

# NEBRASKA NATURAL RESOURCES COMMISSION

## Water Sustainability Fund

Application for Funding

### Section A.

#### ADMINISTRATIVE

**PROJECT NAME:** Upper Niobrara White Groundwater Model Update

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

Sponsor Business Name: Upper Niobrara White Natural Resources District (UNWNRD)

Sponsor Contact's Name: Patrick O'Brien, General Manager

Sponsor Contact's Address: 430 East 2nd Street, Chadron, NE 69337

Sponsor Contact's Phone: 308-432-6190

Sponsor Contact's Email: obrien@unwnrd.org

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

**Grant** amount requested. \$ 82,500

- If requesting less than 60% cost share, what %? 30%

**If a loan is requested** amount requested. \$ N/A

- 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. [Click here to enter text.](#)
- What is the population served by your project? [Click here to enter text.](#)
- Provide a demonstration of need. [Click here to enter text.](#)
- **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"/>

[Click here to enter text.](#)

4. **Partnerships**

List each Partner / Co-sponsor, attach documentation of agreement:  
 Upper Niobrara White NRD (UNWNRD)  
 Nebraska Department of Nebraska Department of Natural Resources (NDNR)  
 Nebraska Natural Resources Commission (NNRC)

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

The UNWNRD (or District) is the project sponsor and will serve as the fiscal agent. The UNWNRD will also provide: financial support as indicated in section 5, data and information, technical support and will review all work products. The UNWNRD will select and enter into a contract with a consultant to complete the project.

The NDNR will provide funding as indicated in section 5, data and information, technical support and review deliverables.

The NNRC will provide funding as indicated in section 5.

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.

NDNR	UNWNRD	WSF	Total
\$137,500	\$55,000	\$82,500	\$275,000

It should also be noted that the UNWNRD will also be contributing to the project through staff time to provide and review data and information, product review and continued support of the model through the data base maintenance.

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!

In 2003, in response to declining groundwater levels, the UNWNRD request NDNR to study the ground and surface water in the district and a joint action plan be developed for the integrated management of the water resources. Concurrently, the UNWNRD imposed a moratorium on the issuance of new high capacity well permits throughout the entire district and convened a citizens advisory committee to assist with the development of the joint action plan.

Following the passage of LB962 in 2004 a portion of the UNWNRD was declared to be fully appropriated and along with the NDNR, an integrated management plan was initiated, completed and adopted in 2009. The planning process is an adaptive one, always seeking to evaluate and incorporate the best available science into management decisions.

In order to assist with the planning process, several studies and models were developed including the Box Butte Model and the Niobrara Basin Hydrostratigraphic Analysis completed by Jerry Ayers, UNL-CSD. Hydrologic model are tools that have been widely used to facilitate understanding of hydrologic systems over vast area. Ultimately, the District and NDNR concluded that a more robust model was needed for the Niobrara Basin above Gordon to meet four purposes:

- To quantify the water supply in the basin that is consistent the DNR's basin water supply concepts;
- To quantify depletions to the baseflow of the Niobrara River due to irrigation development;
- To evaluate management scenarios; and
- To assess the effect of groundwater development in Box Butte County.

The Upper Niobrara-White (UNW) Groundwater Model area encompasses 5,532,160 acres including 520,294 surface and ground water irrigated acres.

Since 2014, the Upper Niobrara-White Groundwater Model has been utilized to complete analysis for aquifer life, well interference, stream flow depletion and the impacts of allocations on the groundwater supply.

The current model was completed in 2014 using the best available data and information. Recently, updated modeling tools have become available. Additionally, the UNWNRD requires flow meters on all irrigation wells and collects water use information annually that is not part of the data being utilized. As well, the current model uses land uses data from 2005. NDNR staff met with the UNWNRD and suggested the model be updated to be uniform with other models being utilized by the Department and NRDs.

Along with the technological and regulatory changes. Starting in 2007, the UNWNRD has allocated groundwater in two sub-areas which has caused a more diverse cropping pattern which includes a mix of high and low water used crops. It should also be noted that no-till and reduced tillage practices have changed water use, crops, infiltration and evaporation that will need to be accounted into the model.

Finally, a newer version of the model background (MODFLOW) has become available and is now considered the optimum software for directing groundwater management decisions.

The purpose of the project will be to update the Upper Niobrara-White Groundwater Model which includes:

- Conversion to MODFLOW 6

- Update the land use data sets to the most current available
- Evaluate and update geology
- Refine and/or complete aquifer property evaluation

In the past and based on the limitations of the software, the model has been primarily used to evaluate groundwater changes as a result of climate and withdrawals. Over the last several years, the UNWNRD along with the NDNR have researched options to recharge the aquifers where significant declines have occurred. These options include both passive and intentional recharge by the capture of surface run-off or transfer of water from areas where groundwater is plentiful. While technically feasible, there have been questions raised on the economically feasibility. Utilization of the upgraded model will allow for the evaluation of the changes to groundwater levels as a result of recharge action that may demonstrate the economic feasibility.

