PIXLEY IRRIGATION DISTRICT

Avenue 116 SCADA System

Tulare County, CA

Application Submitted to

United States Bureau of Reclamation

For A

WaterSMART: Small-Scale Water Efficiency Grant

for FY 2017

(Funding Opportunity Announcement No. BOR-DO-17-F011)

Pixley Irrigation District

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PIXLEY IRRIGATION DISTRICT

Avenue 116 SCADA System

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PIXLEY IRRIGATION DISTRICT

Avenue 116 SCADA System
Technical Proposal and Evaluation Criteria

I. Executive Summary

A. General Project Information

Proposal Name:	Avenue 116 SCADA System
Date:	January 18, 2017
Applicant Name:	Pixley Irrigation District
City, County, State:	Tipton, Tulare County, California

B. Project Description

The Pixley Irrigation District (PID or District) has authored this grant application to seek funding assistance for the Avenue 116 SCADA System Project. The project includes the installation of a supervisory control and data acquisition (SCADA) at the headworks of one of their distribution system canals, referred to by the District as the Avenue 116 Canal.

The objective of this project is to increase efficiencies for managing the water distribution system for the District. The proposed SCADA system will help increase the efficiency of District labor by minimizing time required to field verify diversions, manually operate the diversion into the canal, and providing much quicker real time control of the canal. The SCADA system will also achieve water efficiencies of the canal distribution system by maintaining consistent flows to minimize canal seepage, and allow for maximum diversions into the canal system when water is available.

The proposed project is not located on a federal facility.

The proposed schedule to complete the design and installation of the SCADA system is outlined in **Table 1: Project Schedule**.

Table 1: Project Schedule

Item	Estimated Time to Complete
TASK – 1 – Project Design and Permitting	
1.1 Mechanical Designs	4 months
1.2 Electrical Designs	4 months
1.3 Permitting and Approvals	8 months
TASK – 2 - Construction	
2.1 Construction and Installation	4 months
Total Duration of Project	**12 months**
Estimated Start Date	**July 1, 2017**
Estimated Completion Date	**June 30, 2018**

[1]*Some portions of project to occur simultaneously*

The proposed budget, along with the funding request amount for this grant, to complete the design and installation of the SCADA system is outlined in **Table 2: 2017 Funding Request Summary**.

Table 2: 2017 Funding Request Summary

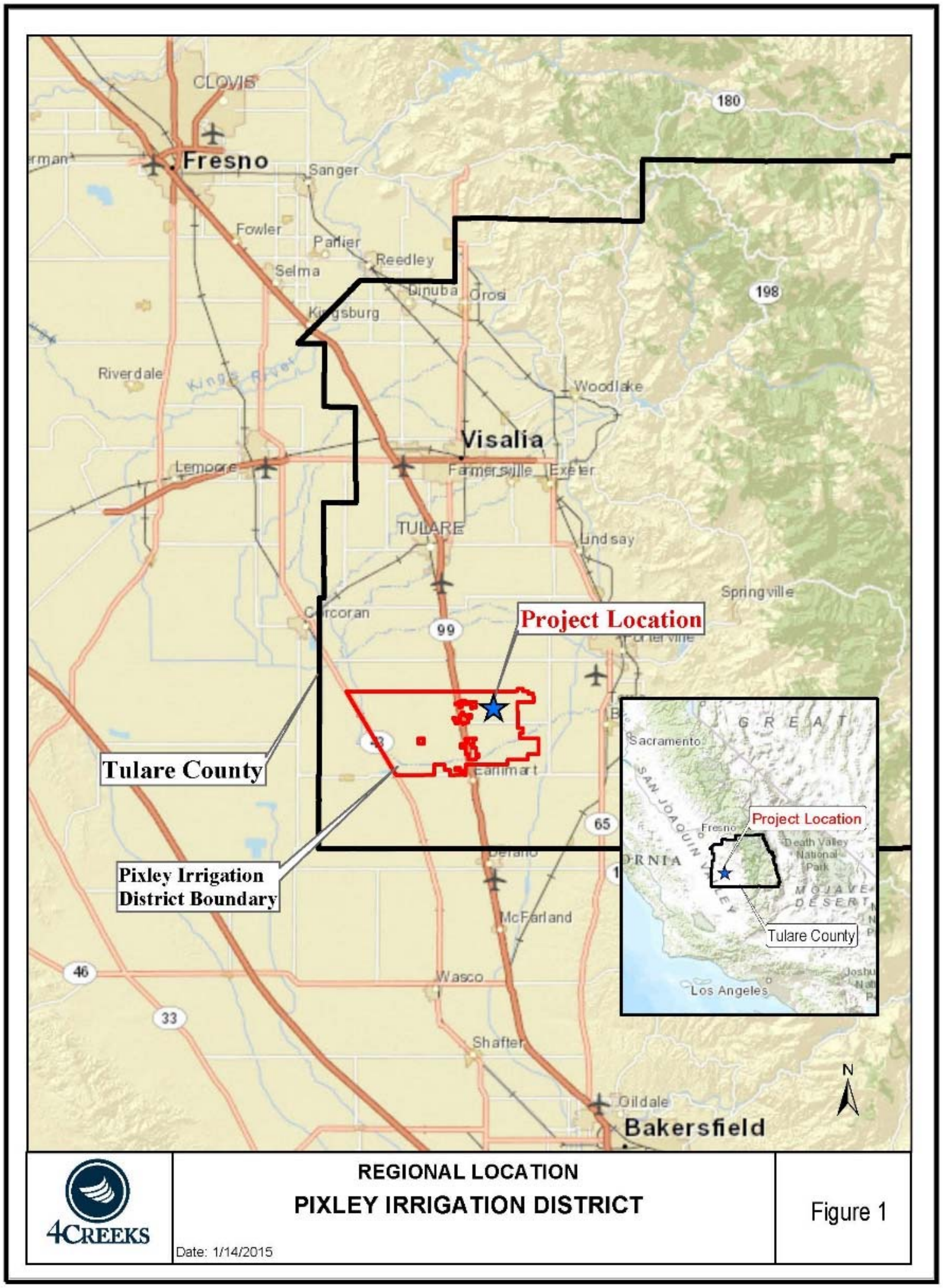
FUNDING SOURCE	Percentage of Total Project Costs	FUNDING AMOUNT
Pixley Irrigation District	**50.0%**	**$37,779.80**
Reclamation Funding	**50.0%**	**$37,779.80**
TOTAL PROJECT FUNDING:	**100.00%**	**$75,559.60**

