

**Environment and Natural Resources Trust Fund
2020 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 010-A

Real-Time Measurements of Nitrate Pollution in Surface Water

Category: A. Foundational Natural Resource Data and Information

Sub-Category:

Total Project Budget: \$ 631,800

Proposed Project Time Period for the Funding Requested: June 30, 2023 (3 yrs)

Summary:

Rising nitrates are threatening Minnesota streams, but current methods for measuring nitrates are not robust enough. We propose a multi-agency effort to measure, understand, and communicate nitrates in real-time.

Name: Joel Groten

Sponsoring Organization: U.S. Geological Survey

Job Title: Hydrologist

Department: _____

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Mounds View MN 55102

Telephone Number: (763) 783-3149

Email jqroten@usgs.gov

Web Address

Location:

Region: Central, Metro, Northwest, Northeast, Southwest, Southeast

County Name: Anoka, Cass, Cook, Fillmore, Goodhue, Hennepin, Marshall, Martin, Morrison, Mower, Rock, Scott, Stearns, Wabasha, Winona

City / Township: Twin Cities, Winona, St. Cloud, Fairmont, Luverene, Jordan

Alternate Text for Visual:

Map of Minnesota showing proposed and existing sites, Cedar River watershed, infographic showing sources of nitrate and continuous nitrate monitoring, and data going online for professional and public consumption.

| | | | |
|--------------------------|-------------------------|-----------------------------|----------------------|
| _____ Funding Priorities | _____ Multiple Benefits | _____ Outcomes | _____ Knowledge Base |
| _____ Extent of Impact | _____ Innovation | _____ Scientific/Tech Basis | _____ Urgency |
| _____ Capacity Readiness | _____ Leverage | _____ TOTAL | _____ % |



PROJECT TITLE: Real-time Measurements of Nitrate Pollution in Surface Water

I. PROJECT STATEMENT

Nitrates are a growing threat to human health and aquatic life in Minnesota streams. Current water quality monitoring provides nitrate concentrations and loads based on relatively frequent sampling and daily streamflow data; however, nitrate levels can change rapidly within single days. Information about these quick changes is needed to accurately define the sources, pathways, and impacts of nitrate in our streams for use in selecting appropriate management practices for implementation to restore and protect Minnesota's water from nitrate contamination. Information will also help inform nitrate levels in groundwater given the strong groundwater and surface water interactions present with nitrate, especially in the karst region of southeast Minnesota and sand plain aquifer areas of central Minnesota.

The United States Geological Survey (USGS) with the support of the Minnesota Pollution Control Agency, Metropolitan Council, Minnesota Department of Natural Resources, and Olmsted Soil and Water Conservation District proposes to purchase, install, and operate 11 nitrate sensors to expand pilot efforts, currently have 4 sensors installed, using nitrate sensors for instantaneous and continuous measurements of nitrate levels in streams. The project will aid in the establishment of high frequency monitoring to more accurately measure nitrate levels. Use of the sensors will also provide real-time access to nitrate levels by agencies, organizations, and individual citizens through the USGS continuous data website. Instead of 10-30 water samples per year from periodic sampling, a sensor records thousands of measurements every year, providing much more accurate and instantaneous information.

Current pilot efforts are fairly limited and are spread among organizations given the high cost of the nitrate sensors. Establishment of a coordinated data collection effort through this project would provide sensors for long-term use and leverage the current staff and resources to provide immediate data in addressing the nitrate problems in Minnesota streams. The coordinated effort would also ensure that the data collected are accurate and comparable. This network would also add to similar networks in Iowa and other Mississippi River Basin states to provide accurate tracking of nitrate movement from individual rivers all the way to the Gulf of Mexico to aid in addressing the Gulf Hypoxia problem.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1 Title: Collecting Real-Time, High Resolution Nitrate Data

Description: *Nitrate sensors will be purchased, installed, and operated at 11 existing stream gage monitoring sites. The 11 sites in conjunction with nitrate sensors at existing pilot sites will provide a geographic cross-section of areas in the state ranging from areas with the highest risk of nitrate contamination to areas of low risk. USGS standard operating procedures will be used to ensure high quality data. Sensor operation and water sample collection will be coordinated between USGS staff, state agencies, and local units of government. USGS will manage and store all of the data.*

Activity 2 Title: Making Sense of the Nitrate Data

Description: *The nitrate data collected during the project will be analyzed to identify patterns in the fluctuations in nitrate concentrations in different parts of the state and at individual sites. Results of the analysis will be combined with data and analyses from other monitoring and studies to assess and describe the dynamic nature of nitrate transport in streams, including sources, pathways, and variability. The results of the project will be published in a report and shared through presentations to citizens, local units of government, and state and federal agencies.*



