ATTACHMENT 2 Project Justification

Att2_2015IRWM_ProJust_1of5

Eastern San Joaquin Region
2015 IRWM Implementation Grant Application

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Attachment 2 – Project Justification

Project Summary Table

Table 4 – 2015 IRWM Grant Solicitation Project Summary Table			
IRWM Project Element		**SSJID West Basin Water Reuse Project**	**SSJID On-Farm Water Conservation Program**
IR.1	Water supply reliability, water conservation, and water use efficiency	Yes	Yes
IR.2	Stormwater capture, storage, clean-up, treatment, and management	Yes	
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands		
IR.4	Non-point source pollution reduction, management, and monitoring	Yes	Yes
IR.5	Groundwater recharge and management projects	Yes	Yes
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users		
IR.7	Water banking, exchange, reclamation, and improvement of water quality	Yes	Yes
IR.8	Planning and implementation of multipurpose flood management programs		
IR.9	Watershed protection and management		
IR.10	Drinking water treatment and distribution		
IR.11	Ecosystem and fisheries restoration and protection		

Project Description #1: West Basin Water Reuse Project

Implementing Agency: South San Joaquin Irrigation District

Brief Description: Construction of new facilities to capture tail water flows and stormwater for reuse in a pressurized irrigation system conserving 10,000 acre-feet of water annually.

Expanded Description: The recent drought has elevated the stress on the District's water supplies. With ever growing water demands by agriculture, cities, industry, and the environment for a finite water supply, new water supplies need to be developed through increased storage and conservation.

Continuing SSJID's tradition of making the most beneficial use out of its agricultural deliveries, the District has designed and permitted the West Basin Water Reuse Project. The Project is the final component to the Division 9 Irrigation Enhancement Pilot Project that was awarded the best application of technology for agricultural water conservation by the International Committee on Irrigation and Drainage. The project will capture spill water, stormwater, and tail water flows and store the water in a reservoir before re-distributing it in a pressured irrigation system for reuse on 3,800 acres. The storage reservoir will have capacity of 37.5 acre-feet and will be equipped with a 14,500 gallon per minute pump station.

By expanding pressurized irrigation service to 700 acres, and adding new water reuse opportunities, the West Basin Water Reuse Project will increase the beneficial use of water resources for the region and allow 10,000 acre-feet of conserved water to be transferred to others, especially humanitarian transfers to disadvantaged communities in need. The Project's water reuse strategies include the conjunctive use of surface and groundwater supplies, the reuse of agricultural tailwater, stormwater, and potentially treated wastewater effluent. If these water reuse strategies are implemented, the stress on available water supplies will decrease. Freed up surface water can be made available for agricultural lands, groundwater recharge, potable and non-potable urban uses, and environmental maintenance. If these measures can reduce the District's water needs from New Melones Reservoir, even in droughts, then the possibility of water transfers to other agencies exists.

Implementation of this Project will also improve overall regional water quality. A performance evaluation of the District's Division 9 Irrigation Enhancement Pilot Project (built in 2012) shows reduced generation of tailwater, which poses the most significant water quality threat to the watershed. As spill water, stormwater, and tail water flows are directed to the storage reservoir, it will reduce non-point source pollution to the Stanislaus River, especially for nitrates found in fertilizers. Furthermore, the project makes it possible to service another 7,500 acres of farmland with pressurized service in the future. This will spur growers to convert from flood irrigation to sprinkler irrigation. Pressurized irrigation delivery improves nitrogen application efficiency and reduces nitrogen leaching into groundwater and surface water bodies. The project will also reduce farmers' reliance on groundwater pumping by increasing efficiency of surface water resources. Slow seepage from the storage reservoir will provide treatment and serve as a recharge point for groundwater supplies.

In 2015, the drought forced deliveries from the District's treatment plant to the cities of Tracy, Manteca, and Lathrop to be cut by 20%. In addition, deliveries were reduced to farmers to 36" of water, which will result in over 50% of the District's 2,000 growers not being delivered enough water to raise a full crop. The Stanislaus River and Sacramento-San Joaquin Delta are struggling as well to maintain healthy aquatic life and meet all of Delta Water Quality Objectives as detailed in the Bay-Delta Water Quality Control Plan. Recognizing that water resources must be used more efficiently, the District's West Basin Water Reuse Project advances the region toward becoming more drought resilient. The Project makes it possible to expand pressurized irrigation and reuse stormwater, drain and tailwater, and potentially even treated wastewater effluent from neighboring cities. SSJID will be able to maximize the beneficial use of the District's water resources by use of the best available technology to conserve water, protect water quality, and reduce groundwater pumping. The Project can demonstrate to other irrigation districts in the Central Valley how they can maximize "crop per drop" by being environmental stewards of limited water resources.

Project Description #2: On-Farm Conservation Program

Implementing Agency: South San Joaquin Irrigation District

Brief Description: Providing financial incentives to farmers to install efficient irrigation systems and measure water usage to reduce non-point source pollution runoff and conserve 2,700 af/yr.

Expanded Description: More now than ever the region needs farmers to install more efficient irrigation systems and implement advanced farming practices to conserve water and improve water quality. Agricultural water conservation is one of the most cost-effective alternatives to free up large amounts of water for other beneficial uses. In response, the South San Joaquin Irrigation District developed a water conservation program to promote and incentivize physical improvements to their growing operations. The program has conserved 8,100 acre feet in three years, and has decreased groundwater pumping, lowered energy consumption, and reduced nonpoint source pollution runoff. The SSJID Division 9 Irrigation Enhancement Project received international attention for its success in agricultural water conservation. By restarting the conservation program, it is expected another 2,700 acre feet per year will be conserved.

Beyond water conservation, this project has a direct impact on the water quality of surface water supplies. Water quality, particularly the runoff of agriculture irrigation into rivers, streams, and the Sacramento-San Joaquin Delta, is of increasing concern in the Central Valley of California. The main driver for nitrate accumulation in water resources is the use of fertilizers. As such, the agricultural industry is a stakeholder in the nitrate accumulation problem.

The primary On-Farm Conservation Program measure is conversion from flood irrigation to sprinkler irrigation which will improve water quality by decreasing the amount of nitrogen leaching into the groundwater and discharging to rivers and streams. The combination of conservation measures listed below substantially improves application and nutrient uptake efficiency, supported by the University of California's Nitrogen Hazard Index scoring methodology, thereby validating the water quality benefits to the groundwater aquifer and neighboring streams and rivers.

These conservation measures improve delivery measurement and comply with SBX7-7, conserve 12 inches of water per irrigated acre with conversion from flood to sprinkler irrigation, promote reuse and recycling with drainage relief options, reduce river diversion needs and reliance on flows to the Sacramento-San Joaquin Delta, and free up water for other beneficial uses including humanitarian water transfers to disadvantaged communities in need.

To conserve water and minimize water quality impairment due to conventional irrigation practices, SSJID is deeply committed to helping farmers make the switch to more efficient irrigation practices. The SSJID On-Farm Conservation Program will help fund the following physical improvements and best management practices:

<u>Delivery measurement for pumped deliveries</u> consists of installing a flow meter to measure SSJID water deliveries for existing or new pumped SSJID deliveries to a pressurized irrigation system. The estimated cost is $5,650 per location. District's cost share will be 80% of the actual cost, not to exceed $4,500.

<u>Conversion from flood to sprinkler or drip/micro irrigation</u> includes installation of the pump, filtration, mainlines, laterals, and emitters for the system. The estimated cost per cropped acre is $1,650. The District's cost share will be 50%, not to exceed $825 per cropped acre.

<u>Drainage relief</u> includes tail water recovery systems, land leveling, and the modifying of discharge valves. This conservation measure applies to any field for which tail water is produced during irrigation that drains back to the SSJID irrigation system. The estimated cost is $1,200 per cropped acre. The District's cost share will be 50%, not to exceed $600 per cropped acre with a maximum payment of $10,000 per grower for this measure.

<u>Scientific irrigation scheduling and soil moisture monitoring</u> determines the frequency, rate and duration of irrigation application needed to meet crop water requirements to minimize excess tail water. The estimated cost is $3,000 per field per season for scientific irrigation scheduling and $1,500 per field per season for soil moisture monitoring. The District will pay 50%, not to exceed $1,125 per field.

