NEBRASKA NATURAL RESOURCES COMMISSION

Water Sustainability Fund

Application for Funding

Section A.

ADMINISTRATIVE

PROJECT NAME: LLNRD/LPNNRD – Nitrates Legacy Assessment

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

Sponsor Business Name: Lower Loup Natural Resources District

Sponsor Contact's Name: Tylr Naprstek, Assistant Manager

Sponsor Contact's Address: 2620 Airport Drive, Ord, NE 68862

Sponsor Contact's Phone: (308) 728-3221

Sponsor Contact's Email: tnaprstek@llnrd.org

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

   Grant amount requested. $163,200

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

   If a loan is requested amount requested. $ NA

   - How many years repayment period? Click here to enter text.
   - Supply a complete year-by-year repayment schedule. Click here to enter text.

2. **Neb. Rev. Stat. § 2-1507 (2)**

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

   If yes:

- Do you have a Long Term Control Plan that is currently approved by the Nebraska Department of Environmental Quality? YES☐ NO☒

- Attach a copy to your application. NA

- What is the population served by your project? 37,000 (estimated)

- Provide a demonstration of need. Nitrate concentrations in groundwater in Platte, Colfax, and Dodge Counties often exceed the Environmental Protection Agency Maximum Contaminant Level of 10 milligrams per liter (U.S. Environmental Protection Agency, 2018). Area 30, which is in the Lower Loup NRD (LLNRD) is located east of Columbus, where the median concentration of nitrate has increased to over 20 mg/L from 1990 to present (2022; Tylr Naprstek, written commun. 2022). To the east, in the Lower Platte North NRD (LPNNRD), the median groundwater nitrate concentration between the towns of Richland and Schuyler is nearly 15 mg/L (Daryl Andersen, written commun., 2022). The elevated nitrate concentrations are likely the result of groundwater irrigated row-crop and concentrated livestock production in an area with permeable soils and shallow depths to water. The LLNRD and the LPNNRD are actively managing groundwater quality to reduce the amount of nitrate entering the groundwater system. Current (2023) rules and regulations dictate the timing of fertilizer application within their management areas; however, there often is a lag between when fertilizer or animal waste is applied to land surface to when groundwater quality is negatively impacted. The lag time is highly variable and dependent on several factors including depth to water, soil type, and land use practices. As such, the current nitrate concentration does not necessarily reflect the effects of current nutrient management practices on groundwater quality. Determining the nitrate concentration and the age of groundwater can assist in developing a history of nitrate loading to the groundwater system and assess the effectiveness of current nitrate management strategies to address management goals.

- **Do not complete the remainder of the application.**

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

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

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

Click here to enter text.

4. **Partnerships**

List each Partner / Co-sponsor, attach documentation of agreement:
The Lower Loup Natural Resources District (LLNRD) is the lead agency for this proposed project and will enter in an interlocal agreement with the Lower Platte North Natural Resources District (LPNNRD). The LLNRD and LPNNRD will enter into a joint funding agreement with the U.S. Geological Survey (USGS) who will be the technical lead for this proposed project. Letters of support from the LPNNRD and the USGS can be found in Appendix A.

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

The LLNRD is the lead agency of this project and will provide administrative support and project coordination which includes reporting to the Water Sustainability Fund. The LPNNRD will assist with project coordination and local support. The USGS will provide technical support and cooperative matching funds.

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 cost of the proposed project is $408,200. The USGS is providing $137,000 in cooperative matching funds, which reduces to total project cost to

$272,000. The LLNRD and the LPNNRD are providing a total of $108,000 for the 40% local match. The remaining 60% ($163,200) would be funded through this grant application. Please refer to budget table below and letters of support (Attachment A) for reference.

	FY24	FY25	FY26	TOTAL
TOTAL	$148,000	$154,000	$106,200	$408,200
USGS	$32,000	$63,000	$42,000	$137,000
WSF	$70,000	$55,000	$38,200	$163,200
LPNNRD	$23,000	$18,000	$13,000	$54,000
LLNRD	$23,000	$18,000	$13,000	$54,000

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!

Nitrate concentrations in groundwater in Platte, Colfax, and Dodge Counties often exceed the Environmental Protection Agency Maximum Contaminant Level of 10 milligrams per liter. The elevated nitrate concentrations are likely the result of groundwater irrigated row-crop and concentrated livestock production in an area with permeable soils and shallow depths to water. The LLNRD and the LPNNRD are actively managing groundwater quality to reduce the amount of nitrate entering the groundwater system. Current (2023) rules and regulations dictate the timing of fertilizer application within their management areas; however, there often is a lag between when fertilizer or animal waste is applied to land surface to when groundwater quality is negatively impacted. The lag time is highly variable and dependent on several factors including depth to water, soil type, and land use practices. As such, the current nitrate concentration does not necessarily reflect the effects of current nutrient management practices on groundwater quality. Determining the nitrate concentration and the age of groundwater can assist in developing a history of nitrate loading to the groundwater system and assess the effectiveness of current nitrate management strategies to address management goals. The focus of this study is to estimate nitrate concentration and age of groundwater in selected areas of Platte, Colfax, and Dodge Counties (project map in Appendix B). Specific objectives are listed here: 1) Determine the nitrate concentration and age of groundwater. Summary of approach: Sample approximately 24 monitoring and domestic wells and analyze environmental tracer and other supporting geochemical data. Groundwater age distributions will be determined using Tracer LPM (Jurgens and others, 2012). The nitrate history of the study area will be described using the estimated age and nitrate concentration of groundwater. Discrete water-quality sample data, including environmental tracer results will be stored in the USGS National Water Information System database. 2) Assess groundwater vulnerability at different locations within the study area. Summary of approach: Estimates of groundwater age, along with supporting hydrogeologic information will be used to estimate groundwater recharge rates using an approach described in Steele and others (2014). Higher rates of groundwater

recharge for a given area is linked to increased vulnerability of groundwater to surface contamination. Furthermore, the calculated susceptibility index (Solder and others, 2020) provides a quantitative estimate of susceptibility of a well to land surface contamination and can identify which areas may need more intensive management. 3) Examine natural processes that can reduce nitrate concentrations. Summary of approach: Examine aquifer geochemistry to determine the role of denitrification, which is a microbially mediated natural attenuation process. The role of mixing and dilution with surface water will be assessed by comparing water-level elevations of groundwater in wells with surface-water features (for ex. Loup Power Canal or Platte River) and examining stable isotope sample data. Young tracers, such as tritium, tritium-helium, and sulfur hexafluoride will be sampled because they are well suited to determine the age of groundwater in unconfined aquifers. Groundwater will also be sampled for major ions, trace elements, dissolved gases, noble gases, and stable isotopes to provide additional geochemical information to support age tracer interpretations. The results of the study will be published as an online USGS Scientific Investigations Report. Availability of an online report helps disseminate the results of the investigations to a broad audience and enables water managers and users to gain access to this information in a timely manner. All products will adhere to the USGS Fundamental Science Practices including peer review and to all other USGS standards for scientific integrity and quality.

