NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: **WWUM Modeling: Creation of Dashboard Data Exchange Web App and Data Processing Improvements**

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

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

Sponsor Contact's Name: **Rod Horn**

Sponsor Contact's Address: **551 Parkland Drive, PO Box 294, Sidney, NE 69162-0294**

Sponsor Contact's Phone: **308.254.2377**

Sponsor Contact's Email: **rlhorn@spnrd.org**

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

   Grant amount requested. **$ 240,000**

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

   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. **N/A**
- What is the population served by your project? **N/A**
- Provide a demonstration of need. **N/A**
- **Do not complete the remainder of the application.**

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

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

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

Click here to enter text.

4. **Partnerships**

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

North Platte Natural Resources District

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 SPNRD and the NPNRD are the sole entities involved in the project. General responsibilities will involve hiring a consultant to complete the project on time and within budget.

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.

The cost of the entire project is $400,000. The SPNRD and the NPNRD would provide 40% of this total, with the Water Sustainability Fund providing the remaining 60%. There are no other sources of funding for the project.

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!

The Western Water Use Management Modeling (WWUMM) is an effort designed to provide the North Platte Natural Resources District, South Platte Natural Resources District, and Nebraska Department of Natural Resources with a set of crop consumptive use, groundwater, and surface water modeling tools to aid in evaluating and providing decision support for management of river, stream, and aquifer systems within the modeling area.

The 5 key objectives of the project are:

1) **Construct a WWUMM Dashboard web application to allow for a seamless data exchange between the NRDs and DNR.**
2) **The modernization of the CROPSIM modeling through upgrades to the crop coefficients, an increased number of soils, utilize enhanced evapotranspiration calculations, climate information quality assurance and control procedures, and provide the ability to complete these model runs for the annual update.**
3) **Implementation of Artificial Intelligence for Annual Land Use Updates**
4) **Integration of Monthly Pumping Information and Other Land Use Classifications**
5) **Collect and Analyze Aquifer Information and Extend Modeling through 2022**

The WWUMM Dashboard web application will provide data exchange, an annual update platform, and Robust Review results portal for the WWUMM. This feature set will significantly enhance the data sharing capabilities with cooperating agencies and stakeholders from both within and outside of the NRD. The modernization of the existing CROPSIM modeling will be undertaken to enhance this program and will be renamed the Enhanced Soil Crop (ESC) Modeling within the WWUMM. The current computing technology includes a useful and capable artificial

intelligence algorithm to aid in land use recognition updates and to utilize the tool to update the land use through 2022. The current land use data set will have municipal/industrial areas, roads, farmyards, railroads, and riparian areas incorporated into the land use datasets, which at present are represented as generic pasture datasets. NPNRD has been collecting monthly pumping information from its network of connected flowmeters and this information will be integrated into the existing annual pumping dataset to greatly increase accuracy of the monthly pumping amounts. The project will also conduct passive and active aquifer testing techniques that utilize NRD monitor wells to determine aquifer properties; geologic log analysis of producible aquifer materials on oil and gas and NRD geophysical logs; and, an extension of the modeling through 2022.

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):

- 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.

Tasks	Year 1	Year 2	Total
WWUMM Dashboard Data Exchange and Annual Update Platform	$22,000	$23,000	$45,000
ESC Modeling	$37,500	$37,500	$75,000
A-I Powered Annual Land Use Update Tool	$20,000	$10,000	$30,000
New Land Use Classifications	$10,000	$15,000	$25,000
Integration of Monthly Pumping Records to Increase Accuracy	$15,000	$25,000	$40,000
Gathering Aquifer Properties Data through Well Testing	$37,500	$37,500	$75,000
Incorporation of Data for Aquifer Parameters of Producible Water	$28,000	$22,000	$50,000
General Update and Extension of Model through 2022	$15,000	$10,000	$25,000
Documentation, Coordination, Robust Review	$15,000	$20,000	$35,000
Totals	$200,000	$200,000	$400,000

8. **IMP**

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

Section B.

DNR DIRECTOR'S FINDINGS

Prove Engineering & Technical Feasibility

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

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

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

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

1.A.1 Insert a feasibility report to comply with Title 261, Chapter 2, including engineering and technical data; **N/A**

1.A.2 Describe the plan of development (004.01 A); **N/A**

1.A.3 Include a description of all field investigations made to substantiate the feasibility report (004.01 B); **N/A**

1.A.4 Provide maps, drawings, charts, tables, etc., used as a basis for the feasibility report (004.01 C); **N/A**

1.A.5 Describe any necessary water and/or land rights including pertinent water supply and water quality information (004.01 D); **N/A**

1.A.6 Discuss each component of the final plan (004.01 E); **N/A**

1.A.7 When applicable include the geologic investigation required for the project (004.01 E 1); **N/A**

1.A.8 When applicable include the hydrologic data investigation required for the project (004.01 E 2); **N/A**

1.A.9 When applicable include the criteria for final design including, but not limited to, soil mechanics, hydraulic, hydrologic, structural, embankments and foundation criteria (004.01 E 3). **N/A**

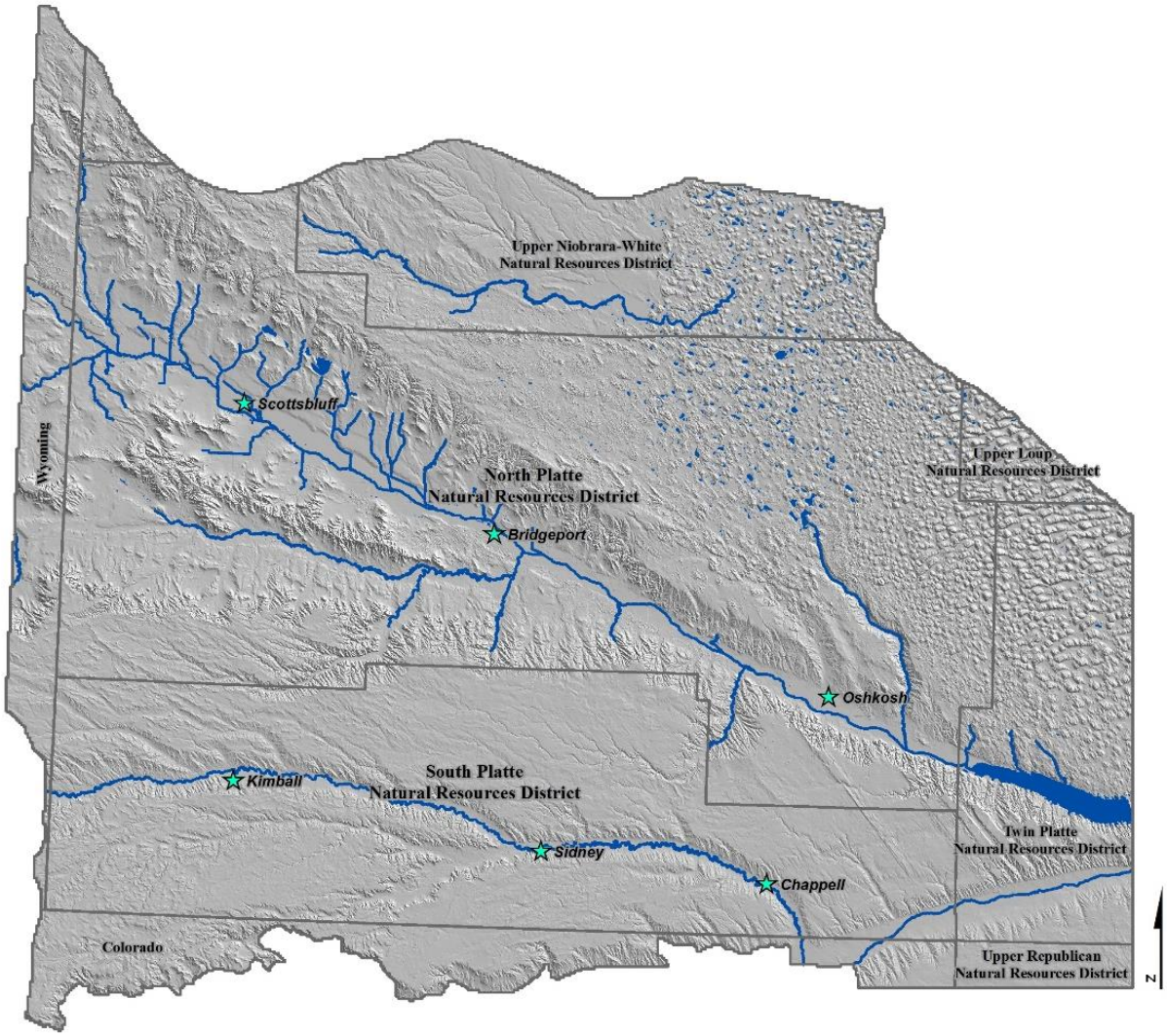
If "NO", it is considered mostly non-structural, so answer the following:

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

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

WWUMM Introduction

Groundwater and surface water models are critical components of Nebraska's water planning efforts. These models work together, creating tools capable of analyzing management scenarios such as the effect of conjunctive management projects, well pumping, alternative surface water operations, among others. One of these essential modeling tools for the upper portions of the North Platte and South Platte Rivers in Nebraska is the Western Water Use Management Modeling (WWUMM), which area is shown on the following map.