Regional and Project Map

Figure 1 - Regional Map: San Joaquin County

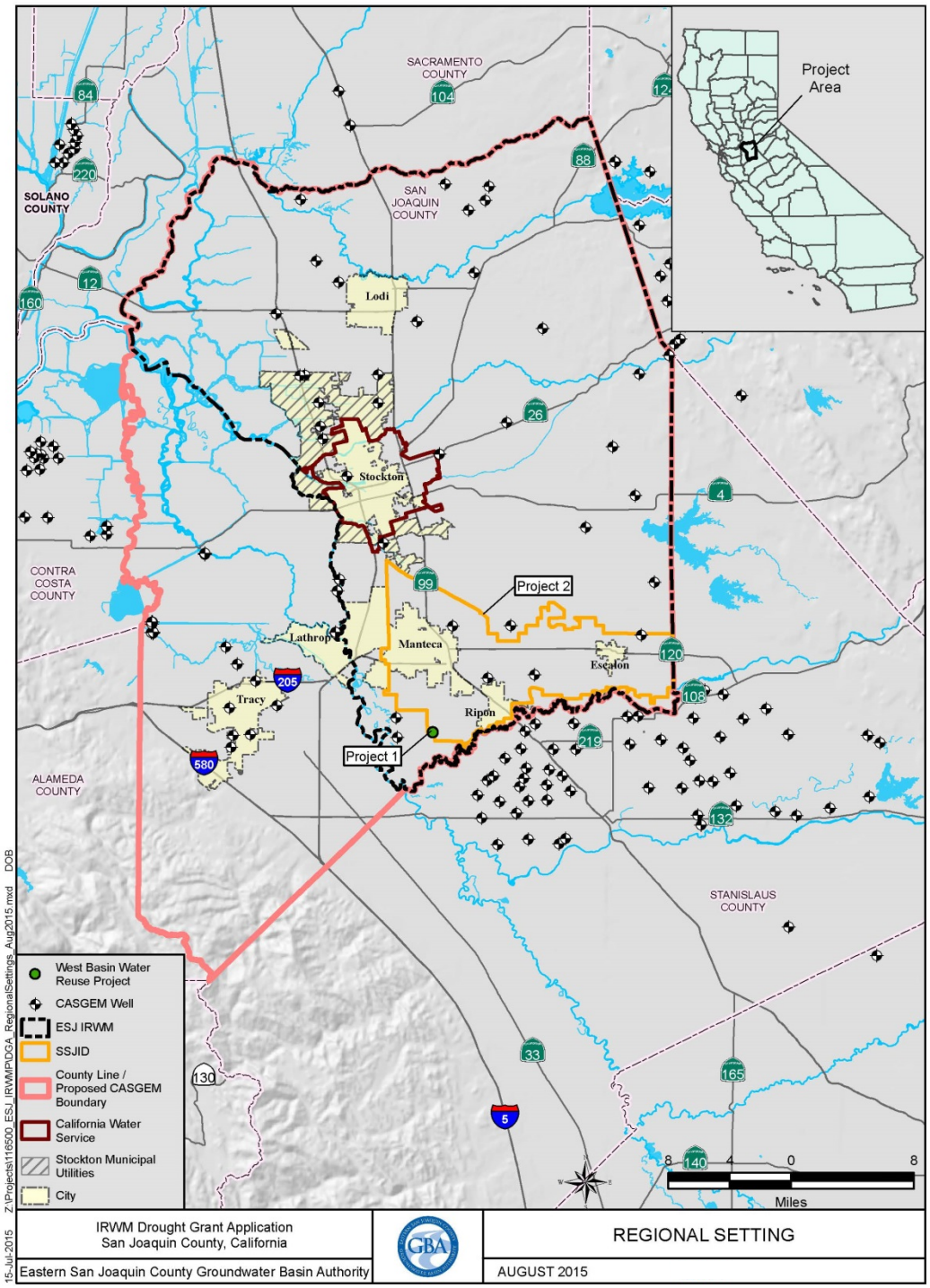


Figure 2 - SSJID Boundary Map

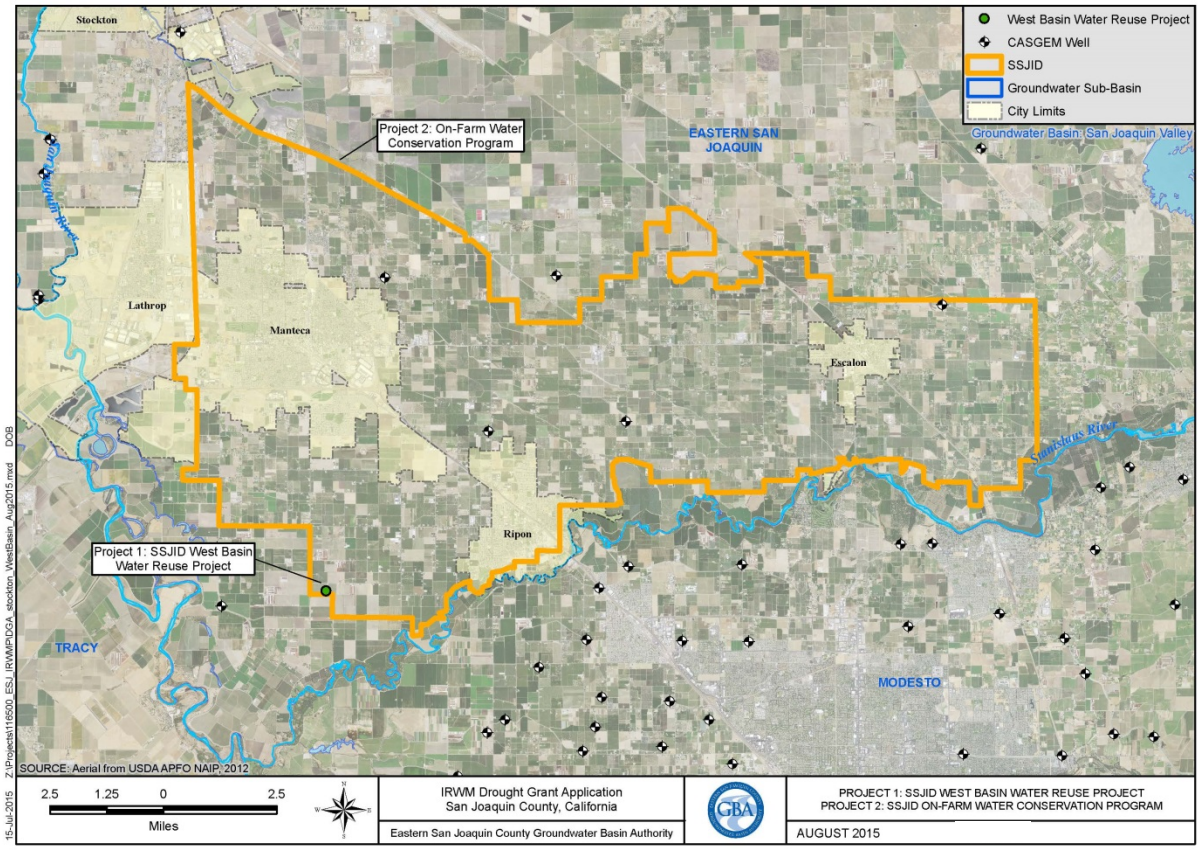


Figure 3 - West Basin Water ReUse Project Service Area

Figure 4 - West Basin Water Reuse Project Service Area

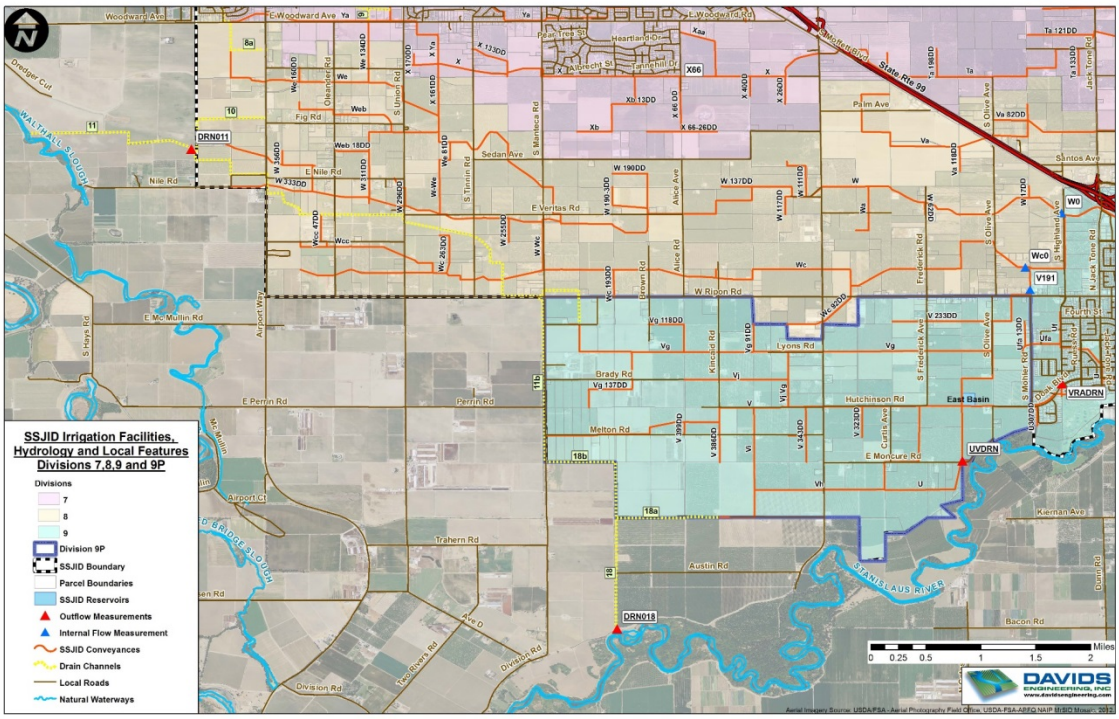


Figure 5 - Design of the West Basin Reuse Site Plan

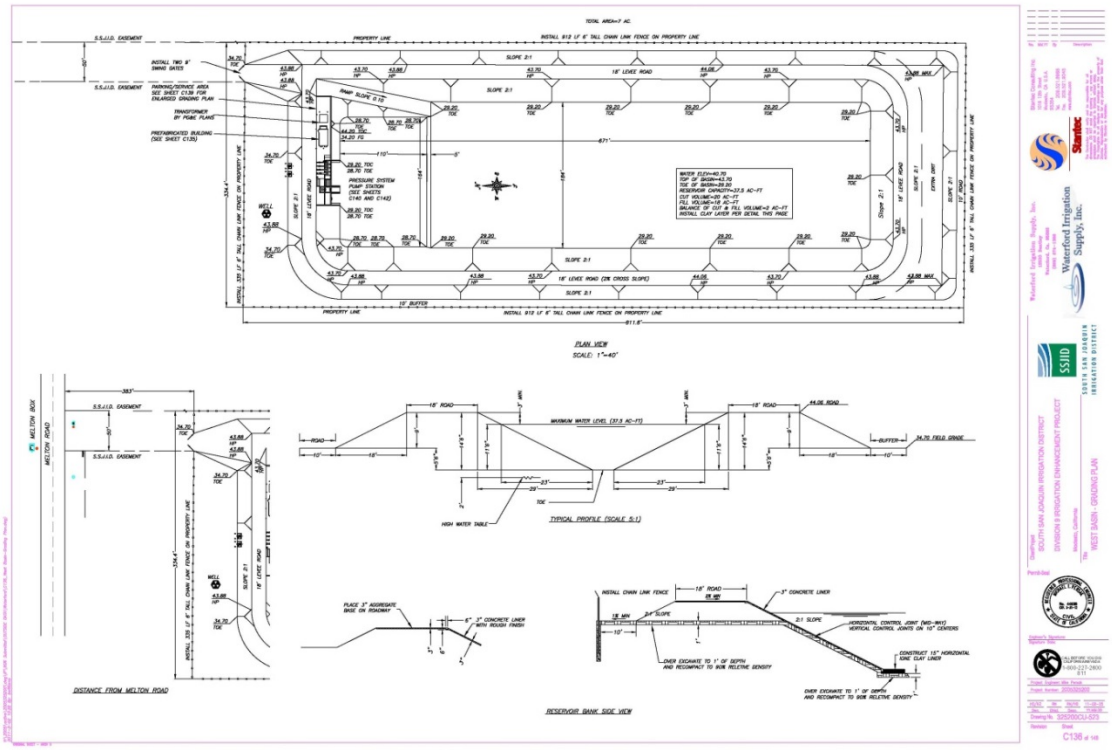
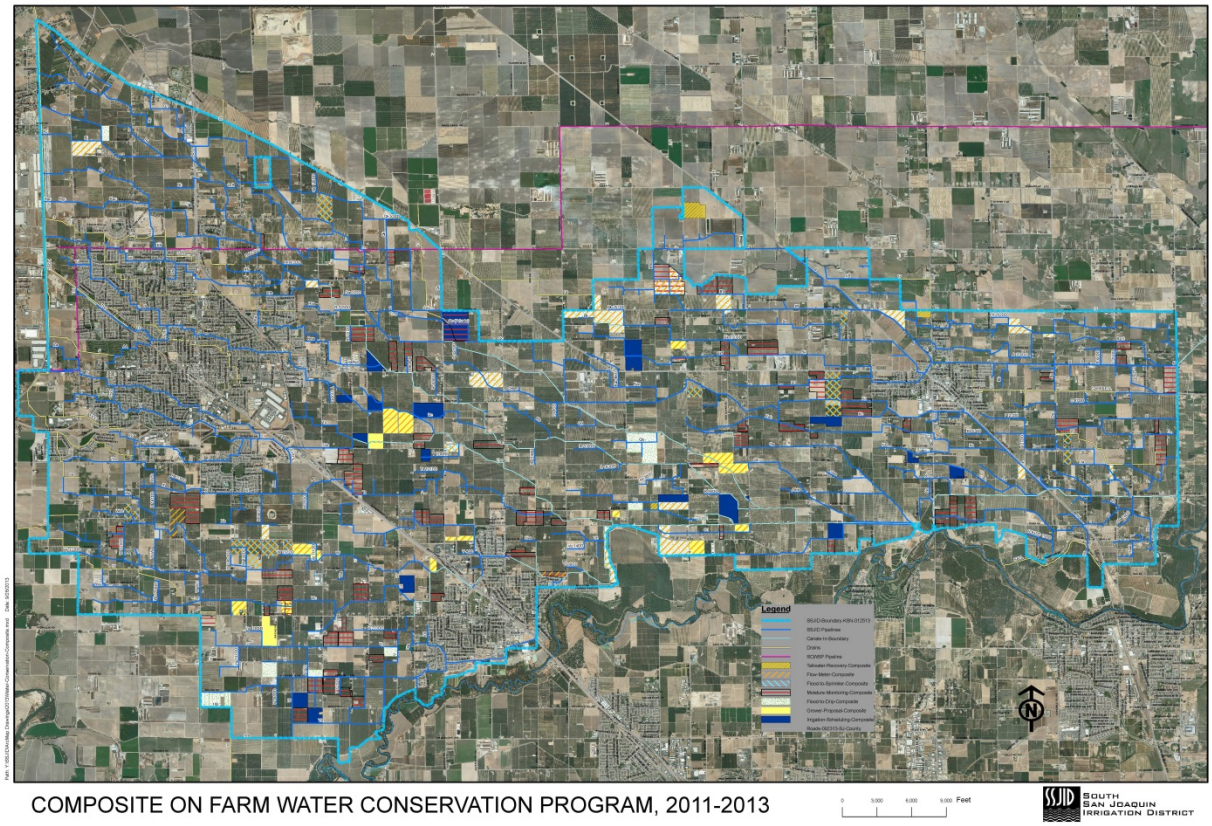