7. Project Tasks and Timeline

Identify what activities will be conducted to complete the project, and the anticipated completion date.
For multiyear projects please list (using the following example):

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

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

Project timeline

	FFY 2024				FFY 2025				FFY 2026			
Activity	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Well selection	X	X										

Groundwater sampling and data review	X	X	X	X	X							
Laboratory analyses					X	X	X					
Environmental tracer analysis and geochemical modeling						X	X	X	X			
Quality assurance and report production							X	X	X	X	X	X

[FFY; Federal Fiscal Year, October 1 through September 30.]

Activity		**FFY2024**	**FFY2025**	**FFY2026**	**TOTAL**
Well selection		$10,000	$0	$0	$10,000
Groundwater sampling and data review		$71,000	$10,000	$0	$81,000
Laboratory analyses		$67,000		$0	$67,000
Environmental tracer analysis and geochemical modeling		$0	$120,000	$61,200	$181,200
Quality assurance and report production		$0	$24,000	$45,000	$69,000
TOTALS		**$148,000**	**$154,000**	**$107,000**	**$408,200**

[FFY; Federal Fiscal Year, October 1 through September 30.]

The tables above show the planned project timeline and budgeted totals for associated project activities. The proposed project will likely begin at the start of Federal Fiscal Year 2024 and will be completed in three years.

8. **IMP**

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

The LLNRD and the LPNNRD have both collaborated with the Nebraska Department of Natural Resources (DNR) to create Voluntary Integrated Management Plans.

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; NA

1.A.2 Describe the plan of development (004.01 A); NA

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

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

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

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

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

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

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). NA

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

1.B.1 Insert data necessary to establish technical feasibility (004.02); Estimating the age of groundwater is an increasingly common approach to inform water resource management strategies. Groundwater age is often used to estimate

groundwater recharge rates, examine the sustainability of groundwater use, and determine the vulnerability of groundwater to surface contamination. For the proposed project two tracers will be sampled; tritium-helium and sulfur hexafluoride, which are well suited for determining the age of groundwater less than 50 years old (Jurgens and others, 2012). The paired sampling of groundwater age tracers and nitrate will determine the approximate time when groundwater entered the shallow aquifer. This approach has been used in other places in Nebraska, including the Bazile Groundwater Management Area (Hobza and Steele, 2020; Snow and Miller, 2018; Burbach and Spalding, 2000) to understand how nitrate concentration and age vary with depth. This type of data set will be invaluable in understanding how legacy nitrate is affecting groundwater quality and to determine if groundwater that has recharged since the time more stringent nitrate management regulations have been enacted still has high concentrations of nitrate.

1.B.2 Discuss the plan of development (004.02 A); The LLNRD and the LPNNRD plan to work with the USGS to complete a study that will focus on determining the nitrate concentration and groundwater age in monitoring and domestic wells selected by the LPNNRD and LLNRD in Platte, Colfax, and Dodge Counties (project map in Appendix B). Young tracers, tritium-helium, and sulfur hexafluoride will be sampled because they are well suited to determine the age of groundwater in unconfined aquifers. Groundwater will also be sampled for major ions, trace elements, dissolved gases, noble gases, and stable isotopes to provide additional geochemical information to support age tracer interpretations. The groundwater age distribution will be determined through geochemical modeling using the Tracer LPM workbook (Jurgens and others, 2012). The age distribution will be used to determine the susceptibility index (Solder and others, 2020) for each sample. The susceptibility index provides a quantitative estimate of susceptibility of a well to land surface contamination and can identify which areas may need more intensive management. In many locations, groundwater recharge can be calculated to assess the effect of irrigation and other land uses on the rates of water movement from the land surface to the aquifer. The calculated recharge, which describes the rate of movement from the land surface to the aquifer can also be used to communicate to stakeholders when the effects of current management strategies can be realized at different locations and depths withing the aquifer. Groundwater level information, either from repeated manual measurements or recorded by transducers will be used to determine vertical groundwater gradients and the influence of surface water, which will be useful in age tracer interpretation.

1.B.3 Describe field or research investigations utilized to substantiate the project conception (004.02 B); Estimating the age of groundwater is an increasingly common approach to inform water resource management strategies. Groundwater age is often used to estimate groundwater recharge rates, examine the sustainability of groundwater use, and determine the vulnerability of groundwater to surface contamination. For the proposed project, two different

tracers will be sampled; tritium-helium and sulfur hexafluoride, which are well suited for determining the age of groundwater less than 50 years old (Jurgens and others, 2012). The paired sampling of groundwater age tracers and nitrate will determine the approximate time when groundwater entered the shallow aquifer. This approach has been used in other places in Nebraska including the Bazile Groundwater Management Area (Hobza and Steele, 2020; Snow and Miller, 2018; Burbach and Spalding, 2000) to understand how nitrate concentration and age vary with depth. This type of data set will be invaluable in understanding how legacy nitrate is affecting groundwater quality and to determine if groundwater that has recharged since the time more stringent nitrate management regulations have been enacted still has high concentrations of nitrate.

1.B.4 Describe any necessary water and/or land rights (004.02 C); No land or water rights are needed for this proposed project.

1. 1.B.5 Discuss the anticipated effects, if any, of the project upon the development and/or operation of existing or envisioned structural measures including a brief description of any such measure (004.02 D). The project will help inform nutrient management decisions needed to improve groundwater quality by determining the role of legacy nitrate on groundwater quality. The anticipated findings from this proposed project will hopefully reduce the possibility of reverse osmosis water treatment systems for well owners, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023).