This WWUMM project will accomplish several required developments, updates, refinements to the modeling that will significantly enhance the model's data exchange, functions, and accuracy. This project allows North Platte and South Platte Natural Resources Districts (NPNRD, SPNRD, or NRDs) to complete essential analyses of their water management actions and projects, as well as to evaluate existing and potential projects to meet their Integrated Management Plan (IMPs) goals of reducing consumptive use and increasing streamflow.

The NRDs implemented actions include allocations, groundwater certified acreage retirements, excess surface water recharge projects, and surface water leasing projects to lease consumptive use of surface water irrigated lands. To determine the success of these actions and adapt to changing

conditions, the NRDs rely on the WWUMM to quantify the effects. The results provide critical information to the NRDs to help them understand how their water management efforts benefit their constituents and downstream water rights users. Beyond the management actions and projects, each NRD works with local municipal, industrial, and agricultural water users to determine the effects of changes in well locations as it relates to the NRDs IMP goals.

WWUMM Dashboard Data Exchange and Annual Update Platform

Since the conception of the WWUMM, cooperation and data sharing has been an essential practice in allowing DNR and others to have access to results, processed data, and even raw datasets. As the model has become significantly more complex and sophisticated, it is increasingly more difficult and, in some respects, impossible to share data using single-file formats or native database formats. The utilization of cloud-based storage techniques to ensure data integrity and access performance has become necessary. Today, the sheer size of the datasets and complexity require DNR or other end-users to gather the data they need directly from the cloud data storage.

The WWUMM Dashboard Data Exchange and Annual Update Platform will enable shared cloud data with DNR and other stakeholders when they require it. This platform will eliminate the necessity that massive files and data preparation efforts be undertaken to enable sharing, only to have it outdated as soon as new information is incorporated into the modeling from many of the WWUMM sources. The WWUMM Dashboard App will be a web-based design to assist in providing secure access to annual pumping, diversion data, modeling input files, modeling results, and other information. The Dashboard will also provide public access to a subset of the data results and various reports relevant to the WWUMM.

Another function of the WWUMM App will be to provide a secure cloud portal to trigger the update process of the various models and to ensure that this process is completed correctly. Being integrated into the app will allow for many users to collaborate and ensure that the process is not local to a computer but done securely in the cloud with proper backup and redundancy enabled. Extensive coordination and cooperation with DNR will be completed to make sure that this data exchange tool will provide the necessary information that is required to complete IMP, data, and modeling file related exchanges.

ESC Modeling

A core module to the WWUMM has been the CROPSIM model. This model was previously updated from its original Fortran code into Python code, to allow the operation within the WWUMM suite instead of an external operation and to enable utilization of new data access techniques, including connection to databases and REST APIs. This project will combine several processes and new capabilities into both the CROPSIM and the existing Regionalized Soil Water Balance Modeling to allow for the use of additional soils, land use types (detailed below), monthly pumping information (described below), newer methods of evapotranspiration analysis, determination of lawn irrigation return flows (LIRFS), and creation of weather quality assurance and control procedures for the collection of data in the study area.

To clearly define the model and to differentiate that we're not modifying or extending the CROPSIM modeling or the Regionalized Soil Water Balance Modeling (RSWBM) that may be used in other parts of the state, this suite of tools will now be called the 'Enhanced Soil Crop Modeling' (ESC) Modeling component of WWUMM. The ESC Modeling will be based upon both CROPSIM and RSWBM but will deviate from its current form to better characterize the conditions found in the modeling area. The

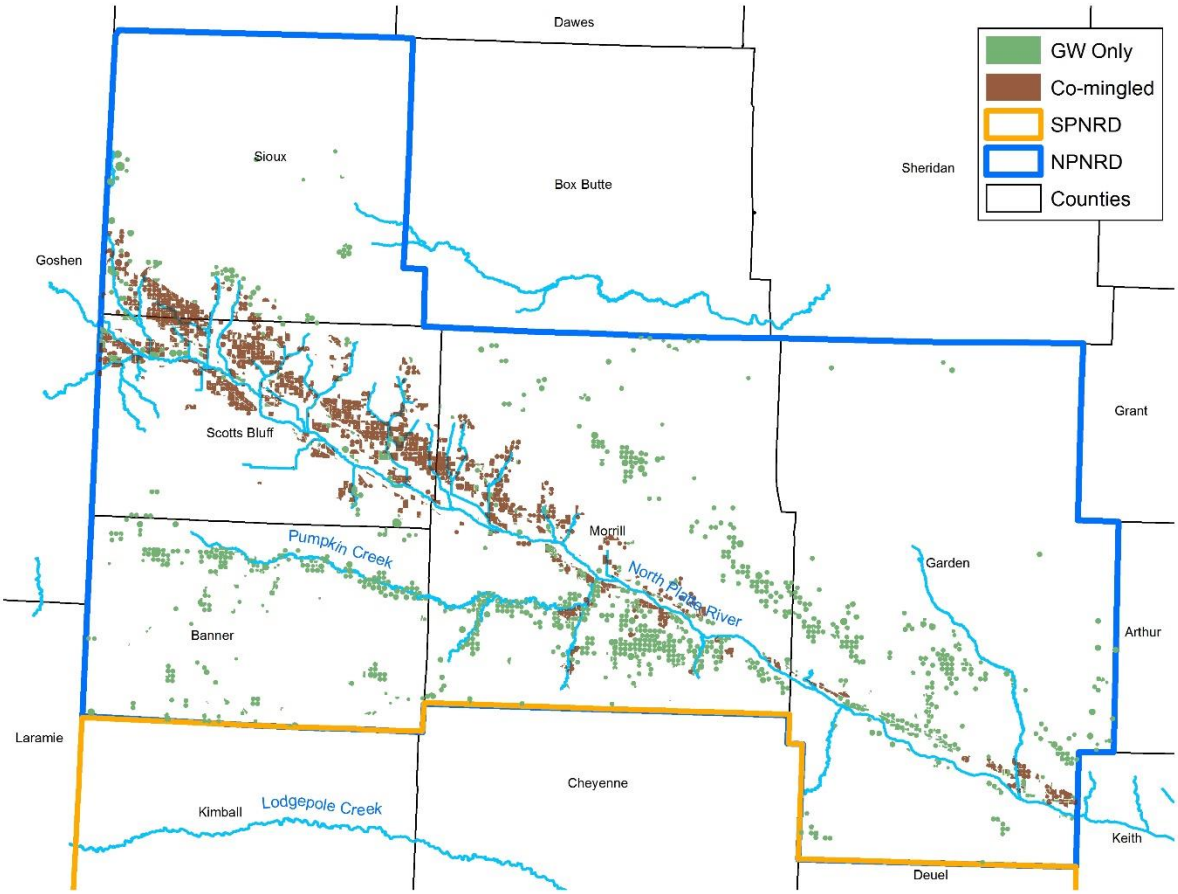
ESC Modeling will be fully integrated into the WWUMM Web App and provide new capabilities that ensure greater accuracy and precision of the modeling results. Also, research will be conducted during this task regarding the potential to integrate remote sensing of field and regional scale evapotranspiration estimates from satellite-based data. Additionally, extensive coordination and cooperation with DNR will be completed for this portion of the modeling development so that these tools are created with the input for all the users of the WWUMM.

