ATTACHMENT E – Division 9 Irrigation Enhancement Project Final Report

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Eastern San Joaquin Region
2014 IRWM Drought Grant Application

Division 9 Irrigation Enhancement Project

Final Project Report

Agreement #R11AP20098
South San Joaquin Irrigation District
11011 E. Highway 120, Manteca, California 95336
November 8, 2012

1. Recipient Information:	
Recipient Name: (Name, contact person, address and phone number)	**South San Joaquin Irrigation District** **Jeff Shields** **11011 E. Highway 120, Manteca, California 95336** **(209)249-4645**
Project Name:	**Division 9 Irrigation Enhancement Project**
Assistance Agreement No:	**R11AP20098**
Date of Award: (Month, Year)	**September, 2011**
Estimated Completion Date (Month, Year)	**September, 2012**
Actual Completion Date: (Month, Year)	**August, 2012**

2. Final Funding Information	**Funding Amount**
Non-Federal Entities	
1.	
2.	
3.	
Non-Federal Subtotal:	0.00
Other Federal Entities	
1.	
2.	
3.	
Other Federal Subtotal:	0.00
Requested Reclamation Funding:	995,000.00
Total Project Funding:	995,000.00

3. One Paragraph Project Summary:

The newly completed pressurized irrigation system holds potential to be among the most water-efficient in the agricultural industry. Designed to be an industry model for water efficiency and provide area growers with individualized, automated irrigation access through the use of online and mobile technology, the new system was designed and constructed over a three-year period. Design of the new system was developed and implemented as a cooperative effort between Stantec Consulting and the SSJID.

The project consists of a 19-mile network of pipeline with flexible pressurization (currently set at 60 psi), a 56-acre-foot water storage basin, a pumping station containing seven vertical turbine pumps totaling 1,225 horsepower, capable of pumping 23,500 gal/min, and a total of 55 solar-powered Field Telemetry Units or FTU's controlling 76 customer connections. The FTUs consist of a PV panel, a flow control valve and meter, and a radio based supervisory control that communicates with data acquisition (SCADA) system in the pump control room.

With the new system, irrigation water will be distributed to the customers across 3,800 acres of California's Central Valley through an automated, pressurized system. Using an online system similar to an airline ticketing platform, growers in the District's Division 9 are enabled to log-in and schedule water deliveries. Additional information on current and past weather forecasts, previous water usage and historical evapotranspiration rates, and real-time moisture sensor readings are also available on the website. Each farmer selects from available delivery dates and receives alerts via email and text message before and after delivery to confirm volume and flow rate data. Also supporting the system, moisture sensors placed in the ground on each grower's property will help indicate optimal ordering times when orchards are at their greatest need.

4. Final Project Description: *Briefly describe components of the project and the work completed, including each element of the scope of work and the work completed at each stage of the project. Please include maps, sketches, and/or drawing of the features of the completed project, as appropriate. In addition, please describe any changes in the project scope.*

The main components of the system are as follows:

4.1. East Basin

4.1.1. 56 acre – ft storage basin with shotcrete line slopes and clay liner. The east basin serves as the water supply for the pressure system.

4.1.2. Reinforced concrete structures at East Basin including 42” and 48” inlets and outlets, junction and pressure boxes, retaining walls, pump bays for pressure system, outlet bay for flood irrigation, walkways, and foundation for control building.

4.1.3. Process piping and mechanical equipment for pump station that includes seven vertical turbine pumps (1225 total horsepower) capable of pumping 23,500 gallons per minute, magnetic flow meters, check valves, pressure relief system, butterfly valve isolation valves, discharge manifold with vents and pressure transmitters, and storm drain system for drainage relief during rain storms, traveling screen operation, and wash down activities.

4.1.4. Traveling Screens to remove debris from basin.

4.1.5. Vertical Screens to prevent debris from load pump bays.

4.1.6. Switchgear and transformer to facilitate 480V MID power to control building.

4.1.7. Radio tower and antennae for communication to field telemetry units across the 3,800 acres of Division 9 and to the District's main control room.

4.1.8. Control Room that houses communication, electrical, and mechanical equipment to operate the system.

4.1.9. Main switchboard, motor control centers, network equipment, and variable frequency drives for pumps at control building.

CPX 3000

4.1.10. Basin level transducers for SCADA monitoring of main and flood basin water levels.

4.2. Pipeline

4.2.1. 19 miles of 12”-24” PVC SDR 32.5-18 pipe.