**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
				<b>TOTAL</b>	<b>\$305,000</b>

- 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.

Task	Year 1	Year 2	Year 3	Total
Conversion to MODFLOW6	\$40,000			\$40,000
Update Land Use	\$1,667	\$11,667	\$41,666	\$55,000
Evaluate and Update GW Modeling Process	\$20,000	\$20,000		\$40,000
Aquifer Property Evaluation	\$20,000	\$20,000		\$40,000
GW Model Calibration and Testing	\$10,000	\$40,000	\$50,000	\$100,000
<b>Total</b>	<b>\$91,667</b>	<b>\$91,667</b>	<b>\$91,666</b>	<b>\$275,000</b>

8. **IMP**

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

The UNWNRD has completed an integrated management plan for a majority of the district and has an initiated a voluntary integrated management plan for the remainder of the District.

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; **Click here to enter text.**
- 1.A.2 Describe the plan of development (004.01 A); **Click here to enter text.**
- 1.A.3 Include a description of all field investigations made to substantiate the feasibility report (004.01 B); **Click here to enter text.**
- 1.A.4 Provide maps, drawings, charts, tables, etc., used as a basis for the feasibility report (004.01 C); **Click here to enter text.**
- 1.A.5 Describe any necessary water and/or land rights including pertinent water supply and water quality information (004.01 D); **Click here to enter text.**
- 1.A.6 Discuss each component of the final plan (004.01 E); **Click here to enter text.**
- 1.A.7 When applicable include the geologic investigation required for the project (004.01 E 1); **Click here to enter text.**
- 1.A.8 When applicable include the hydrologic data investigation required for the project (004.01 E 2); **Click here to enter text.**

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). [Click here to enter text.](#)

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

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

The NDNR has been advocating for the development of hydrologic models to evaluate aquifers statewide. Groundwater models are useful tools to simulate the aquifer and surface water response to water use and recharge to assist with the implementation of structural and non-structural management tools such as recharge basins or changes to rules and regulations.

The UNWNRD has been collecting data and information to support groundwater models such as changes in static groundwater level; water use and crop type. This information will provide a more accurate reflection of the crops and water use than literature values.

The UNWNRD will work with a qualified consulting firm, led by a professional geologist licensed in the State of Nebraska to upgrade the UNW Groundwater Model.

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

The UNW Groundwater Model will be constructed as a refined model based upon existing UNW Groundwater Model completed by the University of Nebraska Conservation and Survey Division (UNL-CSD) and NDNR. The model framework will be based on available geologic data including NDNR well logs and UNL CSD test hole logs. Cropping data, water use information and irrigated acres will be provided by UNWNRD. The tasks for this effort, include:

- Conversion of the model to MODFLOW 6
  - Convert the stream flow package from Stella to SFR2
  - Complete a new uniform grid and quadtree grid refinement
  - Modify the modeling area to exclude the North Platte Valley
- Update the land use datasets to current information
  - Utilize aerial photos, CropScape and UNWNRD cropping information to create data sets through 2024.
  - Complete well to parcel relationships
  - Determine the surface water lands/diversion relationship
- Evaluation and update of the UNW Groundwater Model
  - Evaluate and update geology where necessary and create an initial interpretation
  - Provide for the addition of the Box Butte County clay layer
- Aquifer Property Evaluation

- Complete monitoring well air slug test to provide estimates of hydraulic conductivity and specific yield
- Complete aquifer test using monitoring wells and existing production wells to complete drawdown information
- Groundwater Model recalibration
  - Complete semi-automated and manual recalibration
  - Update groundwater levels and baseflow targets
  - Utilize watershed modeling to aid in calibration
  - Compare to previous modeling results
  - Compare modeling files to watershed model

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

The current UNW Groundwater Model was completed utilizing empirical data collected by the District and NDNR including certified surface and ground water irrigated acres, static groundwater changes, surface water flow, water use and cropping data. Other research utilized and carried forward are the Geology and Groundwater Supplies of Box Butte County (UNN-CSD) Box Butte County Model and the Niobrara Basin hydrostratigraphic analysis conducted by Jerry Ayers, UNL-CSD.

To complete the Model update additional water use and crop information will be collected and incorporated along with changes to irrigated acres. As stated above completion of the update will also require an Aquifer Property Evaluation with the tasks:

- Complete monitoring well air slug test to provide estimates of hydraulic conductivity and specific yield
- Complete aquifer test using monitoring wells and existing production wells to complete drawdown information

Moving forward annual data collected will be incorporated into the model.

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

There will be no water or land rights needed to complete this project.

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).

In the future, the model will be utilized to evaluate recharge concepts that may be implemented which could include the utilization, rehabilitation or construction of detention structures to capture surface run-off and allow the water to infiltrate.