A-I Powered Annual Land Use Update Tool

The WWUMM requires constant updates to provide the most accurate and relevant data in the NRD decision making process. Many of the previous modeling improvements and updates have focused on creating a Land Use dataset that was being updated on a triennial or greater frequency. As many processes become automated, the land use must be updated at an even greater rate, which is a major driving force in the determination of water use and return flows within the regional model.

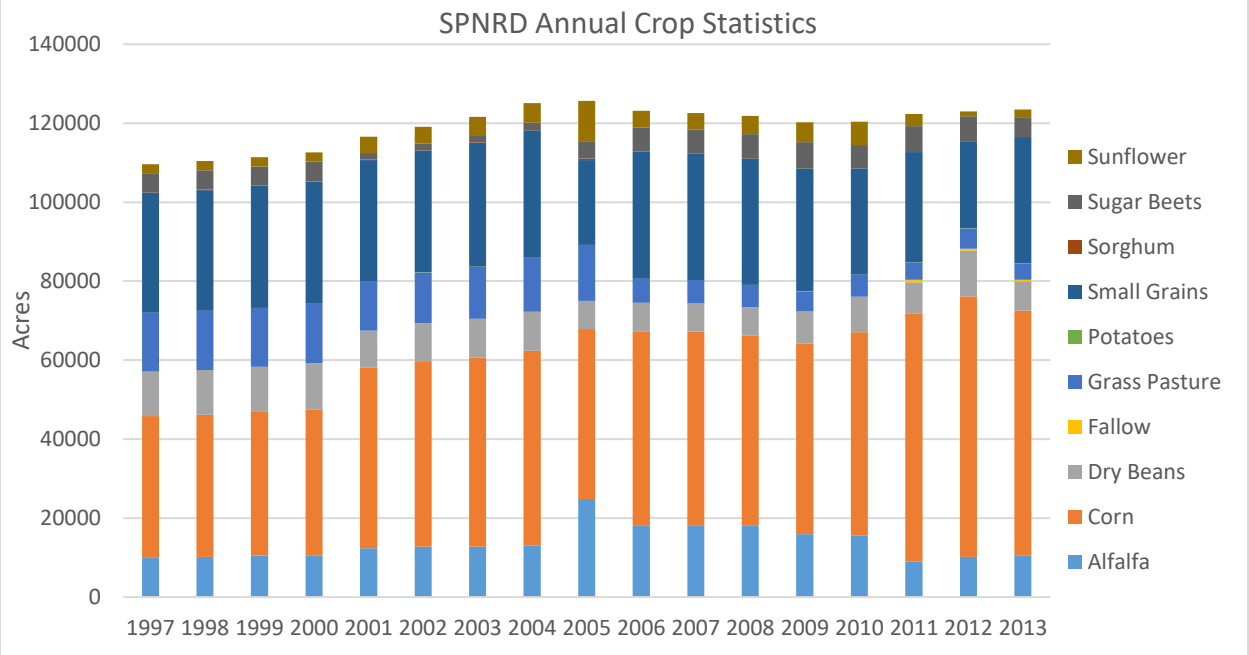
To enable the update frequency to be a cost-effective operation for each NRD and quickly update the Land Use, this project will create an open-source automated tool to create annual land-use datasets using Artificial Intelligence (A-I) techniques using satellite imagery, USDA NASS CropScape data, and NRD data. This tool will also be integrated into the WWUMM App for operations, viewing inputs, and sharing results. As an example, the following map shows the NPNRD ground water certified irrigated acres information that is utilized in the WWUMM land use datasets.

NPNRD Certified Irrigated Acreage



New Land Use Classifications

Once the A-I procedure is implemented, an additional Land Use classification will be required to assess the coverage more accurately. Currently, municipal/industrial areas, roads, farmyards, railroads, small lakes, and riparian areas are all classified as "Grass Pasture" areas. While initially suitable, with the creation of the ESC Modeling having enhanced abilities to estimate soil water balance in these areas and recognition abilities by the A-I to classify these features, these new classifications give WWUMM the ability to appropriately estimate the water balance within the modeling domain. The addition of these datasets will be integrated with the implementation of the A-I datasets and then using the A-I capabilities superimposed on previous recent datasets to enhance



their accuracy. The following figure shows SPNRD's irrigated acreage crop statistics that will be improved with these new classifications.

Integration of Monthly Pumping Records to Increase Accuracy

Since 2017, NPNRD installed telemetry and has been collecting monthly pumping data from a subset of flow meters. This data has been logged on several hundred wells throughout their system but has yet to be integrated into the WWUMM.

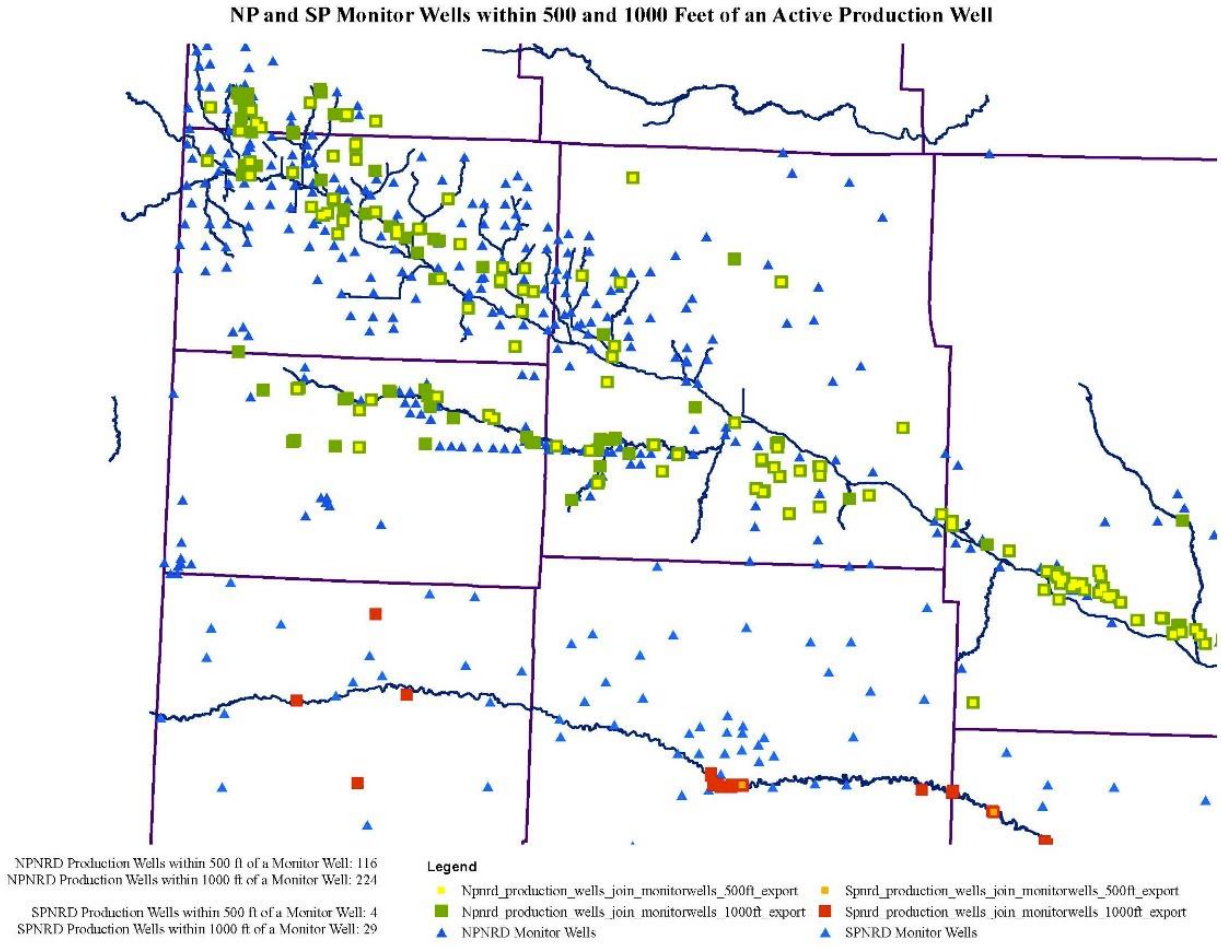
At present, the modeling uses annual pumping volumes of the wells. Those volumes are distributed by a crop demand curve value throughout the year based upon crop type. The monthly pumping information integration will significantly improve the model accuracy by determining when the water is pumped, to reflect individual farm management decisions that are not currently represented. Also, this monthly data will give a new method to determine past pumping distributions based upon recorded farm management decisions instead of the idealized crop water use curves presently used. This new data will be incorporated into the ESC Modeling methods.

