal water to meet crop water needs following irrigation system conversion. Only fields located such that the District can supply surface water at the flow rate and irrigation intervals required after conversion will be approved.**

Minimum standards for this measure have been identified based on the NRCS Conservation Practice Standards listed in Table 1, below. These standards are included in Appendix B of this document.

Table 1. NRCS Conservation Practice Standards Applicable to Conversion from Flood to Sprinkler or Drip Irrigation.

NRCS Conservation Practice Standard	Applies to Conversion from Flood to:	
	Sprinkler	Drip or Micro
Irrigation System, Sprinkler (442)	✓	
Irrigation System, Microirrigation (441)		✓
Pumping Plant (533)	✓	✓
Underground Plastic Pipe (430DD and 430EE, as applicable)	✓	✓

Additionally, the following requirements developed by SSJID shall apply:

- No filters may back flush to District pipelines or open canals
- Each system must be designed by an Irrigation Association Certified Irrigation Designer
- Design Distribution Uniformity must be at least 75% for sprinkler systems and at least 90% for drip or micro systems
- Participants are responsible for submitting an Application for Structure Permit and constructing a District-approved sump prior to receiving reimbursement for system installation costs under this conservation measure.

The estimated cost for conversion from flood to sprinkler or drip/micro for planning purposes is $1,650 per cropped acre based on estimated materials and installation costs of a complete system including pump, filtration, mainlines, laterals, and emitters. The estimated costs are based on discussion with local irrigation suppliers and review of NRCS EQIP cost estimates. Reimbursement for sump costs will be made separately through the ongoing District sump program. Reimbursement for flow meter costs will be made separately under the Program based on the Delivery Measurement for Pumped Deliveries conservation measure, described previously.

The District's cost share for conversion from flood to sprinkler or drip irrigation will be 50% of the actual cost, not to exceed $825 per cropped acre. Additionally, the cost share payment will be limited to a maximum of $25,000 per grower for each measure. Conversion from flood to drip and conversion from flood to sprinkler are considered different measures for purposes of determining the maximum cost share per grower for each measure. As described, this cost share does not include installation of a sump or delivery measurement for pumped deliveries, which will be treated separately.

In addition to conversion from flood to sprinkler or drip/micro irrigation, the District may consider conversion of sprinkler to drip/micro irrigation or replacement of old sprinkler or drip/micro systems.

Tailwater Recovery Systems to Prevent Runoff

Tailwater Recovery Systems to Prevent Runoff consist of systems to collect and convey tailwater to the head of the field from which the tailwater was generated or another nearby field for the purpose of recovering and reapplying the tailwater to supplement irrigation deliveries. For this Program, tailwater recovery systems are targeted at fields that periodically drain tailwater back into the SSJID distribution system where it currently is delivered to a downstream user or spills from the system. SSJID discourages and in the future may no longer allow drainage of tailwater into the distribution system. This conservation measure applies to any field for which tailwater is produced during irrigation that drains back to the SSJID irrigation system. It is anticipated that this only occurs for flood irrigated fields.

Minimum standards for this measure have been identified based on the NRCS Conservation Practice Standards for Irrigation System, Tailwater Recovery (447), Pumping Plant (533), and Underground Low Pressure Plastic Pipe (430EE), included in Appendix B of this document.

The estimated cost of tailwater recovery systems for planning purposes is $1,200 per cropped acre based on estimated materials and installation costs of a complete system including tailwater pond, tailwater return pipeline, and pump. The estimated costs are based on estimated quantities and unit costs for system components and based on review of NRCS EQIP cost estimates.

The District's cost share for tailwater recovery systems will be 50% of the actual cost, not to exceed $600 per cropped acre. Additionally, the cost share payment will be limited to a maximum of $25,000 per grower for this measure.

The District will also consider grower proposals to reduce drainage through laser land leveling and deep ripping, for example. Interested growers may submit a proposal as described under "Grower Proposals," included later in this document.

MANAGEMENT PRACTICES

Scientific Irrigation Scheduling

Scientific Irrigation Scheduling consists of the determination of the frequency, rate, and duration of irrigation application needed to meet crop water requirements while minimizing excess tailwater and deep percolation. Typically, this determination is based on a combination of soil moisture monitoring and root zone water balance calculations based on estimates of crop water use (evapotranspiration, or ET). Scientific irrigation scheduling is applicable to all irrigated crops, regardless of irrigation system type or soil conditions.

In most cases, the optimum frequency, rate, and/or duration of irrigation is constrained by available water supply, the delivery system, the soil, or the irrigation system itself. In the case of SSJID, the delivery frequency and flow rate are generally fixed under current system operation, providing flexibility almost exclusively in the duration of irrigation.

Under the Program, the District requires that scientific irrigation scheduling be conducted by approved service providers using proven technologies. Additionally, the District requires that irrigation recommendations be submitted to both the participating grower and to the District by the service provider. To request a list of preapproved service providers, contact Julie Vrieling at (209) 249-4675 or email jvrieling@ssjid.com.

The estimated cost of scientific irrigation scheduling for planning purposes is $3,000 per field per season, which represents the average seasonal cost for a consulting service to provide irrigation recommendations for an individual field based on discussion with consultants serving the San Joaquin Valley. The difference in cost between consultants depends largely on whether continuously recording soil moisture monitoring equipment is installed in the field; costs will likely be substantially less for weekly field visits using portable soil moisture monitoring equipment.

Unlike physical improvements, the District will pay a portion of the total cost of the scientific irrigation scheduling service directly to the service provider. The portion that the District is willing to pay will be a one-time payment of 75% of the actual cost, not to exceed $2,250 per field for 2012. The maximum payment for Scientific Irrigation Scheduling for 2012 will be limited to $5,000 per grower.

Soil Moisture Monitoring

Soil Moisture Monitoring consists of tracking the moisture content of the crop root zone over the course of the growing season to evaluate whether irrigation practices are sufficient to maintain adequate soil moisture content while limiting excess deep percolation. Soil moisture monitoring is a key component of scientific irrigation scheduling and is applicable to all irrigated crops, regardless of irrigation system type or soil conditions. For the Program soil moisture monitoring is offered as a stand-alone conservation measure to assist growers in tracking soil water content, or it may be implemented as part of scientific irrigation scheduling, described previously.

Under the Program, the District requires that soil moisture monitoring be conducted by approved service providers using proven technologies. Additionally, the District requires that duplicate soil moisture monitoring reports be submitted to both the participating grower and to the District by the service provider. To request a list of preapproved service providers, contact Julie Vrieling at (209) 249-4675.

The estimated cost of soil moisture monitoring for planning purposes is $1,500 per field per season, which represents the average seasonal cost for an agronomic consulting service to provide soil moisture monitoring reports for an individual field. The estimated costs are based on discussion with agronomic consultants serving the San Joaquin Valley. The difference in cost between providers depends largely on whether continuously recording soil moisture monitoring equipment is installed in the field; costs will likely be substantially less for weekly field visits using portable soil moisture monitoring equipment.

Unlike physical improvements, the District will pay a portion of the total cost of the soil moisture monitoring service directly to the service provider. The portion of the cost incurred that the District is willing to pay will be 75% of the actual cost, not to exceed $1,125 per field for 2012. The maximum payment for Soil Moisture Monitoring for 2012 will be limited to $5,000 per grower.

DISTRICT SERVICES

Valve Packing

Valve packing is a service that was traditionally provided by the District to repack irrigation valves to reduce valve leakage. Valve packing is applicable wherever large flood irrigation valves installed on District pipelines are used. Growers are to make arrangements to have their valves packed by contacting Julie Vrieling at (209) 249-4675. District staff will repack the valves. Valves will be packed according to manufacturer specifications, if applicable.

Growers will be charged a fee for valve packing to cover District labor and materials costs for repacking the valves. Additionally, the grower is responsible for the removal and reinstallation of the valve, as well as delivery to and pickup from the District. The District may restrict the availability of this service depending on the availability of personnel.

GROWER PROPOSALS

Overview

As part of the Program, growers are given the opportunity to submit proposals for District cost share to implement conservation measures in addition to those described previously. These proposals will be evaluated on a case by case basis as described below. The allowance for individual grower proposals provides flexibility in the types of conservation measures included. These measures could include laser land leveling, deep ripping, installation of pipelines to replace open ditches, or other measures identified by the applicant as effective water conservation measures for his or her field.

Proposal Requirements

Grower proposals to implement conservation measures not listed previously must include the following information:

- Description of conservation measure to be implemented, including a description of all physical changes to the field and corresponding irrigation management changes
- Itemized cost list giving estimated costs of major system components, with supporting documentation if available
- Sketch of field showing field location and physical changes to field, if applicable
- Description of how the proposed conservation measure will result in water conservation

Evaluation Criteria

Proposals for additional conservation measures will be evaluated by SSJID staff based on the following considerations:

- Completeness of proposal – the proposal must include the requested information at a sufficient level of detail to allow for evaluation by the District.
- Demonstrated effectiveness – the proposed conservation measure must be based on a demonstrated method of reducing deep percolation, tailwater, or other losses (i.e., seepage from farm ditches or evaporation). The proposed measure must be demonstrated conclusively in the SSJID area or other areas with sufficiently similar conditions, and it must be suitably applied. The District may consider new innovations, provided that they are accompanied by a clear description of how the measure will result in water conservation.
- No special administrative requirements – the proposed measure must not cause a burden to SSJID with respect to the continued delivery of irrigation water or to the administration of the Program. The measure must be observable to ensure that implementation of the measure can be documented for verification purposes.

Applicable Standards and Specifications

Proposed measures must be implemented to existing industry standards (e.g., NRCS conservation practice standards), to the extent that established standards exist. In all cases, SSJID may place requirements on measure implementation to ensure that the measure has the potential to be effective and does not provide an undue burden on SSJID water delivery practices or Program administration. Standards will be identified on a case by case basis but will be applied uniformly to all fields proposing to implement a given conservation measure.

Determination of Estimated Costs and Cost Share Amounts

Estimated conservation measure costs will be developed by reviewing grower estimates of costs along with other available sources including NRCS cost share lists and information from irrigation equipment providers or other appropriate sources. Cost share percentages will be determined by SSJID staff on a case by case basis but will be applied uniformly to all fields proposing to implement a given conservation measure. Cost share percentages will be set in part based on relative benefits to the grower and to the District of implementing the measure. In general, it is anticipated that physical improvements will be funded at up to 50% of implementation cost, and management practices will be funded at up to 75% of implementation cost, but the particular cost share will be determined on a case by case basis. In all cases, cost share amounts will be limited based on the estimated implementation cost, which will be determined by staff before the proposal is approved. Additionally, the cost share payment will be limited to a maximum of $25,000 per grower for this measure.

MAXIMUM COST SHARE PAYMENT PER GROWER

In addition to the payment limitations described previously for each conservation measure, the total cost share for 2011 for all fields enrolled by a grower will be limited to $50,000.

INTERACTION WITH OTHER, NON-DISTRICT PROGRAMS

Other Programs may provide cost share payments for implementing conservation measures included in this Program. For example, programs offered by the Natural Resources Conservation Service of the USDA, such as the Environmental Quality Incentives Program (EQIP), offer cost share of 50% (or more in some cases) to cover the cost of installing sprinkler systems, drip/micro systems, tailwater recovery systems, or other on-farm improvements.

Participation in the SSJID On-Farm Water Conservation Program does not prevent growers from participating in EQIP or other Federal programs. Similarly, participation in EQIP or other Federal programs does not prevent participation in the SSJID On-Farm Water Conservation Program.

BUDGET TRACKING

The total budget for cost share payments is $1.14 million for 2012. Initially, cost share amounts will be allocated for each conservation measure as described in Table 2.

Table 2. Initial 2012 Budget Amounts by Conservation Measure Category.