### **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.

The UNW Groundwater Model was developed through a collaborative effort by the District and NDNR. The Model has been used to assess the impacts of water use, management practices and regulations on the long-term water supply. The project purpose is to update the model using an advanced software, current land and crop information and actual crop water use.

The alternative to the project would be to continue to rely on the existing model that utilizes modeling software that is 20+ years old, land use data from 2005; that includes cropping practices before well moratoriums and allocations and crop water use based on literature-based crop irrigation requirements.

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. (Title 261, CH 2 - 005).

The total estimated project cost for the contracted work is \$275,000 that will result in an updated, robust groundwater model that will allow for the assessment of water use, precipitation and recharge impacts on the aquifer of the defined model area. The cost estimate was prepared in consultation with hydrologist licensed as a professional geologist in the State of Nebraska and NDNR. The basis for the cost is generally associated with time and materials need to complete the project. The breakdown of the tasks is provided in the table below.

Task	Cost
Conversion to MODFLOW 6	\$40,000
Update Land Use and Crop Data	\$55,000
Evaluate and Update Modeling	\$40,000
Aquifer Property Evaluation	\$40,000
Model Calibration and Testing	\$100,000
Total	\$275,000

There is no practical method to document the direct benefit of this project in terms of direct monetary returns. The benefit of the project includes:

- Gain a more up to date knowledge of the surface and ground water balance

- Provide a cost and benefit of structural and nonstructural measures to achieve aquifer recharge
- Establish a better understanding of the impacts of water management decisions on protecting the aquifer and maintaining and potentially enhancing irrigated crop production in the District
- Proving information on declines that would result in well interference/harm to domestic wells.

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 cost to complete the project is shown in the table below:

Task	Cost
Conversion to MODFLOW 6	\$40,000
Update Land Use and Crop Data	\$55,000
Evaluate and Update Modeling	\$40,000
Aquifer Property Evaluation	\$40,000
Model Calibration and Testing	\$100,000
Total	\$275,000

In 2021-2022 the UNWNRD initiated the process of congregating all water related data and information into a centralized data base. As a result, the transition of data and information into the model will be more efficiently completed. As indicated previously, more frequent updates of the model will be undertaken based on data and information collected by the District. On-going data collection, data entry and maintenance of the data base will be the responsibility of the UNWNRD. In 2022-2023 the data base management expense was \$9,500 and there is one FTE dedicated to data collection and assessment.

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).

Goal #1 of the UNWNRD Integrated Management Plan is to manage surface and ground water supplies in the fully appropriated portion of the District to be in balance with uses, so that the existing domestic, agricultural, environmental, recreational, commercial and industrial activities are preserved to maintain the economic viability, social and environmental health, safety and welfare of the District both near and long term.

The project will provide an updated tool that will allow for the analysis of the impact on all water uses to determine the extent to which said uses are sustainable. Should the analysis determine conflicts between water uses or current water use will not result in meeting the above stated goal, the Model will be utilized to evaluate the effects of various management actions such as:

- The effects of groundwater levels and stream flow resulting from changes in allocations, irrigated acres, additional wells or other restrictions or recharge events
- The benefit of recharge projects to increase aquifer levels and baseflow to surface waters
- Strategies for conjunctive management of surface and ground water.

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).

The cash flow required to complete the project is comprised of

- NDNR = \$137,500
- UNWNRD = \$55,000
- WSF = \$88,500

Additional funds required to complete the project include database management fee and UNWNRD staff time. These costs will likely change in the future however, most recently have been \$9,500 for data base management and \$100,000 per average UNWNRD FTE.

Based on the estimated work schedule, tasks to be completed and annual cash flow is shown in the table below.

Task	Year 1	Year 2	Year 3	Total
Conversion to MODFLOW6	\$40,000			\$40,000
Update Land Use	\$1,667	\$11,667	\$41,666	\$55,000
Evaluate and Update GW Modeling Process	\$20,000	\$20,000		\$40,000
Aquifer Property Evaluation	\$20,000	\$20,000		\$40,000
GW Model Calibration and Testing	\$10,000	\$40,000	\$50,000	\$100,000
Total	\$91,667	\$91,667	\$91,666	\$275,000

The project benefits will include:

- Frequent and detailed aquifer life analysis to identify areas where additional management may be necessary
- Evaluate the impact of past, present and future regulations on ground water declines
- Define the cost and benefit of structural and non-structural measures to recharge the groundwater supply
- Evaluate the impacts of new or relocated wells on existing adjacent wells to ensure excessive interference does not occur.

- 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 cost for the project is shown in section 3.C. The project will provide an up-to-date tool that will guide decisions on future actions that ensure water sustainability for the District which includes maintaining stream flows, protecting communities and keeping irrigated land irrigated. The next best alternative would be to continue to use a model with outdated software, 20 year-old land and crop use information and estimated versus actual crop water use.

