Bureau of Reclamation

WaterSMART Grants:

Water and Energy Efficiency Grants, 2019

Siskiyou County Flood Control and Water Conservation District

Siskiyou County, California

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Executive Summary

The Siskiyou County Flood Control and Water Conservation District (District) is respectfully submitting this request for the Bureau of Reclamation WaterSMART: Water and Energy Efficiency Grant for fiscal year 2019 for Funding Opportunity Announcement No. BOR-DO-19-F004. The District is an agency under the Siskiyou County Board of Supervisors located in Siskiyou County, Yreka, California. The project is not located on any federal facility.

The District is the Groundwater Sustainability Agency (GSA) responsible for implementing California's Sustainable Groundwater Management Act (SGMA) in the Butte, Scott, and Shasta Valley basins. The District must submit Groundwater Sustainability Plans (GSP's) to the California Department of Water Resources (DWR) by January 31, 2022. The District, through a DWR grant, has contracted with Larry Walker Associates to gather data, build water budgets, balances, and modeling to develop the GSPs for the three basins. The District's grant agreement with DWR does not include substantial groundwater data measurement and monitoring that would assist Larry Walker Associates and therefore is submitting this proposal to secure funding to gather necessary groundwater information in the three basins that will supply much needed data. The Larry Walker Associates team has contracted with the District since Fall of 2018 and has been working to gather available information and identify data gaps in the three valleys. This project starting in late fall/winter of 2019 will install soil moisture sensors and groundwater well measurement equipment to begin monitoring fluctuations in groundwater during the winter, spring, and irrigation seasons. The grant proceeds would fund the cost of the equipment, equaling up to $ 150,000 and a portion of the equipment installation, maintenance and database development. The District's cost/share would come through its DWR grant; installation, data collection, and database management will be conducted by the contractor Larry Walker Associates. The equipment will be permanently installed to provide information on various water year types that providing updated information to the GSP, and contribute to the District's required yearly reporting.

Background Information

Water use in Siskiyou County has been a contentious issue since the Southern Oregon/Northern California Coast (SONCC) Coho Salmon was federally listed as threatened in 1997 and listed as threatened by the State in 2005. The Klamath River is a major system for anadromous fish and the Scott and Shasta Rivers are integral tributaries for the fishery survival. Agriculture is the predominant economy in the county. Therefore, water availability is a key for the economic viability and sustainability of communities of Siskiyou County farmers and ranchers who rely on surface water deliveries from these two rivers as well as groundwater extraction from key aquifers that may be hydraulically connected to them. Since the Coho listing, agriculture has been in a variety of both debates and collaborative efforts with fishery conservationists to maintain and improve anadromous fish populations while maintaining their agricultural operations. Irrigators who can become more efficient with their applied water to their crops and pasture can provide benefit back to the streams in the form of added in-stream flow and preserved water during the dry summer and fall seasons.

In 2014, the Sustainable Groundwater Management Act (SGMA) became California's first comprehensive groundwater law that was enacted to provide for the "*management and use of*

groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results" (DWR SGMA webpage). SGMA provides local agencies the authority to manage their groundwater basins sustainably and requires them to form Groundwater Sustainability Agencies (GSAs) responsible for developing Groundwater Sustainability Plans (GSPs) and submit them to the California Department of Water Resources (DWR). GSPs for medium and high priority basins should be developed by January 31st, 2022. The Siskiyou County Flood Control and Water Conservation District (District) is the GSA responsible for developing GSPs under SGMA for three medium priority basins in Siskiyou County: the Butte, Scott, and Shasta Valley basins. The District is a local agency under the Siskiyou County Board of Supervisors that has water and power authority over the entire County, and was fully supported by local entities, groundwater and surface water users, irrigation districts and residents to act as the GSA. The District has not previously worked with Reclamation.

Each GSP must thoroughly analyze current status of its corresponding basin and describe how the basin will maintain or achieve groundwater sustainability in 20 years by evaluating certain indicators, such as status of groundwater storage and water levels, water quality, land subsidence, and surface water – groundwater interaction and depletion. Within Siskiyou County, agricultural and residential water is supplied from either groundwater extraction or surface water diversions, which includes adjudicated rights as well as rights for individuals and irrigation districts. There are no federal or state project deliveries within the Butte, Scott or Shasta Valley.

The District is applying for funding to install continuous soil moisture and groundwater elevation monitoring devices to fill critical data gaps that will be crucial to successfully develop the GSPs in its three groundwater basins. The augmented observed data will assist with more informed decision-makings for irrigation timing and magnitude, which will result in higher efficiency for irrigation practices, water savings and energy savings. Soil moisture sensors will provide valuable information for farmers to improve their irrigation rotations and reduce their groundwater and surface water use by evaluating the particular crops' water use and tailoring their water application rates to the crops needs.

The installation of the proposed well monitoring devices will address a wide range of evaluation criteria of this FOA. Water savings resulted from higher irrigation efficiency could be quantified by comparing historical water use with potential water savings due to more efficient irrigation scheduling based on enhanced data availability. More efficient irrigation will also support water supply reliability as it balances water demand. For groundwater pumpers this increased detail will help reduce their water use, power consumption and electricity costs, ensuring American Energy is available to meet our security and economic needs. Decreasing extractions from aquifers will contribute to groundwater sustainability and provide increased groundwater flow to hydraulically connected surface waters, or prevent or reduce surface water depletion due to loss to aquifers. Installation of the proposed monitoring devices will also require fostering relationships with conservation organizations advocating for balanced stewardship and use of public lands. Data obtained from these devices will also support modeling efforts within the Scott and Shasta Basins, which will be used to make informed decisions to be in compliance with Endangered Species Act.

Project Location

Each of the Butte, Scott, and Shasta Valley basins, located within the Siskiyou County, has its own water related problems that need to be addressed. However, lack of sufficient observed data on groundwater levels has made finding practical solutions to address these problems more challenging. The following summarizes existing problems in each basin. The basin maps for each of these basins are presented in the attachment.

Butte Valley

The Butte Valley basin as classified under DWR's prioritization standards has 15.5 priority points making it a medium priority basin. The entire basin encompasses 79,730 acres including 23,420 irrigated lands. There are approximately 4 public supply wells and 325 total wells. Approximately 83% of the basin is reliant on groundwater (DWR 2018 Basin Prioritization). Butte Creek is the most relied upon surface water in which the Butte Valley Irrigation District has a water right for recharge.

The basin's hydrographs show declining groundwater levels in portions of the Valley, although not severely overdrafted. With the need to comply with the new Groundwater Sustainability legislation (SGMA) and with the potential for decreased aquifer recharge from precipitation due to climate factors, irrigators must become more efficient with their application rates. Irrigators have a strong desire to build a successful GSP to enable them to maintain and increase the reliability of their groundwater supplies by withdrawing their groundwater resources sustainably. Installing soil moisture sensors will enable farmers to accurately evaluate their soil moisture status and the corresponding crop water demand. They could then adjust their groundwater extraction accordingly to become more efficient with their water use and leave a portion of groundwater in their localized aquifers that would otherwise be wasted through inefficient irrigation practices.

