

NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: Twin Platte Natural Resources District Advanced Aquifer Monitoring System

SPONSOR'S PRIMARY CONTACT INFORMATION (Not Consultant's)

Sponsor Business Name: **Twin Platte Natural Resources District**

Sponsor Contact's Name: **Kent Miller**

Sponsor Contact's Address: **PO Box 1347, North Platte, Nebraska 69103**

Sponsor Contact's Phone: **(308) 535-8080**

Sponsor Contact's Email: **komiller@tpnrd.org**

1. **Funding** amount requested from the Water Sustainability Fund:

Grant amount requested. \$ **249,990**

- If requesting less than 60% cost share, what %? **N/A**

If a loan is requested amount requested. \$ **0**

- How many years repayment period? **N/A**
- Supply a complete year-by-year repayment schedule. **N/A**

2. **Neb. Rev. Stat. § 2-1507 (2)**

Are you applying for a **combined sewer overflow project**? YES NO

If yes:

- Do you have a Long Term Control Plan that is currently approved by the Nebraska Department of Environmental Quality? YES NO
- Attach a copy to your application. **N/A**
- What is the population served by your project? **N/A**
- Provide a demonstration of need. **N/A**
- **Do not complete the remainder of the application.**

3. **Permits Required/Obtained** Attach a copy of each that has been obtained. For those needed, but not yet obtained (box “**NO**” checked), 1.) State when you will apply for the permit, 2.) When you anticipate receiving the permit, and 3.) Your estimated cost to obtain the permit.

(N/A = Not applicable/not asking for cost share to obtain)
 (Yes = See attached)
 (No = Might need, don't have & are asking for 60% cost share to obtain)

G&P - T&E consultation (required)	N/A <input checked="" type="checkbox"/>	Obtained: YES <input type="checkbox"/>	NO <input type="checkbox"/>
DNR Surface Water Right	N/A <input checked="" type="checkbox"/>	Obtained: YES <input type="checkbox"/>	NO <input type="checkbox"/>
USACE (e.g., 404/other Permit)	N/A <input checked="" type="checkbox"/>	Obtained: YES <input type="checkbox"/>	NO <input type="checkbox"/>
FEMA (CLOMR)	N/A <input checked="" type="checkbox"/>	Obtained: YES <input type="checkbox"/>	NO <input type="checkbox"/>
Local Zoning/Construction	N/A <input checked="" type="checkbox"/>	Obtained: YES <input type="checkbox"/>	NO <input type="checkbox"/>
Cultural Resources Evaluation	N/A <input checked="" type="checkbox"/>	Obtained: YES <input type="checkbox"/>	NO <input type="checkbox"/>
Other (provide explanation below)	N/A <input checked="" type="checkbox"/>	Obtained: YES <input type="checkbox"/>	NO <input type="checkbox"/>

4. **Partnerships**

List each Partner / Co-sponsor, attach documentation of agreement:
N/A

Identify the roles and responsibilities of each Partner / Co-sponsor involved in the proposed project regardless of whether each is an additional funding source.

N/A

5. **Other Sources of Funding**

Identify the costs of the entire project, what costs each other source of funding will be applied to, and whether each of these other sources of funding is confirmed. If not, please identify those entities and list the date when confirmation is expected. Explain how you will implement the project if these sources are not obtained.

Project costs that are not covered by a Water Sustainability Fund (WSF) grant will be paid for by the Twin Platte Natural Resources District (TPNRD) (see Table 1). Funding from the TPNRD has been confirmed (see Attachment A).

Table 1 Project costs and funding sources

Year	WSF Grant	TPNRD Portion	Project Cost
1	\$249,990	\$166,660	\$416,650

6. **Overview**

In 1,000 words or less, provide a brief description of your project including the nature/purpose of the project and its objectives. Do not exceed one page!

Beginning in 2019 the TPNRD launched their Water Data Program with the overarching goal of significantly enhancing their understanding of the water supplies and water uses in the TPNRD. A primary component of this program is the collection of real-time water use data on every irrigated parcel in the TPNRD. Now the TPNRD is seeking to expand on this program by deploying additional technology to the field to collect real-time data on aquifer water levels. This additional dataset will be highly complimentary to the real-time water use dataset that is already being generated, allowing for a significantly improved ability to understand the entire water budget in real time.

The TPNRD’s Advanced Aquifer Monitoring System will equip 135 wells (73 existing wells and 62 new monitoring wells) that are currently utilized for the collection of a spring and a fall groundwater level with real-time water level sensors. The water level sensors will be connected to a LoRaWAN network that is being installed across Nebraska. This cutting-edge technology is what makes this project possible by reliably providing extremely low-cost data transmission. This project is an additional component of the TPNRD’s Water Data Program, which was funded in 2019 as a large project with a then total budget of approximately \$3.5 million

The TPNRD has historically sent staff into the field every spring and fall to obtain a single reading of the water level in each well in their monitoring network. Many of these wells are active irrigation wells, making it very difficult to obtain an accurate reading of the water level given the pumping equipment that is installed. Over time, the TPNRD, along with various project partners, have installed many dedicated monitoring wells, however these wells are still only measured twice per

year in most cases due to the extensive nature of staff responsibilities (see Attachment B, Map 1).

While technology has existed for some time to obtain more frequent water level readings without traveling to each well for each water level reading, these technologies are generally cost prohibitive, especially at the scale of the TPNRD’s water level monitoring program. Furthermore, even the most state-of-the-art water level devices cannot be installed in an irrigation well without a significant risk of causing problems, a liability that is too great for a public entity to shoulder responsibly.

With the relatively low cost of well drilling today, this project aims to install dedicated monitoring wells at the location of 62 of the currently measured irrigation wells across the TPNRD. These new wells, along with the 73 currently installed dedicated monitoring wells, will be equipped with a pressure transducer and LoRaWAN transmitter, which will provide *hourly* updates of the water level in each well at an ongoing cost of \$2.00 per well per month. The measurements will be transmitted in real-time and stored in a water data storage platform for long-term use in monitoring, improving the ability to model historic conditions and future changes. For the first time ever, the TPNRD will truly have their finger on the pulse of the aquifer, providing an inestimable increase in the ability to understand and manage the precious groundwater resource of the TPNRD.

7. Project Tasks and Timeline

Identify what activities will be conducted to complete the project, and the anticipated completion date.