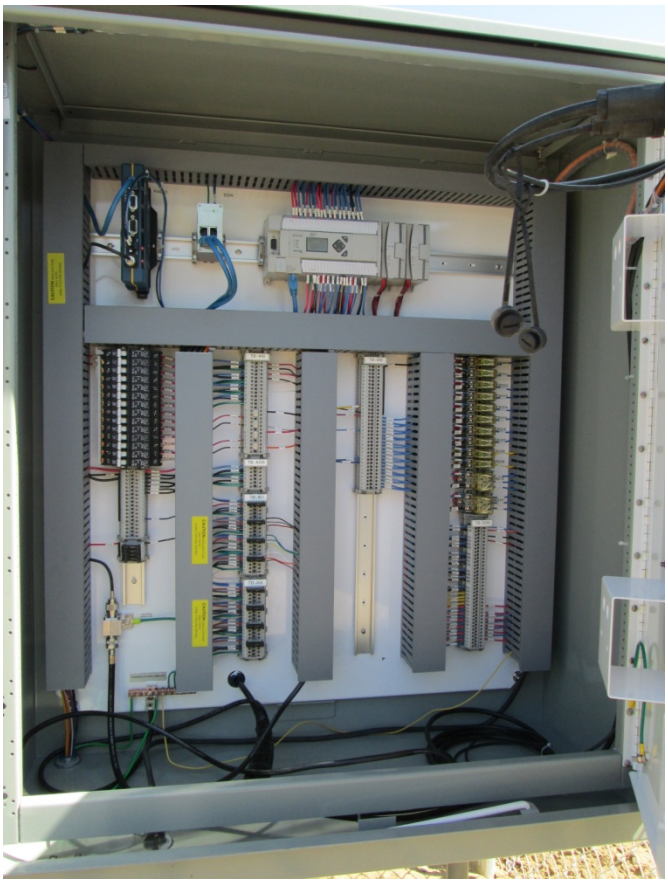
4.2.2. Air and vacuum release valves installed throughout the system.

4.3. Customer Connections

4.3.1. Turnout assembly including isolate gate valve, magnetic flow meter, ductile iron spools, pressure transmitter, automatic flow control valve, moisture sensors, and field telemetry unit.

4.3.2. Automatic flow control valve housed in vault.

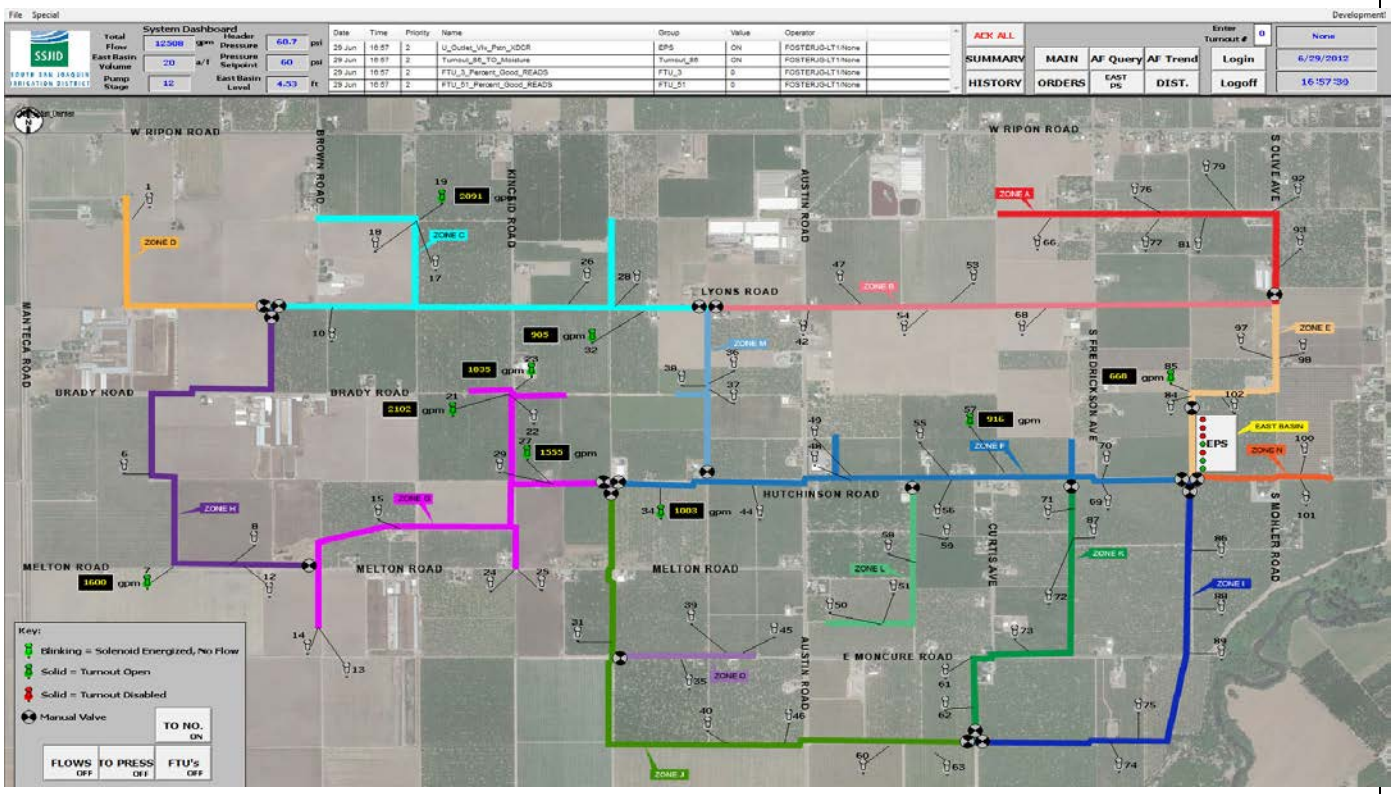
4.3.3. Turnout control panel.



