



**WaterSMART  
Applied Science  
Grant Application**

---

**Net Recharge  
Management  
Tool**

**October 17, 2023**

Notice of Funding Opportunity

---

No. R23AS00446

Grants for Fiscal Year 2023

U.S. Department of the Interior  
Bureau of Reclamation

**TABLE OF CONTENTS**

**1. EXECUTIVE SUMMARY ..... 1**

**2. TECHNICAL PROJECT DESCRIPTION..... 2**

    2.1 Applicant Category ..... 2

    2.2 Project Description..... 2

    2.3 Goal and Objectives ..... 4

**3. PROJECT LOCATION ..... 4**

**4. DATA MANAGEMENT PRACTICES..... 5**

**5. EVALUATION CRITERIA ..... 5**

    5.1 Evaluation Criterion A – Water Management Challenges..... 5

    5.2 Evaluation Criterion B – Project Benefits..... 11

    5.3 Evaluation Criterion C – Project Implementation..... 14

    5.4 Evaluation Criterion D – Dissemination of Results ..... 18

    5.5 Evaluation Criterion E – Presidential and Department of the Interior Priorities ..... 19

**6. PROJECT BUDGET ..... 20**

    6.1 Funding plan and letters of commitment..... 20

    6.2 Budget Proposal ..... 21

    6.3 Budget Narrative ..... 22

**7. ENVIRONMENTAL AND CULTURAL RESOURCES COMPLIANCE..... 23**

**8. REQUIRED PERMITS OR APPROVALS ..... 23**

**9. OVERLAP OR DUPLICATION OF EFFORT STATEMENT..... 23**

**10. CONFLICT OF INTEREST DISCLOSURE STATEMENT ..... 23**

**11. UNIFORM AUDIT REPORTING STATEMENT..... 23**

**12. LETTERS OF SUPPORT AND FINANCIAL COMMITMENT..... 24**

**13. OFFICIAL RESOLUTION ..... 24**

Appendix A: References

Appendix B: Groundwater Maps

Appendix C: Letters of Support

**Figures**

- Figure 1 Project Location  
Figure 2 U.S. Drought Monitor for Nebraska

**Tables**

- Table 1 Schedule Summary and Key Milestones  
Table 2 Summary of Project Outcomes  
Table 3 Summary of Non-Federal and Federal Funding Sources  
Table 4 Project Funding Sources  
Table 5 Budget Summary – Aggregate of Project Costs

# **Technical Proposal**

## **1. EXECUTIVE SUMMARY**

**Date:** October 17, 2023

**NOFO No:** R23AS00446

**Applicant Name:** Tri-Basin Natural Resources District

**Location:** City Headquarters: Holdrege; County: Gosper, Phelps, Kearney; State: Nebraska

**Eligible Applicant:** Category A – Water District

**Project Name:** Net Recharge Management Tool

Groundwater supplies nearly 85% of drinking water for Nebraska residents. It is also critical to the profitability of agriculture, which is the largest industry in the state. Tri-Basin Natural Resources District (TBNRD), located in central Nebraska, is responsible for management of groundwater resources in Gosper, Phelps, and Kearney counties, which are the core of Nebraska's most productive irrigated cropland region. These three counties contain over 580,000 irrigated cropland acres and encompass the irrigated area of Central Nebraska Public Power and Irrigation District (CNPPID), Nebraska's largest irrigation district. Due to this heavy reliance on groundwater for drinking water and irrigated agriculture, there is a need for better decision-making tools to understand groundwater dynamics and compile the best data available into one platform that allows for data-driven management decisions.

TBNRD seeks funding assistance to create a "Net Recharge Management Tool" to help quantify groundwater level changes, particularly in areas of decline, and to improve targeting of groundwater recharge within the district. This tool will be used to help district officials identify areas where supplemental recharge of groundwater aquifers is needed. This information will also help TBNRD identify optimal locations for recharge projects that leverage natural processes of groundwater recharge, aquifer storage, and return flows to surface water, while allowing for long-term sustainable management and forecasting based on varying conditions and groundwater use.

The Net Recharge Management Tool will be calibrated using historical groundwater data from as many as 190 groundwater observation wells located within the district. This large volume of existing water level data will enable the creation of a tool that can estimate the net balance of groundwater contributions and withdrawals down to a township level. Users will have the ability to adjust key input parameters, including precipitation, diversions, groundwater pumping, and evapotranspiration (ET), to forecast outcomes and impacts to groundwater supplies under various scenarios. The tool's capabilities will enable TBNRD to anticipate groundwater decline problems, and to manage groundwater effectively and sustainably for all existing users despite drought conditions.

This project will help the district sustainably manage groundwater, foster climate resiliency, and provide a process and tool for data-driven decision-making in the face of evolving water resources challenges.

**Period of Performance:** June 2024–August 2025 (15 months)

**Is Project on a Federal Facility:** The project is not located on a Federal Facility.

## 2. TECHNICAL PROJECT DESCRIPTION

### 2.1 APPLICANT CATEGORY

TBNRD is an eligible applicant within **Category A** as defined in the Notice of Funding Opportunity (NOFO) as “States, Indian Tribes, irrigation districts, and water districts; and State, regional, or local authorities, which include or more organizations with water or power delivery authority as members.” TBNRD meets this definition as a **water district**. TBNRD is one of 23 Natural Resources Districts (NRDs), political sub-divisions of the State of Nebraska, with boundaries based on Nebraska's major river basins, which are responsible for managing natural resources, including ground water and surface water.

### 2.2 PROJECT DESCRIPTION

TBNRD encompasses over 1,500 square miles in central Nebraska including all of Gosper, Phelps, and Kearney Counties, including portions of the Platte, Republican and Little Blue River basins each with their own water management needs and challenges. **Figure 1**, included in Section 3 Project Location, shows the portions of these river basins located within TBNRD. There are over 5,000 registered irrigation wells irrigating 580,000 acres of cropland. All district residents rely on groundwater for drinking water. Portions of TBNRD have also been declared fully or over-appropriated by the Nebraska Department of Natural Resources (NDNR), which requires additional collaborative planning and management by the district with stakeholders and state agencies (**Figure 1**). Fully appropriated basins in Nebraska are river basins (or sub-basins) where water entering the basin is equivalent to the amount of water consumed or otherwise leaving the basin. Over-appropriated basins in Nebraska are river basins (or sub-basins) where water entering the basin is less than the amount of consumed or leaving the basin. These areas are closed for development of additional groundwater-irrigated land. Several plans have been developed and implemented by the district in cooperation with the NDNR, including Integrated Management Plans (IMPs) for each of the three basins and a district-wide Groundwater Management Plan with provisions to protect both groundwater quality and quantity.

TBNRD is committed to sustaining groundwater supplies at or above average groundwater levels from 1981–85. Groundwater recharge is an important component of sustainable groundwater management, as increasing the amount of recharge can help improve conditions in basins facing or threatened with ground water declines. Groundwater recharge projects are nature-based solutions that include delivery of surface water through CNPPID canals to Elwood Reservoir and five Waterfowl Production Areas (protected natural wetlands). The surface water is then recharged into the aquifer by percolation. Groundwater recharge projects provide multiple benefits such as sustaining domestic water use, maintaining agricultural productivity, sustaining groundwater-dependent ecosystems, and providing enhanced habitats for waterfowl, shorebirds, and riverine fisheries. The critical habitat for endangered whooping cranes and interior least terns and threatened piping plovers is located within TBNRD and can be enhanced by higher levels of groundwater, which support baseflows in the Platte River. (**Figure 1**).

The TBNRD Net Recharge Management Tool project will create a decision-making and forecasting tool to help understand, track, predict and quantify net groundwater recharge and groundwater level changes within TBNRD to optimize utilization of existing recharge sites and to inform placement of future recharge projects in areas experiencing or anticipated to experience groundwater declines. Project activities will include conducting water balance calculations, calibrating the water balance based on historic groundwater data, and evaluating the

relationship between groundwater volume and key factors affecting it. This data will be used to develop the management tool and will allow TBNRD to create multiple scenarios and predict potential outcomes and impacts to groundwater recharge at a township level. Examples of different scenarios include adjusting annual precipitation (dry versus wet years) and annual ET and considering spatial impacts for optimal results (placing a recharge project at one location versus another). Based on this information, TBNRD can make data-driven decisions regarding water management and investments in recharge projects.

The project will be divided into the following key tasks:

### **Task 1 – Development of Tool Calculations**

- ***Assembling and Processing Data.*** This includes compiling existing data needed to calculate a water balance for the study area. The data includes, but is not limited to, precipitation data, canal diversion and delivery data, canal and lake seepage data, groundwater flux data, stream flow data, net runoff data, ET data, and historic groundwater level data.
- ***Water Balance Calculations and Correlation of Volume to Groundwater Levels.*** A water balance equation will be formulated to compute the net variation in water storage. This equation will derive the net storage change by considering precipitation, water inflows, and water outflows. Utilizing historical groundwater levels, a correlation between alterations in groundwater volume and changes in groundwater levels will be established.
- ***Calibration of Water Balance.*** During the calibration phase, trends will be assessed to quantify the impact of various factors, such as annual precipitation, surface water diversions, pumping volumes, irrigation practices, and recharge water deliveries, on critical components of the water balance like net recharge, seepage, evaporation, ET, runoff, and streamflow in and out of the system. Additionally, essential parameters, like travel time through the vadose zone, streamflow exiting the study's boundaries, and the specific yield of the aquifer, based on observed yearly fluctuations in groundwater volume, will be used for calibration.
- ***Development of the Tool Calculations.*** Use the water balance calculations to develop a mathematical model that predicts future changes in groundwater levels by township based on annual assumed precipitation, diversions, additional stored water volume, and ET.