For multiyear projects please list (using the following example):

<u>Tasks</u>	<u>Year 1\$</u>	<u>Year 2\$</u>	<u>Year 3\$</u>	<u>Remaining</u>	<u>Total \$ Amt.</u>
Permits	\$18,000				\$18,000
Engineering		\$96,000			\$96,000
Construction		\$87,000	\$96,000		\$183,000
Close-out				\$8,000	\$8,000
				TOTAL	\$305,000

- What activities (Tasks) are to be completed.
- An estimate of each Tasks expenditures/cost per year.
- Activities in years 4 through project completion under a single column.

The project involves two primary tasks: 1) drilling and installation of 62 dedicated monitoring wells at a location in close proximity to existing irrigation wells; and 2) installation of a pressure transducer and a LoRaWAN transmitter at 135 well sites that will jointly identify the water level in the well at regular intervals and transmit that data to the TPNRD’s cloud-based data management platform. Costs are approximate as well installation will be bid out and the most favorable bid will be selected.

Table 2 Major project task costs and timeline

Tasks	Total \$ Amt.
Monitoring Well Installation (62 sites at \$5,000 per site)	\$310,000
Water Level Sensor / Data Transmitter Installation (135 sites at \$790 per site)	\$106,650
Total	\$416,650

8. **IMP**

Do you have an **Integrated Management Plan** in place, or have you initiated one? YES NO Sponsor is not an NRD

Section B.

DNR DIRECTOR'S FINDINGS

Prove Engineering & Technical Feasibility

(Applicant must demonstrate compliance with Title 261, CH 2 - 004)

1. Does your project include physical construction (defined as moving dirt, directing water, physically constructing something, or installing equipment)?
YES NO

If you answered "YES" you must answer all questions in section 1.A.
If you answer "NO" you must answer all questions in section 1.B.

If "YES", it is considered mostly structural, so answer the following:

- 1.A.1 Insert a feasibility report to comply with Title 261, Chapter 2, including engineering and technical data; **N/A**
- 1.A.2 Describe the plan of development (004.01 A); **N/A**
- 1.A.3 Include a description of all field investigations made to substantiate the feasibility report (004.01 B); **N/A**
- 1.A.4 Provide maps, drawings, charts, tables, etc., used as a basis for the feasibility report (004.01 C); **N/A**
- 1.A.5 Describe any necessary water and/or land rights including pertinent water supply and water quality information (004.01 D); **N/A**
- 1.A.6 Discuss each component of the final plan (004.01 E); **N/A**
- 1.A.7 When applicable include the geologic investigation required for the project (004.01 E 1); **N/A**
- 1.A.8 When applicable include the hydrologic data investigation required for the project (004.01 E 2); **N/A**
- 1.A.9 When applicable include the criteria for final design including, but not limited to, soil mechanics, hydraulic, hydrologic, structural, embankments and foundation criteria (004.01 E 3). **N/A**

If "NO", it is considered mostly non-structural, so answer the following:

- 1.B.1 Insert data necessary to establish technical feasibility (004.02);

Beginning in 2019 the TPNRD launched their Water Data Program with the overarching goal of significantly enhancing their understanding of the water supplies and water uses in the TPNRD. A primary component of this program is the collection of real-time water use data on every irrigated parcel in the TPNRD. Now the TPNRD is seeking to expand on this program by deploying additional technology to the field to collect real-time data on aquifer water levels. This additional dataset will be highly complementary to the real-time water use dataset that is already being generated, allowing for a significantly improved ability to understand the entire water budget in real time.

On the surface this is a very straight forward application of well drilling and water level sensing technology that has been around for decades. The primary difference between this project and previous efforts to monitor groundwater levels is the large-scale real-time data generation at such a low cost. This is made possible by a new wireless network that has been deployed over large areas of Nebraska by a company called Paige Wireless.

This project is an extension of a pilot project recently completed by the TPNRD. The pilot project leveraged a set of eight pre-existing monitoring wells in the TPNRD (See Attachment B, Map 1). The TPNRD obtained eight devices from Paige Wireless that combine an off-the-shelf pressure transducer with a LoRaWAN antennae designed by Paige Wireless. Staff at the TPNRD installed the pressure transducer LoRaWAN devices at the eight monitoring locations (See Figure 1).



Figure 1 A monitoring well equipped with a pressure transducer and LoRaWAN Paige Wireless device in the TPNRD.

Paige Wireless maintains a system of LoRaWAN receivers throughout the TPNRD. These receivers can pick up data from a transmitting device within a range of 10+ miles. The receivers transmit the data and it is received by the TPNRD's data management platform, GeoOptix. GeoOptix is a product of Sitka Technology Group, Inc, a software technology company dedicated to natural resources. All eight of the pilot sites have been successfully collecting and transmitting water level data at hourly intervals for several months (See Figure 2 for an example of the data).