II. Background Data

A. Geographic Location

Pixley Irrigation District (PID), located in Tulare County, California was formed in 1957 in order to provide a reliable and high quality supplemental surface water supply to its landowners who had previously met their water needs solely by groundwater pumping. The District provides services to 67,643 acres within Tulare County and is located in the central San Joaquin Valley. The community of Pixley lies near the middle of the irrigation district and is the largest community within the PID. Adjacent agricultural water agencies include Corcoran Irrigation District, Lower Tule River Irrigation District, Delano Earlimart Irrigation District, Saucelito Irrigation District, and Tulare Irrigation District. **Figure 1: Regional Location** provides the project location and surrounding areas.

Figure 1: Regional Location



B. Water Supply Sources

The water supply in the District is derived from riparian surface water rights from the natural flow of the Deer Creek, federal contracted water imported from the

Friant-Kern Canal and transfers through the Cross Valley Canal. **Table 3: Average Surface Water Supply** shows the average annual surface water from each source. The District's entire water distribution system is unlined earth canals with reinforced concrete control structures and road crossings. The project area is currently severely underserved by the existing distribution system, leaving growers to rely largely on groundwater to supplement crop irrigation demands.

Water demands in PID are almost entirely agricultural. Crop water demands have averaged from 164,000 to 195,000 AF/year between 1985 and 2007.

Table 3: Average Surface Water Supply

Water Source	Average Annual (AF)
Deer Creek Run-Off	4,645
Cross Valley Canal Supply	33,000
Total	37,645

Groundwater Supplies

PID relies heavily on groundwater to supplement limited surface water supplies. Analysis indicates that groundwater overdraft in PID is 25,000 AF/ year, resulting in groundwater levels declining approximately 3 feet/year. Due to a heavy depression in PID groundwater, an average of 68,000 AF/yr of groundwater flowed into PID from neighboring areas between 1994 and 2007. These neighboring areas include three long-term Friant contractors (Lower Tule River Irrigation District, Delano-Earlimart Irrigation District and Saucelito Irrigation District).

The District owns no groundwater wells and therefore has no direct use of groundwater supplies. However, groundwater is used by private landowners within the District. The District tracks depth to groundwater in the area through a network of monitoring wells to identify and address regional issues under their groundwater management plan, a formalized plan prepared in conformance with state law.

Part of the Districts monitoring efforts include measuring the depth to static groundwater measurements that are taken twice a year, once in the Spring (February) and again in the Fall (October). Depth to groundwater contour maps for both the 2015 Spring and Fall measurements have been prepared and are included as **Attachment A and C**. Groundwater elevation contour maps for both 2015 Spring and Fall measurements have been prepared and are included as **Attachment B and D**. **Attachments E and F** show depth to groundwater and groundwater elevations in the district for the Spring of 2016.