### **Task 2 – Groundwater Recharge Potential Project Evaluation and Tool Calculations**

**Refinement.** TBNRD and CNPPID will use existing groundwater recharge sites to evaluate the effectiveness of the tool in predicting the groundwater recharge quantity from these sites and comparing it against the existing groundwater well observation data. The tool will also pinpoint potential new recharge locations, with adjustments made as needed to optimize its efficacy in identifying these sites.

**Task 3 – Tool Interface Development.** The user interface for the tool will be designed with simplicity and utility in mind. The user (TBNRD) will input data for parameters such as precipitation, diversions, groundwater pumping, and ET, specifying these values for different townships and years. Additionally, the user interface will allow users to craft and tailor scenarios to simulate various conditions or strategies. Outputs from the tool will be user-friendly, available in PDF or Excel formats, and include crucial location data that can be seamlessly integrated into ArcGIS for map generation.

**Task 4 – Design Report.** This report will cover the essential aspects of the Net Recharge Management Tool including the project's background and purpose, a thorough breakdown of calculations used within the tool, and a sensitivity analysis alongside an assessment of its

limitations based on available data. It will also evaluate factors that might influence the tool's accuracy and utility in the future. The report will include a user guide for efficient tool utilization and a supplementary guide specifically addressing the adjustment of tool input values for forecasting purposes, focusing on annual precipitation and annual ET. The report will provide historical references for precipitation in drought and wet years as well as insights into potential yearly variations in ET and consider factors such as crop types, irrigation methods, and pumping volume, thus aiding TBNRD in forecasting endeavors.

**Task 5 – Public Outreach and Stakeholder Engagement.** TBNRD will disseminate information regarding the tool's objectives, advantages, and its pivotal role in advancing sustainable groundwater management through its official website. Additionally, the website will serve as a platform for periodic project updates and provision of educational resources aimed at enhancing public awareness about groundwater, its significance, and the pertinent challenges it confronts. The Net Recharge Management Tool will also be utilized to generate graphical representations illustrating both projected and observed variations in groundwater levels across the district, organized by township. These figures will serve as valuable visual aids for understanding groundwater dynamics and trends. The project team will consult with stakeholders regarding water balance calculations, Net Recharge Management Tool calculations, and potential groundwater recharge locations. The project team will also share results and outputs with CNPPID, the Platte River Recovery and Implementation Program (PRRIP), and NDNR.

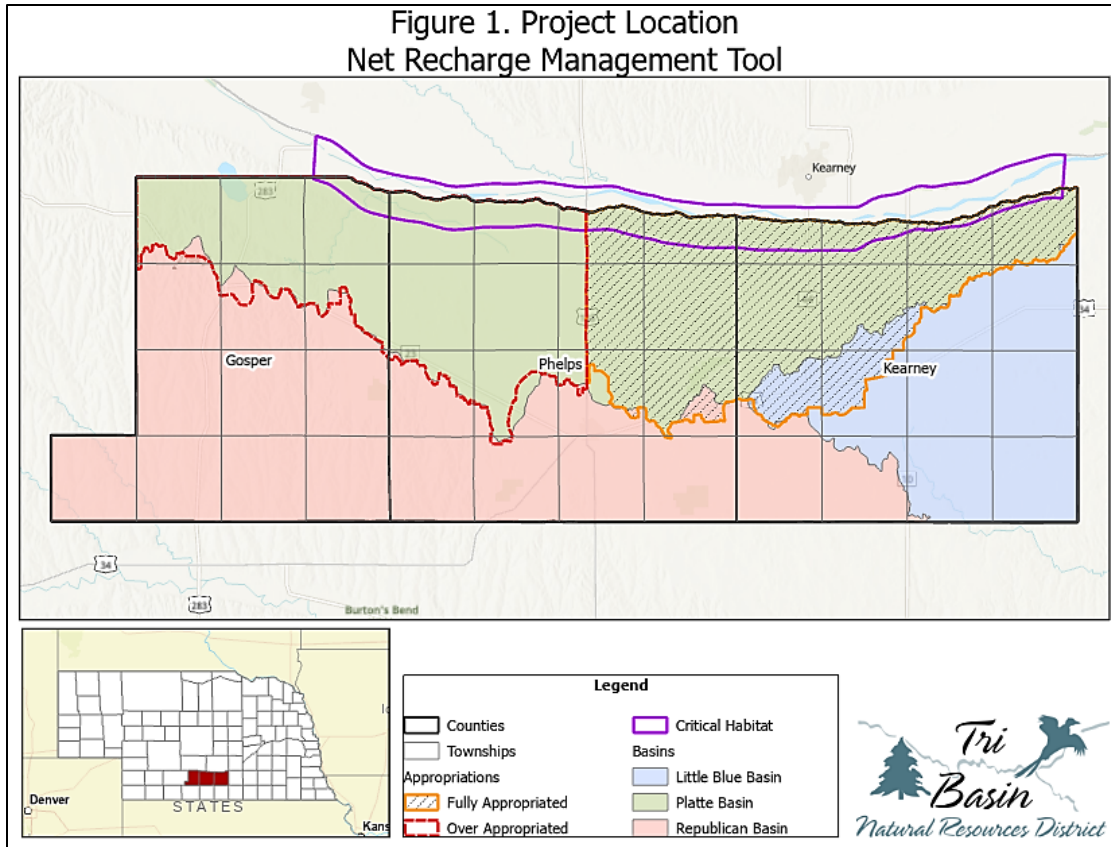
### **2.3 GOAL AND OBJECTIVES**

The primary goal of the Net Recharge Management Tool is to facilitate decision-making in groundwater management by compiling the best data available and identifying the most effective nature-based solution alternatives for natural groundwater recharge. This goal will be achieved through fulfillment of a comprehensive set of objectives aimed at assessing and predicting groundwater levels and their interaction with various influencing factors.

- **Objective 1:** Develop calculation procedures for the tool including data sources, water balance, and calibration.
- **Objective 2:** Evaluate effectiveness of existing groundwater recharge projects, whether they provide recharge where it is most needed and identify potential new sites suitable for groundwater recharge projects.
- **Objective 3:** Creation of a user interface for utilizing and interacting with the tool.
- **Objective 4:** Clear documentation of technical approach, purpose, and limitations of the tool.
- **Objective 5:** Effective communication of results with partners, stakeholders, and the public.

### **3. PROJECT LOCATION**

The project's geographic extent includes the entire TBNRD — Gosper, Phelps, and Kearney counties — in south central Nebraska, as shown in **Figure 1**.



#### 4. DATA MANAGEMENT PRACTICES

The Net Recharge Management Tool will be built using a combination of industry standard software including Microsoft Excel for spreadsheet calculations and ArcGIS for GIS. All outputs from the model will be in user-friendly formats such as PDF or Excel and will include location data to be utilized further within ArcGIS for map generation and data visualization graphics. The tool will not be developed using custom coding or software application development.

#### 5. EVALUATION CRITERIA

The Net Recharge Management Tool is a strong match for the Applied Science WaterSMART grant since it aligns closely with the program goals to improve access to and use of hydrologic data (by compiling existing groundwater data and information from a variety of sources), to develop water management tools (through the creation of a platform to assess groundwater levels and trends), and to improve modeling and forecasting capabilities (by quantifying net recharge and forecasting groundwater supply trends based on different scenarios to help make data-driven decisions for siting groundwater recharge projects in the district).

##### 5.1 EVALUATION CRITERION A – WATER MANAGEMENT CHALLENGES

1. Describe the water management challenge(s). Describe in detail the water management challenge that is occurring within your project area. Describe the severity of the challenge to be addressed with supporting details. For example, will your project address water supply shortfalls or uncertainties, the need to meet competing demands for water and the lack of reliable water



supplies for municipal, agricultural, tribal, environmental, or recreational water uses, complications arising from drought, conflicts over water, or other water management issues?

**Groundwater Management Goal:** Protecting and managing groundwater supplies is one of the primary responsibilities of TBNRD. TBNRD’s goal is to ensure that, “...all groundwater supplies within the TBNRD will be used in a beneficial manner, efficiently managed and properly utilized to preserve this vital resource forever.” Management of groundwater resources has become increasingly challenging due to extremes in weather, unpredictability in future water demands, and continued reliance on groundwater for agriculture and drinking water.

**Challenges Due to Weather Variability:** Achieving that lofty goal is made more difficult by the variability of weather in the region. Just in the past decade, we have seen extremely wet (2019) and dry years (2012 and 2022). This creates water supply uncertainties for residents, municipalities, irrigators, as well as recreational uses, and can create challenges for the many species that rely on surface water (often fed by groundwater) for habitat. There are 580,575 irrigated agricultural acres in TBNRD, and of these, 466,247 acres are irrigated solely with groundwater. (R. Rimsaite et al. 2021). Irrigated agriculture is the primary economic driver within TBNRD. According to the U.S. Drought Monitor, TBNRD is currently experiencing drought conditions ranging from Abnormally Dry to Extreme Drought, as shown in **Figure 2**.