#### **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. Letters of support and financial assurance have been provided.

The UNWNRD and NDNR have committed to devote modeling funds for FY 23-24, 24-25 and 25-26.

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

The projected cost for the UNWNRD will be approximately \$18,500 per year for modeling, \$9,500 for database management and \$100,000 for staff. The UNWNRD annual revenue includes a FY22-23 property tax asking allowable by state law of 0.015057 per \$100 of valuation along with multiple other sources of income. The total operating budget for the current fiscal year is \$1,638,700.

6. If a loan is involved, provide sufficient documentation to prove that the loan can be repaid during the repayment life of the proposal.

No loan is being requested.

7. Describe how the plan of development minimizes impacts on the natural environment (i.e. timing vs nesting/migration, etc.).

The project will have no 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.

Nebraska State Statute Chapter 2, Article 32 and the Groundwater Management and Protection Act, Chapter 46 Article 7 assigns the responsibility of protecting and maintaining the quality and quantity of groundwater for municipal, domestic and agricultural uses to Nebraska's Natural Resources Districts.

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

The UNW Groundwater Model supports the goals and objectives, action items for surface water, water quality goals and other objectives within the following UNWNRD developed and state approved or state coordinated plans:

- UNWNRD Groundwater Management Plan, Revised 2006
- UNWNRD Groundwater Management Area and Integrated Management Area Rules and Regulations, Amended 2018
- UNWNRD/NDNR Integrated Management Plan, Revised 2011
- UNWNRD Mater Plan 2019-2029
- UNWNRD Long Range Plan, 2022-2023

Goal #3 of the UNWNRD/NDNR Integrated Management Plan is to maintain Nebraska's compliance with the Wyoming-Nebraska Compact on the Upper Niobrara River, as adopted October 26, 1962 and ratified by Congress on August 4, 1969. The model area also encompassed the portion of the river subject to the compact and can be utilized to evaluate water use and management actions.

Finally, the Niobrara River, starting in Valentine has been deemed a national scenic river. As such, the NDNR and the US Department of Interior are in discussions over protecting the existing flows through the scenic stretch. The model developed with this project will provide assessments on water use and the impacts to the Niobrara River baseflow which eventually will feed the downstream segments.

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. [Click here to enter text.](#)
  - 10.B Attach proof of ownership for each easements, rights-of-way and fee title currently held. [Click here to enter text.](#)
  - 10.C Provide assurance that you can hold or can acquire title to all lands not currently held. [Click here to enter text.](#)
11. Identify how you possess all necessary authority to undertake or participate in the project.

Nebraska State Statute Chapter 2, Article 32 and the Groundwater Management and Protection Act, Chapter 46 Article 7 assigns the responsibility of protecting and maintaining the quality and quantity of groundwater for municipal, domestic and agricultural uses to Nebraska's Natural Resources Districts.

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

There will be no negative environmental or ecological consequences as a result of this project.

## 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 UNW GW Model project area includes eight communities. All of the residents in the project area rely on groundwater for drinking water. As well, the City of Chadron, with a population of 5,850 municipal well field lies in the model area.

The two major threats to drinking water include groundwater declines and contamination. Groundwater declines in Box Butte County have been measured to be as much as 80 feet since pre-irrigation development with much of this being attributed to the density of irrigation wells, the need for supplemental irrigation and the lack of recharge. The refined and updated model can be utilized to run simulations that will predict how water use will impact the long-term water supplies for the City of Alliance, the Village of Hemingford and the multiple individual domestic wells. In the model areas where declines have not been as pronounced, the model can still be utilized to compare existing use and aquifer life.

As well as the aquifer life analysis, the UNWNRD allows for the transfer of water use, certified acres and irrigation wells from parcel to parcel. Currently, the transfers are limited spatially. Once complete, the model will be utilized to evaluate these transfers to determine if there will be any domestic well interference to potentially avoiding user conflict. Similarly, should the District allow for any new wells in the future, the model will be utilized in the same manner.

At this time, the UNWNRD has not identified areas that require enhanced quality management under the Groundwater Management Plans quality goals. There are however, areas that have seen increased nitrate levels. The updated model can assist in the identification of flow directions and gradients to better understand groundwater movement and velocities. The model would be used to prioritize education in the targeted area to avoid any water quality degradation that would require rules and regulations. Additionally, assessments can also be conducted in source water protection areas developed by the Nebraska Department of Environment and Energy.

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.

The UNWNRD and NDNR completed an Integrated Management Plan (IMP) in 2009 and amended the plan in 2011. The three established goals are:

- To manage surface and ground water supplies in the fully appropriated portion of the District to be in balance with uses, so that the existing domestic, agricultural, environmental, recreational, commercial and industrial activities are preserved to maintain the economic viability, social and environmental health, safety and welfare of the District both near and long term.