Activity 3 Title: Making the Data Accessible to the Public

Description: *The nitrate data obtained with the sensors will be provided to local citizens and the overall public in two ways. The first way will be a light display positioned at each site to show the current conditions as low, moderate, or high to provide people easy access to the current nitrate conditions at a monitoring site. A simple explanation of the light display will also be provided at each site. The second way of communicating the data will be an interactive website that will provide near-real time streamflow and nitrate concentration data in easy to understand graphics and stories. The website will also associate the nitrate levels with associated costs of nitrogen lost from fertilizer and manure applications and potential costs for lowering nitrate levels in drinking water. Both tools provide the opportunity to engage farmers and other citizens in the economic costs of excess nitrate in surface water.*

ENRTF BUDGET: \$631,800

| Outcome | Completion Date |
|--|------------------------|
| <i>Activity 1:</i> | |
| <i>1. Purchase and install sensors and begin data collection</i> | <i>September 2020</i> |
| <i>2. Operate sensors</i> | <i>Ongoing</i> |
| <i>3. Collect and manage sensor data for report</i> | <i>September 2022</i> |
| <i>Activity 2:</i> | |
| <i>1. Complete data analysis</i> | <i>December 2022</i> |
| <i>2. Publish report on project findings</i> | <i>March 2023</i> |
| <i>3. Present report and project findings</i> | <i>June 2023</i> |
| <i>Activity 3:</i> | |
| <i>1. Develop and install light displays at monitoring sites</i> | <i>September 2020</i> |
| <i>2. Develop website to present data in easy to understand format</i> | <i>September 2021</i> |
| <i>3. Use site displays and website in outreach efforts for the public</i> | <i>June 2023</i> |

III. PROJECT PARTNERS AND COLLABORATORS: Minnesota Pollution Control Agency and Metropolitan Council have already worked on installing 4 nitrate sensors before the start of this project and will assist in data collection on this project. Minnesota Department of Natural Resources and Minnesota Department of Agriculture stream gages will be shared and utilized, Olmsted County SWCD will assist with farmer engagement.

IV. LONG-TERM IMPLEMENTATION AND FUNDING:

U.S. Geological Survey, Minnesota Pollution Control Agency, and Metropolitan Council will work cooperatively to fund this data collection effort long-term.

V. SEE ADDITIONAL PROPOSAL COMPONENTS:

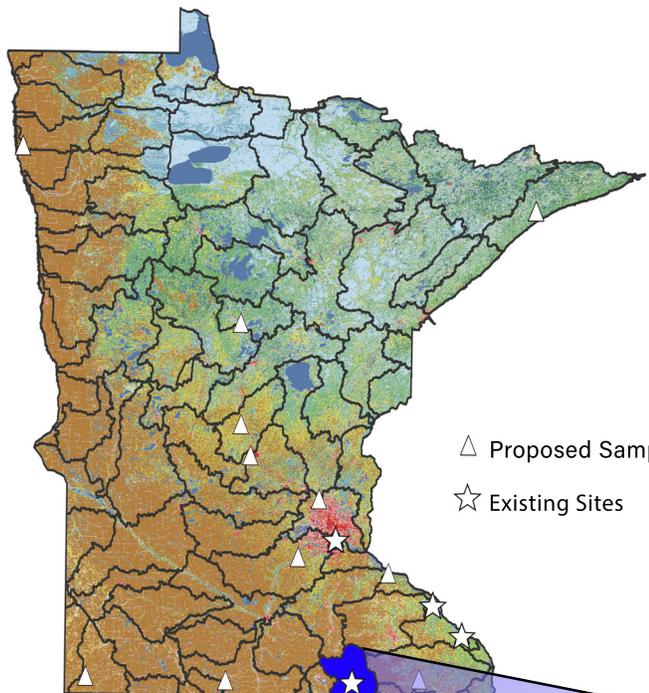
- A. Proposal Budget Spreadsheet**
- B. Visual Component or Map** – list a title or describe what is attached
- C. Project Manager Qualifications and Organization Description**
- D. Letter**

Attachment A: Project Budget Spreadsheet
 Environment and Natural Resources Trust Fund
 M.L. 2020 Budget Spreadsheet