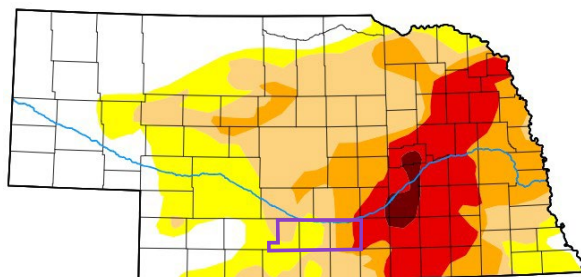


Figure 2. U.S. Drought Monitor for Nebraska (droughtmonitor.unl.edu)

**Hydrologic Basins:** TBNRD encompasses portions of three river basins (shown in **Figure 1**): the Republican River, the Platte River, and the Little Blue River, each with its own water-related challenges. Consequently, different parts of TBNRD are subject to basin-specific rules and regulations administered by TBNRD and NDNR.

**Republican River Basin:** The Republican River Basin (**Figure 1**) is subject to an interstate compact between Colorado, Nebraska, and Kansas. The water management issues here are extremely complex and involve a long history of stakeholder involvement and activities. The Republican River Basin was designated fully appropriated in 2004. TBNRD initially protected integrated water resources under terms of a “joint action plan” that required flowmeters on all wells that irrigate more than 14 acres, put a moratorium on development of additional irrigated acres, and agreed to maintain groundwater levels at or above 1981–1985 average levels. The subsequent [Republican River Basin Integrated Water Resources Management Plan](#), which went into effect in 2012, added several additional conditions, most important being a requirement to offset depletions to stream flows by reducing water use or augmenting stream flows (TBNRD and NDNR 2012). In addition to these integrated water management issues, groundwater levels in portions of southern Gosper County started to decline in the early 2000s. TBNRD initiated Phase 2 and, later Phase 3 groundwater quantity management controls in two townships in this portion of the district. It is the intent of the district and landowners to restore the aquifer in this portion of Gosper County back to at least 1981-85 average levels.

**Platte River Basin:** The Platte River Basin (**Figure 1**) west of Highway 183 was designated as over-appropriated in 2004. The Platte River Basin east of Highway 183 was designated as fully appropriated in 2006. TBNRD and NDNR agreed on terms of an IMP for the Upper Platte River

Basin in 2009, necessitating water use reductions in over-appropriated areas and restricting water use in fully appropriated areas to 1997 levels. The second increment of the [Upper Platte Integrated Management Plan](#) went into effect in 2019 (TBNRD and NDNR 2019).

**Little Blue River Basin:** The Little Blue River Basin is in Kearney County (**Figure 1**). Water use in the Little Blue Basin is also subject to an interstate compact with Kansas. The [2020 Little Blue Basin Voluntary Integrated Management Plan](#) proactively manages water use and safeguards against the basin becoming fully appropriated. Portions of eastern Kearney County are characterized by highly variable groundwater aquifers, which are susceptible to overdraft (TBNRD and NDNR 2020). Two townships (May and Grant) in eastern Kearney County have been designated by TBNRD as a Phase 2 groundwater quantity management area after groundwater levels declined more than five feet below 1981-85 average levels.

**Groundwater Storage:** TBNRD contains a large area of reservoir and canal infrastructure that has provided recharge for about 80 years, resulting in storage of water above the historic “pre-development” groundwater elevations. According to the [2014 Groundwater Evaluation Report](#), groundwater storage within TBNRD is now at a critical point where the general trend of groundwater storage is no longer increasing (Page 7–5, Section 7.1.5 Conclusions, EA 2014). The groundwater levels were steady from 2000 to 2012 despite the average precipitation being higher than the average precipitation for 1954–1999. The report concluded that if surface water diversions were eliminated or continue to be significantly reduced, groundwater levels would significantly decline. Since 2012, a majority of TBNRD area is now experiencing groundwater declines, as shown in **Map 1, Appendix B**.

## 2. Describe the concerns or outcomes if this water management challenge is not addressed?

It is evident that groundwater levels in TBNRD will decline over time unless additional regulations are imposed, and groundwater supplies are regularly augmented with supplemental recharge. A map was prepared by NDNR for projected average annual net recharge by township between 2014 to 2063 (**Map 2, Appendix B**). The map indicates that many townships are projected to experience a net loss of groundwater supplies (i.e., pumping will be greater than recharge), while only a few townships may experience positive net recharge. Therefore, if this water management challenge is not addressed, long-term declines would threaten groundwater sustainability within the district.

If future annual net recharge trends negative, as projections indicate, the impact on TBNRD and its stakeholders will be substantial. TBNRD would be required to expand regulations and restrictions on water use and groundwater pumping. This would result in large social and economic impacts to municipalities, residents, agricultural producers, and industry. Agricultural production drives the economy in the area, and 100% of residents depend on groundwater for their drinking water. Declining groundwater levels will also increase pumping costs, reducing the profitability of irrigated agriculture.

## 3. Explain how your project will address the water management issues identified in your response to the preceding bullets and provide support for your response.

**a. Water supply reliability for municipal, agricultural, tribal, environmental, or recreational water**  
Groundwater is the only source of potable water supply within the region. The purpose of the Net Recharge Management Tool is to help TBNRD improve water supply reliability and sustainability for municipal, agricultural, environmental, and recreational water uses. This will

be accomplished by predicting the rate and volume of groundwater change under different scenarios. The Net Recharge Tool will also allow TBNRD to optimize the use of available funds for development of recharge projects. The tool will allow TBNRD to evaluate the effectiveness of recharge projects based on different scenarios ranging from wet to drought and then locate additional groundwater recharge projects in areas that would be most effective at increasing recharge and groundwater levels. The tool will also help TBNRD better understand the factors impacting groundwater recharge to ensure the sustainability of these resources.

The Net Recharge Management Tool will also help justify investment in new or expanded groundwater recharge projects, by clearly demonstrating the effectiveness and quantifying the benefits of specific projects.

Finally, as described later in section 5.1, answer 3h, aquifer recharge using surface water, which is low in nitrates, reduces overall concentration of nitrates in the aquifer, improving the quality of drinking water.

#### **b. Management of Water Deliveries**

Surface water delivery in Nebraska is administered by NDNR, while water deliveries through groundwater pumping are administered by the NRDs. Excess flows (stream flows determined by NDNR to be above and beyond flows needed for existing water rights and protected flows for endangered species habitat) in the Platte River are limited in quantity and duration. The Net Recharge Management Tool will help both TBNRD and NDNR prioritize excess flow deliveries based on predictions grounded in science and real-world data. The ability to simulate different scenarios will help TBNRD and NDNR be prepared for different climate patterns and make informed decisions with the best data available. In addition, the tool will also enable TBNRD to focus additional monitoring efforts on townships forecast to face groundwater declines.

#### **c. Water Marketing Activities**

TBNRD has developed partnerships with several entities including PRRIP, NDNR, and CNPPID to provide groundwater recharge within the district. Recharge sites include Cottonwood Ranch, Johnson Waterfowl Production Area (WPA), Funk WPA, Phelps Canal, Victor Lakes WPA, Cottonwood WPA, Linder WPA, Elwood Reservoir, and the E65 Canal. The cost of each acre-foot of recharge water varies by project facility, and agreements are in place that account for the delivery credits for the various partners. Over the 10-year period from 2012 through 2021, the partners diverted over 191,000 acre-feet of excess flows from the Platte River which is valued at over \$7.5M, according to records provided by CNPPID. The Net Recharge Management Tool will support targeting of recharge water within TBNRD by assisting water managers in prioritizing areas for diverting surface water flows that have the best cost benefit ratio and help meet groundwater recharge goals.

#### **d. Drought Management Activities**

One important method for mitigating the impact of drought is the capture and underground storage of surface water during times of excess, to be utilized during times of drought. Groundwater recharge via wetlands and other water bodies is a nature-based solution and enhances the natural process to replenish and store water in aquifers, instead of constructing surface water reservoirs. The State of Nebraska is currently developing a Decision Support System (DSS) to provide a systematic approach for allocating excess flows in the Platte River Basin for groundwater recharge projects. This basin and its associated sub-basins cover a large portion of Nebraska and nearly half of TBNRD. One of the objectives of the DSS is to assist

NDNR in ranking and prioritizing recharge projects across the State of Nebraska. The Net Recharge Management Tool will provide TBNRD with valuable information needed by NDNR to supplement the DSS when they make those decisions. Based on the Net Recharge Management Tool, TBNRD can better locate groundwater recharge projects in drought sensitive or groundwater decline areas and allow excess flows to be most effectively used for recharge. Additionally, the ability to forecast the efficacy of net recharge will help TBNRD determine the size and scale necessary for groundwater recharge projects to be most effective.

#### e. Conjunctive Use of Ground and Surface Water

TBNRD has been proactive in adopting IMPs for conjunctive management of surface water and groundwater throughout the district. Portions of TBNRD fall into three different basins as shown in **Figure 1** — the Republican River, the Platte River, and the Little Blue River — each with its own water management challenges. As a result, TBNRD works collaboratively with NDNR on three IMPs. One of the action items of these plans (Page 29, Action Item 10.4 of the second increment of the [Upper Platte Integrated Management Plan](#)) specifically discusses the need for identifying and implementing conjunctive management opportunities (TBNRD and NDNR 2019). Furthermore, it specifically lists conjunctive management practices such as surface water diversions, infrastructure development, and groundwater recharge projects to replenish groundwater or increase net accretions to the river. The Net Recharge Management Tool will directly support this action item by identifying the best locations for these types of groundwater recharge projects and excess flow deliveries.