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 purpose of this project is to help determine the influence of legacy nitrate on groundwater quality. This insight and information from this project will help foster best management practices to preserve groundwater quality from further degradation and for the efficient use of fertilizers which are needed to sustain agricultural production. The next best alternative is to enact overly stringent nutrient management strategies, which may adversely affect crop production and negatively impacting the income of local producers. Conversely, if the necessary steps are not taken, and nitrate concentrations in groundwater may continue to increase, local well owners may need to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023). The

additional water treatment is particularly important because of recent research that suggests a linkage between nitrate in groundwater and certain types of pediatric cancer (Ouattara, 2022).

3. Document all sources and report all **costs** and **benefit data** using current data, (commodity prices, recreation benefit prices, and wildlife prices as prescribed by the Director) using both dollar values and other units of measurement when appropriate (environmental, social, cultural, data improvement, etc.). The period of analysis for economic feasibility studies is the project life. (Title 261, CH 2 - 005). The total cost of the proposed project is $408,200 of which the LLNRD and LPNNRD are requesting $163,200 in funds from the Water Sustainability Fund. The benefits of this project are to provide the needed background information to develop cost-effective solutions to manage fertilizer use and reduce nitrate concentrations in groundwater. The LLNRD and the LPNNRD want to base their future management decisions using the best available science. Water managers want to avoid enacting overly stringent nutrient management strategies, which may adversely affect crop production and negatively impacting the income of local producers. Conversely, if the necessary steps are not taken, and nitrate concentrations in groundwater continue to increase, local well owners may need to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023). The additional water treatment is particularly important because of recent research that suggests a linkage between nitrate in groundwater and certain types of pediatric cancer (Ouattara, 2022).

3.A Describe any relevant cost information including, but not limited to the engineering and inspection costs, capital construction costs, annual operation and maintenance costs, and replacement costs. Cost information shall also include the estimated construction period as well as the estimated project life (005.01). The total cost of the proposed project is $408,200 of which the LLNRD and LPNNRD are requesting $163,200 in funds from the Water Sustainability Fund. The data collected and major findings of this study will be published in a USGS Scientific Investigations Report. Availability of an online report helps disseminate the results of the investigations to a broad audience and enables water managers and users to gain access to this information in a timely manner after publication and into the future. All products will adhere to the USGS Fundamental Science Practices including peer review and to all other USGS standards for scientific integrity and quality. USGS will maintain the data collected and the resulting report as part of their national data management that will not include any maintenance costs to the project. There will be no annual operation, inspection, or replacement costs with this project. The estimated project life or the future relevance or applicability of this research project is undeterminable because of the nature of the system being studied that could change in the future.

3.B Only primary tangible benefits may be counted in providing the monetary benefit information and shall be displayed by year for the project life. In a multi-purpose project, estimate benefits for each purpose, by year, for the life of the project. Describe intangible or secondary benefits (if any) separately. In a case where there is no generally accepted method for calculation of primary tangible benefits describe how the project will increase water sustainability, in a way that justifies economic feasibility of the project such that the finding can be approved by the Director and the Commission (005.02). The benefits of this project are to provide the background information needed to develop cost-effective solutions using sound data representative of current conditions. Use of assumed or dated data and a less than thorough understanding of legacy nitrate and its influence on drinking water quality may lead to uninformed groundwater management decisions that could have negative economic implications or could further impair groundwater quality.

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). Given below is a cost table of the proposed project. Exact tangible benefits cannot be described for the research project.

Activity		**FFY2024**	**FFY2025**	**FFY2026**	**TOTAL**
Well selection		$10,000	$0	$0	$10,000
Groundwater sampling and data review		$71,000	$10,000	$0	$81,000
Laboratory analyses		$67,000		$0	$67,000
Environmental tracer analysis and geochemical modeling		$0	$120,000	$61,200	$181,200
Quality assurance and report production		$0	$24,000	$45,000	$69,000
TOTALS		**$148,000**	**$154,000**	**$106,200**	**$408,200**

[FFY; Federal Fiscal Year, October 1 through September 30.]

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.) There is not a generally accepted method for calculation of primary tangible benefits of the proposed research project. This research will support water sustainability because the information gained will assist the LLNRD and LPNNRD to make

future water management decisions to meet the water needs of approximately 37,000 Nebraskans. The purpose of this project is to help determine the influence of legacy nitrate on groundwater quality. This insight and information from this project will help foster best management practices to preserve groundwater quality from further degradation and for the efficient use of fertilizers which are needed to sustain agricultural production. The next best alternative is to enact overly stringent nutrient management strategies, which may adversely affect crop production and negatively impacting the income of local producers. Conversely, if the necessary steps are not taken, and nitrate concentrations in groundwater continue to increase, local well owners may need to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023). The additional water treatment is particularly important because of recent research that suggests a linkage between nitrate in groundwater and certain types of pediatric cancer (Ouattara, 2022).

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. The LLNRD and LPNNRD have allocated funds for this study. Letters of support are provided in Appendix A. The table below lists the 2022-2023 property tax levies, valuations, and sources of revenue for the LLNRD and LPNNRD (Nebraska Auditor of Public Accounts https://www.nebraska.gov/auditor/reports/index.cgi?budget=1- accessed March 9, 2023). The USGS is providing $137,000 in cooperative matching funds to support this project. See Appendix A for letters of financial support.

Natural Resources District	Tax Levy (per $100 valuation)*	Valuation*	Total Resources Available*	Local match for proposed project
Lower Loup	$0.0367	$16,991,592,902	$19,358,749	$54,000
Lower Platte North	$0.03	$11,108,737,004	$9,881,049	$54,000

5. Provide evidence that sufficient annual revenue is available to repay the reimbursable costs and to cover OM&R (operate, maintain, and replace). There is no revenue anticipated from this project and there will be no operation, maintenance, or replacement costs.

6. If a loan is involved, provide sufficient documentation to prove that the loan can be repaid during the repayment life of the proposal. There is no loan involved with the proposed project.

