



## **Real-Time Water Use Data Delivery System for LRNRD**

**Submitted by:**

**Lower Republican Natural Resources District  
Alma, Nebraska**



## Table of Contents

I.	Technical proposal and Evaluation Criteria .....	1
	Executive Summary.....	1
	Background Data.....	1
	Project Description.....	2
II.	Evaluation Criteria.....	3
	Evaluation Criterion A—Planning Efforts Supporting the Project (35 points) .....	3
	Evaluation Criterion B—Project Benefits (35 points).....	4
	Evaluation Criterion C—Project Implementation Plan (15 points).....	5
	Evaluation Criterion D—Nexus to Reclamation (15 points).....	6
III.	Environmental and Cultural Resources Compliance.....	6
IV.	Required Permits or Approvals .....	7
V.	Official Resolution .....	7
VI.	Project Budget.....	7
	Funding Plan and Letters of Commitment.....	7
	Budget Proposal.....	8
	Budget Narrative.....	9

# **I. Technical proposal and Evaluation Criteria**

## **Executive Summary**

The Lower Republican Natural Resources District (LRNRD) would extend to producers the ability to evaluate real-time water use from a set allocation to support their water management decisions. Producers in the LRNRD have a 5 year water allocation term and the LRNRD requires mechanical flowmeters to prevent meter tampering. Currently, water use information pertaining to a remaining allocation is provided to producers by a mailed print out (allocation sheets) after the irrigation season. Farmers are frequently contacting the NRD during the year to check on their remaining water allocation for the year while they are actively irrigating. This requires staff time as well as being inefficient for the farmer.

The LRNRD is proposing a project that will make water use data information connected with remaining available allocations available in real-time. This project will introduce automated data acquisition from mechanical flowmeters and distribute this data through a web-based application to producers and to the LRNRD for water management purposes.

## **Background Data**

The LRNRD is responsible for 325,000 irrigated acres supported by irrigation wells, that are all required under district rules and regulation to have mechanical flowmeters. Over 3,300 flowmeters inventory irrigation water use in the LRNRD for 2,000 producers. The LRNRD allocates water for a 5-year term at 45 inches per acre. The current allocation period is 2013 through 2017 with the new allocation period started beginning in 2018 and extending until 2022. LRNRD staff currently reads all meters manually at the end of each year. Water meter readings are recorded in the field digitally using a tablet that automatically syncs up with a custom-made water use database housed at the LRNRD office. Annual water use reports (allocation sheets) are mailed out to water users for compliance with district allocations.

The LRNRD supports the State of Nebraska for Interstate Compact Compliance under the Republican River Compact by regulating groundwater pumped. By 2005 LRNRD had established a moratorium on new irrigation wells and a moratorium on the addition of irrigated acres. At the same time, all irrigation wells were metered and a water use allocation was established.

Corn and soybeans are the primary irrigated crops grown in the LRNRD. The LRNRD receives approximately 18 to 20 inches of precipitation between April and September. The average pumping of irrigation water between 2005 - 2016 averages just less than seven inches per acre and the LRNRD total pumping totals averaging 178,000 AF on all 325,000 acres. Considering that corn requires approximately 25 inches per year, this makes the LRNRD a world leader in water efficiency.

The LRNRD has cost-shared to help lead producers with technological efforts by supporting the installation of soil moisture probes on nearly 60,000 acres. Additionally, the LRNRD continues to support water efficiency efforts through cost-sharing on subsurface drip irrigation, end-gun retirement and high intensity soil moisture sensors. Through these efforts the LRNRD, will maintain efforts as a leader in water management and seek improvement such as this project.

## Project Description

LRNRD must be in compliance with the State of Nebraska under the terms of the Republican River Compact Administration (Compact). This includes a moratorium of all new irrigation wells, no new irrigated acres, mandatory metering of all irrigation wells, and maintaining allocations of 9 inches/acre/year. These regulatory efforts have resulted in the water savings of nearly 675,000 AF (219,375,000,000 gallons) since 2002. However, additional water savings is needed to meet Compact compliance and real-time access to water use within the allocation will further provide water savings to the district.

