Environment and Natural Resources Trust Fund
2016 Request for Proposals (RFP)

Project Title: **ENRTF ID: 050-B**

Protecting Drinking Water Aquifers-Phase 2

Category: B. Water Resources

Total Project Budget: $ 433,400

Proposed Project Time Period for the Funding Requested: 3 years, July 2016 to June 2019

Summary:

Building on an ongoing study, two additional sites are needed to measure infiltration variability through clay confining units. The complete study will provide information to protect important drinking water aquifers.

Name: Johnathan Bumgarner

Sponsoring Organization: U. S. Geological Survey

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Web Address http://mn.water.usgs.gov/

Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

State-wide map of confining units and figure showing field-site instrumentation

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

PROJECT TITLE: Protecting Drinking Water Aquifers—Phase 2

PROJECT STATEMENT:

This proposal would complete an on-going LCCMR project to assess the quality and long-term availability of water from confined glacial drinking-water aquifers. This second phase, as noted in the 2013 proposal, adds two additional study sites that are required to complete our understanding of the variability in the hydraulic properties of confining units and confined glacial aquifers throughout the state.

Confined drinking-water aquifers are critical state resources because they provide clean and reliable water to most of the residents of greater Minnesota. Clay confining units, overlaying confined sandy aquifers, are a vitally important part of these aquifer systems because they protect confined aquifers from land-surface contamination (see visual element). The confining units also limit infiltration and recharge ("infiltration" used in this proposal) to confined aquifers, so replenishing water in confined aquifers is a slow process that needs to be understood to assess long-term water availability. Consequently, the variability in the hydraulic properties of confining units and confined aquifers needs to be assessed.

This project would focus on important questions about confining units and confined aquifers:

- What is the source of water replenishing confined aquifers?
- How long does it take water to move along the flow pathways?
- How much water moves along the flow pathways?
- What are the pathways for water and contaminant movement through confining units?
- What are best estimates of long-term sustainable pumping from confined drinking-water aquifers?
- How extensive and variable are confining units across the state?

The project is a major step forward in protecting confined glacial aquifers by measuring the hydrogeological properties of these important aquifers. The work will result in a wide assessment of information about the aquifers. This project is needed to protect the quality of water in these units and to define the amount of water that can be pumped from confined aquifers (MDNR appropriation permit process) on a long-term and sustainable basis.

II. PROJECT ACTIVITIES AND OUTCOMES add where and why?

It is important to protect confined drinking-water aquifers from contamination and from over-pumping. Therefore, sources of infiltration that replenishes these aquifers need to be quantified. This project will collect detailed hydraulic information about protective confining units at two additional sites. Currently, sites in Litchfield and Cromwell are being studied. This proposed work would complete the project to provide information about water-bearing and water-transmitting characteristics of these aquifer systems. The objective is to complete two additional detailed field studies, one in each of the confining-unit types (Superior and Des Moines lobe glacial tills). The four completed sites will help define the variability in the characteristics of confining, statewide.

Activity 1: Select and instrument two additional study sites **Budget: $257,950**

Select two sites for hydraulic testing. One site will located in Des Moines lobe glacial till and one in the Superior lobe glacial till. Scientific boreholes will be installed for hydraulic, geophysical and chemical testing.

Outcome	Completion Date
1. Select two study sites, with appropriate conditions, from the many municipalities having wellhead protection plans	December 2016
2. Install scientific observation wells at appropriate depths (about 12 wells at each site)	June 2017
3. Install measuring instrumentation, in each well, to collect long-term hydraulic data	July 2017
4. Conduct geologic, hydraulic, geochemical and geophysical tests	September 2017

Activity 2: Describe and define hydraulic properties **Budget: $175,450**

Analyze results from boreholes and from geophysical, hydraulic and chemical tests. Define hydraulic properties of confining units and confined aquifers.