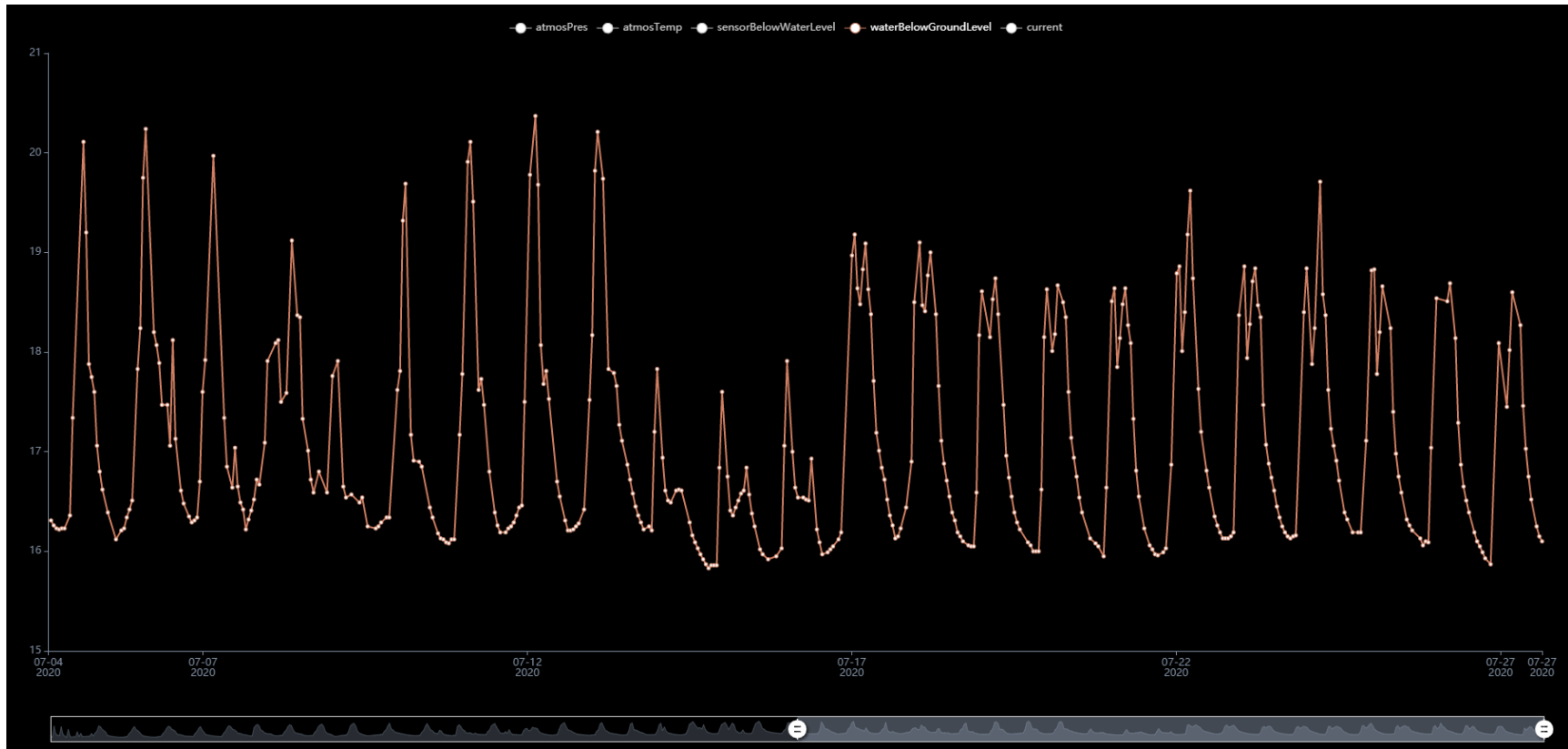


Figure 2 An example of the water level data displayed in the TPNRD's data management platform, GeoOptix.

1.B.2 Discuss the plan of development (004.02 A);

The project will involve two phases of development. The first phase will be the installation of two-inch diameter monitoring wells in close proximity to 62 existing irrigations wells that have been used for spring and fall water level monitoring. The second phase will involve the installation of 135 Paige Wireless devices that will measure and transmit water level measurements. It is anticipated that the project can be completed prior to the 2021 irrigation season.

1.B.3 Describe field or research investigations utilized to substantiate the project conception (004.02 B);

The TPNRD has successfully installed Paige Wireless devices on eight dedicated monitoring wells in 2020. The installation process was seamless, and the devices began transmitting water level measurements immediately. Installation of additional dedicated monitoring wells is a run-of-the-mill process that can easily be completed at the location of each irrigation well during the non-irrigation season.

1.B.4 Describe any necessary water and/or land rights (004.02 C);

The TPNRD will obtain permission from all landowners before installing the new observation wells. The TPNRD will coordinate the timing of the well drilling with the landowners and the TPNRD will maintain the monitoring wells on behalf of the landowners.

1.B.5 Discuss the anticipated effects, if any, of the project upon the development and/or operation of existing or envisioned structural measures including a brief description of any such measure (004.02 D).

The only known structural measure that will be protected by the project are the 62 existing private irrigation wells that are currently accessed every spring and fall by lowering a measuring tape down the well column. In many cases this is an increasingly difficult task as the well infrastructure ages, and the most significant consequence of this activity is that a tape gets stuck and the irrigation pump has to be removed and reset before the well can be utilized for irrigation.

Prove Economic Feasibility

(Applicant must demonstrate compliance with Title 261, CH 2 - 005)

2. Provide evidence that there are no known means of accomplishing the same purpose or purposes more economically, by describing the next best alternative.

This project will result in the creation of real-time water level data in wells that are currently only measured twice per year. Moreover, it will be providing water level

data during the irrigation season for many wells that would be virtually impossible to measure during the irrigation season because they are or may be in use at any time. This enhanced level of information has become critical to the ability of the TPNRD to manage the precious groundwater resource that underlies their part of the state.

For purposes of documenting economic feasibility, we will assume that the next best alternative would be to collect weekly water levels in every one of the 135 water level monitoring sites that will be part of this project. The fall and spring measurement activities currently require two staff members for six days each season. They travel a total of 2,400 miles each season. So weekly water level measurements could conceivably be accomplished with two full time personnel traveling approximately 125,000 miles per year. The combined staffing cost would be approximately \$180,000 per year (\$45 per hour salary and benefits for 2,080 hours annually for two people) and travel costs would be approximately \$70,000 per year. Therefore, a weekly water level measurement program would cost approximately \$500,000 in a two-year period. This project will provide hourly water level data at an initial cost of \$416,650 and an ongoing cost of \$3,240 per year (\$2 per device per month). So this project will be more economically feasible than the next available alternative after two years of operating, though it is expected that the project will have a life of many decades and will provide over 100 times the amount of data than a manual weekly water level program could provide.

3. Document all sources and report all **costs** and **benefit data** using current data, (commodity prices, recreation benefit prices, and wildlife prices as prescribed by the Director) using both dollar values and other units of measurement when appropriate (environmental, social, cultural, data improvement, etc.). The period of analysis for economic feasibility studies is the project life, up to fifty (50) years; or, with prior approval of the Director up to one hundred (100) years, ([Title 261, CH 2 - 005](#)).

As part of this project, the TPNRD will receive access to real-time data on the water levels throughout the district. This project inherently beneficial as it will result in a dramatically improved understanding of short-term and long term water level changes that result from variability in water use and aquifer recharge. It will also give the TPNRD data that is comparable in its time discretization to the water use data being generated by the TPNRD Water Data Program, a project that was approved for cost share funding from the Water Sustainability Fund in 2019. This project has also been identified as the least-cost alternative by a significant margin.

- 3.A Describe any relevant cost information including, but not limited to the engineering and inspection costs, capital construction costs, annual operation and maintenance costs, and replacement costs. Cost information shall also

include the estimated construction period as well as the estimated project life (005.01).

The total project cost is \$416,650. This will include the installation of 62 dedicated monitoring wells at an estimated average cost of \$5,000 per well and 135 real-time monitoring devices at a cost of \$790 per well. Ongoing operation and maintenance costs will be covered by the TPNRD and are estimated to be \$270 per month.

- 3.B Only primary tangible benefits may be counted in providing the monetary benefit information and shall be displayed by year for the project life. In a multi-purpose project, estimate benefits for each purpose, by year, for the life of the project. Describe intangible or secondary benefits (if any) separately. In a case where there is no generally accepted method for calculation of primary tangible benefits describe how the project will increase water sustainability, in a way that justifies economic feasibility of the project such that the finding can be approved by the Director and the Commission (005.02).