Allowing farmers access to real-time data will allow them to monitor pumping so that they will not exceed their allocation limit. Currently, all farmers are mailed an allocation sheet at the end of the year. However, many farmers call during or near the end of the irrigation season with a meter reading to see if they are within or over their allocation. Often farmers have already exceeded their allocation limit. Assessing water use figures annually from a mailed hard copy is not conducive to “on the ground and active” water conservation during the irrigation season. Establishing real-time water use access connected directly to their allocation will provide water conservation benefits. In addition, real-time water use information can allow the farmer to make in-season decisions for water management based on crop water use requirements as determined by the farmer or producer.

The LRNRD is proposing to create a web-based tool to allow water users real-time access to their irrigation water use for improved irrigation water management. This project will create a web-based application to enable the water user a view in real-time his/her pumpage in relation the water allocation. To create the project a software link will be created to transfer real-time water meter readings from the web-based server to the district’s water database for basin-wide water management. Automated meter reading devices will be placed on approximately 1% of the meters on irrigation wells evenly distributed across the district to develop the data delivery system. The current LRNRD allocation is 9 inches/ac. Water savings from this project is realistically 1 inch/acre. This would result in annual water savings of 10-15%. Once the implementation of this technology is made available to all 325,000 irrigated acres in the LRNRD, this would result in over 27,000 AF of water savings annually.

In addition, the LRNRD will be able to use this technology to improve the ability of the district to forecast water-short years in order to plan for management actions for Compact compliance. This project will also be able to assess conservation savings related to adoption of technology and provide insight to implementation of the technology throughout the district.

## II. Evaluation Criteria

### **Evaluation Criterion A—Planning Efforts Supporting the Project (35 points)**

The LRNRD has established an Integrated Management Plan (IMP) with the Nebraska Department of Natural Resources (NDNR). This IMP was prepared by the Board of Directors for LRNRD and the NDNR in accordance with the Nebraska Ground Water Management and Protection Act, *Neb. Rev. Stat.* §§ 46-701 to 46-754 (Cum. Supp. 2008).

The proposed project will continue to support LRNRD IMP goal number 1 that states; Ensure that groundwater and surface water users within the LRNRD assume their share of the responsibility to keep Nebraska in compliance with the Republican River Compact. Furthermore the proposed project supports the LRNRD objective number 2 that states: Achieve the required reductions in water use through a combination of regulatory and incentive programs designed to reduce beneficial consumptive use.

The IMP specifically addresses allocations as a specific effort by the NRD as Ground Water Controls. The only way to track compliance with allocations is monitoring water use measurements through flowmeters. To prevent tampering, the LRNRD Groundwater Rules and Regulations requires mechanical flowmeters. The LRNRD's IMP further identifies and lists the efforts of incentive programs and monitoring of efforts. Section IX (Monitoring and Studies) Subpart A (Plan to Gather and Evaluate Data, Information and Methodologies) states:

*"As outlined in Neb. Rev. Stat. §§ 46-715(2)(e) ongoing programs and new studies or other projects may become a source of information that is used to evaluate the effectiveness of controls adopted by the LRNRD and the DNR. The DNR and the LRNRD will jointly pursue and/or evaluate studies, contingent upon budget and staff resources, to evaluate their potential effectiveness in achieving the goals and objectives of this IMP. The following potential studies have been identified by the DNR and the LRNRD: (1) crop rotation; (2) vegetation management; (3) irrigation scheduling; (4) a survey of the type and location of irrigation systems throughout the LRNRD; (5) tillage practices; and (6) conjunctive management."*

Item number #3 (Irrigation Scheduling) listed in the plan is a direct beneficiary of this project. The efforts of the DNR and the LRNRD spent considerable time preparing the IMP to identify these priorities. The installation of real-time water use to assist producer irrigation scheduling efforts connected real-time with allocations available or unavailable will assist the LRNRD through a water savings.

Water savings is a detailed effort in the IMP under priority allocation efforts in Section VI. Groundwater Controls (B) Other Controls and Management Activities. The IMP requires compliance to maintain a 20% reduction from 2002 baseline pumping standards. The LRNRD has been able to achieve 25% through the establishment of the allocation system. Flowmeters were installed in 2005 District wide to monitoring pumping on the 325,000 irrigated acres. If irrigation scheduling provides one acre/inch of water savings it could result in 27,000 AF (8.775 billion gallons).