Conservation Measure Category	2011 Budget by Conservation Measure
Physical Improvements	
Delivery Measurement for Pumped Deliveries	$ 190,000
Conversion from Flood to Sprinkler or Drip/Micro	$ 475,000
Tailwater Recovery Systems to Reduce Runoff	$ 190,000
Management Practices	
Scientific Irrigation Scheduling	$ 47,500
Soil Moisture Monitoring	$ 47,500
Grower Proposals	$ 190,000
TOTAL	$ 1,140,000

The budget amounts will be reviewed periodically and may be adjusted based on the number of applications received for each conservation measure at the discretion of the Program Manager.

As applications for participation are received, they will be added to a list in the order they are received. At any given time, the applications subject to review and approval will be limited to those for which the total potential cost share is less than the total available budget by conservation measure category. If upon review, the District does not approve an application, the associated cost share will be released to fund applications received later within that category. As documentation of actual costs is received by the District from participating growers, the difference between the cost share limit and the actual cost share amount paid for each category, if any, will likewise be released to fund applications received later in the order in which they were received.

PAYMENT APPROVAL AND PROCESSING

Upon receipt of a request for payment and documentation showing actual payment of the incurred conservation measure implementation costs from an approved applicant, the District will verify that the measure has been implemented (as described in the following section) and payment will be issued based on the Program cost share percentage for the measure or measures implemented and based on the actual cost, not to exceed the cost share limit for the measure or measures.

Requests for reimbursement must be accompanied by documentation of implementation costs, including invoices and receipts from equipment and service providers, along with proof of payment. Costs incurred by the grower internal to his or her operation that are associated with the installation of the conservation measure are not considered eligible for reimbursement.

Payments will be issued as a separate check to the participating grower, rather than as a reduction in water charges. It is anticipated that payment will be made within 30 days of the District's verification that the measure was implemented.

MONITORING AND VERIFICATION

Monitoring and verification of implementation of conservation measures will be accomplished through a combination of documentation of implementation costs (receipts and payments) and operational reports (flow measurement records, soil moisture monitoring reports, and irrigation recommendations), along with field visits to verify that physical improvements are implemented according to Program standards. Additionally, the District will seek feedback from participating growers in the form of interviews or questionnaires with the objective of evaluating the Program and documenting changes to irrigation practices resulting from conservation measure implementation.

APPENDIX A: APPLICATION FOR PROGRAM PARTICIPATION

For District Use Only
Date Received: ____________________

APPLICATION FOR ON-FARM WATER CONSERVATION PROGRAM

1. Applicant/Landowner name ____________________ email ____________________
2. Mailing address ____________________
3. Telephone # ____________________

Complete one application for each field to be included in the Program. All measures must be implemented after the application approval date and completed within 1 year to be eligible for reimbursement.

SUBMIT COMPLETED APPLICATION TO SSJID

1. A detailed design plan and cost estimate must be submitted with applications including physical improvements to a field.
2. Your application will be reviewed and processed according to District policy and as described in the Program Description. A determination will be made as to the eligibility and potential effectiveness of the proposed conservation measure or measures for each field, and a recommendation will be made to the General Manager, Jeff Shields.
3. Following review, you will be sent a letter summarizing the conservation measures approved for implementation for each field application and providing explanation of why any fields or conservation measures were not approved, if applicable.
4. **COST SHARE PAYMENTS ARE NOT GUARANTEED UNTIL YOUR APPLICATION HAS BEEN APPROVED.**
5. If you have any questions concerning your Application please feel free to contact Julie Vrieling at (209) 249-4675.
6. By signing below, you agree to implement the conservation measures described in this application and to abide by all Program requirements as described in the Program Description.

APPLICANT/LANDOWNER SIGNATURE ____________________

DATE ____________________

APPLICATION FOR ON-FARM WATER CONSERVATION PROGRAM (CONTINUED)

BASIC INFORMATION

1. Applicant/Landowner name ______________________________
2. Assessor's Parcel Number (APN) ______________________________
3. SSJID Delivery Location (example: Lat. Wc, St. 120) ______________________________
4. Field size[1] (acres) ____________________ 6. Crop ____________________

PROPOSED PHYSICAL IMPROVEMENTS
(Select up to one of the following by entering an "**X**" to the right of the description)

1. Delivery Measurement for Pumped Deliveries _______
2. Conversion from Flood to Sprinkler Irrigation[21] _______
3. Conversion from Flood to Drip/Micro Irrigation[2] _______
4. Tailwater Recovery System to Prevent Runoff _______

PROPOSED MANAGEMENT IMPROVEMENTS
(Select up to one of the following)

1. Scientific Irrigation Scheduling _______
2. Soil Moisture Monitoring _______

OTHER CONSERVATION MEASURES[22] _______

For other conservation measures, attach one or more sheets including the following information as described in the Program Description:

- Description of conservation measure to be implemented, including description of physical changes to the field and irrigation management changes
- Sketch of field showing field location and physical changes to field, if applicable
- Description of how the proposed conservation measure will result in water conservation

Have you applied for funding for these conservation measures under any other programs, such as NRCS EQIP? Yes ___ No ___

APPLICANT/LANDOWNER SIGNATURE ______________________________ DATE _______________

[1] Fields less than 10 acres in size will be considered for participation on a case-by-case basis based on the potential to achieve water conservation as described in the Program Description.
[21] Conversion from flood to sprinkler or drip/micro must include the delivery measurement for pumped deliveries conservation measure.
[22] Other conservation measures will be considered as described in the Program Description.

APPENDIX B: APPLICABLE NRCS CONSERVATION PRACTICE STANDARDS

The following NRCS Conservation Practice Standards are attached:

1. Irrigation System, Sprinkler (442)
2. Irrigation System, Microirrigation (441)
3. Pumping Plant (533)
4. Irrigation Pipeline (430)
5. Irrigation System, Tailwater Recovery (447)

APPENDIX C: CONSENT TO SOUTH SAN JOAQUIN IRRIGATION DISTRICT'S ENTRY OF PROPERTY TO READ AND OWNER'S AGREEMENT TO MAINTAIN FLOW METER

AFTER RECORDING RETURN TO:

SOUTH SAN JOAQUIN IRRIGATION DISTRICT
P.O. Box 747
Ripon, CA 95366

CONSENT TO
SOUTH SAN JOAQUIN IRRIGATION DISTRICT'S
ENTRY OF PROPERTY TO READ
AND OWNER'S AGREEMENT TO MAINTAIN FLOW METER

The undersigned owner of the property located at ______________, APN ________ ___("Property") and further described in the attached Exhibit "A", has, with the financial assistance of South San Joaquin Irrigation District ("District"), installed a flow meter to measure deliveries of District surface water to the Property. State law requires that starting in July 2012, the District base its water charges, at least in part, on the quantity of water it delivers. The District will use flow meter measurements in future water charges after its Board of Directors approves a policy that requires water charges be based at least in part on the measurement of quantity delivered.

Owner consents to the entry of District officers, employees or agents ("District Personnel") on the Property for the purposes of inspecting and reading the flow meter installed to measure deliveries of District surface water to the Property. District Personnel may enter the Property at any reasonable hour and on a monthly basis or at such other time as District reasonably determines to be necessary, to inspect the working condition of the meter and to record water usage. District shall also be permitted to enter the Property for the purpose of installing telemetry control hardware to the meter such that the meter can be read remotely. District Personnel may enter the Property outside any District easement area using marked District vehicles on available access roads, on foot or as Owner and District may otherwise agree. District shall use reasonable care to avoid interfering with Owner's farming operations.

Owner agrees to take no action that would prevent the meter from accurately measuring the volume of District surface water delivered to Owner's Property. If District determines that the meter is nonfunctioning, Owner agrees to repair or replace the meter at Owner's expense.

This Consent shall remain in effect until such time as deliveries of District surface water to the Property shall terminate as evidenced by recordation of an Irrigation Service Abandonment Agreement signed by District and Owner or Owner's success or in interest.

This Consent shall run with the land described above and be binding on Owner and Owners' heirs, successor and assigns.

SOUTH SAN JOAQUIN IRRIGATION DISTRICT
"DISTRICT"

By________________________Date:_________
John Holbrook, President
Board of Directors

By________________________Date:_______
Jeff Shields, Secretary
Board of Directors

"OWNER(S)"

By________________________Date:_________

By________________________Date:______

Mailing Address: ____
____

Phone Number:__________________

<u>SIGNATURES MUST BE NOTARIZED AND BE PER RECORDED DEED</u>

ATTACHMENT D: EVALUATION OF 2011 ON-FARM WATER CONSERVATION PROGRAM

TECHNICAL MEMORANDUM

To: South San Joaquin Irrigation District

From: Davids Engineering

Date: September 10, 2012

Subject: Initial Evaluation of On-Farm Conservation Program

OVERVIEW AND SUMMARY

The South San Joaquin Irrigation District (SSJID) developed an ambitious on-farm water conservation program (Program) that was implemented in 2011 and has been continued in 2012. Through the Program, the District has provided direct funding to growers for the implementation of various water conservation measures, ranging from soil moisture monitoring to installation of drip irrigation systems. Overall objectives of the Program include the following:

- Promote and incentivize on-farm physical improvements, irrigation management practices and water measurement to support efficient water management.
- Ensure that water is being used efficiently and that it is being put to beneficial use.
- Support ongoing efforts to preserve existing water rights and to comply with current and emerging regulations, for example SBx7-7.
- Enhance the control of available surface water and groundwater supplies while promoting improved crop production within SSJID.

This technical memorandum describes an initial evaluation of the outcomes of the program. The objectives of the evaluation are as follows:

- Gather participant feedback in the following areas:
    - Program policies and procedures
    - Benefits of conservation measure implementation
    - Additional opportunities for improved water management
    - General feedback regarding water delivery service
- Increase understanding of on-farm irrigation practices and overall water management
- Perform a preliminary assessment of potential reductions in applied water that may occur as a result of conservation measure implementation

The evaluation included three primary activities. First, a participant survey was developed and provided to all Program participants to elicit feedback on the Program. The survey was structured to gather background information on farming and irrigation practices, general program feedback, and specific feedback regarding conservation measure implementation. Second, focused interviews were conducted with selected program participants to better understand farming and irrigation practices, and obtain general program feedback and specific feedback regarding conservation measure implementation. Interviews were conducted with four program participants. Each interview lasted approximately one hour and included visits to fields enrolled in the program. Third, an evaluation of water use prior to and following conservation measure implementation for participating fields was performed using available data from the District's TruePoint water order entry and delivery tracking system and from magnetic flow meters installed as part of the Program.

Based on the results of the evaluation, the following general observations are made regarding the Program:

- The Program objectives are being met. Through the implementation of conservation measures, there is increased awareness of the importance of efficient management of available surface and groundwater supplies to maintain long term supply reliability, to protect and improve water quality, and to maximize productivity.
- The overall response of participants is very positive. Most participants are pleased with the program design and implementation.
- Some suggestions to make the program even better have been provided.
- All responding participants are interested in continuing to participate in the program, to the extent that they have fields that have not yet been enrolled.
- The program has helped improve relations between the District and participants, leading to increased understanding of District operations by participants and increased understanding of irrigation practices by District staff.
- For some fields, less water use has been observed, for others the Program has helped identify that more water is needed to maximize production. In many cases, it is difficult to quantify reductions in applied water due to the limited availability of pre- and post-implementation water use information.
- Participants note a range of benefits other than water conservation, including both increased crop health and yields and decreased costs.

The remainder of this technical memorandum describes the results of the evaluation in greater detail. The following sections are included:

1. Participant Survey Results
2. Summary of Focused Interviews
3. Comparison of 2010 and 2011 Deliveries for Participating Fields

Attachment A. Participant Survey Form

Attachment B. Detailed Review of Survey Results and Individual Comments from Participant Survey

Attachment C. Outline for Focused Interviews

Attachment D. Photos from Focused Interviews

1. PARTICIPANT SURVEY RESULTS

1.1 OVERVIEW

This section provides a summary of responses from growers in SSJID to a survey conducted by the District in July and August of 2012 (Attachment A). The objective of the survey was to gain feedback from growers who participated in the District's On-Farm Water Conservation Program during 2011.