The primary benefit of this project will be the delivery of real-time (hourly) water level data at 135 well locations across the district. Historically this data was only collected twice per year due to the manual effort required to do so. This project will also improve TPNRD's ability to analyze the impacts of water use and to determine the extent to which those uses are sustainable without taking additional actions to manage water uses and supplies.

- 3.C Present all cost and benefit data in a table to indicate the annual cash flow for the life of the project (005.03). **See Attachment C.**
- 3.D In the case of projects for which there is no generally accepted method for calculation of primary tangible benefits and if the project will increase water sustainability, demonstrate the economic feasibility of such proposal by such method as the Director and the Commission deem appropriate (005.04). (For example, show costs of and describe the next best alternative.)

The TPNRD has several goals and objectives in their IMP and groundwater management plan (GMP) that they are required to accomplish. This project will be an essential component to the TPNRD in determining whether those goals and objectives have been met. In the past, spring and fall water levels were better than no information at all, but it has become abundantly clear over time that these measurements alone provide too little information to meet the ever growing management issues and needs surrounding the groundwater resource in the TPNRD.

The TPNRD is also required to utilize the "best available information" (Nebraska Rev. Statutes §46-709) in carrying out these duties. Without the proposed project, there is no other cost-effective means to obtain real-time water level information

and determine if the IMP goals and objectives are being met using the best available information. The IMP is in place to ensure the long-term water sustainability of the area, making the goals and objectives of the IMP inherently beneficial.

The goals of the IMP are related to the obligations that the State of Nebraska has to the Platte River Recovery Implementation Program (PRRIP). The PRRIP is an interstate agreement between Nebraska, Colorado, Wyoming, and the federal government. Nebraska receives benefits provided by the PRRIP related to the Endangered Species Act and three endangered species on the Platte River—the whooping crane, the least tern, and the piping plover. Without the PRRIP, the U.S. Fish and Wildlife Service may require water users in the Platte River Basin to curtail their water use activities, likely costing hundreds of millions of dollars in direct expenses and reduced economic output. In the Environmental Impact Statement for the PRRIP, the implementation of other alternatives was estimated to cost approximately \$250 million with a reduction in economic output of \$10 million per year.

Prove Financial Feasibility

(Applicant must demonstrate compliance with Title 261, CH 2 - 006)

4. Provide evidence that sufficient funds are available to complete the proposal.

See Attachment A from the General Manager of the TPNRD documenting the District's 2020 budget.

5. Provide evidence that sufficient annual revenue is available to repay the reimbursable costs and to cover OM&R (operate, maintain, and replace).

There are no reimbursable costs related to this project. See Attachment A from the General Manager of the TPNRD documenting the District's 2020 budget. The TPNRD is funded by a tax levy that has been in place for many decades. The costs to operate and maintain the water level network will be \$270 per month, or \$3,240 per year. These costs can be readily absorbed within the annual budget of the TPNRD.

6. If a loan is involved, provide sufficient documentation to prove that the loan can be repaid during the repayment life of the proposal. **N/A**
7. Describe how the plan of development minimizes impacts on the natural environment (i.e. timing vs nesting/migration, etc.).

This project will not have a negative impact on the natural environment.

8. Explain how you are qualified, responsible and legally capable of carrying out the project for which you are seeking funds.

The TPNRD has a wide range of statutory responsibilities and authorities, including but not limited to Nebraska Revised Statutes §2-3,201 through 2-3,243 and the Ground Water Management and Protection Act (Nebraska Rev. Statutes §46-701 through 46-756). As the state of Nebraska's preferred regulator of groundwater, the TPNRD is clearly both qualified and responsible to carry out the proposed project.

9. Explain how your project considers plans and programs of the state and resources development plans of the political subdivisions of the state.

This project is being implemented to assist the TPNRD to fulfill the requirements of their IMP. The IMP is written in accordance with the Basin-Wide Plan for the Upper Platte River Basin. Both the IMP and the Basin-Wide Plan are required by the Nebraska Ground Water Management and Protection Act (GWMPA). Nebraska is also a signatory to the interstate agreement called the PRRIP. The TPNRD also has a GMP pursuant to the GWMPA. This project will assist Nebraska and the TPNRD in meeting the requirements of all of these plans.

10. Are land rights necessary to complete your project? YES NO

If yes:

- 10.A Provide a complete listing of all lands involved in the project. **N/A**
- 10.B Attach proof of ownership for each easements, rights-of-way and fee title currently held. **N/A**
- 10.C Provide assurance that you can hold or can acquire title to all lands not currently held. **N/A**
11. Identify how you possess all necessary authority to undertake or participate in the project.

The TPNRD has a wide range of statutory responsibilities and authorities, including but not limited to Nebraska Revised Statutes §2-3,201 through 2-3,243 and the Ground Water Management and Protection Act (Nebraska Rev. Statutes §46-701 through 46-756). As the state of Nebraska's preferred regulator of groundwater, the TPNRD is clearly both qualified and responsible to carry out the proposed project.

12. Identify the probable consequences (environmental and ecological) that may result if the project is or is not completed. **N/A**

Section C.

NRC SCORING

In the NRC's scoring process, points will be given to each project in ranking the projects, with the total number of points determining the final project ranking list.

The following 15 criteria constitute the items for which points will be assigned. Point assignments will be 0, 2, 4, or 6 for items 1 through 8; and 0, 1, 2, or 3 for items 9 through 15. Two additional points will be awarded to projects which address issues determined by the NRC to be the result of a federal mandate.

Notes:

- The responses to one criterion will not be considered in the scoring of other criteria. Repeat references as needed to support documentation in each criterion as appropriate. The 15 categories are specified by statute and will be used to create scoring matrixes which will ultimately determine which projects receive funding.
- There is a total of 69 possible points, plus two bonus points. The potential number of points awarded for each criteria are noted above. Once points are assigned, they will be added to determine a final score. The scores will determine ranking.
- The Commission recommends providing the requested information and the requests are not intended to limit the information an applicant may provide. An applicant should include additional information that is believed will assist the Commission in understanding a proposal so that it can be awarded the points to which it is entitled.

Complete any of the following (15) criteria which apply to your project. Your response will be reviewed and scored by the NRC. Place an N/A (not applicable) in any that do not apply, an N/A will automatically be placed in any response fields left blank.

1. Remediates or mitigates threats to drinking water;
 - Describe the specific threats to drinking water the project will address.
 - Identify whose drinking water, how many people are affected, how will project remediate or mitigate.
 - Provide a history of issues and tried solutions.
 - Provide detail regarding long-range impacts if issues are not resolved.