Outcome	Completion Date
1. Analyze geologic, hydraulic, geochemical, and geophysical tests to define aquifer properties	December 2017
2. Construct models to analyze long-term pumping to refine aquifer and confining bed properties	July 2018
3. Compare differences in hydraulic properties of aquifers and confining beds among sites	August 2018
4. Publish a paper defining hydraulic properties and water-supply implications	June 2019

III. PROJECT STRATEGY

A. Project Team/Partners

Name	Affiliation	Role
John Bumgarner	USGS	Management, hydraulic testing, reporting
MGS Geologist	Minnesota Geological Survey	Describe and interpret geology. Advise on site selection
Professor Bill Simpkins*	Iowa State University	Hydrogeological analysis
Jared Trost	USGS	Borehole testing, data analysis, reporting

* Dr. Simpkins would not be supported by Environmental Trust funds

B. Project Impact and Long-Term Strategy

This overall project began in 2014. The project measures critical hydraulic properties of the state's most important confining units--the Des Moines and Superior lobe glacial deposits. Currently two sites are being studied. Two additional sites are needed to complete the analysis and to understand differences in aquifer properties over space. Study sites are locate near municipal wells to measure how pumping affects water movement. This information is needed to protect the quality of confined drinking-water aquifers and to define the amount of water that can be pumped from confined aquifers on a long-term basis. The approach involves conducting detailed field studies in areas representing major confining- unit types. Scientific bore holes are completed in the confining units and in underlying confined aquifers. Field measures include hydraulic, geophysical and chemical testing. Site selection and access permission are significant parts of this study. Study-site selection is a collaborative effort among MDNR, MGS, MDH, and USGS staff. Study sites are located in cites having MDH- approved wellhead protection plans. The project provides critical information for sustainable management of Minnesota's groundwater resources. The results will be a major step toward defining properties of these important confined aquifers. The project complements and augments work being done by the County Geologic Atlas Program (MGS and MDNR) and fits with MDNR's planned changes to the MDNR water appropriation-permit process. The project fulfills strategic directions for understanding water budgets as described in the University of Minnesota's Water Sustainability Framework.

C. Timeline Requirements: Three years. This project would run from July 2016 through June 2019.

Appropriation Language:

IX. VISUAL ELEMENT or MAP(S): attached: Conceptualized graphic showing extent of the Des Moines lobe glacial till (gray) and the Superior lobe glacial till and site instrumentation

2016 Detailed Project Budget

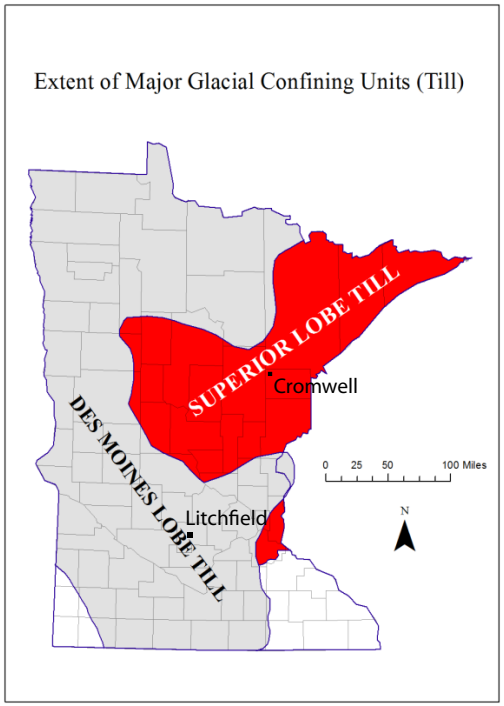
Project Title: Protecting Drinking Water Aquifers—Phase 2

