NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: Lower Platte South Natural Resources District Three-Dimensional Hydrogeologic Framework

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

Sponsor Business Name: Lower Platte South Natural Resources District

Sponsor Contact's Name: Dick Ehrman

Sponsor Contact's Address: 3125 Portia Street, Lincoln NE 68510

Sponsor Contact's Phone: (402) 476-2729

Sponsor Contact's Email: dehrman@lpsnrd.org

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

   Grant amount requested. $ 247,500

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

   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☐ N/A
- 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☐

No permits are required for this project.

4. **Partnerships**

List each Partner / Co-sponsor, attach documentation of agreement:
Lower Platte South Natural Resources District (LPSNRD)
LPSNRD is the sponsor and lead agency for this project. Its role will be to serve as the fiscal agent to the Nebraska Department of Natural Resources (NeDNR) and Nebraska Natural Resources Commission (NNNRC), communicate and

guide the project with input from the partners, and manage the contractor(s) responsible for the hydrogeologic framework and associated products. LPSNRD will provide technical support and data to the contractor(s), and will review all work products.

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

Papio-Missouri River Natural Resources District (PMRNRD)
Lower Platte North Natural Resources District (LPNNRD)
Nemaha Natural Resources District (NNRD)
Lower Big Blue Natural Resources District (LBBNRD)
Upper Big Blue Natural Resources District (UBBNRD)
These five NRDs adjoin LPSNRD, and PMRNRD, LPNNRD, and NNRD either have been or are in the process of collecting and analyzing AEM data for their own regional and District-wide efforts. In all cases, these NRDs share some aquifer units and other groundwater-related concerns with LPSNRD. All of these NRDs are supporting partners for this project and will provide AEM data if available to be included in a five-mile buffer around LPSNRD, and provide technical input on possible future cooperation on cross-boundary groundwater issues.

Nebraska Department of Natural Resources (NeDNR)
The NeDNR is consulting with LPSNRD on this project to help ensure that products will be compatible with NeDNR's groundwater modeling, other recent modeling efforts that have used AEM data in building the hydrogeologic frameworks, and associated issues of mutual concern. NeDNR staff will also be responsible for reviewing products and providing technical support.

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 total project cost is $412,500. LPSNRD is requesting $247,500 in WSF funding (60%) and has included $165,000 of LPSNRD funds (40%) in its draft FY2022 budget. The cost breakdown is provided in Table 1.

Table 1 – Cost Breakdown

Project Total	WSF	LPSNRD
$412,500	$247,500	$165,000
% Share	60%	40%

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!
Airborne electromagnetic (AEM) data is currently available for a large portion of eastern Nebraska in the Platte River watershed and associated aquifer units. The goal of this project is to organize and utilize this data in a user friendly and practical way to assist in water management decisions, both now and into the future.

LPSNRD is proposing this project to develop a three-dimensional (3D) AEM-based hydrogeologic framework (or "Framework" for brevity) using existing AEM data, geologic logs, and other relevant available geologic and hydrogeologic reports and data. The Framework will be developed using state-of-the-art 3D visualization computer software to develop 3D geological models from large datasets (like AEM). All of the AEM data is currently available for LPSNRD, and so the project can begin quickly upon receipt of funding.

This project will implement a similar approach to that employed by the Lower Elkhorn NRD (LENRD) and PMRNRD/LPNNRD in projects supported by NeDNR and funded by WSF in 2019-2020 (#5243) and 2020-2021 (#5303), respectively. Using this method to develop the Framework based on AEM, geologic logs, and other available data will provide LPSNRD and neighboring NRDs with a consistent and comprehensive assessment and deliverable that will include the most recent data and make it useable between NRD boundaries. The 3D geologic model created from the AEM data will be delivered in a user-friendly platform that can be utilized by the NRD's staff, management, and board members; regulators; producers and other high-capacity water users; public water suppliers; and the general public for future groundwater quality and quantity evaluations, resource management, and educational purposes.

The Framework when completed can be used for, but will not be limited to, actions such as:

- Better understanding of water-bearing geologic strata and the process and quantity of groundwater flowing through these materials;
- Evaluating existing wells, siting new monitoring wells, assessing well permit applications, and better understanding limitations of areas of future development, if any;
- Completing an aquifer vulnerability assessment for protection of groundwater resources and identifying areas for implementing best management practices (BMPs);
- Identifying actual and potential groundwater recharge areas;
- Evaluating hydrologically connected surface and groundwater, based on a framework that is consistent across NRD boundaries;
- Constructing new and refining existing numerical groundwater flow models

(e.g., MODFLOW) and other tools that can be used to assist with several of the assessment needs above;
- More sophisticated defining and refining of Wellhead Protection Areas, and utilizing this information in developing and revising Drinking Water Protection Management Plans

This project will produce the following products:

- A variety of datasets based on the analyses and interpolation of the processed AEM data and all available geologic logs. All data will also be made available to the Nebraska GeoCloud in order to enhance its availability and usability.
- A 3D visualization geologic model for the AEM data to provide the LPSNRD with the data files for use in a free downloadable 3D model software viewer that allows the user to use the 3D model.
- Data sets suitable for input and initial discretization and layers for a future numerical groundwater flow model(s).
- A detailed hydrogeologic assessment mapping of the key hydrostratigraphic surfaces and constructed cross sections through the NRD using the borehole lithology (i.e. sand, gravel, clay, etc.) from all the test holes, well logs, and any other available data.
- A final geodatabase and other mapping files in an electronic and/or hard copy assessment report (i.e., “map book”) deliverable format. The assessment deliverable can be used in conjunction with the 3D model software viewer to have the most up to date robust format to assist the NRD with water management decisions.
- An analysis of and recommendations for areas within LPSNRD that will or may require additional, more detailed data collection and/or analysis, e.g. test hole drilling, dedicated monitoring well installation, groundwater modeling, etc.

LPSNRD is consulting with NeDNR and neighboring NRDs who will be providing available AEM data and technical support, as the framework construction includes a 5-mile buffer beyond LPSNRD boundaries. In addition, this project will seek input from and coordinate with representatives from the Eastern Nebraska Water Resources Assessment (ENWRA), the University of Nebraska-Lincoln Conservation & Survey Division (UNL-CSD), and the United States Geological Survey (USGS) to ensure that data products are available to and utilized by entities working in water resources.

7. **Project Tasks and Timeline**

The cost estimates by task for the two-year are provided in Table 2. The project is anticipated to begin January 2022 and be complete by December 2023. The WSF funding will be applied to all aspects of the project.

Table 2 – Costs by Task by Year

TASKS	Year 1 (2022) $	Year 2 (2023) $	Total $ Amt.
Project Management	$30,000	$10,000	$40,000
Meetings	$5,000	$5,000	$10,000
Develop Geology Database	$55,000	$20,000	$75,000
Create Cross Sections, Surfaces, GIS	$60,000	$20,000	$80,000
Create AEM 3D Model Framework	$65,000	$40,000	$105,000
Reporting/Map Books	$60,000	$20,000	$80,000
Analysis/Recommendations for Future Work	$7,500	$15,000	$22,500
		TOTAL	**$412,500**

8. **IMP**

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

LPSNRD and NeDNR jointly adopted an Integrated Management Plan effective May 15, 2014.

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);
This project will utilize AEM data collected by LPSNRD and apply the same proven approach and techniques that have been recently used to complete the 3D

Hydrogeologic Framework supported by the LENRD and NeDNR, and are currently being used in similar joint efforts by PMRNRD and LPNNRD. The AEM surveys have provided excellent characterization of the hydrostratigraphy across the NRDs based on the electrical properties of earth materials from the land surface downward using electromagnetic induction. AEM data was used by LENRD's contractor in 2019 and 2020 to construct a 3D Hydrogeologic Framework for a similar project, and similar products are being developed for the PMRNRD and LPNNRD, which adjoin LPSNRD. This project will therefore provide detailed, highly refined data which will be consistent across these neighboring NRDs' boundaries and shared hydrogeologic units, and will provide an excellent opportunity for adjoining NRDs and other entities to work on groundwater issues of mutual interest and concern.

Also, the LENRD, PMRNRD, and LPNNRD projects have demonstrated that defining the stratigraphic contacts between the principal aquifer and underlying bedrock units from AEM data alone could be difficult because of similar electrical properties of different geologic materials. These projects have employed borehole lithology data from registered wells and UNL-CSD test holes to define various geologic surfaces, and have demonstrated that the borehole data was best suited to define the bedrock-principal aquifer boundary, whereas AEM data could best be employed to differentiate between overlying unconsolidated materials such as various Quaternary deposits.

This same approach and workflow will be applied to the LPSNRD datasets to capture the benefits of both borehole data and AEM data when building regional, NRD-wide, or localized 3D geological framework models and groundwater flow models. The AEM data will be used to develop the Framework that will serve as the foundation for future numerical models by creating a series of rows, columns and layers, which defines a unique set of grid blocks (i.e. model cells). The cells, which are necessary for MODFLOW and other possible groundwater models, will be used to represent the distribution of hydrogeologic properties and boundary conditions within LPSNRD, plus a 5-mile buffer into adjacent NRDs.

