Environment and Natural Resources Trust Fund
2014 Request for Proposals (RFP)

Project Title: **ENRTF ID:** **035-B**

Protecting the State's Confined Drinking-Water Aquifers

Category: B. Water Resources

Total Project Budget: $ 394,000

Proposed Project Time Period for the Funding Requested: 3 Years, July 2014 - September 2017

Summary:

Confined aquifers are critical because they provide reliable drinking water to many State residents. Some critical information is needed to manage these aquifers to ensure clean and sustainable water.

Name: James Stark

Sponsoring Organization: U. S. Geological Survey

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Location

Region: Statewide

County Name: Statewide

City / Township:

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

PROJECT TITLE: Protecting the State's Confined Drinking-Water Aquifers

PROJECT STATEMENT: Many glacial aquifers used for drinking water are overlain by clayey glacial deposits (confining units, see figure). These **confined drinking-water aquifers are a critical State resource** because they provide the only source of clean, reliable drinking water to tens of thousands of urban and outstate residents of Minnesota. The confining units overlaying the confined drinking-water aquifers are a vitally important part of the aquifer system because they are protective barriers to the confined aquifers from land-surface contamination. The confining units also, however, limit water flow (infiltration) to confined aquifers, so replenishing water in confined aquifers is a slow and limited process. We need to better understand the hydraulic properties of confining units to ensure sustainable use of water from these important drinking-water aquifers. This project would assess hydraulic properties for the State's two major regional confining units: the Des Moines and Superior lobe till confining units (see figure). The project would provide key information for a complementary study under discussion by the Minnesota Department of Natural Resources (MDNR) and the U. S Geological Survey (USGS) to map the extent and general properties of the two confining units (this second project is not proposed for funding by the LCCMR funding). **The project proposed here would focus on important questions about confining units and confined aquifers:**

- **What are the pathways for water and contaminant movement through confining units?**
- **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 best estimates of long-term sustainable pumping from confined drinking-water aquifers?**

It is important to protect confined drinking-water aquifers from contamination and from over-pumping. Therefore, the sources of water to these confined aquifers must be understood. This project would measure detailed site-specific information about protective confining units at two study sites that represent the State's most important confining units, the Superior and Des Moines glacial till deposits (see figure). The measurements would provide information to estimate the water-bearing and water-transmitting characteristics of the aquifer system. This proposed project would be a collaborative effort by the USGS, the Minnesota Geological Survey (MGS) and the MDNR. It augments work completed in the County Geologic Atlas Program.

The important factor defining sustainable water use from confined aquifers is the rate of water flow (infiltration) through overlying confining units downward to replenish confined drinking-water aquifers. We lack information about infiltration to confined aquifers because infiltration depends upon the hydraulic properties of the overlying confining units. Infiltration rates are needed to manage confined aquifers so that they are protected for the future. Although the MGS and MDNR have an active County Geologic Atlas Program, which maps the protective confining layers, the Program needs supplementary specific information about hydrologic properties of confining units. Filling this gap in understanding is also required for the MDNR water appropriation-permit process to ensure long-term sustainability of water supply from confined aquifers. Finally, there is a need to understand how confining units protect the water quality in confined aquifers. The quality of water in confined aquifers is presumed to be protected by overlying confining beds. However, scattered and isolated information suggests that groundwater and contaminants can flow from land surface through confining units to confined aquifers at varying rates. These many concerns identify our need to better understand the State's two important confining units.

II. DESCRIPTION OF PROJECT ACTIVITIES: The project would test methods to define properties and continuity of the State's most important confining units, the Des Moines and Superior till confining units. The approach would be to conduct two detailed field studies, one in areas representing each of the confining unit types. Study sites would be located in areas with existing high-capacity pumping wells (likely irrigation wells) to understand how pumping stress affects water movement. Scientific bore holes would be drilled into confining units and the underlying confined aquifers. Field analyses would include hydraulic,

geophysical and chemical tests. These tests may include pump tests, gamma, temperature, fluid resistivity measurements and measures of water chemistry. Based on the results and on ongoing geologic mapping and analysis, several additional test sites may be needed. Additional test sites would begin a long-term, state-wide effort to gather needed information about confined glacial aquifers. Additional information is needed to protect confined drinking water aquifers and to define the amount of water that can be pumped from individual confined aquifers (MDNR appropriation permit process) on a long-term and sustainable basis.

