Environment and Natural Resources Trust Fund
2010 Request for Proposals (RFP)

LCCMR ID: 002-A1

Project Title:

Capture and Use of Groundwater Sustainability Data

LCCMR 2010 Funding Priority:

A. Water Resources

Total Project Budget: $ $700,000

Proposed Project Time Period for the Funding Requested: 2 years, 2010 - 2012

Other Non-State Funds: $ $20,000

Summary:

We propose to capture currently discarded groundwater data, make it useful to evaluate long-term groundwater sustainability decisions, assist communities with monitoring requirements and save the public money.

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Sponsoring Organization: DNR

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Web Address: www.dnr.state.mn.us

Location:

Region: Statewide

County Name: Statewide

City / Township:

_____ Knowledge Base _____ Broad App. _____ Innovation

_____ Leverage _____ Outcomes

_____ Partnerships _____ Urgency _____ TOTAL

MAIN PROPOSAL

PROJECT TITLE: Capture and Use of Groundwater Sustainability Data

I. PROJECT STATEMENT

Tremendous amounts of groundwater water level and use data are routinely collected and discarded during the normal operation of community water supply systems. This project will demonstrate a process to strategically take advantage of these existing data collection systems, resulting in the preservation of and public access to data that would significantly improve the sustainable management of Minnesota's water resources.

Most Minnesotans (78%) rely on groundwater for all their water supply needs. The state's efforts to protect groundwater quality and quantity for future generations would be greatly aided by access to the volumes of groundwater level and pumping data currently being measured but not saved by water users' automated control systems (e.g. SCADA (Supervisory Control and Data Acquisition) systems). The USGS estimates the value of a detailed water level record from one well for one year at $2,500. The value of data that could be captured from just half the state's approximately 2,350 permitted drinking water supply wells would be close to $3,000,000 per year.

Most control systems can be modified and programmed to record and compile operational information and measurements of water levels in wells at specified times, creating a detailed record of pumping and water level response. The capture, compilation, and accessibility of these data could support many ongoing and future groundwater management applications. For example:

- Evaluate the sustainability of ground water use with respect to impacts on nearby wells, on other aquifers, and on interconnected surface water resources (springs, streams, lakes and wetlands). DNR, in part through ongoing community water supply planning efforts, recommends that major water users take responsibility for monitoring their impacts on groundwater levels. These data could assist communities to meet DNR's monitoring requirements.
- Improve efforts to investigate groundwater contamination. For example, recent investigations of groundwater contamination by MDH and local water suppliers (i.e., perfluorinated compounds in southern Washington County and volatile organic compounds in central Hennepin County) have highlighted the difficulties in tracking groundwater flow and associated contaminants in heavily used aquifers. Managers have learned that there is a limited scientific understanding of the effects of pumping, seasonal changes, climatic effects, induced infiltration, and changing recharge on groundwater flow system. Previous efforts could not build on data at the proper spatial and temporal scale to characterize the effects of 1) geologic complexity and 2) seasonal changes in pumping and rainfall, at least for sub-regional or smaller areas that are managed by individual jurisdictions. ·
- Provide high quality detailed pumping and water level change information that could be evaluated as an efficient continuous aquifer test. Some required aquifer tests, for example those required for wellhead protection or water supply planning, could be conducted at much lower cost. Results would augment the state's database of aquifer test information maintained by the MDH.

II. DESCRIPTION OF PROJECT RESULTS

Result 1: Capture of Control System Data **Budget: $107,000**

Automated pumping control systems monitor sensor readings continuously, generating unlimited volumes of raw data. We will determine optimal data storage intervals for known current needs and anticipated future needs. We will assess currently deployed control systems in communities of different sizes for their ability to capture the needed data and evaluate potential costs of control system improvements required for optimal data collection, if needed. We will also consider other sources of time series data for future compatibility. We will create automated routines to upload data to a secure Internet site at a state or federal agency.