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

One of LPSNRD's primary considerations in this project is to ensure the data created is consistent with that of its neighboring NRDs, especially LPNNRD and PMRNRD. This will in turn enable the Lower Platte River Basin NRDs to work in sync on water management strategies. This will prove beneficial during the development of a future AEM-based MODFLOW groundwater model. The NeDNR is consulting with LPSNRD and will provide technical support should the grant be awarded.

The AEM resistivity data has been correlated to ranges of hydraulic conductivity of the aquifer and non-aquifer materials. The contractor will obtain data from the Eastern Nebraska Water Resources Assessment (ENWRA) website or directly from ENWRA personnel, or Nebraska's GeoCloud. The AEM data will be used in a robust 3D geological modeling software to define 3D solids of resistivity zones that

represent the hydrostratigraphy. These 3D resistivity zones will be used to evaluate the hydrogeologic framework, which will then be used to construct 3D numerical groundwater flow model grids with a range of hydraulic conductivity values (see Figure 1 for an example from LENRD's project). In the future, these files can then be exported to Groundwater Vistas, a pre- and post-processing program for MODFLOW, or other processing programs for other groundwater models.

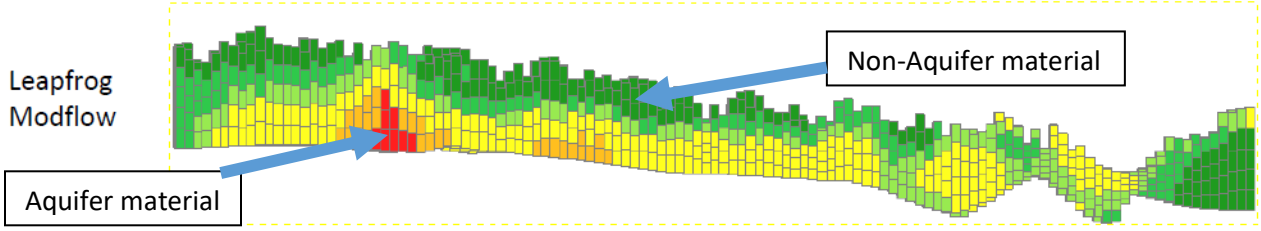

Figure 1 – LENRD Leapfrog Five Layer MODFLOW Profile Example

Due to the geographic extent of the LPSNRD, its highly variable subsurface geology, large datasets, and required data analyses, 3D analysis software is necessary to compile, manipulate, interpolate, and interpret the data. Once the 3D model is developed, it will be provided to LPSNRD to access and view with a free viewing application. This application will allow LPSNRD personnel (or others, particularly neighboring NRDs) to "fly around and through" the interpolated AEM data, cut slices (profiles or cross-sections) through the AEM data, and view select saved "scenes" that could target certain areas of interest at or near the hydrogeologic cross sections. Such techniques will be highly valuable to NRD staff, management, Board members, water suppliers, and the affected public in visualizing the complexity of LPSNRD's groundwater geology and challenges and actions necessary to manage groundwater resources.

The Framework will include data from the ground surface down to bedrock. LIDAR data will be used to represent the topography of the ground surface and define the top of the of the 3D geologic model. The AEM data will be used to define the hydrostratigraphy of the unconsolidated materials. AEM data, in addition to geology logs from UNL-CSD test holes and NDNR well logs will be used to define the contact between the unconsolidated material and underlying bedrock in the 3D geologic model. Additionally, well and test hole lithology data will be incorporated into the project to display the lithology as boreholes. A flow chart description of the overall process is provided in Figure 2. A final deliverable will be provided to the NRDs in ESRI geodatabase format and hard copy and/or digital Detailed Hydrogeologic Assessment Mapping deliverable (i.e., "map book"). The contractor selected by LPSNRD will:

1) Obtain and manage hydrogeologic AEM and borehole lithology datasets for GIS, 3D software, and groundwater modelling;
2) Conduct GIS spatial analyses to develop key hydrostratigraphic surfaces for future spatial analyses, provide ESRI geodatabase deliverables, and create the top of bedrock hydrostratigraphic surface for constraining the AEM data;
3) Create datasets from the processed AEM data for analyses and interpolation in the 3D software from all existing and future AEM flight data;

4) Complete a 3D visualization geologic model for the AEM data and provide the LPSNRD with the data files for their use;
5) Prepare data sets for input and initial discretization and layers for a future numerical groundwater flow model; and
6) Provide an analysis and recommendations for additional, more detailed work in areas of limited groundwater supply, highly variable groundwater geology, etc. These recommendations will include but not be limited to consideration of test hole drilling, aquifer testing, dedicated monitoring well installation, localized groundwater modelling, etc.

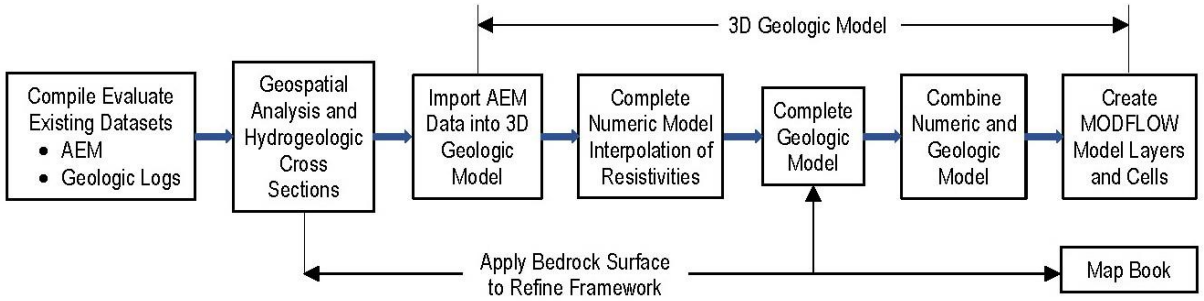

Figure 2 – Major Steps in Developing Framework

Detailed Hydrogeologic Assessment Mapping

In addition to the Framework, LPSNRD will also be establishing a detailed hydrogeologic assessment which uses all available well logs and test holes. The detailed hydrogeologic assessment mapping displays the key hydrostratigraphic surfaces (clay, sand, gravel, etc.) and constructs cross sections across the NRD using the borehole lithology from all the test holes and wells logs. The detailed hydrogeologic assessment will complement the Framework, allowing LPSNRD to 'cross check' information, should the data show anything that needs more assessment, in line with the contractor's item 6) above.

The project area covers the entire LPSNRD and is shown in Figure 3. The various colored lines indicate AEM flight lines as flown in various years from 2007-2018; these flights total approximately 4,180 line-miles of data acquisition.

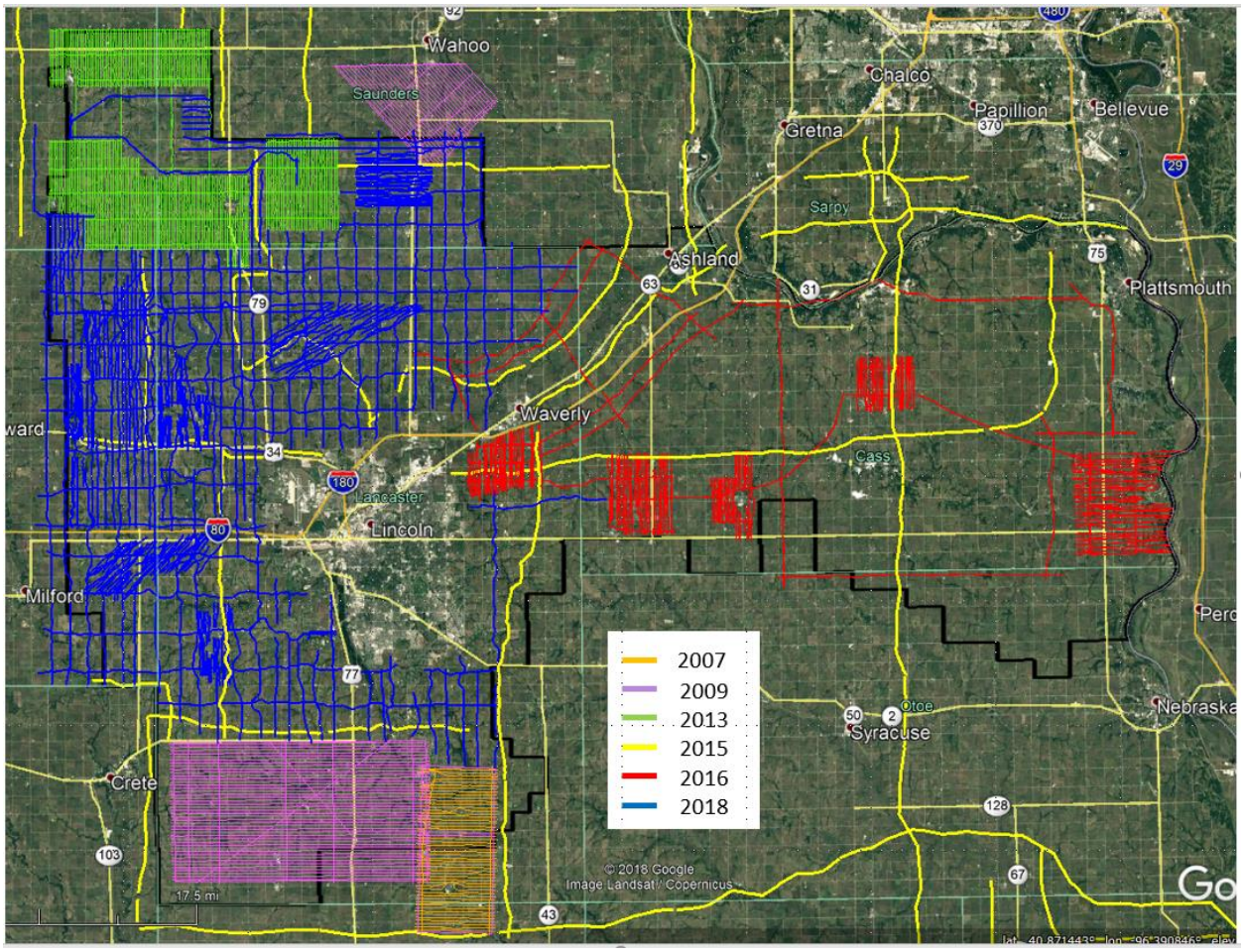

Figure 3. Project Location and AEM Flight Lines.