7. Describe how the plan of development minimizes impacts on the natural environment (i.e. timing vs nesting/migration, etc.). The proposed project has minimal impacts on the natural environment because the field activities are limited to sampling existing monitoring and domestic wells. The groundwater sampling and other field activities will result in no adverse or detrimental impact to the environment.

8. Explain how you are qualified, responsible and legally capable of carrying out the project for which you are seeking funds. The LLNRD and the LPNNRD have the authority under the Nebraska Groundwater Management and Protection Act, Chapter 46 Article to enter into contracts or agreements, budget, and expend levied property taxes, own and operate property and equipment, and conduct investigations relative to the protection and management of groundwater. Nebraska State Statute Chapter 2 Article 32 gives the LLNRD and the LPNNRD authority to carry out projects related to the development, management, utilization, and conservation of groundwater and surface water. The NRD staff members have local knowledge of the area and groundwater resources and current licensed Natural Resource Technicians. The USGS has a major role in studying the Nations water resources and serves as the lead earth science agency of the Federal Government. The Nebraska Water Science Center employs 35 scientists whose mission is to deliver timely, accurate, and relevant information on Nebraska's water resources. Project staff with the USGS include Professional Geologists licensed with the State of Nebraska.

9. Explain how your project considers plans and programs of the state and resources development plans of the political subdivisions of the state. The proposed project will support the goals and objectives of management plans for the LLNRD and the LPNNRD aimed at sustaining groundwater quality and availability. This project would provide supporting data and background on groundwater quality (nitrate) for the current iteration of the LLNRD Groundwater Management Plan and will supplement annual water-quality reports (example Lower Loup Natural Resources District, 2021). The LLNRD Groundwater Management Plan outlines the water-quality monitoring program and provides important baseline data. The proposed project could serve as a template for other special management areas for both the LLNRD and the LPNNRD. The LPNNRD outlines in its Groundwater Management Area Rules and Regulations, including the triggers and management actions aimed at reducing nitrate concentrations in groundwater. The proposed project will provide critical information and determine if the LPNNRD's current rules and regulations are having the intended effect by determining the age and nitrate concentration of groundwater. The proposed project also supports the voluntary IMPs for the LLNRD and the LPNNRD, which has been developed with DNR. Groundwater

age tracer information will be used to determine the groundwater recharge rates for different locations within the project area, which will be used to assess the vulnerability of groundwater to surface contamination. This information can also be used to assess the time of travel, groundwater/surface-water interaction, and groundwater residence time which are all important considerations to water availability. The LLNRD and the LPNNRD are two of seven NRDs included int the Lower Plate River Basin Coalition which created a basin wide plan to protect existing groundwater and surface-water uses. The proposed project supports the goals and objectives of the Lower Plate River Basin Coalition by improving the understanding of groundwater recharge processes and groundwater surface-water interaction along critical reaches of the Platte and Loup Rivers. The proposed project also supports other groundwater management plans that are administered by other state agencies. The Nebraska Ground Water Management and Protection Act which allows for the protection and conservation of groundwater which are essential to economic prosperity and future well-being. The proposed project is intended to provide the necessary information to protect drinking water for approximately 37,000 Nebraskans. The proposed project also supports the Nebraska Department of Environment and Energy's Title 130 because the findings will have direct impacts nutrient management practices which include applying manure as fertilizer. The age-dating data will be published and available to the NDEE for their consideration of the nitrate contamination problem in the area around the Loup/Platte Confluence. Furthermore, the proposed project will also support the Wellhead Protection Areas for the cities of Columbus, Schuyler, and North Bend.

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. NA

10.B Attach proof of ownership for each easements, rights-of-way and fee title currently held. NA

10.C Provide assurance that you can hold or can acquire title to all lands not currently held. NA

11. Identify how you possess all necessary authority to undertake or participate in the project. The participating NRDs have the authority under Nebraska State Statute Chapter 2 Article 32 to carry out this project under its authorized purposes relating to the development, management, utilization, and conservation of groundwater and surface water. This includes the NRDs' authorities (furthered under the Nebraska Groundwater Management and Protection Act Chapter 46 Article 7 regarding groundwater) to enter into contracts or agreements, budget and expend levied property taxes, own, and operate property and equipment,

and conduct investigations relative to the protection and management of groundwater.

12. Identify the probable consequences (environmental and ecological) that may result if the project is or is not completed. The proposed project was envisioned to help determine the influence of legacy nitrate on groundwater quality. The information gathered from this project will help foster best management practices to preserve groundwater quality from further degradation and for the efficient use of fertilizers which are needed to sustain agricultural production. If this project is not completed the LLNRD and LPNNRD will make future groundwater management decisions without the needed scientific information. This may result in enacting overly stringent nutrient management strategies, which may adversely affect crop production and negatively impact the income of local producers. Conversely, if the necessary management steps are not taken, and nitrate concentrations in groundwater continue to increase, local well owners may need to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023). The additional water treatment is particularly important because of recent research that suggests a linkage between nitrate in groundwater and certain types of pediatric cancer (Ouattara, 2022).

Section C.

NRC SCORING

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

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

Notes:

- The responses to one criterion ***will not*** be considered in the scoring of other criteria. Repeat references as needed to support documentation in each criterion as appropriate. The 15 categories are specified by statute and will be used to create scoring matrixes which will ultimately determine which projects receive funding.

- There is a total of 69 possible points, plus two bonus points. The potential number of points awarded for each criteria are noted above. Once points are assigned, they will be added to determine a final score. The scores will determine ranking.

- The Commission recommends providing the requested information and the requests are not intended to limit the information an applicant may provide. An applicant should include additional information that is believed will assist the Commission in understanding a proposal so that it can be awarded the points to which it is entitled.