- To manage surface and ground water in an equitable manner.
- To maintain Nebraska's compliance with the Wyoming-Nebraska Compact on the Upper Niobrara River, as adopted on October 26, 1962 and ratified by Congress on August 4, 1969.

The IMP includes eight objectives that are being pursued to meet these goals.

Along with the IMP, the UNWNRD Groundwater Management Plan (GMP) was updated in 2006 and includes the following goals:

- Short term goal of minimizing ground water depletions and long-term goal of a sustained aquifer.
- Prevention of ground water contamination and, where ground water is already contaminated, sufficient reduction in the level of contaminants to meet applicable water quality standards.

The GMP included objectives, policies and programs aimed at meeting each of these goals.

To implement the plans, the UNWNRD has established rules and regulations to carry out the established goals and objectives. The rules and regulations are updated as needed to ensure the plans move forward.

Since update of the GMP, the adoption of the IMP and the amendments of the rules and regulations, the UNWNRD has instituted the following:

- A moratorium on all new high-capacity wells
- A requirement that all irrigated acres be certified
- Flow meters on all high-capacity wells
- A restriction on the establishment of new irrigated acres in five of six groundwater management subareas
- Groundwater allocations in two groundwater management subareas

To assist in the decision-making process, the UNWNRD and NDNR collaborated to complete the Upper Niobrara White Groundwater Model in 2014. The model was based on an early model and several previous studies completed by UNL-CSD and has been utilized to conduct aquifer life analysis, run management scenarios and create a groundwater vulnerability index.

Additional work conducted under the IMP and GMP have been:

- Annual collection of water use, crop information, static water level measurements and groundwater quality monitoring
- Groundwater Recharge Potential Analysis, 2019
- Water Relocation Analysis, 2020
- Watershed and Flood Prevention and Operation Program, Ongoing
- GW Management Sub-area IV Dam Inventory, 2023

The project will assist the UNWNRD in achieving the goals of both the IMP and the GMP by providing an updated tool to evaluate management scenarios such as allocations, recharge projects, expansion of irrigated acres and contaminant tracking. These assessments will provide information to the UNWNRD Board of Directors and allow for the establishment of programs, policies, rules and regulations to ensure progress continues.

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.

Annually, UNL-CSD prepares and distributes information on groundwater level changes throughout the state. Figure 1 show the pre-development to spring 2022 conditions for the state and figure 2 show the pre-development to spring 2022 conditions in the UNWNRD. As the figures show, some areas have experienced 80 or more feet of depletions.

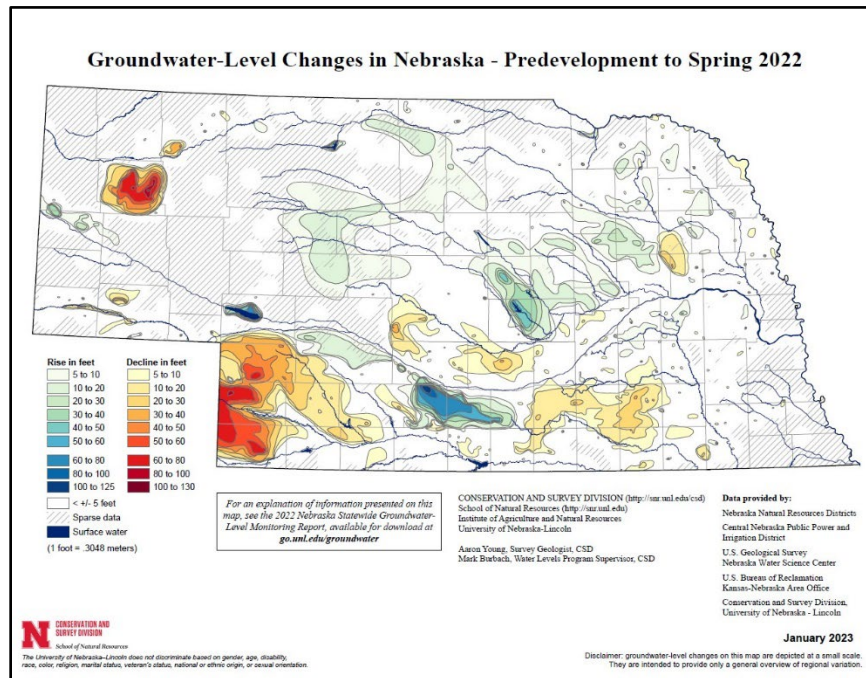


Figure 1. Static Water Level Changes Predevelopment to Spring 2022.