1.B.3 Describe field or research investigations utilized to substantiate the project conception (004.02 B);
This project will not involve any new field or research investigations, only analysis of existing data. However, as already mentioned, it builds upon techniques developed and knowledge gained through similar projects in LENRD, PMRNRD, and LPNNRD.

1.B.4 Describe any necessary water and/or land rights (004.02 C);
This project will not require any water or land rights.

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).
This project will not have any effect on structural measures.

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 methodology being used to incorporate geophysical data (i.e., AEM) into a Framework, and eventually a groundwater model, is based upon the successful work completed by the LENRD and NeDNR during development of a Pilot-scale Area (PSA) Model (2019), and LENRD-scale model (in progress). The same Framework completed by LENRD and proposed by LPSNRD is also currently being completed by LENRD districtwide (WSF #5243) and PMRNRD and LPNNRD jointly (WSF #5303), and has provided LENRD and NeDNR with a proven methodology on how to best use AEM data in both a Framework and groundwater flow model (MODFLOW).

The PSA and LENRD-scale projects have shown that the AEM surveys provide excellent characterization of the hydrostratigraphy across the NRDs based on the electrical properties of earth materials from the land surface downward using electromagnetic induction. But it became apparent that defining some stratigraphic contacts from AEM data alone could benefit by using borehole lithology (sand, clay, gravel) data to define specific geologic surfaces.

The LENRD project team concluded that the borehole data was best suited to define the top of bedrock surface and bottom of principal aquifer, and to use the AEM data to define the hydrostratigraphy of the unconsolidated materials (i.e., Quaternary units). This same approach and workflow is being applied to the PMRNRD and LPNNRD datasets to capture the benefits of both borehole data and AEM data when building regional, NRD-wide, or localized 3D geological framework models and groundwater flow models. This approach is well-suited to LPSNRD's project goals as well as its highly variable groundwater geology.

The next best alternative is developing a framework using only point-based geologic data (well logs and test holes). That alternative would not take advantage of the LPSNRD's, NeDNR's, and NNRC's investment in AEM flight data collection and would certainly take a greater amount of time and effort to develop geologic layers without using a computer automated evaluation of AEM resistivity data. Likewise, in some areas additional test hole drilling may be necessary to fill in data gaps. Test hole drilling is expensive and time consuming compared to AEM data collection. Therefore, this alternative would certainly cost more and take much longer to complete.

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).

The total cost estimate is $412,500 and was estimated based upon existing projects underway or completed in other NRDs using similar methodology. The project cost was correlated from these project efforts and then based upon the number of AEM flight miles, number of well logs, and test holes per NRD.

One of the project's benefits is establishing a consistent hydrogeologic dataset between LPSNRD, PMRNRD, and LPNNRD boundaries. This consistency will enable the Lower Platte River Basin NRDs to manage groundwater in a sustainable and consistent manner across political, watershed, and hydrogeologic boundaries.

Nebraska statute sets out preferences of use for groundwater, with domestic supply being highest, followed by agriculture, and industry/commerce. One of LPSNRD's top priorities is to ensure that future groundwater development can occur while maintaining this preference of use and ensuring that existing uses are protected. This project will utilize the best available scientific information to provide NRD staff and Boards, municipalities, property owners, and the general public with reliable and visually compelling products to support future decision making in groundwater management. It will also be utilized to make sure that surface water flows within hydrologically connected areas are protected.

A detailed benefit cost analysis has not been completed, but it appears evident that the long-term water management benefits as outlined above will far exceed the cost of the framework development cost.

The project shelf life extends well into the future because the data is geologic in nature but is also in a format which can be utilized by a wide variety of groundwater models and visualization tools. The project will provide benefit until more accurate methods to collect geologic data are developed, but even so it will provide experiential and historical context for future groundwater data collection. Given that AEM is currently the most advanced technology available and is the preferred alternative for eastern Nebraska NRDs, it should be beneficial for several decades.

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).

A breakdown of costs by project task is provided in Table 3.

Table 3. Project Cost Breakdown by Task

TASKS	Year 1 (2022) $	Year 2 (2023) $	Total $ Amt.
Project Management	$30,000	$10,000	$40,000
Meetings	$5,000	$5,000	$10,000
Develop Geology Database	$55,000	$20,000	$75,000
Create Cross Sections, Surfaces, GIS	$60,000	$20,000	$80,000
Create AEM 3D Model Framework	$65,000	$40,000	$105,000
Reporting/Map Books	$60,000	$20,000	$80,000
Analysis/Recommendations for Future Work	$7,500	$15,000	$22,500
		TOTAL	**$412,500**

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).

Estimating the monetary value of long-term tangible benefits on data assessment and mapping projects is difficult. There is not an immediately known and accepted method for calculating tangible benefits for groundwater modeling projects. The LPSNRD's staff and Board of Directors are confident it will greatly promote and increase water sustainability efforts throughout the region and within the Lower Platte River Basin. This fact is based upon the millions of dollars of investment into AEM in the past several years by eastern Nebraska's NRDs (through ENWRA) as well as other NRDs across the state.

The assessment of AEM and geologic data will provide LPSNRD with a solid scientific background for basing water management decisions and is one step closer to having a groundwater flow model that utilizes the AEM data. The project could also assist the NRD on making decisions that evaluate current and/or limit future water allocations, thus safeguarding the use of groundwater for domestic use, irrigation and commercial development. Lastly, this project takes full advantage of the millions of dollars invested into AEM data, test holes, and monitoring wells by the LPSNRD, NNRC, and NeDNR.

Beyond the NRD's goals, the data will also help communities to base decisions using the available information, in a user-friendly format, to help with projects such as siting new wells, or planning for drought, among many other ancillary benefits.

In addition to direct benefits to LPSNRD, adjoining NRDs, and NeDNR, this project will provide tangible advantages in visualizing and utilizing AEM and related data to other State and Federal entities. For example, the Nebraska Department of Environment and Energy (NDEE) oversees the Wellhead Protection program, which involves the capture zones of public water supply wells across the State. This project will provide NDEE with a wealth of detailed and highly-sophisticated data and products to better delineate those areas and help water suppliers in LPSNRD manage their sources. UNL-CSD and various other University of Nebraska entities as well as USGS can employ the Framework and associated data to better analyze and understand the complex geology and hydrogeology of LPSNRD, especially with regard to depositional environments of sand and gravel deposits which are important aquifer units in this area.

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 total project cost is $412,500 (see Table 4) over a two-year period, split by LPSNRD and this WSF grant. The overall benefit is sound water management in the LPSNRD, Lower Platte Basin utilizing the NRD, NeDNR, and previous WSF grant investments in AEM data. As previously described, there is no acceptable method to calculate cost vs. benefit for a geologic framework and assessment project. Some of the many specific benefits include:

- Better understanding of water-bearing geologic strata and the process and quantity of groundwater flowing through these materials;
- Evaluating existing wells, siting new monitoring wells, assessing well permit applications, and better understanding limitations of areas of future development, if any;
- Completing an aquifer vulnerability assessment for protection of groundwater resources and identifying areas for implementing best management practices (BMPs);
- Identifying actual and potential groundwater recharge areas;
- Evaluating hydrologically connected surface and groundwater, based on a framework that is consistent across NRD boundaries;
- Constructing new and refining existing numerical groundwater flow models (e.g., MODFLOW) and other tools that can be used to assist with several of the assessment needs above;
- More sophisticated defining and refining of Wellhead Protection Areas, and utilizing this information in developing and revising Drinking Water Protection Management Plans.

Table 4. Cost by Task, Years 1 (2022) and 2 (2023)

TASKS	Year 1 (2022) $	Year 2 (2023) $	Total $ Amt.
Project Management	$30,000	$10,000	$40,000
Meetings	$5,000	$5,000	$10,000
Develop Geology Database	$55,000	$20,000	$75,000
Create Cross Sections, Surfaces, GIS	$60,000	$20,000	$80,000
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Analysis/Recommendations for Future Work	$7,500	$15,000	$22,500
		TOTAL	**$412,500**

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.)
Project costs are outlined above, and as already mentioned there is no known accepted and standard method for demonstrating benefits. The only likely existing alternative to utilizing AEM data for this process is to make use of existing point data (registered well logs, test hole logs, etc.) which is far more limited data and would be much more expensive and time-consuming to utilize for production of a three-dimensional framework than is the existing AEM data. Likewise, such a method would ignore the significant investment LPSNRD, NNNRC, and NeDNR have already made in collecting and utilizing AEM data to date.