Activity 1: Select sties for detailed hydraulic studies of Des Moines and Superior lobe confining units. Install scientific boreholes. Conduct hydraulic, geophysical and chemical testing. **Budget: $ 288,500**

Outcome	Completion Date
1. Locate appropriate test sites near existing high-capacity pumping wells	October, 2014
2.Obtain site access and site-use permission	December 2014
3. Install boreholes and conduct hydraulic, geophysical and chemical tests to define hydraulic properties of confining units	September 2015

Activity 2: Analyze result from borehole geophysical hydraulic and chemical tests. Define hydraulic properties of confining units. **Budget: $ 171,500**

Outcome	Completion Date
1. Define hydraulic properties of confining units based on analyses of test data.	September 2016
2. Compare and synthesize data from test sites with other available data. Report on results	June 2017
3. Seal test wells as required by the Minnesota Department of Health	June 2017

III. PROJECT STRATEGY

A. **Project Team/Partners**

Name	Affiliation	Role
Tony Runkel	Minnesota Geological Survey	Hydraulic testing, reporting
Bob Tipping	Minnesota Geological Survey	Hydraulic testing, reporting
Jan Falteisek*	Minnesota Department of natural Resources	Regional hydrogeological analysis
Perry Jones	United States Geological Survey	Borehole testing; report
James Stark	United States Geological Survey	Site selection, hydraulic testing

* Participant as advisor and in associated regional analysis

B.**Timeline Requirements:** This project would run July 2014 through June 2017. This timeline would include two field seasons. Final reports and manuscripts will be submitted by June 30, 2017.

C. Long-Term Strategy and Future Funding Needs: This project provides critical information for sustainable management of Minnesota's groundwater resources. 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 MDNR water appropriation-permit program. The project fulfills strategic directions for understanding water budgets described in the University of Minnesota's Water Sustainability Framework. Finally, the project meshes seamlessly with a separate, but related, USGS/MDNR project under discussion to compile and map statewide variability in hydrogeologic properties of the Des Moines and Superior Lobe confining unit using existing data. These two related projects are major step forward toward defining the hydrogeologic properties of the important protective Des Moines and Superior confining till units throughout the state. The project is similar to an ongoing LCCMR project focused on confining properties of the St. Lawrence bedrock confining unit.

2014 Detailed Project Budget

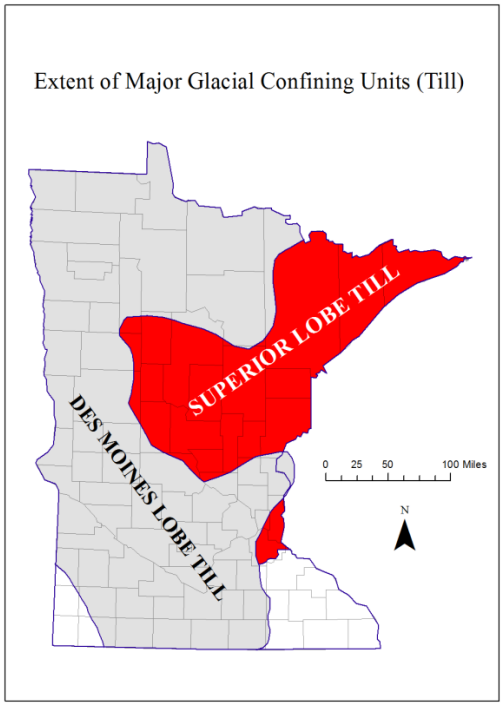
Project Title: Protecting the State's Confined Drinking-Water Aquifers

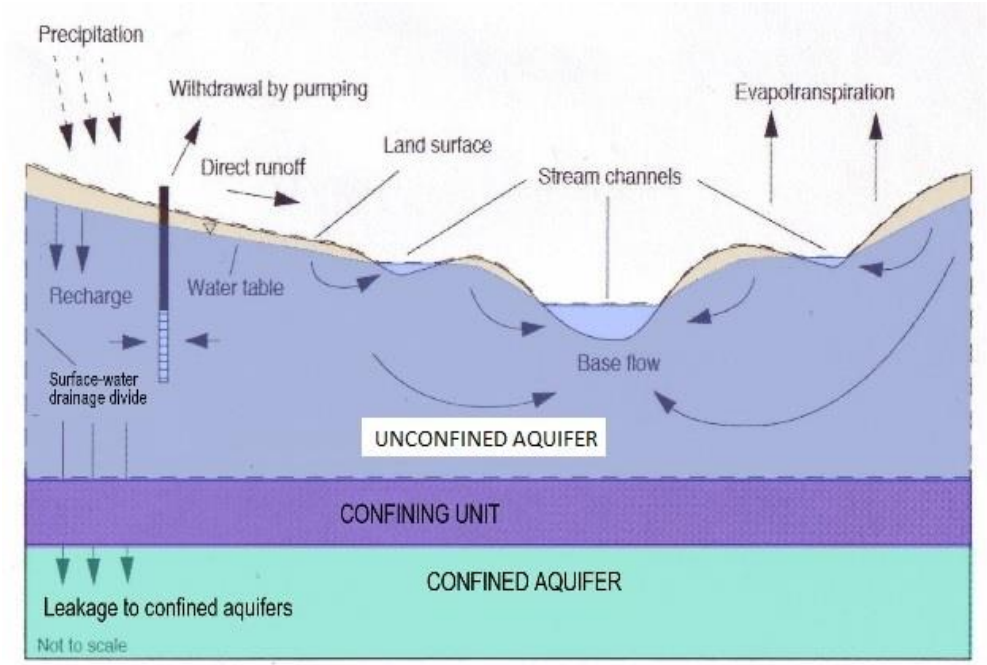
IV. TOTAL ENRTF REQUEST BUDGET - *3* years

