**PROJECT TITLE: Novel field methods to evaluate groundwater quality investments**

**I. PROJECT STATEMENT**

Will forcing a farmer to use best management practices result in cleaner groundwater for a municipal water supply? What if neighboring farmers don’t also participate? How much of a difference can one land owner make? SHOW ME THE DATA!

The proposed project will demonstrate “direct‐push” vertical groundwater sampling as a robust sampling strategy for evaluating investments made to reduce nitrate leaching to groundwater. The methods developed in this project are intended to be used in the future by stakeholders who need to evaluate land management investments made to achieve groundwater quality outcomes for water supplies in shallow, vulnerable aquifers.

“Direct push” rigs provide temporary access to groundwater by simply pushing a sample screen, pump, and a series of sensors through soil and aquifer to *provide instantaneous data in the field about groundwater flowpaths and vertical contaminant distribution*. Direct‐push technology has been used for decades to map point‐source contaminants like petroleum. Recent improvements in direct‐push samplers and nitrate sensors make possible rapid field measurements of the vertical distribution of nitrate. This method provides much higher resolution data about aquifer nitrate distributions and flowpaths compared to traditional monitoring wells. Compiling vertical profile data from several locations within drinking water supply management areas will provide insights into the spatial distribution of nitrate contributions to groundwater.

Many water suppliers and private well owners in Minnesota are faced with high nitrate and desperately need data to inform investments made to improve groundwater quality. The project will take place in southwestern Minnesota (in Lincoln, Pipestone, and Rock Counties) where several water suppliers are currently facing high nitrate in drinking water supplies.

**II. PROJECT ACTIVITIES AND OUTCOMES**

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| **Activity 1 Title: Design and test direct‐push vertical groundwater sampling system**  **Description:** *The primary objective of this activity is to acquire, design, and test the vertical groundwater sampling system. A significant expenditure in this activity is the purchase of a Geoprobe HPT/EC system. This system logs vertical profiles of hydraulic conductivity and electrical conductivity in real time in the field. The first outcome will be a functioning water quality (including nitrate) pumping and logging system capable of generating data in the field. A data acquisition platform will be devised to efficiently capture digital data in the field. The second outcome will be a standard operating procedure for logging hydrogeological and water quality data in vertical profiles with a direct push rig. This will be accomplished through field trials.*  **ENRTF BUDGET: $80,400** |

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| **Outcome** | **Completion Date** |
| *1. Design field data sampling and logging system* | *March, 2021* |
| *2. Develop direct‐push groundwater sampling protocol: vertical profiles of hydrogeologic*  *properties, instantaneous measurements of nitrate, oxygen, pH, conductance,*  *temperature, and lab confirmation samples)* | *July, 2021* |

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| **Activity 2 Title: Conduct field study to evaluate investments made in best management practices.**  **Description:** *The primary objective of this activity is to design, conduct, and document a field study that demonstrates the vertical profiling method. The first outcome will be a sampling strategy optimized to demonstrate the effects that different areas within a drinking water supply management area fields have on groundwater quality. Historical and geologic data will be used to identify important sampling locations. The second outcome will be a data set containing vertical profiles of hydrogeologic properties and water quality upgradient and downgradient of land parcels managed with BMPs. Duplicate water-quality samples will be collected and sent to the lab to confirm that field nitrate sensors are producing accurate data. The third outcome will be a dissemination of project data and results that describe the system operating procedures, evaluations of field-scale sampling designs, and interpretations of field study results. The form of the disseminated results will be determined by stakeholder preferences.*  **ENRTF BUDGET: $139,500** |

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| **Outcome** | **Completion Date** |
| *1. Site selection and sampling design at Rock County Rural Water, Lincoln Pipestone Rural Water, or City of Edgerton well fields* | *June, 2021* |
| *2. Collect field data with direct-push system. Up to 150 groundwater sample points will be analyzed for nitrate in the field and a subset sent to lab for confirmation.* | *October, 2021* |
| *3. Analyze data; present results at local conferences; produce publicly‐available final synthesis report; publish hydrogeologic and water‐quality data* | *June, 2022* |

**III. PROJECT PARTNERS AND COLLABORATORS:**

Laura DeBeer, Pipestone County Soil and Water; Jared Trost, Tim Cowdery, Hydrologists, U.S. Geological Survey; Andrew Berg, James Letsos, John Lund, field technicians, U.S. Geological Survey; Aaron Meyer, Source water specialist, Minnesota Rural Water; Doug Bos, Rock County Soil and Water Conservation District; Ryan Holtz, Director Rock County Rural Water; Jason Overby, General Manager Lincoln-Pipestone Rural Water System; Doug Brands, City of Edgerton; Steve Robertson, Minnesota Department of Health; William VanRyswyk, Minnesota Department of Agriculture; Jacob Jungers, University of Minnesota

**IV. LONG-TERM IMPLEMENTATION AND FUNDING:**

This proposed project will produce a sampling approach intended to be used statewide for evaluating land management investments made to achieve groundwater quality outcomes in quality in shallow, vulnerable aquifers. After completion of this project, the method will be available to stakeholders faced with source water quality management. The Minnesota Department of Agriculture may use this method to document BMP effectiveness. Water suppliers could acquire funding through the MN Department of Health’s Source Water Protection Competitive Grant program to support direct-push sampling of their drinking water supply areas.

**V. SEE ADDITIONAL PROPOSAL COMPONENTS:**

**A. Proposal Budget Spreadsheet**

**B. Visual Component or Map**

**F. Project Manager Qualifications and Organization Description**

**G. Letter or Resolution**