Groundwater level data is fairly sparse among the valley, other than biannual measurements by DWR and the CASGEM program. To achieve substantial data for GSP development, the groundwater monitoring grid needs to be expanded and continuous measurements added to strategic well locations. Gathering data and observing groundwater fluctuations with continuous well monitoring devices will provide much needed information regarding the groundwater aquifer function and where water is moving through the ground. Utilizing soil moisture sensors in key areas will provide farmers the opportunity to become more efficient with their application rates preserving their stored groundwater. The District and the community acknowledge that the need for substantive data collection is necessary to fully analyze groundwater information for GSPs. The valley is also lacking available technical resources, such as a Resource Conservation District (RCD), to provide additional funding and technical support for data collection services so it is critical that the District can secure funding.

Through initial work conducted by the Larry Walker Associates team, significant portions of valley have been identified as critical zones needing to be evaluated with continuous monitoring for groundwater elevation and soil moisture. This will enable the team to track changes in soil moisture and fluctuations in the aquifer during the winter recharge months, dry periods, and times of increased agricultural extractions to develop more efficient irrigation schedules and practical aquifer recharge

plans. This funding will support farmers in the Butte Valley to install continuous well monitoring devices and soil moisture sensors in strategic wells to acquire required data for two critical concurrent reasons: to ensure water and energy savings and to support planning and GSP development purposes.

Shasta Valley

The Shasta Valley basin originally consisted of 52,589 acres with 26,842 acres irrigated acres and classified as medium priority. The District successfully applied to DWR to modify the basin boundary during their 2018 Basin Boundary Modification Process. The modified basin was finalized by DWR in February of 2019 and is now going through a reprioritization process in which a draft is expected in March. The modified basin increased to 217,980 total acres with 62,119 acres irrigated acres. This modification substantially not only increased the area to be designated under SGMA compliance, but it also expanded the basin into various complex geological and hydrological areas of the watershed which will require significantly more resources to fully build an understanding of the various hydrological connections in the valley. Gaining such understanding will require filling numerous data gaps that already exist. Portions of the basin are lacking sufficient well monitoring in its network grid and some regions are completely lacking monitoring wells at all. Some locations, where slim datasets show declining groundwater level trends, are in need of improved monitoring and management activities. Surface water-groundwater interaction is a key sustainability factor to evaluate within the Shasta basin's GSP. Therefore, continuously measured water levels are demanded to build on the biannual measurements under DWR's CASGEM program.

Additionally, groundwater and surface water are hydraulically connected in the Shasta Valley. Under the California Water Action Plan, the Shasta River was named one of five priority stream reaches that the State Water Resources Control Board (SWRCB), in coordination with the California Department of Fish and Wildlife, will "*seek to enhance flows to support and improve critical habitat for anadromous fish*". In September 2018, SWRCB released their "*Draft Shasta River Watershed Characterization and Model Study Plan*" which outlines a proposed groundwater-surface water modeling plan on the Shasta River. Creation of such model could also be an integral part of the basin's GSP development process to enable the decision-makers to run different scenarios, create the basin's water budget, and determine projects that will assist the valley attaining groundwater sustainability and improving in-stream flows for anadromous fishery needs in the Shasta River. Siskiyou County, Shasta Valley stakeholders, and SWRCB have been collaborating on combining aspects of both modeling projects including collaborating on data collection. Data gaps should be filled for modeling inputs to enable tracking water movement through the basin and establishing a water budget. Therefore, strategic continuous groundwater observations and measurements will provide valuable information for model building and installing soil moisture sensors is crucial in Shasta Valley. Additionally, water users must comply with the Regional Water Board's TMDL Conditional Waiver of Waste Discharge therefore any project that aids in preventing tailwater from entering a stream is encouraged for ranchers in order to comply with their TMDL requirements.

Specific locations or regions within the Shasta Valley that further data is needed for evaluation of soil infiltration capacity pertaining to the District's GSP development needs and the SWRCB's modeling efforts include:

- Gazelle/Grenada conjunctively use surface water and groundwater for hay and pasture. Surface water deliveries provide valuable recharge for agricultural and residential groundwater extraction. Hydrographs from DWR's CASGEM program display declining groundwater levels in portions of this region, demonstrating the need for better understanding of groundwater movement throughout the year. Additional soil moisture data can also help farmers evaluate their water application rates and become more efficient with their irrigation practices providing the opportunity to preserve the aquifer.
- The Gazelle region accounts for almost 50% of groundwater use in the entire Shasta Valley watershed. Providing opportunities for irrigators to use tools to become more efficient with their water application rates is important for the District's SGMA compliance requirements.
- Some irrigators have pasture adjacent or nearby the Parks Creek, Shasta River, and Little Shasta River and divert surface water from these streams. The agricultural return flows entering these streams have created water quality concerns. Due to the hydraulic connectivity between these streams and the underlying groundwater basins, the impacted water quality could affect the quality of groundwater, which is one of the six undesirable results identified by SGMA that need to be addressed are key evaluation aspects. Irrigators can use soil moisture sensors on strategic locations within their pastures adjacent to these streams to monitor soil infiltration rates and adjust their irrigation to prevent or decrease tailwater amounts from entering the stream.

Scott Valley

The Scott Valley basin is classified as medium priority basin under DWR's Prioritization with 18 priority points. The entire basin consists of 63,831 total acres including 27,288 acres of irrigated lands. The basin also has a groundwater adjudicated zone that encompasses 10,015 acres that borders the west and eastside of the Scott River. The Scott River Adjudication Decree was entered into the Siskiyou County Superior Court in 1980 (Scott River Decree) and starting in 2016, an annual report was required to be submitted to DWR (DWR Adjudicated Areas). Currently, the County of Siskiyou Natural Resources submits the report utilizing a statistical summary from a private monitoring network (Scott River Stream System Annual Report). In 2017, the County reported 37,000 acre/feet of water was used in the adjudicated zone. There are 4 public supply wells and approximately 778 total wells. 61% of the basin is reliant on groundwater with the remaining 39% utilizing surface water deliveries (DWR Prioritization).

Groundwater – surface water interaction and water quality are critical issues within the Scott Valley and Shasta Valley that need to be addressed in their GSPs as well. Additionally, water users must comply with the Regional Water Board's TMDL Conditional Waiver of Waste Discharge. Installing soil moisture sensors to track water applications near a stream will enable irrigators to rotate irrigation schedules

based on the desired soil moisture infiltration rates and more efficiently use their water by cutting back either their surface water diversions or groundwater extraction rates.