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

1. Remediates or mitigates threats to drinking water;

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

   The project will address groundwater nitrate and groundwater sustainability. Groundwater is an important drinking water source for the 37,000 people within the study area (project map in Appendix B) where nitrate concentrations often

exceed the Environmental Protection Agency Maximum Contaminant Level of 10 milligrams per liter (U.S. Environmental Protection Agency, 2018). The elevated nitrate concentrations are likely the result of groundwater irrigated row-crop and livestock production in an area of Platte, Colfax, and Dodge Counties with permeable soils and shallow depths to water. The LLNRD and the LPNNRD are actively managing groundwater quality to reduce the amount of nitrate entering the groundwater system within the study area. Current (2023) rules and regulations dictate the timing of fertilizer application within their management areas; however, there often is a lag between when fertilizer or animal waste is applied to land surface to when groundwater quality is negatively impacted. The lag time is highly variable and dependent on several factors including depth to water, soil type, and land use practices. As such, the current nitrate concentration does not necessarily reflect the effects of current nutrient management practices on groundwater quality. Determining the nitrate concentration and the age of groundwater can assist in developing a history of nitrate loading to the groundwater system and assess the effectiveness of modern nitrate management strategies to address the management goal of improving drinking water quality. The outcomes of this study will allow for more informed decisions on groundwater-quality management. The results will also provide information on areas within the study that may have higher or lower groundwater recharge rate indicating areas that may be more vulnerable to overuse or future contamination. The LLNRD and the LPNNRD want to base their future management decisions using the best available science. Water managers want to avoid enacting overly stringent nutrient management strategies, which may adversely affect crop production and negatively impacting the income of local producers. Conversely, if the necessary steps are not taken, and nitrate concentrations in groundwater continue to increase, local well owners may need to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023). The additional water treatment is particularly important because of recent research that suggests a linkage between nitrate in groundwater and certain types of pediatric cancer (Ouattara, 2022).

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

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

The proposed project will support the goals and objectives of management plans for the LLNRD and the LPNNRD aimed at sustaining groundwater quality and

availability. This project would provide supporting data and background on groundwater quality (nitrate) for the current iteration of the LLNRD Groundwater Management Plan and will supplement annual water-quality reports (example Lower Loup Natural Resources District, 2021). The LLNRD Groundwater Management Plan outlines the water-quality monitoring program and provides important baseline data. The proposed project could serve as a template for other special management areas for both the LLNRD and the LPNNRD. The LPNNRD outlines in its Groundwater Management Area Rules and Regulations the triggers and management actions aimed at reducing nitrate concentrations in groundwater. The proposed project will provide critical information and determine if the LPNNRD's current rules and regulations are having the intended effect by determining the age and nitrate concentration of groundwater. The proposed project also supports the approved voluntary IMPs for the LLNRD and the LPNNRD. Groundwater age tracer information will be used to determine the groundwater recharge rates for different locations within the project area, which will be used to assess the vulnerability of groundwater to surface contamination. This information can also be used to assess the time of travel, groundwater/surface-water interaction, and groundwater residence time which are all important considerations to water availability. The proposed project also supports other groundwater management plans that are administered by other state agencies. The Nebraska Ground Water Management and Protection Act which allows for the protection and conservation of groundwater which are essential to economic prosperity and future well-being. The proposed project is intended to provide the necessary information to protect drinking water for approximately 37,000 Nebraskans. The proposed project also supports the Nebraska Department of Environment and Energy's Title 130 because the findings will have direct impacts on when and how much manure may be applied to fields as well as locating and permitting Confined Animal Feeding Operations. The age-dating data will be published and available to the NDEE for their consideration of the nitrate contamination problem in the area around the Loup/Platte Confluence.

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 study focuses on the determining the nitrate concentration and age of groundwater in the study area in Platte, Colfax, and Dodge Counties near the confluence of the Loup and Platte Rivers. Although the focus is on water-quality

the proposed project supports the approved voluntary IMP goals for the LLNRD and the LPNNRD, which are aimed at maintaining streamflows within the Loup River and Platte River basins. Groundwater age tracer information will be used to determine the groundwater recharge rates for different locations within the project area; furthermore, this information can also be used to assess the time of travel, groundwater/surface-water interaction, and groundwater residence time which are all important considerations to water availability. This information will provide insight into the recharge of the area, such as the location of where recharge to groundwater might occur at higher rates and areas where sustainability could be of concern. Older groundwater ages generally indicate lower recharge rates and a potential sensitivity to additional development and aquifer depletion. An increased reliance on groundwater that is determined to be old (recharged pre-1950s) may lead to unsustainable groundwater depletions negatively impacting future municipal, domestic, commercial, industrial, and agricultural water supplies.

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.

This project focuses on the conservation and preservation of groundwater as a drinking water source for approximately 37,000 Nebraskans. The information provided by this project will enable water resource managers to assess the effectiveness of current nitrate management strategies to address management goals, communicate the concept of legacy nitrate to area residents, and assess nitrate loading history within the study area. Potential project benefits are listed here:1. Make more informed decisions on groundwater-quality management. The results and interpretations provided by this study will allow groundwater managers to examine the efficacy of current nitrate management strategies and determine if areas may need more stringent nitrate management. 2. Communication with area residents and producers on the influence of legacy nitrate and its effects on groundwater quality. The concept of groundwater age is intuitive, and the results of this project will allow groundwater managers to effectively communicate when current nitrate management strategies may produce a noticeable effect on groundwater nitrate concentrations. 3. Methods used in this study may be applied to other areas of Nebraska experiencing similar groundwater quality problems. The results, data, and lessons learned from this study will be shared with the Department of Environment and Energy, other NRDs, and water managers at meetings and conferences. It is expected that the benefits of the proposed project will last for decades as it will enable

water managers from the LLNRD and LPNNRD make sound water management decisions based on the best-available science. If the LLNRD and LPNNRD continue on the current path, water managers will make future groundwater management decisions without the needed scientific information. This may result in enacting overly stringent nutrient management strategies, which may adversely affect crop production and negatively impacting the income of local producers. Conversely, if the necessary management steps are not taken, and nitrate concentrations in groundwater continue to increase, local well owners may need to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023).