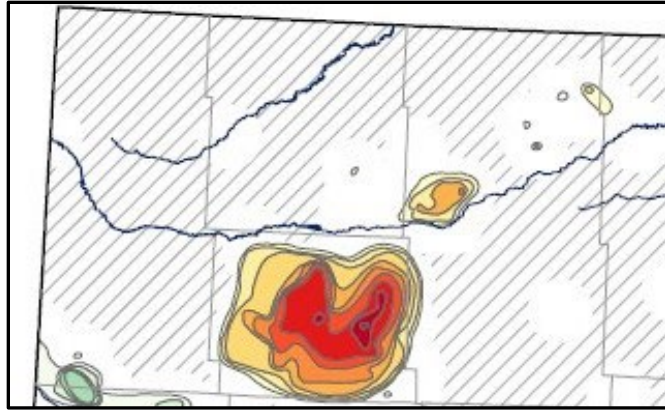


Figure 2. UNWNRD Static Water Level Changes Pre-development to Spring 2022

Over the last several years the UNWNRD has conducted or is conducting analysis to identified area where structural or non-structural groundwater recharge projects could be implemented to stabilize and eventually reverse declines. The three primary studies are:

- Groundwater Recharge Potential Analysis, 2019
- Groundwater Management Subarea IV Dam Inventory, 2023
- Watershed and Flood Prevention Operations Program, Ongoing

These analyses have identified several locations in the decline area where conditions such as watershed yield, topography, soils and geology will be suitable for recharge projects. The updated model will be utilized to quantify recharge and provides a cost-benefit analysis for each location that would allow the UNWNRD to prioritize the sites and establish a long-term budget for implementation.

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 updated UNWNRD Groundwater model will be a tool used to meet multiple goals that include:

- Addressing groundwater declines – the model will evaluate, based on current land use and actual water use – the potential benefits of artificial recharge, changes in allocations and other management options.

- Changes to stream baseflow – the model will be utilized to evaluate the impact of management actions on stream baseflow to ensure the strategies do not negatively impact Niobrara River flows.
- Water Quality – the current model has not been utilized to evaluate water quality. The updated model will be utilized to evaluate flow directions and gradients to gain a better understanding of nitrate movement.
- Sustaining the agriculture economy - The District is committed to finding solutions that address groundwater declines and protect or enhance stream baseflow, and ensuring agricultural producers can continue to irrigate and support the regional and state economy.

The UNW Groundwater Model will be utilized to conduct aquifer life analysis, management scenario testing, climate analysis and well interference analysis to identify solutions that have the least impact and most benefit for all water users in the District.

The benefits of this project will be long lasting. The model will frequently be updated with crop water use, climate and cropping information. If the project is not completed, the District will continue to utilize the an existing – outdated model that may lead to erroneous conclusions – for decision making purposes.

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.

Annual rainfall and recharge in the UNWNRD average approximately 16 and 1.5 inches, respectively. Meaning on average, long-term sustainability of the water resources is not achievable without active management. The updated GW model will enhance the District’s ability to manage water for all beneficial uses. The model will be utilized to determine aquifer life of 5 of 6 different groundwater management subareas. Separation into management subareas allows for independent actions to occur to match the water use, aquifer capabilities and land use of an area, thus maximizing the water that is available.

As stated previously, the model will also be used to evaluate the potential for new wells, transfer of wells and certified acres to ensure the existing uses are not compromised by the new well or transfer.

According to UNL Media, agriculture remains a critical component of Nebraska’s economy, including support for approximately one-quarter of the state’s jobs. Agriculture remains a vital part of the UNWNRD. Irrigation is an important part of the agriculture industry, especially during periods of drought or where precipitation is limited. The project will benefit the state by incorporating education, incentives and where necessary regulation into management of the groundwater in northwest Nebraska to ensure property owners retain the ability to access clean and plentiful water for beneficial uses of irrigation, livestock water supplies and domestic drinking water.

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 \$275,000. There are no other technically comparable methods to achieve the same goal/results.

Models have been successfully utilized to simulate environmental cause and effects based on historic observations. These simulations are often based on the impacts over years. In the case of the UNWNRD, the accepted modeling projects out 50 years. One alternative to modeling would be to implement a management action and document the effects over time. Challenges with the alternate approach include the time needed to observe the changes and accounting for changes in climate and crop. The cost associate with the alternative includes, staffing, in-direct costs and time. There may also be cost to the producers associated with implementing management decisions that are proved unnecessary.

Previous studies to evaluated recharge potential and identify recharge locations have established a use for the model to simulate the changes in groundwater levels if structural and non-structural projects were implemented. The results will then allow the District to prioritize, pursue or abandon projects.

The cost per year and task are provided in the table below.

Task	Year 1	Year 2	Year 3	Total
Conversion to MODFLOW6	\$40,000			\$40,000
Update Land Use	\$1,667	\$11,667	\$41,666	\$55,000
Evaluate and Update GW Modeling Process	\$20,000	\$20,000		\$40,000
Aquifer Property Evaluation	\$20,000	\$20,000		\$40,000

GW Model Calibration and Testing	\$10,000	\$40,000	\$50,000	\$100,000
Total	\$91,667	\$91,667	\$91,666	\$275,000

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.

