Environment and Natural Resources Trust Fund (ENRTF)
2010 Work Program

Date of Report: 11/24/09
Date of Next Progress Report: 12/31/10
Date of Work Program Approval:
Project Completion Date: 6/30/13

I. PROJECT TITLE: Minnesota Geological Survey County Geologic Atlases and Related Hydrogeologic Research

Project Manager: Dale R. Setterholm
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Location: Result 1: Sherburne County and tentatively Morrison or Isanti (formal agreements not yet finalized); Result 2: that part of Minnesota where the St. Lawrence Formation exists (southeastern third of MN); Result 3: Greater Rochester area

Total ENRTF Project Budget:	**ENRTF Appropriation**	**$1,130,000**
	Minus Amount Spent:	**$ 0**
	Equal Balance:	**$1,130,000**

Legal Citation: ML 2010, Chap.[____], Sec.[____], Subd._____.

Appropriation Language:

II. PROJECT SUMMARY AND RESULTS:

The largest part of this proposal will be the initiation of two or more county geologic atlases. These atlases generate geologic maps and associated databases designed to support sustainable management of water. Specifically, the atlases provide the boundaries and characteristics of aquifers, and define their connections to the land surface (recharge) and to surface water bodies (discharge). The County Well Index (CWI) database will provide accurate digital locations and geologic interpretations for wells in the counties, relating them to the aquifers. The funding for this project is sufficient to cover the cost equivalent of two average cost atlases. Some funds may be applied to completing atlases already under way. Geologic atlases support most water management activities including monitoring, water allocation, permitting, remediation, and well construction.

Two related studies will provide research findings that will strengthen the application of geologic atlases to water management. The first will construct and instrument a borehole to test the water bearing and transmitting characteristics of the St. Lawrence Formation. This unit occurs under much of the southeastern third of the state. It was thought to act as a barrier to vertical movement of water, but recent findings suggest it may not. Knowing how this formation affects water flow is essential to protecting lower aquifers and to understanding and modeling ground water movement.

The other related study will take advantage of an existing set of water chemistry data to investigate the use of chemistry in determining ground water flow paths and rates. This may reveal a tool useful in managing water.

III. PROGRESS SUMMARY AS OF:

IV. OUTLINE OF PROJECT RESULTS*:*

RESULT 1: Geologic Atlas Projects- Initiate 2 new County Geologic Atlas Part A projects (Sherburne County and possibly Isanti or Morrison counties), complete earlier LCCMR supported geologic atlas projects as necessary. Note: all components listed below may not be completed within the time frame and budget of this project, but substantial progress in both counties is anticipated.

Description:

- create geologic maps, illustrations, and databases in print and GIS formats (files made available on our web site).
- map location, boundaries, size, and hydrologic characteristics of aquifers and the materials that confine them in these counties as essential information in efforts to protect and wisely allocate ground water and support these related activities and programs:
    - ground water monitoring, wellhead protection, ground water allocation, well construction, wellfield design, facility siting, permitting, application of agricultural best management practices, remediation, and management of ground water dependent surface water features (springs, fens, lakes, rivers).
- products:
    - maps of bedrock geology, surficial geology, subsurface Quaternary geology, bedrock topography, and thickness of glacial deposits
    - database of well construction records to support the mapping, describe water use, and to help resolve well problems; scientific test drilling as necessary

Summary Budget Information for Result 1:	**ENRTF Budget:**	**$ 800,000**
	Amount Spent:	**$ 0**
	Balance:	**$ 800,000**

Deliverable	Completion Date	Budget
1. County Well Index databases	6/30/2011	$ 18,000
2. geologic maps and associated data	6/30/2013	$782,000

Result Completion Date: 6/30/2013

Result Status as of: 12/31/2010

Result Status as of: 6/30/2011

Result Status as of: 12/31/2011

Result Status as of: 6/30/2012

Result Status as of: 12/31/2012

Result Status as of: 6/30/2013

Final Report Summary:

RESULT 2: Investigation of the hydrologic properties of the St. Lawrence Formation

Description:
Result 2: Investigation of the hydrologic properties of the St. Lawrence Formation at the regional scale – *MGS $183,000*

- Conduct field measurements, outcrop investigations and collect data throughout southeastern Minnesota that will be used characterize the range of primary and secondary porosity and permeability of the St. Lawrence Formation over regional scales.
- Drill and collect data from 2 to 4 scientific boreholes that characterize the horizontal and vertical hydraulic conductivity of the St. Lawrence Formation at the borehole scale.
- Arrange for dye traces by *Dept. of Geology, $15,000 from Trust Fund to U of MN.*
- Provide data loggers, dye, and other supplies for participation in dye trace, *$30,000 from Trust Fund to DNR*.