BUDGET ITEM	AMOUNT
Personnel: MGS Staff: Robert Tipping (Geologist)	38,000
Personnel: MGS Staff: Tony Runkel (Geologist)	22,000
Personnel USGS Staff: Perry Jones (Hydrologist--Project Lead)	79,000
Personnel USGS Administrative staff support (contract, agreement and billing admiration)	18,000
Personnel USGS Technical Specialists support (technical support)	22,000
Personnel: USGS Staff: Michael Menheer (hydrologic technicians support)	42,000
Personnel: USGS Staff: James Stark (support for site selection and permits)	6,000
Contracts: Scientific borehole installation and construction	$ 126,000
Contracts: Report Printing	$ 9,000
Equipment: USGS: equipment, tools, supplies (packer systems, traducers, data loggers)	$ 17,000
Travel: MGS travel lodging, food and vehicle costs	$ 5,000
Travel: USGS travel lodging, food and vehicle costs	$ 7,000
Additional Budget Items: USGS: supplies and materials, shipping costs	$ 2,000
Additional Budget items:MGS Supplies and materials, shipping costs	$ 1,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 394,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Applied to Project During Project Period: USGS cooperative water funding (33% of USGS budget)	$ 66,000	*Secured, pendingFederal budget allocations*
In-kind Services During Project Period: This project complements work being done by the County Geologic Atlas Program and fits with planned revisions to the MDNR water appropriation permit program. The project also fits hand-in-glove with a statewide analysis being proposed by thy USGS and MDNR to map statewide variability in properties of the Des Moines and Superior Lobe confining units. That proposed project is not part of an LCCMR request. These two related projects are major steps in a process to define the properties of these important protective units throughout the sta**te.**	$ 100,000	*Pending*
Remaining $ from Current ENRTF Appropriation (if applicable): NA	$ -	*Indicate: Unspent? Not Legally*
Funding History: MGS County Geologic Atlasses and Related Hydrologic Research (2010). Result 2: Investigate the hydraulic properties of the St. Lawrence Formation including specific findings on its effects on vertical flow of ground water. This is a similar project focused on sedimentary bedrock aquifers.	$307,184	





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James R. Stark
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Career Summary:

Thirty years of professional, technical and managerial experience. Strong background in technical research, program development, and financial and personnel management.

Education:

Masters in Business Administration (MBA), University of St Thomas
Masters of Science Degrees (Water Resources and Hydrogeology) Univ. of Wisconsin-Madison
Bachelor of Arts in Geology, University of Minnesota-Duluth

Professional and Academic Experience:

Supervisory Hydrologist and Hydrologist; Progression of increasingly responsible positions in the Department of the Interior's U. S. Geological Survey (1978-2010).

- Director, Minnesota Water Science Center, U. S. Geological Survey (2008-present). Coordinated and managed hydrologic and environmental programs for USGS programs in Minnesota.
- Chief, Environmental Assessment Section, U. S. Geological Survey, Minnesota. (2001-208). Coordinated and supervised hydrologic and environmental programs including technical, financial and personnel functions.
- Chief, Hydraulic Investigations, U. S. Geological Survey, Minnesota (1997-98).
- Chief, Upper Mississippi River Basin-National Water Quality Assessment, U. S. Geological Survey, Minnesota (1994 to present). Coordinated all functions for a large national interpretative program.
- Chief of Hydrologic Investigations, U. S. Geological Survey, Minnesota (1991-94).
- Ground Water Specialist, U. S. Geological Survey, Minnesota (1983-91).
- Hydrologist, U. S. Geological Survey, Utah (1981-83)—Chief of Regional Aquifer Analysis Program for the Great Basin in Utah and in Nevada.
- Hydrologist, U. S. Geological Survey, Michigan (1978-1981) -- Project Chief.

Activities, Awards and Skills:

- Frequent public speaking engagements to local, state, national and international organizations.
- Distinguished Career Service Award, U. S. Geological Survey
- Past President: Minnesota Ground Water Association
- Board Memberships: Grass Lake Water Management Organization; State Interagency Water Resources Committee; St. Croix Basin Water Management Planning Committee
- Minnesota Pollution Control Agency Program Evaluation and Coordination Teams
- Professional Hydrogeologist, American Institute of Hydrology
- Professional Geologist, State of Minnesota; Licensed Monitoring Well Contractor

Publications:

Author or coauthor of more than 60 scientific reports, abstracts and journal articles.