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.
As already mentioned, LPSNRD has included $165,000 in its draft budget/Long Range Implementation Plan (LRIP) for FY 2022. The appropriate page from that budget is included in Attachment A, along with letters of support from the five NRDs adjoining LPSNRD as well as from NeDNR.

5. Provide evidence that sufficient annual revenue is available to repay the reimbursable costs and to cover OM&R (operate, maintain, and replace).
LPSNRD is contributing $165,000 or 40% of the project total. LPSNRD has estimated the 2021-2022 property tax request at 0.030024 cents per $100 of

valuation resulting in $10,156,870 from property taxes, and a total operating budget of $34,258,2432.

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.). N/A

8. Explain how you are qualified, responsible and legally capable of carrying out the project for which you are seeking funds.
Groundwater management is a statutory duty of NRDs. The development of this project will aid LPSNRD in adhering to the statutory responsibilities and authorities given to the NRDs by the State of Nebraska, including but not limited to Nebraska Revised Statutes 2-3,201 through 2-3,243 and 46-701 through 46-755. LPSNRD is well qualified to carry out this project and supported by the NeDNR as well as its neighboring NRDs. LPSNRD has demonstrated this commitment by implementing a District-wide Groundwater Management Area, and delineating seven different areas as Phase II Management Areas and one as a Phase III Management area for groundwater quality concerns (nitrate), and one Special Management Area for in-season groundwater level declines. Since the NRDs started in 1972, they have been collecting groundwater data and utilizing that data for management decisions. The NRD has been instrumental in incorporating cutting edge AEM data into its management process and cooperating with other like-minded NRDs. As one of the state's preferred regulators of groundwater, LPSNRD is clearly both qualified and responsible to carry out the proposed project.

9. Explain how your project considers plans and programs of the state and resources development plans of the political subdivisions of the state.
This project supports implementation of actions to achieve goals of the Lower Platte River Basin Coalition's Basin Water Management Plan for LPSNRD and NeDNR, as well as LPSNRD's neighboring Districts that are part of the Coalition. Additionally, LPSNRD has a voluntary integrated water management plan (IMP), whose primary goal is to management the hydrologically connected portions of LPSNRD to achieve and sustain a balance between water uses and water supplied for the long-term. LPSNRD's voluntary IMP was one of the first in Nebraska, becoming effective on May 15, 2014. Finally, this project is directly related to implementation and support of plans and programs of the state resource development 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.
As described above, LPSNRD as one of Nebraska's 23 NRDs possesses a wide variety of statutory authorities in managing groundwater resources noted in the Nebraska Revised Statutes referenced above. This project will substantially improve LPSNRD's scientific basis for making such groundwater management decisions for both groundwater quality and quantity.

12. Identify the probable consequences (environmental and ecological) that may result if the project is or is not completed.
Although LPSNRD will continue to implement its groundwater management programs regardless of the completion of this particular project, the District's ability to utilize the existing AEM data, collected at considerable cost, will be substantially enhanced if the project is funded. As already described, completion of the Framework will provide greater insight into the occurrence and nature of the groundwater resources of LPSNRD as well as providing a distinctive visual method for cooperators and the general public to gain more insight and understanding of groundwater occurrence in the District. Likewise, as a result of this project, the AEM data will be organized in such a way as to facilitate its inclusion in future groundwater modeling efforts using MODFLOW or other models all across LPSNRD. This will ensure that the data utilized by LPSNRD in its groundwater programs will be the best available, and will also enable LPSNRD to have comparable data to its neighboring NRDs in working with mutual groundwater concerns.

Section C.

NNRC SCORING

In the NNRC'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 NNRC 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 NNRC. 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;

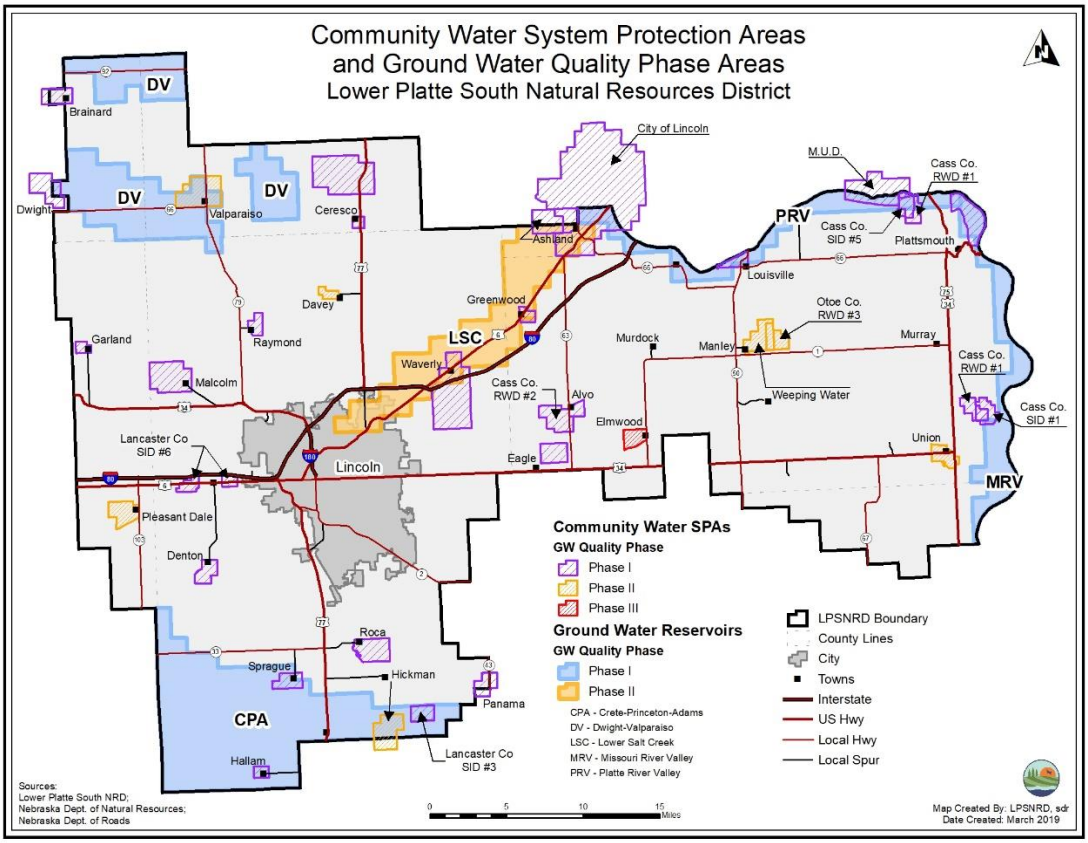
   - Describe the specific threats to drinking water the project will address.
   - Identify whose drinking water, how many people are affected, how will project remediate or mitigate.
   - Provide a history of issues and tried solutions.
   - Provide detail regarding long-range impacts if issues are not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

   Throughout Nebraska as in LPSNRD, the most commonly occurring and persistent groundwater contaminant is nitrate-nitrogen. NRDs are statutorily granted the responsibility of dealing with nonpoint source (NPS) groundwater contamination, and the land application of fertilizer and animal waste over

decades has resulted in many areas of the state and LPSNRD having elevated levels of nitrate in groundwater. LPSNRD's Groundwater Management Plan (GWMP), adopted in 1995 as noted below, sets out triggers for different Phase actions to address increasing levels of contaminants based on the federal Maximum Contaminant Level (MCL) for those contaminants. Although nitrate is the most common and widespread contaminant, LPSNRD's GWMP can and will be used if any other NPS contaminants (such as pesticides) exceed the triggers described in the GWMP.

As of this writing, LPSNRD has a population of nearly 315,000 in 31 different communities, essentially all of whom depend on groundwater for their domestic supply. LPSNRD has implemented a vigorous program of groundwater monitoring over its existence, and that monitoring has resulted in identification of several areas in its jurisdiction where nitrate concentration in groundwater are elevated, resulting in designation of either Phase II or Phase III Groundwater Management Areas (GWMAs). Figure 4 shows the locations of those GWMAs.

Figure 4. GWMAs (in orange/red) and CWSPAs/WHPAs (in purple).



In addition to designated GWMAs where nitrate levels are elevated, LPSNRD actively works to protect groundwater quality and quantity in the remaining areas

surrounding public water supplies. These areas, delineated by the Nebraska Department of Environment and Energy (NDEE), are commonly called Wellhead Protection Areas (WHPAs), and are usually based on the area estimated to include a 20-year time-of-travel zone for groundwater movement. LPSNRD's GWMP refers to these WHPAs as Community Water System Protection Areas (CWSPAs), but for the purpose of this application, those two terms are synonymous. LPSNRD is home to 31 of these areas, and they are shown in purple on Figure 4.