Groundwater – surface water interaction in the Scott and Shasta Valleys is not only a key evaluation component for SGMA, it is also important due to the increased scrutiny and in-stream water demands for anadromous fish, specifically for fall run Chinook Salmon and federally and state listed Coho Salmon. Irrigators are exploring various methods to increase water delivery efficiencies and provide more water during strategic timing anadromous fish needs. Data collection tools such as continuous groundwater monitoring and soil moisture readings will provide valuable data for irrigators that can learn about their water application rates and crop effectiveness and therefore, build strategies to decrease their irrigation amounts. It is also critical to capture data that shows connection between applied surface water to the aquifer and its connection to the streams so that the irrigators can develop strategic irrigation management practices.

Technical Project Description

The crops' evapotranspiration rate, the rainfall pattern, and the soil type together determine the timing and amount of irrigation that needs to be applied to prevent crop stress and produce high crop yields. Weather conditions are usually unpredictable and the changing climate is making such predictions much more complicated. Therefore, measuring soil moisture is one of the limited ways to specify proper irrigation timing and amount to save water, reduce energy costs, increase yields, and protect the environment. While excessive irrigation could increase production costs and have negative environmental effects, insufficient irrigation could also result in crop stress and reduced yields. Therefore, a proper estimation of soil moisture is crucial for the sustainability of the farming community.

Through the implementation of this proposal, 15 soil moisture monitoring systems, which continuously collect soil moisture data as well as 15 groundwater elevation monitoring devices will be installed in each of the Scott, Shasta, and Butte basins. We are currently still evaluating specific soil moisture sensors appropriate for use in Siskiyou County. However, one option is the Wildeye's choice of the Meter Group's GS3 soil moisture sensor that Wildeye uses in their telemetered package (**Figure 1**). Measurement specifications for this group of sensors are presented in **Table 1**.

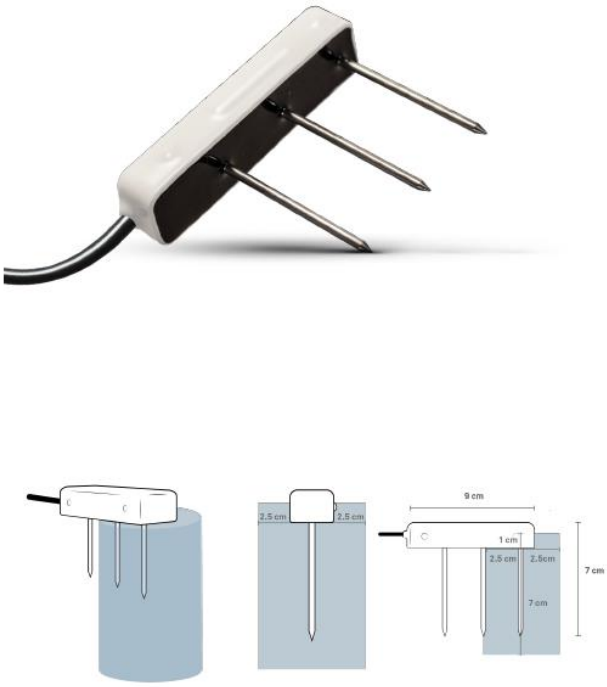


Figure 1 Wildeye's Meter Group GS3 Soil Moisture Sensor

Table 1 Measurement Specifications for Wildeye's Meter Group GS3 Soil Moisture Sensor

MEASUREMENT SPECIFICATIONS	
Volumetric water content (VWC)	**Range** Mineral soil calibration: 0.0–1.0 m^3/m^3 Soilless media calibration: 0.0–1.0 m^3/m^3 Apparent dielectric permittivity (ε_a): 1 (air) to 80 (water) **Resolution** 0.1 ε_a (unitless) from 1–20 <0.75 ε_a (unitless) from 20–80 0.002 m^3/m^3 from 0.0–0.4 m^3/m^3 0.001 m^3/m^3 for >0.4 m^3/m^3 **Accuracy** Generic calibration: ±0.03 m^3/m^3 typical Medium-specific calibration: ±0.01–0.02 m^3/m^3 Apparent dielectric permittivity (ε_a): 1–40 (soil range), ±1 ε_a (unitless) 40–80, 15% measurement

Instruments for continuous measurements of groundwater levels and temperature are already being installed in the Shasta Valley through the existing DWR Prop. 1 grant. The first instruments have been installed in March 2019 and the **Figure 2** shows an example of the installation. Soil moisture sensors have not been installed yet. The soil moisture sensor is not pictured in this figure but would consist of a

cable extending from the equipment housing to the ground sensor. **Figure 3** depicts an example of telemetered data from groundwater level sensors.

Figure 2 Installed groundwater data logging equipment with telemetry and compact solar array

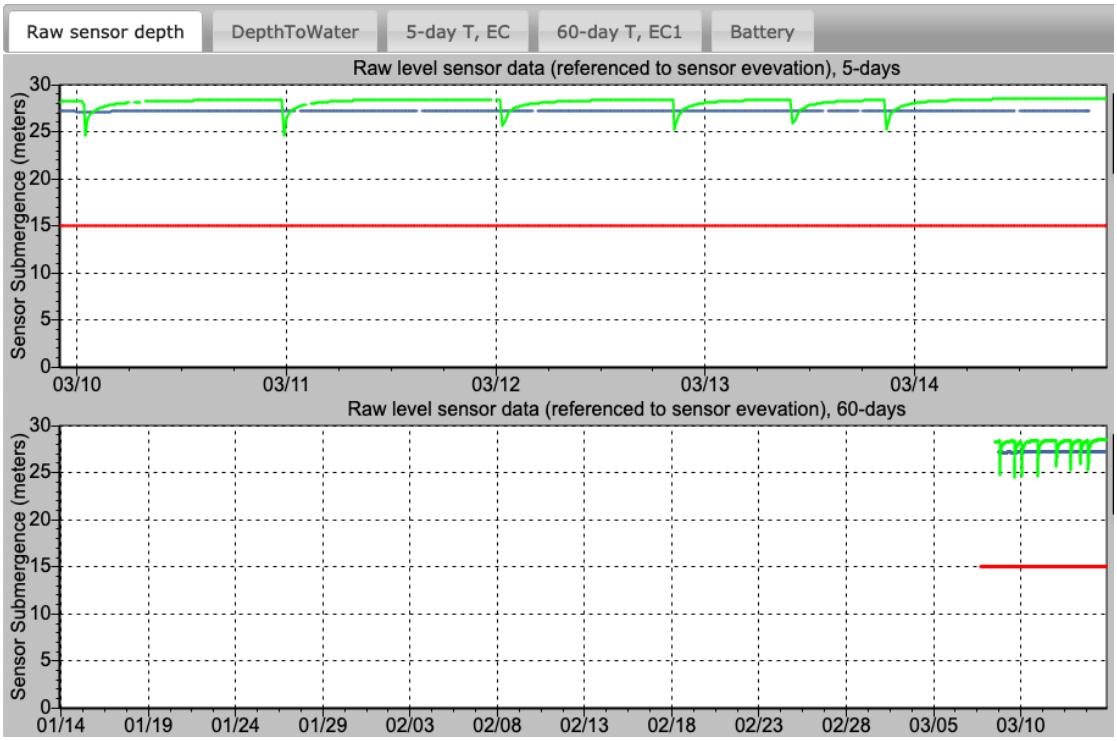


Figure 3 An example of telemetered data from groundwater level sensors

Table 2 Sensor equipment options used in various configurations at each well location site