Responses were received from 26 individuals representing approximately 5,040 acres, or about 10% of the District's cropped area in recent years. For each question, the number of respondents and respondent acres are summarized for each response. Detailed comments received from respondents are provided in Attachment B.

1.2 GENERAL OBSERVATIONS

The following general observations are made based on the participant survey responses:

- The overall response of participants was very positive. Most participants are pleased with the program design and implementation.
- Some suggestions to make the program even better were provided.
- All responding participants are interested in continuing to participate in the program.
- The program has helped improve relations between the District and participants, leading to increased understanding of District operations by participants and increased understanding of irrigation practices by District staff.
- For some fields, less water use has been observed, for others the Program has helped identify that more water is needed to maximize production. In many cases, it is difficult to quantify reductions in applied water due to difficulties in measuring water.
- Participants note a range of benefits other than water conservation, including both increased crop health and yields and decreased costs.

1.3 SUMMARY OF SURVEY RESULTS

1.3.1 Background Information

- Most responding growers indicated that farming is their full time occupation.
- Of the growers who provided their farming experience, most have more than 20 years of farming experience in SSJID or elsewhere.
- The majority of responding growers decide when to irrigate depending on availability of surface water when flood irrigating and soil moisture monitoring when irrigating by sprinkler or drip/micro.
- Most respondents decide which flow rate to irrigate with based on water delivery system constraints when flood irrigating and soil moisture monitoring when irrigating by sprinkler or drip/micro.
- Respondents generally decide how long to irrigate based on when the water reaches the end of the field or close to the end or delivery system constraints when flood irrigating, on past experience/always the same number of hours for a field when irrigating with sprinklers or use soil moisture monitoring when irrigating with drip/micro.

1.3.2 General Program Feedback

- Of all the conservation measures, soil moisture monitoring was implemented by the most responding growers on the largest number of fields.
- Respondents are generally satisfied with the enrollment and selection process of the Program.
- Most respondents were pleased with the type of conservation measures included in the Program.
- The majority of respondents felt the Program's payment amounts and limits were sufficient to encourage participation.
- Most responding grower indicated they would participate in the Program again if it were offered.

1.3.3 Specific Feedback Regarding Conservation Measure Implementation

- Most participating growers were able to implement the conservation measure(s) in time for the 2011 growing season.
- Most respondents thought that the implemented conservation measures resulted in less water use.
- The majority of responding growers indicated that there were additional benefits from the conservation measures and these benefits were about as expected.

2. SUMMARY OF FOCUSED INTERVIEWS

2.1 OVERVIEW

This memorandum summarizes the interviews conducted with on-farm conservation program participants conducted by Davids Engineering on July 18, 2012. The primary objectives of the interviews were to obtain feedback from participants regarding their experience with the Program and to perform a qualitative assessment of water conservation and other benefits realized as a result of participation.

A total of four interviews were conducted with selected program participants. Interviewees were selected by SSJID staff based on perceived willingness to provide candid feedback and the level of participation in the Program. Each interview was structured more as a conversation, with a predetermined list of key topics to be addressed and lasted approximately 1 hour, including visits to fields enrolled in the Program.

Based on the interviews, the following objectives of the Program are being met:

- Promote and incentivize on-farm physical improvements, irrigation management practices and water measurement to achieve water conservation.
- Ensure that water is being used efficiently and that it is being put to beneficial use.
- Support ongoing efforts to preserve existing water rights and to comply with current and emerging regulations, for example SBx 7-7.
- Enhance the control of available surface water and groundwater supplies while promoting improved crop production within SSJID.

2.2 BACKGROUND INFORMATION

All growers interviewed grow almonds exclusively, with the exception of one grower who also grows pomegranates. All are full time farmers ranging in age from approximately 40 to 60. Collectively, the interviewees farm approximately 1,550 acres, including 1,140 acres in SSJID's service area. Individual farming operations ranged in size from approximately 160 acres to over 600 acres. Based on typical field sizes in SSJID, it is estimated that approximately 100 fields are owned or managed by the interviewees.

Most interviewees farm at least one field using either flood, drip, micro, or solid set sprinkler irrigation. The timing of irrigation varies from field to field based on a number of factors, including the following:

- Surface water availability from SSJID - Varies depending on location in the system, delivery type (pump vs. gravity vs. Division 9 system), and division manager
- Time of year – including changes in weather and agronomic objectives (e.g., water stress to promote hull split and reduce hull rot prior to harvest; or timed to allow soil to dry for access to spray, mow weeds, harvest, etc.)
- Irrigation method and application rate

- Orchard age and soil characteristics
- Soil moisture levels relative to target amount
- Visual indicators of crop stress
- Experience (combining all of the factors above)

Irrigation delivery rates are typically fixed by SSJID based on the available flow for a flood head or are defined by the pump flow rate required to irrigate using a particular pressurized irrigation system and set size. Irrigation duration varies based on the following factors:

- Time required to flood the entire field (varies depending on soil type, existing moisture content, delivery flow rate)
- Time required to refill soil based on soil moisture monitoring data (pressurized irrigation)
- Time required to apply target depth of water (pressurized irrigation)

As indicated above, most participants interviewed use a combination of experience, visual observations, and soil moisture monitoring to manage irrigation of their fields.

Overall, the interviewees indicated that SSJID provides a good level of service, considering the constraints of the distribution system and relatively low cost of water. Additionally, one grower specifically noted that Jeff Shaw who has been helping get the Division 9 deliveries working should be commended. Specific suggestions for improvement include the following:

- Some Division Managers (DMs) are able to accommodate a 14 day rotation, while others strictly follow a 10-day or 20-day rotation. 10 days is too short and 20 days is too long. It would be great if a 14 day rotation could be provided more consistently.
- Drip, micro, and sprinklers are difficult on dead end lines due to flow fluctuations. It would be great if SSJID could better control flows to dead end laterals to avoid excess or insufficient flows, which typically result in spills to the farm due to having more flow than the pump can take or not enough flow, followed by pump shutoff, followed by spillage if not attended.
- During aquatic herbicide applications, deliveries for flood have a decreased flow rate. The grower is often unaware of this in advance and may need to make additional unplanned trips to the field due to irrigation requiring more time to complete. Better notification would be helpful.
- A system to allow growers to see where water is in the rotation and a schedule for future deliveries, including information on flow rates in the system would be helpful. This would allow growers to better plan their daily activities and manage their labor in advance.
- Better communication from DMs regarding changes in delivery measurement would be helpful. In at least some instances, only recently have DMs contacted growers to find out how much they are using at pump deliveries.

- Some growers must switch to groundwater for irrigation during aquatic herbicide treatment due to large amounts of algae moving through the system.
- One grower experienced a situation in which a district employee indicated that the district would cover the cost of a connection to the Division 9 pressurized pipeline, only to have the decision later reversed. He requested that in the future the District be consistent in its representations to growers.
- A shorter wait time to receive water in Division 9 would be appreciated (apparently water must currently be ordered 48 hours in advance).
- Recently, it was necessary to place orders 6 days ahead due to magnacide treatment. Advance notice of such delays in filling orders would be helpful to growers.
- The ability to adjust order duration in Division 9 would be appreciated. For example, it would be beneficial to add a few hours to an irrigation after it has begun, if needed to meet crop water requirements.
- Activation of the soil moisture sensors installed as part of the Division 9 project would be appreciated.

2.3 GENERAL PROGRAM FEEDBACK

All participants interviewed have experience enrolling at least two fields in the program, and all have performed conversion to either drip, micro, or solid set sprinkler irrigation on at least one field. All but one have enrolled fields for either scientific irrigation scheduling or soil moisture monitoring. One grower converted an old solid set sprinkler system to drip under the program, reducing both water and electrical use. Another grower constructed an on-farm regulating reservoir to facilitate operation of a drip/micro system using District water.

All participants expressed satisfaction with the ease of enrollment in the program and flexibility to choose appropriate conservation measures for their fields. In particular, almost every participant contrasted the efficiency and practicality of the SSJID program as compared to the NRCS EQIP program. Growers greatly appreciate the timeliness of the District in reviewing and approving applications and issuing payment once conservation measures are implemented. Additionally, the timely, practical and convenient inspection of system installations by the District is appreciated to avoid unnecessary construction delays.

All participants indicated that they will continue to enroll in the program if it is offered in the future. One participant emphasized that he would not have implemented the conservation measures without program funding being available, and another indicated that the program funding for system conversion helped him encourage the landowner to install the pressurized irrigation system by helping incentivize the lease agreement.

The following suggestions were offered to help improve the program:

- Growers often plan improvements to fields a year or more in advance. Starting program enrollment for the following year in July or August would better match participants' planning horizons.
- The program payment amounts are meant to cover a set percentage of implementation costs, up to a limit per acre or per field. As costs increase, the district will need to increase payment caps to continue to pay the set percentage.
- A conservation measure to help pay the cost of converting surface drains to pipes would be helpful to increase the area that can be cropped and to reduce safety risks of operators running into large ditches.

2.4 SPECIFIC FEEDBACK REGARDING CONSERVATION MEASURE IMPLEMENTATION

With the exception of the on-farm reservoir, soil moisture monitoring, and scientific irrigation scheduling conservation, participants had past experience with the conservation measures that they implemented (conversion to drip, micro, or solid set sprinkler). Although participants feel that they are using less water as a result of implementing the conservation measures, they were unsure as to how much less they are using, primarily due to difficulty in knowing how much water was used in the past under flood irrigation. Specific benefits of conservation measure implementation indicated by the participants include the following:

- Soil moisture monitoring and scientific irrigation scheduling
    - Better management of soil moisture to avoid water stress and control deep percolation
    - Better monitoring of temperature for frost protection (via weather station and temperature alarm systems installed for two of the participants)
    - Reduced water use
        - Example: 20 hrs/week of sprinkler run time vs. 30 hrs/week previously (33% reduction)
    - Reduced fertilizer use
    - Improved yields
- Conversion to drip/micro/solid set irrigation
    - Better control of amount of water applied
    - Reduced deep percolation and overall water use
    - Increased flexibility in timing of irrigation events
    - Improved yields
    - Better overall health of trees and better resistance to pests and disease
    - Ability to control orchard microclimate to reduce hull rot
    - Able to overcome soil limitations (e.g. sand streaks, etc.)
    - Reduced fertilizer and herbicide use
    - Reduced labor for irrigation, mowing weeds, etc.

        - Example: 3 hours to check drip system now vs. 8 hours irrigation labor in the past for flood
        - Example: no need to mow weeds now with drip
        - Example: drip system takes little time to run, only needs to be checked every 2 weeks or so
    - More convenient scheduling of labor (e.g., no need to change sets in middle of night)
    - Reduced wetting of orchard floor between trees to allow access to orchard for spraying, harvest, etc.
    - Reduced electrical use (conversion from 50 HP solid set to 20 HP drip pump)
- On-farm regulating reservoir[23]
    - Reduced labor (no need to frequently check pump)
    - Avoid spillage of excess delivery flows to the farm
    - Avoid spillage of delivery flows if pump shuts down

[23] This conservation measure was proposed by the grower to help him efficiently implement micro and drip irrigation on a deadend lateral. The reservoir helps to overcome mismatches between the SSJID delivery flow and the flow rate of the pump used to operate the microirrigation system. On-farm reservoirs could be considered as a listed CM for future programs.

3. COMPARISON OF 2010 AND 2011 DELIVERIES FOR PARTICIPATING FIELDS

3.1 OVERVIEW

This technical memorandum provides a summary of a preliminary comparison of deliveries during the 2010 and 2011 growing seasons for fields participating in the District's 2011 On-Farm Water Conservation Program (Program). Although this comparison does not provide a definitive quantification of conserved water achieved by the program participants, it provides insight into the potential magnitude of conserved water.