Gathering Aquifer Properties Data through Well Testing

Another essential modeling component of WWUMM is the aquifer properties used in groundwater modeling. During the past two major model update cycles, the groundwater modeling has been changed substantially using the latest techniques and software for analysis. It has become evident that the aquifer properties need further enhancement in the modeling. These properties are the

critical component in determining the effects of the pumping of groundwater and return flow timing throughout the aquifer. A refined understanding of these properties will significantly enhance the modeling results and add to the reliability of decision making for the NRD.

To determine the aquifer properties, this project task will utilize the extensive monitoring well network in NPNRD and SPNRD, where more than 270 monitoring wells are capable of being field-tested for this purpose. The following map shows the NPNRD and SPNRD monitor wells that can be field-tested to provide this enhanced information for the WWUMM.



Analyzation and Integration of the Producible Aquifer Material Information

Within the WWUMM, the assumption that the entire Ogallala Formation and Arikaree Formation aquifers can produce water has been called into question with the recent creation of extensive and detailed geophysical well logs. There are, in many instances, silty or highly cemented layers within the aquifer that produce little water. This information needs to be analyzed and incorporated into the groundwater modeling to enhance the model's representation of these aquifers. This modeling enhancement will likely have a substantial effect on the results of the aquifer life analysis that the NRDs complete to understand future drawdown in these deep aquifers, which results help inform the NRD Boards and the public while also providing an accurate understanding of current and potential aquifer management.

General Update and Extension of Model through 2022

The final operational task will be the general update of the modeling from its current operational time period of 1953 to 2020, to be modified to operate through 2022. This will include the addition of surface water diversions and gauge records, new climate data, ground water level data, and crop type data from the NRDs and CropScape. This new data combined with the modeling, land use data enhancements, and A-I processes included above, will create operational datasets and modeling results datasets for the implementation and decision making of the NRDs through 2022.

Documentation, Coordination, Robust Review

The last component of this project is the documentation, coordination, and robust review dataset creation of the modeling. Reports will be created for each modeling component to document the changes in the modeling and the update and extension through 2022. As with any modeling upgrade effort, extensive coordination with the NRDs and DNR will commence.

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

The WWUM modeling can generally be described as an effort designed to provide the NPNRD, SPNRD, and DNR with a set of crop consumptive use, groundwater, and surface water modeling tools to aid in the management of river, stream, and aquifer systems within the modeling area. The current WWUM model is the product of many years of model development and data collection going back to the initiation of the Cooperative Hydrology Study in 1997. The WWUM modeling project builds on these prior studies. The following two excerpts are provided to document the previous research investigations utilized to substantiate the proposed project.

1. **The report entitled "Groundwater Flow Model for the Southern Half of the Nebraska Panhandle" by Richard R. Luckey dated 2013 provides the following description of previous work:**

"Luckey and Cannia (2006) previously described this study area and much of this section is repeated directly from that report. The earliest studies of groundwater in western Nebraska were done by Darton (1899, 1903, and 1905). Meinzer (1917) did a brief investigation of Lodgepole Creek Valley and Bjorklund (1957) did a more extensive study of the area. Cady and Scherer (1946) did the first of several studies of Box Butte County. Later studies of Box Butte County included those of Nace (1953), Souders and others (1980), and Pettijohn and Chen (1984). Wenzel and others (1946) studied Scotts Bluff County, Babcock and Visher (1951) studied the Dutch Flats area, and Babcock and Visher (1952) studied the Pumpkin Creek valley, which is predominately in Banner and Morrill Counties. Bjorklund and Brown (1957) studied the South Platte valley. Smith (1969) studied Cheyenne County, Smith and Souders (1971) studied Kimball County, and Smith and Souders (1975) later studied Banner County.

Large area studies after the Darton (1905) study began with the Missouri River Basin Commission (1975). This was later followed by the Missouri Basin States Association (1982a and 1982b). A study of the entire High Plains aquifer was reported by Gutentag and others (1984) and Weeks and others (1988). Pettijohn and Chen (1983a and 1983b) did more detailed reports on the Nebraska portion of this study of the High Plains aquifer. Conservation and Survey Division (1998)

did a report on the groundwater resources of the entire state of Nebraska. Stanton and others (2011) prepared water budgets for the entire High Plains aquifer.

More recent groundwater studies in the North Platte valley include those of Steele and others (1998), Verstraeten and others (2001), and Steele and others (2002). These studies covered only small parts of the study area. Studies of canal bed sediments and canal leakage potential include Kress and others (2004), Ball and others (2006), Burton and others (2009), and Vrabel and others (2009). Studies of western Nebraska that included a groundwater flow model or other detailed numerical analysis include Missouri River Basin Commission (1975), Lappala and others (1979), Missouri Basin States Association (1982a and 1982b), Pettijohn and Chen (1984), Luckey and others (1986), McLean and others (1997), Luckey and Cannia (2006), Ayers (2007), Peterson and others (2008), and Stanton and others (2010).

Studies of the geology of western Nebraska of particular importance to the current study include Swinehart and Diffendal (1997) and Swinehart and others (1985). Land-use studies were published for 1982 (Dappen and Merchant, 2004), 1997 (Dappen and Tooze, 2001), 2001 (Dappen and Merchant, 2003), and 2005 (Dappen and others, 2006). Testhole descriptions have been published for most of the counties in the study area. These include Arthur County (Diffendal and Goeke, 2000), Banner County (Smith, 2000a), Box Butte County (Smith, 2000b), Cheyenne County (Diffendal, 2000), Deuel County (Diffendal, 1999), Garden County (Smith and Swinehart, 2000), Keith County (Diffendal and Goeke, 2004), Kimball County (Smith 2000c), Morrill County (Souders and Swinehart, 2000), Perkins County (Dreeszen, 2000), and Scotts Bluff County (Sibray and Smith, 2000)."

2. **The summary of the Luckey, 2013 report follows:**

"This report documents a groundwater flow model of 11,100 mi2 of the southern two-thirds of the Nebraska Panhandle. The study area extends from the limit of the High Plains aquifer on the south to groundwater divides and flow lines on the north and from 6 mi into Wyoming on the west to the dam on Lake McConaughy on the east. Groundwater generally flows from west to east in the study area, and more locally flows to streams that drain the area. Geologic units that make up the High Plains aquifer include the fractured Brule Formation, Arikaree Group, Ogallala Group, Broadwater Formation, and various sediments of Quaternary age. Saturated thickness in the study area ranges from essentially zero to over 800 ft.

The largest saturated thickness occurs beneath the Sand Hills in the northeastern part of the study area. Elsewhere, saturated thickness is quite variable, and in places is controlled by paleovalleys. Prior to settlement, recharge occurred because of precipitation on rangeland. This recharge ranged from less than 0.20 in/yr on the tablelands in the southwestern part of the study area to more than 2.4 in/yr in the Sand Hills in the northeastern part. Beginning in the late 1800s, canals were used to irrigate land and this caused additional recharge. The primary natural discharge from the aquifer was baseflow to streams and rivers that drain the area. Prior to development of the surface-water system, most of the discharge occurred to the North Platte River and its western tributaries had little flow. In the east, Blue Creek received substantial discharge from the aquifer. A secondary mechanism for discharge from the aquifer was evapotranspiration where the water table was near land surface. The largest such area is in the Sand Hills in northern

Garden County and southern Sheridan County where there are numerous lakes. There also is evapotranspiration from the riparian forests along the North Platte River and South Platte River.