As described above, LPSNRD's GWMP specifies different Phases depending upon the concentration of contaminants in groundwater samples. The entire LPSNRD is in Phase I, and this consists mostly of general outreach, cost-share on best management practices, and statutorily required programs like water well permitting. Phase II areas, shown in orange on the map, are those areas where nitrate or other contaminants are at or above 50% of the federal Maximum Contaminant Level. In those areas, individuals who apply nitrogen fertilizer are required to take a certification class offered by LPSNRD. Phase III areas, the one of which is shown in pink on the map, are where NPS contaminants are at or above 80% of the federal MCL. In this area, preplant fertilization is banned until after March 1 of each year, and farmers must have soil samples analyzed for nitrate content and adjust their applications accordingly. It's important to note that the above strategy not only applies to public water suppliers, but also to the large number of private drinking water wells across LPSNRD. Historically, most farmsteads in the District have been served by water wells producing a widely varying amount of water for human consumption. But as the population of the District continues to grow, more and more acreages are being developed, and in some areas many new wells are being installed to supply these housing units. As already mentioned, the LPSNRD's highly variable groundwater geology sometimes makes it difficult to find the desired amount of groundwater of appropriate quality. This project will provide a large number of high-quality, visually striking data products that will help property owners, developers, and financial lenders understand the challenges associated with rural development of housing and plan accordingly.

While LPSNRD's programs have contributed to some stabilization and even possible declines of nitrate levels in groundwater in some areas, nitrate and other NPS concerns are long-term issues which must be dealt with over decades. Elevated levels of nitrate in drinking water have been demonstrated to cause methemoglobinemia or "blue baby syndrome" in infants, and may have some relation to certain kinds of cancers in older humans; recent research indicates this might be particularly true for certain forms of pediatric cancer. Regardless of the success of this grant application, LPSNRD will continue to implement its groundwater quality programs to help deal with the concerns of nitrate and other contaminants in groundwater. But long experience with groundwater and geology has indicated that detailed, scientifically accurate and defensible, visually appealing demonstrations of how groundwater occurs, moves, and is recharged

can substantially help in designing effective management programs, and is especially important in helping farmers and members of the public understand the relationships between activities at the land surface and the quality of the groundwater they depend on. Thus, given the nature of the NPS groundwater concern, the amount of time and effort LPSNRD and neighboring NRDs have already put into management efforts and data collection such as AEM, and the long-term nature of the problem, LPSNRD believes that funding of this project will substantially boost its efforts to help all of its citizens have a safe source of drinking water.

While it is customary to think of "threats to drinking water" as concerns involving groundwater quality, it's also important to note that, in many parts of LPSNRD, the amount of groundwater available to supply wells is also a concern. In some parts of the District, highly confined aquifers, when subjected to stress during the hot parts of the irrigation season, can show in-season groundwater level declines of over 100'. In response to this problem, LPSNRD in 2014 delineated a Special Management Area (SMA) in the northwest portion of the District around the towns of Dwight and Valparaiso (the blue areas indicated by "DV" on Figure 4), and in this area, LPSNRD limits the amount of irrigation water applied, will not allow the development of new irrigated acres, and requires irrigators to become certified by attending educational classes. But in other parts of LPSNRD, there is little if any groundwater available at any time, and domestic wells must utilize very thin and/or isolated deposits of sand (and maybe finer material) to supply small amounts of groundwater. This project will provide a great advance in the ability of District staff, Board members, well drillers, landowners, water suppliers, and other interested parties to access and visualize cutting-edge technology to understand these challenges and evaluate possible options as far as groundwater supply.

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.

LPSNRD GWMP, IMP, and Master Plan

The LPSNRD has both an approved Groundwater Management Plan, approved by the Nebraska Dept. of Water Resources on June 26, 1995, and an approved voluntary Integrated Management Plan, effective May 15, 2014. Both of these plans as well as other District activities are governed by the philosophy outlined in LPSNRD's Master Plan, the most recent of which was produced in 2019.

Since 1995, LPSNRD has worked to implement its GWMP for both groundwater quality and quantity. The GWMP identifies three different areas of management

within LPSNRD: Groundwater Reservoirs (GWRs), which are the portions of the District where groundwater is generally readily available; Community Water System Protection Areas (CWSPAs), which are the areas where communities draw their groundwater supplies from (essentially the same as Wellhead Protection Areas); and the Remaining Area, which is the portion of LPSNRD where groundwater quality and availability is highly variable. The GWMP also sets out three phases of management for both quality and quantity; these phases are triggered by a) increases in NPS groundwater contamination for quality, and/or decreases in groundwater levels. As described above, to date LPSNRD has designated seven Phase II and one Phase III GWMAs for groundwater quality relating to nitrate levels, but has not yet designated any higher Phase areas for groundwater quantity due to long-term water level declines. However, LPSNRD has delineated the Dwight-Valparaiso-Brainard Special Management Area (DVB SMA) in the northwest portion of the District to address in-season water level declines in a highly confined aquifer system there. All of these management efforts have been guided by adoption and implementation of LPSNRD's Groundwater Rules and Regulations, which have been revised multiple times since 1995; the most recent version of these regulations took effect in January 2020.

LPSNRD's voluntary Integrated Management Plan was adopted by LPSNRD and NeDNR and became effective on May 15, 2014. Since that time, LPSNRD has worked with NeDNR and other NRDs to implement the IMP's basic goals of water inventory, water supply management, and water use management through a variety of non-regulatory and regulatory means. As required, LPSNRD has worked with NeDNR to issue an IMP Annual Report every year since that time, outlining the NRD's and NeDNR's activities and accomplishments in managing interrelated ground and surface water in LPSNRD. LPSNRD and NeDNR meet on a regular basis to coordinate activities in integrated management, and have cooperated on a number of events such as a drought tournament in 2016, drought contingency planning, and cooperation in the Lower Platte River Basin Coalition.

LPSNRD's 2019 Master Plan sets out the overall goal of "Sustainable Water Resources" to govern its activities in groundwater management, and integrates many of the ideas set forth in LPSNRD's GWMP and IMP. The Master Plan lists several "Desired Outcomes" for that overall goal. Those outcomes related to groundwater management are listed here, along with a brief description of how this project will support those outcomes:

- OUTCOME: *Groundwater quality and quantity is known for the entire NRD.* This project will fundamentally advance LPSNRD's knowledge of groundwater quality and quantity by providing advanced, three-dimensional visualization of the NRD's geology and hydrogeology, and will provide the foundation for future groundwater modeling, both on a local and regional scale.

- OUTCOME: *Groundwater levels stable, and quality meets standards.* By creating the Framework and preparing for future groundwater modeling, the NRD will better be able to understand changes in groundwater levels, groundwater recharge, and how various quality parameters are being affected both by human activity at the surface and the highly varied hydrogeology of the District.
- OUTCOME: *Ability to predict changes in groundwater quantity and quality.* The development of the Framework will greatly enhance the District's and public's ability to visualize and understand how groundwater quantity and quality is changing over time. However, perhaps the greatest effect of this project in this regard will be the preparation of LPSNRD's considerable set of AEM data for integration into MODFLOW and other groundwater models. Utilization of this cutting-edge data in groundwater modeling will provide LPSNRD with the best possible information to make sound decisions on groundwater quality and quantity management, and will ensure that LPSNRD's knowledge base is consistent and coordinated with neighboring NRDs.
- OUTCOME: *Areas of interrelated ground and surface waters are managed.* One of the great challenges for NRDs in general is gaining knowledge about and effectively managing the interrelated ground and surface waters of Nebraska. This is particularly true in the highly variable glaciated eastern portion of the state where LPSNRD is located. Again, the Framework will provide a distinct improvement in the ability of LPSNRD and the concerned public to visualize if and how ground and surface waters are linked within its jurisdiction. But as above, this project will provide a critical upgrade to LPSNRD's ability to understand the interrelationships between surface and groundwater in its jurisdiction by providing the best available data to introduce into MODFLOW and other groundwater models. This will allow for the greatest accuracy in quantification of these relationships and again will ensure that LPSNRD's data is consistent with that of its neighbors. Critically, it will also provide the best basis for NeDNR's ongoing modeling efforts, especially as the agency works with the Lower Platte River Basin Coalition NRDs to further evaluate management activities necessary under the Coalition.
- OUTCOME: *Domestic water supplies meet or exceed regulatory standards and are of adequate quantity.* One of the unique characteristics of LPSNRD is its highly variable geology, which corresponds with equally great variability in the quality and quantity of available groundwater. Parts of LPSNRD have plentiful sources of high quality groundwater for nearly any use. Other portions of the District have groundwater sources which are more marginal, both in terms of quality and quantity. And other parts of LPSNRD are underlain by geologic units which yield little if any groundwater of any quality. This project will considerably enhance LPSNRD's ability to deal with this heterogeneity, both in terms of communicating the complexity of the groundwater resources to municipalities, home and landowners, water well contractors, developers,

and other concerned groups and in preparing the AEM data for utilization in groundwater models, again at the local and regional level.

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

   List the following information that is applicable:

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

   This project will utilize the best available scientific information to support decisions that can help ensure that LPSNRD's highly variable groundwater resources will be wisely managed, while sustaining surface water flows within hydrologically connect areas. It is anticipated that creating the Framework for LPSNRD will lead to an enhanced and more accurate groundwater modeling effort which will be better suited to managing aquifer depletions and reducing streamflow depletion across LPSNRD and its neighboring NRDs.