## **Evaluation Criterion B—Project Benefits (35 points)**

Access to real-time water use readings will improve irrigation water management for on-farm water management decisions. The significance of the proposed project can best be described as a new realm in water management for the LRNRD. Farmers will have improved information for compliance with district allocations they are responsible to ensure. The Compact establishes Water-Short Years. During those Compact compliance years, producers in the LRNRD have a pumping cap that cannot exceed more than thirteen inches/acre. In these Water-Short Years, farmers are likely more likely to exceed their water allocation cap because of increased crop water use demands. Access to real-time water use will allow farmers to make water management decisions based on actual water use and schedule water applications with this in mind. Real-time water use information can also allow the farmer to make on-farm decisions for water management based on crop water use requirements as determined by the farmer or producer.

Real-time water use data will also give the LRNRD the ability to forecast in water-short years. Currently the LRNRD must deliver water to Kansas based on actual pumping data which is currently collected manually and not until after the irrigation season is complete. Having the ability to access real-time water use data will give the district the ability to estimate earlier the amount of water that needs to be delivered to Kansas in the Republican River from augmentation facilities constructed and designed to meet Compact requirements on the Republican River.

Water management will benefit across the LRNRD as cooperators begin to use this technology on project fields, they may also seek to implement the same technology on other field under their management. The development of the web-based tool for accessing real-time water use will also be a practice that can be replicated in other water-short districts in Nebraska or in other states. Another key benefit of this project is that it utilizes existing flowmeters already installed and paid for by the producers.

Groundwater conserved will also improve baseflow to the Republican River to the benefit of surface water users, including Reclamation water users as well as wildlife. Improvements to the base streamflow of the Republican River will have a positive effect that will benefit the natural environment including fish and wildlife. These benefits will be very important during dry years when management of groundwater pumping is essential. In some areas immediately adjacent to the Republican River, the main stream in the District, modeling indicates that up to 90 percent of groundwater pumped to irrigate crops would otherwise result in stream flow over a two-year period if not for irrigation. In tributaries of the Republican River throughout the District the high end of the percentage impact on streamflow is generally lower than 90 percent but still significant – upwards of 70 percent to 80 percent near some tributaries. To the extent that water-saving management practices make more water available during drought are established where impacts to streamflow from groundwater pumping are significant, the proposed project could help increase stream flow, benefiting the natural environment either directly or indirectly the socioeconomic environment.

The LRNRD personnel will be able benefit from a resource allocation perspective. Currently, it requires three full time District employees in the field for three to four months to read all the flowmeters. Additionally, the LRNRD does meter maintenance which takes an additional three to

four months. Currently, the LRNRD spends no less than one-half a year on flowmeter efforts. Access to flowmeters is often difficult due to access across farm fields and road.

In addition to providing real-time access related to allocations, this project would provide quality assurance and quality control on flowmeter information. The mechanical information will be available along with real-time telemetry information at the flowmeters. The availability of these two readings should serve well to cross-check water pumping and locations necessary for flowmeter repairs or maintenance. Flowmeters that do not operate properly can provide inaccurate usage and considerable over pumping if not addressed. This project may provide secondary benefits such as ensuring flowmeter maintenance.

This project employed across the entire LRNRD could result in less time spent reading meters so that employees could spend time on other tasks important to the district. This will also result in less wear and tear on district vehicles and reduced fuel consumption and expense.

### **Evaluation Criterion C—Project Implementation Plan (15 points)**

During the summer of 2017, the LRNRD was a cooperator in the beta testing program of the new Flow Connect Product from McCrometer. This device integrates all of the equipment necessary for remote telemetry data acquisition into the register of the mechanical flowmeter. This design eliminates the need for transmitters, external cables, solar panels, and masts associated with traditional remote telemetry systems creating a much more efficient and streamlined installation. After participating in the beta program, the LRNRD wishes to integrate this technology into its water management programs for groundwater allocations, water conservation and integrated management for flows in the Republican River.