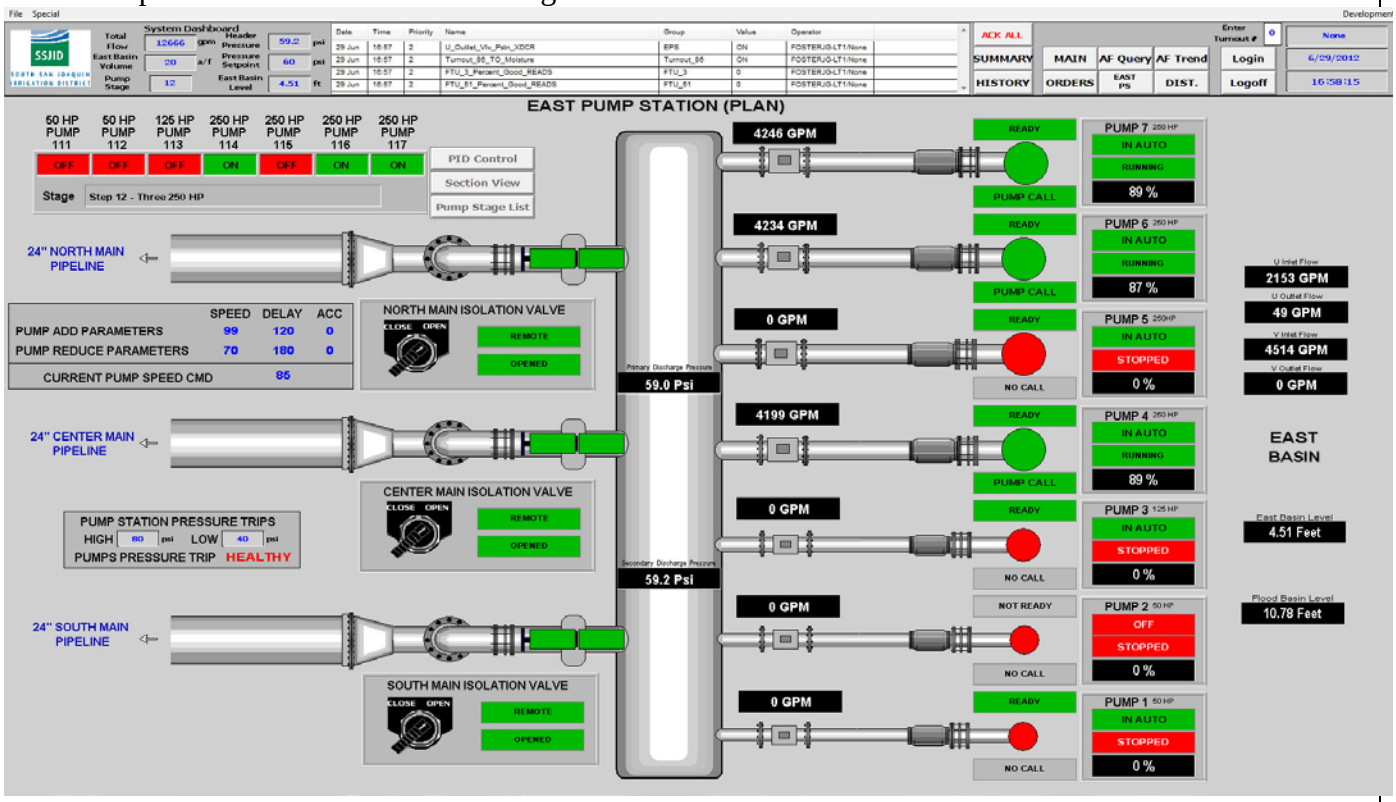
4.3.4. Turnout battery panel.

4.4. District Operator Interface

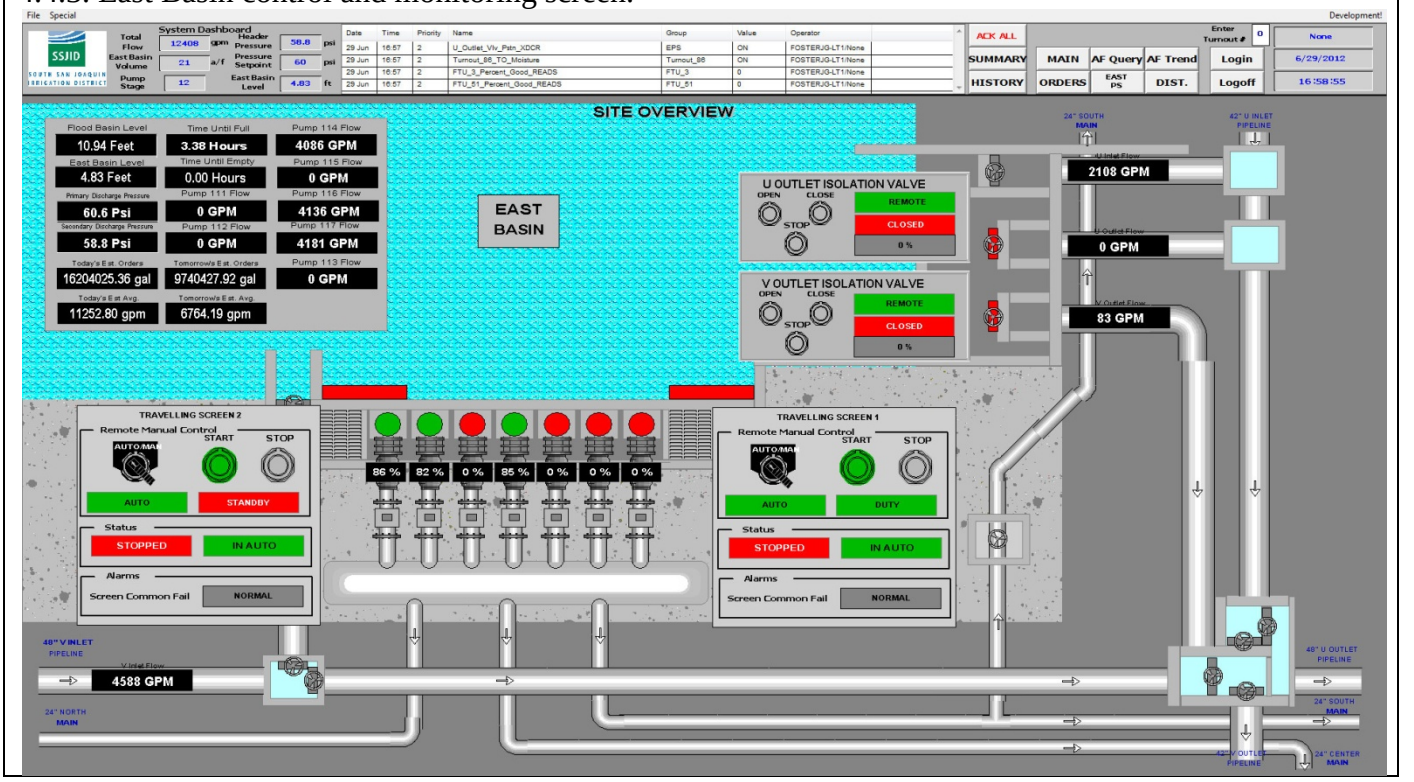
4.4.1. System overview screen to monitor pipelines and customers using the pressure system.