   Another one of the project's benefits is establishing a consistent hydrogeologic dataset between LPSNRD and its adjacent NRDs, especially PMRNRD and LPNNRD, which are working on a similar project. This uniformity will enable the Lower Platte River Corridor NRDs the ability to collaboratively manage groundwater in a sustainable and consistent manner across political boundaries and the ability to create a groundwater flow model that isn't restricted by NRD boundaries. This improved geologic assessment will help inform NRDs about ground level geology and potential near-surface recharge, guiding future projects aimed at enhancing or protecting these groundwater recharge areas.

   The Framework, when completed can be used for, but not limited to:
   - Better understanding of water-bearing geologic strata and the process and quantity of groundwater flowing through these materials;
   - Evaluating existing wells, siting new monitoring wells, assessing well permit applications, and better understanding limitations of areas of future development, if any;
   - Completing an aquifer vulnerability assessment for protection of groundwater resources and identifying areas for implementing best management practices (BMPs);
   - Identifying actual and potential groundwater recharge areas;
   - Evaluating hydrologically connected surface and groundwater, based on a framework that is consistent across NRD boundaries;
   - Constructing new and refining existing numerical groundwater flow models (e.g., MODFLOW) and other tools that can be used to assist with several of

the assessment needs above;
- More sophisticated defining and refining of Wellhead Protection Areas, and utilizing this information in developing and revising Drinking Water Protection Management Plans

The project is designed to open the door for future cross basin benefits by having a consistent hydrogeologic dataset with neighboring NRDs based on AEM data, NeDNR well logs, and UNL CSD test holes. This project's approach, key tasks, and costs are based on the work completed by Lower Elkhorn Natural Resource District (LENRD) and NeDNR since 2018 on the LENRD's pilot study (completed) and district-wide hydrogeologic framework and district-scale numerical groundwater flow modeling project (in progress). This is a similar approach to that being currently used by PMRNRD and LPNNRD, and once again, this similarity will lead to much more uniformity in assessing and managing groundwater concerns that pay no attention to political boundaries.

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 primary goal of the project is to enhance LPSNRD's ability to make sustainable management decisions regarding use of water supplies for agricultural, environmental, private, municipal, and industrial purposes. This is a legislative purpose for all NRDs. The Framework provides a robust and scientifically advanced tool to support achieving multiple water supply goals as listed in the LPSNRD's IMP, GWMP, Master Plan,. Lower Platte River Drought Contingency Plan, and Lower Platte River Basin Coalition Basin Water Management Plan. All of these activities will contribute to maintenance of reliable, high-quality drinking water supplies for the more than 30 public water suppliers and many private wells which serve LPSNRD's 315,000 residents.

As already mentioned, LPSNRD is committed to comprehensive management of its groundwater resources to support and maintain residential, irrigation, commercial, and industrial development. This project brings forth the best available scientific information to support decisions that can help ensure economic growth of all kinds can occur while maintaining acceptable groundwater levels and while sustaining surface water flows within hydrologically connected areas. A highlight of specific plans, purposes and goals this project benefits are listed below:

Lower Platte Basin Coalition – Basinwide Water Management Plan

This project helps achieve the three listed purposes of the LPBC Basin Water Management Plan (October 2017) by making use of the investment in AEM data and providing a consistent hydrogeologic dataset across NRD boundaries, increase the capability for NRDs to management cross-basin water issues.

"The purpose of this Plan is to:

1) Provide guidance and a framework for Coalition members to develop water use policies and practices that contribute to the protection of existing surface and groundwater uses, while allowing for future water development.

2) Assist in the development and maintenance of a water supply and use inventory, based on the best available data and analysis.

3) Provide consistency and information for incorporation into individual NRD Integrated Management Plans."

LPSNRD GWMP, IMP, and Master Plan

LPSNRD's 2019 Master Plan sets out the overall goal of "Sustainable Water Resources" to govern its activities in groundwater management, and integrates many of the ideas set forth in LPSNRD's GWMP and IMP. The Master Plan lists several "Desired Outcomes" for that overall goal. Those outcomes related to groundwater management are listed here, along with a brief description of how this project will support those outcomes:

- OUTCOME: *Groundwater quality and quantity is known for the entire NRD.* This project will fundamentally advance LPSNRD's knowledge of groundwater quality and quantity by providing advanced, three-dimensional visualization of the NRD's geology and hydrogeology, and will provide the foundation for future groundwater modeling, both on a local and regional scale.
- OUTCOME: *Groundwater levels stable, and quality meets standards.* By creating the Framework and preparing for future groundwater modeling, the NRD will better be able to understand changes in groundwater levels, groundwater recharge, and how various quality parameters are being affected both by human activity at the surface and the highly varied hydrogeology of the District.
- OUTCOME: *Ability to predict changes in groundwater quantity and quality.* The development of the Framework will greatly enhance the District's and public's ability to visualize and understand how groundwater quantity and quality is changing over time. However, perhaps the greatest effect of this project in this regard will be the preparation of LPSNRD's considerable set of AEM data for integration into MODFLOW and other groundwater models. Utilization of this cutting-edge data in groundwater

modeling will provide LPSNRD with the best possible information to make sound decisions on groundwater quality and quantity management, and will ensure that LPSNRD's knowledge base is consistent and coordinated with neighboring NRDs.

- OUTCOME: *Areas of interrelated ground and surface waters are managed.* One of the great challenges for NRDs in general is gaining knowledge about and effectively managing the interrelated ground and surface waters of Nebraska. This is particularly true in the highly variable glaciated eastern portion of the state where LPSNRD is located. Again, the Framework will provide a distinct improvement in the ability of LPSNRD and the concerned public to visualize if and how ground and surface waters are linked within its jurisdiction. But as above, this project will provide a critical upgrade to LPSNRD's ability to understand the interrelationships between surface and groundwater in its jurisdiction by providing the best available data to introduce into MODFLOW and other groundwater models. This will allow for the greatest accuracy in quantification of these relationships and again will ensure that LPSNRD's data is consistent with that of its neighbors. Critically, it will also provide the best basis for NeDNR's ongoing modeling efforts, especially as the agency works with the Lower Platte River Basin Coalition NRDs to further evaluate management activities necessary under the Coalition.
- OUTCOME: *Domestic water supplies meet or exceed regulatory standards and are of adequate quantity.* One of the unique characteristics of LPSNRD is its highly variable geology, which corresponds with equally great variability in the quality and quantity of available groundwater. Parts of LPSNRD have plentiful sources of high quality groundwater for nearly any use. Other portions of the District have groundwater sources which are more marginal, both in terms of quality and quantity. And other parts of LPSNRD are underlain by geologic units which yield little if any groundwater of any quality. This project will considerably enhance LPSNRD's ability to deal with this heterogeneity, both in terms of communicating the complexity of the groundwater resources to municipalities, home and land owners, water well contractors, developers, and other concerned groups and in preparing the AEM data for utilization in groundwater models, again at the local and regional level.

A unique aspect of the groundwater resources of LPSNRD is the relationship between groundwater and the saline wetlands complexes present, especially in portions of Lancaster County. Although salt water is not usually considered a beneficial occurrence, in the case of the saline wetlands it is a fundamental contributor to one of the rarest ecosystems anywhere in Nebraska or the country, and these ecosystems support a number of threatened and/or endangered species such as the Salt Creek Tiger Beetle, saltwort, and others. The AEM surveys, by being sensitive to salinity in groundwater, have greatly increased our knowledge of the occurrence and movement of saline groundwater in LPSNRD, especially preferential flowpaths for such groundwater to rise to the land surface, and the

possibilities for visualization of this data as well as utilization in groundwater modeling are exciting. Such activity can provide significant support to the efforts of LPSNRD, the Nebraska Game and Parks Commission, UNL, Lincoln/Lancaster County, and many other interested parties in managing and preserving this precious resource.

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.

This project will enhance the LPSNRD's ability to manage water for beneficial uses with an impact to a total population of about 315,000. Improved water management in the Lower Platte Basin would also benefit the City of Lincoln and Omaha's MUD Water Systems located on, or near, the Platte River, and those smaller municipalities relying on groundwater throughout LPSNRD.

A specific topic of statewide interest that will be benefited by the framework is using the geologic data to evaluate projects that may reduce the impacts of severe drought on the Lower Platte River and specifically the impact to Omaha and Lincoln water supplies. Drought was addressed as part of the Lower Platte River Drought Contingency Plan, completed in October 2019. There were several action items suggested in that plan, including new reservoirs, pumping from sandpits, and release from upstream sources to ensure an adequate supply to Lincoln and Omaha water supplies. Sound water management decisions throughout the Lower Platte Basin will benefit streamflows, which in turn, increase flows in the Platte River. Increased flows in the Platte, especially during drought, reduce the chances of either Lincoln or Omaha using their authority under Nebraska Revised Statue 46-233 for 'induced groundwater recharge' which could cause irrigators upstream of the Lincoln and Omaha wellfields to cease surface water irrigation when water level triggers reach a certain threshold. This project will help evaluate a preferred alternative should action be taken as a result of the Drought Contingency Plan.