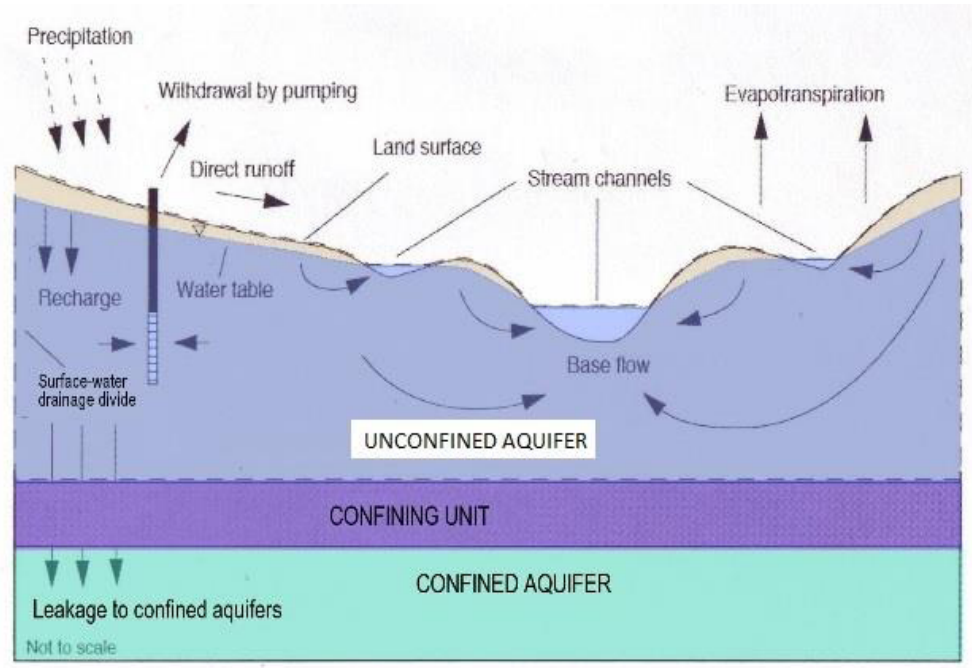
IV. TOTAL ENRTF REQUEST BUDGET: *$ 433,400 over three years*

Personnel:	**AMOUNT**
Personnel: John Bumgarner, USGS Studies Program Manager (72% salary, 28% benefits) (4% FTE for three years). Project supervision, staff scheduling, quality control and technical support	14,755
Personnel: Project Chief (TBD) (71% salary, 29% benefits) 26% FTE for three years. Manages, conducts and supervises project. Quality quality.	$ 67,202
Personnel: USGS Hydrologic Technician (TBD) (74% salary, 26% benefits) 16% FTE for three years. Conducts data collection and field activities. Quality control.	41,500
Personnel: USGS Hydrologist (TBD) (73% salary, 27% benefits) 16% FTE for three years. Conducts field activities including data collection. Analyzes data. Assists in report preparation.	27,675
Personnel: USGS Administrative Assistant (69% salary, 31% benefits) 4% FTE for three years. Provide administrative support for funding agreements, cost accounting and billing.	10,210
Personnel: USGS Groundwater and Water Quality Technical Specialists (79% salary, 21% benefits). Each at 5% FTE for three years. Provides quality control, technical advice, report review and proposal reveries to ensure USGS technical standards.	19,500
Personnel: USGS Student Employee (TBD): (81% salary, 19% benefits) 23% FTE for three years. Assists in data collection and field activities.	33,258
Personnel: USGS Database and IT support (73% salary, 27% benefits). Two individuals each at 1.5 % FTE for three years. Provides database and Information Technology support to meet USGS standards and requirements	11,800
Professional/Technical/Service Contracts:	
Professional/Technical/Service Contracts: USGS contract drilling ($141,000). Minnesota Geological Survey (MGS) technical support for description and interpretation of geologic materials at drill sites ($35,000)	$ 176,000
Professional/Technical/Service Contracts: USGS contract feel for USGS report preparation, editing and production (Science Publishing Network . This includes electronic publishing and distribution of report products.	10,000
Equipment/Tools/ Supplies:	
Equipment/Tools/Supplies: Miscellaneous field equipment and supplies for data collection, including pumps, pressure transducers, electronic recording devices, well packers, well casing and well shelters, None of these individually exceeds $5,00 each.	$ 10,000
Travel:	
Travel: MGS travel to field sites and to local meetings. Includes local conference fee, vehicles, lodging and meals.	$ 2,500
Travel: USGS travel to field sites and to local meetings. Includes local conference fees, vehicles, lodging and meals.	4,000
Additional Budget Items	
Shipping: Expenses for shipping samples to MGS and USGS laboratories	$ 5,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 433,400