Result 2: Investigation of the hydrologic properties of the St. Lawrence Formation at the borehole scale – *$79,000 from Trust Fund to USGS; USGS will provide $52,485 in goods and services at no cost.*

- Drill and collect data from scientific boreholes that characterize the horizontal and vertical hydraulic conductivity of the St. Lawrence Formation at the borehole scale. Specific tasks include the installation of packers to measure hydraulic head at discrete intervals, and the installation of real-time monitoring equipment for continuous data collection.

Summary Budget Information for Result 2:	**ENRTF Budget:**	**$ 307,000**
	Amount Spent:	**$ 0**
	Balance:	**$ 307,000**

Deliverable	Completion Date	Budget
1. Peer-reviewed report on the hydraulic properties of the St. Lawrence Formation, borehole to regional scales.	June 30, 2013	$307,000

Result Completion Date: 6/30/2013

Result Status as of: 12/31/2010

Result Status as of: 6/30/2011

Result Status as of: 12/31/2011

Result Status as of: 6/30/2012

Result Status as of: 12/31/2012

Result Status as of: 6/30/2013

Final Report Summary:

RESULT 3: Evaluation of using chemical and isotopic data to trace ground-water flow pathways in an urban area - Rochester Minnesota

Description:

- Assemble historic ground-water chemical and isotopic data for the city of Rochester and surrounding area.
- Analyze data in the context of revised hydrogeologic framework for the Paleozoic rocks in southeastern Minnesota.
- Report on results using cross sections, fence diagrams or other means that best illustrate the three-dimensional distribution of ground-water chemical types.

Summary Budget Information for Result 3:	**ENRTF Budget:**	**$ 23,000**
	Amount Spent:	**$ 0**
	Balance:	**$ 23,000**

Deliverable	Completion Date	Budget
1. Report describing the three-dimensional distribution of ground-water chemical facies for the city of Rochester	June 30, 2012	$23,000

Result Completion Date: 6/30/2013

Result Status as of: 12/31/2010

Result Status as of: 6/30/2011

Result Status as of: 12/31/2011

Result Status as of: 6/30/2012

Result Status as of: 12/31/2012

Result Status as of: 6/30/2013

Final Report Summary:

V. TOTAL ENRTF PROJECT BUDGET:

Personnel: $ 764,089 These are MGS and U of M staff salaries and fringes.
Contracts: $ 273,000 Includes $79,000 to USGS, 2 drilling contracts (competitive bids), and a printing contract (competitive bid)
Equipment/Tools/Supplies: $ 43,000
Acquisition (Fee Title or Permanent Easements): $ 0
Travel: $ 49,911
Additional Budget Items:

TOTAL ENRTF PROJECT BUDGET: $1,130,000

Explanation of Capital Expenditures Greater Than $3,500:

VI. PROJECT STRATEGY:

A. Project Partners: Result 1 and result 3 will be conducted entirely by MGS. The work under Result 2 involves MGS, USGS, DNR, and the Dept. of Geology and Geophysics at the U of MN. The USGS will conduct borehole scale testing of the hydrologic properties of the St. Lawrence Formation ($79,000). The Dept. of Geology will be subcontracted ($15,000) to carry out dye traces through the St. Lawrence, and the project will provide equipment and supplies to DNR ($30,000) for their role in the dye traces.

B. Project Impact and Long-term Strategy: County geologic atlases support water and mineral resource management as carried out by state and local government. They increase the value and efficiency of most water programs (allocation, wellhead protection, well construction, monitoring, modeling, sustainability evaluation) and are also used by businesses and private citizens. We intend to complete county geologic atlases statewide.

The St. Lawrence research will strengthen these same activities in any part of Minnesota where the St. Lawrence Formation exists. Understanding its hydrologic properties and effects on flow are essential to managing ground water above, below, or

within it. This information will affect modeling of ground water flow and well construction practices.

Mapping the distribution of water chemistry in the Rochester area will establish the value of this type of work to understanding ground water flow paths. Flow paths are critical for understanding recharge, ground water and surface water interaction, and ground water sensitivity. This may be a less expensive and quicker method of obtaining this kind of information.

C. Other Funds Proposed to be Spent during the Project Period:

The MGS will propose elements of the county geologic atlases for cost-sharing under the USGS STATEMAP Program.

The USGS Water Resources Center (Mounds View) will provide unbilled services in the amount of $52,485 in result 2B.