Average depths to groundwater from the 2015 measurements are represented in **TABLE 4: 2015 Average Depth to Groundwater.** Between the 2015 Spring and

Fall sampling events, the average depth to groundwater dropped by twenty feet (20.93), as computed as the arithmetical average of all measurements within the Member boundary.

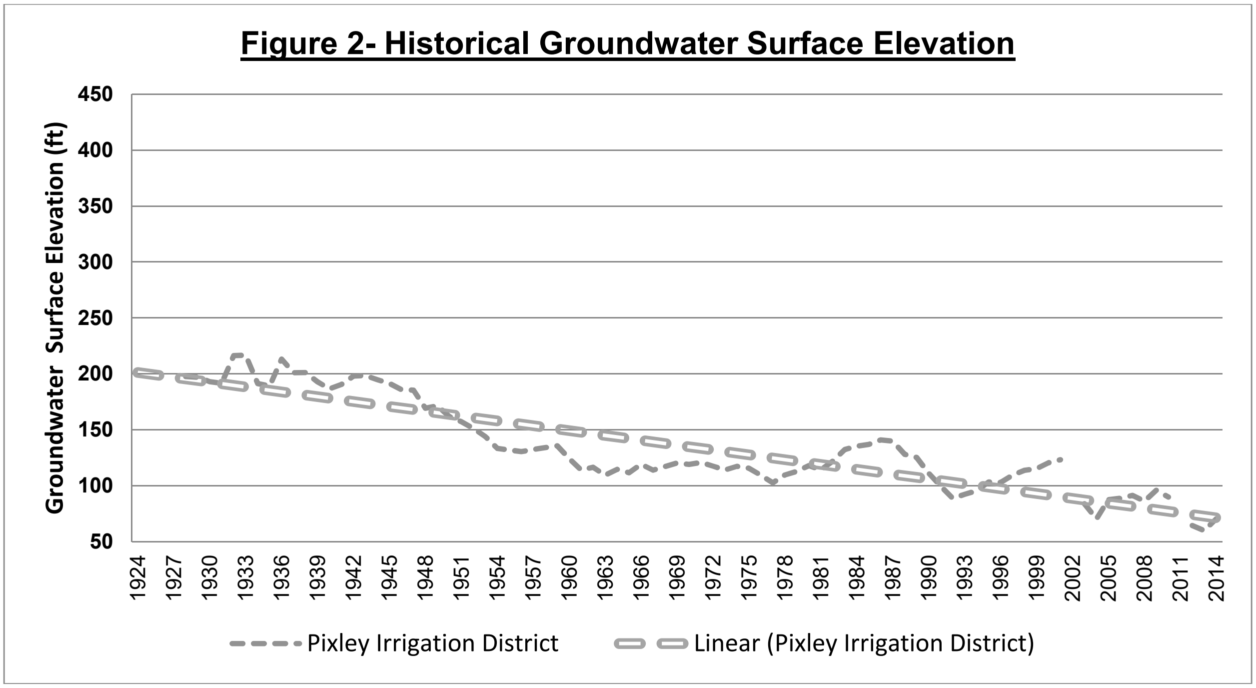
TABLE 4: 2015 Average Depth and Elevation of Groundwater

Irrigation District	*# of Wells Measured*	*Spring 2015 Average Depth to Groundwater (ft)*	*Spring 2015 Average Groundwater Elevation (ft)*	*Fall 2015 Average Depth to Groundwater (ft)*	*Fall 2015 Average Groundwater Elevation (ft)**	*Change in Groundwater Elevation (ft)*
Pixley Irrigation District	27	186.85	58.17	207.79	34.71	-20.93

Based upon the arithmetical annual average depth to groundwater of the wells measured, Summarized in **Table 5: Average Depth to Groundwater Historic Summary** and **Figure 2: PID Historic Groundwater Surface Elevation**, the level in groundwater depth over the past 65 years has dropped 86.35 feet. The more recent average in depth to groundwater for the past 15 years has dropped 14.95 feet. The reason for the increase in depth to groundwater is due to additional land development, landowners farming more than one crop per year, and less imported water due to drought and environmental restrictions requiring pumping of additional groundwater. In addition, the recent data is more representative of the areas than the older data because of additional data points.