The LPSNRD is also committed to helping ensure that rural residential, agricultural, commercial, and industrial development has a sustainable water supply. The project improves how the NRD staff and Board of Directors can work one-on-one with home and land owners, agricultural producers, developers, municipalities, and industries. Once the Framework is developed, it will be provided to the NRD to access and view with a free 3D model viewer application. This viewer application will allow NRDs (or others, including neighboring NRDs) to "fly around and through" the interpolated AEM data, cut slices (profiles or cross-sections) through the AEM data, and view select saved "scenes" that could target certain areas of interest or near the hydrogeologic cross sections. The NRD staff will be able to create customized maps

specific to the needs of those asking important questions. This tool will provide benefits to the state's residents in terms of visualizing and understanding LPSNRD's varied and complex geology, evaluating risks and benefits of future development, etc.

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 project approach, key tasks, and costs estimates are based on a proven, cutting-edge methodology from a similar project completed by the LENRD and NeDNR in 2019/2020 to establish a district-wide 3D AEM Hydrogeologic Framework and model files, which is now being used to construct a district-scale numerical groundwater flow modeling project. The LENRD project has provided a means for other NRDs to follow with an approach that was successful in converting AEM data into a hydrogeologic framework and creation of groundwater modeling files. A similar approach is being used by PMRNRD and LPNNRD, and will provide consistency in data and visualization across these three NRDs; this project will further that effort toward consistency and comparability. Throughout these and other efforts, NeDNR has indicated its support for the acquisition and utilization of AEM data as it will provide the Department with the best available technology to utilize in groundwater modeling and other resources evaluations. The estimated cost for the LPSNRD project is shown in Table 6.

Table 6 – Project Cost by Task

TASKS	Year 1 (2022) $	Year 2 (2023) $	Total $ Amt.
Project Management	$30,000	$10,000	$40,000
Meetings	$5,000	$5,000	$10,000
Develop Geology Database	$55,000	$20,000	$75,000
Create Cross Sections, Surfaces, GIS	$60,000	$20,000	$80,000
Create AEM 3D Model Framework	$65,000	$40,000	$105,000
Reporting/Map Books	$60,000	$20,000	$80,000
Analysis/Recommendations for Future Work	$7,500	$15,000	$22,500
		TOTAL	**$412,500**

LPSNRD, as well as several other NRDs, have invested a significant amount of time and financial resources to better understand the hydrogeology by obtaining state-of-the art AEM survey data. Implementing a similar approach as used for the LENRD, PMRNRD, and LPNNRD projects will provide the LPSNRD with a proven consistent and comprehensive assessment deliverable that is cost-effective and will include the most recent data, delivered in a user-friendly platform that can be utilized by the NRD's staff, management, and board members; regulators; producers and other high-capacity water users; public water suppliers; and, the general public for future groundwater quality and quantity evaluations, resource management, and educational purposes.

As previously discussed, the next best alternative is the more traditional methodology of developing a framework using only point-based geologic data (well logs and test holes). That alternative would not take advantage of the NRD's, NeDNR's, and NNRC's investment in AEM flight data collection and would certainly take a greater amount of time and effort to develop geologic layers without using a computer automated evaluation of AEM resistivity data. Therefore, this alternative would certainly cost more and take much longer to complete.

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.

This project will help LPSNRD work more effectively with other Lower Platte River NRDs, including LENRD, PMRNRD, and LPNNRD, to achieve the NeDNR's goal of having all basins 'not fully or overappropriated'. The LPSNRD understands that the potential to become fully appropriated is real and water management needs to be addressed in a consistent manner among all the lower basin NRDs. Datasets and information analyzed as part of this project will allow for smarter water management decisions and will lead to robust sub-regional and local groundwater flow models for the entire LPSNRD. This project will reduce the chances of the State needing to intervene with further IMP requirements.

Areas of the LPSNRD are home to several threatened or endangered species. This project will assist the state and NRDs in managing groundwater and surface water to meet its obligation under the instream flow appropriation permit granted to the Nebraska Game and Parks Commission for the central and lower Platte River on June 26, 1998 (with a instream flow priority date of November 30, 1993).

As described above, this project will also have a significant positive impact on LPSNRD's and other entities' response to drought. By creation of the Framework as well as integration of the AEM data into groundwater models, this project will allow LPSNRD to assist large municipalities like Lincoln and Omaha/MUD evaluate effects of and possible actions in response to drought, thus reducing the likelihood of these municipalities issuing a "call" on upstream water uses in the Platte basin. Likewise, it will help the smaller municipalities and rural residents plan for and respond to drought.

The proposed project will promote water conservation which will have a positive cumulative impact on stream flow by minimizing aquifer depletion. More educated decisions can be made by LPSNRD's Board, particularly within the hydrologically connected areas, which will help reduce pumping impacts on streamflow. The beneficial impacts will be maximized in areas with the highest stream flow depletion factor (SDF) as defined by the NeDNR SDF analysis.

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.

Preservation of private property owners' abilities to beneficially use the groundwater resources beneath their property using the information to be provided by this project is a major facet of this application. Sound water management requires the use of the best available science, in this case AEM data, ensuring a sustainable water supply for municipalities (including Lincoln and Omaha), thousands of private well owners, agricultural users, and commercial and industrial concerns.

As mentioned above, a severe drought could lead to Lincoln and Omaha utilizing their authority under Nebraska Revised Statue 46-233 for 'induced groundwater recharge' which could cause irrigators upstream of the Lincoln and Omaha wellfields to cease surface water irrigation when water level triggers reach a certain threshold. This project may have the ability to help prevent such a priority call from occurring depending on accurate groundwater modeling and management decisions.

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 primary groundwater quality issue affecting LPSNRD at present is the widespread presence of nitrate as a result of traditional farming practices. In addition, in certain areas, pesticides associated with agriculture can be a concern. LPSNRD is also somewhat unique in that naturally-occurring materials such as salts, dissolved solids, iron, selenium, and other minerals associated with underlying bedrock units are a concern for many residents. But conversely, these dissolve salts are also a fundamental component in supporting LPSNRD's unique saline wetland complexes. In areas where ground and surface water are intimately connected, it's also vital to understand how these contaminants and natural components can be transported between ground and surface water bodies.

This project will provide LPSNRD with several advanced tools to further its work in protecting water quality. As has already been discussed, LPSNRD has used its authorities to manage groundwater quality throughout its history. Completion of the Framework and integration of AEM into more detailed and accurate groundwater models, while not changing any of LPSNRD's authorities, will allow the District to better understand how various human activities influence ground and surface water quality, and especially to target limited resources where the new insights have the potential to produce the greatest return. LPSNRD's efforts, along with those of farmers, landowners, municipalities, etc. have in some

cases contributed to stabilization or reduction of nitrate in groundwater. Again, this project will not change the fundamental approach used by LPSNRD to manage groundwater quality, but will allow for more detailed understanding and targeting of groundwater management activities, as well as provide better public understanding and visualization of the complex factors contributing to water quality concerns.

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.

LPSNRD has included $165,000 in its draft budget/Long Range Implementation Plan (LRIP) for FY 2022. The appropriate page from that budget is included in Attachment A, along with letters of support from the five NRDs adjoining LPSNRD and NeDNR. LPSNRD's contribution of $165,000 or 40.25% of the project total. LPSNRD has estimated the 2021-2022 property tax request at 0.030024 cents per $100 of valuation resulting in $10,156,870 from property taxes, and a total operating budget of $34,258,2432. It's important to note that LPSNRD has demonstrated significant commitment to collection and utilization of AEM data; since the inception of the effort in 2006, LPSNRD has spent over $2 million of its own funding to collect this data. This project will be the next step in utilization of this valuable information.

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.

LPSNRD, as one of Nebraska's 23 Natural Resources Districts, has long-established and well-identified authorities and responsibilities in groundwater management and other areas. LPSNRD's GWMP, voluntary IMP, and Master Plan provide philosophy, detail, and structure for its efforts in these areas (see Section 4 above).

The target area for this project is the entire LPSNRD, which covers slightly less than 1 million acres or more than 1,500 square miles in eastern Nebraska. The population of the NRD is about 315,000. Groundwater resources in LPSNRD are utilized for essentially the entire spectrum of beneficial uses: domestic and municipal supply, agriculture (including livestock production), and commercial/industrial uses.

The stakeholders/participants in this project include the following:

Lower Platte South Natural Resources District (LPSNRD)
LPSNRD is the sponsor and lead agency for this project. Its role will be to serve as the fiscal agent to NeDNR and NNRC, communicated and guide the project with input from NeDNR, PMRNRD, LPNNRD, NNRD, LBBNRD, and UBBNRD, and manage the contractor(s) responsible for the hydrogeologic framework and associated products. LPSNRD will provide technical support and data to the contractor(s), and will review all work products.

Papio-Missouri River Natural Resources District (PMRNRD)
Lower Platte North Natural Resources District (LPNNRD)
Nemaha Natural Resources District (NNRD)
Lower Big Blue Natural Resources District (LBBNRD)
Upper Big Blue Natural Resources District (UBBNRD)
These five NRDs adjoin LPSNRD, and PMRNRD, LPNNRD, and NNRD either have been or are in the process of collecting and analyzing AEM data for their own regional and District-wide efforts. In all cases, these NRDs share some aquifer units and other groundwater-related concerns with LPSNRD. All of these NRDs are supporting partners for this project and will provide AEM data if available to be included in a five-mile buffer around LPSNRD, and provide technical input on possible future cooperation on cross-boundary groundwater issues.