D. Spending History:
M.L. 2007, Chapter 30, Subd 5(j) County Geologic Atlas Program Acceleration (Chisago and Benton counties)
M.L. 2008, Chapter 367, Sec.2, Subd.4(h). South-Central MN Groundwater Monitoring and County Geologic Atlases (Blue Earth, Nicollet, and Sibley counties)
M.L. 2009, Chapter 143, Sec. 2, Subd. 3(b) County Geologic Atlas Acceleration (Anoka and Wright counties)

VII. DISSEMINATION: MGS will make all products available at its web page http://www.geo.umn.edu/mgs/. Any completed county geologic atlas products will also be available in print from MGS, or from the host county.

VIII. REPORTING REQUIREMENTS: Periodic work program progress reports will be submitted not later than January 2011, July 2011, January 2012, July 2012, January 2013, and July 2013. A final work program report and associated products will be submitted between June 30 and August 1, 2013 as requested by the LCCMR.

IX. RESEARCH PROJECTS:

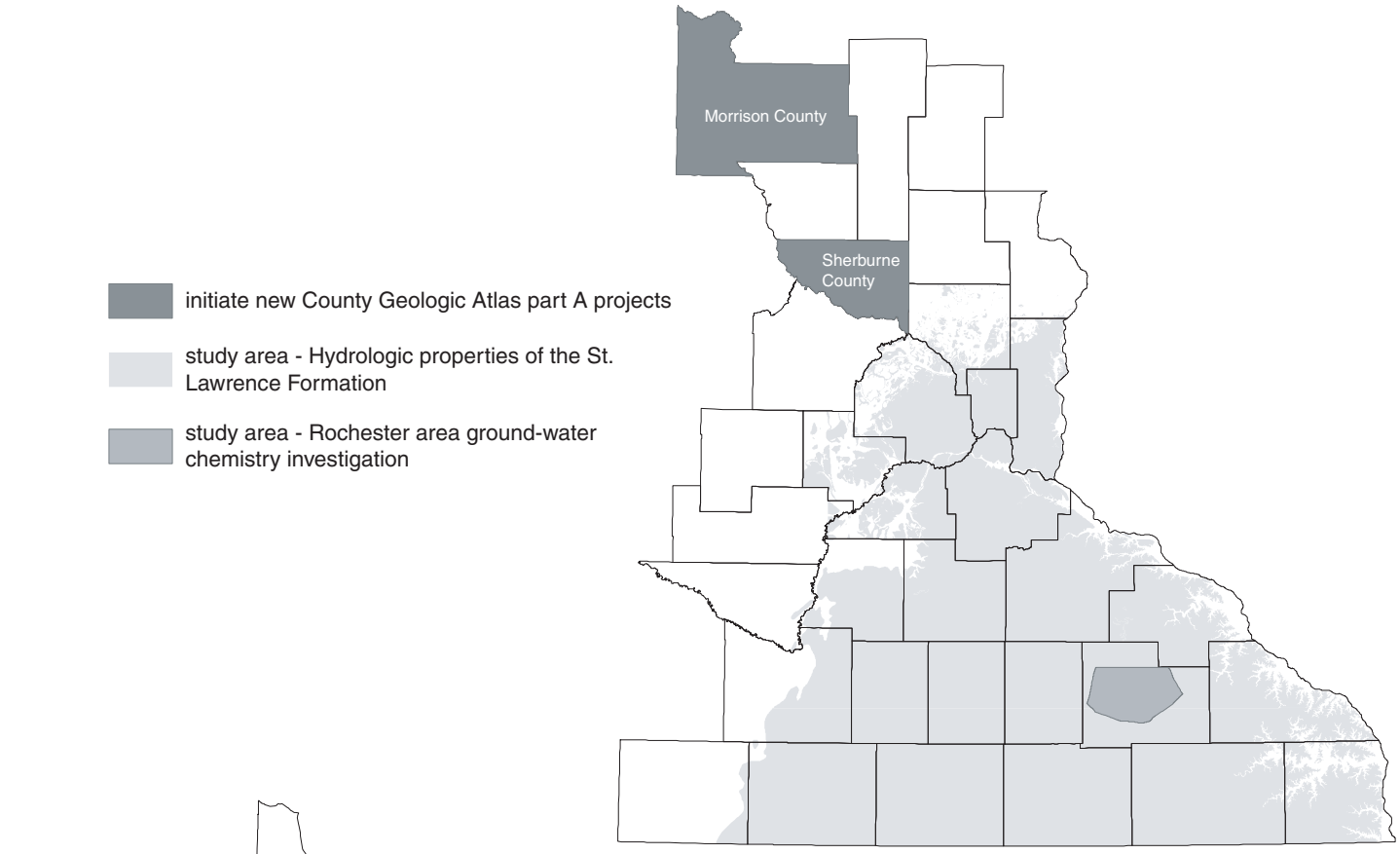
Attachment A: Budget Detail for 2010 Projects - Summary and a Budget page for each partner (if applicable)