3.2 APPROACH

The volume of water conserved through improvements funded by the Program is equal to the difference between the without-improvement and with-improvement water deliveries (AWMC, 2004). The conserved water volume is estimated based on the difference in delivery volumes for participating fields between 2010 and 2011, according to Equation 1:

$$\text{Conserved Water Volume} = (\text{Farm Delivery})_{\text{without}} - (\text{Farm Delivery})_{\text{with}} \qquad [1]$$

For this preliminary assessment, it is assumed that neither evaporative demand nor resulting crop water requirements varied between 2010 and 2011 for participating fields, such that recorded deliveries between 2010 and 2011 for participating fields can be compared directly. Additionally, for purposes of this preliminary conservation estimate, we assume that the reduction in delivered water results in a corresponding reduction in irrecoverable water losses. In the future, it is anticipated that these estimates will be refined to consider both changes in evaporative demand and cropping over time. Additionally, improved delivery measurement accuracy will further reduce uncertainties in conservation estimates. Finally, the additional benefits of groundwater recharge and reuse of surface water runoff by downstream users will be considered.

As described above, with and without project farm deliveries were estimated based on TruePoint (TP) delivery records between March 1 and October 31 in 2010 (without project) and 2011 (with project). Delivery records were extracted from a database of SSJID irrigation deliveries developed by Davids Engineering that imports delivery records from spreadsheets provided by SSJID. Delivery records in TP were matched to participating fields by Delivery Location, APN, participant name, crop, and acreage as identified in the Program Administration Tool (PAT) spreadsheet. In many cases, it was difficult to identify the TP records corresponding to a participating field with certainty, or there may have been no deliveries to the field during the time period of interest (e.g. the 2010 or 2011 growing seasons). Fields for which links could not be made between data sources or that appeared not to have been irrigated for substantial portions of either the 2010 or 2011 growing season were not included.

TP delivery amounts were compared for fields with recorded deliveries between March and October of 2010 and 2011 and that had a field visit for the 2011 program by August 2011 (suggesting that the conservation measure had been implemented prior to or during the 2011 growing season). Comparisons were made for approximately 51% of participating fields with conservation measures implemented before the end of the 2011 growing season (45% of participating acres with implementation during 2011).

Additionally, for some fields MagMeter (magnetic flowmeter) delivery measurements were obtained. Where available, these measurements were compared to corresponding TruePoint delivery records.

3.3 RESULTS AND DISCUSSION

3.3.1 2010-2011 TruePoint Delivery Comparison

The following table (Table 1) provides a summary of 2010 and 2011 deliveries by conservation measure. For each measure, the total number of fields and corresponding acreage with available delivery data is provided, along with the 2010 and 2011 delivery totals. Finally, the difference between 2010 and 2011 deliveries is provided, expressed as acre-feet and inches.

Table 1. Comparison of 2010 and 2011 TruePoint Delivery Records for Selected Fields.

Conservation Measure	Fields Evaluated	% of Total	Acres	% of Total	True Point Deliveries, ac-ft (March - October)		Preliminary Conservation Estimate	
					2010	2011	ac-ft	inches
Drip Conversion	8	53%	379	54%	1093	719	374	11.8
Sprinkler Conversion	4	80%	220	90%	472	373	99	5.4
Tailwater Recovery	0	NA	0	NA	NA	NA	NA	NA
Grower Proposed	1	11%	25	10%	100	101	-1	-0.6
Irrigation Scheduling	7	30%	278	30%	996	721	275	11.9
Soil Moisture Monitoring	47	61%	1497	58%	5242	4695	547	4.4
Totals	67	51%	2399	45%	7902	6608	1294	6.5

Assuming that the sample within each conservation measure is representative of all fields implementing that measure during 2011, the total preliminary conservation estimate for the 2011 growing season is approximately 2,700 acre-feet. This estimate is subject to substantial uncertainty due to the following factors:

- Uncertainty in the accuracy of TruePoint delivery records
- Differences in groundwater use between 2010 and 2011 for participating fields with access to groundwater as a supplementary source of water
- Changes in crop water requirements at participating fields between 2010 and 2011 due to weather and/or crop changes

Additionally, it should be noted that for the conservation measures including physical improvements in particular, it is anticipated that conservation will be achieved over the full life of the improvements.

The following figures (Figures 1 through 4) show the individual field results for each conservation measure with more than 1 participating field with available delivery data. As expected, differences in water use between 2010 and 2011 vary widely among fields, with some fields using more water in 2011 than 2010 based on the available records. Due to the large variability among fields, it is anticipated that overall estimates of conserved water amounts will improve as the number of field participating in the Program increases, as the Program continues over multiple years, and as TP delivery records improve.

Figure 1. Difference in TruePoint Deliveries between 2010 and 2011 Growing Seasons (March – October) for Fields Implementing Drip Conversion, Inches.

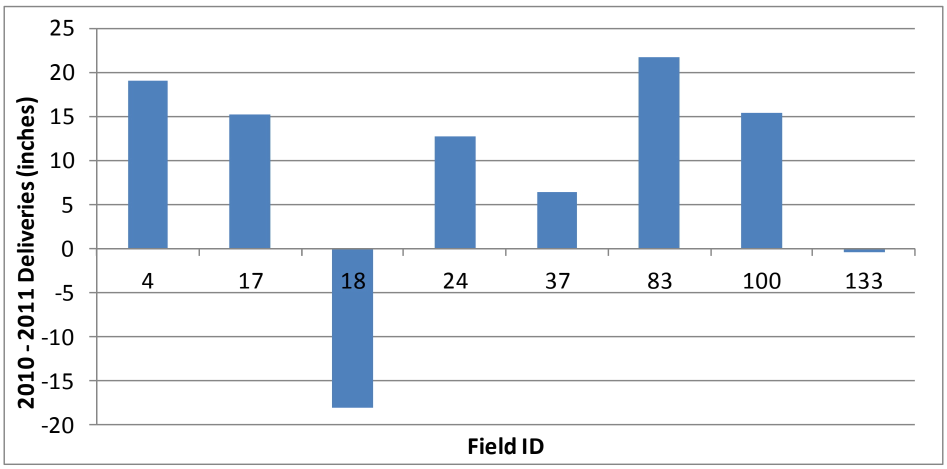


Figure 2. Difference in TruePoint Deliveries between 2010 and 2011 Growing Seasons (March – October) for Fields Implementing Sprinkler Conversion, Inches.

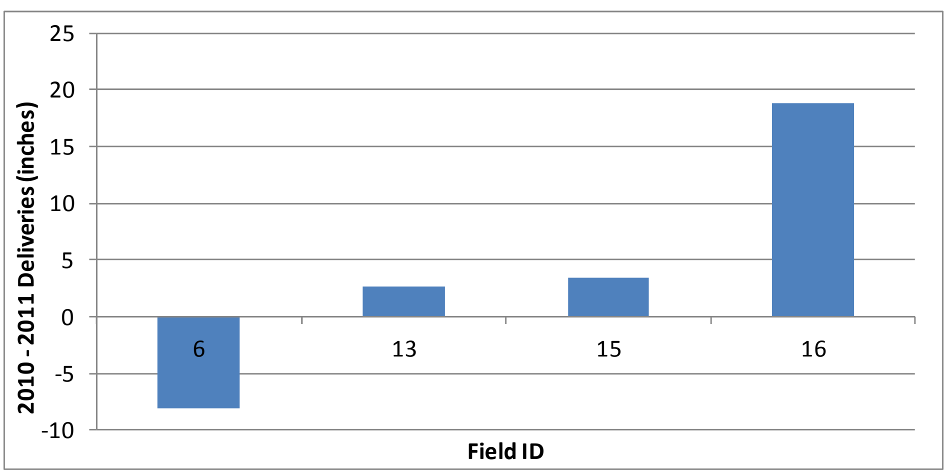


Figure 3. Difference in TruePoint Deliveries between 2010 and 2011 Growing Seasons (March – October) for Fields Implementing Irrigation Scheduling, Inches.

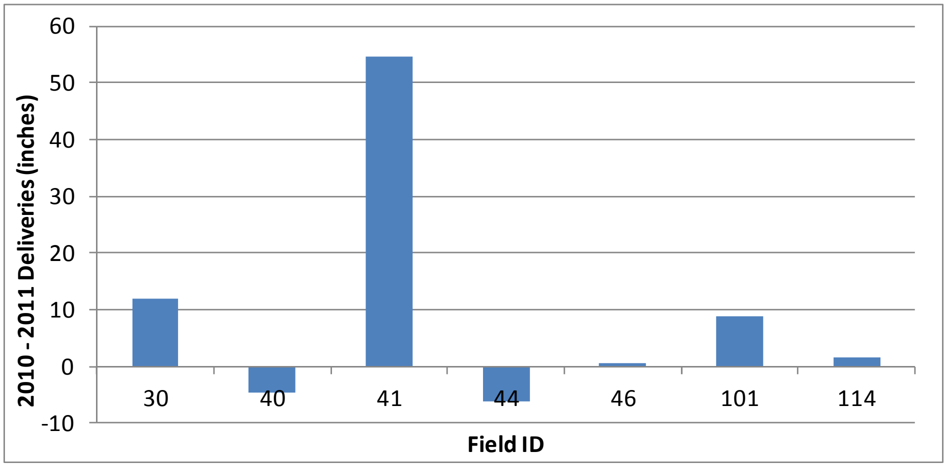
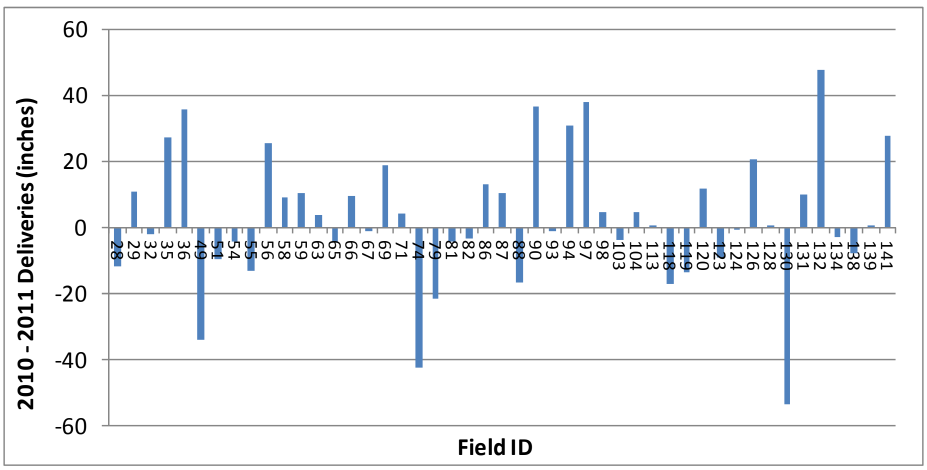


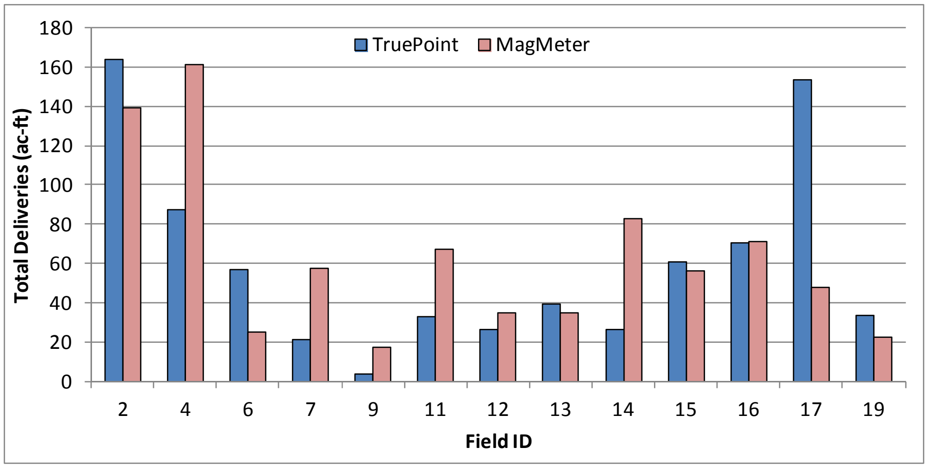
Figure 4. Difference in TruePoint Deliveries between 2010 and 2011 Growing Seasons (March – October) for Fields Implementing Moisture Monitoring, Inches.