#### f. Water Rights Administration

TBNRD regulates groundwater use within the district. Surface water rights are administered through NDNR, including water rights for diverting excess flow from the Platte River and associated reaches for groundwater recharge. The Net Recharge Management Tool will help TBNRD to utilize excess flows most effectively when they are available by identifying areas with negative net recharge rates.

The Net Recharge Management Tool extends its utility by facilitating an in-depth assessment of the impact of water rights allocations on groundwater resources. Users have the flexibility to modify parameters associated with groundwater pumping and canal irrigation diversions, enabling them to simulate diverse allocation scenarios. This functionality enables a comprehensive evaluation of the sustainability of current water uses in relation to projected groundwater levels, helping to inform decisions regarding water rights administration.

#### g. Ability to Meet Endangered Species Requirements

The Platte River Basin, part of which is in TBNRD, provides critical habitat for several endangered species (whooping crane, interior least tern, pallid sturgeon) and threatened species (piping plover). The Whooping Crane-designated Critical Habitat area is located along the Platte River within the project area (**Figure 1**). The PRRIP has been a key partner with TBNRD in management of water resources in the region. One of the strategies of PRRIP is the ‘retiming’ of stream flow. The retiming is accomplished by diverting flows during times exceeding target flows as designated by the United States Fish & Wildlife Service (USFWS), allowing the water to recharge in wetlands, canals, and reservoirs, then return to the Platte River through augmentation projects or as baseflow to offset times when flows are below target flows. The effectiveness of groundwater recharge projects in reducing shortages to target flows for endangered species and instream flow appropriations is an important use for the Net Recharge Management Tool, providing benefit to PRRIP in addition to TBNRD.

#### **h. Watershed Health**

Since the Net Recharge Management Tool is built for implementation in the entire TBNRD area, which encompasses parts of three river basins, improving the effectiveness of water resources management in the area will improve holistic watershed health by maintaining water sustainability, reducing groundwater declines and improving groundwater quality by adding low nitrate surface water and allowing it to seep through the vadose zone and into the aquifer, thus reducing overall concentrations of contaminants such as nitrate-nitrogen. Groundwater base flows in streams also supports aquatic habitats during drought and enhances water availability for native ecosystems.

#### **i. Restore a natural feature/use a nature-based feature to reduce water supply and demand imbalances, the risk of drought or flood, or to increase water supply reliability for ecological values.**

The entire concept of enhancing groundwater recharge within TBNRD aligns with the definition of a nature-based solution. This concept uses the existing natural features of subsurface geologic formations to provide natural water storage and aquifer replenishment to help sustain the resource. Excess flows can be diverted through existing infrastructure to wetlands to allow water to infiltrate into soils and move through pore spaces down to the aquifer. The natural subsurface formations also provide gradual return of recharged water back to the Platte River, tributaries, and wetlands as baseflow.

One purpose of the Net Recharge Management Tool is to enable identification of appropriate locations for groundwater recharge projects that are most effective at recharging the aquifer. A primary requirement of the tool is to be able to predict the rate of groundwater recharge under a variety of climatic conditions. TBNRD will be able to directly predict the natural recharge during drought and wet scenarios and look for water supply/ demand imbalances in the district, ultimately guiding selection of locations for groundwater recharge projects. The capability to predict the most cost-effective sites and scales for groundwater recharge projects will directly improve water supply reliability for irrigation, drinking water, and as baseflow where groundwater and surface water are interconnected. Additionally, implementing groundwater recharge projects in Rainwater Basin wetlands will provide direct ecological benefits by enhancing habitat for migratory and resident waterfowl and shorebirds.

#### **j. Conservation and Efficiency**

TBNRD's mission is to "...manage, conserve and protect the district's land and water resources." This mission will be accomplished by protecting the quantity of surface water and groundwater and subsequently protecting the district's agricultural lands, woodlands, and fish and wildlife habitats. The evaluation of historical groundwater trends, calibration of water balance calculations, and subsequent development of the Net Recharge Management Tool all directly address conservation and efficiency goals by improving water resources sustainability in the district.

#### **k. Other Improvements to Water Supply Reliability**

The key tasks prior to the development of the tool are calibration of the water balance calculations and trends analysis. This will provide a broader understanding of changes to the groundwater in the district over time. Additionally, the development of the Net Recharge Management Tool will assist CNPPID with improved understanding of water supply reliability by providing them with data evaluating the water conveyance efficiency of different types of infrastructure such as canals and reservoirs.

## 5.2 EVALUATION CRITERION B – PROJECT BENEFITS

### 1. Describe how the need for the project was identified. Was the proposed project identified using a collaborative process with input from multiple and diverse stakeholders?

TBNRD has participated in several collaborative planning and discussion processes to conserve land and water resources including the development of IMPs for all three basins, with stakeholders including NDNR, CNPPID, PRRIP, Lower Republican NRD, and Little Blue NRD.

The need for this tool was identified as a result of several collaborative studies with various stakeholders. In 2014, the CNPPID completed the [2014 Groundwater Evaluation Report](#) to provide a more thorough understanding of the groundwater storage area in the vicinity of lands irrigated by CNPPID facilities (EA 2014). The report concluded that although groundwater storage had been increasing in size and volume for 60 years, it subsequently appeared to be at a critical point where the general trend has shifted from rising to flattening and declining. The groundwater storage did not increase from 2000 to 2012 despite above average precipitation. The report was shared with TBNRD and prompted the district to intensify groundwater level monitoring, including development of a network of over 125 dedicated observation wells across the district. The results of the CNPPID groundwater evaluation and the data provided by these wells led TBNRD to recognize the need for this tool.

In 2019, NDNR prepared a Projected Average Annual Net Recharge Map (**Map 2, Appendix B**) using general statewide data available within the Platte River Cooperative Hydrology Study (COHYST) model. This map confirmed the need for more precisely identifying and addressing groundwater decline issues.

Goal B stated under Chapter 5 (Page 5) of the [Republican River Basin Integrated Water Resources Management Plan](#) states:

*“Tri-Basin NRD and NDNR will continue to support the development and maintenance of digital water management models, databases, stream gauges, observation wells and other tools and facilities needed to accurately measure and clearly depict the current state of groundwater and surface water resources as well as potential future water resource trends and conditions. These tools will be essential for decision makers as they consider whether and how to regulate consumption of integrated water resources. They will also serve as one mechanism to monitor and measure the progress of this plan.”*

While the studies and resources listed above clearly indicate a need for tools such as the Net Recharge Management Tool, the goals of the IMPs explicitly include action items highlighting the need to discern groundwater level trends. These action items align well with the goals of this project. The IMPs also describe the importance of using a collaborative approach with NDNR, stakeholders within TBNRD, as well as other neighboring NRDs sharing the basins.

### 2. Describe how the tool, method, or information will be applied and when it will be applied.

The tool will be a pivotal asset for data-driven water management decisions in TBNRD. Built on a water balance framework an

d correlating water volume changes with groundwater level shifts, the tool will allow users to fine-tune variables such as percentage of average annual precipitation, canal irrigation water diversions, groundwater pumping volumes, and ET percentages. The tool will identify optimal locations for recharge projects and guide resource investments. The tool's annual time-step

analysis serves as a preemptive measure to ensure long-term sustainability of the district's groundwater resources. The tool will offer insights into potential outcomes resulting from a wide range of future scenarios, allowing TBNRD to make proactive adjustments to groundwater management activities.

While tool inputs and outputs will be based on an annual time step, it is expected that the tool will be used immediately and consistently throughout the year and be adapted to evolving conditions, making it a central component of both near-term decision-making and long-term planning within TBNRD. As additional data is collected and additional groundwater recharge projects are implemented, TBNRD will update the tool with measured field observations, so refinement and calibration of the tool will be an ongoing process.

**a. Will the tool or information be used immediately, or will additional work need to be done before the tool will be used?**

The Net Recharge Management Tool will be used immediately after development. Part of the tool's development involves evaluating existing groundwater recharge projects to determine if water delivered to these sites is effectively providing recharge. Another task is identification of potential recharge projects. The assessment of existing projects and the identification of new ones will inform the tool's development. This will also occur once the tool is developed and launched.

**3. Describe, in detail, the extent of benefits that can be expected to occur upon implementation of the project and provide support for your responses.**

The Net Recharge Management Tool will provide benefits to TBNRD and other stakeholders that are currently not possible through other sources, many of which have a narrow focus or do not compile data from multiple sources. For example, existing models such as the COHYST groundwater model used by NDNR, provide general results on a broader scale, with coarse inputs which do not adequately address the specific needs of the district. The Net Recharge Management Tool will be developed using local data and calibrated water balance calculations at higher resolution than what is currently available from other sources. This tool will intentionally have a simplified interface that allows TBNRD staff to utilize the tool with in-house resources and an output interface that makes it easy and efficient to convey results to TBNRD board of directors, stakeholders, and the public using commonly used, existing systems and formats such as ArcGIS, Microsoft Office applications, PDF, and web-interfaces.