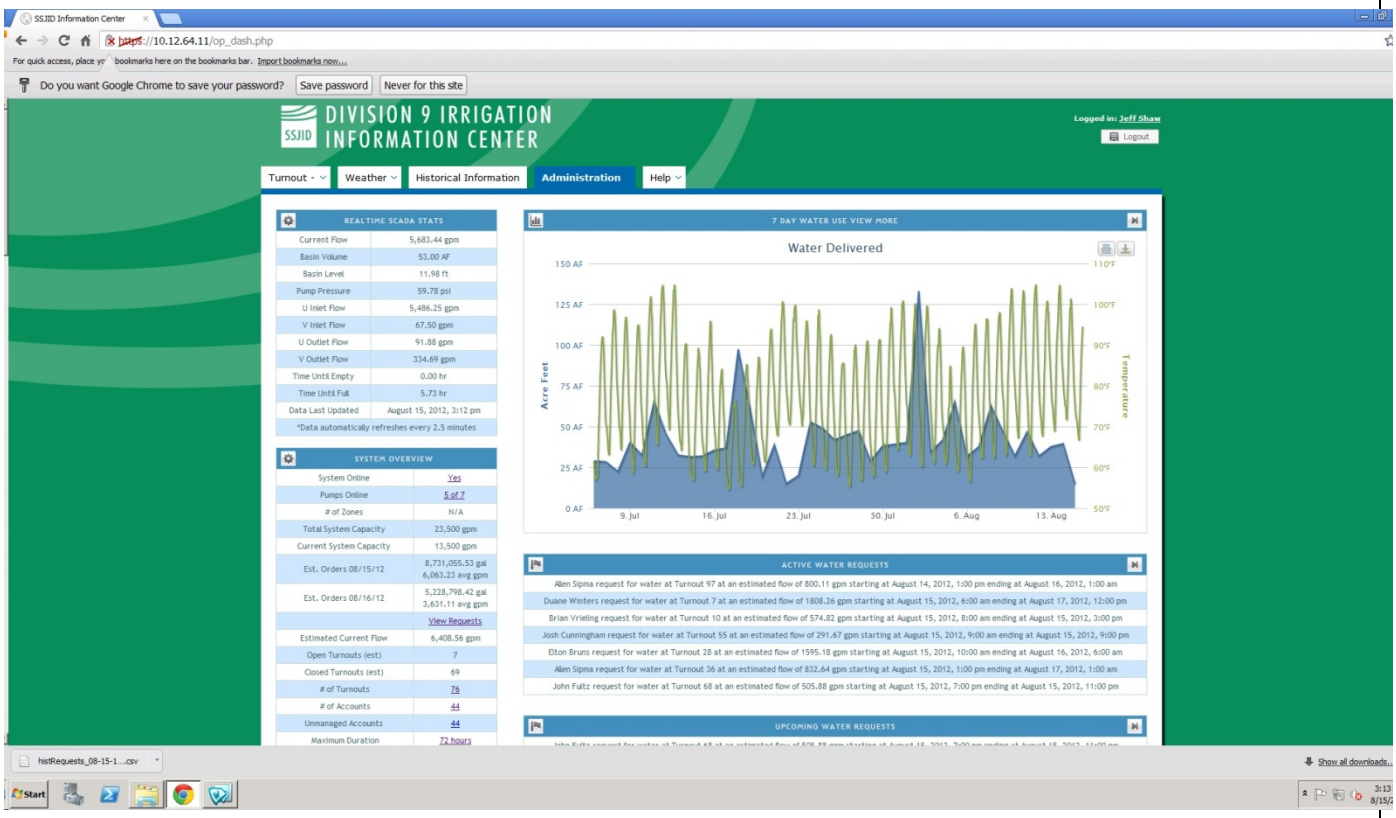
4.4.2. Pump Station control and monitoring screen.