The approximately 44,000 people that live in the TPNRD rely on groundwater for drinking water. According to the Nebraska Department of Environment and Energy's 2019 Groundwater Quality Monitoring Report (see Attachment D), there are three community water supply systems with mandatory requirements triggered by high levels of nitrates within the TPNRD. In addition, there is one community public water supply system that is required to treat their drinking water due to high levels of uranium. Should future alternate drinking water supplies be needed, other groundwater sources could be evaluated with the modeling platform produced by this project. Because the TPNRD was designated as fully appropriated and overappropriated in 2004, any new use of hydrologically connected groundwater can only be developed if this use does not adversely impact existing users. This requirement means that only the most scientifically sound and up-to-date modeling tools should be used to ensure adverse impacts would not occur when evaluating other groundwater sources. The proposed automated water level monitoring program which is one part of the overall groundwater modeling platform funded through the Water Sustainability Fund in 2019, will have the ability to document impacts to the aquifer automatically and in real time.

Irrigation pumping contributes to elevated nitrate levels by facilitating the movement of overapplied fertilizers into groundwater supplies and depleting groundwater supplies available for drinking water. One of the goals of the TPNRDs Water Data Program is to educate irrigators on how much water they are using and how their water use affects the aquifer and nearby streams. The automated water level monitoring program will be used to verify the groundwater modeling results that provide this information. By delivering information on water use and aquifer levels to the irrigators in an easy-to-understand way, they will feel empowered to more responsibly manage their water use, which promotes sustainability of the drinking water supply in the TPNRD. The groundwater monitoring will also serve as a means of identifying areas where the TPNRD could impose limitations to protect drinking water supplies if it becomes necessary.

2. Meets the goals and objectives of an approved integrated management plan or ground water management plan;
 - Identify the specific plan that is being referenced including date, who issued it and whether it is an IMP or GW management plan.
 - Provide the history of work completed to achieve the goals of this plan.
 - List which goals and objectives of the management plan the project provides benefits for and how the project provides those benefits.

This project will assist the TPNRD in meeting the goals and objectives of the TPNRD's Integrated Management Plan (IMP) and Groundwater Management Plan (GMP). The first ten years (first increment) of the IMP concluded in September 2019. The TPNRD's current IMP became effective September 3, 2019 (see

Attachment E). The TPNRD's GMP was adopted on December 14, 1995 (see Attachment F).

TPNRD IMP

The TPNRD's IMP has the vision of “jointly managing and balancing water use and water supply while optimizing economic, social and environmental benefits for the near and long term”, and the following goals:

- **Protect to the extent possible existing users, local economy, environmental health, and recreational uses**
- **Manage total water supply in the TPNRD to achieve sustainability of supply and use while allowing for growth and changes in use**
- **Recognize there are multiple causes of streamflow depletion and to the extent possible distribute responsibilities appropriately**

In the overappropriated area of the TPNRD, the goal of the IMP is to return the area to a fully appropriated designation and sustain it. It was determined that progress toward this designation would be benchmarked in ten (10) year increments. Within the first increment of the IMP (September 2009-August 2019), a major goal of the TPNRD was to “address impacts of streamflow depletions to surface water appropriations and water wells constructed in aquifers dependent upon recharge from streamflow to the extent those depletions are due to water use initiated after July 1, 1997.” The TPNRD is required by the IMP to provide annual accretions to the river equal to or exceeding the post-1997 depletion amount.

This project will assist the TPNRD in achieving all of these goals by automatically providing the groundwater monitoring data required to assess their progress toward the 1997 condition. The proposed monitoring well network will have the ability to quantify their aquifer depletion and through modeling, estimate the streamflow offsets on an annual basis rather than the current process of measuring progress every four years. More frequent offset water estimates give the TPNRD an enhanced ability to proactively manage their water resources.

The TPNRD has expended significant resources to meet the goals and objectives of their IMP since its adoption in 2009. These efforts have included the issuance of a moratorium on new or expanded water well construction, requiring water users to certify their irrigated acres, the development of provisions for groundwater transfers, and the establishment of an accounting system for municipal, industrial, and commercial water users. In addition, the TPNRD has attended basin-wide meetings and implemented a number of studies and data collection efforts to monitor their progress toward meeting IMP goals. The TPNRD has also developed a number of projects utilizing state and local funding to assist them in meeting the IMP goals. This automated groundwater monitoring project will assist the TPNRD in evaluating the benefits of these projects, ensuring that the value of these investments are fully recognized.

TPNRD GMP

The goals of the TPNRD's GMP are to "identify the groundwater supplies, identify changes of the groundwater levels, and identify the sources and levels of groundwater contamination within an NRD boundary, to establish groundwater quantity and quality goals, as well as a goal for the life of the groundwater reservoir, and to develop long-term solutions necessary for the prevention and/or reduction of groundwater declines or of high levels of groundwater contaminants posing environmental and health hazards." The GMP specifically recognizes the "lack of good scientific knowledge about groundwater systems."

To address this lack of knowledge, the TPNRD has completed studies, collected data, and pursued groundwater modeling projects to further their understanding of the hydrologically connected surface and groundwater systems since the adoption of the GMP. This project will give the TPNRD water level change data from the automated water level monitoring network and that will be used to estimate impacts to the aquifer and to baseflow. Monitoring is a fundamental part of the TPNRD GMP since without an understanding of the water level changes over time, it is impossible to manage the resource sustainably. Currently, water levels are only monitored twice a year, once in the spring and once in the fall. Once this project is completed, the TPNRD will get hourly updates to water levels throughout the entire year. In other words, the TPNRD will increase their groundwater monitoring recurrence interval by a factor of approximately 4300 by collecting a reading every hour instead of twice a year.

3. Contributes to water sustainability goals by increasing aquifer recharge, reducing aquifer depletion, or increasing streamflow;

List the following information that is applicable:

- The location, area and amount of recharge;
- The location, area and amount that aquifer depletion will be reduced;
- The reach, amount and timing of increased streamflow. Describe how the project will meet these objectives and what the source of the water is;
- Provide a detailed listing of cross basin benefits, if any.

This automated groundwater monitoring project is a critical component of the overall approach to managing the approximately 320,000 irrigated acres in the TPNRD in accordance with their IMP and GMP. The project is one part of the geospatial farm operation data platform called AgHub that is being used by irrigators in the TPNRD to store data related to their farming practices. AgHub is being used by the TPNRD to track real-time water use estimates calculated using power records. The irrigator has access to AgHub and information about how their water use affects the aquifer and nearby streams. By educating irrigators on their water use and impacts to the hydrologic system, it is likely that many irrigators will voluntarily reduce pumping. This benefit will help the TPNRD

reduce their aquifer depletions and meet their IMP requirement to return streamflow in the Platte River to historic 1997 levels.