**a. Who will use the tool or data developed under this proposal and how will they benefit from the project? Support could include but is not limited to letters from stakeholders expressing support for the project and explaining how they will benefit.**

The primary users of the Net Recharge Management Tool will be TBNRD staff. The tool will be developed with a user-friendly interface for input of data and development of scenarios to allow for ongoing use and maintenance in-house by TBNRD staff. This will benefit TBNRD by avoiding costs and delayed schedules associated with hiring a consulting firm to complete analyses or constraints on resources if requesting analyses from partner agencies.

Another primary benefit of the tool will be efficient and effective communication of water balance conditions to TBNRD board of directors. The tool will include a user interface that can easily export information and results to GIS for development of maps and graphics for presentations at board meetings. The graphical output from the tool will also be useful to

communicate important concepts and information about groundwater sustainability with the public through postings on TBNRD's website, news releases and at conferences and seminars.

**b. How will the project improve water management decisions?**

Excess flows are unpredictable, and they are made available on short notice. Rapid analysis of groundwater needs, and facility recharge capabilities will enable TBNRD, NDNR and CNPPID to make informed, science-based decisions on short time scales to most effectively utilize these excess flows when they become available. Water managers will be able to use the Net Recharge Management Tool to forecast the efficiency of existing and proposed groundwater recharge projects. Using this capability, the district can calculate the Return on Investment (ROI) of these projects and help water managers optimize the location and timing of groundwater recharge water deliveries within TBNRD. The tool will also help TBNRD evaluate which areas of the district would have challenges reaching a sustainable net balance between groundwater recharge and groundwater pumping. This will allow TBNRD to better understand if additional groundwater recharge projects would be sufficient or if additional regulatory actions are needed to restrict groundwater use in certain areas.

**c. Describe if the results of your project will be applicable elsewhere. What additional work would need to be done to make the project results transferable to others?**

While the Net Recharge Management Tool will have inputs and output data specific to TBNRD, the tool development methodology can be applied to other areas facing similar issues of groundwater declines, regardless of whether they can be mitigated by groundwater recharge projects. Many other NRDs share portions of the three basins found in TBNRD, have similar needs, and lack a tool such as the one proposed. To make the tool transferable to others, region-specific data will be required, and the tool will need to be recalibrated using new water balance calculations, groundwater level trends, and region-specific geologic and hydrologic parameters. If implemented, the tool will be beneficial for water managers across the state who need to assess the feasibility and cost versus benefit of new and existing groundwater recharge projects. Additionally, the forecasts from Net Recharge Management Tool will benefit the PRRIP directly as they track the timing of excess flow diversions conveyed through CNPPID canals within TBNRD to augment critical habitat maintenance flows in the Platte River.

**d. To what extent will the project address the water management challenges described in E.1.1.?**

TBNRD faces water management challenges for each of its three river basins. A detailed response to how this project will address water management challenges is provided in Question 3, Section 5.3. Ensuring sustainability of water resources with a focus on groundwater recharge is one of the primary challenges across the entire TBNRD. Essentially, this tool will help water managers make better, data-driven decisions and increase the ROI for groundwater recharge projects, while improving groundwater supply reliability. Additionally, use of the natural process of infiltration for groundwater recharge aligns well with the definition of a nature-based solution. The implementation of this tool to support future recharge projects will also support climate resiliency and help mitigate against the effects of unpredictable future climate conditions in the district as described later in Section 5.5, Evaluation Criterion E.



4. Explain how your project complements other similar efforts in the area where the project is located. Will your project complement or add value to other, similar efforts in the area, rather than duplicate or complicate those efforts? Are there other similar efforts in the area that have used a similar methodology successfully which can be complimented? Applicants should make a reasonable effort to explore and briefly describe related ongoing projects. Consider efforts by any Federal, state, local agency, or non-governmental organizations.

This project will complement important efforts of several other agencies and organizations, including but not limited to: NDNR, PRRIP, and CNPPID. NDNR is actively supporting TBNRD with their ongoing DSS for diverting excess flows to support groundwater storage within the Platte River Basin, which represents the shared objective to optimize the beneficial use of excess flows through groundwater recharge. When NDNR notifies stakeholders within the Platte River Basin about available excess flow, the Net Recharge Management Tool can be used to assess which groundwater recharge projects have the greatest potential to effectively recharge aquifers and enable the district to target excess flow diversions based on the tool outputs. The current phase of the DSS qualified for WaterSMART grant funding in 2022 through the Applied Science Program. The NDNR currently uses the COHYST model, which is a multi-entity effort to improve understanding of hydrologic conditions in the Platte River Basin in Nebraska. The Net Recharge Management Tool will use several datasets from COHYST for the water balance including groundwater flux, stream and drain baseflows, net runoff, field losses, lateral losses, and field ET. In addition, the Net Recharge Management Tool will add other datasets from TBNRD and other stakeholders such as seepage quantities, precipitation, livestock and industrial consumption, historical groundwater levels, and changes in groundwater levels.

The Net Recharge Management Tool will also complement ongoing work by PRRIP to reduce shortages to target flows in the Platte River by diverting excess flows, allowing the water to recharge groundwater which provides return baseflow to the river. The Bureau of Reclamation (BOR) is one of the partners in the PRRIP. The tool will also be valuable to CNPPID as they consider canal and reservoir infrastructure improvement projects that may impact recharge through their facilities.

### 5.3 EVALUATION CRITERION C – PROJECT IMPLEMENTATION

1. Briefly describe and provide support for the approach and methodology that will be used to meet the objectives of the project. You do not need to repeat the full technical project description included in Section D.2.2.4 under Technical Project Description. However, you should provide support for your chosen methodology, including use of any specific models, data, or tools.

The Net Recharge Management Tool Project is split into five tasks as described in greater detail within Section 2.3 of this application and summarized below. Each task will support the creation of a comprehensive, reliable, and user-friendly tool.

**Task 1 – Development of Tool Calculations.** Using a *collaborative approach*, the project team will compile the most relevant and up-to-date data from several sources and organize them in a central location. Specifically, this approach will link and compile data and information from the University of Nebraska-Lincoln Conservation and Survey Division database, the COHYST model administered by NDNR, water delivery and water balance data from CNPPID, and TBNRD groundwater measurement data. Version and dates of data will be tracked. Using a *detail-oriented approach*, the water balance calculations will be formulated using Excel or

ArcGIS. The water balance calibration and tool calculations will then be developed in the same file format and organized using version control.

**Task 2 – Groundwater Recharge Potential Project Evaluation and Tool Calculations Refinement.** Using a *verification approach*, the tool will be used to evaluate existing groundwater recharge sites and the results will be compared to historical data. The tool will also be tested for identifying potential groundwater recharge sites and the results will be compared against actual cases. TBNRD will then track the differences and update the tool calculations accordingly. Version control will allow tracking of changes made to the tool.

**Task 3 – Tool Interface Development.** Using a *simplified approach*, a user-friendly interface will be built that allows users to input data, create scenarios and simulate various conditions or strategies. Outputs from the tool will be user-friendly, available in PDF or Excel formats, and include crucial location data that can be seamlessly integrated into ArcGIS for map generation. This approach works well for a collaborative project that includes data sharing and public outreach as described in **Task 5**.

**Task 4 – Design Report.** Using a *detailed and analytical* approach, a technical design report will be completed which will include project overview, calculation details, sensitivity analysis, limitations, future factors, a step-by-step user guide, and a forecasting supplement for guidance on adjusting input values for forecasting.

**Task 5 – Public Outreach and Stakeholder Engagement.** Using an *outreach-focused approach and public-facing format*, information about the tool including visual representations and graphics will be disseminated via TBNRD’s website and news releases to increase public awareness and understanding of groundwater management in the district. Using a *collaborative approach*, discussions and consultations with stakeholders including CNPPID, PRRIP, and NDNR will be conducted to ensure alignment of shared goals.

2. Describe the work plan for implementing the proposed scope of work. Such plans may include but are not limited to a. an estimated project schedule that shows the stages and duration of the proposed work, b. milestones for each major task, c. start and end dates for each task and milestones, and d. costs for each task.

The project's work plan is described under the Project Description and Work Plan presented previously in **Section 2.2**. The timing and duration of the major tasks, milestones and dates are shown in **Table 1**. The project is anticipated to begin in June of 2024.

**Table 1. Schedule Summary and Key Milestones**

Task	Duration (days)	Start Date	Finish Date	Cost
<b>Task 1 – Development of Tool Calculations</b>	330	6/1/2024	3/13/2025	<b>\$205,000</b>
Assembling and Processing Data	60	6/1/2024	7/31/2024	
Water Balance Development and Correlation of Volume to Groundwater Levels	150	6/16/2024	11/13/2024	
Calibration of Water Balance	30	11/13/2024	12/13/2024	
Development of Tool Calculations	60	12/13/2024	2/11/2025	
<b>Task 2 – Groundwater Recharge Potential Project Evaluation and Tool Calculations Refinement</b>	90	2/11/2025	5/12/2025	<b>\$110,000</b>

Task	Duration (days)	Start Date	Finish Date	Cost
<b>Task 3 – Tool Interface Development</b>	120	3/13/2025	7/11/2025	<b>\$50,000</b>
<b>Task 4 – Design Report</b>	30	7/11/2025	8/10/2025	<b>\$30,000</b>
<b>Task 5 – Public Outreach and Stakeholder Engagement</b>	Ongoing	6/1/2024	8/10/2025	<b>\$5,000</b>
			<b>Total</b>	<b>\$400,000</b>

3. Provide a summary description of the products that are anticipated to result from the project. These may include data, metadata, digital or electronic products, reports, and publications. Note: using a table to list anticipated products is suggested.