Upon the approval of this proposal, the LRNRD will proceed with the implementation of this project as follows:

**Fall, 2017:** LRNRD staff will proceed with the selection of sites for approximately 12 automated meter reading (AMR) devices within the district. Meters will be delivered to the McCrometer Great Plains facility in Aurora, NE for the service upgrade to Flow Connect. In addition, meters will receive a new certified test to ensure accuracy. These will be placed in strategic areas across the district to measure water use on various types of irrigation systems and within microclimates across the district.

**Winter, 2018:** LRNRD will contract with McCrometer to create the web-based application to deliver pumping data to water users for on-farm water management decisions. This will be a critical first step to create this delivery channel to the water users once initial AMR devices are in place.

Next, the LRNRD will contract with its database administrator. to write the programming language to create the data transfer link between the McCrometer web-based server and the LRNRD District Water Management database. This will replicate water readings taken in the field by NRD staff.

**Spring, 2018:** LRNRD staff will conduct an informational workshop for project cooperators to educate and inform producers on the use of the software to retrieve water use data and incorporate into on-farm water management decisions.

LRNRD will also seek additional locations for placement of approximately 8-10 AMR units within the district to have several units placed in the field for the 2018 growing season.

**Summer, 2018:** Support and maintain deployed AMR systems in the field and support any questions from cooperators.

**Fall, 2018:** Seek additional locations for placement of remaining 3-5 AMR units within the district.

**Winter, 2019:** Conduct informational workshop for project cooperators to educate and inform producers on the use of the software to retrieve water use data and incorporate into on-farm water management decisions.

**Spring, 2019:** Seek additional locations for any remaining AMR units in the district.

**Summer, 2019:** Support and maintain deployed AMR systems in the field and support any questions from cooperators.

**Fall, 2019:** Prepare final report for the Bureau of Reclamation.

### **Evaluation Criterion D—Nexus to Reclamation (15 points)**

The proposed project is in the same basin – the Republican Basin – as Reclamation projects:

- Frenchman-Cambridge Irrigation District,
- Harlan County Lake, serving Nebraska Bostwick and Kansas Bostwick Irrigation Districts.

The LRNRD does not receive Reclamation water and is not on Reclamation lands. However, water users within the LRNRD do have acres that are supported by groundwater wells and by surface water from Reclamation projects (co-mingled acres). The project will contribute water to Reclamation facilities through reduced groundwater usage which will increase stream base flow relied upon by Reclamation projects.

### **III. Environmental and Cultural Resources Compliance**

The project will have “No Adverse Effect” on environmental and cultural resources. No ground disturbance will be required by this project. No compliance documents or permits are necessary for installation of the AMR systems.

The project will likely have a beneficial effect on the natural and socioeconomic environment for the Republican River Basin.



## **IV. Required Permits or Approvals**

No permits or approvals are required by this project.

## **V. Official Resolution**

Attached to this application is an approved Resolution supporting the grant and from the LRNRD Board of Directors. See Attachment A.

## **VI. Project Budget**

### **Funding Plan and Letters of Commitment**

Currently flow meter readings are collected manually on an annual basis by district staff. Flow meter readings are recorded digitally on a tablet in the field after the growing season - often after a water user has exceeded his/her allocation. Automation will replace the time and expense of NRD staff manually reading flow meters and make the water use data available to the farmer in real-time for water management decisions. Bureau funds will be used to purchase 25 Automated Meter Reading (AMR) units for mechanical McCrometer Propeller meters. The total cost of AMR equipment will be \$51,500. McCrometer will donate 25% of the cost of the AMR equipment, communications, and upgrade services to contribute approximately \$14,000 of in-kind products and service for this project.

Bureau funds will also be used for the development of two computer applications: 1) A web-based application to enable farmers to receive their water use data in real-time, either by personal computer or a smart-phone and 2) LRNRD will contract with their computer consultant to write the programming language necessary to transfer automatically collected flow meter readings from the web-based server to the District's water use database to replace the entry of manual readings taken in the field. Both of these computer services are estimated to cost approximately \$11,000. The expenditure of Bureau funds for AMR equipment and these computer applications benefits the project by developing an automated mechanism to retrieve and distribute water use data from the field directly to the water users for on-farm management as well as the water managers at the LRNRD for basin-wide management.