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 maximize beneficial use of Nebraska's water resources by determining the nitrate concentration and age of groundwater which is used for municipal, domestic, and agricultural purposes. The LLNRD and the LPNNRD are actively managing groundwater quality for the 37,000 people within the study area to reduce the amount of nitrate entering the groundwater system. Current (2023) rules and regulations dictate the timing of fertilizer application within their management areas; however, there often is a lag between when fertilizer or animal waste is applied to land surface to when groundwater quality is negatively impacted. The lag time is highly variable and dependent on several factors including depth to water, soil type, and land use practices. As such, the current nitrate concentration does not necessarily reflect the effects of current nutrient management practices on groundwater quality. Determining the nitrate concentration and the age of groundwater can assist in developing a history of nitrate loading to the groundwater system and assess the effectiveness of current nitrate management strategies to address management goals. Water managers from the LLNRD and LPNNRD wishing to maximize the beneficial use of the resource are relying on the best available science to avoid the need for more expensive drinking water treatment. If nitrate concentrations in groundwater continue to increase, local well owners may need to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023). Conversely, decisions may result in enacting overly stringent nutrient management strategies, which may adversely affect crop production and negatively impacting the income of local producers. Groundwater within the

study area discharges to the Platte River, or the Loup River, which is a major tributary to the Platte. Groundwater with high nitrate concentrations may adversely affect water quality of the alluvial aquifer downstream where Metropolitan Utility District (MUD) Platte West and City of Lincoln wellfields are located. Information gained from this project will increase the beneficial use of water resources for nearly 800,000 Nebraskans. The proposed project would not directly lead to reductions in beneficial uses.

6. Is cost-effective;

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

The total cost of the proposed project is $408,200 of which the LLNRD and LPNNRD are requesting $163,200 in funds from the Water Sustainability Fund. From the perspective of the NRDs involved in this project the funding from the USGS and this grant would provide a seven-fold return on their initial investment. The collaboration of multiple agencies provides the most benefit to financial investment. There are no construction, O/M, or land/water acquisition costs. The benefits of this project are to provide needed background information to develop cost-effective solutions to manage fertilizer use and reduce nitrate concentrations in groundwater. The LLNRD and the LPNNRD want to base their future management decisions using the best available science. Water managers want to avoid enacting overly stringent nutrient management strategies, which may adversely affect crop production and negatively impacting the income of local producers. Conversely, if the necessary steps are not taken, and nitrate concentrations in groundwater continue to increase, local well owners may need to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023). The additional water treatment is particularly important because of recent research that suggests a linkage between nitrate in groundwater and certain types of pediatric cancer (Ouattara, 2022). This project will benefit the 37,000 area residents who rely on safe, clean drinking water to meet their everyday needs.

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

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

- Describe current deficiencies and document how the project will reduce deficiencies.

The proposed project will assist the LLNRD and the LPNNRD in managing their groundwater systems for sustainable domestic, agricultural, municipal, and industrial uses. The responsibility for ensuring safe drinking water is divided among the U.S. EPA, states, tribes, water systems, and the public. Additionally, Nebraska Title 118 policy as applicable to "interstate compacts, decrees, or other state contracts or agreements or federal law." As stated in Nebraska Title 118-Ground Water Quality Standards and Use Classifications, "It is the public policy of the State of Nebraska to protect and improve the quality of ground water for human consumption; agriculture, industry and other productive, beneficial uses…". Nebraska Title 118 also defines the maximum contaminant levels for specific constituents in drinking water supplies. Additionally, NRDs monitor nitrate and other contaminants in groundwater within their districts to determine the impact of agriculture on groundwater quality. NRDs have the authority to regulate fertilizer application when nitrate concentrations exceed set thresholds to drinking water quality. Nitrate concentrations in groundwater in Platte, Colfax, and Dodge Counties often exceed the Environmental Protection Agency Maximum Contaminant Level of 10 milligrams per liter (U.S. Environmental Protection Agency, 2018). Area 30, which is in the Lower Loup NRD (LLNRD) is located east of Columbus, where the median concentration of nitrate has increased to over 20 mg/L from 1990 to present (2022; Tylr Naprstek, written commun. 2022). To the east, in the Lower Platte North NRD (LPNNRD), the median groundwater nitrate concentration between the towns of Richland and Schuyler is nearly 15 mg/L (Daryl Andersen, written commun., 2022). The LLNRD and the LPNNRD have management objectives and nitrate thresholds in place through their Groundwater Management Plans; however, the LLNRD and the LPNNRD do not understand how legacy nitrate affects groundwater quality. The proposed project will seek to reduce this deficiency by concurrently sampling for nitrate and age tracers. Determining the nitrate concentration and age of groundwater will help managers from the LLNRD and LPNNRD know if modern nutrient management strategies are effective at reducing nitrate concentrations in shallow groundwater. This understanding will guide future management decisions aimed at reducing nitrate concentrations in groundwater.

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.

Water security and public health and safety for Nebraskans is directly tied to clean and sustainable groundwater resources. About 85% of the state's population uses groundwater as drinking water. However, decades of crop production have allowed fertilizers and some agricultural chemicals to reach groundwater. The proposed project will benefit public security, health, and safety by informing water managers the role of legacy nitrate on groundwater quality. Determining the nitrate concentration and age of groundwater will help managers from the LLNRD and LPNNRD know if modern nutrient management strategies are effective at reducing nitrate concentrations in shallow groundwater. Critical infrastructure for public water supply systems in these areas are threatened by elevated nitrate concentrations in groundwater. Wise water management decisions which protect drinking water supplies will preclude the need for more costly water treatment. If nitrate concentrations in groundwater continue to increase, local well owners may need to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. For a municipality, the cost of a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023). The additional water treatment is particularly important because of recent research that suggests a linkage between nitrate in groundwater and certain types of pediatric cancer (Ouattara, 2022). Protecting this infrastructure is critical to Nebraska because the cost of installing reverse osmosis treatment systems is enormous and would likely incur significant financial burdens on small communities with limited tax base. In addition to local water treatment costs the Platte River is an important stream reach that provides nearly 100 percent of drinking-water supplies to Lincoln, Nebraska, and 40 to 60 percent of drinking-water supplies to Omaha, Nebraska. High-nitrate groundwater discharging into the Platte River can increase surface and groundwater nitrate concentrations downstream, potentially impacting these water supplies.

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.