Beginning in about the 1950s, pumpage for irrigation became a substantial artificial discharge from the aquifer. The history of the groundwater flow system was broken into three periods: the pre-canal period before the late 1800s; the pre-ground-water development period before the early 1950s; and the groundwater development period after the early 1950s. In the model, the first period ended in 1895, the second period ended in 1953, and the third period ended in 2011.

MODFLOW-2000 was selected as the groundwater flow modeling code for this study. The code uses block-centered finite-difference techniques to solve the groundwater flow equation at numerous points throughout the study area. The study area was divided into 177,780 cells of 40 acres each in the model. The pre-canal period was simulated using a 2,000-year period with time steps of 5 or 10 days. The pre-ground-water period was simulated with 5-day time steps for an irrigation period and a non-irrigation period each year. The groundwater development period was simulated using 5-day time steps for monthly periods. The external boundaries of the model included lateral fixed head (water-level) boundaries, lower no-flow boundaries at the base of the aquifer, and the simulated water table. Internal boundaries of the model included streams, lakes, springs, and evapotranspiration areas.

Two aquifer properties were estimated during calibration of the model: hydraulic conductivity and specific yield. Hydraulic conductivity, which describes the flow through the aquifer under laboratory conditions, ranged from 7 ft/d in part of the Arikaree Formation to 150 ft/d in part of the Quaternary age alluvium. Specific yield, which describes release of water from storage in the aquifer, ranged from 0.135 to 0.15 (dimensionless). Other model inputs adjusted during model calibration included streambed conductance and paleovalleys. Streambed conductance, which is one parameter that controls stream-aquifer interaction, ranged from 1.0 ft/d per foot of length to 20 ft/d per foot of length in the calibrated model. Paleovalleys were used to adjust both base of aquifer and hydraulic conductivity. Within paleovalleys, base of aquifer was lowered 200 ft and hydraulic conductivity was increased to 120 ft/d. Two aquifer stress, recharge and pumpage, were estimated in concurrent studies and were provided to this study. These stresses were not changed during model calibration.

Other model inputs were set during model construction and were not changed during model calibration. Simulated 1953 water levels at 297 targets ranged from 100 ft below observed values to 86 ft above observed values. The weighted average difference was -2.9 ft and the unweighted average difference was -7.2 ft. The weighted mean absolute difference was 7.2 ft and the unweighted mean absolute difference was 20.6 ft. Simulated fall 1952 baseflow for north side tributaries to the North Platte River above Pumpkin Creek was about the same as observed baseflow. Simulated spring 1953 baseflow for the same tributaries was 19 percent greater than observed baseflow. The largest simulated inflow component of the 1952-53 water budget was recharge and the largest outflow component was streamflow.

The overall error in the water budget was 546 acre-feet, compared to overall recharge of 1,197,000 acre-feet. Simulated 2010-11 water levels at 85 targets ranged from 71 ft below observed values to 94 ft above observed values. The average difference was +2.5 ft. For 1953-

2011, there were 8,290 targets at 131 sites. The weighted average difference was -2.5 ft and the unweighted average difference was -4.6 ft. The weighted mean absolute difference was 10.0 ft and the unweighted mean absolute difference was 17.0 ft. Simulated fall 2010 baseflow for north side tributaries to the North Platte River above Pumpkin Creek was about 18 percent greater than observed baseflow. Simulated spring 2011 baseflow for the same tributaries was 12 percent greater than observed baseflow. The average simulated 1953-2011 baseflow to the North Platte River at Lewellen was about 1,320 ft3/s while the average observed baseflow was about 1,290 ft3/s. The largest simulated inflow component of the 2010-11 water budget was recharge and the largest outflow components were streamflow, pumpage, and decrease in storage. The overall error in the water budget was 4 acre-feet, compared to overall recharge of 2,009,500 acre-feet."

For the full suite of research investigations utilized to substantiate the proposed project, please see the following webpage for all of the model's documentation http://www.spnrd.org/Html/WWUM.html.

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

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).

There are currently no known structural measures which may be affected by the project. However, the WWUM modeling will provide the analysis tools upon which many projects will be evaluated in the future because of the requirements of the IMPs for the NRDs. Any projects that may impact streamflow and aquifer declines will need to be analyzed and projects specifically designed to improve streamflow will be assessed with the WWUM modeling for their effectiveness.

The anticipated analyses include allocation effects, certified groundwater acreage retirement effects, canal recharge project effects, and surface water consumptive use leasing. These projects are designed to enhance streamflow or reduce groundwater level declines and require complex analyses to determine the effectiveness of the management actions. In addition to these analyses, a calculation of their first and second increment depletion obligations must be completed by identifying the groundwater irrigated acres that have been developed after July 1, 1997, and then determining the depletion associated with those acres. Finally, the NRDs need to identify the change in irrigation efficiencies from a less efficient flood irrigation method to a much more efficient center pivot sprinkler irrigation method, which can only be accomplished using a robust land use dataset provided through this project. This will provide additional information on these peripheral changes in irrigation methods that are influencing the surface and groundwater systems.

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 next best option to the current WWUMM effort's advanced modeling techniques and highly complicated numerical groundwater modeling is the utilization of basic information, processes, and an analytical calculation approach to groundwater depletion. Attempting to utilize this the basic data and the analytical approach would be exceedingly cumbersome, overly simplistic, and would likely fail to hold up under scrutiny.

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

3.A Describe any relevant cost information including, but not limited to the engineering and inspection costs, capital construction costs, annual operation and maintenance costs, and replacement costs. Cost information shall also include the estimated construction period as well as the estimated project life (005.01).

The total project cost is $400,000. These costs are for payment to consultants to complete the scope of work.

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

The project will directly increase water sustainability by providing a means to analyze the impacts of water uses in the sponsor NRDs and to determine the extent to which those uses are sustainable without taking additional actions to manage water uses and supplies. To the extent water uses are not sustainable, the WWUMM will provide a tool for the analysis of the effect of various management actions in reaching water sustainability to aid in management decision making. The WWUM modeling is essential to the NRDs as

they implement management actions required within their Integrated Management Plans, evaluate the effectiveness of those actions, and ultimately reach and maintain a level of water use in the districts that is sustainable over the long term.

3.C Present all cost and benefit data in a table to indicate the annual cash flow for the life of the project (005.03).

See attached Table (Attachment A).

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 WWUM modeling project is a mandatory project for the sponsor NRDs. This is because the NRDs have several goals and objectives in their Integrated Management Plans and Groundwater Management Plans that they are required to accomplish, and the WWUM modeling project is essential to determine if these goals and objectives have been met. Moreover, the NRDs are required to utilize the "best available information" (Nebraska Rev. Statutes §46-709) in carrying out these duties. Without the WWUM modeling project, there are no other cost-effective means to determine if these goals and objectives have been accomplished utilizing the best available information. These goals and objectives are inherently beneficial because they are designed to meet statutorily mandated requirements that are in place to ensure long-term water sustainability in the project area.

In addition, many of these goals are related to obligations that the State of Nebraska has to the Platte River Recovery Implementation Program (PRRIP), an interstate agreement signed by the Governors of Nebraska, Colorado, and Wyoming, and the U.S. Secretary of the Interior. Under the PRRIP, Nebraska has made several commitments to the other States and the signatory federal agencies. Without the WWUM modeling project, Nebraska will be unable to demonstrate that it has met those obligations, which otherwise would threaten to deprive Nebraska of the benefits provided by the PRRIP. These benefits are related to the Endangered Species Act; more specifically to three endangered and one threatened species on the Central Platte River, the whooping crane, the least tern, the pallid sturgeon, and the piping plover, respectively. The PRRIP is beneficial to Nebraska. It fully meets any conditions that the U.S. Fish and Wildlife Service might require for water users in the Platte River Basin, which would, without the program, likely cost many hundreds of millions of dollars in direct expenses and reduced economic output. For example, the Environmental Impact Statement for the PRRIP indicated that the implementation of other alternatives could cost approximately $250

million and the economic output could be reduced by over $10 million annually for the Platte River Basin in Nebraska.