1. Identify optimal scalable technology for very large raw time series data (report) 06/30/11
2. Ascertain types and technology levels of current systems and sensors (report) 06/30/11
3. Create code for secure data transfer routines (code and report) 06/30/11
4. Estimate costs to bridge the gap between the current systems and optimized systems that can provide sustainability data (report) 06/30/12

Result 2: Processing and Serving of the Data **Budget: $345,000**

We will establish a new data management system, complementary to those in place, capable of handling several orders of magnitude more data. We will create software tools that automatically analyze and process large quantities of data. We will serve these data, in directly usable form, via the Internet.

1. Create data management system (code and documentation) 12/31/11
2. Develop calibration and analysis tools (code and documentation) 12/31/11
3. Complete web interface (active website and documentation) 06/30/12

Result 3: Prove the Concept **Budget: $168,000**

We will implement the concepts described above in two communities: one urban and one rural. The pilot project will assess the existing monitoring wells and control systems, and upgrade software, and equipment as needed.

1. Assess community water control system components (report) 12/31/10
2. Make necessary upgrades to the monitoring system (permanent upgrades, report) 06/30/11
3. Assess capacity of the data management system, from well to web (report) 12/31/11
4. Train local personnel to operate and maintain the upgraded data collection system (training complete, operations manual addendum) 06/30/11
5. Develop draft implementation plan and cost estimation template for other communities' use (report) 06/30/12

Result 4: Demonstration of Value **Budget: $80,000**

We will demonstrate the value of the captured data and the data management system by performing two, potentially significant, water resource evaluations supporting water sustainability.

1. Compare our ability to accurately determine critical aquifer properties using this new data versus traditional – expensive – aquifer tests (report) 06/30/12
2. Compare our ability to accurately determine groundwater elevation trends using this new data versus conventional monitoring well data (report) 06/30/12

III. PROJECT STRATEGY

A. Project Team/Partners

Minnesota Department of Health, Minnesota Department of Natural Resources, Dakota County, University of Minnesota, United States Geological Survey, Metropolitan Council, two communities (yet to be invited), one urban, one rural.

B. Timeline Requirements

The goal is to implement the project completely during the two-year duration of the grant period. A minimum of one full year of monitoring will be obtained during this period. Results 1, 2 and 3 are interdependent. Result 4 can be independently completed, but its value would depend upon future availability of data as described in Results 1 and 2.

C. Long-Term Strategy

No project of this type has been attempted in Minnesota. Should this effort prove its cost effectiveness in providing useful high quality data, then a second phase of the project will be proposed to expand its implementation and promote its use by many other communities and other types of water users.