This project focuses determining if the current nitrate management strategies are effective at reducing nitrate concentrations in groundwater for Platte, Colfax, and Dodge Counties. Determining the nitrate concentration and the age of

groundwater can assist in developing a history of nitrate loading to the groundwater system and assess the effectiveness of modern nitrate management strategies to address the management goal of improving drinking water quality. The outcomes of this study will inform decisions made by the LLNRD and LPNNRD on groundwater-quality management in their phase 3 areas in Platte, Colfax, and Dodge counties. This area includes about 37,000 people who rely on a clean drinking water source. Groundwater within the study area discharges to the Platte River, or the Loup River, which is a major tributary to the Platte. Groundwater with high nitrate concentrations may adversely affect the water quality of the alluvial aquifer downstream where the Metropolitan Utility District (MUD) Platte West and City of Lincoln wellfields are located. The information gained from this project will help improve the water-quality for nearly 800,000 Nebraskans. Other solutions to this issue is to provide funds for local well owners to install reverse osmosis systems in their homes, which may cost $35 to $60 per month per user. Or for a municipality, the cost for a reverse osmosis system is likely to cost $2 to 3 million, plus maintenance costs (Lower Elkhorn Natural Resources District, 2023).

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

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

The LLNRD and LPNNRD have allocated funds for this study. Letters of support from the supporting jurisdictions are provided in Appendix A. The table below lists the 2022-2023 property tax levies, valuations, and sources of revenue for the LLNRD and LPNNRD (Nebraska Auditor of Public Accounts https://www.nebraska.gov/auditor/reports/index.cgi?budget=1- accessed March 9, 2023). The USGS is providing $137,000 in cooperative matching funds contributed to this project.

Natural Resources District	Tax Levy (per $100 valuation)*	Valuation*	Total Resources Available*	Local match for proposed project
Lower Loup	$0.0367	$16,991,592,902	$19,358,749	$54,000
Lower Platte North	$0.03	$11,108,737,004	$9,881,049	$54,000

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.

This project addresses the concerns of the Lower Loup and Lower Platte North NRD with regards to groundwater sustainability and groundwater quality. The LLNRD and LPNNRD have the authority under the Nebraska Groundwater Management and Protection Act, Chapter 46 Article 7 to enter into contracts or agreements, budget and expend levied property taxes, own, and operate property and equipment, and conduct investigations relative to the protection and management of groundwater. Nebraska State Statute Chapter 2 Article 32 gives the NRDs authority to carry out projects related to the development, management, utilization and conservation of groundwater and surface water. Nitrate concentrations in groundwater in Platte and Colfax Counties often exceed the Environmental Protection Agency Maximum Contaminant Level of 10 milligrams per liter (U.S. Environmental Protection Agency, 2018). This area serves a population of about 37,000 people. Area 30, which is in the Lower Loup NRD (LLNRD) is located east of Columbus, where the median concentration of nitrate has increased to over 20 mg/L from 1990 to present (2022; Tylr Naprstek, written commun. 2022). To the east, in the Lower Platte North NRD (LPNNRD), the median groundwater nitrate concentration between the towns of Richland and Schuyler is nearly 15 mg/L (Daryl Andersen, written commun., 2022). The elevated nitrate concentrations are likely the result of groundwater irrigated row-crop and livestock production in an area with permeable soils and shallow depths to water. This project focuses on the conservation and preservation of groundwater as a drinking water source for approximately 37,000 Nebraskans. The LLNRD and the LPNNRD are actively managing groundwater quality to reduce the amount of nitrate entering the groundwater system. Current (2023) rules and regulations dictate the timing of fertilizer application within their management areas; however, there often is a lag between when fertilizer or animal waste is applied to land surface to when groundwater quality is negatively impacted. The lag time is highly variable and dependent on several factors including depth to water, soil type, and land use practices. As such, the current nitrate concentration does not necessarily reflect the effects of current nutrient management practices on groundwater quality. Determining the nitrate concentration and the age of groundwater can assist in developing a history of nitrate loading to the groundwater system and assess the effectiveness of current nitrate management strategies to address management goals.

12. Addresses a statewide problem or issue;

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

The proposed project will address the statewide problem of high nitrate in groundwater in Nebraska, which is the drinking water source for approximately 85% of its residents. Similar to many areas across the state, the nitrate concentration of groundwater in Dodge, Colfax, and Platte counties often exceed the Environmental Protection Agency Maximum Contaminant Level of 10 milligrams per liter (U.S. Environmental Protection Agency, 2018). The LLNRD and the LPNNRD are actively managing groundwater quality to reduce the amount of nitrate entering the groundwater system for the 37,000 people within the study area. Current (2023) rules and regulations dictate the timing of fertilizer application within their management areas; however, there often is a lag between when fertilizer or animal waste is applied to land surface to when groundwater quality is negatively impacted. The lag time is highly variable and dependent on several factors including depth to water, soil type, and land use practices. As such, the current nitrate concentration does not necessarily reflect the effects of current nutrient management practices on groundwater quality. Determining the nitrate concentration and the age of groundwater can assist in developing a history of nitrate loading to the groundwater system and assess the effectiveness of modern nitrate management strategies to address the management goal of improving drinking water quality. The additional water treatment is particularly important because of recent research that suggests a linkage between nitrate in groundwater and certain types of pediatric cancer (Ouattara, 2022). This project will benefit the 37,000 residents who rely on safe, clean drinking water to meet their everyday needs. By reviewing the Nebraska Groundwater Quality Clearinghouse, it is evident that nearly all 23 NRDs across the state have high nitrate areas. NRDs continue to actively manage to improve groundwater quality. The methods used in this study may be applied to other areas of Nebraska experiencing similar groundwater quality problems. The results, data, and lessons learned from this study will be shared with the Department of Environment and Energy, other NRDs, and water managers at meetings and conferences.

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

- List other funding sources or other partners, and the amount each will contribute, in a funding matrix.

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

The total cost of the proposed project is $408,200. The USGS is providing $137,000 in federal cooperative matching funds, which reduces to total project cost to $272,000. The LLNRD and the LPNNRD are providing a total of $108,000 for the 40% local match. The remaining 60% ($163,200) would be funded through this grant application by the WSF. Please refer to budget table below and letters of support (Appendix A) for reference. The LLNRD, LPNNRD, and the USGS have indicated firm support for the project and have set aside the dollar amounts indicated below in their operating budgets.