The remaining non-federal cost-share component of this grant proposal will consist of in-kind time from staff of the LRNRD and McCrometer, Inc. In-kind time from the LRNRD includes project administration, field time and mileage to retrieve and install meters, and educational programs for water users within the district amounting to approximately \$26,181. In-kind time from McCrometer, Inc. includes technical support for telemetry and flowmeter hardware as well as computer software support for transmitting and receiving data to district databases and making water use data available to water users in the district through a web-based application at an amount of \$15,000.

Attachment B is the letter of commitment from McCrometer, Inc. for this project.

## **Budget Narrative**

### **Salaries and Wages**

The Program Manager for this project will be Scott Dicke, Assistant General Manager for the LRNRD. Project Administration is estimated to take approximately 120 hours over the life of the project at a rate of \$48/hr. Water Resources Technicians at the LRNRD will contribute to staff time for conducting fieldwork for this project at the rate of 28.77/ hr for a total of 300 hrs over the two span of this project. Educational training for district water users will also be conducted by the Program Manager at a rate of \$48/hr for 210 hrs.

### **Fringe Benefits:**

All employees of the LRNRD are provided health insurance and employee retirement contribution match which contributes to the hourly rate determination.

### **Travel:**

The only travel included in this project is the distance traveled by district staff from the LRNRD headquarters in Alma, NE to field locations of the irrigation flow meters for retrieval and installation of the flow meter before and after the upgrade of the automated meter reading equipment. The mileage to be traveled by district vehicles is estimated to be 3000 mi. and expense was calculated at \$0.57/mi.

### **Equipment:**

A quotation was received from McCrometer Inc. for the equipment and services to upgrade a standard mechanical flow meter to be fully equipped with AMR capability. The amount to upgrade a typical mechanical McCrometer propeller meter to AMR capability is \$2,060. As part of this quotation, McCrometer has agreed to donate 25% of this equipment and services to the LRNRD for this project.

**Material and Supplies:** None

### **Contractual:**

Data Monitoring costs will be incurred for the cellular transmission and data hosting costs of each AMR unit. Quotations of these services were received from McCrometer at a rate of \$168/yr. Twenty-five AMR units will be installed to retrieve data - half in the first year, half in the next. The total cost for data monitoring and hosting is estimated to be \$6,300, 20% of which will be donated by McCrometer, Inc.

Technical Support will be donated from McCrometer for telemetry and flowmeter hardware as well as computer software support for transmitting and receiving data to district databases and making water use data available to water users in the district through a web-based application. This is estimated at \$150/hr for 100 hrs over the two-year life of the project.

Database Consulting: LRNRD has requested a quote from Custom Data Solutions for consulting services to create the computer link between the web-based server where the AMR data will be stored and distributed to water users to the District's established Water Database for

compliance purposes with the district's allocation rules and regulations. This quotation was at \$52.50/hr for 100 hours (Attachment C).

Creating Water Allocation Views is the final contractual service for this project. LRNRD will contract with McCrometer to develop a custom web-based tool for farmers to access water use data collected automatically. The estimates costs for these services is \$60/hr for 100 hrs.

**Environmental and Regulatory Compliance Costs:** None

**Total Cost:**

The total cost for this project will be **\$110,231** including Federal and non-Federal cost share amounts. Federal funds requested are **\$54,915**. Non-Federal funds are **\$55,316** including \$26,181 from the LRNRD and \$29, 135 from McCrometer, Inc.

RESOLUTION OF THE LOWER REPUBLICAN NATURAL RESOURCES DISTRICT  
RESOLUTION No. LR 2017-05-11-01

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WHEREAS, THE BOARD OF DIRECTORS AGREES THAT MIKE CLEMENTS, GENERAL MANAGER OF THE LOWER REPUBLICAN NATURAL RESOURCES DISTRICT, AND SCOTT DICKE, ASSISTANT MANAGER, HAVE LEGAL AUTHORITY TO ENTER INTO AN AGREEMENT WITH THE U.S. BUREAU OF RECLAMATION TO EXECUTE PROVISIONS OF THE WATERSMART SMALL-SCALE WATER EFFICIENCY PROJECT GRANT PROGRAM; AND

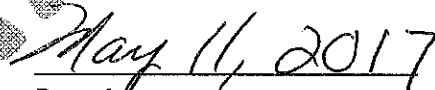
WHEREAS, MANAGEMENT OF THE LOWER REPUBLICAN NATURAL RESOURCES DISTRICT HAS REVIEWED AND SUPPORTS THE APPLICATION FOR WATERSMART GRANT FUNDS; AND