Item	Brand	Model
DataLogger/Telemetry	Campbell Sci.	CR300-Cell210
Sensor	In-Situ	LT400-100psig (Level/T)
	In-Situ	AT200-100psig (Level/T/EC)
Barometric Pressure Sensor w/ cable (1-2 per watershed)	In-Situ	LT400-15psig (Level/T)
Sensor Cable	In-Situ	Rugged Cable
Rain Gauge	Davis Instr.	6465 AeroCone Tipping Bucket
Weather Station (includes BP and Rain)	Campbell Sci.	ClimaVUE50-10-PT
Soil Moisture	Meter Group	GS3

The data collected through these newly installed instruments will be available online for the stakeholders participating or interested in this project and its outcomes. The instruments included in this new effort will also help in the development of an appropriate network of data and creation of a database system that the County needs for future SGMA reporting and compliance. The data will complement and help validating the numerical models that the GSA technical team is developing.

Evaluation Criteria

Evaluation Criterion A – Quantifiable Water Savings

Estimated water savings

Water savings are going to come from delaying any unnecessary irrigation and having a better understanding on when to irrigate and how much water to apply. For example, farmers may cut back one or more irrigations during every cutting or instead of irrigating a land for six-hour sets through the growing season, the soil moisture measurement device may suggest the farmer to switch to two-hour sets in early spring, three-hour sets through mid-spring, and up to eight-hour sets during hot summer days. Installing the proposed continuous soil moisture and water level monitoring devices will support more efficient and timely water deliveries and could considerably decrease the amount of water diverted from the streams and extracted from groundwater basins within each of the Butte, Shasta, and Scott Valleys.

Due to the lack of sufficient data on existing usage of applied water, it is difficult to estimate the exact water savings within the Butte, Shasta, and Scott Valley. However, a farmer growing alfalfa in Scott Valley, who has installed continuous soil moisture measurement devices, has reported that on an average year, he would save 15-20% of water. He could cut back one irrigation on first cutting and one irrigation on third cutting. He believed the more precise irrigation also helped with weed control, because overwatering benefited weeds like dandelions. Generalizing his water saving experience over the entire agricultural lands producing alfalfa in the Scott Valley, i.e. 13,893 acres, which would use a total of 24,871 ac-ft per year of water, the total water saving only in the Scott Valley would be between 3,731 to 4,974 AF/yr corresponding to 15% to 20% reduction in irrigation water, respectively (**Table 3**). Assuming the same level of water saving that occurs in Scott Valley would occur in lands producing alfalfa within all three basins, the total water saving could be between 9,841 to 13,121 AF/yr out of which, 6,083 to 8,111 AF/yr is only saved from groundwater extractions for irrigating lands producing alfalfa.

Table 3 Estimated water saving rates on Scott, Shasta, and Butte Valley only on lands producing alfalfa

	Scott Valley	Shasta Valley	Butte Valley
Total irrigated land producing alfalfa (acres)	13,893	7,919[†]	14,834[†]
Total irrigation (AF/yr)	24,871	14,177[*]	26,556[*]
SW irrigation (AF/yr)	3,207	3,864	0
GW irrigation (AF/yr)	21,665	4,055	14,834
Total water saving based on 15% reduction (AF/yr)	3,731	2,127	3,983
Total water saving based on 20% reduction (AF/yr)	4,974	2,835	5,311
SW saving based on 15% reduction (AF/yr)	481	580	0
SW saving based on 20% reduction (AF/yr)	641	773	0
GW saving based on 15% reduction (AF/yr)	3,250	608	2,225
GW saving based on 20% reduction (AF/yr)	4,333	811	2,967

[†]Data from the 2010 land use survey

[*]Irrigation rates have been assumed to be equal to those for the Scott Valley

Current losses

Current losses are primarily due to over irrigation of agricultural lands that would require over-delivery of surface water and excessive extraction of groundwater resources. Annually, about 4,974 ac-ft water is lost due to over irrigation only in lands producing alfalfa within Scott Valley. This value would be 2,835 and 5,311 ac-ft per year for the Shasta and Butte Valley, respectively. Therefore, a total of approximately up to13,121 ac-ft of water is lost in the entire region every year (**Table 3**).

Support/documentation of estimated water savings

Experimental water saving information has been gathered through direct communication with farmers who have installed continuous soil moisture measurement devises on different lands in the Scott and Butte Valley. Data on the total area of irrigated lands, total irrigation water, irrigation water from surface water and groundwater sources to produce alfalfa in the Scott Valley have been obtained from a 2018 study on groundwater management in a basin with river-aquifer interactions by Foglia et al.

Verification of actual water savings upon completion of the project

This proposal suggests installing groundwater level monitoring devices along with continuous soil moisture devices. Comparison of observations of groundwater levels at the beginning of installing these devices and after one year of installation, taking precipitation, evapotranspiration, and other influential factors into account, will help provide a better estimation of total groundwater water savings. Additionally, comparing seasonal or annual diversions from surface water sources before and after installation of these devises will help estimate total surface water savings.

Evaluation Criterion B – Water Supply Reliability

As mentioned earlier, approximately 83% of the Butte groundwater basin is reliant on groundwater and sporadic groundwater level data shows some declines of groundwater levels within this region. Groundwater level decline has also been observed in significant portions of Scott and Shasta Valley, where groundwater and surface water are hydraulically connected. There is an increased scrutiny and in-stream water demands for anadromous fish in these basins and SWRCB seeks to enhance flows to improve critical habitat for anadromous fish. Additionally, agricultural return flows entering these streams have created water quality concerns that need to be properly addressed in the basins' GSPs. All of these jeopardize the reliability of agricultural water supply within these regions.

Reducing agricultural water use by 15 -20% will significantly increase the reliability of water supply in these areas and enhance their resiliency to drought. The conserved water will be remained in the aquifers, offsetting groundwater pumping, or left in the river system, reducing diversions and addressing shortages that impact diversions. The conserved water left in the rivers will also benefit federally threatened or endangered and state listed species. As water is conserved by simply reducing water withdrawals, there is no specific mechanism to be used to put the conserved water to the intended use.