Several internal and external deliverables will be developed during this project. Some deliverables will be public facing while some will be for internal TBNRD use. Additionally, some internal deliverables will still be shared with stakeholders, as needed. **Table 2** describes a list of anticipated project outcomes within specific tasks.

**Table 2. Summary of Project Outcomes**

Task	Format	Internal/Public
<b>Task 1 – Development of Tool Calculations</b>		
Calibrated Water Balance Calculations	Excel	Internal
Mathematical Model for the Tool	Excel	Internal
<b>Task 2 – Groundwater Recharge Potential Project Evaluation and Tool Calculations Refinement</b>		
Tool Testing Summary and Details of Refinement	PDF	Internal
<b>Task 3 – Tool Interface Development</b>		
The Net Recharge Management Tool	Excel, ArcGIS	Internal
The Tool Outputs	PDF, Excel, ArcGIS	Internal, Stakeholders
<b>Task 4 – Design Report</b>		
User Guide (for tool utilization)	PDF	Internal
Supplementary Guide (for tool adjustments)	PDF	Internal
Project Report	PDF	Public
<b>Task 5 – Public Outreach and Stakeholder Engagement</b>		
Web Article	Web	Public
Educational Materials	Web, Paper	Public
Graphs, maps, and forecast results	PDF	Internal, Stakeholders
Tool calculations, outputs, potential project locations	PDF	Internal, Stakeholders

4. Who will be involved in the project as project partners? What will each partner or stakeholder’s role in the project be? How will project partners and stakeholders be engaged in the project and at what stages? If you are a Category B applicant, be sure to explain how your Category A partners will be engaged in the project.

TBNRD will work in close collaboration with CNPPID early in the development process and throughout the project to acquire and update surface water delivery information for the water balance at the most detailed level practical, while still protecting the confidentiality of private information of CNPPID customers. Throughout the project, input and guidance will be solicited from NDNR regarding criteria for evaluating specific projects and for utilization of COHYST

model data. The IMPs jointly administered by TBNRD, NDNR, and other affiliated NRDs all provide information for tool development and will benefit from the tool's outputs in future updates. TBNRD will engage the Rainwater Basin Joint Venture, PRRIP, and local stakeholders to identify recharge sites that can be used as case studies for refinement of the tool. Results and output from the tool will be communicated and shared with project partners, stakeholders, neighboring NRDs with common needs, municipalities, irrigators, USFWS and others who rely upon or help manage groundwater for drinking water, agriculture, and to support fish and wildlife habitat.

**5. Identify staff with appropriate credentials and experience and describe their qualifications. Describe the process and criteria that will be used to select appropriate staff members for any positions that have not yet been filled. Describe any plans to request additional technical assistance from Reclamation or via a contract. Please answer the following**

TBNRD will request proposals from qualified engineering consulting firms to complete the project using established procurement requirements. The engineering consulting firm that presents the most qualified team with the best understanding of the project will be selected through a competitive qualifications-based selection process. Completing the project will require a multidisciplinary team with a range of expertise. Below are the known key personnel roles that will be included on the project team:

**TBNRD Project Manager – John Thorburn, TBNRD General Manager**

Role: Provide overall direction for the project and manage the engineering consultant.

Qualifications: Mr. Thorburn has been General Manager for TBNRD for 28 years and is intimately familiar with the water resource concerns and challenges within the district. He has bachelor's and master's degrees in Geography (emphases on hydrogeomorphology, soils) and has served with Nebraska's NRDs since 1994.

**Technical Manager – Nolan Little, TBNRD Assistant Manager**

Role: Provide technical input and support for the project, including coordination with the engineering consultant by providing existing data and resources, resolution of technical issues, and review of technical work elements.

Qualifications: Mr. Little is the Assistant Manager for TBNRD and has been working for the district since 2008. He began his career with TBNRD in 2008 as a water resources technician, later becoming water resources manager in 2012, and assistant manager in 2023. His responsibilities include overseeing groundwater quantity and quality programs, as well as GIS needs of the district.

**Consultant Project Manager**

Role: Coordinate project activities, manage timelines, budgets, and resources, and ensure effective communication among team members.

Qualifications: Direct experience managing recharge water balance and recharge calculations within the project area, proven experience delivering projects for TBNRD and project partners.

**Project Engineer (Consultant)**

Role: Lead development of tool calculations including water balance, correlation of groundwater volumes to groundwater levels, and calibration efforts. Lead identification and evaluation of potential groundwater recharge projects, oversee data collection, oversee tool

user interface development, lead development of the design report, and assist with public outreach and stakeholder engagement.

Qualifications: Professional engineer with experience in water balance calculations, groundwater level studies, and groundwater recharge projects in TBNRD.

### **GIS Specialist (Consultant)**

Role: Assist with development of the tool's user interface, handle spatial data, create maps, and assist in integrating geographical information with the tool.

Qualifications: Proficiency in ArcGIS software, spatial analysis skills, and experience in groundwater-related GIS projects.

### **Data Analyst (Consultant)**

Role: Manage and analyze large datasets needed for the tool calculation development and assist in calibration and validation processes.

Qualifications: Strong data analysis skills, expertise in statistical analysis, and experience with groundwater data.

#### **a. Have the project team members accomplished projects similar in scope to the proposed project in the past either as a lead or team member?**

John Thorburn and Nolan Little have completed many related water resources projects over the years including several groundwater recharge projects and have considerable experience collecting and assessing groundwater monitoring data. A qualifications-based selection process will be used to select an engineering consultant that has direct experience with groundwater recharge and water balance calculations.

#### **b. Is the project team capable of proceeding with tasks within the proposed project immediately upon entering into a financial assistance agreement? If not, please explain the reason for any anticipated delay.**

The project team will be able to proceed immediately upon entering into a financial assistance agreement with the BOR. Once TBNRD is notified that this WaterSMART Applied Science grant application has been selected for funding, TBNRD will initiate the Request for Proposal process for selection of an engineering consultant. The selection process will be completed while the financial assistance agreement documentation is being prepared by the BOR. The engineering consultant will be selected using the district's competitive procurement process, a consulting agreement negotiated, and the contract secured contingent upon BOR issuing the financial assistance agreement documentation for signature.

## **5.4 EVALUATION CRITERION D – DISSEMINATION OF RESULTS**

### **1. Describe how the tools, frameworks, or analyses being developed will be disseminated, communicated, or made available to water resources managers who may be interested in the results.**

Working collaboratively with stakeholders is one of the most important aspects of TBNRD's overall mission. Disseminating information and data from this tool benefits more than just TBNRD, particularly since groundwater transcends political boundaries. TBNRD has developed three IMPs, all in collaboration with NDNR, and continues to update and implement them on a continuous basis. Additionally, the three river basins that lie within TBNRD are also shared with four neighboring NRDs. The other NRDs would benefit from the tool's capabilities and outputs,

including the ability to forecast groundwater level changes and evaluate recharge project sites. Other key stakeholders in the project include PRRIP and CNPPID. TBNRD serves over 17,000 residents, all of whom rely on groundwater resources for many purposes, and all will benefit from the results of this project, including sustainable and more reliable groundwater supplies. All this fits within the mission of TBNRD to be transparent and collaborative in protecting natural resources and promoting good stewardship of land and water resources in the district.

**Table 2** in Question 3 of Section 5.3 Evaluation Criterion C displays a detailed list of deliverables resulting from this project. While some deliverables will be for internal use, others will be shared with stakeholders and other agencies, including CNPPID, NDNR and PRRIP, to aid them in making their own water management decisions. Additionally, as required by the IMPs, the outputs of the tool will be shared with NDNR for meeting conjunctive groundwater and surface water management goals and objectives. **Task 5 – Public Outreach and Stakeholder Engagement** in Section 2 details the dissemination of results and information to the public as well as water managers and stakeholders.

## **5.5 EVALUATION CRITERION E – PRESIDENTIAL AND DEPARTMENT OF THE INTERIOR PRIORITIES**

**1. Climate Change:** E.O. 14008 emphasizes the need to prioritize and take robust actions to reduce climate pollution; increase resilience to the impacts of climate change; protect public health; and conserve our lands, waters, oceans, and biodiversity.

a. If applicable, describe how the project addresses climate change and increases resiliency. For example, does the project help communities respond to or recover from drought or reduce flood risk?

The Net Recharge Management Tool will directly help TBNRD, irrigation districts, water users, and other stakeholders such as the PRRIP better prepare for drought and reduce flooding risk during times of excess. The tool will be able to simulate drought scenarios which can help stakeholders better identify areas that would be most vulnerable to adverse impacts and to proactively seek ways to mitigate those vulnerabilities. Additionally, one of the objectives of groundwater recharge is to increase resiliency by helping alleviate flooding by diverting surface water into canals and reservoirs upstream of flood impacted areas. This has the added benefit of recharging groundwater in many cases. This capability of the tool is an efficient way to mitigate impacts from extreme climate scenarios, provide for greater climate resiliency, and directly provide a nature-based groundwater recharge solution. Additionally, nature-based solutions like wetlands will also be evaluated under the extreme scenarios, which can help TBNRD and the Rainwater Basin Joint Venture conserve them appropriately and minimize negative impacts on biodiversity within those areas.

b. How will the project build long-term resilience to drought? How many years will the project continue to provide benefits? Please estimate the extent to which the project will build resilience to drought and provide support for your estimate.