Figure 6 - Composite On-Farm Water Conservation Program Map



Project Physical Benefits

The West Basin Water Reuse Project will offer the following physical benefits:

- Water Conservation of 10,000 acre-ft. annually; ***(Primary Benefit)***
- Improved regional Water Quality by reducing farm run-off to rivers and streams through on-farm infrastructure modernization improvements; ***(Secondary Benefit)***
- Reduction in groundwater pumping;
- Reduction in fertilizer use;
- Reduction in overall energy use due to higher efficiency associated with centralized, larger pumps (compared to decentralized on-farm pumping);
- Increased drought year resiliency;
- Increase capacity to serve another 7,500 acres of farmland with pressurized irrigation;
- Greater ability to transfer conserved water to communities in dire need.

Table 5.1a – Annual Project Physical Benefits **Project Name: SSJID West Basin Water Reuse Project** **Type of Benefit Claimed: Water Conservation** **Units of the Benefit Claimed : AF/Year** **Additional Information About this Benefit: N/A**			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2017-2067	0	-10,000	10,000
Comments: An explanation on these calculations is available below in the Technical Analysis section.			

Table 5.1b – Annual Project Physical Benefits Project Name: SSJID West Basin Water Reuse Project Type of Benefit Claimed: Water Quality (Reduction of farm runoff to streams and rivers) Units of the Benefit Claimed : mg/L Additional information about this benefit:											
(a)	(b)					(c)	(d)				
	Physical Benefits										
	Without Project						Change Resulting from Project				
Year	EPA Method 507 Pesticides (Total)	EPA Method 8321A Herbicides (Total)	Total Dissolved Solids (TDS)	Total Kjeldahl Nitrogen (TKN)	Total Phos-phorus (TP)	With Project *	EPA Method 507 Pesticides (Total)	EPA Method 8321A Herbicides (Total)	Total Dissolved Solids (TDS)	Total Kjeldahl Nitrogen (TKN)	Total Phos-phorus (TP)
2017 - 2067	0.03	0.71	29.48	2.04	1.72	0	0.03	0.71	29.48	2.04	1.72
Comments: * With the project intercepting all drain flows, 0 mg/l will be discharged to the rivers and streams. Please see measurement and verification program for further details.											

SSJID's On-Farm Conservation Program will offer the following physical benefits:

- Water Conservation through saving 2,700 AFY; ***(Primary Benefit)***
- Improved regional Water Quality by improving Nitrogen Update Efficiency through on-farm infrastructure modernization improvements; ***(Secondary Benefit)***
- Reduction in fertilizer use and farm runoff for growers converting to sprinkler & drip systems;
- Reduced farm runoff and related improved ability to comply with water quality regulations;
- Reduced seepage, spillage and evaporation losses from the distribution system, leading to increased drought year resiliency, and enhanced opportunities to beneficially use the District's water rights;
- Conservation of groundwater supplies as existing groundwater users convert to surface water and protection of groundwater quality due to reduced leaching of fertilizers;
- Support ongoing efforts to comply with current and emerging regulations, such as SBx7-7 and the resulting Agricultural Water Measurement regulation; and
- Greater ability to transfer conserved water to communities in dire need.

Table 5.2a – Annual Project Physical Benefits Project Name: SSJID On-Farm Water Conservation Program Type of Benefit Claimed: Water Conservation Units of the Benefit Claimed : AF/Year Additional Information About this Benefit: N/A			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2017-2067	0	-2,700	2,700
Comments: Conservation goals are consistent with actual water conservation achievements of past years of the On-Farm Conservation Program.			

Table 5.2b – Annual Project Physical Benefits Project Name: SSJID On-Farm Water Conservation Program Project Type of Benefit Claimed: Water Quality (Reduction of Nitrogen loading into the aquifer) Units of the Benefit Claimed : Mg/L Additional information about this benefit:			
(a)	**(b)**	**(c)**	**(d)**
	Physical Benefits		
Year	**Without Project**	**With Project**	**Change Resulting from Project (b) – (c)**
2017-2067	3.9	1.5	2.4
Comments: * Participants of the conservation program will have varying improvements in water quality measured in mg/L depending on their conservation measure, source water quality, current on-farm practices, soils, etc. A general analysis was done to demonstrate there would be a significant decrease of on farm nitrate leaching into the groundwater.			

Technical Analysis: SSJID West Basin Water Reuse Project

The technical analysis below will describe the primary and secondary benefits expected from the West Basin Water Reuse Project. First, an explanation of the need for the project, particularly as it relates to water conservation and water quality issues will be discussed. Then figures calculated in Table 5 describing "without-project" conditions and the methods used to estimate physical benefits will be described. Identification of the facilities, policies, and actions required to obtain the physical benefits will also be provided. Potentially adverse physical effects and what is being done to mitigate those impacts will be explored. Lastly, a discussion will occur information how the project is addressing long-term drought preparedness.

NEED FOR THE PROJECT: Roughly 40% of California's water demand comes from agriculture. As the drought continues, there is ongoing conflict between irrigation districts and other water users for limited water supplies. The Stanislaus River is the primary source of water for the South San Joaquin Irrigation District (SSJID or District). Current water supplies have become at-risk over the years due to drought, irrigation deliveries, environmental stream flow requirements, and increased demands from the District's water treatment plant serving urban water customers. In 2015, deliveries from the District's treatment plant to the cities of Tracy, Manteca, and Lathrop were cut by 20%. In addition, delivery to farmers was reduced to 36 inches in applied water, resulting in over half of the District's 2,000 customers will not be delivered enough water to raise a full crop. Improving agricultural water conservation by installing more efficient irrigation systems is crucial to maximizing the beneficial uses of water resources in California.

In addition to water supply challenges, the Central Valley of California is increasingly troubled by the buildup of salinity and nitrates in groundwater and surface water resources. The Sacramento-San Joaquin Delta had often flooded during dry summer months with ocean water, but salinity was flushed back to sea during winter and spring runoff. As flows were saved in reservoirs and less flow reached the Delta, salt intrusion became a significant water quality problem. The salinity problem is further aggravated by salinity buildup from fertilizers and nitrates used on farms. When a portion of the flood irrigation evaporates, salts are concentrated and eventually flushed to surface waters or leach through to groundwater. The San Joaquin River is Clean Water Act 303(d) listed for 8 of the 12 current water quality standards. Water quality violations are largely due to nonpoint source runoff from irrigated agriculture.[1] Recognizing the role that irrigation districts play in protecting water quality and water resources, the project is needed to reduce nonpoint source pollution runoff from fertilizers.

Since its formation in 1909, the South San Joaquin Irrigation District has delivered water to its growers through a gravity-based distribution system that was designed to provide water on a rotational schedule for flood irrigation of primarily field crops. The system has worked well for more than a century for the District's flood irrigation customers. However, over the past approximately 20 years, there has been a significant increase in use of pressurized on-farm irrigation systems due to its water conservation, sustainability benefits, and increased crop yields. On-farm pressurized systems typically require smaller, more precise and steadier flow rates at more frequent intervals, and for longer durations, compared to the flood systems they replace. Such deliveries are difficult to provide reliably with the existing gravity system. Consequently, many growers who adopt pressurized systems have also converted to groundwater as their primary water supply source in order to fully realize the benefits of pressurized irrigation. In some areas of the District, elevated salinity levels in groundwater deter growers from giving up District service or have forced growers to switch back to it, despite the fact that the District's service is not optimal for pressurized on-farm systems.

In 2012, the District implemented a $14 million pilot project to provide pressurized service of surface water to 3,100 acres in Division 9, an area that was particularly desperate for a new way to irrigate. High quality surface water is now delivered to farm turnouts at a pressure of 55 pounds per square inch (psi), eliminating the need for growers to operate and maintain their own pumping and pressurization facilities. Additionally, an on-demand water ordering system has reduced the wait time for water delivery and provides feedback to growers about how much water they are using.

[1] Lee, Fred G. PhD and Jones-Lee, Anne PhD, *Water Quality Issues of Irrigated Agricultural Runoff/Discharges San Joaquin River, Central Valley, California*, November 2007.

To meet the District's conservation goals and become drought resilient, the intent of the project was to:

- Ensure water is being used efficiently and that it is being put to beneficial use;
- Provide high quality surface water at a pressure, flow rate and frequency necessary to support high efficiency and high productivity irrigation with micro irrigation systems;
- Promote and incentivize on-farm physical improvements, irrigation management practices and water measurement to support efficient water management;
- Support ongoing efforts to comply with current and emerging regulations, such as SBx7-7 and the resulting Agricultural Water Measurement regulation (CCR 23 §597);
- Enhance water quality in both surface water and groundwater supplies; and
- Capture and recycle outflow to reduce nonpoint source pollution from fertilizer runoff.

The data for the technical analysis of physical benefits builds upon an evaluation of the Division 9 pressurized irrigation system project initiated in 2008. The project incorporated a regulating reservoir and pressurized pipeline network into the District's existing gravity distribution system to serve the Division 9 service area (west of Ripon, California) with pressurized surface water. Irrigation water originates from the Stanislaus River before being distributed to customers across 3,100 acres using 19 miles of pressured pipelines.

Using an online system similar to an airline ticketing platform, system growers can now log in to schedule water deliveries using current and past weather forecasts, previous water usage information, and historical evapotranspiration rates. Each farmer selects from available delivery dates and later receives alerts via email and text message before and after delivery to confirm volume and flow rate data. Moisture sensors are placed in the ground on each grower's property to help indicate optimal ordering times when almond and walnut trees are in greatest need. After providing each parcel with water through 76 solar-powered customer connections including valves and meters, delivery information is recorded on a dedicated, secure website for both the district and the growers. The District estimated that only 30-40% of the farmers in the pilot project area would adopt the new delivery system; instead, nearly every farmer is now using it.