To be compliant with SGMA requirements to manage aquifers sustainably and at the local level, there is currently a healthy collaboration among irrigators and stakeholders. However, insufficient data availability for planning and verification of plan results could jeopardize the likelihood of successful approval of the GSP by the Department of Water Resources. Under such circumstances, potential water-related crisis or conflicts may arise and obtaining soil moisture and groundwater elevation data could help prevent potential future water-related conflicts.

Evaluation Criterion C – Implementing Hydropower

While this proposal does not directly install new hydropower capacity, implementation of this proposal will save significant amounts of energy, which could be made available to meet other sectors' security and economic needs by more efficient utilization of natural resources. To estimate the energy requirements of groundwater pumping, multiple assumptions are made. Groundwater pumps are not 100% efficient, there are multiple energy losses depending on the age of the pump and the condition of the well. An average overall pump efficiency of 53% is used here and is based on data from 40,000 irrigation pumps analyzed by CSU Fresno's Center for Irrigation Technology. The energy required to lift 1 ac-ft of water 1 foot is 1.023 kWh and is based on energy calculations of lift and the weight of water. The amount of energy being saved through more efficient irrigation timing and volume could be calculated using the following equation:

$$Energy\ Saved = \frac{(Volume\ Less\ Pumped)*(Lift)*(1.023\frac{kWh}{(acre\ foot)-ft})}{Well\ Efficiency}$$

Based on the information provided in **Table 3**, 6,083 to 8,111 AF/yr of water is saved from groundwater extractions for irrigating lands producing alfalfa over the three basins. Including these values in the above equation, the total amount of energy that could be saved is 11,741 to 15,656 kWh per every foot of water lift:

$$E_{Saved} = \frac{6{,}083\times1\times1.023}{0.53} = 11{,}741\ kWh$$

$$E_{Saved} = \frac{8{,}111\times1\times1.023}{0.53} = 15{,}656\ kWh$$

These values should be multiplied by the depth of groundwater level from the ground surface (in feet) to provide the total energy saved. Clearly, the more water left in the aquifer, the lower lift elevation and therefore, the higher energy saving.

These energy savings could be translated to large savings on electricity costs. Based on PG&E published electricity rates (https://www.pge.com/tariffs/electric.shtml) agricultural rates can vary between $0.166/kilowatt-hour (kWh) to $0.316/kWh; we assume irrigators taking advantage of off-peak

prices and pumping in the summer during off peak times with a cost of $0.19584/kWh. The cost of pumping for an additional foot can then be considered with:

$$Energy\ Cost = \ Eenergy\ Saved * Electricty\ Rate$$

For every inch of over irrigation and assuming an average lift of 100 feet within the three basins, an average additional cost of up to $13,237 per year is incurred. **Table 4** shows the cost when considering over irrigating between 1 and 2.5 inches with a depth of water from 25 to 100 feet.

Table 4 Additional Pumping Costs for over irrigating between 1 and 2.5 inches with a depth of water from 25 to 100 feet

Water Saving	Over Irrigation Depth (in)	Average Depth to Water; i.e Lift (ft)			
		25 (ft)	50 (ft)	75 (ft)	100 (ft)
15%	1	$4,790	$9,581	$14,371	$19,161
	1.5	$7,185	$14,371	$21,556	$28,742
	2	$9,581	$19,161	$28,742	$38,323
	2.5	$11,976	$23,952	$35,927	$47,903
20%	1	$6,388	$12,775	$19,163	$25,551
	1.5	$9,581	$19,163	$28,744	$38,326
	2	$12,775	$25,551	$38,326	$51,101
	2.5	$15,969	$31,938	$47,907	$63,876

Evaluation Criterion D – Complementing On-Farm Irrigation Improvements

The proposed project not only improves on-farm irrigation by considerably reducing water *use* by implementing more precise irrigation scheduling, it will also decrease water *consumption* as the more precise irrigation will help control weed. Having less unwanted vegetation in an agricultural land will result in less water consumption this vegetation. Additionally, lower weed control efforts can be translated into less application of herbicides and therefore reducing their negative impacts on water quality.

Evaluation Criterion E – Department of the Interior Priorities

Creating a conservation stewardship legacy second only to Teddy Roosevelt: Siskiyou County sees water conservation as a promising way to sustain agricultural activities that will greatly support the social and economic sustainability of the communities within the County. Through installation of continuous soil moisture and groundwater elevation monitoring devices in lands producing alfalfa, the irrigators will get to utilize science empowered by collected data to identify best practices to manage their irrigation schedules and water resources. This would also require fostering relationships with conservation organizations advocating for balanced stewardship and use of public lands. Upon

successful implementation of this project, the beneficial value of using data obtained from these devises to conserve water will be revealed to farmers growing other agricultural products, which could promote widespread installation of such devices across other agricultural lands resulting in significant reductions in agricultural water use across Siskiyou County. Through installation of these highly demanded devises, irrigators within Siskiyou County will create a water conservation legacy of which Teddy Roosevelt would be proud.

Utilizing our natural resources: This program promotes the sustainable utilization of natural resources. Through water conservation, energy is also conserved by reducing the amount of water pumped out from groundwater resources. Therefore, Implementation of the proposed project will result in considerable amounts of water and energy savings that would ensure "American Energy is available to meet our security and economic needs."

Restoring trust with local communities: In an area with increasing scrutiny and in-stream water demands for anadromous fish, and increasing obligations to comply with SGMA requirements, the involvement of Reclamation in supporting better use of water resources could be vital. By providing Reclamation funds to the farmers, Siskiyou County will communicate the importance of conserving water while showing that Reclamation is providing the resources to help them achieve water savings goals. The act of engaging farmers in water efficiency programs and providing monetary assistance can help solidify trust between the community and the local and federal government. Such support could also ignite or improve dialogue among farmers, especially neighboring ones, in favor of the value of such water conservation practices. Practical demonstration of the effectiveness of using such devices in reducing water and energy demands could also expand the lines of communication with Governors, state natural resource offices, Fish and Wildlife offices, water authorities, county commissioners, Tribes, and local communities.

Evaluation Criterion F – Implementation and Results

Subcriterion F.1— Project Planning

The California Water Conservation Act of 2009 requires all water suppliers to increase water use efficiency 20% by the year 2020. Installation of the proposed monitoring devices will be supportive of water conservation efforts and improvements in water efficiency with the potential to completely address water use efficiency increase requirements; i.e. by 20%.

Subcriterion F.2. - Performance Measures

Installation of the proposed monitoring devices is expected to have an enormous impact on water and energy savings within each of the Butte, Shasta, and Scott Valley basins. Towards the completion of this project, the County plans to analyze total amounts of annual and seasonal water and energy savings in each of the basins by comparing total annual and seasonal water and energy use with those in similar water year types. As presented in Tables 3 and 4, it is expected that on average up to 8,111 AF/yr of groundwater is saved within the three basins, resulting in a total energy reduction of 15,656 kWh per every foot of lift.