One of the most important aspects of the Net Recharge Management Tool is to be able to predict the impact on groundwater supplies under drought scenarios. **Task 1 – Development of Tool Calculations – Calibrate Water Balance Based on Historic Groundwater Analysis** already considers historical groundwater data which is helpful for long-term forecasting. Due to the long-term prediction capability, the tool will continue to provide benefits into the foreseeable future. Additionally, the tool will continually be updated with observations from implemented

groundwater recharge projects. The capability to compare the predicted results to field observations, and then further recalibrate the tool, will ensure that the tool will continue to accurately predict groundwater level trends as climate conditions change. Targeted groundwater recharge using excess flows is one of the primary nature-based solutions being implemented to increase long-term resiliency to drought by increasing the volume of water stored in the subsurface that can naturally return to streams as base flow over months, years, and even decades.

c. Will the proposed project reduce greenhouse gas emissions by sequestering carbon in soils, grasses, trees, and other vegetation? Does the proposed project seek to reduce or mitigate climate pollution such as air or water pollution? Does the proposed project contribute to climate change resiliency in other ways not described above?

TBNRD will be able to use the Net Recharge Management Tool to identify and implement groundwater recharge solutions that support the natural wetland resources across the district. All wetlands sequester carbon from the atmosphere through plant photosynthesis and by acting as sediment traps for runoff. Carbon is held in the living vegetation as well as in litter, peats, organic soils, and sediments that have built up, in some instances, over thousands of years. Thus, this project will directly provide multiple benefits like increasing groundwater recharge, creating carbon sinks, reducing water pollution, and increasing biodiversity. TBNRD has already implemented five wetland projects, and the tool can be used to evaluate future enhancements, or even restoration of additional, previously drained wetland areas.

## 6. PROJECT BUDGET

### 6.1 FUNDING PLAN AND LETTERS OF COMMITMENT

The total proposed project budget is \$400,000 (see SF-424A). TBNRD and NDNR will be providing the non-federal cost share portion through monetary contributions totaling \$100,000 assuming qualification under the Nature-Based Solutions category at the 75% federal cost share level. **Table 3** summarizes Non-Federal and Federal sources of funding for the proposed project.

**Table 3. Summary of Non-Federal and Federal Funding Sources**

<b>FUNDING SOURCES</b>	<b>AMOUNT</b>
<b>Non-Federal Entities</b>	
1. Tri-Basin Natural Resources District	\$ 40,000
2. Nebraska Department of Natural Resources	\$ 60,000
<b>Non-Federal Subtotal</b>	<b>\$ 100,000</b>
<b>REQUESTED RECLAMATION FUNDING</b>	<b>\$ 300,000</b>
<b>TOTAL PROJECT FUNDING</b>	<b>\$ 400,000</b>

## 6.2 BUDGET PROPOSAL

TBNRD proposes to apply all Federal and Non-Federal funds that may be associated with the grant agreement to funding the development and implementation of the Net Recharge Management Tool. A summary of the estimated project costs by funding source is presented in **Tables 3 and 4**. The Budget Proposal presented in **Table 5** has been prepared using the prescribed outline from the NOFO.

Section 2.3 of this application provides a summary of the Scope of Work Tasks necessary for the successful completion of the project. The Federal and local cost share funding will be used to cover all costs required to perform the Scope of Work.

**Table 4. Project Funding Sources**

FUNDING SOURCES	AMOUNT	PERCENTAGE
Costs to be reimbursed with the requested Federal funding	\$ 300,000	75%
Costs to be paid by the applicant	\$ 100,000	25%
Value of in-kind contributions	\$ -	0%
<b>TOTAL PROJECT COST</b>	<b>\$ 400,000</b>	<b>100%</b>

**Table 5. Budget Summary – Aggregate of Project Costs**

BUDGET ITEM DESCRIPTION	COMPUTATION		QUANTITY TYPE	TOTAL COST
	\$/Unit	Quantity		
Salaries and Wages				\$ -
Fringe Benefits				\$ -
Equipment				\$ -
Supplies and Materials				\$ -
Contractual/Construction				
Consulting Services	\$ 400,000	1	Per Contract	\$ 400,000
Third-Party In-Kind Contributions				\$ -
Other				\$ -
<b>TOTAL DIRECT COSTS</b>				<b>\$ 400,000</b>
Indirect Costs				\$ -
<b>TOTAL ESTIMATED PROJECT COSTS</b>				<b>\$ 400,000</b>



## 6.3 BUDGET NARRATIVE

### a. Salaries and Wages

Mr. John Thorburn, TBNRD General Manager, and Mr. Nolan Little, TBNRD Water Resources Manager, will provide overall administration and oversight of the project on behalf of TBNRD including overall project management and reporting. In this regard, the district's office personnel will track costs, maintain financial records, handle any invoicing, and will manage any contracting and consultant oversight activities. **Work performed by TBNRD staff will be completed as part of the district's daily operations and will not be included as part of the local cost share commitment.**

TBNRD will not be asking for reimbursement or reporting any "In-Kind" contributions for any Salaries and Wages costs. TBNRD is proposing not to track these costs separately from daily operations even though employees will be providing services necessary for completion and implementation of the grant-funded project. Accordingly, no expenses under "Salaries, Wages, and Fringe Benefits" have been included in **Table 5**.

### c. Travel

Local travel by TBNRD staff will be covered under TBNRD's operating budget. Accordingly, no expenses have been included under "Travel" in **Table 5**.

### d. Equipment

Equipment expenses have not been included in the budget because TBNRD is not expected to purchase or lease any equipment as part of this project. Any computers or other equipment necessary for development, implementation, and application of the project will be provided by TBNRD. Accordingly, no "Equipment" expenses have been included in **Table 5**.

### e. Materials and Supplies

Acquisition of office supplies needed for the project will be a general operating expense of TBNRD that will take place outside of the grant agreement. Accordingly, no "Materials and Supplies" expenses have been included in **Table 5**.

### f. Contractual

Due to the specialized nature of the project, TBNRD will hire a consultant. Through a competitive, qualification-based process in accordance with TBNRD policies, TBNRD will select a qualified engineering consultant firm. One contract, totaling an estimated **\$400,000**, will be executed for the development and implementation of the Net Recharge Management Tool.

### g. Third-Party In-Kind Contributions

No third-party in-kind contributions are budgeted for this project. As noted above, TBNRD will not be asking for reimbursement or reporting any "In-Kind" contributions for any Salaries, Wages, or Fringe Benefit costs.

### h. Environmental and Regulatory Compliance Costs (as applicable to the project)

The project proposed for funding will not result in any physical changes to the environment and therefore no environmental and regulatory compliance costs have been budgeted for this project in **Table 5**.

### i. Other Expenses

All project expenses are included in the cost items described above. Therefore, no costs are associated with this budget category in **Table 5**.

#### j. Indirect Costs

No indirect costs are budgeted for this project; thus, this category does not apply in **Table 5**.

#### k. Total Costs

The estimated budget for the proposed project is presented in **Table 5**. The total budget for the project is estimated at **\$400,000**, with **\$300,000 in requested grant funds** (Federal cost-share) and **\$100,000 in Non-Federal** cost-share funds to be furnished by TBNRD and NDNR. The total Federal cost-share requested is 75 percent of total project costs (based on qualifying for Nature-Based Solutions) with the remainder contributed by the applicant. If it is determined by BOR that the total Federal cost-share would only be 50 percent of project costs because the Nature-Based Solution is not applicable to the project, TBNRD recognizes that the non-Federal subtotal in **Table 3** would be increased from \$100,000 to \$200,000. Due to the importance of this project, TBNRD would still proceed with the project, but development and implementation of the Net Recharge Management Tool may need to proceed at a slower rate.

### 7. ENVIRONMENTAL AND CULTURAL RESOURCES COMPLIANCE

Proposed project activities will not require environmental or cultural resources compliance through the National Environmental Policy Act. A final Whooping Crane designated Critical Habitat area is located along the Platte River within the Platte River Basin illustrated on **Figure 1**. The development and implementation of the Net Recharge Management Tool as proposed in this grant application will not affect any species listed or proposed to be listed as a Federal endangered or threatened species or designated critical habitats. As discussed in **Section 5.1.3g**, the Net Recharge Management Tool can be used to help TBNRD reduce shortages to stream baseflows in the Platte and its tributaries which will enhance habitat for several target species.

### 8. REQUIRED PERMITS OR APPROVALS

No permits or additional approvals are required to complete the Net Recharge Management Tool.

### 9. OVERLAP OR DUPLICATION OF EFFORT STATEMENT

There is no overlap between the proposed project and any other active or anticipated proposals or projects in terms of activities, costs, or commitment of key personnel. This proposal is not in any way duplicative of any proposal or project that has been or will be submitted for funding consideration to any other potential Federal or Non-Federal funding source.

### 10. CONFLICT OF INTEREST DISCLOSURE STATEMENT

No conflict of interest exists at the time of this submission.

### 11. UNIFORM AUDIT REPORTING STATEMENT

TBNRD acknowledges the requirement for a Single Audit Report and has/will continue to comply with this requirement. TBNRD does not meet the threshold of expending \$750,000 USD or more in Federal award funds in the applicant's fiscal year that requires a Single Audit report for that year through the Federal Audit Clearinghouse's Internet Data Entry System and was not required to submit a Single Audit report for the most recently closed fiscal year.