4.4.3. East Basin control and monitoring screen.

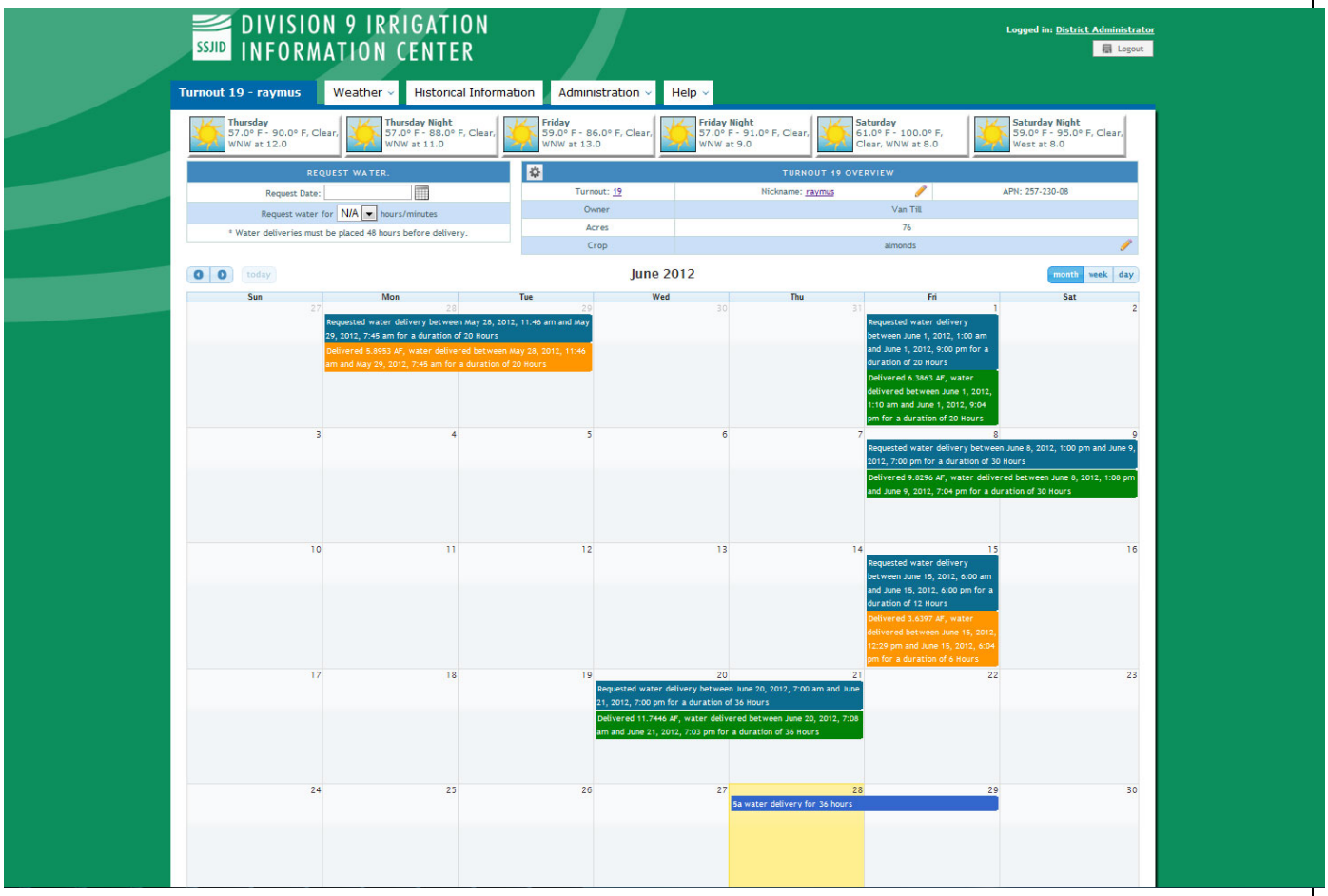


4.4.4. Operator and ditch tender dashboard to monitor water deliveries, SCADA information, text/email alerts, active and upcoming water orders, and system status.