Subcriterion F.3 – Readiness to Proceed

Instruments for continuous measurements of groundwater levels and temperature are already being installed in the Shasta Valley through the existing DWR Prop. 1 grant. The first instruments have been installed in March 2019. However, to obtain data required to effectively plan for water use reductions, analyze the basins' water budget, develop computer simulation models, comply with SGMA requirements, and also to cover the other two basins, the County has to install more monitoring devices through this proposal.

Evaluation Criterion G – Nexus to Reclamation Project Activities

There is no connection between the area of the proposed project and Reclamation Project activities.

Project Budget

Funding Plan and letters of commitment

The Flood Control District was awarded a total of $1,367,000 through the California Department of Water Resources (DWR) 2017 Proposition 1 Sustainable Groundwater Planning (SGWP) grant. The funding is budgeted between the Butte, Scott, and Shasta Valley basins for assisting in the development of Groundwater Sustainability Plans (GSP). The District has been utilizing the funding since fall of 2018 and is available until April 30, 2022. These funds provided the District the financial ability to contract with Larry Walker Associates who can provide the expert technical experience to develop the necessary information to build and submit GSP's for the three basins.

Budget Proposal

See Attachment A

Budget Narrative

Salaries and Wages

The program manager for this project will be Matt Parker, Natural Resources Specialist for Siskiyou County. Matt will be responsible for overseeing the organizing of installing equipment on landowners property. His hourly rate will not exceed $60/hr at a maximum of 5 hrs per week during project work.

Fringe Benefits

No fringe benefits are included in the budget proposal.

Travel

Travel to sites is included in installation and maintenance.

Equipment, Materials, and Supplies

In each location, pressure transducers for measuring groundwater level and temperature and soil moisture sensors will be installed. All the instruments will be connected via telemetry.

Contractual and Construction

The Flood Control District has contracted with Larry Walker Associates under its DWR SGWP Prop 1 grant for the purpose of GSP development.

Indirect Costs

No indirect costs are budgeted.

Environmental and Regulatory Compliance Costs

There are no expected environmental or regulatory compliance costs.

Reporting

Reporting will be done by program manager, Matt Parker.

Other Expenses

There are no other expected expenses for this project.

Third-Party In-Kind Contributions

The Flood Control District's contribution comes from its California DWR SGWP Prop 1 grant.

Environmental and Cultural Resources Compliance

Continuous well level equipment will be installed in already drilled and cased wells and soils moisture sensors are installed with very little ground disturbance. Therefore, there should be zero impacts that will contribute to introduction, continued existence or spread of noxious weeds. There is no expected impact to cultural or environmental resources from either of these activities. Federal and California listed species include the Southern Oregon/Northern California Coast (SONCC) Coho Salmon which inhabits the Scott and Shasta River. However, project activities including equipment installation will have no impact to either of these streams or tributaries, and devices will not be installed in wetland locations or impact streams under "Water of the United States".

This project will not modify or improve current irrigation infrastructure, equipment will only evaluate water application rates and provide information on applied water to the irrigator. There are no known building, sites or structures in the project area nor would be effected that are listed under the *National Register of Historic Places*. There are no known archeological sites or access limits to Indian sacred or ceremonial sites in the project area. The project is located in disadvantaged and severely disadvantaged communities; however, the project will not negatively affect these communities.

Required Permits or Approvals

The Flood Control District will have an authorization and access agreement between the District and participating landowners.

Letters of Project Support

Official Resolution

The Siskiyou County Flood Control and Water Conservation District will convene on April 2nd, 2019 to review and vote to approve an official resolution supporting this grant proposal.

References

California Department of Water Resources (2019, March 15). *DWR Adjudicated Areas*. Retrieved from https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Adjudicated-Areas.

California Department of Water Resources (2019, March 15). *DWR SGMA Basin Prioritization Dashboard*. Retrieved from https://gis.water.ca.gov/app/bp2018-dashboard/p1/.

California Department of Water Resources (2019, March 15). *Scott River Decree*. Retrieved from https://water.ca.gov/LegacyFiles/watermaster/ND_Watermasters/Decrees/Scott/ScottRiverDecree_30662_1980.pdf.

California Department of Water Resources (2019, March 15). *Scott River Stream System Annual Report*. Retrieved from https://sgma.water.ca.gov/adjudbasins/report/editreport/119.

California Department of Water Resources (2019, March 15). *SGMA Groundwater Management*. Retrieved from https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management.

ATTACHMENT A

Budget Proposal

	Butte Valley		Scott Valley		Shasta Valley		
	Request	**Cost share**	**Request**	**Cost share**	**Request**	**Cost share**	Total
Project administration (5 years)		$ 15,000.00		$ 15,000.00		$ 15,000.00	$ 45,000.00
Equipment	$ 50,000.00		$ 50,000.00		$ 50,000.00		$ 150,000.00
Installation	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 120,000.00
Maintenance over the next 5 years (including maintanance of telemetry system)	$ 5,000.00	$ 15,000.00	$ 5,000.00	$ 15,000.00	$ 5,000.00	$ 15,000.00	$ 60,000.00
Database development & management for SGMA	$ 5,000.00	$ 20,000.00	$ 5,000.00	$ 20,000.00	$ 5,000.00	$ 20,000.00	$ 75,000.00
SGMA Reporting (until 2027, 5 years after GSP submission)		$ 10,000.00		$ 10,000.00		$ 10,000.00	$ 30,000.00
	$ 80,000.00	$ 80,000.00	$ 80,000.00	$ 80,000.00	$ 80,000.00	$ 80,000.00	$ 480,000.00