Goal #3 of Integrated Management Plan is:

- To maintain Nebraska’s compliance with the Wyoming-Nebraska Compact on the Upper Niobrara River, as adopted on October 26, 1962 and ratified by Congress on August 4, 1969.

The current model footprint does include the compact area and extends into the Wyoming portion of the basin. The area has been subject to the well moratorium, restrictions on the addition of irrigated acres and flow meter requirements. All of these actions have impacted water use in the area. The model will be utilized to ensure the actions are appropriate – for the long-term to ensure compliance.

Also, the Niobrara River from Valentine to the Highway 137 bridge north of Newport has been designated as a National Scenic River. As such, the National Park Service and the United States Fish and Wildlife Service have asserted the desire to obtain a federal reserved water right to protect the instream flows within the scenic stretch. Over the past few years, NDNR and the federal agencies have been discussing options that could be used in lieu of a seeking a reserved water right.

It is anticipated that there will be some oversight mechanism on stream flows and water management within the basin. The updated model can be utilized by the District and NDNR to simulate long term management decisions and the impact to Niobrara River flows to ensure the state agreement or federal reserved water right are met.



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 UNNWRD through NRCS are currently completing a Watershed Plan and Environmental Assessment for the Box Butte Creek Watershed under the auspice of the Watershed Flood Prevention and Operation (WFPO) program. The plan was initiated based on the impacts several high-water events have had throughout the watershed in the recent past. The area, as indicated previously has also experienced groundwater declines. Several structures have been identified that will be considered multi-use. That is, flood waters will be retained and allowed to infiltrate to reduce property damage and recharge the aquifer.

Multiple community well fields lie in the model footprint. Specifically, the City of Alliance and the Village of Hemingford's wells reside in areas that have experienced dramatic groundwater declines. The model can be utilized to conduct aquifer life analysis in these areas to determine if the municipal wells will be sufficient and for how long. The model can also be used to assist municipalities in the district when searching for new or additional water sources.

Ensuring the protection of private property owners' access to clean and plentiful drinking water, the ability to irrigate and water livestock is one of outcomes of this project. Prior to pursuing recharge projects or regulations, the best available science needs to be utilized to allow for a sustainable water supply and that the intended consequences are the end goal.

Finally, the model will be utilized to evaluate the impacts of transfers on adjacent land owners. Failure to consider third party impact may result in an irrigation well causing a domestic well to go dry.

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.

The Nebraska Groundwater Management and Protection Act has charged the NDEE and NRDs with protecting groundwater quality. Goal #2 of the UNWNRD's Groundwater Management Plan is:

- Prevention of groundwater contamination and where groundwater is already contaminated, sufficient reduction in the level of contaminants to meet applicable water quality standards.

Groundwater monitoring conducted across the district has not yielded areas where nitrates or other contaminants have required the implementation of elevated management or controls. The project will be used to determine groundwater flow direction and gradients to better understand how water quality may change in the future. The information will then be utilized to identify vulnerable areas and allow for a proactive approach to nitrate management rather than reacting when monitoring indicates an issue.

As stated, one of the uses of the model will be to evaluate the impact of recharge on the aquifers by capturing storm water flows and allowing for passive intentional infiltration. The project will allow for scenarios to be developed that ensure that addressing a water quantity issue does not result in a water quality issue.

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 UNWNRD is the project sponsor and has committed to supporting the project for the next three fiscal years. For the fiscal year 2022-2023 the valuation for the District was \$4,207,754,771 and the property tax levy is \$0.15057 per \$100. If necessary, additional levy authority will be utilized to complete the project. Additional sources of revenue used to support the UNWNRD budget include the conservation tree program, Nebraska Water Quality funds, customer charges and miscellaneous income.

Additional sources of funding for the project are \$137,500 from the NDNR and \$88,500 from the Water Sustainability Fund.

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 UNWNRD is the local project sponsor and the UNW Groundwater Model supports goal and objectives, action items, surface water, water quality goals and others within the following UNWNRD developed and state approved or state coordinated plans:

- UNWNRD Groundwater Management Plan, Revised 2006
- UNWNRD Groundwater Management Area and Integrated Management Area Rules and Regulations, Amended 2018
- UNWNRD/NDNR Integrated Management Plan, Revised 2011
- UNWNRD Mater Plan 2019-2029
- UNWNRD Long Range Plan, 2022-2023

Since update of the GMP, the adoption of the IMP and the amendments of the rules and regulations, the UNWNRD has instituted the following:

- A moratorium on all new high-capacity wells
- A requirement that all irrigated acres be certified
- Flow meters on all high-capacity wells
- A restriction on the establishment of new irrigated acres in five of six groundwater management subareas
- Groundwater allocations in two groundwater management subareas

Additional work conducted under the IMP and GMP have been:

- Annual collection of water use, crop information, static water level measurements and groundwater quality monitoring
- Groundwater Recharge Potential Analysis, 2019
- Water Relocation Analysis, 2020
- Watershed and Flood Prevention and Operation Program, Ongoing
- GW Management Sub-area IV Dam Inventory, 2023

The goals and objectives being supported by the project are:

*UNWNRD Integrated Water Management Plan:*

- To manage surface and ground water supplies in the fully appropriated portion of the District to be in balance with uses, so that the existing domestic, agricultural, environmental, recreational, commercial and industrial activities are preserved to maintain the economic viability, social and environmental health, safety and welfare of the district both near and long term.
- To manage surface and ground water in an equitable manner.
- To maintain Nebraska's compliance with the Wyoming-Nebraska Compact on the Upper Niobrara River, as adopted on October 26, 1962 and ratified by Congress on August 4, 1969.

*UNWNRD Groundwater Management Plan:*

- Short term goal of minimizing ground water depletions and long-term goal of a sustained aquifer.
- Prevention of ground water contamination and, where ground water is already contaminated, sufficient reduction in the level of contaminants to meet applicable water quality standards.

*UNWNRD Mater Plan: 2019-2029*

- Maintain and protect the water resources to meet future needs for domestic, agricultural, urban, industrial, recreational and fish and wildlife uses.

The updated UNW groundwater model will assist the District in establishing water quantity and quality targets that are based on aquifer life and vulnerability analysis throughout the 5,532,160 acre model area. The stakeholders and beneficiaries include all residents of the model footprint which includes the City of Chadron due to the location of the municipal well field.

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.

In the future, the Niobrara River, downstream of the UNWNRD will be subject either an agreement or a federal reserved water right that will direct water management decisions within the Niobrara Basin. Upstream of the scenic designated river stretch, streamflow is heavily groundwater influenced. Within the UNWNRD the project will provide information on impacts of current irrigation development on streamflow as well as determine the impacts of additional irrigated acres. The information will be utilized by the District and the NDNR when making integrated management decisions. The benefit to the state of Nebraska would be maintaining compliance with the agreement and the lack of administration of the federal reserve water right.

The population benefited would be the entire State of Nebraska, as the State would be the signatory of the agreement with the basin NRDs being a partner in managing the water to meet the requirements.

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 total cost of the project will be \$275,000 with contributions being:

- NDNR = \$137,500
- UNWNRD = \$55,000
- WSF = \$88,500

Letters confirming the commitments by NDNR and the District have been included with the application.

Should the WSF fail, the UNWNRD will likely continue to use the outdated model, research other funding source and apply again in 2024.

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.

The project will evaluate several structural and non-structural recharge projects that include recharge basins, ponds, wetlands restoration and other options. Watershed benefits derived from these projects include:

- Restoration and improvement of the quality of wetland habitat

- Flood reduction
- Wildlife and aquatic habitat enhancement
- Restored floodplain function

In the model areas where declines are not as dramatic, the model will be utilized to ensure the hydrologically connected surface and groundwater remains balanced so surface water habitats are not overly stressed by groundwater use.

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.

#### NDNR Annual Report and Plan of Work 2021-2022

Goal One: Establish strong state leadership, involvement, and support for science-based decision making that is necessary to sustain state and local water management outcomes.

The Department has been diligently working with the USGS, USFWS and the NPS to develop a groundwater model for a majority of the Niobrara Basin. The basin model does not include the basin above the Dunlop Diversion, south of Hay Springs. The UNWNRD model does include the upper Niobrara River and thus will provide modeling capabilities for the entire basin.

Goal Three: Develop and implement customized and decentralized water management plans established through collaboration with local Natural Resource Districts and stakeholders that provide for long-term sustainability of the state's water resources.

To accompany the mandatory IMP, the UNWNRD and NDNR have undertaken the process of developing a voluntary integrated management plan for the portion of the district that is not fully appropriated. Once the plan and the model are complete scenarios can be run that will ensure the established goals and objectives are being properly worked towards.

Goal Five: Protect existing water uses through collaborative investments in water resource projects, planning, administration and permitting of surface water rights, and the registration of groundwater wells.

The updated model will be used as a collaborative investment water resource project that will utilize annual field measurements and observations to determine if surface and groundwater management activities are sufficient to sustain the resources.

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.

In 1991, 76 miles of the Niobrara River, from Valentine to Highway 137 north of Newport was designated as national scenic river. Since the designation, the National Park Service and the US Fish and Wildlife Service have been moving towards obtaining a federal reserved water right. The NDNR recently has been meeting with the parties to develop an agreement with the state and the NRDs without the federal right. Said agreement would protect the flows of the river, while at the same time protect all existing uses.

The project would be utilized to conduct planning exercises and scenarios to determine the most appropriate management techniques that would achieve the requirements of the agreement.

While not in place currently, NDNR is confident one mechanism will be exercised in the near future.