WHEREAS, THE LOWER REPUBLICAN NATURAL RESOURCES DISTRICT IS A POLITICAL SUBDIVISION OF THE STATE OF NEBRASKA AND AS SUCH HAS TAXING AUTHORITIES AND CURRENT BUDGETARY CAPABILITIES SUFFICIENT TO PROVIDE THE AMOUNT OF FUNDING SPECIFIED IN THE WATERSMART GRANT APPLICATION FUNDING PLAN; AND

WHEREAS, THE LOWER REPUBLICAN NATURAL RESOURCES DISTRICT AGREES TO WORK WITH THE U.S. BUREAU OF RECLAMATION TO MEET ESTABLISHED DEADLINES FOR ENTERING INTO A COOPERATIVE AGREEMENT.

NOW, THEREFORE, BE IT RESOLVED, THAT THE LOWER REPUBLICAN NATURAL RESOURCES DISTRICT BOARD OF DIRECTORS AUTHORIZES MANAGEMENT OF THE DISTRICT TO MEET LEGAL AND FINANCIAL OBLIGATIONS REQUIRED UNDER THE U.S. BUREAU OF RECLAMATION'S WATERSMART SMALL-SCALE WATER EFFICIENCY PROJECT GRANT PROGRAM.

  
MARLIN MURDOCH, CHAIRPERSON

  
DATE APPROVED



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May 10, 2017

Scott Dicke, Assistant Manager  
Lower Republican NRD  
30 North John Street  
P.O. Box 618  
Alma, NE 68920

Re: Letter of Commitment for the project **Real-Time Water Use Data Delivery System for LRNRD**

Dear Mr. Dicke:

McCrometer is glad to be a partner in the project **Real-Time Water Use Data Delivery System for LRNRD** that will make use of Water Smart funds from the US Bureau of Reclamation. Upon the award of this grant application McCrometer will contribute up to **\$29,135** of in-kind products and services toward this project

McCrometer has provided durable and accurate flow measurement devices for the agricultural irrigation industry for over 60 years and now also provides remote telemetry products and services for advanced irrigation water management.

McCrometer applauds the US Bureau of Reclamation for the recognition of practices that will enhance irrigation water management in the industry of agriculture through the Water Smart Grant program and strongly encourages the advancement of this proposal.

Respectfully Submitted,

*Kenneth A Quandt*

Kenneth A Quandt  
Market Development Manager  
McCrometer, Inc.



**Lower Republican Natural Resources**

05/08/2017

**RE: Computer support for real-time water use data delivery system that incorporates flowmeter data via telemetry Data into Water Allocation Database for inquiry.**

This proposal is for using Telemetry meter reading data in conjunction with the existing irrigation allocation application to deliver current usage and allocation data to the grower via the internet.

This project will consist of approximately 25 meters related to various irrigation pools. The web interface will allow growers to login, select desired pool, and receive current volume and allocation information.

This proposal covers the following:

- Convert the existing allocation/field/pool data to a new SQL database
- Connect the current Access user interface application to the SQL database
- Create stored procedures for the selection of pools and the calculations of usage and allocation remaining.

The proposed project implementation:

- Selected meters will be equipped to share telemetry data.
- The selected meters will be identified via the Node ID. This ID will be maintained by LRNRD personnel in the Allocation application.
- Any other data related to the selected meters, fields, wells, pools, etc will also be maintained in the Allocation application by LRNRD personnel.
- Spectrum software will develop the web interface the growers will use. It will be hosted on the LRNRD server, or hosted on a Spectrum server.
- Growers will be able to log into the web application, select a pool from the presented list, and see current year inches used, current year allocation remaining, and period inches/allocation remaining.