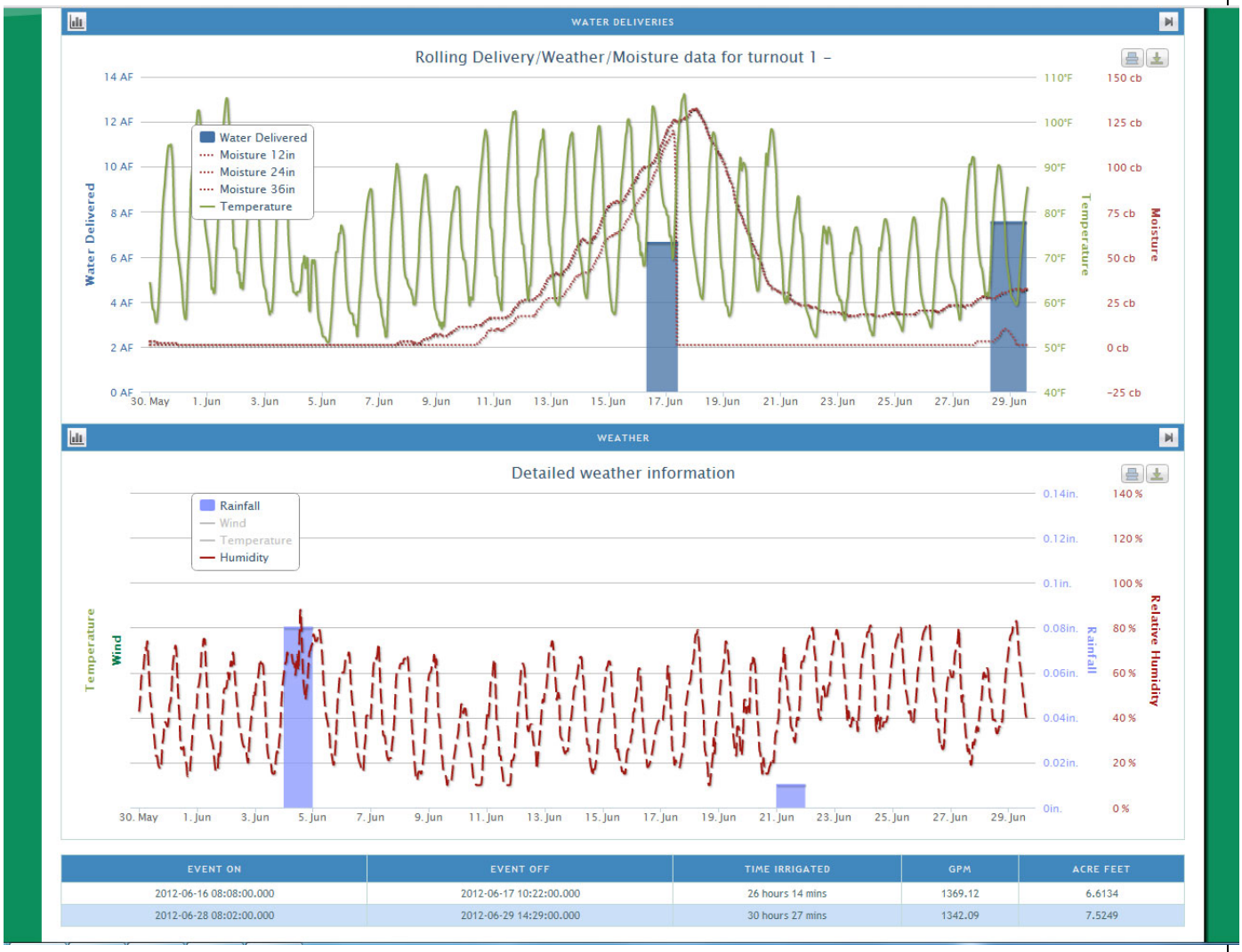


4.5. Farmer Web Interface

4.5.1. Farmer order and calendar page.

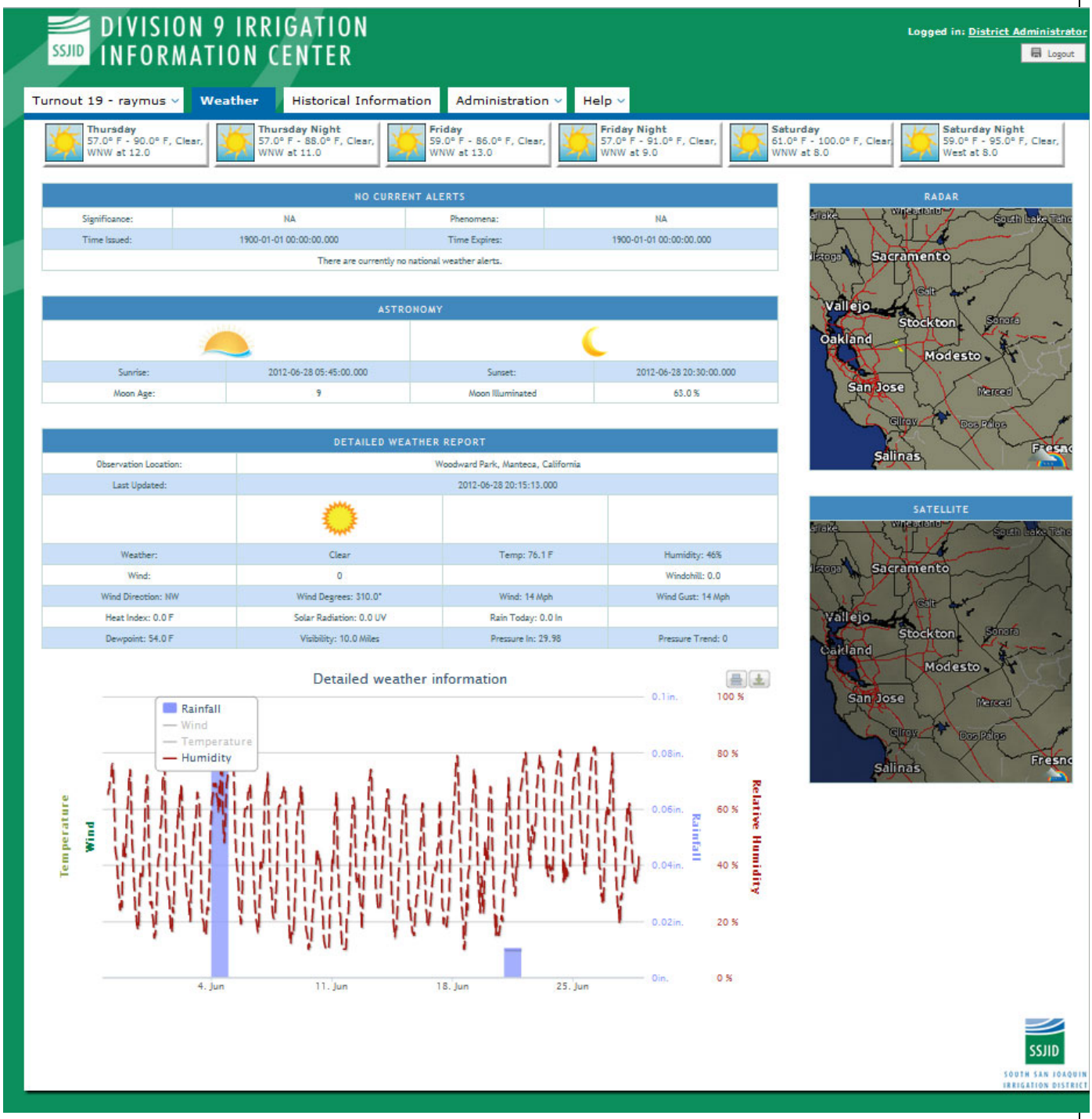


4.5.2. Farmer historical information page.



EVENT ON	EVENT OFF	TIME IRRIGATED	GPM	ACRE FEET
2012-06-16 08:08:00.000	2012-06-17 10:22:00.000	26 hours 14 mins	1369.12	6.6134
2012-06-28 08:02:00.000	2012-06-29 14:29:00.000	30 hours 27 mins	1342.09	7.5249

4.5.3. Farmer weather page.



5. Accomplishment of Project Goals: *Describe the goals and objectives of the project and whether each of these was met. Where appropriate, state the reasons why goals and objectives were not met, and describe any problems or delays encountered in completing the project. Please include whether or not the project was completed within cost.*

Goal #1: To provide the highest level of service to the customers of SSJID.
The community of farmers that make up Division 9 of SSJID for the first time get water exactly when they need it at the pressure they desire. Since the valves are automatic and the web based interface allow management through an internet connection(smart phone and Ipad compatible), farmers can concentrate on other faucets of their farming operation.

Goal #2: Improve beneficial use of water.
With a pressure system available, farmers can reduce flood irrigation and utilize drip, micro, and solid state sprinklers to irrigate their orchards which improves crop yield, and conserves water by up to 50%. Additionally, the new system has eliminated operational spills and has allowed remaining flood irrigators to irrigate their fields in significantly less time due to the fact that they are able to use the full head of water from the gravity pipeline.

Goal #3: Comply with volume billing requirements.
Customers of this system comply with State regulations via a magnetic flow meter accurate to 0.5% at each customer connection.

Goal #4: Reduce groundwater pumping.
Since gravity water was often not available when farmers needed it, groundwater pumping had become commonplace. Due to the new surface water supplied pressure system, there has been a considerable reduction in the pumping of salinity stricken groundwater, and the trees in Division 9 are already benefiting.

Goal #5: Improve air quality.
With less groundwater pumping, air quality though out Division 9 has improved due to the reduced use of diesel powered well pumps.

6. Discussion of Amount of Water Conserved, Marketed or Better Managed: *In responding to the questions set forth below, Recipients should rely on the best data or information available. Actual field measurements should be used whenever possible (e.g., baseline data or post-project data derived from measuring devices, diversion records, seepage tests, etc.) Where actual field measurements are not available, water savings (or amounts marketed or better managed) may be estimated based on studies, other similar improvement projects, or anecdotal evidence.*