Examination from two years of data showed a 30% reduction in on-farm water usage, a 30% increase in crop yields, 500 acres removed from groundwater-pumped irrigation, a 30% reduction in energy costs, and up to 95% irrigation application efficiency.[2] The project received an ACEC National *Grand Award*, American City and County Magazine *Crown Communities Award,* and the International Committee on Irrigation and Drainage *WatSave Technology Award.*

Steve Brocchini of Brocchini Farms provided the following anecdote of his experience of the District moving to pressurized water delivery[3]:

> "In fall of 2010, I attended a meeting at SSJID to discuss the possibility of a pressurized water delivery system for the area known as Division 9. Our family was quite excited about the possibility of improved surface water conveyance to our property, as the current system was grossly inadequate. While there was some skepticism about the logistics and viability of the project in the early stages, we jumped on board and were willing to help in any way possible to see the plan come to fruition.
>
> Our farming business is comprised entirely of permanent crops: almonds, walnuts, wine grapes, cherries, and olives. We have always known the benefits of irrigating with surface water, but with micro sprinklers and drip irrigation systems in place the district deliveries were insufficient for our needs. Micro and drip systems are designed to get the exact amount of water where you need it and when you need it, and the un-reliable flows every 10 days definitely did not meet demands. We had one 90 acre orchard using SSJID delivered water prior to the pressurized system. On this 90 acre field, the trees were always lacking water, even though we applied more in those days than we do

[2] Jeff Shaw, "Maximizing Crop Per Drop for California Farmers," *American City and County,* March, 2015: 4-5.
[3] Steve Brocchini, email message to author, August 4, 2015.

> now. The 10 day schedule forced us to irrigate for longer to try and meet the demands of the trees, yet we would have run off because the soil wouldn't take all of the water. Additionally, we were irrigating inconsistently due to variable low volume flows within the district's gravity pipeline at the low end of Division 9. Hence, we were forced to use groundwater for the remaining acreage even though it resided within the District.
>
> We began irrigating with the Division 9 high pressure system in spring of 2013. After upgrading several filtration systems, we now irrigate all of our 540 acres located within Division 9 with SSJID delivered water. The results, both objective and subjective, have shown tremendous success. Healthier trees, improved crop yields, and increased water use efficiency while eliminating water treatment applications, decreasing energy consumption and reducing stress on groundwater supply. It's been a win-win for our family's business."

Though the Division 9 Pilot Project has received international recognition and accolades from growers, the South San Joaquin Irrigation District has only scratched the surface on the impact it could have on the region's water supplies and its quality. Because pressurized irrigation has proven to be so effective at conserving water and reducing groundwater pumping, the District wants to accelerate adoption of conservation methods. The West Basin Water Reuse Project will make this possible. The 37.5 acre storage reservoir and pump station will reuse spillage, stormwater, and tailwater flows in 3,800 acres of pressurized irrigation, with the potential of servicing an additional 7,500 acres. In conjunction with the On-Farm Conservation Program, the West Basin Water Reuse Project will reduce water consumption and reliance on groundwater supplies and nearly eliminate nonpoint source pollution runoff.

WITHOUT-PROJECT CONDITIONS: Since 1909, farmers received water through a distribution system that provided water on a rotational schedule for flood irrigation of field crops. Though highly inefficient, the original system generally met user needs. For a multitude of reasons, there has been a significant increase in use of pressurized on-farm irrigation systems. In 1990, 75% of the field crops were flood irrigated by gravity-fed systems, while 25% were irrigated using sprinklers or micro-systems. By 2000, this ratio had shifted to 55% gravity and 45% sprinkler/micro systems.[4] Compared to flood systems, pressurized systems typically require smaller, more precise and steadier flow rates at more frequent intervals, and for longer durations. The existing gravity system cannot reliably meet these demands, so many growers converted to groundwater. Elevated salinity levels in groundwater has turned trees yellow and reduced yields in parts of the District's service area. Without the project, farmers will continue to augment SSJID delivered water with groundwater – a choice that impacts groundwater levels and agricultural production in the entire Eastern San Joaquin Subbasin.

Further, without the project, flood irrigation will continue to impact nonpoint source runoff pollution. With flood irrigation, the nutrient uptake from fertilizers is only 44% and irrigation efficiency is just 60%.[5] By moving to pressurized systems, nutrient uptake and irrigation efficiency both increase to 85%.

PRIMARY BENEFIT EXPLANATION: The main outflows from the project area are Drain 11 and Drain 18 which carry flows from the Division 9 area to natural waterways outside of the District's service area. During the irrigation season, the majority of these outflows occur because of on-farm tailwater, irrigation system spillage, or stormwater runoff. Outflows at these locations have been measured by the District since 2003. **Figure 7** below is an overview of the project area and boundary outflows.[6] The red triangles show where outflow measurements have been taken at Drain 11 and Drain 18. In 2011, the District began implementing a three-year boundary outflow improvement program. Rigorous quality control measures, consisting of detailed review, estimate development, and gap filling were applied to available SCADA data for most of 2010, 2012, and 2013 to replace missing data due to communication problems. For 2003 through 2009, 2011, and other periods when SCADA data was not available, flow data from the Districts drain flow report was used.

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[4] Stantec Consulting, *South San Joaquin Irrigation District Feasibility Assessment of Pressurized Water Delivery (Draft),* July 2015.

[5] U.S. Geological Survey, *Water Quality in the San Joaquin-Tulare Basins, 1992-1995*

[6] Davids Engineering, *Technical Memorandum: Initial Evaluation of On-Farm Conservation Program.* Dec. 2012.

Figure 7 – Overview of Project Area and Surrounding Area and Boundary Outflows

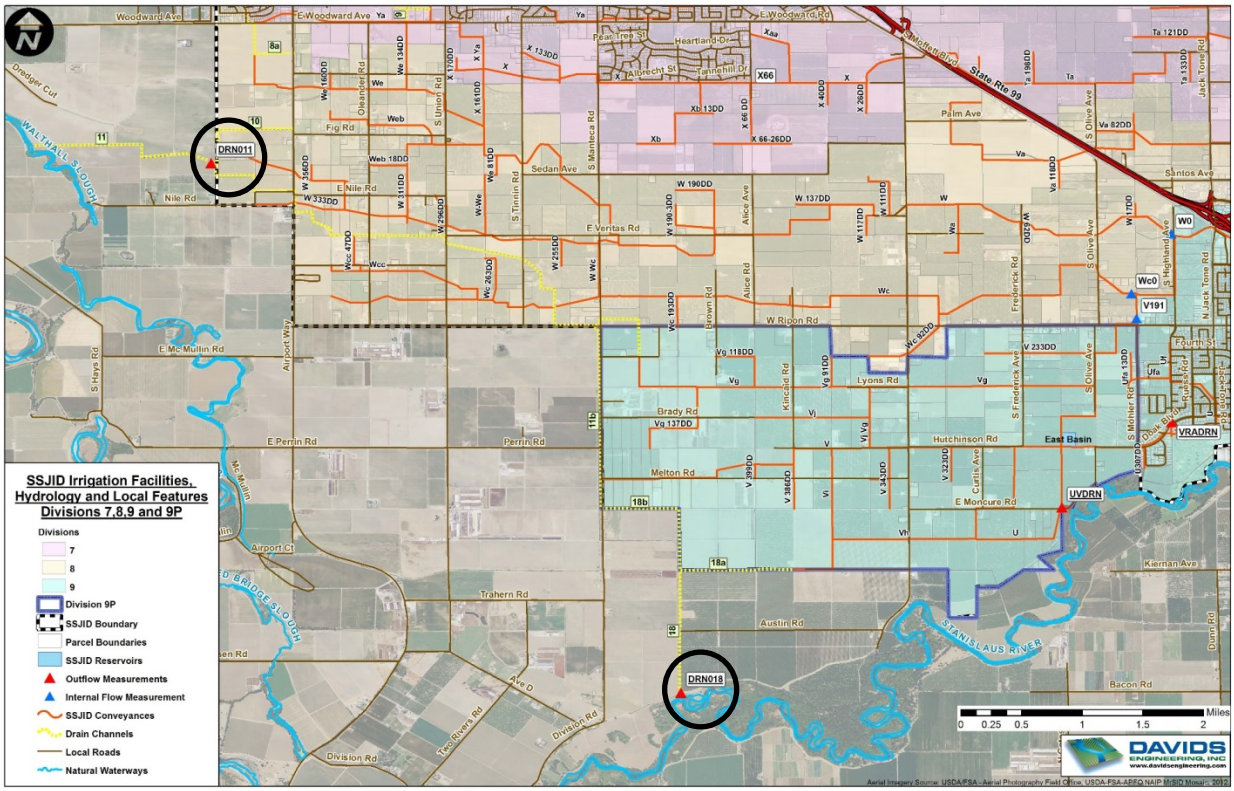

Table 1 shows the annual totals in acre-feet for 2003 through 2013 for these drain sites. Daily data is available for 2006 and 2008 through 2013; 2003 through 2005 and 2007 were monthly data.

Table 1. Annual (complete year) boundary outflow site volumes in acre-feet

Year	Boundary Outflow Site Volumes (acre-feet)	
	Drain 11	Drain 18
2003	8,130	1,184
2004	10,415	1,033
2005	11,138	500
2006	8,702	573
2007	5,127	1,116
2008	7,711	1,044
2009	8,168	771
2010	7,583	911
2011	8,301	3,027
2012*	6,461	663
2013	7,907	608
Minimum	5,127	608
Average	**8,149**	**1,171**
Maximum	11,138	3,027

* First year of Division 9 Pilot Project

In addition to capturing outflow from Drains 11 and 18 and directing it to the West Basin for reuse, the pressurized system will also be expanded by another 700 acres. The water conservation benefit is expected to total 12-inches of water per acre. Of the 76 customers who participated in the Division 9 Pilot Project, the average reduction in water applied was 12 inches of water per acre. In 2014, median water use by pressurized service customers was 30.3 inches. Median use by non-pressurized customers was 42 inches. By multiplying 700 acres by 12 inches, the project yields an additional 700 acre feet per year in water savings.

Total acre feet per year of water supply saved and recycled was calculated by adding the average outflow volumes of Drain 11 and Drain 18 (8,148 AF and 1,171 AF respectively) with the additional 700 AF to be added to the pressurized distribution system to total just over 10,000 AFY.

The significance of conserving 10,000 acre-feet of water per year is that the District can put the conserved water to other beneficial uses including humanitarian water transfers to disadvantaged communities.

SECONDARY BENEFIT EXPLANATION: Beyond water conservation, this project has a direct benefit on water quality in the Stanislaus River. Runoff into rivers, streams, and the Sacramento-San Joaquin Delta, is of increasing concern in the Central Valley of California. The West Basin Water Reuse Project will capture tail water flows eliminating runoff into the Stanislaus River. Water running off the lower end of a field as part of irrigation is referred to as tailwater. "Tailwater is typically associated with flood irrigation; while sprinkler and micro-irrigation systems rarely produce tailwater."[7] By recovering tailwater and returning it to the irrigation distribution system, where it will be blended with fresh water, water use efficiency will be maximized and prevent runoff from flowing into the Stanislaus River.

It is estimated that the project will reduce pesticides, herbicides, total dissolved solids, total nitrogen, and total phosphorous in the following concentrations:

Constituents	Estimated Reduction in Concentration	Unit
EPA Method 507 Pesticides (Total)	0.03	mg/L
EPA Method 8321A Herbicides (Total)	0.71	mg/L
Total Dissolved Solids (TDS)	29.48	mg/L
Total Kjeldahl Nitrogen (TKN)	2.04	mg/L
Total Phosphorus (TP)	1.72	mg/L

These figures were calculated reviewing the water quality data made available by the U.S. Geological Survey for the San Joaquin-Tulare Basins[8] and by augmenting it with raw data SSJID has available.[9] The higher concentration samples from monitoring reports of drain 11 from 2005 to 2009 were averaged and the typical concentration for each individual pesticide and herbicide is measured as mg/L. By combining them and averaging the sum, we were able to estimate how much each constituent contaminant will be reduced.