3.3.2 2011 TruePoint and Magnetic Flowmeter Comparison

TruePoint and magnetic flowmeter data for 2011 are shown in Figure 5. As indicated, differences vary widely between TruePoint and MagMeter delivery amounts. Overall, the total TruePoint delivery volume of 776 acre-feet is 42 acre-feet less than the total MagMeter delivery volume of 818 acre-feet, a 5% overall difference.

Figure 5. Comparison of TruePoint and Magnetic Flowmeter Delivery Volumes.



3.4 REFERENCES

AWMC. 2004. Monitoring and Verification On Farm. Available at http://www.agwatercouncil.org/images/stories/monitoring_and_verification_on_farm.pdf

ATTACHMENT A. PARTICIPANT SURVEY FORM

SOUTH SAN JOAQUIN IRRIGATION DISTRICT

2011 ON-FARM WATER CONSERVATION PROGRAM

PARTICIPANT SURVEY

JULY 2012

OVERVIEW

The District desires to evaluate its On-Farm Water Conservation Program. As part of this evaluation, the District is interested in obtaining feedback from Program participants regarding their experience with the Program and water conservation and other benefits they have realized as a result of participation. This survey includes a series of questions designed to gather valuable feedback regarding the Program.

The District is hoping you can take time out of your busy schedule to fill out the survey and help us with our conservation efforts. After you have completed the survey, please return it in the enclosed self addressed stamped envelope.

Information provided is for District use only. No information will be shared with any third parties.

INSTRUCTIONS

Please take a few minutes to fill out the survey below. The questions are straightforward and should take no more than ten minutes to complete. We have also provided open-ended questions at the end of the survey for anyone wishing to provide additional thoughts on this topic**.** Please use the enclosed postage-paid envelope to return the survey directly to Attention: Julie Vrieling, South San Joaquin Irrigation District, Post Office Box 747, Ripon, CA 95366. **Please return your survey by August 15, 2012**.

If there are any questions that require more space to respond to, please feel free to use the back of the form or attach additional pages.

Thank you for your participation!

BACKGROUND INFORMATION

1. Of the total acreage you farm within SSJID, how many acres fall into the following crops? What irrigation methods do you use (please enter approximate acres as appropriate)?

	Flood	Sprinkler	Drip/Micro
a) Almonds	_____	_______	_________
b) Forage/feed crops (alfalfa, corn, oats, etc.)	_____	_______	_________
c) Vineyards	_____	_______	_________
d) Walnuts	_____	_______	_________
e) Other: ____________________________	_____	_______	_________
f) Other: ____________________________	_____	_______	_________
g) Other: ____________________________	_____	_______	_________

2. Is farming your full time occupation?
   a. ________ Yes
   b. ________ No

3. How many years of farming experience do you have in SSJID or elsewhere? ________

4. How do you decide when to irrigate? (Mark as many of the following as apply.)

	Flood	Sprinkler	Drip/Micro	
h)	____	____	____	Availability of surface water
i)	____	____	____	Soil moisture monitoring
j)	____	____	____	Crop evapotranspiration (ET) calculation
k)	____	____	____	Visual crop indicators (stress, wilting, etc.)
l)	____	____	____	Calendar/past experience
m)	____	____	____	Other: ___________________________________

5. How do you decide which flow rate to irrigate with? (Mark as many of the following as apply.)

	Flood	Sprinkler	Drip/Micro	
a)	____	____	____	Fixed by water delivery system constraints
b)	____	____	____	Turnout/irrigation system capacity
c)	____	____	____	Soil moisture monitoring
d)	____	____	____	Past experience
e)	____	____	____	Other: ___________________________________

6. How do you decide how long to irrigate? (Mark as many of the following as apply.)

Flood   Sprinkler   Drip/Micro

a) _____ _____ _____ Fixed by water delivery system constraints
b) _____ _____ _____ Soil moisture monitoring
c) _____ _____ _____ Water reaches end of field or close to end
d) _____ _____ _____ Target depth of water applied
e) _____ _____ _____ Past experience/always the same number of hours for a field
f) _____ _____ _____ Other: ______________________________________

7. Are there steps that SSJID could take to improve its level of service to help you irrigate more effectively or efficiently?

____

____

____

____

GENERAL PROGRAM FEEDBACK

8. How many fields did you enroll in the program during 2011, and which conservation measures did you implement?

	Conservation Measure	Fields	Acres
a.	Delivery measurement for pumped deliveries.	______	______
b.	Conversion from flood to sprinkler irrigation.	______	______
c.	Conversion from flood to drip/micro irrigation.	______	______
d.	Tailwater recovery systems to prevent runoff.	______	______
e.	Scientific irrigation scheduling.	______	______
f.	Soil moisture monitoring.	______	______
g.	Other: ____	______	______

9. Were you satisfied with the enrollment and selection process?
   a. _________ Yes
   b. _________ No

Please provide any suggestions to improve the enrollment and selection process: __________

____

____

____

10. Would you like to see additional conservation measures included?
    a. ________ Yes
    b. ________ No

Please describe any additional conservation measures you would like included: __________

____

____

____

11. Were the payment amounts and limits sufficient and appropriate to encourage your participation?
    a. ________ Yes
    b. ________ No

Please provide any additional feedback regarding Program incentive payments: __________

____

____

____

12. If the program continues to be offered, would you enroll/apply again?
    a. ________ Yes
    b. ________ No

Why or why not? ____

____

____

13. Please provide suggestions of how to make the program more attractive or effective:

____

____

____

____

SPECIFIC FEEDBACK REGARDING CONSERVATION MEASURE IMPLEMENTATION

14. For the fields that you entered into the program and conservation measures implemented, did you have prior experience with these conservation measure(s) on other of your fields?
    a. ________ Yes
    b. ________ No

Please describe: ____

____

____

15. Did the timing of Program enrollment and selection allow you to implement the conservation measure(s) in time for the 2011 growing season?
    a. ________ Yes
    b. ________ No

Please explain: ____

____

____

16. Did conservation measure implementation result in less water use for the enrolled field(s)?
    a. ________ Yes
    b. ________ No

If possible, please explain how much less water was used: ____________________

____

____

17. Were there other benefits from the conservation measure, such as improved yields, labor savings, reduced energy costs, reduced chemical costs, or others?
    a. ________ Yes
    b. ________ No

Please describe the additional benefits including, if possible, an estimate of how much benefit was achieved:

____

____

____

18. Were the benefits less or more than expected?
    a. ________ About as expected
    b. ________ Less than expected
    c. ________ More than expected

Please explain: ____

____

____

____

19. Please describe any unexpected outcomes or implications of participating in the Program:

____

____

____

____

20. Please share any additional feedback regarding the Program: ____________________

____

____

____

____

21. Please provide your name and contact information below (Optional):

Name: ____

Address: ____

Daytime Phone Number: ____

<u>Please return your survey to Julie Vrieling by August 15, 2012.</u> *If you have any questions regarding this survey or the overall Conservation Program, please contact Julie Vrieling at (209)249-4675 or jvrieling@ssjid.com. Thank you for your involvement, we appreciate your participation.*

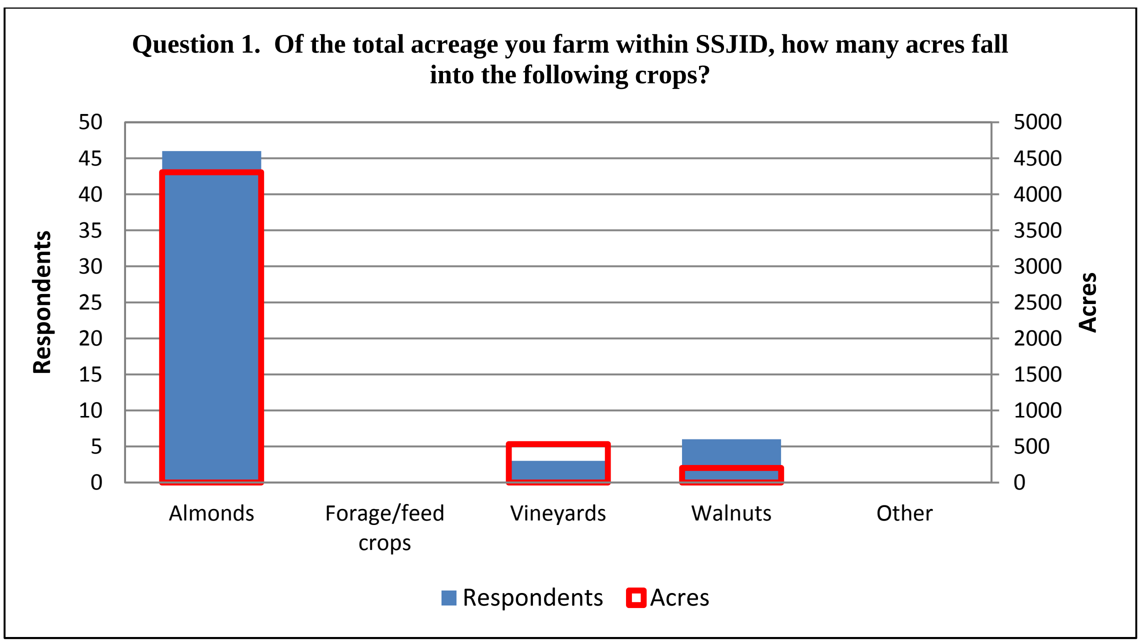
ATTACHMENT B. DETAILED REVIEW OF SURVEY RESPONSES AND INDIVIDUAL COMMENTS FROM PARTICIPANT SURVEY

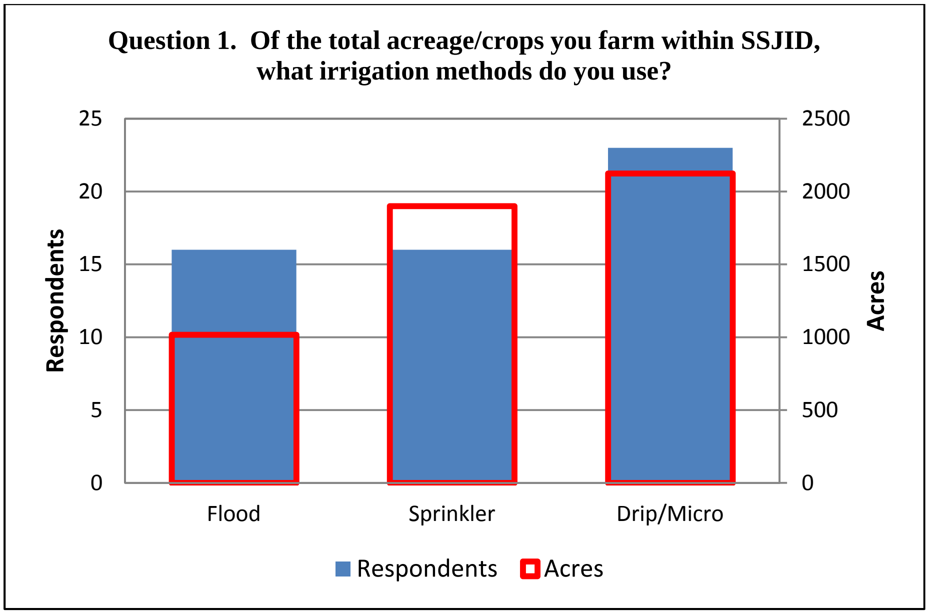
DETAILED REVIEW OF SURVEY RESULTS

Background Information

Question 1. Of the total acreage you farm in SSJID, how many acres fall into the following crops? What irrigation methods do you use?