The water level monitoring data along with the water use information from AgHub will be used as input data for the watershed and groundwater models housed in the Groundwater Evaluation Toolbox (GET) platform. Using GET, the TPNRD will be able to simulate management actions that increase water aquifer recharge, reduce aquifer depletion, or increase streamflow. GET will produce maps and graphs that will assist the TPNRD in assessing the spatial and temporal benefits of their management decisions. These modeling tools will help the TPNRD evaluate not only their current water use, but also how their water use might be managed in the future for the long-term sustainability of the aquifer and streams.

For example, studies have been done on the effects of conservation tillage practices on groundwater recharge in the TPNRD. Results have indicated that implementing no-till farming can increase groundwater recharge by 1-2.5 inches per acre. Over time, the groundwater monitoring data will be used to validate the modeling results and make changes to water management requirements if the IMP and GMP goals to reduce aquifer depletion are not met.

4. **Contributes to multiple water supply goals, including, but not limited to, flood control, agricultural use, municipal and industrial uses, recreational benefits, wildlife habitat, conservation of water resources, and preservation of water resources;**
 - [List the goals the project provides benefits.](#)
 - [Describe how the project will provide these benefits](#)
 - [Provide a long range forecast of the expected benefits this project could have versus continuing on current path.](#)

The proposed project will contribute to multiple water supply goals such as sustainable agricultural water use, the protection of municipal, industrial, domestic, and livestock uses, the conservation of water resources, and the preservation of water resources. The automated groundwater monitoring program will supply the TPNRD with essential information that will drive decision making to support these water supply goals. This project will provide education to irrigators on their water use and how it affects the aquifer and streamflow, empowering them to conserve the future groundwater resource.

The TPNRD will use the groundwater monitoring data to calibrate the groundwater models used to predict the potential benefits of future management actions, monitor the actual benefits of actions taken, and make adjustments to their actions in an informed manner. Adding the automated groundwater monitoring level data to the modeling platform represents the best science available and will be critical to the TPNRD in ensuring these water supply goals are met. Without the monitoring data to validate the modeling results, water

management decision-making will be made based on incomplete information reactively rather than using the proactive, validated approach that is needed to ensure water sustainability.

5. Maximizes the beneficial use of Nebraska's water resources for the benefit of the state's residents;
 - Describe how the project will maximize the increased beneficial use of Nebraska's water resources.
 - Describe the beneficial uses that will be reduced, if any.
 - Describe how the project provides a beneficial impact to the state's residents.

The TPNRD is required by their IMP to return overappropriated areas in the District to a fully appropriated condition. In order to accomplish this, the TPNRD must "address impacts of streamflow depletions to surface water appropriations and water wells constructed in aquifers dependent upon recharge from streamflow to the extent those depletions are due to water use initiated after July 1, 1997." Pursuant to the IMP, the TPNRD must provide annual accretions to the river equal to or exceeding the post-1997 depletion amount.

To meet this requirement, it is necessary for the TPNRD to be as informed as possible on the water use in their District and its implications on future aquifer levels and streamflow. This project will provide real-time automated water level data to the TPNRD so that they can educate irrigators on how their groundwater use affects the hydrologic system, encouraging them to optimize their operations. Both the TPNRD and the irrigator will be working together to strike the appropriate balance between maximum beneficial consumptive use and limiting adverse impacts to the aquifer and streamflow. The proposed project will accomplish this goal by providing the information necessary to quantify this balance. Promoting the sustainability of the local economy will provide a benefit to all of the state's residents.

6. Is cost-effective;
 - List the estimated construction costs, O/M costs, land and water acquisition costs, alternative options, value of benefits gained.
 - Compare these costs to other methods of achieving the same benefits.
 - List the costs of the project.
 - Describe how it is a cost effective project or alternative.

The total cost of the project is \$416,650. This project will result in the creation of real-time water level data in wells that are currently only measured twice per year. Moreover, it will be providing water level data during the irrigation season for many wells that would be virtually impossible to measure during the irrigation season because they are or may be in use at any time. The next best alternative would be to collect weekly water levels in every one of the 135 water level

monitoring sites that will be equipped under this project. The fall and spring measurement activities currently require two staff members for six days each season. They travel a total of 2,400 miles each season. So weekly water level measurements could conceivably be accomplished with two full time personnel traveling approximately 125,000 miles per year. The combined staffing cost would be approximately \$180,000 per year (\$45 per hour salary and benefits for 2,080 hours annually for two people) and travel costs would be approximately \$70,000 per year. Therefore, a weekly water level measurement program would cost approximately \$500,000 in a two-year period. This project will provide hourly water level data at an initial cost of \$416,650 and an ongoing cost of \$3,000 per year (\$2 per device per month). This project is clearly a highly cost-effective approach to sustaining the TPNRD's water level monitoring program into the future.

7. Helps the state meet its obligations under interstate compacts, decrees, or other state contracts or agreements or federal law;
 - Identify the interstate compact, decree, state contract or agreement or federal law.
 - Describe how the project will help the state meet its obligations under compacts, decrees, state contracts or agreements or federal law.
 - Describe current deficiencies and document how the project will reduce deficiencies.

The proposed project will assist the State of Nebraska in meeting its obligations under the Platte River Recovery Implementation Program (PRRIP), an interstate agreement between Nebraska, Colorado, and Wyoming. The TPNRD lies upstream of the critical habitat areas of the Platte River. Impacts to flows must be quantified and limited within or above the critical habitat reach. Both the New Depletions Plan (NNDP) (see Attachment G), a component of the Water Plan for the PRRIP, and the TPNRD's Integrated Management Plan (IMP) require the TPNRD to offset any new depletions to Platte River streamflow that have occurred since July 1, 1997.

This project will enable the TPNRD to automatically monitor groundwater elevations in real time in 135 dedicated monitoring wells. The data will be used to track depletions and offset requirements using advanced modeling techniques. The TPNRD has also undertaken various management actions pursuant to their IMP to comply with the NNDP. The only way to document whether these actions have been successful is with groundwater monitoring.

8. Reduces threats to property damage or protects critical infrastructure that consists of the physical assets, systems, and networks vital to the state or the United States such that their incapacitation would have a debilitating effect on public security or public health and safety;
 - Identify the property that the project is intended to reduce threats to.
 - Describe and quantify reductions in threats to critical infrastructure provided by the project and how the infrastructure is vital to Nebraska or the United States.
 - Identify the potential value of cost savings resulting from completion of the project.
 - Describe the benefits for public security, public health and safety.