	FY24	FY25	FY26	TOTAL
TOTAL	$148,000	$154,000	$106,200	$408,200
USGS	$32,000	$63,000	$42,000	$137,000
WSF	$70,000	$55,000	$38,200	$163,200
LPNNRD	$23,000	$18,000	$13,000	$54,000
LLNRD	$23,000	$18,000	$13,000	$54,000

14. Contributes to watershed health and function;

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

The project will provide information that can be used to analyze the effectiveness of modern nitrate management strategies and minimize future nitrate contamination of the aquifer. Sustainable groundwater is a significant component of watershed system health and function. The project will provide information that can be used to evaluated modern nitrate management strategies and potentially implement more effective strategies to maintain and improve the health of the aquifer. Groundwater aquifer boundaries do not always align with surface water boundaries. Both the Lower Loup and Lower North Platte watersheds will be affected by this project as well as the potential for other watersheds that are impacted by the discharge of groundwater to a stream or spring downgradient of the recharge areas of the study area. The Platte River is an important stream reach that provides nearly 100 percent of drinking-water supplies to Lincoln, Nebraska, 40 to 60 percent of drinking-water supplies to Omaha, Nebraska. Groundwater flow with high nitrate discharging into the Platte River can caused increased surface and groundwater nitrate concentrations downstream impacting these water supplies

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.

This project addresses the needs stated in Goal 5 in the 2022 Nebraska DNR Annual Report (Nebraska Department of Natural Resources, 2023) which states "Protect existing water uses through collaborative investments in water resource projects, planning, administration and permitting of surface water rights, and the registration of groundwater wells". Managers from the LLNRD and LPNNRD have identified a need for more information to make water-management decisions on the best available science to sustain drinking water supplies for residents of Platte, Colfax, and Dodge Counties. The project will protect existing water uses, in this case drinking water, by informing water managers of the role of legacy nitrate on groundwater quality. Determining the nitrate concentration and age of groundwater will help managers from the LLNRD and LPNNRD know if modern nutrient management strategies are effective at reducing nitrate concentrations in shallow groundwater. The proposed project also supports Goal 1 which "Establish strong state leadership, involvement, and support for science-based decision making that is necessary to sustain state and local water management outcomes." The proposed project will provide water managers from the LLNRD and LPNNRD with necessary information to support science-based decision making to ensure the residents of Platte, Colfax, and Dodge Counties have adequate drinking water supplies in the future.

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:

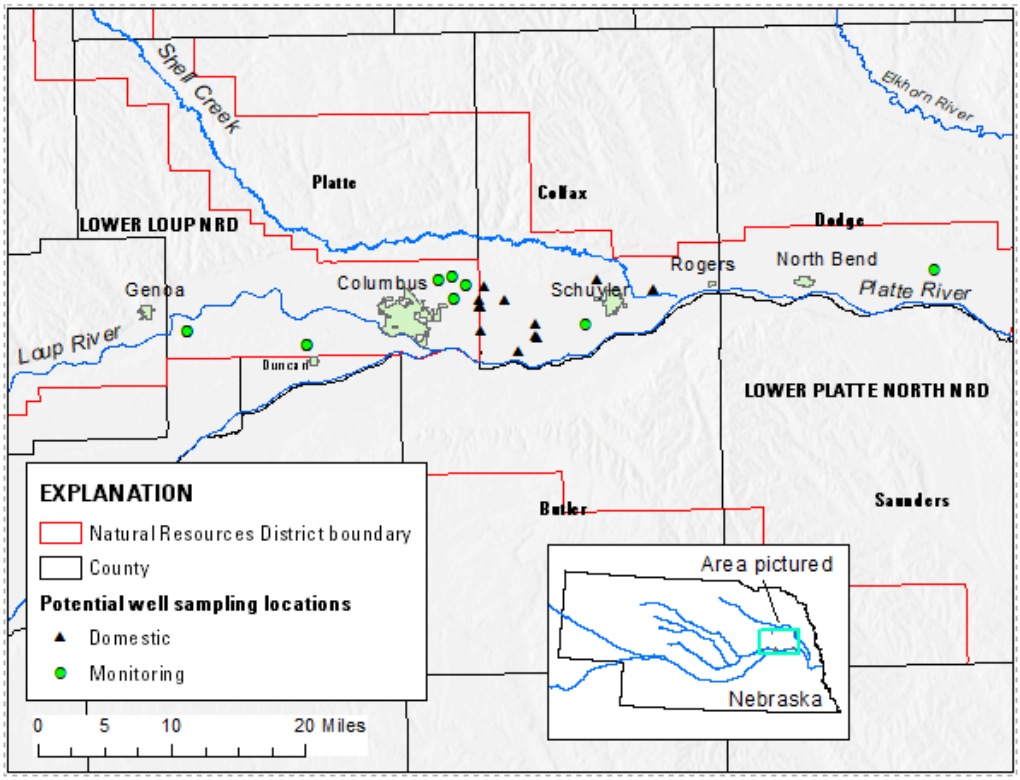
- Describe the federal mandate.
- Provide documentary evidence of the federal mandate.
- Describe how the project meets the requirements of the federal mandate.
- Describe the relationship between the federal mandate and how the project furthers the goals of water sustainability.

The Safe Drinking Water Act of 1974 (SDWA; Pub.L.93-523 88 Stat. 1660 42 U.S.C. §300) was created for the protection of groundwater resources from contaminants. The federal mandate also identifies and quantifies the acceptable levels of contaminants in public water supplies. Public water suppliers are required to provide drinking water that meets various federal standards or Maximum Contaminant Levels (MCLs), including nitrate. The SDWA also discusses the designation of a sole source aquifer (section 1427) and the establishment of wellhead protection areas (section 1428). The proposed project

will enable managers from the LLNRD and the LPNNRD to understand the influence of legacy nitrate on groundwater quality. Determining the nitrate concentration and age of groundwater will help managers from the LLNRD and LPNNRD know if modern nutrient management strategies are effective at reducing nitrate concentrations in shallow groundwater. The information gathered from this proposed project will help communities meet the standards established by the SDWA. The project would provide the LLNRD and the LPNNRD with additional information to promote agricultural best management practices in these areas to minimize the occurrence and likelihood of nitrate contamination of groundwater supplies.

Appendix A: Project Partner Support Letters

Appendix B: Supplemental information (project map and references cited)



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