Table 5: Average Depth to Groundwater Historic Summary

Irrigation District	**Average Depth to Groundwater**								
	1950	*1960*	*1970*	*1980*	*1990*	*2000*	*2010*	*2015*	*1950 - 2015 Change*
Pixley Irrigation District	99.5	128.5	131.2	136.7	130.1	140.8	171.4	186.85	(87.35)



Surface Water Supply

The District's average annual surface water supply totals approximately 37,645 AF/year. This supply is generated from three main sources, diversions from Deer Creek's unregulated flows, purchase of surplus Friant Division CVP supplied from long-term contractors, and a water supply contract with Bureau of Reclamation for CVP water that originates in northern California and has historically been delivered through the Cross Valley Canal (CVC).

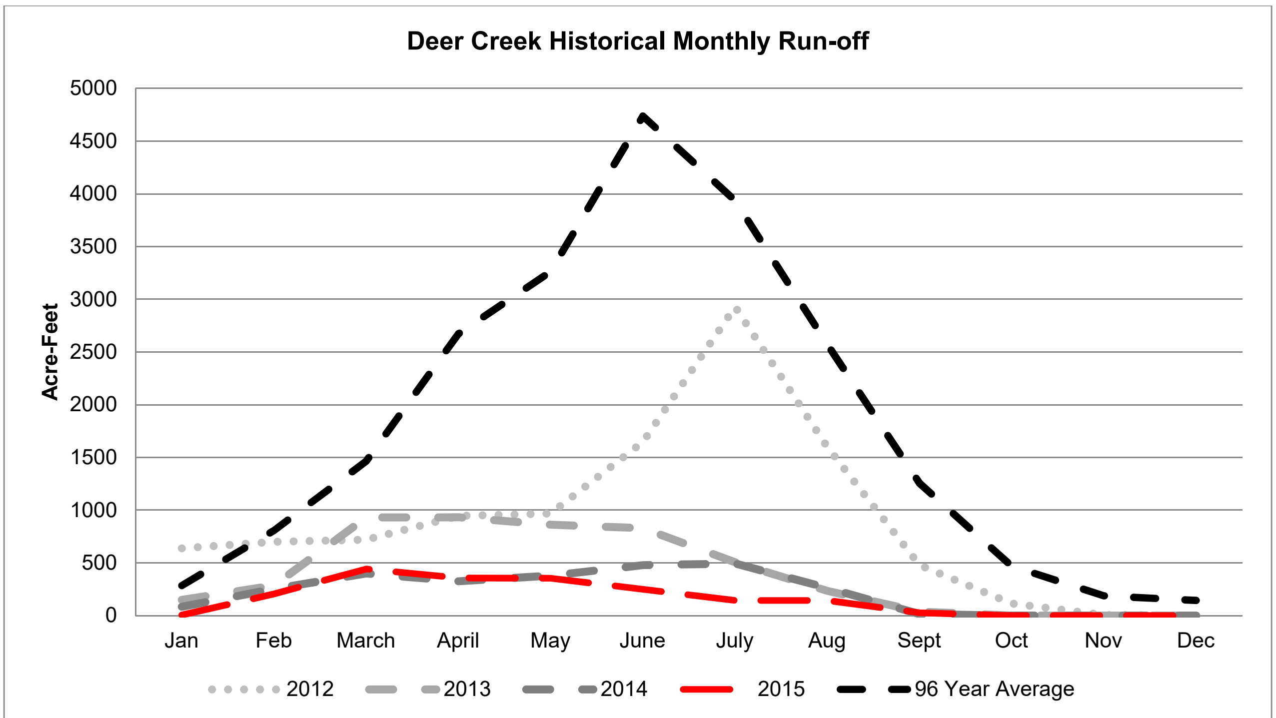
Deer Creek is a very sandy ephemeral stream that runs the entire width of PID. The Creek is an uncontrolled stream, wherein the run-off is seasonal based upon precipitation and snow melt from the Sierra Nevada Mountains, without a dam to control the flow. Temporary embankments and diversions to recharge basins along Deer Creek help to manage the seasonal flow. Typically, the timing of the seasonal flows does not correspond with the downstream irrigation water demands. Due to the low elevation of the watershed and lack of dams or reservoirs, available supplies are largely the result of rainfall events. PID has been diverting Deer Creek water for over 60 years, and could therefore claim an appropriative right to the water. PID diverts almost all of the available Deer Creek water that flows into the District except for very large flood events.

Deer Creek surface water run-off during the calendar years of 2012, 2013, 2014 and 2015 as compared to the historical average from 1918 – 2015 is provided in **FIGURE 3: Deer Creek Monthly Surface Water Run-Off for 2012, 2013, 2014, 2015 & Long**

Term Average. Data for Deer Creek was gathered from Gauging Station USGS 11200800 DEER CREEK NR FOUNTAIN SPRINGS CA.