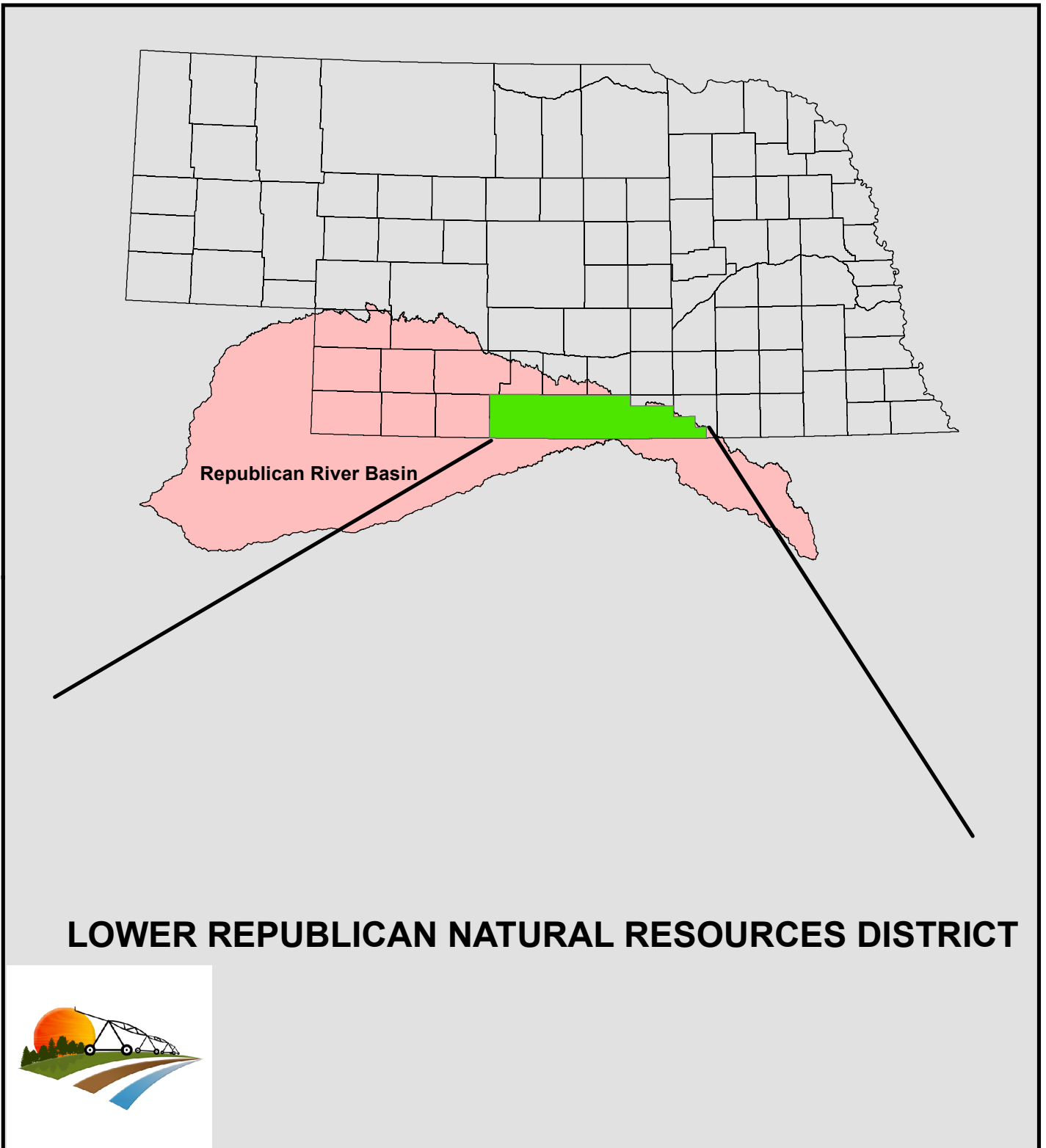
Once the project has been proven, full implementation benefits would include convenient and timely allocation information at the fingertips of the growers. Please note that full water district implementation will require some additional web application and Allocation application investments.



The anticipated investment in the Allocation Application with the new SQL database for the sole purpose of the project is \$3,750.

Spectrum software estimated investment for the project is \$1,500. (Once the location of the web user interface and the SQL DB has been determined, some additional time may need to be quoted for web server or hosting setup.

# NEBRASKA



**Question #14 – Areas Affected by Project:**  
**Lower Republican Natural Resources District that are comprised of:**  
**Furnas County, Harlan County, Franklin County, Webster County, Nuckolls County.**