Prove Financial Feasibility

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

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

See attached documents that present the NRDs budgets for FY 2019-2020 and attached letters documenting that the NRDs intend to budget adequate funds in FY 2021-2022 and FY 2022-2023 (Attachment B).

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

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

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

The project will have no negative impact on the natural environment.

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

The NRDs have a wide range of statutory responsibilities and authorities, including but not limited to Nebraska Revised Statutes §2-3,201 through 2-3,243 and the Ground Water Management and Protection Act (Nebraska Rev. Statutes §46-701 through 46-756). As Nebraska's preferred regulator of groundwater, they are clearly both qualified and responsible for carrying out the proposed project. Specifically, Nebraska Rev. Statutes §46-707(f) confers to the NRDs the power to "conduct investigations and cooperate or contract with ... public or private corporations, or any association or individual on any matter relevant to the administration of the [Ground Water Management and Protection] act." The NRDs have several potential funding sources available to use in meeting their share of the project cost.

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

The project is being implemented to fulfill, in part, the requirements of the Integrated Management Plans (IMPs) for the sponsor natural resources districts. The IMPs are written in accordance with the Basin-Wide Plan for the Upper Platte River Basin. Both the IMPs and the Basin-Wide Plan are required by the Nebraska Ground Water Management

and Protection Act (GWMPA). In addition, Nebraska is a signatory to an interstate agreement called the Platte River Recovery Implementation Program (PRRIP). This project will assist the NRDs and the State of Nebraska to demonstrate that the State is meeting its obligations under the PRRIP. Finally, both NRDs have groundwater management plans (GMP) pursuant to the GWMPA. The WWUM modeling will assist Nebraska and the sponsor NRDs in meeting the requirements of all these plans.

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

If yes:

10.A Provide a complete listing of all lands involved in the project. **N/A**

10.B Attach proof of ownership for each easements, rights-of-way and fee title currently held. **N/A**

10.C Provide assurance that you can hold or can acquire title to all lands not currently held. **N/A**

11. Identify how you possess all necessary authority to undertake or participate in the project.

The South Platte and North Platte Natural Resources Districts are specifically tasked by the Legislature to manage groundwater as well as hydrologically connected groundwater and surface water. They have a wide range of statutory responsibilities and authorities, including but not limited to Nebraska Revised Statutes §2-3,201 through 2-3,243 and the Ground Water Management and Protection Act (Nebraska Rev. Statutes §46-701 through 46-756). These responsibilities and authorities require the development and use of management tools such as the WWUMM. Specifically, Nebraska Rev. Statutes §46-707(f) confers to the NRDs the power to "conduct investigations and cooperate or contract with agencies of the United States, agencies or political subdivisions of this state, public or private corporations, or any association or individual on any matter relevant to the administration of the [Ground Water Management and Protection] act."

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 the 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.

Approximately 62,000 people that live in the North Platte Natural Resources District (NPNRD) and South Platte Natural Resources District (SPNRD) rely on the High Plains Aquifer for drinking water. The Nebraska Department of Energy and Environment's 2019

Nebraska Groundwater Quality Monitoring Report indicates there are already three community public water supply systems with mandatory requirements triggered by high levels of nitrates. In addition, there is one community public water supply system that is required to treat their drinking water due to high levels of uranium. The annual maps included in the report clearly indicate that the nitrogen contamination has become an increasingly important concern over the last several decades. Also, the uranium is naturally occurring, so there is every reason to expect that drinking water quality will continue to be at issue for this area.

Future alternate drinking water supplies will likely need to be identified, most likely coming from other groundwater sources. However, all of the NPNRD and SPNRD is designated as either fully appropriated or overappropriated. This means that any new use of hydrologically connected groundwater can only be developed if such use will not adversely impact existing users. In the absence of alternate water supplies, communities will be forced to turn to treatment options, which are generally much more expensive to implement and maintain, making this alternative a poor long-term solution. The most scientifically sound and up-to-date modeling tools are required to analyze new uses to ensure that these adverse impacts do not occur. Therefore, the WWUMM is a critical tool for communities to meet the increased challenges of providing safe drinking water to the people in this area.

2. Meets the goals and objectives of an approved integrated management plan or ground water management plan;

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

This project will assist the SPNRD and the NPNRD in meeting the goals and objectives of each NRDs' Integrated Management Plan (IMP) and Groundwater Management Plan (GMP). The NRD's Groundwater Management Plans are provided in Attachments C and D. The SPNRD's original IMP was jointly adopted by the SPNRD and the DNR on June 20, 2008 and updated on August 19, 2009. SPNRD adopted a second increment IMP on August 6, 2019. This increment was adopted by the DNR on August 9, 2019 and became effective on September 11, 2019, with the next increment in progress. The NPNRD's IMP was jointly adopted by the NRD and the DNR on August 13, 2009 and updated on April 16, 2013. Their second IMP was adopted by NPNRD on August 8, 2019 and by the DNR on August 9, 2019. This IMP became effective on September 11, 2019. The WWUMM has been essential in guiding and evaluating the first increment's success and will be used to determine the next increment's goals and objectives. The most recent version of the

SPNRD's GMP was adopted in 2002. The most current version of the NPNRD's GMP was adopted in 1993.

SPNRD IMP

The vision of the SPNRD's IMP is to work together for the greater good of all citizens of the South Platte Natural Resources District and to cooperatively develop and implement a local Integrated Surface Water/Ground Water Plan that has an acceptable degree of certainty of 1) maintaining a sufficient water supply for use by present and future generations, 2) maintaining, enhancing and protecting the region's agricultural economy and the viability of its cities and villages, and 3) promoting the growth of economic activities while seeking to avoid adverse impacts on the environment.

The goals and objectives of the SPNRD IMP are to 1) incrementally achieve and sustain a fully appropriated condition, 2) ensure that no act or omission of the SPNRD would cause noncompliance by Nebraska with any interstate compact or decree or other formal state contract or agreement pertaining to any groundwater or surface water use or supplies, and 3) keep the IMP current, maintain consistency with the Basin-Wide Plan, and keep water users informed of items relating to plan implementation. This project will assist the SPNRD by providing the necessary tools to assess meeting these goals.

NPNRD IMP

The vision of NPNRD's IMP is to 1) manage water resources in the NPNRD in a manner to balance water use and water supply while optimizing economic, social, and environmental benefits in the District for the near and long term; 2) protect to the extent possible existing users, local economy, environmental health, and recreational uses in the District; 3) manage total water supply in the NPNRD to achieve sustainability of supply and use while allowing for growth and changes in use; and 4) recognize there are multiple causes of streamflow depletion and to the extent possible distribute mitigation responsibilities appropriately.

The goals and objectives of the NPNRD IMP are to 1) incrementally achieve and sustain a fully appropriated condition while maintaining economic viability, social and environmental health, safety and welfare of the basin, 2) Prevent or mitigate human-induced reductions in the flow of a river or stream and ensure that no act or omission of the NPNRD or NeDNR would cause noncompliance by Nebraska with any interstate decree, compact, or other formal state contract or agreement pertaining to any groundwater or surface water use or supplies, and 3) keep the IMP current by maintaining consistency with the Basin-Wide Plan and keeping water users informed.

The history of work that has gone into meeting the goals and objectives of the SPNRD's and NPNRD's IMP began with the original adoption of their respective IMP in 2009. Since that time, the NRDs and the DNR have held annual basin-wide meetings, developed a

detailed protocol for use in monitoring the success in meeting these goals, and implemented numerous studies and data collection efforts. This has and will continue to culminate in the required Robust Review modeling evaluation utilizing the WWUMM.

SPNRD and NPNRD GMPs

The goal of the SPNRD's GMP is "to maintain an adequate supply of groundwater for all reasonable uses into the future. An adequate supply of groundwater is a supply that can maintain current annual demands without depleting the aquifers and without degrading groundwater quality." The goal of the NPNRD's GMP is to "(m)aintain an adequate supply of acceptable quality groundwater to forever fulfill the reasonable groundwater demands within the North Platte NRD for domestic, municipal, agricultural, industrial, wildlife habitat and other uses deemed beneficial by the people of the North Platte NRD." The WWUMM project will assist the SPNRD and the NPNRD in meeting these goals by supplying the information necessary to take management actions that will be required to ensure an adequate supply of groundwater will be available over the long-term.