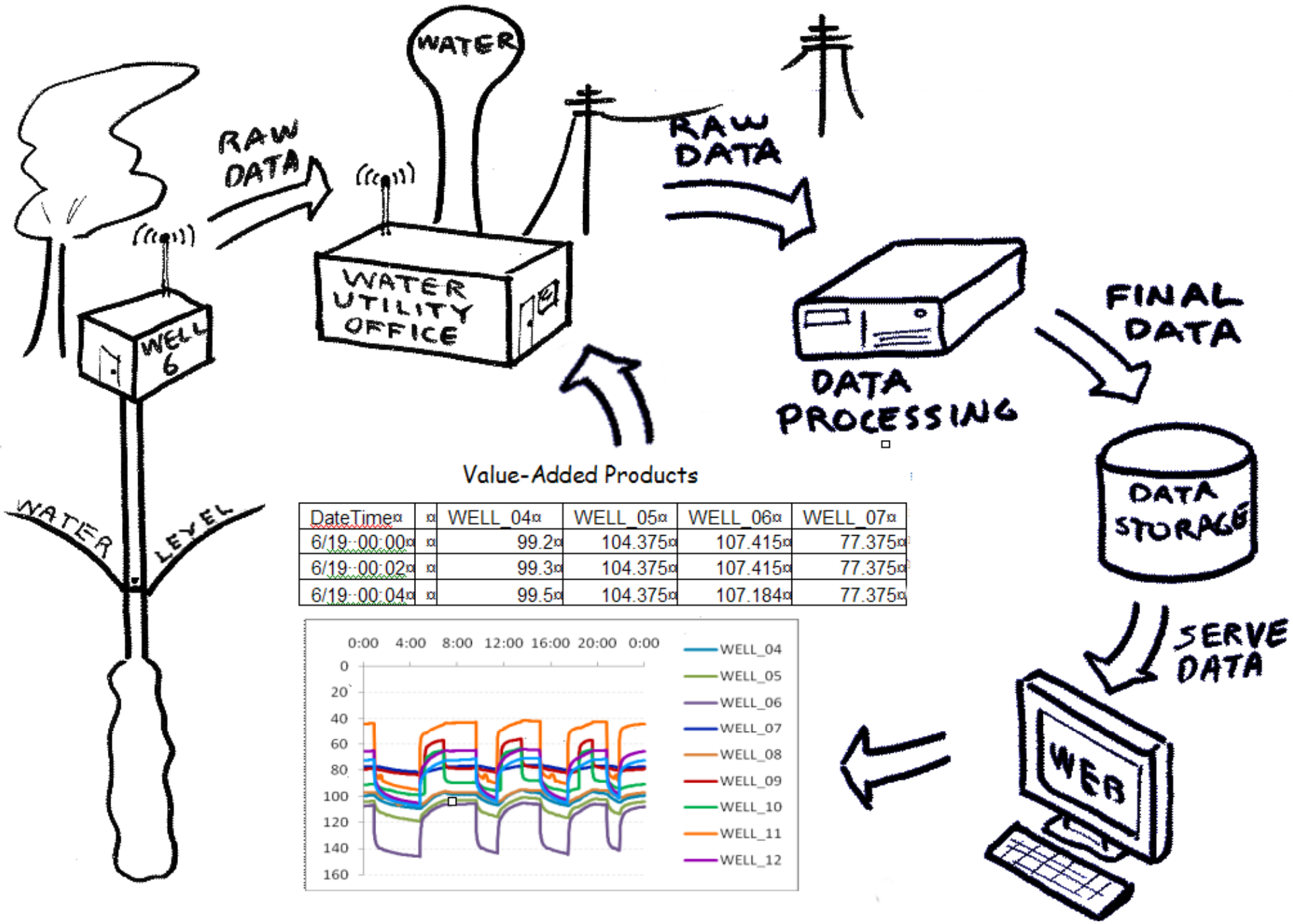
Project Budget

IV. TOTAL PROJECT REQUEST BUDGET (*2* years)

BUDGET ITEM	AMOUNT
Personnel:	$ 406,000
1 FTE Natural Resources Program Consultant, $152,424 salary; $50,576 benefits = $203,000	
1 FTE Information Technology Specialist, $152,256 salary, $50,744 benefits = $203,000	
Contracts:	$ 274,000
Dakota County, Environmental Services, William Olsen: To provide local assistance with Dakota County pilot, assessment of existing water control systems in the County, collection of calibration data, training of local personnel, and writing of draft training manual based on Dakota County experience during the pilot = $20,000	
United States Geological Survey, Tim Cowdery: To test storage, calibration, and web service of pilot data and to calculate firm costs for producing, storing and serving calibrated time series data from pumping wells on the existing USGS database platform = $30,000	
Water system control vendor(s): To reprogram and/or upgrade components of existing pilot community municipal control systems, to include instrumentation of additional wells and metering of possibly unmetered production rates = $40,000	
Well driller(s): To drill additional deep groundwater level monitoring well(s) at appropropriate locations in appropriate aquifers to allow the pilot systems to collect adequate sustainability data because cities may monitor only the aquifers they pump and not include those they impact = $74,000	
University of Minnesota, graduate student and supervisor Dr. Randal Barnes, Civil Engineering: To develop and test algorithms for quality control of time series data, to develop and test a methodology and prototype code for inferring aquifer properties from operational time series data, to characterize the statistical properties and limits of precision for inferred aquifer properties, and test the above with data from the proof of concept pilot projects, to prepare scientific and technology transfer results for presentation at national meetings = $110,000	
Equipment/Tools/Supplies: Drilling Supplies for shallow wells, pressure transducers for water level measurements in observation wells.	$ 16,000
Travel: Travel for Dakota County and the University of Minnesota is minimal and is considered within the contract amounts above. DNR travel to the rural pilot community is estimated at 12 trips.	$ 4,000
TOTAL PROJECT BUDGET REQUEST TO LCCMR	$ 700,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State $ Being Applied to Project During Project Period: USGS can match up to 40% of the USGS component valued at $50,000	$ 20,000	pending
In-kind Services During Project Period: Metropolitan Council's $15,000 inkind contribution to Result 4 will be use of the transient and trend data within the Metro Area Groundwater Model, a test of the feasibility of using high-density rather than sparse water level data. Minnesota Department of Health's $6,000 inkind contribution to Result 4 will be a trial use of the time series data to estimate aquifer parameters. MDH will analyze the data from the pilot communities for time periods with multiple pump-on and pump-off cycles.	$ 21,000	confirmed