The project will improve the quality of surface water by reducing evaporation of water during distribution and irrigation. Evaporation concentrates the salts naturally present in all surface water and groundwater. These concentrated salts, ultimately, must be flushed to surface waters or groundwater to maintain the fertility of the soil. Reduced evaporation improves water quality (specifically, reduced salinity) in area surface waters and groundwater, including the downstream southern Delta which is Clean Water Act Section 303(d) listed as being impaired by salinity. Reduced evapotranspiration by weeds and other non-crop vegetation also helps improve water quality. Evapotranspiration, like evaporation, concentrates naturally occurring salts.

The project will reduce the dissolution of soil minerals into aqueous salts. Freshwater naturally dissolves soil minerals. Pressurized irrigation systems allow application of water only to soil where crops make beneficial

[7] Agricultural Water Management Council, *Efficient Water Management: Irrigation District Achievements*, Pg. 6
[8] U.S. Geological Survey, *Water Quality in the San Joaquin-Tulare Basins,* Circular 1159, *1992-1995 (Appendix 2-1)*
[9] Extensive amounts of monitoring report data were used. We can provide this if requested.

use of it. This reduces dissolution of soil minerals to the minimum amount needed to grow the crop. Again, these dissolved salts end up in area surface waters and groundwater when using traditional irrigation methods.

By capturing and reusing tailwater, the project will prevent nonpoint source pollution from flowing into the Stanislaus River and eventually the Sacramento-San Joaquin Delta. On average, the reduction of tail water overflow is 8,148 AF from Drain 11 and 1,171 AF from Drain 18. With pressurized irrigation systems, there is little to no tailwater, therefore there is little to no potential for agriculturally used fertilizer or pesticides to reach surface waters.

It is expected that the project to result in somewhat less pesticide and fertilizer use. The Division 9 pilot project showed improved crop vitality with pressurized irrigation. Vital crops are less inclined to disease, which may reduce pesticide use. Additionally, there will be less use of chemical weed control chemicals because aquatic weeds that plague open canals do not grow in closed pipes. As was found during the Division 9 Pilot Project, farmers are also using less fertilizers and pesticides because nutrient uptake efficiency increased from 44% (flood irrigation) to 85% (drip irrigation). Pressurized systems improve water use efficiency and fertilizer use efficiency.

To ensure the project is a success, there will be continuing measurements at Drains 11 and 18 to confirm there are zero discharges to surface waters. Data from these flowmeters will verify that little to no tailwater is discharging to surface water supplies.

The primary benefit of the project is conserving 10,000 acre-feet per year and reducing groundwater demands. The secondary benefit of the project is protecting surface water quality from agriculture runoff. Beyond the primary and secondary benefits that the project provides, the West Basin Water Reuse project will also:

- Improve air quality by eliminating diesel powered pumps;
- Reduce overall energy use due to higher efficiency associated with centralized, larger pumps (compared to decentralized on-farm pumping);
- Reduce operations labor, fleet mileage, and air emissions (dust) due to reduced need to accompany flow changes through the system;
- Reduce maintenance costs;
- Streamline water administration due to automated billing and account management;
- Significantly enhance the District's ability to comply with State volumetric billing requirements;
- Reduce aquatic weed growth and need for chemical weed control applications;
- Increase capacity to serve another 7,500 acres of farmland with pressurized irrigation;
- Increase drought year resiliency; and
- Increase the opportunity to transfer conserved water to disadvantaged communities.

FACILITIES, POLICIES, AND ACTIONS REQUIRED TO OBTAIN PHYSICAL BENEFITS: To obtain the physical benefits described above, facilities, policies, and actions are required. First, the project is only possible by the design and construction of a storage reservoir, pump station, and pressurized distribution system for an additional 700 acres. Without the storage reservoir and pump station, an acceptable level of service to growers on pressurized infrastructure cannot be delivered. Besides providing pressure to the existing 3,100 acres in Division 9 and an additional 700 acres of pressurized line to be installed as a part of this project, the project also provides the foundation to serve another 7,500 acres of farmland.

Beyond providing reliable delivery, the project eliminates nonpoint source pollution runoff by reusing spillage, tailwater, and stormwater runoff. To ensure that the physical benefits of the project are actualized, the Project Performance Monitoring Plan will be followed to ensure the project is on pace to meet the benefits claimed in Table 5.

In terms of policies, none are required to obtain physical benefits, but regional and statewide policies could impact the project. For instance, the California Regional Water Quality Control Board has been tasked with implementing various plans, policies, and programs to address groundwater salinity and nitrate problems. Most notable in the region is the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS),

a collaborative stakeholder driven and managed program to develop sustainable salinity and nitrate management programing for the Central Valley. The studies that to be performed on Division 9 and for the West Basin Water Reuse project will provide invaluable data to CV-SALTS and the State on how irrigation efficiencies impact water conservation and water quality.

POTENTIAL ADVERSE EFFECTS: CEQA documentation has been completed and no significant impacts are expected with the construction and operation of this project. The environmental clearances were completed at the same time as the approvals were granted for the already completed Division 9 Irrigation Enhancement Project. The Negative Declaration from Insite Environmental, Inc. stated there was "no substantial evidence, in light of the whole record before the agency, that the project as revised may have a significant effect on the environment."[10]

ADDRESSING LONG-TERM DROUGHT PREPAREDNESS: To deal with future droughts, the West Basin Water Reuse Project promotes the maximum beneficial use of irrigation releases from New Melones Reservoir. With the potential to reduce irrigation demands by 30% and capture tailwater flows, the proposed Project has the potential to free up 10,000 acre-feet per year of surface water storage at New Melones Reservoir for other beneficial uses.

One of the objectives of the West Basin Water Reuse Project is to enhance drought resiliency by implementing the following protect measures:

- Reduce on-farm water use demands and groundwater pumping by implementing a District-wide pressurized system;
- Capture stormwater for use in a District-wide pressurized irrigation system and groundwater recharge/banking plan;
- Reuse tailwater and drain water for pressurized irrigation systems and groundwater recharge/banking;
- In the future, reuse treated wastewater from the City of Manteca for groundwater recharge and use in the pressurized irrigation system;
- Reuse banked groundwater in the pressurized irrigation system;
- Utilize stormwater blended with surface water in the pressurized irrigation system; and
- Ensure the best use of water derived from irrigation efficiency gains.

As the San Joaquin Basin and State of California brace for future droughts, the District is willing to be a helpful stakeholder as evidenced by this project. Preserving groundwater resources, protecting surface water, and reducing nonpoint source pollution runoff ensures California has the water resources necessary for long-term droughts.

The project responds to climate change needs by reducing energy consumption by replacing farm diesel pumps with a centralized electric pump station at the West Basin. By operating variable frequency drive pumps at optimal efficiency and by scheduling irrigations in off-peak times, the load on the electric grid will be reduced. Greenhouse gases will be reduced with the automation of customer turnouts completely powered by solar. This will eliminate ditchtender truck trips to each turnout to manually open and close valves.

By saving 500,000 acre-feet over the lifetime of the project, conserved water can be used to maintain natural stream flows and aquatic habitats. The project has the potential to leave high quality surface water in the District's volumetric allocation of New Melones Reservoir for other beneficial uses, such as endangered species habitat needs in the lower Stanislaus River, lower San Joaquin River, and southern Delta. The project provides the storage needed to allow this water to be released when needed to maximize its benefits to the endangered species. Further, by capturing stormwater and infiltrating it in the reservoir, the West Basin Water Reuse Project will reduce the magnitude of flood flows in the area's natural stream channels.

Though the primary benefit of the project is improving reliability of the region's water supply through re-use, the significance of this is making more water available for humanitarian purposes. Savings in irrigation

[10] Insite Environmental, Inc., *Final Study/Mitigated Negative Declaration*, August 25, 2009. Appendix 2-2

efficiencies may allow SSJID to transfer water to communities in need, ensuring that every human being has clean, affordable, and accessible water for human consumption, cooking, and sanitary purposes as outlined in the **Human Right to Water** statement. SSJID has been engaged in these types of humanitarian transfers as the current drought wears on. Most recently, the District completed an agreement with the community of Mountain House to provide an average of 5 cfs (10 acre-feet/day) through December 31, 2015. The total amount of water allocated to Mountain House is 1,800 AF. The water transfer won't impact the Eastern San Joaquin Groundwater Subbasin. The price of the transfer is $250/AF, which is approximately 50% of the market rate.

On February 11, 2014, the District made a similar humanitarian water transfer to the citizens of Tuolumne County. Tuolumne County was left without water after the California Department of Forestry fought the Rim Fire at Yosemite last year and drew down the Lions Reservoir. At the time, the reservoir was expected to be dry in 80 days or less. The Tuolumne County Office of Emergency Services said the immediate crisis would be resolved with 2,400 AF of water. SSJID authorized the transfer at a discounted rate of $200 per AF, approximately 40% of the market rate.

All at the District agreed that when it comes to people's lives, the District has a responsibility to share resources during times of need. Using available water resources more efficiently will allow for more opportunities to share with disadvantaged communities facing water shortages. The West Basin Re-Use project helps the state become more resilient to long-term drought conditions.

Technical Analysis: SSJID On-Farm Conservation Program

The technical analysis below will describe the primary and secondary benefits expected from the On-Farm Conservation Program. First, an explanation of the need for the project, particularly as it relates to water conservation and water quality problems, will be provided. Then a detailed description of the figures calculated in Table 5 describing "without-project" conditions and the methods used to estimate physical benefits will be provided. Facilities, policies, and actions required to obtain the physical benefits will be identified. Potentially adverse physical effects and what is being done to mitigate those impacts will be explored. Lastly, information how the project is addressing long-term drought preparedness will be provided.

NEED FOR THE PROJECT: More now than ever the region needs farmers to install more efficient irrigation systems and implement advanced farming practices to conserve water and improve water quality. The recent drought has made meeting all of the State of California's water needs has become increasingly difficult. With the agricultural sector consuming a significant portion of the State's water supply to feed the nation, recent advances in technology and on-farm infrastructure hold promise to conserve water while at the same time lessening the environmental impacts of growing food.

Since its formation in 1909, the South San Joaquin Irrigation District (SSJID or District) has delivered water to its growers through a gravity-based distribution system that was designed to provide water on a rotational schedule for flood irrigation of primarily field crops. As drought conditions persist, there is an increased interest in conserving water and farming sustainably.

Encouraging adoption of various conservation measures was largely made possible by the District's ambitious On-Farm Conservation Program. The District budgeted $1.14 million for cost share participation. Implemented in 2011 and lasting through early 2014 (before funding was suspended due to budgetary constraints), the Program provided direct funding to growers for implementing delivery measurement, sprinkler and drip conversion, tailwater recovery, irrigation scheduling, moisture monitoring, and other grower-proposed measures. On average, growers were notified of selection within one month of submitting an application, and reimbursement payments were made to growers an average of 4.5 months after the application was submitted and the conservation measure was implemented. The overall objectives of the program including 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 comply with current and emerging regulations, such as SBx7-7 and the resulting Agricultural Water Measurement regulation (CCR 23 §597);
- Enhance water quality in both surface water and groundwater supplies;

After two years of running the program, the District gathered participant feedback and quantified potential reductions in water use. A survey of program participants and several one-on-one interviews showed a general consensus that the program was being well received. Conservation measures showed an increased awareness of the importance of efficiently managing available surface and groundwater supplies to maintain long term supply reliability, to protect and improve water quality, and to maximize productivity.

Program participants said the soil moisture monitoring and scientific irrigation scheduling avoided water stress on plants, controlled deep percolation, reduced water use and fertilizer use, and improved yields. Conversion to drip or micro irrigation allowed for better control of the amount of water applied, reduced overall water use, resulted in better overall health of the trees, reduced fertilizer and herbicide use, and reduced electric use. Given this feedback, the District elected to extend the On-Farm Conservation Program another year with a budget of $738,000. (It was originally approved for three years between 2011 and 2013).