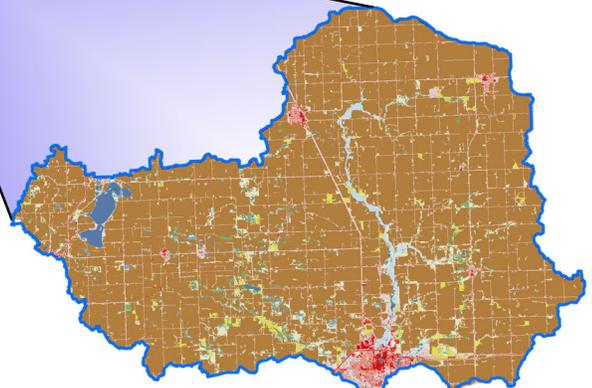
Legal Citation: NA
 Project Manager: Joel Groten
 Project Title: Real-time Measurements of Nitrate Pollution in Surface Water
 Organization: U.S. Geological Survey
 Project Budget: \$631,800
 Project Length and Completion Date: 3 Years and Ends June, 2023
 Today's Date: 4/12/2019

| ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET | | Budget | Amount Spent | Balance |
|---|---|---------------|--------------|----------------|
| BUDGET ITEM | | | | |
| Personnel (Wages and Benefits): 2 Hydrologic Technicians (0.62 FTE per person, GS-9: \$115,000, GS-8: \$92,000), | | \$ 354,000 | \$ - | \$ 354,000 |
| 1 Website Developer (0.38 FTE, GS-11: \$72,000), 1 Water Quality Specialist (0.14 FTE, GS-13: \$48,000), and 1 Budget Analyst (0.14 FTE, GS-9: \$27,000) | | | | |
| Professional/Technical/Service Contracts | | | | |
| Manufacturer Service Agreement with HACH (11 sensors at \$800 per year for 3 years) | | \$ 26,400 | \$ - | \$ 26,400 |
| Equipment/Tools/Supplies | | | | |
| 11 HACH SC controllers (\$2,200 per unit), 22 solar pannels (\$125 per unit), solar panel mount and cables (\$200 per setup), 11 solar charge controller (\$100 per unit), 11 cables (\$450 per unit), 22 batteries(\$150 per unit), 11 sensor mounting accessory setups (\$650 per unit) | | \$ 45,650 | \$ - | \$ 45,650 |
| Capital Expenditures Over \$5,000 | | | | |
| 11 Hach Nitratax nitrate sensors (\$18,250 per sensor) | | \$ 200,750 | \$ - | \$ 200,750 |
| Fee Title Acquisition | | | | |
| | | \$ - | \$ - | \$ - |
| Easement Acquisition | | | | |
| | | \$ - | \$ - | \$ - |
| Professional Services for Acquisition | | | | |
| | | | \$ - | \$ - |
| Printing | | | | |
| | | \$ - | \$ - | \$ - |
| Travel expenses in Minnesota | | | | |
| Site visits for instalation of sensors, training of Met. Council and MPCA staff, and troubleshooting (\$0.58 per mile) | | \$ 5,000 | \$ - | \$ 5,000 |
| Other | | | | |
| | | \$ - | \$ - | \$ - |
| COLUMN TOTAL | | \$ 631,800 | \$ - | \$ 631,800 |
| SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT | | | | |
| | Status (secured or pending) | Budget | Spent | Balance |
| Non-State: USGS Cooperative Water Program Match Dollars (1 Hydrologist/Project Manager (0.85 FTE, GS-12: \$190,000, USGS is already providing 2 nitrate sensors) | | \$ 190,000 | \$ - | \$ 190,000 |
| State: | | \$ - | \$ - | \$ - |
| In kind: MPCA (0.75 FTE data collection, already providing 1 nitrate sensor), Met. Council (0.25 FTE data collection, already providing 1 nitrate sensor), MDA (sharing stream gages), DNR (sharing stream gages), and Olmsted SWCD (0.10 FTE; farmer outreach) | | \$ 200,000 | \$ - | \$ 200,000 |
| Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS | | | | |
| | Amount legally obligated but not yet spent | Budget | Spent | Balance |
| | | \$ - | \$ - | \$ - |