The groundwater supply in the TPNRD is critically important to the State of Nebraska and to the United States. Without this supply, effects to public security, public health, and safety would be debilitating. The TPNRD automated groundwater monitoring program is absolutely essential in promoting the sustainability of the groundwater supply in the Upper Platte River Basin. Enhancing the TPNRD's ability to make informed decisions shifts the reactive management of the past to a proactive approach for the future.

This proactive approach will be especially critical as projected declines in groundwater supplies contribute to uncertainties in future food security. A report released by the United States Department of Homeland Security's Office of Cyber and Infrastructure Analysis titled Analysis of High Plains Resource Risk and Economic Impacts (see Attachment H) outlines the importance of the High Plains Aquifer to the country. The report analyzed how continued depletions of the High Plains aquifer in Kansas and Nebraska might impact critical infrastructure and the economy at local, regional, and national levels. According to the report, groundwater supplies in some areas of the TPNRD are projected to face exhaustion in 100-200 years. How the TPNRD monitors and manages their supply in the present will dictate whether groundwater is available in the future. The proposed project is clearly beneficial to public security, public health, and safety by supplying the TPNRD with information on the current state of groundwater availability in the District and how that might change over time.

9. Improves water quality;

- Describe what quality issue(s) is/are to be improved.
- Describe and quantify how the project improves water quality, what is the target area, what is the population or acreage receiving benefits, what is the usage of the water: residential, industrial, agriculture or recreational.
- Describe other possible solutions to remedy this issue.
- Describe the history of the water quality issue including previous attempts to remedy the problem and the results obtained.

Groundwater supplies in some areas of the TPNRD have experienced high levels of nitrates. According to the Quality-Assessed Agrichemical Contaminant Database for Nebraska Ground Water maintained by the Nebraska Department of Environment and Energy, 7 of the 9 monitoring wells sampled in the TPNRD in 2017 exhibited nitrate levels well above the drinking water Maximum Contaminant Limit of 10 milligrams per liter. Irrigation pumping contributes to elevated nitrate levels by promoting the downward movement of over applied fertilizers into groundwater supplies by leaching nutrients in the soil downward into the aquifer. One of the goals of this project is to educate irrigators on how much water they are using and how their water use affects the aquifer and nearby streams. This project will also enhance the TPNRD's ability to monitor the real-time and long-term effects of pumping. With the groundwater level monitoring data, the TPNRD can work with irrigators that overirrigate to reduce their water application rate. Reducing overirrigation improves groundwater quality by reducing nitrate movement through the soil profile to the aquifer.

The TPNRD has worked to address this issue of high nitrates by regularly collecting water samples to monitor nitrate levels. The TPNRD also provides worksheets and forms to help irrigators calculate the total nitrogen needed for their predicted yield. Irrigators can use these forms and water samples to take advantage of any residual nitrogen from the previous year and avoid nitrogen overapplication.

10. Has utilized all available funding resources of the local jurisdiction to support the program, project, or activity;

- Identify the local jurisdiction that supports the project.
- List current property tax levy, valuations, or other sources of revenue for the sponsoring entity.
- List other funding sources for the project.

The local jurisdiction that supports this project is the TPNRD. The TPNRD has the ability to support the proposed project as evidenced by the budget provided for fiscal year 2019 (see Attachment A). To demonstrate the TPNRD's commitment to the project, the TPNRD has already executed contracts with software developers and well drilling companies to begin estimating water use. The TPNRD has

covered the costs of the proof of concept project which initially equipped 8 dedicated monitoring wells with Paige Wireless water level devices,

The TPNRD also has the option to support this project through their tax levy authority. The current tax levy for the TPNRD is 2.3308¢ per \$100 valuation. The TPNRD has developed a number of projects utilizing state and local funding to assist them in meeting the IMP goals. This project will assist the TPNRD in evaluating the benefits of these projects, ensuring that the value of these investments is fully recognized.

11. Has a local jurisdiction with plans in place that support sustainable water use;

- List the local jurisdiction and identify specific plans being referenced that are in place to support sustainable water use.
- Provide the history of work completed to achieve the goals of these plans.
- List which goals and objectives this project will provide benefits for and how this project supports or contributes to those plans.
- Describe and quantify how the project supports sustainable water use, what is the target area, what is the population or acreage receiving benefits, what is the usage of the water: residential, industrial, agriculture or recreational.
- List all stakeholders involved in project.
- Identify who benefits from this project.

The local jurisdiction, the TPNRD, has multiple plans in place that support sustainable water use, including an Integrated Management Plan (IMP) and a Groundwater Management Plan (GMP). The first ten years (first increment) of the IMP concluded in September 2019. The second increment IMP became effective September 3, 2019 (see Attachment E). The TPNRD's GMP was adopted on December 14, 1995 (see Attachment F).

TPNRD IMP

The TPNRD's IMP has the vision of "jointly managing and balancing water use and water supply while optimizing economic, social and environmental benefits for the near and long term", and the following goals:

- Protect to the extent possible existing users, local economy, environmental health, and recreational uses
- Manage total water supply in the TPNRD to achieve sustainability of supply and use while allowing for growth and changes in use
- Recognize there are multiple causes of streamflow depletion and to the extent possible distribute responsibilities appropriately

In the overappropriated area of the TPNRD, the goal of the IMP is to return the area to a fully appropriated designation and sustain it. It was determined that progress toward this designation would be benchmarked in ten (10) year increments. Within the first increment of the IMP (September 2009-August 2019),

a major goal of the TPNRD was to “address impacts of streamflow depletions to surface water appropriations and water wells constructed in aquifers dependent upon recharge from streamflow to the extent those depletions are due to water use initiated after July 1, 1997.” The TPNRD is required by the IMP to provide annual accretions to the river equal to or exceeding the post-‘97 depletion amount.

This project will assist the TPNRD in achieving all of these goals by automatically providing the groundwater monitoring data required to assess their progress toward the 1997 condition. The proposed monitoring well network will have the ability to quantify their aquifer depletion and through modeling, estimate the streamflow offsets on an annual basis rather than the current process of measuring progress every four years. More frequent offset water estimates give the TPNRD an enhanced ability to proactively manage their water resources.

The TPNRD has expended significant resources to meet the goals and objectives of their IMP since its adoption in 2009. These efforts have included the issuance of a moratorium on new or expanded water well construction, requiring water users to certify their irrigated acres, the development of provisions for groundwater transfers, and the establishment of an accounting system for municipal, industrial, and commercial water users. In addition, the TPNRD has attended basin-wide meetings and implemented a number of studies and data collection efforts to monitor their progress toward meeting IMP goals. The TPNRD has also developed a number of projects utilizing state and local funding to assist them in meeting the IMP goals. This automated groundwater monitoring project will assist the TPNRD in evaluating the benefits of these projects, ensuring that the value of these investments are fully recognized.