WITHOUT-PROJECT CONDITIONS: Currently the District is experiencing without-project conditions. Though funded by SSJID for another year, the On-Farm Conservation Program was suspended on February 11, 2014 due to budgetary constraints. The District struggles to deliver water on a fixed 10-day delivery schedule. This system doesn't provide an optimal water supply at the frequency need to be most efficient and often results in drain spillage. Without connecting more growers to pressurized systems, the District can't deliver water on an on-demand basis, which means that growers will shore up the deficiency in service with groundwater pumping. This is problematic in the overdrafted Eastern San Joaquin Subbasin. Without installing flow meters, the District will struggle to comply with the volumetric billing requirements of the Water Conservation Act. A lack of investment in scientific irrigation scheduling and soil moisture monitoring will mean that the farmers are essentially guessing when their crops are in need of water, resulting in waste. Without the project, the region loses the potential to save 2,700 acre-feet per year, which over the life of the infrastructure investment, is over 135,000 acre-feet.

PRIMARY BENEFIT EXPLANATION: Project benefits of the On-Farm Conservation Program can be quantified using data provided through an evaluation conducted by Davids Engineering in 2012 and through studies completed on the Division 9 pressurized irrigation system. The Division 9 pressure system includes a number of the same conservation features that the On-Farm Conservation Program promotes. These measures include drip and sprinkler conversions, tail water recovery, intelligent irrigation scheduling, and soil moisture monitoring.[11] The On-Farm Conservation Program will accelerate conversion from flood irrigation to more efficient irrigation methods in this region, as well as throughout the rest of the District.

The primary benefit of the On-Farm Conservation Program is saving an estimated 2,700 acre-feet per year in water consumption. This estimate is drawn from the results experienced when the Conservation Program ran between 2011 and early 2014. Between 2011 and 2013, the program resulted in saving 8,100 acre-feet and has assisted a total of 17,131 acres. The Conservation Program's greatest investment was $1.7M in conversions to sprinkler and drip systems from flood irrigation. The program saw an invested $239,000 in scientific irrigation scheduling and soil moisture monitoring, $161,000 in the installation of flow meters and $611,000 of investment in unique grower proposals. Summarized below is the investment and impact of the On-Farm Conservation Program:

[11] South San Joaquin Irrigation District, *On-Farm Water Conservation Program*, 2014. Appendix 2-3

Table 2: On-Farm Conservation Program Metrics

	2011	2012	2013	2014	Totals
Total Acres Assisted	5,450.40	5,519.66	5,351.52	810.29	17,131.87
Number of Applications	143	160	154	19	476
Flow Meters (Delivery Measurement)	$ 39,388	$ 36,603	$ 75,425	$ 10,419	$ 161,835
Conversions to Sprinkler & Drip Systems	$ 389,494	$ 578,673	$ 578,529	$ 180,778	$ 1,727,474
Tailwater Recovery Systems	$ 41,871	$ -	$ -	$ -	$ 41,871
Scientific Irrigation Scheduling & Soil Moisture Monitoring	$ 89,954	$ 85,543	$ 61,354	$ 2,558	$ 239,409
Grower Proposals	$ 144,261	$ 248,536	$ 218,416	$ -	$ 611,213
Totals	**$ 704,968**	**$ 949,355**	**$ 933,724**	**$ 193,755**	**$ 2,781,802**

Based on data from the previous 3+ years of the program, it is expected the On-Farm Conservation Program to benefit 5,300 acres with a total savings of 2,700 acre-feet per year. For growers who convert to micro irrigation systems, some plants are able to retain as much as 85 to 95 percent of applied water in the root zone.[12] That is a remarkable increase over flood irrigation.

Table 3 and Table 4 below provide a projection of the number of fields and acres to participate in the program based on available funding and assumptions related to cost share amounts per field, field size, and other factors. These estimates are meant to be a rough estimate of the number of applications that will be approved. It is assumed that all fields converting to sprinkler or drip/micro irrigation will also participate in delivery measurement for pumped deliveries. Data from Table 4 was used in Attachment 4.

Table 3: Anticipated Grower Participation in the Conservation Program

Anticipated Project Participation			Implementation Cost		
Conservation Measure	**Parcels Receiving Cost Share**	**Acres**	**Total**	**Average**	**$/acre**
Delivery Measurement	27	1,005	$46,287	$1,714	$46
Sprinkler Conversion	7	272	$414,589	$59,227	$1,524
Drip Conversion	19	770	$601,993	$31,684	$782
Tailwater Recovery	3	228	$106,978	$35,659	$470
Irrigation Scheduling	23	909	$87,084	$3,786	$96
Moisture Monitoring	79	2,663	$54,380	$688	$20
Grower-Proposed	9	179	$310,482	$34,498	$1,736

[12] Agricultural Water Management Council, *Efficient Water Management Irrigation District Achievements*, pg. 60

Table 4: Anticipated Grower Participation and Cost Share Values for SSJID and Each Grower

Anticipated Project Participation		**SSJID Cost Share**				**Grower Cost Share**			
Conservation Measure	*Parcels*	*Total*	*Average*	*$/acre*	*% of Total*	*Total*	*Average*	*$/acre*	*% of Total*
Delivery Measurement	27	$39,388	$1,459	$39	85%	$6,899	$256	$7	15%
Sprinkler Conversion	7	$125,571	$17,939	$462	30%	$289,018	$41,288	$1,063	70%
Drip Conversion	19	$263,923	$13,891	$343	44%	$339,070	$17,793	$439	56%
Tailwater Recovery	3	$41,871	$13,957	$184	39%	$65,107	$21,702	$286	61%
Irrigation Scheduling	23	$49,500	$2,152	$54	57%	$37,584	$1,634	$41	43%
Moisture Monitoring	79	$40,454	$512	$15	74%	$13,926	$176	$5	26%
Grower Proposed	9	$140,088	$15,565	$783	45%	$170,394	$18,933	$953	55%

The methodology used to determine the primary benefit of the project is based on the results from the Initial Evaluation of the Conservation Program.[13] Consider the following comparison of 2010 and 2011 delivery records for selected fields participating in the Conservation Program:

Table 5: Comparison of 2010 and 2011 Delivery Records for Selected Fields

Conservation Measure	Fields Evaluated	% of Total	Acres	% of Total	Deliveries, ac-ft. (Mar.-Oct.)		Preliminary Conservation Estimate	
					2010	2011	ac-ft.	inches
Drip Conversion	8	53%	379	54%	1,093	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	0	0
Irrigation Scheduling	7	30%	278	30%	996	721	275	11.9
Soil Moisture Monitoring	47	61%	1,497	58%	5,242	4,695	547	4.4
Totals	67	51%	2,399	45%	7,902	6,608	1,294	6.5

Between 2011 and 2013, the program resulted in saving 8,100 acre-feet. Divided by three years, the average conservation savings total 2,700 acre-feet. Assuming that the sample within each conservation measure is representative of all participating fields, the total preliminary conservation estimate for the 2011 growing season was approximately 2,700 acre-feet. This estimate is subject to substantial uncertainty due to the following factors:

- Uncertainty in the accuracy of delivery records;
- Differences in groundwater use between 2010 and 2011 for participating fields with access to groundwater as a supplementary source of water; and

[13] Davids Engineering, *Technical Memorandum: Initial Evaluation of On-Farm Conservation Program.* Dec. 2012.

- Changes in crop water requirements at participating fields between 2010 and 2011 due to weather and/or crop changes.

SECONDARY BENEFIT EXPLANATION: Beyond water conservation, this project has a direct benefit on water quality. Water quality challenges, particularly the buildup of nitrate in groundwater resources and nonpoint source runoff into rivers, streams, and the Sacramento-San Joaquin Delta, is of increasing concern in the Central Valley. The main driver for nitrate accumulation in water resources is the use of fertilizers. As such, the agricultural industry is a stakeholder in the nitrate accumulation problem. The primary On-Farm Conservation Program measure of conversion from flood irrigation to sprinkler irrigation will improve water quality by decreasing the amount of nitrogen leaching into the groundwater and discharging to rivers and streams.

The project will improve the quality of surface water and groundwater by the:

- Reduced evaporation of water during distribution and irrigation. Evaporation concentrates the salts naturally present in all surface water and groundwaters. These concentrated salts, ultimately, must be flushed to surface waters or groundwater to maintain the fertility of the soil. Thus, reduced evaporation equals improved water quality (specifically, reduced salinity) in area surface waters and groundwaters, including downstream southern Delta which is Clean Water Act Section 303(d) listed as being impaired by salinity.

- Reduced evapotranspiration by weeds and other non-crop vegetation. Evapotranspiration, like evaporation, concentrates naturally occurring salts in water.

- Reduced dissolution of soil minerals into aqueous salts. Freshwater naturally dissolves soil minerals. Pressurized irrigation systems allow application of water only to soil where crops make beneficial use of it. This reduces dissolution of soil minerals to the minimum amount needed to grow the crop. Again, these dissolved salts end up in area surface waters and groundwater.

- Reduced use of fertilizers and pesticides by increased nutrient uptake efficiency from 44% (flood irrigation) to 85% (drip irrigation). Pressurized systems improve water use efficiency and fertilizer use efficiency. The Division 9 pilot project showed improved yields, i.e., improved crop vitality, with pressurized irrigation systems. More vital crops are less inclined to disease, which may reduce pesticide use.

- Reduced tailwater reaching surface waters. With pressurized irrigation systems, there is little to no tailwater, therefore there is little to no potential for agriculturally used fertilizer or pesticides to reach surface waters.

Almond orchards are the primary crop to apply On-Farm Conservation Program funds. Flood irrigators broadcast nitrogen materials, often in large doses once or twice a season in the fall, winter, or early spring. Flood irrigation follows, and a portion of the nitrogen applied, that was not lost to volatilization, moves below the active root zone. In flood irrigation, the "Nitrogen Use Efficiency" (NUE, or the percentage of Nitrogen applied actually removed in the crop) is about 44%.

With the conversion from flood irrigation to drip or sprinkler irrigation, uniformity of application improves, the grower has the ability to schedule applications to meet crop demands, and fertilizer is injected straight into the root zone of the crop to match the needs of the orchards. In a recent trial in Belridge ranches at Paramount Farms, research funded by the Almond Board, USDA and others, has documented NUEs of 75% to 85%.[14] To summarize:

- Flood Irrigation Nitrogen Use Efficiency = 44%
- Drip Irrigation with Fertigation Nitrogen Use Efficiency = 75 – 85%
- Water Quality Improvement = *Minimum* 30% increase in Nitrogen Use Efficiency

An increase in the NUE of a crop due to more precise irrigation coupled with the decrease in applied water provides a significant decrease in the mass loading of nitrogen. General assumptions were made based on

[14] Curtis, "Almond Nitrogen Research and Practices", 1-9.

general agricultural practices for almonds specifically. They will be discussed and referenced accordingly. The following analysis should be viewed as a general analysis, as real-world values will vary by season, age of tree, individual farming practice, and a host of other variables.