The 2015 calendar year average monthly run-off of Deer Creek at Fountain Springs was totaled to be 1,926 acre-feet, or 11.3% of normal, as compared to the long term average annual Deer Creek flow of 21,792 acre-feet.

FIGURE 3: Deer Creek Monthly Surface Water Run-Off for 2012, 2013, 2014, 2015 & Long Term Average



	Oct	*Nov*	*Dec*	*Jan*	*Feb*	*March*	*April*	*May*	*June*	*July*	*Aug*	*Sept*	**Total**
2012	638	700	720	945	968	1,646	2,928	1,599	478	114	5	0	**10,741**
2013	150	286	930	932	863	829	506	235	37	0	0	0	**4,769**
2014	85	252	400	326	378	478	494	264	15	0	0	0	**2,693**
2015	5	205	442	357	354	249	144	144	27	0	0	0	**1,926**
96 Yr. Avg	**284**	**807**	**1,464**	**2,673**	**3,262**	**4,737**	**3,936**	**2,573**	**1,255**	**469**	**188**	**144**	**21,792**

III. Existing Water Delivery System

Conveyance System: The District's entire distribution system is unlined earth canals with reinforced concrete control structures and road crossings. Improvement districts were formed to provide local financing for the construction of the distribution systems. After completion, the facilities were turned over to the District for operation and maintenance. Collectively, the District owns or controls approximately 46 miles of canals and approximately 14 miles of Deer Creek channel. The District has two main canals originating at the Friant-Kern Canal with capacity ranging from 25 cubic-feet per second (CFS) to 100 CFS. The main canals run from east to west with the fall of the Valley floor in the area. The capacity of the sub-laterals branching out from the main canals range from 5 CFS to 100 CFS. Water delivery measurements are performed by means of calibrated slide gate (meter gates). The District does not have groundwater extraction facilities. Each individual landowner provides his own well(s) to sustain irrigation during periods when the District does not have surface water available.

The on-farm irrigation efficiency is not regularly calculated by the District, but within the region has been estimated to range from 75 to 85%. Seepage losses to the earthen canal system are regularly estimated from measuring stations throughout the system.

Table 6: PID Conveyance Facilities

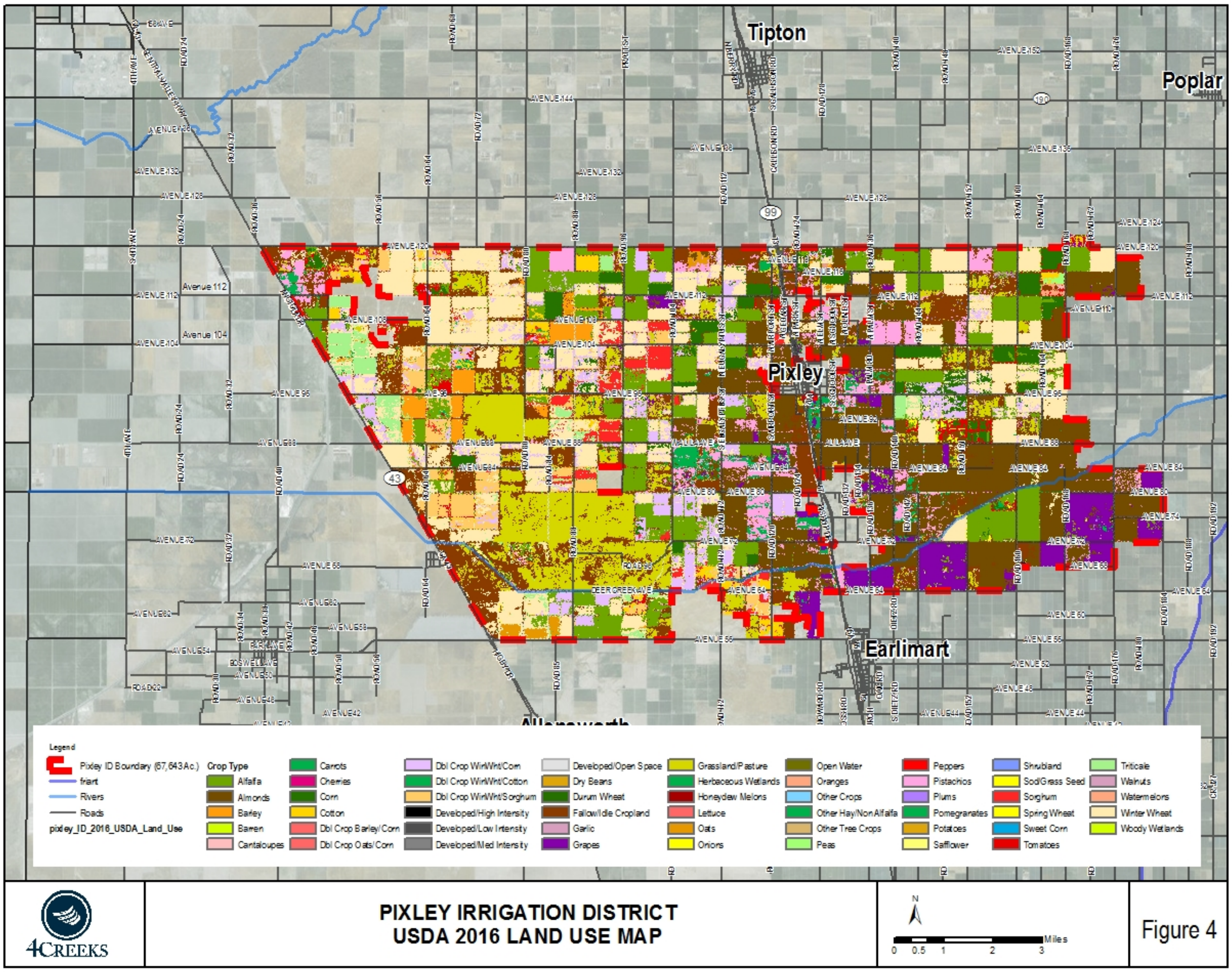
	Diversion Sources	Description
1	Friant-Kern Canal	Deer Creek Turnout
2	Deer Creek	East Main Canal
3	Deer Creek	Harris Ditch
4	Deer Creek	West Main Canal