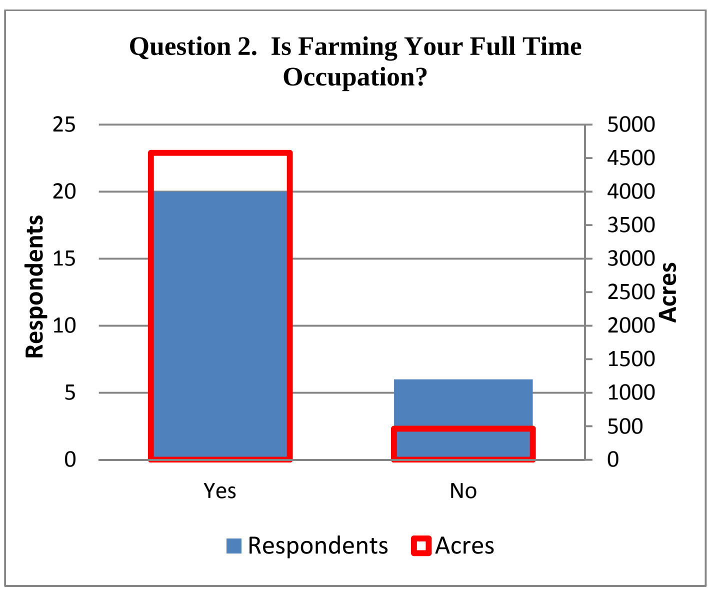
Crop	Method	Number of Respondents	% of Respondents	Acres	% of Respondent Acres
Almonds	Flood	13	50%	693	14%
Almonds	Sprinkler	14	54%	1798	36%
Almonds	Drip/Micro	19	73%	1815	36%
Forage/feed crops	Flood	0	0%	0	0%
Forage/feed crops	Sprinkler	0	0%	0	0%
Forage/feed crops	Drip/Micro	0	0%	0	0%
Vineyards	Flood	1	4%	308	6%
Vineyards	Sprinkler	0	0%	0	0%
Vineyards	Drip/Micro	2	8%	224	4%
Walnuts	Flood	2	8%	16	0%
Walnuts	Sprinkler	2	8%	101	2%
Walnuts	Drip/Micro	2	8%	85	2%
Other	Flood	0	0%	0	0%
Other	Sprinkler	0	0%	0	0%
Other	Drip/Micro	0	0%	0	0%





Question 2. Is farming your full time occupation?

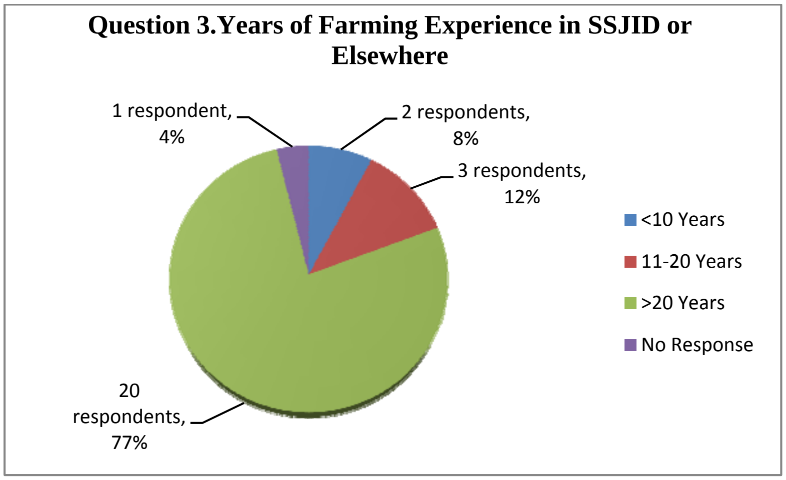
20 respondents (77% of respondents representing 4,577 respondent acres) are full time farmers while 6 respondents (23% of respondents representing 463 respondent acres) indicate that farming is not their full time occupation. All respondents provided an answer to this question.

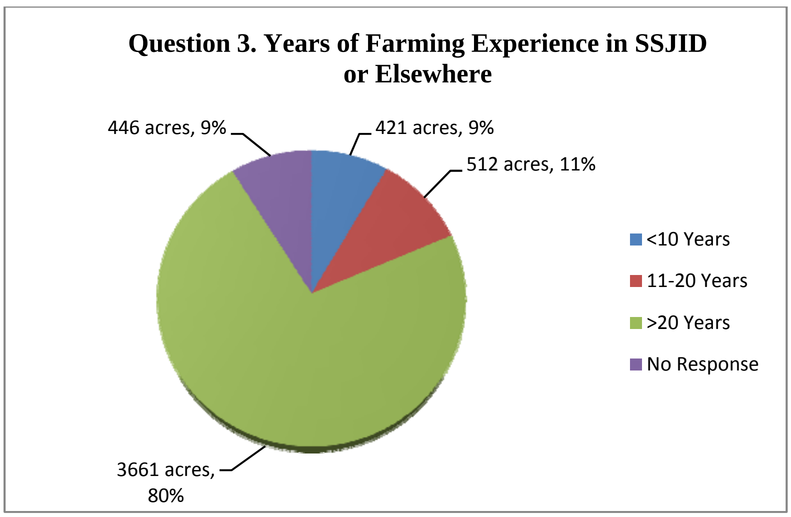


Question 3. How many years farming experience do you have in SSJID or elsewhere?

- 2 respondents (8% of respondents representing 421 respondent acres) indicated they had less than 10 years farming experience.
- 3 respondents (12% of respondents representing 512 respondent acres) indicated they had between 11 and 20 years of farming experience.

- 20 respondents (77% of respondents representing 3661 respondent acres) indicated they had more than 20 years of farming experience.
- 1 respondent (4% of respondents representing 446 respondent acres) did not provide a response to this question.





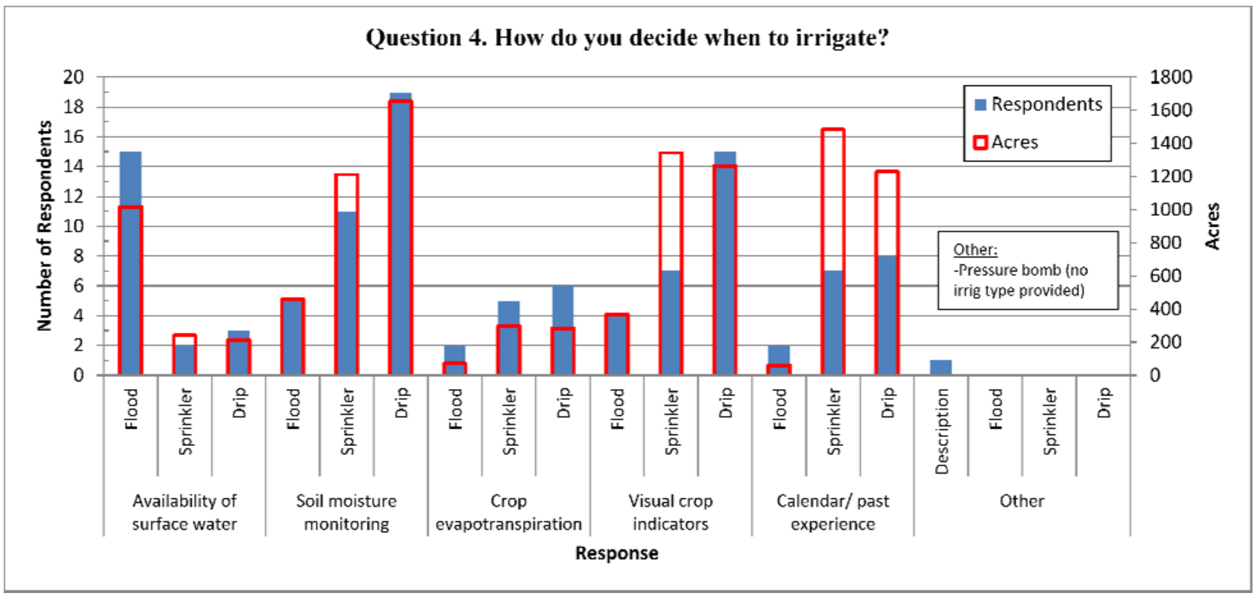
Question 4. How do you decide when to irrigate?

- Flood
  - 15 respondents (58% of respondents representing 1,017 acres) decide when to flood irrigate based on availability of surface water.
  - 5 (19% of respondents representing 458 acres) use soil moisture monitoring.
  - 2 (8% of respondents representing 70 acres) use crop evapotranspiration data.
  - 4 (15% of respondents representing 368 acres) use visual crop indicators.
  - 2 (8% of respondents representing 60 acres) use calendar/past experience.
- Sprinkler
  - 2 respondents (8% of respondents representing 240 acres) decide when to sprinkler irrigate based on availability of surface water.

- o 11 (42% of respondents representing 1,212 acres) use soil moisture monitoring.
- o 5 (19% of respondents representing 296 acres) use crop evapotranspiration data.
- o 7 (27% of respondents representing 1,343 acres) use visual crop indicators.
- o 7 (27% of respondents representing 1,483 acres) use calendar/past experience.

- Drip/Micro
  - o 3 respondents (12% of respondents representing 213 acres) decide when to drip/micro irrigate based on availability of surface water.
  - o 19 (73% of respondents representing 1,654 acres) use soil moisture monitoring.
  - o 6 (23% of respondents representing 285 acres) use crop evapotranspiration data.
  - o 15 (58% of respondents representing 1,265 acres) use visual crop indicators.
  - o 8 (31% of respondents representing 1,228 acres) use calendar/past experience.

1 respondent indicated using other methods including leaf or stem water potential (e.g. pressure bomb) to decide when to irrigate, but no irrigation type was indicated and so it was not categorized.

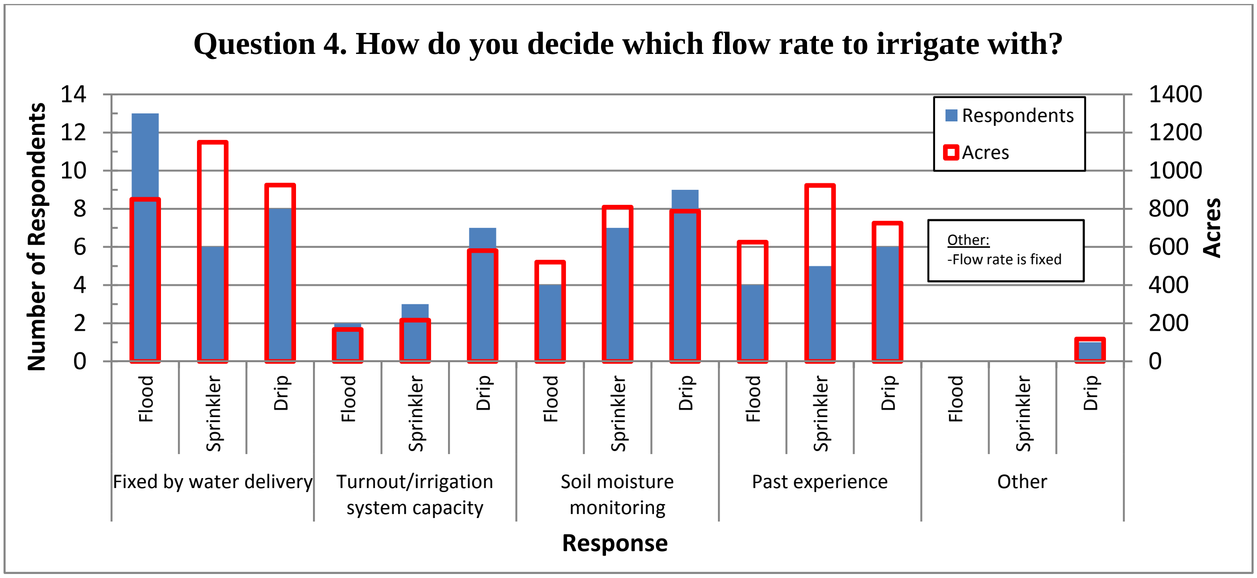


Question 5. How do you decide which flow rate to irrigate with?

- Flood
  - o 13 respondents (50% of respondents representing 850 acres) decide which flow rate to flood irrigate with based on fixed water delivery system constraints.
  - o 2 (8% of respondents representing 167 acres) are limited to turnout/irrigation system capacity.
  - o 4 (15% of respondents representing 520 acres) use soil moisture monitoring data.
  - o 4 (15% of respondents representing 625 acres) use past experience.
  - o 0 (0% of respondents representing 0 acres) decide which flow rate to flood irrigate with based on “other” methods.
- Sprinkler
  - o 6 respondents (23% of respondents representing 1149 acres) decide which flow rate to sprinkler irrigate with based on fixed water delivery system constraints.