The first step in the analysis is calculating how much nitrate is applied to the orchard by irrigation style, as this will provide the amount of the constituent by weight. An acceptable general guideline for applied nitrogen on a flood irrigated crop is 150 pounds per acre (lbs/ac).[15] Using the NUE values the applied nitrogen value for drip irrigation was calculated to be 83 lbs/ac.

$$150\frac{lbs}{acre} * \frac{.44\ (NUE\ Flood)}{.80\ (NUE\ Sprinkler)} = 83\frac{lbs}{acre}$$

The second step in the analysis is calculating the amount of water the orchard would need using both irrigation styles. The amounts of applied water for flood irrigation and drip irrigation were calculated to be 5 acre-feet per acre (AF/ac) and 4 AF/ac, respectively. These values were derived from calculating the evapotranspiration (ET) values for both types of irrigation styles. ET is directly related to the amount of water used in an orchard. While the definition of evapotranspiration is the sum of evaporation and plant transpiration, in agricultural terms it's used as a guide for how much water the plant needs. For example, if ET is measured at 50 inches of water per year per plant, then the farmer needs to provide at least 50 inches of water per year to that plant.

ET values were calculated using a widely accepted and published method of multiplying a reference crop evapotranspiration value by the crops coefficient for almond trees. The California Irrigation Management Information System (CIMIS) uses an extensive network of weather stations to collect weather data and to estimate the daily reference crop evapotranspiration (ET_o). The project area is located in Zone 12 on the Reference Evapotranspiration (ETo) Zones. Those values are provided in **Table 6** below.

$$ETc = ETo\ x\ kc$$

Table 6: Evapotranspiration Rates for Almond Crops

CIMIS Zone 12	ETo (in/yr)[16]	Kc	ETc (Almond) (in/yr)[17]
Jan	1.24		
Feb	1.96		
Mar	3.41	0.2	0.682
Apr	5.1	0.67	3.417
May	6.82	0.95	6.479
Jun	7.8	1.09	8.502
Jul	8.06	1.15	9.269
Aug	7.13	1.17	8.3421
Sep	5.4	1.12	6.048
Oct	3.72	0.85	3.162
Nov	1.8		
Dec	0.93		
Total (in/acre)			**45.9011**
Total (acre-ft)			**3.8250**

[15] Warren Micke, *Almond Production Manual*, Publication 3364, Univ. of California, Division of Agriculture and Nature Resource, 1996.
[16] California Irrigation Management Information System (CIMIS). Accessed August 2015. Appendix 2-4
[17] Almond Board of California. Irrigation Scheduling and Evapotranspiration (ET) and Updated Almond Crop Coefficients. Appendix 2-4.

To calculate the applied water requirements the application efficiencies for different irrigation systems were multiplied by the ET value from **Table 6**. The application efficiencies for furrow (flood) and drip irrigation were used and are 73%, and 81%, respectively.[18] These percentages yield the result for flood and sprinkler applied water requirements as 5.2 acre-feet and 4.4 acre-feet, respectively.

The third step in the analysis was to calculate the nitrate (as nitrogen) concentration utilized by each irrigation style. This was simply calculated by dividing the applied nitrogen by the applied water to yield loads in pounds per acre-foot, then converted to milligrams per liter (mg/L). The amount of nitrogen calculated for flood irrigation is 10.5 mg/L, and for sprinkler irrigation it is 6.4 mg/L. This indicates a lower nitrogen load is required for sprinkler irrigation than flood.

Deep percolation was calculated as the difference between applied water and evapotranspiration. It is assumed for the purpose of this analysis there is no surface runoff during typical irrigation activities, particularly for drip irrigation. That all water is used by the plant or percolated to the aquifer. Deep percolation values are 1.41 AF/ac for flood irrigation and 0.9 AF/ac for sprinkler irrigation.

These calculations ultimately yield the amount of nitrogen loading that could reach the aquifer. Therefore, the nitrogen concentration that could reach the aquifer for each irrigation style was calculated as a percentage of the load. The percentage value was calculated by dividing the deep percolation value by the expected ET value. The expected nitrate load to reach the aquifer without the project is 3.9 mg/L. The expected nitrate load to reach the aquifer with the project is 1.5 mg/L. This is a 61% potential reduction of nitrate loading to an already contaminated groundwater aquifer.

$$Naq = \frac{Deep\ Percolation}{Evapotranspiration} x\ Ni$$

SSJID's On-Farm Conservation Program will allow growers to convert from flood to drip irrigation and use state-of-the-art irrigation and nutrient management practices to ensure minimal environmental impact on groundwater quality. The 40% increase in Nitrogen Use Efficiency will ensure the groundwater, streams, and river water quality improves due to the reduction in nitrogen leaching to water bodies.

The primary benefit of the project is conserving groundwater and surface water supplies by helping farmers implement conservation measures. The secondary benefit of the project is protecting water quality from leaching fertilizers and runoff into the groundwater and rivers. Beyond the primary and secondary benefits that the project provides, the On–Farm Conservation Program will also provide the following benefits:

- Reduced maintenance costs;
- Significantly enhance the District's ability to comply with State volumetric billing requirements;
- Increased drought year resiliency;
- Reduced aquatic weed growth and need for chemical weed control applications; and
- Increase the opportunity to transfer conserved water to disadvantaged communities.

FACILITIES, POLICIES, AND ACTIONS REQUIRED TO OBTAIN PHYSICAL BENEFITS: Though the program was a remarkable success, it was suspended on February 11, 2014 due to budgetary constraints. There has since seen a slump in the installation of improvements. To resume implementing efficient irrigation systems and advanced farming practices, the On-Farm Conservation Program needs additional funding. In concert with the West Basin Water Reuse Project, it will soon be more and more appealing for late adopters to make the conversion. Doing so will reduce their reliance on groundwater, notoriously of lower quality and higher salinity. Encouraging movement to District-provided surface water helps reduce groundwater basin overdraft; an issue important to the entire region.

The On-Farm Conservation Program has already developed a manual to describe the enrollment process, conservation measures, budget, and the payment approval process. Besides updating the budget section, the Manual doesn't require any further changes. To ensure conservation measures are being implemented and accomplishing the anticipated results, the On-Farm Conservation Program Manual has a monitoring and

[18] Samuel Sandoval Solis, Ph.D. *Application Efficiency: Hydrologic Region 2010*, UC Davis Water Management Research Group, 2013. Appendix 2-4.

verification program. This includes requiring documentation of implementation costs (receipts and payments) and operation 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.

POTENTIAL ADVERSE EFFECTS: No potential adverse impacts are expected with this program.

ADDRESSING LONG-TERM DROUGHT PREPAREDNESS: The On-Farm Conservation Program helps address drought preparedness by improving irrigation efficiency. More efficient use of water resources puts the District in a better position to respond to climate change, environmental stream flow needs, evapotranspiration needs of customer crops, deliveries to cities from SSJID's treatment plant, and provides help to others suffering from the drought with humanitarian water transfers.

The Stanislaus River is the primary source of water for the District. The District's use of water is based on pre-1914 adjudicated and post-1914 appropriative rights that are shared with the Oakdale Irrigation District. After the construction of New Melones Reservoir, the District entered into an agreement with the United States Bureau of Reclamation to receive the first 600,000 (split evenly between SSJID and OID) acre-feet (AF) of inflow to New Melones. If New Melones inflow is less than 600,000 AF, then the District is entitled to 100,000 AF plus inflow divided by three. Water that is unused in any year may be stored at New Melones in a "conservation account", up to a total of 200,000 AF that can be used in water short years. These current water supplies have become at-risk over the years due to droughts, environmental stream flow requirements, increased demands from the District's water treatment plant serving urban water needs, and irrigation deliveries.

In 2015, deliveries from the District's treatment plant to the cities of Tracy, Manteca, and Lathrop were cut by 20%. In addition, deliveries were reduced to farmers to 36" of applied water, meaning that over 50% of the District's growers would not be delivered enough water to raise a full crop. The On-Farm Conservation Program holds promise to improve flow conditions in natural stream channels by conserving high quality surface water in the District's volumetric allocation of New Melones Reservoir for other beneficial uses, such as endangered species habitat needs in the lower Stanislaus River, lower San Joaquin River, and southern Delta.

The On-Farm Conservation Program works to help address these complex water shortage issues and prepare for long term drought conditions. The Projects helps delivery water efficiently with the best available technology while conserving saved water for other highest and best uses.

Direct Water Related Benefit to a DAC

The Eastern San Joaquin Groundwater Basin Authority (GBA) developed its 2014 IRWM Plan Update to include a more focused Disadvantaged Community (DAC) outreach plan. Including this component in the Plan was essential. According to DWRs' DAC definition, nearly 59% of San Joaquin County qualifies as a DAC.

MHI, population data, and Geographical Information Systems (GIS) files have been downloaded from the Department of Water Resources Disadvantaged Communities Mapping Tool. The data and GIS files are derived from the US Census Bureau's American Community Survey (ACS) and are compiled for the 5-year period 2009-2013. There are a total of three different census geographies (Place, Tract, and Block Group) used to identify DAC areas. There is a total population of approximately 192,899 people in 58,675 households that are in disadvantaged Census Places, Tracts, and/or Blocks reported as being at the MHI or below in the project area (see Attachment 7).

As a water wholesaler, SSJID delivers water to several municipalities in southern San Joaquin County. The cities of Lathrop, Manteca and Tracy currently receive treated surface water from the SSJID's South County

Water Supply Program (SCWSP), and the city of Ripon currently purchases raw untreated water from SSJID.[19] The city of Escalon is under contract to purchase water from the SCWSP but has not yet constructed a pipeline to convey the water to its facilities.

SSJID's service area contains both Manteca and Escalon, which are also both over 25% disadvantaged areas, according to data from the American Community Survey (ACS).

Supply of adequate high-quality drinking water supplies to meet health and safety needs is a major concern for the local disadvantaged community. The Cities of Lathrop, Tracy and Manteca divert the water into their distribution system and deliver it to all water sectors (i.e., residential, multi-family, commercial, industrial, office, etc.). Tracy also uses some treated water for groundwater recharge. The city of Ripon currently uses untreated SSJID water exclusively for groundwater recharge. Demand for SCWSP water is expected to increase over time as the cities grow, and as they replace some of their groundwater pumping with surface water deliveries. Each city has an agreement with SSJID to receive treated water through December 2029. The total amount of water expected to be delivered is 43,090 acre-feet per year.[20]

The intent of both the West Basin Reuse Project and the On-Farm Water Conservation project is to conserve and re-use irrigation and stormwater. These projects directly affect the amount of drinking water SSJID can provide to their customers by replacing raw agricultural surface water supplies for irrigation with recycled water, and reducing the amount of water currently used on farms. Replacing and reducing the existing irrigation supply means any water that would normally be used for irrigation purposes can now be used for drinking water purposes. Because SSJID provides water to municipalities that are comprised of disadvantaged households, these projects directly affect disadvantaged communities.

In addition, SSJID has made several humanitarian water transfers, such as the 2014 transfer to Tuolumne County after they lost their water supply in Rim Fire near Yosemite (see Attachment 7).

Project Performance Monitoring Plan

Table 6.1 – Project Performance Monitoring Plan

Project: SSJID West Basin Water Reuse Project

Proposed Physical Benefits	Targets	Measurement tools and methods
Water Conservation	10,000 AF/Year	Flow Measurement at west basin influent flowmeters.
Water Quality Improvement	Boundary outflow measurements through the seasons at the two drainage outfalls in Division 9; Drains 11 and 18.	Flowmeters at drains 11 and 18 will confirm zero discharges to rivers and associated 0 mg/L discharged to environment. As needed, follow up testing at drains in 2016 before project is on-line to confirm existing water conditions (in mg/L).