## **12. LETTERS OF SUPPORT AND FINANCIAL COMMITMENT**

Letters of support have been provided by NDNR, CNPPID, and the Rainwater Basin Joint Venture, (**Appendix C**). These organizations have been long-term partners with TBNRD and have collaborated to help best manage water resources in the region. The project provides particular benefit to NDNR, complementing their efforts to develop the DSS to manage and use excess flows in the Platte River for groundwater recharge more effectively. After the project is selected for the award, NDNR will provide a statement of funding commitment for their share of the Non-Federal cost share match.

## **13. OFFICIAL RESOLUTION**

TBNRD will be the agency responsible for administering the grant award. TBNRD has committed existing budget resources to ensure the financial and legal obligations associated with receiving Federal financial assistance through the WaterSMART Applied Science Grants FY23 will be met. After the project is selected for the award, the TBNRD will provide a signed letter to indicate this commitment.

**Appendix C: Letters of Support**

# NEBRASKA

Good Life. Great Water.

DEPT. OF NATURAL RESOURCES



Jim Pillen, Governor

John Thorburn, General Manager  
Tri-Basin Natural Resources District  
1723 Burlington St.  
Holdrege, NE 68949

Dear John,

Please consider this letter a formal expression of support and commitment from the Nebraska Department of Natural Resources to provide up to \$200,000 of matching state funding for your Bureau of Reclamation WaterSMART grant application for the Net Recharge Management Tool Project. This project fulfills the requirements of the Water Resources Cash Fund by increasing groundwater recharge and enhancing streamflow through an improved decision-making tool. Current Department plans in the project area, including the integrated management plan jointly developed with your District and the Basin-Wide Plan, recognize the benefits of quantifying net recharge and evaluating recharge sites to make data-driven decisions regarding water use and storage.

Should your grant application be approved, Department staff will work with you to develop a contract that implements this financial commitment. Again, the Department fully supports your District's efforts to enhance the evaluation and implementation of groundwater recharge projects and appreciates your District's efforts in working to support the state's integrated management plan and basin-wide plan goals.

Sincerely,

A handwritten signature in blue ink that reads "Thomas E. Riley".

Thomas E. Riley, P.E., Director

Thomas E. Riley, P.E., Director

Department of Natural Resources

245 Fallbrook Blvd., Suite 201 OFFICE 402-471-2363  
Lincoln, Nebraska 68521 FAX 402-471-2900

[dnr.nebraska.gov](http://dnr.nebraska.gov)

415 Lincoln St.  
P.O. Box 740  
Holdrege, NE 68949-0740



Phone: (308) 995-8601  
Fax: (308) 995-5705  
Web: [www.cnppid.com](http://www.cnppid.com)

Bureau of Reclamation  
WaterSMART Applied Science Grant Program  
Attn: Ms. Stephanie Micek  
P.O. Box 25007, MS 84-27810  
Denver, CO 80225

**RE: Letter of Support for Tri-Basin Natural Resources District's Net Recharge Management Tool Project Application to the Bureau of Reclamation's WaterSMART Applied Science Grant Program**

The Central Nebraska Public Power and Irrigation District (CNPPID) is writing this letter of support for the Tri-Basin Natural Resources District's (TBNRD) grant application to the Bureau of Reclamation's (BOR) WaterSMART Applied Science Program. The TBNRD proposed project will develop a Net Recharge Management Tool for a region of Nebraska covering three counties and including portions of three river basins (Platte, Republican, and Blue), which rely heavily upon groundwater for a variety of beneficial uses that includes both water quantity and quality, agriculture, and threatened and endangered species habitat.

CNPPID utilizes its facilities for the storage and conveyance of Platte River water for irrigation, hydropower, fish and wildlife habitat, and recreation to western and central Nebraska. CNPPID operations provide far-reaching benefits to hundreds of thousands of acres, in and adjacent to the TBNRD footprint. Specifically, CNPPID irrigation deliveries account for an imported water supply resulting in what is referred to as the "Groundwater Mound." With more than 500 miles of canals, laterals and pipelines, CNPPID has a vested interest in the effective management of the enhanced groundwater elevations created from Central surface water customer deliveries that overlap the TBNRD counties and the three river basins (Platte, Republican, and Blue).

TBNRD's Net Recharge Management Tool project would provide an additional tool to better understand subsurface water dynamics affecting the water table and assist TBNRD and CNPPID in making decisions regarding their work together in developing future recharge projects. The tool may also assist Central in the evaluation and understanding of its U2 and U12 incidental underground storage rights within and adjacent to the TBNRD area. Due to the hydrological connection between groundwater and surface water in this region, it is important to have effective tools to assess and manage the use of water resources. CNPPID has a vested interest to maintain a reliable and resilient supply for our customers into the future as changing climatic conditions are certain.

CNPPID supports the development of a Net Recharge Management Tool creating a useful decision-making and forecasting tool to help understand, track, predict, and quantify recharge and water table changes within the CNPPID's service area. Optimizing the use of existing recharge sites and assisting with the placement of future dedicated recharge sites can help promote the sustainability of higher water table elevations.

For the reasons stated, CNPPID supports TBNRD's application to the WaterSMART Applied Science Grant Program to develop a Net Recharge Management Tool. We urge the BOR to recognize the importance of developing assessment and forecasting tools to optimize the beneficial use and management of our water resources by funding this application request.

Sincerely,

A handwritten signature in blue ink, appearing to be "D. B. 24", written over a circular stamp or seal.

Central Nebraska Public Power and Irrigation District



## RAINWATER BASIN JOINT VENTURE

2550 N Diers Ave, Suite G  
Grand Island, NE 68803-1214  
(308) 382-8112  
[www.rwbjv.org](http://www.rwbjv.org)  
Andy Bishop, Coordinator  
(308) 380-8691



North American Waterfowl  
Management Plan

October 12, 2023

WaterSMART Applied Science Grant Application Review Panel,

The Rainwater Basin Joint Venture (RWBJV) is a public/private partnership that is focused on wetland and grassland conservation in Nebraska's mixed grass prairie ecoregion. The partnership fully supports the WaterSMART Applied Science Grant Application "Net Recharge Management Tool" being submitted by Tri-Basin Natural Resources District (TBNRD).

The outcome of this grant will provide a unique tool that will help multiple partners better leverage resources to support groundwater recharge and provide wildlife habitat. Most Rainwater Basin wetlands, found in TBNRD, can receive supplemental water deliveries through the Central Nebraska Public Power and Irrigation District (CNPPID). Over the last five years the RWBJV has leveraged nearly \$1.25 million in for infrastructure projects to improve supplemental water deliveries to these wetlands. These infrastructure improvements allow U.S. Fish and Wildlife (USFWS) Managers to coordinate with TBNRD and CNPPID to take advantage of excess flows to fill the wetlands. The upgraded infrastructure allows wetlands to go from dry conditions to fully flooded in a seven-day period. The WaterSMART funded tool will help focus future infrastructure investments and maximize deliveries.

As a result of the efficiency afforded by the upgrades, habitat conditions have been improved. In the spring of 2023, the wetlands that received supplemental water in the Rainwater Basin Wetland Complex provided over 70% of the available habitat. As a result of the drought conditions over 10% of the federally endangered Whooping Crane population used these wetlands.

The RWBJV contracted a hydrologist to quantify groundwater recharge. Each acre of playa wetland can recharge 1.14 million gallons of water over a 45-day hydroperiod. The proposed tool will be invaluable at targeting recharge deliveries to maximize recharge and wildlife habitat. The WaterSMART funded tool will also help with engaging private landowners in developing new private recharge sites.

I look forward to collaborating with you on this proposal should it be funded.

Sincerely,

Andy Bishop  
Coordinator, Rainwater Basin Joint Venture  
[andy\\_bishop@fws.gov](mailto:andy_bishop@fws.gov)

### Management Board Members

<b>Bob Bettger</b> Landowner Fairmont, NE	<b>Barb Cooksley</b> Landowner Anselmo, NE	<b>Roric Paulman</b> Landowner Sutherland, NE	<b>Mel Taylor</b> Landowner Milligan, NE	<b>Kelsi Wehrman</b> Pheasants Forever Nelson, NE	<b>Brad Dunbar</b> Lindsay Corporation Omaha, NE
<b>John Denton</b> Ducks Unlimited Grand Island, NE	<b>Joe Bilka, Alternate</b> Landowner Tri-Basin NRD Holdrege, NE	<b>Steve Shaw</b> Landowner Little Blue NRD Edgar, NE	<b>David Raffety</b> Landowner Tri-Basin NRD Kearney, NE	<b>Mike Bantam</b> Nebraska Farm Service Agency Alma, NE	<b>Dave Eigenberg</b> Upper Big Blue NRD York, NE
<b>James Huntwork</b> Natural Resources Conservation Service Grand Island, NE	<b>Dr. Tim McCoy</b> Nebraska Game and Parks Commission Lincoln, NE	<b>Brian Smith</b> U.S. Fish & Wildlife Service Denver, CO	<b>John Thorburn, Chairman</b> NE Association of Resources Districts Holdrege, NE	<b>Rich Walters</b> The Nature Conservancy Kearney, NE	