A. Recipient's total water supply (average, annual, available water supply in acre-feet per year):

The ten year average water supply(2002-2011) to the Division 9 pressure system customer base has been 7,528 acre-feet.

B. Amount of water conserved, marketed or better managed as a result of the project (in acre-feet per year):

The amount of water conserved as a result of the project amounts to 2,833 acre-feet after the first irrigation season.

C. Describe how the amounts stated in response to 6.B were calculated or estimated: *In responding to this question, please address (1) – (3) below.*

(1) Describe the information/data being relied on to calculate/estimate the project benefits. State how that data/information was obtained, if appropriate. Provide any other information necessary to explain how the final calculation/estimate of project benefits was made.

The summation of water deliveries (calculated via magnetic flow meters at each customer connection) through the pressure system for the first year amounted to 4,695 ac-ft. When compared to the 10 year historical average water demand for these customers of 7,528 acre-ft, a 2,833 acre-ft conservation has been achieved.

(2) As appropriate, please include an explanation of any concerns or factors affecting the reliability of the data/information relied on.

N/A

(3) Attach any relevant data, reports or other support relied on in the calculation/estimate of project benefits, if available. Please briefly describe the data/information attached, if any.

N/A

D. Use of Conserved Water: *Please explain where the water saved, better managed, or marketed as a result of the project is going (e.g. used by the recipient, in stream flows, available to junior water users, etc.*

The use of conserved water is currently being used to fund our conservation account at New Melones, have a larger dry weather contingency, and to meet the demand of existing and new customers within District boundaries.

E. Future tracking of project benefits: *Please state whether and how the recipient plans to track the benefits of the project (water saved, marketed or better managed) in the future. If no actual field measurements are currently available to support the estimate of project benefits in 6.B., please state whether actual field measurements will become available in the future. If so, please state whether the Recipient is willing to provide such data to Reclamation on a voluntary basis once it is available.*

The District plans to compile usage data on an annual basis and compare the water demands for the pressure customers to the historical demands prior to the project.