TPNRD GMP

The goals of the TPNRD’s GMP are to “identify the groundwater supplies, identify changes of the groundwater levels, and identify the sources and levels of groundwater contamination within an NRD boundary, to establish groundwater quantity and quality goals, as well as a goal for the life of the groundwater reservoir, and to develop long-term solutions necessary for the prevention and/or reduction of groundwater declines or of high levels of groundwater contaminants posing environmental and health hazards.” The GMP specifically recognizes the “lack of good scientific knowledge about groundwater systems.”

To address this lack of knowledge, the TPNRD has completed studies, collected data, and pursued groundwater modeling projects to further their understanding of the hydrologically connected surface and groundwater systems since the adoption of the GMP. This project will give the TPNRD water level change data from the automated water level monitoring network and that will be used to estimate impacts to baseflow. Monitoring is a fundamental part of the TPNRD GMP since with and understanding of the water level changes over time, it is impossible to manage the resource sustainably.

12. Addresses a statewide problem or issue;

- List the issues or problems addressed by the project and why they should be considered statewide.
- Describe how the project will address each issue and/or problem.
- Describe the total number of people and/or total number of acres that would receive benefits.
- Identify the benefit, to the state, this project would provide.

This project helps the state meet its obligations under the PRRIP, which is clearly a statewide issue. This interstate agreement was signed by the Governor. The Legislature has provided a significant amount of general fund appropriations through the DNR to implement the PRRIP. This project is essential to Nebraska's ability to meet its obligations under the PRRIP.

Nebraska's obligations are contained within the NNDP, a component of the Water Plan for the PRRIP. Generally speaking, the NNDP requires Nebraska to offset any depletions to Platte River streamflow that result from new or expanded uses that have occurred subsequent to July 1, 1997. Successful implementation of the PRRIP and the NNDP provides benefits to the approximately 500,000 irrigated acres in the Platte River Basin that were developed subsequent to 1997. By successfully offsetting the impact of these irrigated acres, Nebraska's economy will benefit significantly by allowing those acres to remain in irrigated agriculture.

The TPNRD has undertaken various management actions pursuant to their IMP in order to provide compliance with the NNDP. However, the only way to document whether these actions have, in fact, been successful requires groundwater monitoring. This project will enable the TPNRD to automatically monitor groundwater elevations in real time in 135 dedicated monitoring wells. The data will be used to track depletions and offset requirements using advanced modeling techniques. Using the producer platform developed for this project called AgHub, irrigators in the TPNRD will be given information on how their water use affects the aquifer and streamflow, helping them optimize their irrigation practices for water sustainability. This will provide direct benefits to the 320,000 groundwater irrigated acres in the TPNRD, as well as to residents across the state by ensuring adequate groundwater and surface water supplies will be available into the future.

13. Contributes to the state's ability to leverage state dollars with local or federal government partners or other partners to maximize the use of its resources;

- List other funding sources or other partners, and the amount each will contribute, in a funding matrix.
- Describe how each source of funding is made available if the project is funded.
- Provide a copy or evidence of each commitment, for each separate source, of match dollars and funding partners.
- Describe how you will proceed if other funding sources do not come through.

The TPNRD will pay 40% of the project cost in this WSF application. Significant additional investments have been made by the TPNRD to initiate this project as quickly as possible. These initial efforts and the TPNRD's budget from fiscal year 2019 and 2020 demonstrates their commitment to the project (see Attachment A).

14. Contributes to watershed health and function;

- Describe how the project will contribute to watershed health and function in detail and list all of the watersheds affected.

This project will contribute to watershed health and function in the South Platte River, North Platte River, Birdwood Creek, and Platte River watersheds. Benefits to water quality and quantity will be realized across the entire TPNRD. This project will provide the TPNRD with real-time automated groundwater monitoring data they need to make appropriate management decisions regarding water consumption and potential actions they could take to reduce aquifer depletions and increase streamflow.

15. Uses objectives described in the annual report and plan of work for the state water planning and review process issued by the department.

- Identify the date of the Annual Report utilized.
- List any and all objectives of the Annual Report intended to be met by the project
- Explain how the project meets each objective.

The following excerpt is taken from the Annual Report and Plan of Work published by the Department of Natural Resources (Department) in September 2018:

“The Department plans to use the WWUM and COHSYT models and pertinent datasets for future IMP analyses, which will include implementing additional management actions and scenarios to improve understanding of conjunctive management of groundwater and surface water. The robust review of

management actions at the river basin scale will also be conducted using these models.”

This project will provide real-time automated groundwater monitoring data that will be used to calibrate the COHYST model to evaluate and document the progress of the TPNRD’s water use and management activities toward their IMP goals. The newest and most scientifically advanced data will be incorporated into the model, which will assist the Department in their objective of an improved understanding of groundwater and surface water supplies in the Upper Platte River Basin.

16. Federal Mandate Bonus. If you believe that your project is designed to meet the requirements of a federal mandate which furthers the goals of the WSF, then:

- Describe the federal mandate.
- Provide documentary evidence of the federal mandate.
- Describe how the project meets the requirements of the federal mandate.
- Describe the relationship between the federal mandate and how the project furthers the goals of water sustainability.

This project will aid in meeting the requirements of a federal mandate called the Platte River Recover and Implementation Program (PRRIP). PRRIP is the means by which the states of Colorado, Wyoming, and Nebraska are providing regulatory compliance with regard to the U.S. Endangered Species Act. The federally listed least tern, piping plover, and whooping crane must be addressed under the Endangered Species Act. If the PRRIP did not exist, other water management actions would be required of the states or individual water users on the Platte River. The TPNRD automated real-time groundwater monitoring data is essential for Nebraska to evaluate compliance with and document meeting its obligations under the PRRIP. Nebraska’s obligations are contained within the Nebraska New Depletions Plan (NNDP), a component of the Water Plan for the PRRIP. Generally speaking, the NNDP requires Nebraska to offset any depletions to Platte River streamflow that result from new or expanded uses that have occurred subsequent to July 1, 1997. The TPNRD has undertaken various management actions pursuant to their IMP in order to provide compliance with the NNDP. However, the only way to document whether these actions have been successful requires the use of the groundwater model that is based on validated groundwater monitoring data. Without this project, it will be difficult to properly document Nebraska’s compliance with the NNDP for water uses within the TPNRD.