Value-Added Products

DateTime¤	¤	WELL_04¤	WELL_05¤	WELL_06¤	WELL_07¤
6/19·00:00¤	¤	99.2¤	104.375¤	107.415¤	77.375¤
6/19·00:02¤	¤	99.3¤	104.375¤	107.415¤	77.375¤
6/19·00:04¤	¤	99.5¤	104.375¤	107.184¤	77.375¤

MN DNR Waters
500 Lafayette Road (651)259-5687
St. Paul MN 55155-4032

Dr. Jeanette H. Leete, CPG, PG

EMPLOYMENT HIGHLIGHTS

Hydrologist 4. Oct. 2007 to present. Unit Supervisor, Ground Water and Hydrogeology Unit, Department of Natural Resources (DNR), Division of Waters (DOW). Supervision of technical staff involved in groundwater analysis and groundwater/surface water interaction studies.

Hydrologist Supervisor. 1988 to 2007, Ground Water Unit, DNR DOW. Responsibilities: independent investigations of ground water-surface water interaction, supervision of technical staff, write or review DNR's ground water publications. During discrete intervals: supervised the Department's geophysics program, managed the observation well network, and taught hydrogeology to area and regional hydrologists as part of the decentralization of ground water appropriation permits.

Hydrologist I through III. 1981 to 1988, Aquifer Storage Assistant, Technical Analysis Support Hydrologist, Ground Water Management Specialist and Ground Water Modeler. Responsibilities: design, schedule, carry out, and interpret aquifer tests, collect bottomhole and other water samples, and ground water modeling, with emphasis on ground water/surface water interaction, calcareous fen wetland studies.

Project Assistant, 1976 to 1981, University of Minnesota. Responsibilities: Field investigations in peatland hydrology, remote sensing, snow hydrology, watershed management, water quality, and limnology.

CERTIFICATES AND LICENSES

Professional Geologist License #30140. Licensure through the Minnesota State Board of Architecture, Engineering, Land Surveying, Landscape Architecture, Geoscience and Interior Design
Certified Professional Geologist #7499. Certification through American Institute of Professional Geologists

PROFESSIONAL AFFILIATIONS

American Geophysical Union, American Institute of Professional Geologists, Geological Society of America, Minnesota Ground Water Association, Society of Wetland Scientists

EDUCATION

Ph.D. in Hydrology, 1986. University of Minnesota. St. Paul, Minnesota. Major: Forest Hydrology. Supporting fields: Geology, Civil Engineering, Applied Statistics. Ph.D. Thesis was an applied fluvial geomorphology study that related activities on the land surface to transport within the watershed.

MS in Hydrology, 1978. University of Minnesota. Major field Forest Hydrology. Supporting fields: Geology, Civil Engineering, and Applied Statistics. Xi Sigma Pi, Phi Kappa Phi.

BA in Geology. 1976. Other major: Environmental Studies. Minor in Biology. Macalester College, St. Paul, Minnesota. Summa cum laude, Phi Beta Kappa.

Abitur (Baccalaureate) Natural Sciences and Math. 1974. Wildermuth Gymnasium, Tuebingen, Germany.