7. Discussion of Amount of Renewable Energy Added: *If your project included the installation of a renewable component, please describe the amount of energy the system is generating annually. Please provide any data/reports in support of this calculation.*

The powered components(radio, plc, flow meter, flow control valve) of each customer connection is powered by solar. The energy requirements of these components amount to 204,156 watts per year per field telemetry unit. With 55 telemetry units installed with the project, the system is generating 11,228,580 watts per year of renewable energy.

SOLAR CALCULATIONS - All FTUs						
			Effective Sun	**4.5**	**Hrs/Day**	
Item	**Description**	**Voltage(V)**	**Current (mA)**	**Power (Watts)**	**Duty Cycle**	**Ahrs/Day**
1	PLC - AB Mlogix 1400	24	833	20.0	100%	20.0
2	AI Card 5 loops	24	100	2.4	100%	2.4
3	Radio TS2400 Rcv	24	125	3.0	12.5%	0.4
4	Flow Meters Battery w/ Pulse	24	50	1.2	100.0%	1.2
5	Relay & Solenoid Valve - 4W	24	667	16.0	50.0%	8.0
6	Radio TS2400 - Xmt	24	1000	24.0	12.5%	3.0
	Total		2775		**3.8**	**35.0**
	Recharge Allowance	Recharge in	**4**	Days	Watts/Day	630
	Power to be produced				Watts/Day	839
	Solar Efficiency					90%
	Spring Summer Sun				Hrs/Day	4.5
	Min. Solar Power				Watts/Day	363
	Solar Selection	**24VDC**	**STP190S-24/Ad+**		**Watts/Panel**	**190**
			SunTech or =		**PV Panels**	**2**
	Charge Controller		**Sun Saver MPPT 15A**			
			MorningStar or =			
					Battery Days of Storage	**3**
	Min. Battery Capacity				**Storage Ahrs**	104.93
	Battery Useage					60%
					Ahrs	174.9
	Battery Selection	**12VDC**	**PVX-1080T (77# each)**		**Amp Hours at 100hour rate**	**108**
			Concorde or =		**Batteries in Parallel**	2
					Total Batteries	**4**

8. Describe how the project demonstrates collaboration, stakeholder involvement or the formation of partnerships, if applicable: *Please describe the collaboration involved in the project, and the role of any cost-share or other types of partners. If there were any additional entities that provided support (financial or otherwise) please list them.*

Since the success of the District 9 project was contingent on participating farmers' usage, the biggest challenge for SSJID was garnering acceptance from their farming customers. Farmers depend on the delivery of water for their livelihood and the District was met with intense skepticism from farmers about the new technology required and the unfamiliar mobile phone applications. In order to gain approval from their customers, the District in concert with Stantec's construction manager, organized a public outreach initiative to educate farmers on new technology such as iPhone applications and web-based irrigation controls. Additionally, SSJID staff educated the community regarding the economic and environmental benefits to the region through a series of one-on-one conversations, a project-specific website, phone calls, and public meetings.

By the end of the project, SSJID garnered 100% participation among their farmers – even among the most steadfast of skeptics. According to Sam Bologna, SSJID's Engineering Manager, the farmers have gone from "I don't like what you're doing" to "I love this."

Easements presented a challenge to the design and constructions teams. The original design of the gravity system placed the lines in 30-foot easements; however, the lines weren't always straight and in many cases, farmers didn't pay attention and planted crops into the easements. Many times, the construction team encountered alignments that threaded through trees and they needed to clip branches or remove trees. Staff from the District, Stantec and Knife River Construction had to work together to strike a balance between being aggressive with SSJID rights to easements and being good neighbors to adjacent growers. In one case, the team adjusted the easement to run between two walnut trees, in order to not interfere with the growing season. When the team did have to remove trees, they offered to cut the trees for use as firewood.

9. Describe any other pertinent issues regarding the project:

N/A

10. Feedback to Reclamation regarding the WaterSMART Program: *Please let us know if there is anything we can do to improve the WaterSMART program in general, including the process for applying for or completing a WaterSMART project. Your feedback is important to us.*

11. Attachments: *Please attach the following*
▪ **Any available data or information relied on in responding to paragraph 7, above;** ▪ **A map or illustration showing the location of the recipient's facilities (see paragraph 4, above);** ▪ **Maps, sketches, and/or drawings of the features of the completed project, as appropriate (see paragraph 5, above);** ▪ **Representative before and after photographs, if available;** ▪ **A table showing the total expenditures for the completed project (please see Sample Final Project Costs Table, below).**

FINAL PROJECT COSTS TABLE. *Please provide a breakdown of the final costs of your project. The following table is provided as an example and may be modified as needed.*

BUDGET ITEM DESCRIPTION	RECIPIENT FUNDING	RECLAMATION FUNDING	TOTAL COST
CONTRACTUAL/ CONSTRUCTION	12,673,025.55	995,000.00	13,668,025.55
ENVIRONMENTAL AND REGULATORY COMPLIANCE	66,152.06	0.00	66,152.06
OTHER			
Property Acquisition	410,102.47	0.00	410,102.47
Engineering Design & Construction Management	2,468,964.37	0.00	2,468,964.37
TOTAL PROJECT COSTS	15,618,244.45	995,000.00	16,613,244.45