[19] South San Joaquin Irrigation District Urban Water Management Plan, 2011, p.6.
[20] South San Joaquin Irrigation District 2011 Urban Water Management Plan, p. 17

Table 6.2 – Project Performance Monitoring Plan **Project:** SSJID On-Farm Water Conservation Program		
Proposed Physical Benefits	**Targets**	**Measurement tools and methods**
Water Conservation	2,700 AF/Year	Flow measurement at customer turnout.
Water Quality	1. Flood to Sprinkler Conversions 2. Drainage Relief 3. Scientific Irrigation Scheduling	1. Reporting of surface water quality delivered to crops from District's Delivery system. 2. Site visits to confirm zero farm runoff and associated 0 mg/L discharged to environment.

Cost Effective Analysis

Table 7.1 – Cost Effective Analysis **Project 1: SSJID West Basin Water Reuse Project**		
Question 1	Types of benefits provided as shown in Tables 5.2	The main benefit of this project is that SSJID will be able to conserve 10,000 acre-feet of water annually while at the same time improving delivery service by providing on-demand pressurized irrigation service. The 10,000 acre-feet of water conserved will be made available to new beneficial uses including but not limited to: humanitarian water transfers (at below market rates) to Disadvantaged Communities and agencies in need; conveyance to groundwater recharge ponds in the San Joaquin basin to meet future sustainable yield goals in compliance with the Sustainable Groundwater Management Act; increased domestic deliveries; hydroelectric production; and replacement of groundwater pumping for domestic and irrigation needs with conserved surface water.
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?	Yes. Seven alternative design methods for a pressurized SSJID water system have been considered to achieve the same types and amounts of physical benefits as the proposed project. This was conducted by analyzing the extent to which the existing gravity system is retained or is replaced with pressurized pipelines. Bounding the range of options on one end is a "decentralized" pressurization design concept where the existing system would be largely retained and used to supply a number of relatively small-scale, local pressurized systems. On the other end of the range, a "centralized" design approach would be to replace the entire existing system from Woodward Reservoir down to each farm turnout. The West Basin Water Reuse Project is a part of the

Table 7.1 – Cost Effective Analysis Project 1: SSJID West Basin Water Reuse Project		
		alternative with the lowest present value of costs.
	If no, why?	The approach in identifying a representative range of centralized and decentralized alternatives is to conduct a sensitivity analysis with the quantity and location of pump stations placed at strategic locations across the District. This range of alternatives were then analyzed for up-front capital cost including pipelines, pump stations, turnouts, remote telemetry units, SCADA system, engineering, environmental permitting, construction management, and construction contingency. Annual costs were also calculated for pump station energy to pressurized system, and maintenance and replacement of the pressurized system. To find the least-cost alternative for District pressurization, projected water demands were evaluated for the pressurized system. The service area and water demands analysis and the Division 9 capacity and operational review were completed to find the peak demand for the pressurized alternatives. A monthly time-step of demands was also developed to characterize the flow at each month of the irrigation system. With the monthly demand at each pump station for each alternative, pump stations and pipelines were sized to convey peak flows essentially on-demand to every customer in the District's service area and potential areas of annexation in the District's sphere of influence. The pipelines were design to convey peak on-demand flows from the irrigation customers without exceeding a velocity of 5 feet per second. Velocities in excess of 5 feet per second generally produce significant head losses across the system, reduce service life of pipelines requiring premature maintenance and replacement of pipelines, and require the pump stations to have larger pumps and increased annual energy costs. Pipelines designed for flows in the 2-3 feet per second in this scenario yield pipe sizes that create significant impacts to grower operations and would require District easement acquisition and corresponding farmland having to be taken out of production. The pump stations total dynamic head requirements each month were modeled to successfully deliver 55 psi at each farm-gate across the District's 55,000 acres. Once the pipeline and pump stations were sized to meet the projected Project's peak demands, a monthly irrigation operations plan was developed at each pump station to determine the exact horsepower requirements needed each month of the year. Pump station designs were evaluated and a proper motor and impeller efficiency, and energy rate were selected to determine the monthly and annual energy costs the pump stations would require to provide irrigation service. With the pipeline and pump stations appropriately sized, detailed investigations were conducted for the delivery system to find the total construction cost for each pump station, pipeline, and associated appurtenances. The pipeline investigation including a materials evaluation covering all viable options including High Density Polyethylene, Polyvinyl Chloride, Fiber Reinforced Polymer, Ductile
	If yes, list the methods (including the proposed project) and estimated costs.	

Table 7.1 – Cost Effective Analysis Project 1: SSJID West Basin Water Reuse Project		
		Iron Pipe, Concrete Cylinder Pipe, Reinforced Concrete Cylinder Pipe, and Welded Steel Pipe. As a means of identifying the most cost-effective way to provide pressurized water service District-wide, an analysis was conducted to assess the economic and financial advisability of the following seven alternatives: • **Alternative 1**: Pressurization from ***one*** pump station in the vicinity of Victory Road with piping the main canal. • **Alternative 1A**: Pressurization from ***one*** pump station in the vicinity of Victory Road ***without*** piping the main canal. The first set of alternatives provides District-wide pressurization from one large, centralized pump station near Victory Road where the Lower Main Supply Canal ends and the Main Distribution Canal begins. The pump station would be situated just upstream of the first lateral heading originating from the MDC. The location for the one pump station scenario was selected to conveniently pressurize all existing laterals from a very robust, looped backbone system. The pump station was not sited closer to Woodward Reservoir because raising the hydraulic grade line near Woodward would require the LMSC to be piped in the first phase of the project, and the design of the LMSC pressurized pipe would need to be more robust to accommodate the higher pressures on the LMSC pipeline reach. • **Alternative 2**: Pressurization from ***three*** pump stations at locations along the MDC with piping the main canal. • **Alternative 2A**: Pressurization from ***three*** pump stations at locations along the MDC ***without*** piping the main canal. The second set of alternatives pressurizes the District from three medium sized pump stations adjacent to the MDC. These pump stations would be spaced at strategic locations to allow the District's service area to be split into three, somewhat similarly sized pressure zones. This design allows increased flexibility, system redundancy, and increased hydraulic efficiencies since each pump station serves a smaller service area. The smaller pump stations would more evenly balance out the electrical load across the service area and allow the pump stations individually to fit within District easements. • **Alternative 3**: Pressurization from ***six*** pump stations at locations along the MDC with piping the main canal. • **Alternative 3A**: Pressurization from ***six*** pump stations at locations along the MDC ***without*** piping the main canal. The third set of alternatives pressurizes the District's service area from six pump stations, all from the MDC. The pump stations would be spaced evenly along the MDC to allow the District to phase in the project very strategically, allowing select laterals to be pressurized from small booster pump stations, providing even more flexibility and additional system redundancy. • **Alternative 4**: The Division 9 model. Pressurization from ***six*** pump stations at decentralized locations throughout the

Table 7.1 – Cost Effective Analysis Project 1: SSJID West Basin Water Reuse Project		
		District. This alternative does not pipe the main canal. The fourth alternative pressurizes the District much like the Division 9 Pilot Project. Water would be pressurized from regulating reservoirs that are decentralized throughout the District's service area. This alternative would allow the pipelines to be sized the smallest, allowing much of the District's gravity infrastructure to be utilized to supply water to the reservoirs for pumping and reducing easement acquisition. The seven different scenarios for District-wide pressurization were evaluated against five different factors described below. The purpose of looking at this wide range of scenarios was to reveal factors that have the strongest effect on project costs and benefits. 1. **Future water demands**: Future water demands in 2040 were projected for two conditions – one based on the existing cropping, on-farm system and water source preference trends and another based on maximum adoption of pressurized systems and use of SSJID surface water. Both scenarios are based on a total irrigated area of about 56,000 acres, including the existing SSJID service area plus certain adjoining areas that would presumably be annexed into SSJID, minus areas projected to convert from agriculture to other (mainly urban) land use by 2040. 2. **Pipe configuration**: Pipe configurations were selected based on District available pipeline easements, roads and county right-of-way, optimization for hydraulic efficiencies, spurline suitability, utilization of District assets, urban areas to avoid, environmental factors, and water reuse strategies. 3. **Pipe sizing strategy:** For a feasibility assessment, the pipelines were sized to convey peak on-demand flows from the irrigation customers without exceeding a velocity of 5 feet per second. If the least cost alternative is carried through to predesign, an exhaustive sensitivity analysis will be conducted to find the exact optimal pipe sizes for each foot of the over 1.5 million feet of pipe this project proposes to install. 4. **Pipe material**: The following materials were considered and their impact on construction and long-term costs: High Density Polyethylene (HDPE), Polyvinyl Chloride (PVC), Fiber Reinforced Polymer (FRP), Ductile Iron Pipe (DIP), Concrete Cylinder Pipe (CCP), Reinforced Concrete Cylinder Pipe (RCCP), and Welded Steel Pipe (WSP). 5. **Appurtenances:** Accessories including communications systems, electrical systems, instrumentation, mechanical equipment, and turnouts were considered. Below is a summary of the present value costs of each alternative. The West Basin Water Reuse Project is part of alternative four, which is the lowest cost alternative.

Table 7.1 – Cost Effective Analysis

Project 1: SSJID West Basin Water Reuse Project

		District Pressurization Master Plan Present Value of Costs: Alternative 1: $652,662,059 Alternative 3: $610,309,725 Alternative 1A: $658,556,662 Alternative 3A: $584,587,831 Alternative 2: $646,561,301 *Alternative 4: $551,829,077* Alternative 2A: $590,918,467
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.	The project is the least cost alternative. Expected accomplishments with this project are described in the technical analysis section.

Table 7.2– Cost Effective Analysis

Project 2: SSJID On-Farm Water Conservation Program

Question 1	Types of benefits provided as shown in Tables 5.3	This Program allows the District to conserve water and make the water available for other beneficial uses in California. In addition, this program assists in satisfying the 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. An evaluation of the On-Farm Conservation Program in 2012 showed that the overall response from participants to be positive. Most participants are pleased with the program design and implementation and all respondents expressed interest in continuing to participate.

Table 7.2– Cost Effective Analysis Project 2: SSJID On-Farm Water Conservation Program		
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified?	Yes. Alternative methods have been considered including on-farm physical improvements, irrigation management practices and water measurement 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
	If no, why?	Yes. Alternative methods to meet the water management goals of the District include:
	If yes, list the methods (including the proposed project) and estimated costs.	• **Delivery measurement for pumped deliveries** 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 irrigation** 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. • **Drainage relief options** 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 District's cost share for drainage relief options 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 $10,000 per grower for this measure. The estimated costs are based on estimated quantities and unit costs for system components and based on review of NRCS Environmental Quality Incentives Program cost estimates. • **Scientific irrigation scheduling** The estimated cost of scientific irrigation scheduling for planning purposes is $3,000 per field per season. The estimated cost of soil moisture monitoring for planning purposes is $1,500 per field per season. These costs represent the average seasonal cost for a consulting service to provide irrigation recommendations or provide soil moisture monitoring reports 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 and/or soil moisture monitoring service directly to the service provider. The portion that the District is willing to pay will be a one-time payment of 50% of the actual cost, not to exceed $1,125 per field. The maximum payment for Scientific

Table 7.2– Cost Effective Analysis Project 2: SSJID On-Farm Water Conservation Program		
		Irrigation Scheduling and/or Soil Moisture Monitoring will be limited to $2,500 per grower.
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.	The conservation measures are the preferred alternatives because they are listed as Efficient Water Management Practices (EWMPs) in SBx7-7 and are supported by the National Resources Conservation Service Environmental Quality Incentives Program. Accomplishments with each conservation method are described in the technical analysis section.
Comments:		