Nebraska Department of Natural Resources (NeDNR)
The NeDNR is consulting with LPSNRD on this project to help ensure that products will be compatible with NeDNR's groundwater modeling and associated issues of mutual concern. NeDNR staff will also be responsible for reviewing products and providing technical support.

The beneficiaries of this project will primarily be the individuals and entities within LPSNRD who depend on groundwater for the above-referenced uses. This project will enable LPSNRD to provide those users with high-tech, visually descriptive products to help them understand all of the complexities and concerns surrounding groundwater supply and quality in LPSNRD. Further, this project will allow LPSNRD to utilize the AEM data in a variety of groundwater modeling efforts (i.e. MODFLOW) at the regional and local scale, and will increase knowledge of the availability and movement of groundwater as well as to evaluate future scenarios considering varying use. Such modeling results will

be useful for municipalities, planners, consultants, and any individuals concerned with future groundwater use and availability. Finally, this project will benefit LPSNRD's neighboring NRDs as well as NeDNR and other state and federal agencies by helping to ensure that available hydrogeologic data and model results are consistent and comparable across NRD boundaries.

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.

Nitrate contamination of groundwater is a statewide issue, and the potential for pesticide contamination can also be a concern. This is demonstrated by decades' worth of groundwater monitoring data from the NRDs as well as state and federal entities. Essentially, anywhere that row crop production is practiced, and especially those areas of shallow groundwater and/or coarse soils are vulnerable to elevated levels of agricultural contaminants. As noted, several areas in LPSNRD have shown elevated levels of nitrate. Around the Village of Elmwood in Cass County, groundwater nitrates are high enough that the Village has installed a water treatment plant at the cost of several million dollars, so it's obvious that increasing nitrate levels in groundwater are an economic as well as health concern. This project will help address these concerns by increasing understanding and visualization of complex groundwater geology, and providing state-of-the-art AEM data for use in groundwater modeling, thereby allowing water suppliers and well owners to better manage existing sources as well as evaluating possible new locations for wells..

All across Nebraska, the possibility of drought can be a concern, and one of the primary effects of drought is on the availability of groundwater supplies. By providing advanced technologies to understand and predict groundwater availability, movement, and simulate future scenarios, this project will provide an important new set of tools to understand, respond to, and predict drought effects.

Nebraska is home to many threatened and endangered species, some of whom are intimately connected with the interaction between ground and surface water. This project, by providing greater detail and knowledge of the nature and location of ground and surface water interactions, will allow resources managers to better make decisions in areas where those species are concerned.

This project is largely concerned with utilizing past experiences and knowledge from entities such as LENRD, PMRNRD, and LPNNRD. As mentioned, this specific project will contribute to consistency and comparability of data across

NRD boundaries. This knowledge can be transferred to any NRDs (or other entities) which share political boundaries, and the resulting consistency and comparability can be replicated.

The target area for this project is the entire LPSNRD, which covers slightly less than 1 million acres or more than 1,500 square miles in eastern Nebraska. The population of the NRD is about 315,000. But as noted above, the techniques and knowledge gained by implementation of this project can and will produce benefits for natural resources issues faced by the entire State of Nebraska.

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 proposed cost breakdown for this project is shown in Table 7:

Table 7. Project Cost Breakdown

Project Total	WSF	LPSNRD
$412,500	$247,500	$165,000
% Share	60%	40%

LPSNRD's contribution to this project ($165,000) has been included in its draft budget/Long Range Implementation Plan (LRIP) for FY2022; a copy of the appropriate budget page is included in Attachment A. Should WSF funding not be available, LPSNRD has, through its past expenditures on collecting AEM data, demonstrated its dedication to the use of this important tool and would continue to explore ways of doing so. Lack of WSF funding would set this effort back substantially, however.

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 LPSNRD has an approved IMP and is an active partner in support of implementation the Lower Platte River Drought Contingency Plan and Lower Platte River Basin Coalition Basin Water Management Plan. These three plans include similar goals aimed at maintaining adequate flows in the Lower Platte River and associated tributaries. Understanding the hydrological connection between groundwater and surface water is paramount in the success of these planning efforts

and will direct actions within LPSNRD to maintain adequate flows through sound groundwater management.

The Framework will provide information to enhance integrated management decisions, ultimately leading to actions that will safeguard, or enhance streamflow as water demand and supply are balanced.

This in turn directly contributes to watershed health and function, especially in the Lower Platte River, home to the endangered pallid sturgeon and least tern, and the threatened piping plover and a source of drinking water to Lincoln and Omaha.

This project will assist the state and NRDs in managing groundwater and surface water to meet its obligation under the instream flow appropriation permit granted to the Nebraska Game and Parks Commission for the central and lower Platte River on June 26, 1998 (with a instream flow priority date of November 30, 1993).

The primary major watersheds benefited through this project include: Salt Creek, Lower Platte River, Weeping Water, and Missouri River tributaries.

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.

NeDNR Annual Report and Plan of Work - 2020

In 2020, the NeDNR completed the most current Annual Report and Plan of Work[1]. The NeDNR utilizes several of its program areas to implement the state water planning and review process. Five of the six implementation objectives identified in the Annual Plan of Work will be addressed through this project. They include:

1) Maintain data, information, and analysis capabilities for water planning, including specific programs for collecting, maintaining, and distributing information on stream flows, as well as analyzing water uses and water supplies across the state;

This objective is achieved with the establishment of the Framework and model files for the LPSNRD. NeDNR is consulting with LPSNRD, providing data, product reviews, and technical support.

[1] NeDNR. Annual Report and Plan of Work for the State Water Planning and Review Process. September 2019. Page 1 - 2

2) Provide staff and resources to support planning and implementation of water resources projects;

NeDNR staff are involved with ENWRA and individual NRDs to support IMP implementation. Staff have been supporting this application and will be supporting development of the Framework. In the future, it is anticipated that NeDNR will integrate the results of this project into their planning and groundwater modeling activities.

3) Support locally developed water management plans for conjunctively managing hydrologically connected groundwater and surface water supplies;

The LPSNRD Framework and model files are a first major step to establishing flow models utilizing AEM. These models will be used by LPSNRD and NeDNR to model stream depletion factors and mapping hydrologically connected groundwater and surface water supplies.

4) Provide resources to map and identify areas vulnerable to flood damage;

NA

5) Participate in interagency collaboration with federal agencies, state agencies, local natural resources districts (NRD's), and other water interest entities on various water resources programs and projects; and

This project is exemplifies collaboration as LPSNRD is working with multiple NRDs to create consistent datasets allowing for effective water resource management across political boundaries. This interagency collaboration will reduce future conflicts between NRDs, NeDNR, and other agencies related to water management in the Lower Platte River.

6) Consolidate and present information in a form that is understandable and useful to the public and interagency collaborators.

A primary deliverable to LPSNRD, NeDNR, and other stakeholders is completion of a 3D visualization geologic model for the AEM data, with the data files for use a free downloadable 3D model software viewer that allows the water management staff to use the 3D model. The 3D modelling software is highly illustrative, visually compelling, and will aid in education of the public when discussing groundwater management.

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 Safe Drinking Water Act of 1947 (SDWA; Pub.L.93-523 88 Stat. 1660 42 U.S.C. §300) discusses the protection of groundwater sources from contaminants identified as threats to public health and quantifies the acceptable levels of these contaminants in public systems. Public water suppliers are required to provide drinking water that meets various federal standards or Maximum Contaminant Levels (MCLs), with the most applicable being the 10 parts per million MCL for nitrate-nitrogen, but also including MCLs and other guidance limits for many agricultural and industrial contaminants as well as naturally occurring constituents. The SDWA also discusses the designation of a sole source aquifer (section 1427) and the establishment of wellhead protection areas (section 1428); as already mentioned several of LPSNRD's GWMAs are based upon established wellhead protection areas. This project will help communities meeting the standards set forth by the SDWA. The project would create and improve maps as recharge potential that could be used to assess groundwater vulnerability of drinking water aquifer from surface contamination. Historic groundwater quality data will be evaluated, and statistical testing will be used to improve maps of groundwater recharge potential or groundwater vulnerability. Updated water-level maps could be used by municipalities to delineate groundwater capture zones and update or create well head protection areas for newly drilled wells. In addition, the project will provide LPSNRD with additional information to promote agricultural best management practices (BMPs) in these areas so as to minimize the occurrence and likelihood of nitrate contamination of groundwater supplies.

As previously mentioned, LPSNRD is home to a number of saline wetlands complexes due to its unique geology and hydrogeology, and the presence of distinct groundwater flow paths which allow highly saline water to rise to the land surface. These wetlands play host to a number of endangered or threatened species such as the Federally listed Salt Creek Tiger Beetle and State listed saltwort. Efforts to manage and enhance critical habitat for the Tiger Beetle and other at-risk species are difficult under the best of circumstances, but this project will provide advanced, cutting edge technologies to better understand saline groundwater occurrence and movement, and how this relates to the establishment and maintenance of saline wetlands, especially given the sensitivity of AEM technology to saline groundwater.