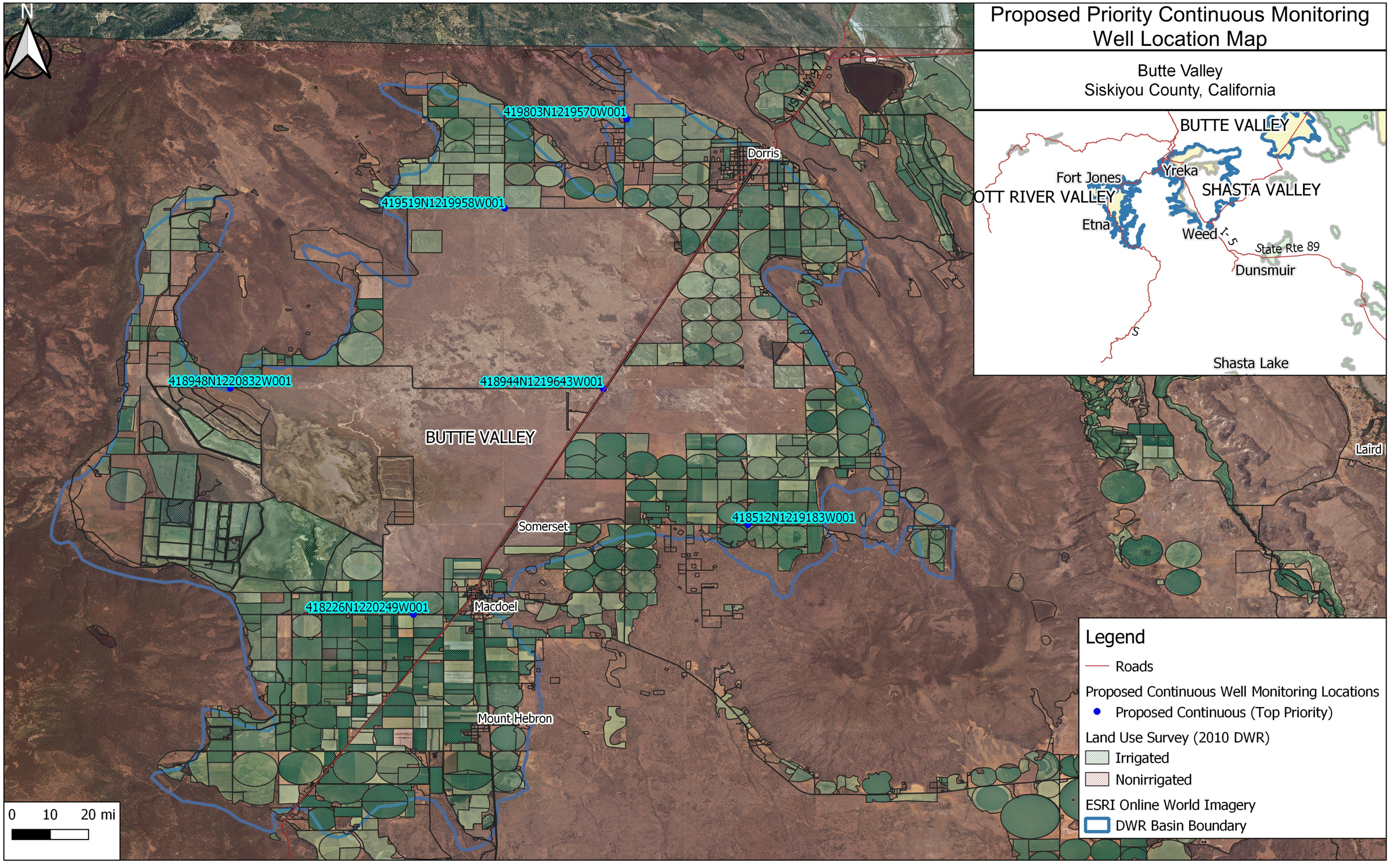
Total Project Cost Table

SOURCE		AMOUNT
Costs to be reimbursed with the requested Federal Funding		$ 240,000.00
Costs to be paid by the applicant		$ 240,000.00
TOTAL PROJECT COST		$ 480,000.00

Supplies & Materials					Notes
Soil Moisture sensors	$ 1,400.00	30		$ 42,000.00	10 per valley
Well equipment	$ 3,600.00	30		$ 108,000.00	10 per valley

Attachment: Basins' Maps

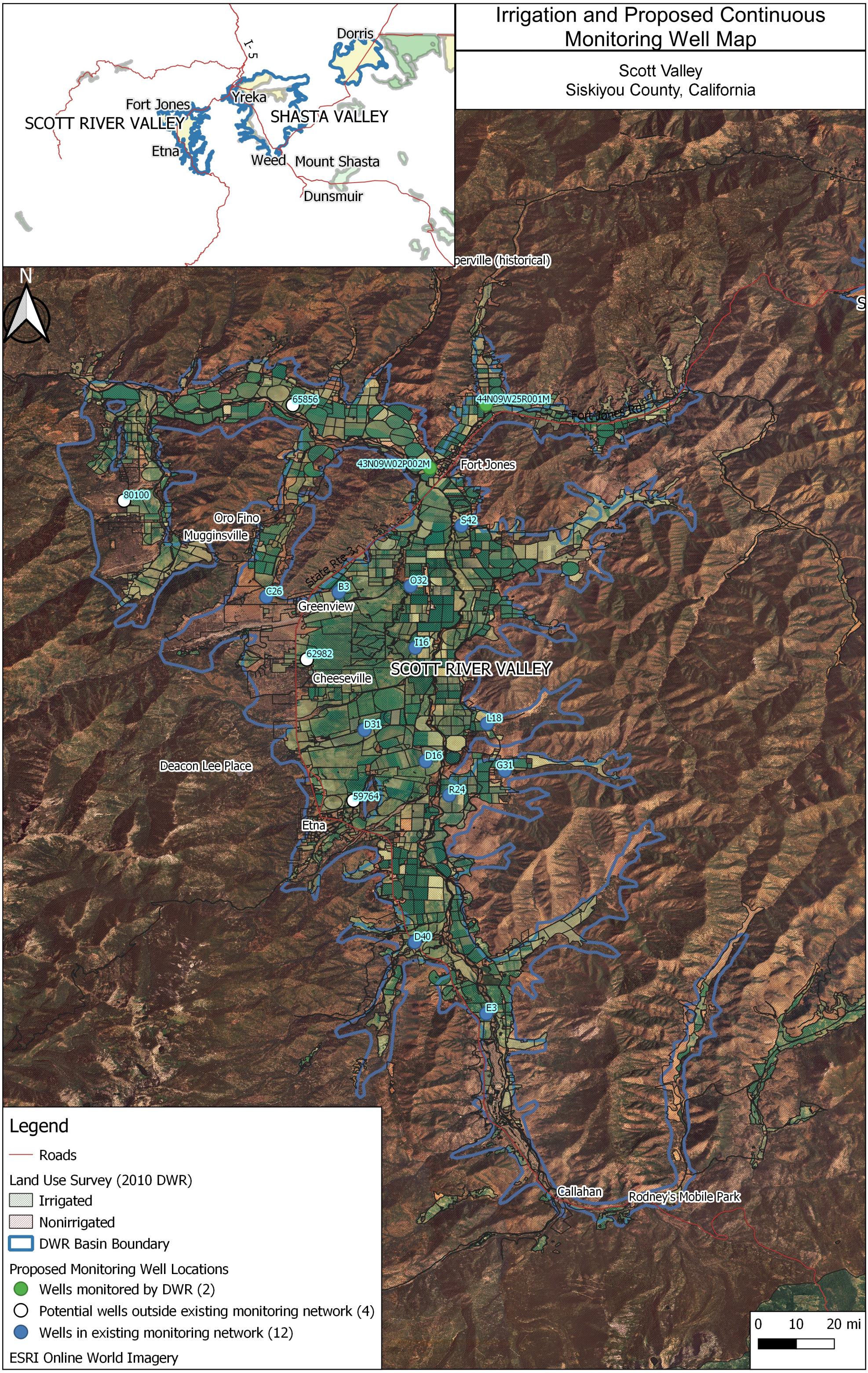
ATTACHMENT B



ATTACHMENT C

Irrigation and Proposed Continuous Monitoring Well Map

Scott Valley
Siskiyou County, California



Legend

- Roads

Land Use Survey (2010 DWR)