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.

The WWUMM project will contribute to water sustainability by providing the necessary tools to implement management actions that will increase aquifer recharge, reduce aquifer depletion, or increase streamflow by delivering an accessible decision support system to the SPNRD and the NPNRD.

Aquifer recharge can be increased through diversions of surface water during times of excess flows, allowing the water to soak into the ground beneath canals, laterals, and recharge pits. These efforts have been conducting by the NRDs numerous times since 2011, where canals such as Farmers Canal, Central Canal, Belmont Canal, Enterprise Canal, etc. in NPNRD and Western Canal in SPNRD have been utilized for excess flow diversion and recharge. Additionally, both NPNRD and SPNRD have invested heavily in recharge pits to increase the amount of excess flow that can be diverted and recharged. The NPNRD currently has one main recharge pit complex within Enterprise Irrigation District, while SPNRD currently has 13 pits within Western Irrigation District. The modeling tools will help these efforts by providing information on potential diversion times, amounts, and the quantification of the benefits of these operations.

The modeling tools also assist the NRDs in reducing aquifer depletion and increasing streamflow by providing the information required to make future regulatory decisions. These NRDs have utilized allocations to limit the pumping in areas where aquifer depletions have been occurring, such as in the Ogallala and Arikaree Formations in the Tablelands of NPNRD and SPNRD where the aquifer is being depleted and water level declines are occurring. Numerous critical evaluations have been completed using the WWUMM to help the NRDs determine the appropriate amount of regulation to reduce aquifer depletion and provide a reliable future water supply in these areas.

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 WWUMM project will contribute to multiple water supply goals, including conservation and preservation of water resources and aquifer sustainability, by providing a comprehensive decision support system. The SPNRD and the NPNRD require the WWUMM to predict the potential benefits of various management actions, to quantify those actual benefits, and to provide guidance for future management decisions. Over the long term, the ability to make these informed management decisions will ensure these water supply goals are met. Without the continued development of the WWUMM project, the relative success of achieving these goals will be unknown and cannot be ensured.

5. Maximizes the beneficial use of Nebraska's water resources for the benefit of the state's residents;

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

The Integrated Management Plans for the SPNRD and the NPNRD, which address hydrologically connected surface and groundwater, has the goal of achieving and maintaining a fully appropriated condition for the overappropriated portions of the NRDs. The aquifers in these NRDs are highly stressed due to the extremely low average precipitation in this part of Nebraska. As a result of these factors, both NRDs have rules and regulations that limit the amount of groundwater that can be pumped per irrigated

acre. Both NRDs are striving to strike the appropriate balance between maximizing beneficial consumptive use and limiting impacts on the aquifers and streamflow.

The WWUMM project will allow the NRDs to make informed decisions regarding the appropriate level of regulation to accomplish their goals. This provides a beneficial impact to Nebraska's residents by ensuring that the contribution of the residents of these NRDs to the state's economy will be impacted only to the extent required as a result of any necessary regulations on water use.

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 $400,000. There is no other technically comparable way of achieving the same benefits. The WWUMM project is mandatory for the SPNRD and the NPNRD to accomplish a number of goals and objectives in their Integrated Management Plans. The WWUMM project is essential to determine if these goals and objectives have been met and to guide future conditions as they arise. In other words, without the WWUMM project, there are no other cost-effective means to determine if these goals and objectives have been accomplished. These goals and objectives are inherently cost-effective because they are designed to meet statutorily mandated requirements that are in place to ensure long-term water sustainability in the project area.

In addition, many of these goals are related to obligations that the State of Nebraska has to the Platte River Recovery Implementation Program (PRRIP), an interstate agreement signed by the Governors of Nebraska, Colorado, and Wyoming, and the U.S. Secretary of the Interior. Under the PRRIP, Nebraska has made several commitments to the other States and the signatory federal agencies. Without the WWUMM project, Nebraska will be unable to demonstrate that it has met those obligations, which otherwise would threaten to deprive Nebraska of the benefits provided by the PRRIP. These benefits are related to the Endangered Species Act; more specifically to three endangered and one threatened species on the Central Platte River, the whooping crane, the least tern, the pallid sturgeon, and the piping plover, respectively. PRRIP ensures Nebraska meets the conditions U.S. Fish and Wildlife Service requires for water users in the Platte River Basin and, without the program would likely cost many hundreds of millions of dollars in direct expenses and reduced economic output. For example, the Environmental Impact Statement for the PRRIP indicated that the implementation of other alternatives could cost approximately $250 million and the economic output could be reduced by over $10 million annually for the Platte River Basin in Nebraska.

7. Helps the state meet its obligations under interstate compacts, decrees, or other state contracts or agreements or federal law;

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

The WWUMM project is essential to Nebraska's ability to meet its obligations under the Platte River Recovery Implementation Program (PRRIP), an interstate agreement. Nebraska's obligations are contained within the Nebraska New Depletions Plan (NNDP), a component of the Water Plan for the PRRIP. Generally speaking, the NNDP requires Nebraska to offset any depletions to Platte River streamflow that result from new or expanded uses that have occurred subsequent to July 1, 1997. The sponsor NRDs have undertaken various management actions pursuant to their IMPs in order to provide compliance with the NNDP. However, the only way to document whether these actions have, in fact, been successful requires the WWUMM results using the updated management decisions and documented inputs. Without this project, it will be impossible to accurately document Nebraska's compliance with the NNDP for water uses within the sponsor NRDs.

8. Reduces threats to property damage or protects critical infrastructure that consists of the physical assets, systems, and networks vital to the state or the United States such that their incapacitation would have a debilitating effect on public security or public health and safety;

    - Identify the property that the project is intended to reduce threats to.
    - Describe and quantify reductions in threats to critical infrastructure provided by the project and how the infrastructure is vital to Nebraska or the United States.
    - Identify the potential value of cost savings resulting from completion of the project.
    - Describe the benefits for public security, public health and safety.

The groundwater supply in the SPNRD and the NPNRD is vital to the State of Nebraska and the United States. Without this supply, there would be a debilitating effect on public security, public health and safety. The ability to manage this supply through an informed decision-making process is vital to ensuring the sustainability of this supply, and the WWUMM project is absolutely necessary for this to happen.

As an example of the concern, the United States Department of Homeland Security's Office of Cyber and Infrastructure Analysis released a report in August of 2015 entitled Analysis of High Plains Resource Risk and Economic Impacts (Attachment E). The report analyzed how continued depletion of the High Plains aquifer in Kansas and Nebraska might impact critical infrastructure and the economy at the local, regional, and national levels. A key finding of this report is that "(i)f current water use practices are continued into the future, sixty counties in Kansas and seven in Nebraska are projected to face exhaustion of groundwater supplies in 100 years or less."

It is clear that water use practices will need to be carefully managed to ensure that groundwater is available in the future. This clear benefit to public security, public health and safety will be provided by the WWUMM project. It will provide information on the current status of groundwater availability and how that might change over time, informing SPNRD and the NPNRD on impacts of management decisions both present and for future generations.

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.

Both the SPNRD and NPNRD have nitrogen management subareas within their boundaries where high nitrates in the groundwater are a severe problem. The WWUMM can be utilized by the NRDs to provide geologic/hydrogeologic information, water source information from either surface water diversions or precipitation, and modeling to determine direction and movement of water in the aquifer to help determine how water quality may change in the future. This information is necessary for the NRDs to determine their non-point source pollution management strategies that impact both water users such as domestic and municipal supplies while helping the agricultural producer improve water quality and utilize existing sources of nitrates in the groundwater, which reduces input costs for growing crops.

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

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

The local jurisdictions that support the WWUMM project are the SPNRD and the NPNRD. These NRDs have and will continue to support the proposed project through their tax levy authority. The tax levy from the FY 2019-2020 for the NPNRD is 4.9302¢ per $100 valuation and for the SPNRD is 4.8884¢ per $100 valuation. The sponsor NRDs have also utilized other funding sources for this continued effort in the past, including the Interrelated Water Management Plan Program Fund administered by the NDNR and the Nebraska Environmental Trust (when the WWUMM was a part of the Cooperative Hydrology Study).