Land Use: The total area within the District is 67,643 acres, and the irrigated area within the District is 48,302 acres. The major crops served in within the District are Alfalfa, Almonds, Grapes and Silage. A breakdown of all crops grown in the District are shown in **Table 7: Pixley Irrigation District 2016 land Use** Irrigation methods in the district include Micro Sprinklers (9.6%), Furrow (39%), Flood Irrigation (24.1%), Sprinklers (1.6%) and Other (25.7%). Land Use for the District is Shown in **Figure 4: Pixley Irrigation District Land Use Map**

Table 7: Pixley Irrigation District 2016 Land Use

Pixley Irrigation District 2016 Land Use					
Crop Type	**Acreage**	**Percentage**	**Crop Type**	**Acreage**	**Percentage**
Corn	2,359.19	3.49%	Open Water	15.76	0.02%
Cotton	766.79	1.13%	Developed/Open Space	2,031.97	3.00%
Sorghum	1,093.35	1.62%	Developed/Low Intensity	286.82	0.42%
Sweet Corn	1.55	0.00%	Developed/Med Intensity	128.54	0.19%
Barley	1,042.07	1.54%	Developed/High Intensity	14.65	0.02%
Durum Wheat	0.89	0.00%	Barren	35.30	0.05%
Spring Wheat	0.22	0.00%	Shrubland	31.97	0.05%
Winter Wheat	10,587.18	15.65%	Grassland/Pasture	6,185.36	9.14%
Oats	385.61	0.57%	Woody Wetlands	7.33	0.01%
Safflower	42.40	0.06%	Herbaceous Wetlands	4.88	0.01%
Alfalfa	8,041.51	11.89%	Pistachios	2,989.01	4.42%
Other Hay/Non Alfalfa	131.20	0.19%	Triticale	1,056.05	1.56%
Dry Beans	0.44	0.00%	Carrots	39.96	0.06%
Potatoes	2.00	0.00%	Garlic	13.54	0.02%
Other Crops	5.55	0.01%	Cantaloupes	9.99	0.01%
Watermelons	60.16	0.09%	Oranges	5.11	0.01%
Onions	117.22	0.17%	Honeydew Melons	0.22	0.00%
Peas	57.72	0.09%	Peppers	2.00	0.00%
Tomatoes	612.05	0.90%	Pomegranates	842.71	1.25%
Sod/Grass Seed	2.89	0.00%	Plums	7.55	0.01%
Fallow/Idle Cropland	7,374.17	10.90%	Dbl Crop WinWht/Corn	3,168.83	4.68%
Cherries	0.67	0.00%	Dbl Crop Oats/Corn	2.00	0.00%
Grapes	2,953.71	4.37%	Lettuce	2.22	0.00%
Other Tree Crops	0.22	0.00%	Dbl Crop WinWht/Sorghum	1,736.48	2.57%
Almonds	13,252.07	19.59%	Dbl Crop Barley/Corn	6.88	0.01%
Walnuts	104.34	0.15%	Dbl Crop WinWht/Cotton	23.09	0.03%
Total				**67,643.40**	100.00%

Figure 4: Pixley Irrigation District Land Use Map



IV. Working Relationship with Reclamation

The District has maintained a good working relationship with Reclamation while implementing projects, on schedule, which were funded by grants received by Reclamation.