- Irrigated
- Nonirrigated
- DWR Basin Boundary

Proposed Monitoring Well Locations

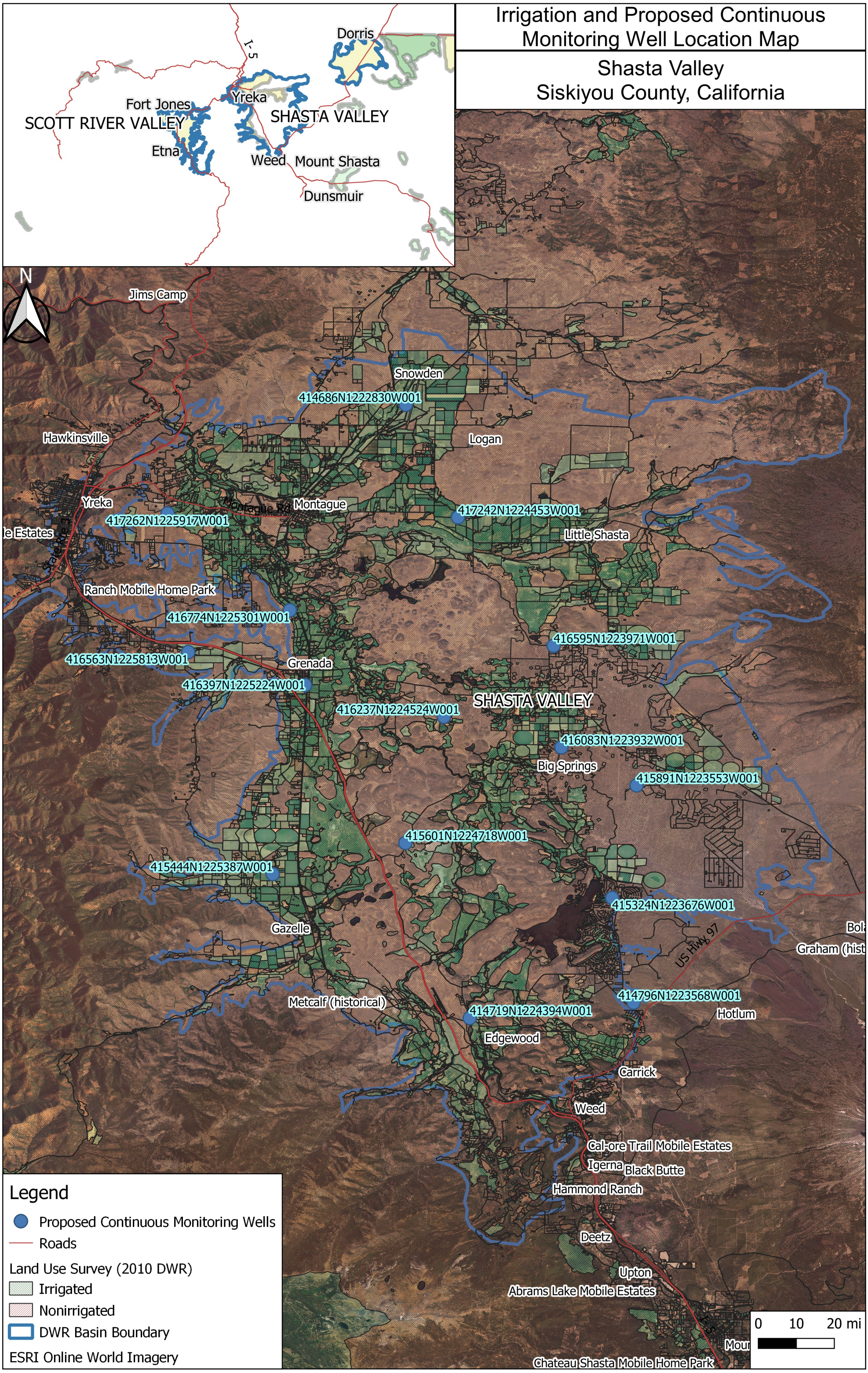
- Wells monitored by DWR (2)
- Potential wells outside existing monitoring network (4)
- Wells in existing monitoring network (12)

ESRI Online World Imagery

ATTACHMENT D

Irrigation and Proposed Continuous Monitoring Well Location Map

Shasta Valley
Siskiyou County, California



ATTACHMENT E

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY **EDMUND G. BROWN JR.,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

May 8, 2018

Terry Barber, County Administrator
Siskiyou County Flood Control and Water Conservation District
PO Box 750
Yreka, CA 96034

Award Notification: Proposition 1:
2017 Sustainable Groundwater Planning Grant

Dear Terry Barber:

We are pleased to inform you that the proposal, Grant Proposal for the Scott, Shasta and Butte Valley Groundwater Basins GSP Development, filed by your agency has been conditionally recommended by the Department of Water Resources (DWR) for funding in the amount of $1,367,000.00 for the 2017 Groundwater Sustainability Plans and Projects Solicitation under Proposition 1 Sustainable Groundwater Planning Grant Program. This award is conditioned upon the execution of a Grant Agreement between DWR and your agency. A copy of the Grant Agreement template is available at the following website:
http://author.water.ca.gov/-/media/DWR-Website/Web-Pages/Work-With-Us/Grants-And-Loans/Sustainable-Groundwater/Files/AgreementTemplate_Prop1SGWP_FINAL_30April18.pdf

Please be aware that this provision of State funds awarded to your Agency does not constitute an approval by the State for any project, component, or plan as it pertains to an adopted Final Groundwater Sustainability Plan (GSP).

Attachment 1 includes a list of conditions that must be satisfied before DWR will enter into the agreement with your agency, as well as the requirements that must be met to maintain your eligibility to receive grant funds. Your attention to these details are critical for the timely execution of the Grant Agreement. Failure to meet these conditions and requirements in a timely manner may result in DWR revoking the grant award.

Please return the requested information to the DWR Regional Lead, Bill Ehorn at 2440 Main Street, Red Bluff, CA 96080 within the time periods listed in Attachment 1. If you have any questions you may reach Bill Ehorn at (530) 528-7403 or Bill.Ehorn@water.ca.gov.

Sincerely,

Art Hinojosa, Chief
Division of Integrated
Regional Water Management