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 SPNRD's original IMP was jointly adopted by the SPNRD and the DNR on June 20, 2008 and updated on August 19, 2009. SPNRD adopted a second increment IMP on August 6, 2019. This increment was adopted by the DNR on August 9, 2019 and became effective on September 11, 2019, with the next increment in progress. The NPNRD's IMP was jointly adopted by the NRD and the DNR on August 13, 2009 and updated on April 16, 2013. Their second IMP was adopted by NPNRD on August 8, 2019 and by the DNR on August 9, 2019. This IMP became effective on September 11, 2019. The WWUMM has been essential in guiding and evaluating the first increment's success and will be used to determine the next increment's goals and objectives. The most recent version of the SPNRD's GMP was adopted in 2002. The most recent version of the NPNRD's GMP was adopted in 1993.

<u>SPNRD IMP</u>

The vision of the SPNRD's IMP is to work together for the greater good of all citizens of the South Platte Natural Resources District and to cooperatively develop and implement a local Integrated Surface Water/Ground Water Plan that has an acceptable degree of certainty of 1) maintaining a sufficient water supply for use by present and future generations, 2) maintaining, enhancing and protecting the region's agricultural economy and the viability of its cities and villages, and 3) promoting the growth of economic activities while seeking to avoid adverse impacts on the environment.

The goals and objectives of the SPNRD IMP are to 1) incrementally achieve and sustain a fully appropriated condition, 2) ensure that no act or omission of the SPNRD would cause noncompliance by Nebraska with any interstate compact or decree or other formal state contract or agreement pertaining to any groundwater or surface water use or supplies, and 3) keep the IMP current, maintain consistency with the Basin-Wide Plan, and keep water users informed of items relating to plan implementation. This project will assist the SPNRD by providing the necessary tools to assess meeting these goals.

NPNRD IMP

The vision of NPNRD's IMP is to 1) manage water resources in the NPNRD in a manner to balance water use and water supply while optimizing economic, social, and environmental benefits in the District for the near and long term; 2) protect to the extent possible existing users, local economy, environmental health, and recreational uses in the District; 3) manage total water supply in the NPNRD to achieve sustainability of supply and use while allowing for growth and changes in use; and 4) recognize there are multiple causes of streamflow depletion and to the extent possible distribute mitigation responsibilities appropriately.

The goals and objectives of the NPNRD IMP are to 1) incrementally achieve and sustain a fully appropriated condition while maintaining economic viability, social and environmental health, safety and welfare of the basin, 2) Prevent or mitigate human-induced reductions in the flow of a river or stream and ensure that no act or omission of the NPNRD or NeDNR would cause noncompliance by Nebraska with any interstate decree, compact, or other formal state contract or agreement pertaining to any groundwater or surface water use or supplies, and 3) keep the IMP current by maintaining consistency with the Basin-Wide Plan and keeping water users informed.

The history of work that has gone into meeting the goals and objectives of the SPNRD's and NPNRD's IMP began with the original adoption of their respective IMP in 2009. Since that time, the NRDs and the DNR have held annual basin-wide meetings, developed a detailed protocol for use in monitoring the success in meeting these goals, and implemented numerous studies and data collection efforts. This has and will continue to culminate in the required Robust Review modeling evaluation utilizing the WWUMM.

The goal of the SPNRD's GMP is "to maintain an adequate supply of groundwater for all reasonable uses into the future. An adequate supply of groundwater is a supply that can maintain current annual demands without depleting the aquifers and without degrading groundwater quality." The goal of the NPNRD's GMP is to "(m)aintain an adequate supply of acceptable quality groundwater to forever fulfill the reasonable groundwater demands within the North Platte NRD for domestic, municipal, agricultural, industrial, wildlife habitat and other uses deemed beneficial by the people of the North Platte NRD." The WWUM modeling project will assist the SPNRD and the NPNRD in meeting these goals by supplying the information necessary to take management actions that will be

required to ensure an adequate supply of groundwater will be available over the long-term.

The WWUM modeling project will support sustainable water use by providing the information required to properly manage the groundwater and hydrologically connected water supply in the NPNRD and the SPNRD. These NRDs are home to nearly 62,000 people and cover nearly 5 million acres of the state. The aquifer in this area is used for many beneficial purposes, including agricultural, domestic, livestock, industrial, and municipal uses. The stakeholders in this project are the nearly 62,000 people that live in the sponsor NRDs and will benefit from this project.

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.

The WWUMM project helps the state meet its obligations under the Platte River Recovery Implementation Program (PRRIP), which is a statewide issue. This interstate agreement was signed by the Governor in cooperation with the Legislature providing a significant amount of general fund appropriations through the DNR to implement PRRIP. The WWUMM project is essential to Nebraska's ability to meet its obligations under the PRRIP.

Nebraska's obligations are contained within the Nebraska New Depletions Plan (NNDP), a component of the Water Plan for the PRRIP. Generally speaking, the NNDP requires Nebraska to offset any depletions to Platte River streamflow that result from new or expanded uses that have occurred subsequent to July 1, 1997. The SPNRD and the NPNRD have undertaken various management actions pursuant to their IMPs in order to provide compliance with the NNDP. However, documentation of successful implementation requires the WWUMM project.

Without this project, it will be impossible to accurately document Nebraska's compliance with the NNDP for water uses within the sponsor NRDs. Successful implementation of the PRRIP and the NNDP provides benefits to the approximately 500,000 irrigated acres in the Platte River Basin that were developed subsequent to 1997. By successfully offsetting the impact of these irrigated acres, Nebraska's economy will benefit significantly by allowing those acres to remain in irrigated agriculture.

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 NPNRD and the SPNRD will pay 40% of the project cost, thereby contributing $160,000 to the project. This funding source is made available through the budgets of the sponsor NRDs, which are provided through their tax levy authority. Attached are copies of the NRD budgets showing their commitment to the project and letters documenting the NRDs intent to include the appropriate matching funds in their budgets for Fiscal Years 2021-2022 and 2022-2023 (See Attachment B). The budgetary commitment authority ensures the project will proceed and be completed.

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 WWUMM project will assist the NPNRD and the SPNRD in managing the hydrologically connected water supply of the North Platte River, the South Platte River, Pumpkin Creek, and Lodgepole Creek. The project will contribute to watershed health and function by providing the information required to make appropriate management decisions regarding consumption of these water supplies, and potential replacement of water supplies through managed recharge or streamflow augmentation.

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

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

The WWUMM project is a significant part of the DNR's objective of Integrated Management Modeling efforts for the Upper Platte River Basin. This can be seen on page 38 of the Annual Report and Plan of Work for the Nebraska State Water Planning and Review Process, submitted to the Governor and Legislature by the DNR in September of 2019. As stated in the report, "(t)he model integrates watershed, surface water

operations, and groundwater modeling components to create tools capable of analyzing varied management scenarios. Scenarios have included conjunctive management projects, well pumping, alternative surface water operations, etc." It also states that "The models are being used to help achieve and measure progress towards the goals of the Upper Platte Basin NRDs' IMP's."

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.

The federal mandate is the Platte River Recovery Implementation Program (PRRIP), which is the means by which the states of Colorado, Wyoming, and Nebraska are providing regulatory certainty with regard to the U.S. Endangered Species Act (ESA). The federally listed least tern, pallid sturgeon, piping plover, and whooping crane must be addressed under the ESA; if the PRRIP did not exist, other water management actions would be required of the states or individual water users.

The WWUMM project is essential to Nebraska's ability to meet its obligations under the PRRIP. Nebraska's obligations are contained within the Nebraska New Depletions Plan (NNDP), a component of the Water Plan for the PRRIP. Generally speaking, the NNDP requires Nebraska to offset any depletions to Platte River streamflow that result from new or expanded uses that have occurred subsequent to July 1, 1997. The sponsor NRDs have undertaken various management actions pursuant to their IMPs in order to provide compliance with the NNDP. However, the only way to document whether these actions have, in fact, been successful requires the WWUMM project. Without this project, it will be impossible to accurately document Nebraska's compliance with the NNDP for water uses within the sponsor NRDs.