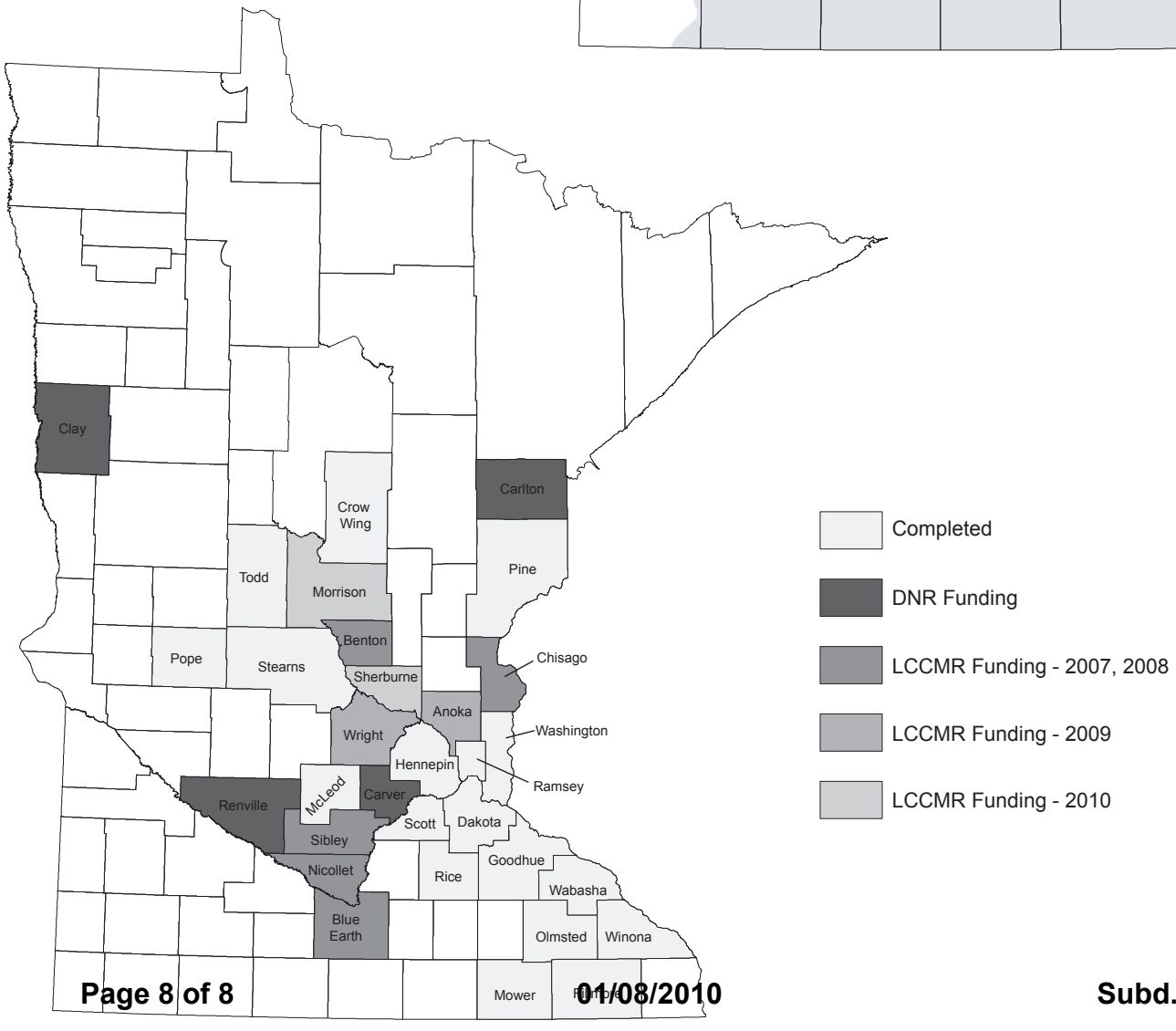
Project Title: Minnesota Geological Survey County Geologic Atlases and Related Hydrogeologic Research