- 3 (12% of respondents representing 216 acres) are limited to turnout/irrigation system capacity.
- 7 (27% of respondents representing 809 acres) use soil moisture monitoring data.
- 5 (19% of respondents representing 923 acres) use past experience.
- 0 (0% of respondents representing 0 acres) decide which flow rate to sprinkler irrigate with based on "other" methods.

- Drip/Micro
  - 8 respondents (31% of respondents representing 924 acres) decide which flow rate to drip/micro irrigate with based on fixed water delivery system constraints.
  - 7 (27% of respondents representing 581 acres) are limited to turnout/irrigation system capacity.
  - 9 (35% of respondents representing 788 acres) use soil moisture monitoring data.
  - 6 (23% of respondents representing 725 acres) use past experience.
  - 1 (4% of respondents representing 117 acres) decide which flow rate to drip/micro irrigate with based on "other" methods.



Question 6. How do you decide how long to irrigate?

Flood Irrigation

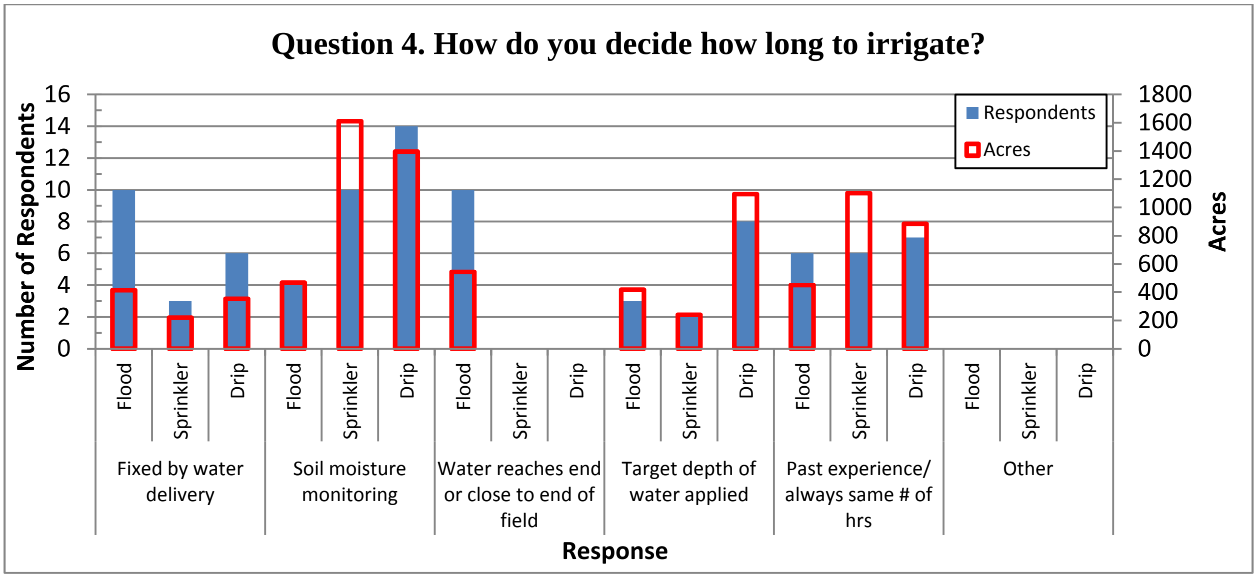
- 10 respondents (38% of respondents representing 415 acres) decide how long to flood irrigate based on water delivery system constraints.
- 4 (15% of respondents representing 468 acres) use soil moisture monitoring.
- 10 (38% of respondents representing 544 acres) finish irrigating when water reaches end of field or close to end.
- 3 (12% of respondents representing 418 acres) finish irrigating when a target depth of applied water is achieved.
- 6 (23% of respondent representing 451 acres) use past experience/always the same # of hours.

Sprinkler Irrigation

- 3 respondents (12% of respondents representing 220 acres) decide how long to sprinkler irrigate based on water delivery system constraints.
- 4 (15% of respondents representing 468 acres) use soil moisture monitoring.
- 2 (8% of respondents representing 240 acres) finish irrigating when a target depth of applied water is achieved.
- 6 (23% of respondent representing 1,101 acres) use past experience/always the same # of hours.

Drip/micro Irrigation

- 6 respondents (23% of respondents representing 353 acres) decide how long to drip/micro irrigate based on water delivery system constraints.
- 14 (54% of respondents representing 1,395 acres) use soil moisture monitoring.
- 8 (31% of respondents representing 1,094 acres) finish irrigating when a target depth of applied water is achieved.
- 7 (27% of respondent representing 884 acres) use past experience/always the same # of hours.



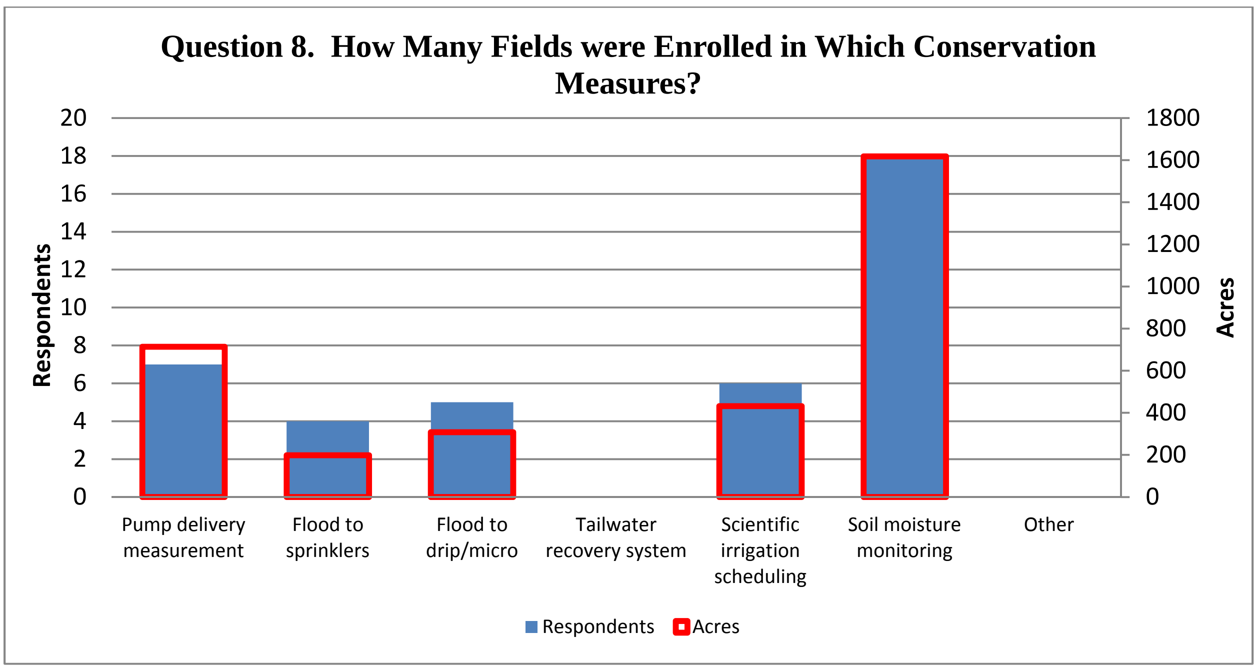
Question 7. Are there steps that SSJID could take to improve its level of service to help you irrigate more effectively or efficiently?

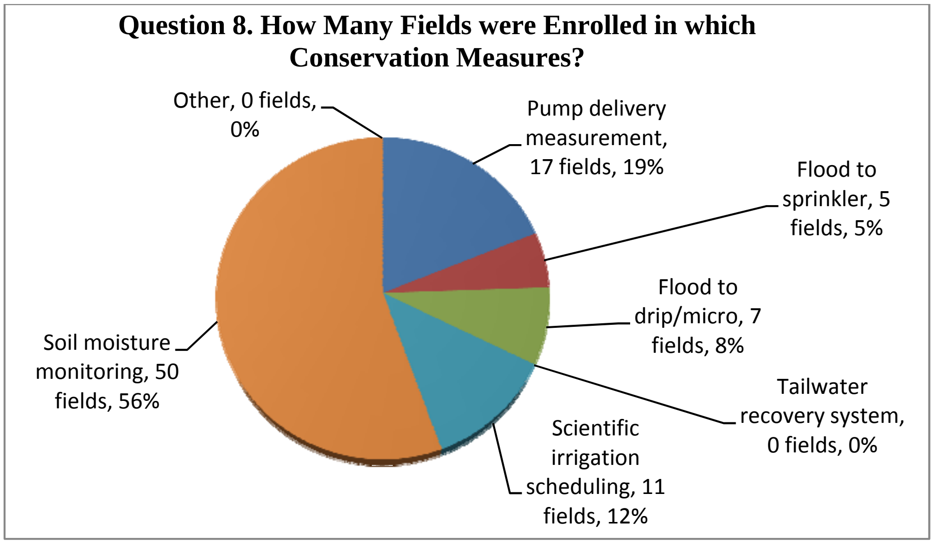
Responses to Question 7 are provided as an attachment to this summary. Key themes regarding steps that SSJID could take to improve its level of service included increased flexibility in irrigation frequency, installation of a District-wide pressurized pipeline system and filtration of District water.

General Program Feedback

Question 8. How many fields did you enroll in the program during 2011, and which conservation measures did you implement?

Conservation Measure	Fields	% of Fields	Acres	% of Acres	# of Respondents	% of Respondents
Pump delivery measurement	17	19%	714	22%	7	27%
Flood to sprinklers	5	6%	198	6%	4	15%
Flood to drip/micro	7	8%	308	9%	5	19%
Tailwater recovery system	0	0%	0	0%	0	0%
Scientific irrigation scheduling	11	12%	432	13%	6	23%
Soil moisture monitoring	50	56%	1618	49%	18	69%
Other	0	0%	0	0%	0	0%





Question 9. Were you satisfied with the enrollment and selection process?

- 24 respondents (92% of respondents representing 4,822 respondent acres) indicated they were satisfied with the enrollment process.
- No respondents indicated they were dissatisfied with the process
- 2 respondents (8% of respondents representing 218 respondent acres) did not answer this question
- Comments regarding Question 9 are provided as an attachment to this summary.

Question 10. Would you like to see additional conservation measures included?

- 7 respondents (27% of respondents representing 1,388 respondent acres) indicated they would like to see additional conservation measures included
- 11 respondents (42% of respondents representing 2,650 respondent acres) indicated they were satisfied with the current conservation measures included
- 8 respondents (31% of respondents representing 1,002 respondent acres) did not answer this question
- Responses to Question 10 are provided as an attachment to this summary. A common theme amongst suggested additional conservation measures was pressurized pipeline options.

Question 11. Were the payment amounts and limits sufficient and appropriate to encourage your participation?

- 24 respondents (92% of respondents representing 4,723 respondent acres) indicated they were satisfied with the payment amounts and limits.
- No respondents indicated they were dissatisfied with the payment amounts or limits
- 2 respondents (8% of respondents representing 317 respondent acres) did not answer this question
- Responses to Question 11 are provided as an attachment to this summary.

Question 12. If the program continues to be offered, would you enroll/apply again?

- 23 respondents (88% of respondents representing 4,683 respondent acres) indicated that they would enroll in the program again if it were offered.
- 1 respondent (4% of respondents representing 135 respondent acres) indicated that they would not enroll in the program again. Respondent commented that he already had all of his acreage enrolled in the Program.
- 2 respondents (8% of respondents representing 222 respondent acres) did not answer this question
- Responses to Question 12 are provided as an attachment to this summary

Question 13. Please provide suggestions of how to make the program more attractive or effective?

- Responses to Question 13 are provided as an attachment to this summary.

Specific Feedback Regarding Conservation Measure Implementation

Question 14. For the fields that you entered into the program and conservation measures implemented, did you have prior experience with these conservation measure(s) on other of your fields?