V. OTHER FUNDS

SOURCE OF FUNDS	**AMOUNT**	**Status**
Other Non-State $ To Be Applied To Project During Project Period:	$ 88,700	*pending*
Other State $ To Be Applied To Project During Project Period: *cash support from the Minnesota Department of Heath.*	$ 50,000	*pending*
In-kind Services To Be Applied To Project During Project Period: *In kind support from state agencies and municipalities*	$ 50,000	*pending*
Funding History: Phase 1 study for this proposed study is underway. It began in 2014 and will be completed in 2017. There are $394,00 of Trust fund dollars in this ongoing project. In addition there are 118,200 of USGS federal cooperative water funds in phase 1. Approximately $300,000 of that amount will expended prior to July 1, 2016.	$394,000	*awarded*
Remaining $ From Current ENRTF Appropriation: *As of January 1, 2015 there had been only $12,069 spent on the phase one project, for salary. The field work for the project begins this summer*	$ 381,931	*Unspent*





PROJECT TITLE: Drinking-Water Aquifers - Phase 2

Confining units overlaying confined drinking-water aquifers are an important part of aquifer systems because they are protective barriers to the confined aquifers. We need to understand the hydraulic properties of confining units to ensure susainable use of water.

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Career Summary:

Professional, technical, and managerial experience. Background in technical research, program development, and financial and personnel management. Expertise in water-resources assessments, watershed science, hydrogeology, groundwater and surface-water interaction, unsaturated-zone hydrology, and contaminated sediments.

Education:

- Master of Science (Geological Sciences), University of Texas at Austin
- Bachelor of Science with Honors (Geological Sciences: Hydrogeology Option), University of Texas at Austin

Professional and Academic Experience:

- U.S. Geological Survey, Supervisory Hydrologist; Investigations Chief, Minnesota Water Science Center, 2014 to Present
- U.S. Geological Survey, Supervisory Hydrologist; Chief of Hydrologic Studies, South Texas Program Office, 2012 to 2014
- U.S. Geological Survey, Hydrologist; Project Chief, Central Texas Program Office, 2010 to 2012
- Anchor QEA, Scientist, 2004 to 2010
- Jackson School of Geosciences, The University of Texas at Austin, Graduate Research and Teaching Assistant, 2003 to 2004
- Environmental Science Institute, The University of Texas at Austin, GK-12 Fellow, 2002 to 2003
- U.S. Geological Survey, Hydrologic Technician, 2001 to 2002

Activities, Awards and Skills:

- Professional Geologist, State of Texas
- USGS Office of Groundwater Report of the Year 2012; Early-Career Scientist
- USGS Information Technology Advisory Committee: Member 2014-2015
- North and East Metro Groundwater Management Area Advisory Council: Member 2014-2015
- Texas State Soil and Water Conservation Board WSEP Science Advisory Committee: Member 2011-2014
- Austin Geological Society: President 2011-2012

Publications:

- Clark, B.R., Bumgarner, J.R., Houston, N.A., and Foster, A.L., 2014.
- Asquith, W.H., and Bumgarner, J.R., 2014
- Thomas, J.V., Stanton, G.P., Bumgarner, J.R., Pearson, D.K., Teeple, A.P., Houston, N.A., Payne, J.D., and Musgrove, MaryLynn, 2013
- Bumgarner, J.R., Stanton, G.P., Teeple, A.P., Thomas, J.V., Houston, N.A., Payne, J.D., and Musgrove, MaryLynn, 2012
- Bumgarner, J.R., Thompson, F.E., 2012
- Pearson, D.K., Bumgarner, J.R., Houston, N.A., Stanton, G.P., Teeple, A.P. and Thomas, J.V., 2012.
- Bumgarner, J.R., McCray, J.E., 2007
- Asquith, W.H., Bumgarner, J.R., Fahlquist, L.S., 2003