<u>San Joaquin River Restoration Program Grant for Pixley Irrigation District/Delano-Earlimart Irrigation District Joint Groundwater Bank</u>

In 2013 PID partnered with Delano-Earlimart Irrigation District (DEID) to develop the DEID-PID Joint Groundwater Banking Project which includes recharge basins, an in-lieu service area and the needed facilities to divert and return water from the Friant-Kern Canal. Once construction is completed the project will provide broad benefits to any Friant Division CVP contractor that chooses to participate in this cost effective, feasible and environmentally responsible groundwater banking project. This project was proposed through the District's System Optimization Review which was funded by Reclamation in 2011. The project is currently on schedule.

Water, Energy and Efficiency Grant for Avenue 116 Lateral Project
In 2012 PID was awarded a $1.5 million grant from the Bureau of Reclamation for the Avenue 116 Lateral Project. The project includes construction of a new surface water delivery system to an 8,000 acre area that previously did not receive surface water. Construction on this $4.8 million project began in 2013 and was completed in March 2015.

Water, Energy and Efficiency Grant for System Optimization Review System
In 2011 the District completed a $300,000 System Optimization Review Study that was partially funded by the Bureau of Reclamation. The Study evaluated the District's operations and facilities, made recommendations on how to optimize available resources, and ranked potential projects to improve water reliability. The District completed the study on schedule and under the allocated budget. The study provided a detailed evaluation of the groundwater bank proposed in this application.

V. Project Description

Currently, water flowing into the Avenue 116 turnout and canal is managed through manual manipulation of the headgate. Through this project, the District intends to install a SCADA system on this turnout to increase the District's management capabilities at this location and promote the efficient use of water resources. The project will be broken up into two Tasks:

Task 1 – Project Design and Permitting

During Task 1, Pixley Irrigation District will contract work with a third-party vendor to prepare mechanical and electrical design drawings. The District will secure all required permitting and approvals from various regulatory agencies. Finally, the District will amass all the necessary project components, materials, and equipment necessary for project installation.

Task 2 - Construction

Task 2 of the proposed project will include project construction and installation. This task will be completed by District staff once all Task 1 objectives are complete.

In basic SCADA architectures, information from sensors or manual inputs are sent to PLCs (programmable logic controllers) or RTUs (remote terminal units), which then send that information to computers with SCADA software. SCADA software analyzes and displays the data in order to help operators and other workers to reduce waste and improve efficiency. Thus, when water is directed through the Avenue 116 turnout, District employees will be able to more efficiently manage water resources through this section of the District's irrigation system.