- 13 respondents (50% of respondents representing 2,552 respondent acres) indicated that they did have prior experience with the conservation measures implemented during 2011
- 12 respondents (46% of respondents representing 2,371 respondent acres) indicated that they did not have prior experience with the conservation measures they implemented during 2011
- 1 respondent (4% of respondents representing 117 respondent acres) did not answer this question
- Responses to Question 14 are provided as an attachment to this summary

Question 15. Did the timing of Program enrollment and selection allow you to implement the conservation measure(s) in time for the 2011 growing season?

- 23 respondents (88% of respondents representing 4,095 respondent acres) indicated that the Program timing allowed sufficient time to implement the measures for the 2011 growing season.
- 1 respondent (4% of respondents representing 800 respondent acres) indicated that Program timing limited their ability to implement the measures for the 2011 growing season.
- 2 respondents (8% of respondents representing 145 respondent acres) did not answer this question.
- Responses to Question 15 are provided as an attachment to this summary.

Question 16. Did conservation measure implementation result in less water use for the enrolled field(s)?

- 14 respondents (54% of respondents representing 3,742 respondent acres) indicated that implemented measures resulted in less water use on the enrolled field(s).

- 7 respondents (27% of respondents representing 664 respondent acres) indicated that the implemented measures did not result in less water use
- 2 respondents (8% of respondents representing 260 respondent acres) were undecided as to whether the measures resulted in less water use.
- 3 respondents (12% of respondents representing 374 respondent acres) did not answer this question.
- Responses to Question 16 are provided as an attachment to this summary.

Question 17. Were there other benefits from the conservation measure, such as improved yields, labor savings, reduced energy costs, reduced chemical costs, or others?

- 12 respondents (46% of respondents representing 2,465 respondent acres) indicated that implemented measures resulted in additional benefits.
- 6 respondents (23% of respondents representing 1,663 respondent acres) indicated that implemented measures did not result in additional benefits.
- 1 respondent (4% of respondents representing 85 respondent acres) were undecided as to whether the measures resulted in other benefits.
- 7 respondents (27% of respondents representing 827 respondent acres) did not answer this question.
- Responses to Question 17 are provided as an attachment to this summary.

Question 18. Were the benefits less or more than expected?

- 19 respondents (73% of respondents representing 4,116 respondent acres) indicated that the benefits were about as expected.
- No respondents indicated that the benefits were less than expected.
- 5 respondents (19% of respondents representing 744 respondent acres) indicated that the benefits were more than expected.
- 2 respondents (8% of respondents representing 180 respondent acres) did not answer this question.
- Responses to Question 18 are provided as an attachment to this summary.

Question 19. Please describe any unexpected outcomes or implications of participating in the Program.

- Responses to Question 19 are provided as an attachment to this summary.

Question 20. Please share any additional feedback regarding the Program.

- Responses to Question 20 are provided as an attachment to this summary.

INDIVIDUAL COMMENTS FROM PARTICIPANT SURVEY

Responses to Question 7 Regarding Steps that SSJID Could Take to Assist Growers in Irrigating More Effectively or Efficiently

- General satisfaction with existing service
    - Satisfactory at this point

- Current process has worked for our farms, it has been efficient and service has been good
- No
- It's fine

- Provide increased flexibility in irrigation frequency
  - Times to water more flexible
  - Make water available throughout growing season
  - If I could receive SSJID water more frequently I would use it exclusively and not pump ground water
  - Provide water on shorter intervals
  - More flexibility of flood irrigation water
  - We need to break away from the old timing of irrigation (10 or 20 days) and continue to get more into the 21st century w/ the rest of the world
  - Make drip applications have more flexibility in water availability
  - Make flood water available more often, otherwise all works nicely
- Filtration of water by District
  - Make sure water is always clean. They (SSJID) do pretty well except sometimes at beginning and end of irrigation season
- Desire for a pressurized system
  - Division 9's pressure system has been great
  - Pressurized line
  - Pressurized system
  - Fix the soil moisture monitoring devices in Division 9

Comments on Question 9 Regarding the Enrollment and Selection Process of the Program

- Respondents who were content with the process
  - All was fine, ladies in office very helpful and nice to deal with
  - Program is run well, user friendly
  - I feel that it has worked well so far

Comments on Question 10 Regarding the Inclusion of Additional Conservation Measures

- Suggestions of Additional Conservation Measures
  - More pressure lines to switch from flood to drip
  - Pressurized system
  - Pipe the water from the dam to create pressure, not w/ pumps
  - Scientific approaches
  - More flexibility of flood water

Comments on Question 11 Regarding the Payment Amounts and Limits of the Program

- Comments
  - Everything is fine
  - More is always better
  - Very pleased
  - Very good partnership between grower and District

Responses to Question 12 Regarding Growers Continued Enrollment in Program(s)

- Growers who would enroll again
  - It is very important to know the water profile in your soil
  - I would like to talk about removing impact sprinklers and switch to drip on 2 or 3 fields
  - It is a great tool to use and any help to do so is appreciated
  - Micro is much more efficient and help with expense is encouraging
  - Easy to work with
  - Conservation and soil moisture information are important
  - I like free money
  - Very helpful in determining when and how much to water
  - Save water
- Growers who would **<u>not</u>** enroll again
  - No more acreage left in District not already enrolled

Responses to Question 13 Regarding Making the Program more Attractive or Effective

- Responses
  - Free
  - Everything is fine, maybe make less rules. I was going to use SSJID to help with a drip system in 2013 but found it a hassle and switched to a well on that ranch
  - Have water delivery match the performance of the installed system. It should (may) be possible to make some progress by changing the culture. Some will take and develop vision to make it happen
  - Once I implement conservation, make water more available to those that conserve vs. those who do not

Responses to Question 14 Regarding Prior Experience with the Conservation Measures that were Implemented

- Prior experience
  - I have all 3 kinds and that should benefit SSJID also. Anybody else do that for you?
  - I worked with NRCS in 2007 on a system already
  - I have these on the fields with program
  - Micros on almost all trees, much more efficient
  - Micros
  - Neutron probe before it was offered by SSJID
  - Changed from flood to sprinklers
  - Drip…???, couldn't read the rest
  - Farming was done by visual and soil moisture in past
  - NRCS program
  - EQIP program
  - Used Jacobsen Pacific in our fields on the west side

Responses to Question 15 Regarding Timing of Program to Allow Implementation of measure(s) in Time for the 2011 Season

- Comments

- We signed up to monitor early and company was able to install their pipes
    - I was already in the program on my own
    - Got OK late, started project in July so ran system for 2 months
    - Soil moisture monitoring in place from last year
    - System was installed before summer
    - SSJID program is more fluid and works faster than EQUIP program

Responses to Question 16 Regarding the Impact of Conservation Measures on Water Use

- Using less water than before
    - Didn't flood young trees and waste water
    - Newly planted orchard so less water required
- Using more water than before
    - I found I was under watering ~25% so I increased watering to once a week on 1 field of sprinklers
    - I used more water
- Not sure of the impact
    - That is impossible to determine as there was no check
    - Don't know
- Other
    - Not really sure any less, but timing of applications has resulted in healthier orchards
    - Have no idea, no run off on micros vs. flood
    - Energy bill about the same
    - Hard to say how much but with better tools you make better decisions
    - Flood to micros
    - They were new orchards with drip instead of flood, easier to manage amount of water applied
    - Not measurable, but was able to water less often
    - By using scientific irrigation monitoring

Responses to Question 17 Regarding the Other Benefits of Implementing Conservation Measures

- Improved yields and/or crop health
    - Improved yields say it all
    - Yes – trees and crop are improved but my costs went up b/c of more pumping time, also more weed control
    - I also gained improved yields, energy costs went up, also labor
    - I have healthier trees that I believe will be more productive. I also believe that my fertilizer is used more efficiently by keeping it in the root zone
    - Possible improved yields
    - Trees are stronger and healthier, uniform fields
    - I'm hoping for improved yields but yet to be seen
- Operability of system and/or energy use
    - Energy
    - Improved water timing, trees less stressed
    - Easy to turn on sprinklers
    - Less labor and chemicals

- Better availability of water, better water quality, availability to measure water used

Responses to Question 18 Regarding Whether the Benefits were More or Less than Expected

- Comments
  - As expected now, more than expected later on
  - Benefits have been helpful
  - My crops have been going up since being on the program
  - No run off
  - Irrigation decision before were made by observation and experience, moisture monitoring game me much more information
  - Uniform growth in fields
  - Trees 1 yr. old

Responses to Question 19 Regarding Unexpected Outcomes or Implications of Participating in the Program

- Comments
  - I think I have healthier orchards and maybe better crops in the future
  - Beginning of season showed District didn't understand difference between various irrigation methods and water use, rain helped management
  - Better appreciation for District staff, better understanding of District
  - Monitoring, more knowledge of what goes on
  - Dealing with 3rd party company a little difficult, will look into other companies associated with program
  - None
  - Water not always available, water should be more accessible to those that conserve
  - Soil moisture testing was and is a disaster (Division 9)

Responses to Question 20 Regarding Additional Feedback for Program

- Comments
  - It's a very good program and all help is very much appreciated
  - I think it's great, no one can say agriculture is wasting water
  - It is impossible to obtain all the benefits of a state of the art irrigation system with a delivery system and philosophy developed in the early 1900s; I appreciate all your help during the 2011 and 2012 programs
  - Good program and good results
  - Very happy with program
  - Again, if I could access your water more often, I would
  - I'm sure the program will help SSJID control its own destiny in the future. It will show we are good stewards of the water we control
  - The whole process was good, good people to work with

ATTACHMENT C. OUTLINE FOR FOCUSED INTERVIEWS

PARTICIPANT INTERVIEW OUTLINE

7/2/2012

OVERVIEW

SSJID desires to evaluate its On-Farm Water Conservation Program. As part of this evaluation, the District is interested in obtaining feedback from participants regarding their experience with the Program and water conservation and other benefits they have realized as a result of participation. This outline provides a series of topics anticipated for discussion as part of focused participant interviews. These interviews will include visits to fields that have implemented conservation measures as part of the Program.

BACKGROUND INFORMATION

- Crops grown
- Full time or part time farmer
- Age/years in farming
- Number of fields and acres managed
- Irrigation methods used
- Irrigation management practices
  - Basis for irrigation decisions (timing, amount, etc.)
  - Management aids employed (soil moisture sensors, visual indicators, ET calculations, etc.)
- General feedback regarding SSJID (level of service, flexibility, water quality)

GENERAL PROGRAM FEEDBACK

- Number of fields in program and conservation measures implemented
- Enrollment and selection process
- Conservation measure choices, flexibility and standards
- Payment amounts
- If the program continues to be offered, would you enroll/apply again? Why/why not?
- Do you have any suggestions to making the program more attractive or more effective?

SPECIFIC FEEDBACK REGARDING CONSERVATION MEASURE IMPLEMENTATION

- General information for participating field
  - Location and size

    - Crop and irrigation method
    - Conservation measure(s) implemented
    - Payment amount relative to implementation cost
- Experience with conservation measure on other fields
- Timing of implementation relative to the crop growing season
- Changes in irrigation practices before and after implementation. Able to quantify any less water use? Savings in irrigation costs (labor, energy, etc.)?
- Other benefits (yield benefits, less maintenance or labor, less chemicals)? Able to quantify?
- Any unexpected outcomes or implications?
- Less or more benefit than expected? Why?

ATTACHMENT D. PHOTOS FROM FOCUSED INTERVIEWS

New Pump and Filter Station and Drip Irrigated Almonds.

New On-Farm regulating Reservoir (approx. 7 acre-feet).

ADCON Soil Moisture and Weather Monitoring Station.

New Drip Irrigation System and Pump and Filter Station.

New Pump and Filter Station and Magnetic Flowmeter.

PureSense Soil Moisture and Irrigation System Operation Sensor.

New Solid Set Sprinkler System and Division 9 Dual Groundwater Surface Water Turnout.