**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**

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

**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**