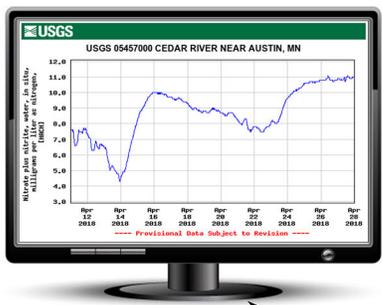


- △ Proposed Sampling Sites
- ☆ Existing Sites

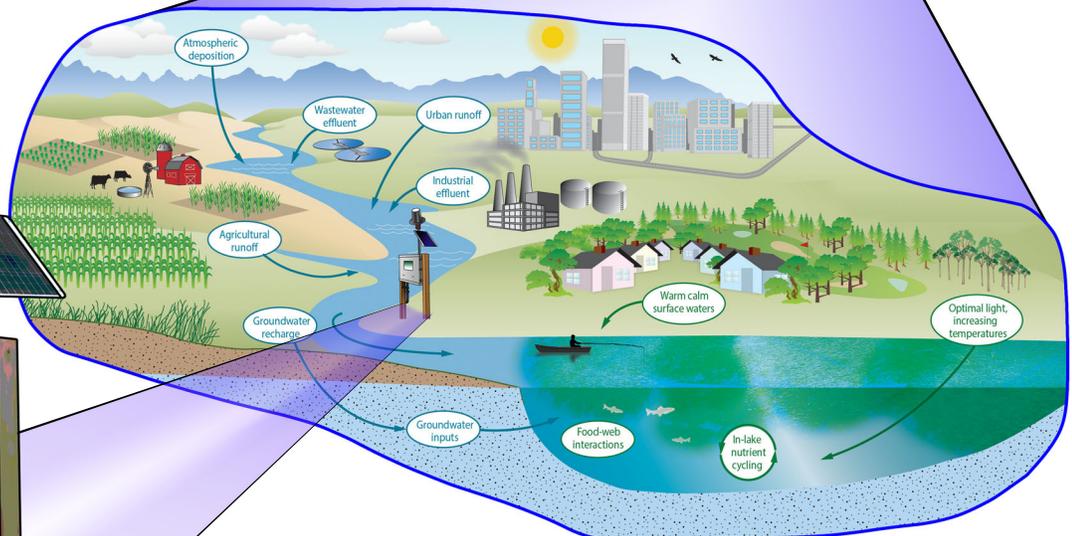
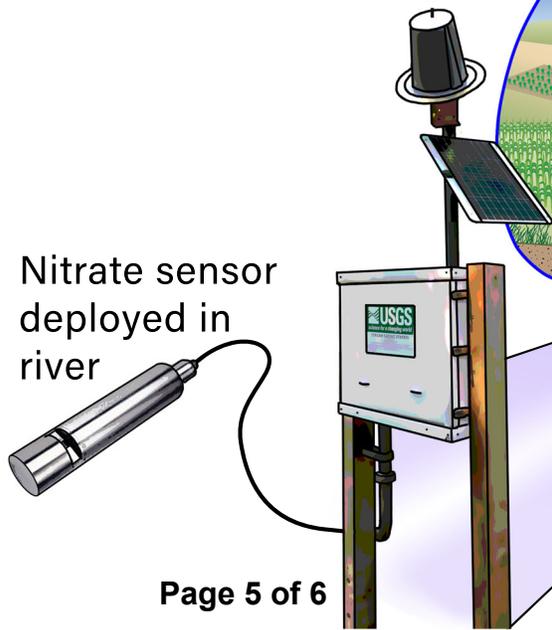
Watershed



Real-Time Website Displays



Nitrate sensor
deployed in
river



Nitrate Sources

PROJECT MANAGER QUALIFICATIONS AND ORGANIZATION DESCRIPTION

Joel Groten is a Hydrologist with the U.S. Geological Survey (USGS) Upper Midwest Water Science Center in Minnesota. He has a M.S. in Water Resources Science from the University of Minnesota. Joel serves as a principal investigator related to USGS nutrient and sediment studies. In this capacity, he provides project oversight, technical assistance, teaching, training, data analysis, and reporting in support of projects for the Minnesota Pollution Control Agency, Minnesota Department of Natural Resources, U.S. Army Corps of Engineers, Lower Minnesota Watershed District, Rice Creek Watershed District, and the Institute for Technological Research in São Paulo, Brazil. These projects vary in scope and relate to continuous data acquisition in real-time, aquatic habitat, TMDL studies, stream restoration, geomorphology, nutrient and sediment budgets, and flood retention and diversion. He has been a primary author of 4 peer-reviewed papers and a co-author on 3 peer-reviewed papers. Joel also is responsible for research and implementation of new technologies to improve understanding of nitrate and sediment sources, fate, and transport mechanisms.

The **USGS** works as a partner with state agencies towards collecting and analyzing a myriad water quality data. The USGS is uniquely positioned to carry out the work for this project through its operation of the statewide stream gaging network, standard techniques and methods, and experienced hydrologists and hydrologic technicians. The USGS Upper Midwest Science Center has state-of-the-science expertise in the office and has access to the most current science and technology related data collection and analyses nationwide.