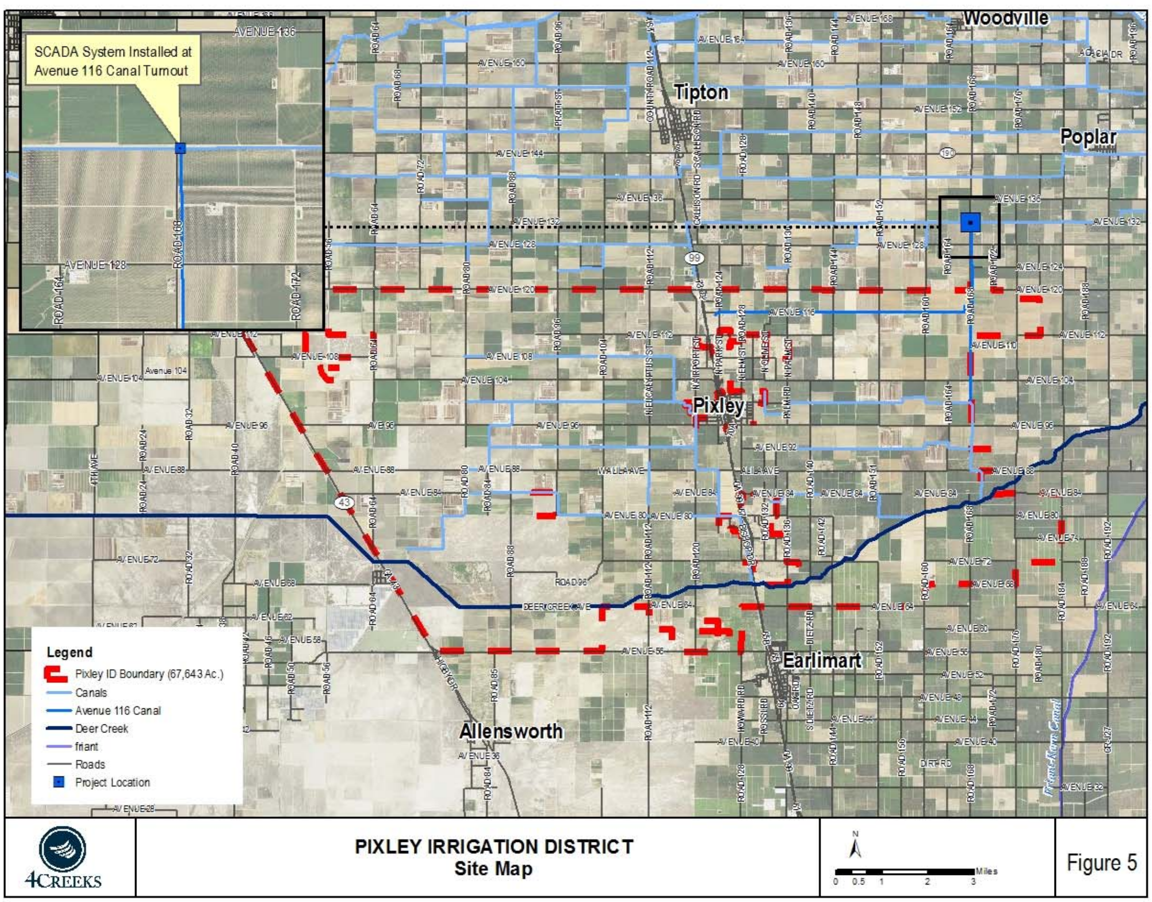
VI. Evaluation Criteria

A. Criterion A - Planning Efforts Supporting the Project

Describe how your project is supported by an existing planning effort.
(Ex. Water Management Plan, water Conservation Plan, System Optimization Review)

- **Does the proposed project implement a goal or address a need or problem identified in the existing planning effort?**
  The planned SCADA system is an automated addition to the Avenue 116 Lateral System proposed in the 2008 Pixley Irrigation District Water Management Plan. Section 1.B.9 of the Water Management Plan proposes the implementation of the Avenue 116 Lateral System, which was installed and completed in March of 2015 in collaboration with the Bureau of Reclamation through a Water, Energy, and Efficiency Grant. **FIGURE 5 – Site Map** illustrates the location of the project in the Pixley Irrigation District.

Figure 5 – Site Map



The proposed SCADA system will be installed on the new Avenue 116 Lateral System of the District's water distribution system which has been prioritized by PID. This section delivers water to a new service area that was previously underserved by the district as it relied on surface deliveries through the natural channel of Deer Creek where seepage losses occurred heavily. This SCADA system would be responsible for managing water deliveries for 8,000 acres of agricultural land that was previously not served by the District. Since the District is susceptible to a highly variable surface water supply, it is vitally important to properly manage surface water resources timely and efficiently when they are available.

- **Explain how the proposed project has been determined as a priority in the existing planning effort as opposed to other potential projects/measures.**

  Recently, the District completed a System Optimization Review Study that evaluated Pixley Irrigation District's available resources and potential projects that could be undertaken in the next five years. Through this cost benefit analysis, the automation of the Avenue 116 Lateral System headgate was determined to be a high priority project, providing the highest water efficiency benefit to the District.

B. Criterion B – Project Benefits

- **Describe the expected benefits and outcomes of implementing the proposed project.**

  The expected benefits of the proposed project are to increase water use efficiency and management in the northern portion of the irrigation district. The automation of the flow measurement and water diversion shall allow the District to direct the exact amount of water required to meet irrigation demand on 8,000 acres of farmland. The increased precisions allow the District to accurately and efficiently divert water to members in the District while decreasing the amount of time spent by District employees checking flow stations and opening/closing gate valves on the Avenue 116 Later System headgate.

  - **What are the benefits to the applicant's water supply delivery system?**

    Under current operating procedures, the headgate must be managed manually in the field. PID employees make several trips a day to this location to adjust the gate and match the downstream flow rate demand. Through the proposed automation, these multiple trips per day would be eliminated and the downstream flow demand would be matched at the gate instantaneously. The