Project Manager Name: *Dale Setterholm*

Trust Fund Appropriation: $1,130,000

2010 Trust Fund Budget	**Result 1 Budget:**	**Amount Spent** *(date)*	**Balance** *(date)*	**Result 2 Budget:**	**Amount Spent** *(date)*	**Balance** *(date)*	**Result 3 Budget:**	**Amount Spent** *(date)*	**Balance** *(date)*	**TOTAL BUDGET**	**TOTAL BALANCE**
	Geologic Atlas Projects			*Investigaton of the hydrologic properties of the St. Lawrene Formation*			*Use of chemical and isotopic data to trace ground-water flow in an urban area - Rochester Minnesota*				
BUDGET ITEM											
PERSONNEL: wages and benefits											
5 to 15 MGS staff including mappers, editors, technicians, geophysicist, database managers- none at full time; 63% salary, 37% fringe	650,000	0	650,000							650,000	650,000
Tony Runkel, MGS: 30% of full time, two years - borehole siting; on-site geologist during drilling; outcrop investigations; data compilation and report writing. 63% of total listed is salary, 37% is benefits				61,254	0	61,254				61,254	61,254
Bob Tipping, MGS: 10% of full time, two years - borehole siting, hydraulic testing, data compilation and report writing. 63% of total listed is salary, 37% is benefits				17,443	0	17,443				17,443	17,443
Lori Robinson, MGS: 4% of full time, one year - editor. 63% of total listed is salary, 37% is benefits				2,610	0	2,610				2,610	2,610
U of M, Calvin Alexander salary and benefits				6,000	0	6,000				6,000	6,000
U of M, Scott Alexander salary and benefits				4,000	0	4,000				4,000	4,000
Bob Tipping: 23% of full time, 1 year - database assembly and analysis; final report and database delivery. 63% of total listed is salary, 37% is benefits							20,570	0	20,570	20,570	20,570
Tony Runkel: 1% of full time, 1 year - scientific review. 63% of total listed is salary, 37% is benefits							907	0	907	907	907
Lori Robinson: 2% of full time, 1 year - editor. 63% of total listed is salary, 37% is benefits							1,305	0	1,305	1,305	1,305
Contracts										0	0
Professional/technical *(Result 2 - scientific borehole drilling, southeastern MN, competitive bid)*				94,000	0	94,000				94,000	94,000
Professional/technical (Result 2- USGS; personnel (Jones, Green, Menheer, Shapiro, geophysicist, 14.5 weeks) $40,385; travel $5,350; GIS support, IT support, report review, safety, and report preparation $15,745; equipment shipping $1,920; equipment to adapt packer system to drill rig, supplies for borehole surveys, pressure transducers and data loggers $15,600 -no item >$3,500)				79,000	0	79,000				79,000	79,000
Professional/technical *(Result 1 - scientific borehole drilling; competitive bid)*	75,000	0	75,000							75,000	75,000
Professional/technical *(Result 1 - printing of atlas maps, competitive bid)*	25,000	0	25,000							25,000	25,000
Non-capital Equipment / Tools *(Result 1 - expendable augers, core boxes, sample bags, lab supplies (chemicals, sieves, settling tubes, sample envelopes) services (repairs, age dating, analyses)*	10,000	0	10,000							10,000	10,000
Non-capital Equipment / Tools *, dye, chemicals, bottles, charcoal detectors, and other to be used for dye-tracing*				3,000	0	3,000				3,000	3,000
Capital equipment over $3,500 Result 2A - DNR: 2 to 4 submersible fluorometric data loggers @ $7,500 to $15,000 each; will continue use beyond project				30,000	0	30,000				30,000	30,000
Travel expenses in Minnesota MGS (trips to project areas to make observations and conduct tests)	40,000	0	40,000	7,693	0	7,693	218	0	218	47,911	47,911
Travel expenses in Minnesota U of M (trips to field areas to make observations, collect samples, conduct tests)				2,000	0	2,000				2,000	2,000
COLUMN TOTAL	**$800,000**	**$0**	**$800,000**	**$307,000**	**$0**	**$307,000**	**$23,000**	**$0**	**$23,000**	**$1,130,000**	**$1,130,000**


Morrison County
Sherburne County
initiate new County Geologic Atlas part A projects
study area - Hydrologic properties of the St. Lawrence Formation
study area - Rochester area ground-water chemistry investigation


Clay
Carlton
Crow Wing
Pine
Todd
Morrison
Benton
Pope
Stearns
Chisago
Sherburne
Anoka
Wright
Washington
Hennepin
Ramsey
Renville
McLeod
Carver
Scott
Dakota
Sibley
Goodhue
Nicollet
Rice
Wabasha
Blue Earth
Olmsted
Winona
Mower
Fillmore
Completed
DNR Funding
LCCMR Funding - 2007, 2008
LCCMR Funding - 2009
LCCMR Funding - 2010