Final Abstract

Final Report Approved on November 27, 2024

M.L. 2020 Project Abstract

For the Period Ending June 30, 2024

Project Title: Geologic Atlases For Water Resource Management

Project Manager: Barbara Lusardi

Affiliation: U of MN - MN Geological Survey

Mailing Address: Minnesota Geological Survey 2609 Territorial Road

City/State/Zip: St. Paul, MN 55114

Phone: (612) 626-5119

E-mail: lusar001@umn.edu

Website: https://www.mngs.umn.edu/

Funding Source:

Fiscal Year:

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 03a

Appropriation Amount: $2,000,000

Amount Spent: $2,000,000

Amount Remaining: -

Sound bite of Project Outcomes and Results

During this phase of the ongoing Geologic Atlas program, we have printed 7 counties, and continued work in 6 others. This is equivalent to “completing” about 5 atlases. Atlas maps and data provide foundational information that supports water management activities to the benefit of drinking water and aquatic habitat.

Overall Project Outcome and Results

A Geologic Atlas provides the geologic framework of our state. It describes the materials and features at the land surface and extends all the way down to the bedrock surface. An atlas provides information useful for resource management and land-use planning. Each Atlas typically requires more than 7,000 person-hours of work. Some of that work is in the field: drilling test borings, examining, sampling, and describing outcrops. Much of the work follows after: interpreting field measurements, recognizing and formally naming geologic units described in well records, and making maps. The result is a detailed account of the distribution and properties of the rock and sediment that lie below the land surface. These materials, and their ability to store or transmit water, determine where we can find water, and how we can protect and make wise use of that water. This includes our lakes and rivers as well as groundwater. The County Geologic Atlas program began in 1981 and continues with support of the Environment and Natural Resources Trust Fund as well

as the Clean Water Fund, the Department of Natural Resources, and the U.S. Geological Survey. To date we have completed atlases for 52 counties, 27 are underway; and 8 have yet to be started. All of our mapping products and data are available in print or digital format.

As part of this 2020 award, we completed Aitkin, Steele, St. Louis, Lake, Lac Qui Parle, Lincoln, and Ottertail counties, and continued working in 6 other counties. We've described hundreds of outcrops, taken thousands of hand samples, and drilled 11 continuous cores allowing us to sample rocks and sediment up to 420 ft deep.

In addition, we were able to replace our outdated geophysical logging equipment. This highly specialized equipment is used to collect geologic data from water wells and scientific drill

Project Results Use and Dissemination

Completed atlas products have been posted to the MGS website and linked to the University's Digital Conservancy as noted above. PDF products as well as all of the related GIS data are available on these pages. In addition, the MGS hosts an Open Data Portal on which many of our county geologic atlases are presented as "Story Maps" that allow for direct access of the data without any special software or interface.

Environment and Natural Resources Trust Fund

M.L. 2020 Approved Final Report

General Information

Date: December 19, 2024

ID Number: 2020-074

Staff Lead: Noah Fribley

Project Title: Geologic Atlases For Water Resource Management

Project Budget: $2,000,000

Project Manager Information

Name: Barbara Lusardi

Organization: U of MN - MN Geological Survey

Office Telephone: (612) 626-5119

Email: lusar001@umn.edu

Web Address: https://www.mngs.umn.edu/

Project Reporting

Final Report Approved: November 27, 2024

Reporting Status: Project Completed

Date of Last Action: November 27, 2024

Project Completion: June 30, 2024

Legal Information

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 03a

Appropriation Language: $2,000,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota, Minnesota Geological Survey, to continue producing county geologic atlases to inform management of surface water and groundwater resources. This appropriation is to complete Part A, which focuses on the properties and distribution of earth materials to define aquifer boundaries and the connection of aquifers to the land surface and surface water resources.

Appropriation End Date: June 30, 2024

Narrative

Project Summary: Geologic atlases provide maps/databases essential for improved management of ground and surface water. This proposal will complete current projects and start new projects to equal about 8 complete atlases.

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Geologic atlases provide maps and databases essential for improved management of ground and surface water. This is foundational data that supports management of drinking water, domestic and industrial supply, irrigation, and aquatic habitat. County Geologic Atlases are specifically identified as essential data in the Statewide Conservation Plan, and in the efforts of the Environmental Quality Board, DNR Eco-Waters, and the Water Resources Center at the University of Minnesota to design a sustainable water management process. The distribution of geologic materials defines aquifer boundaries and the connection of aquifers to the land surface and to surface water resources to enable a comprehensive water management effort. This proposal will complete current projects and start new projects to equal about 8 complete atlases.

Atlases are complete or underway for 66 of the 87 counties in Minnesota with recent starts in Faribault, Waseca, Grant, Douglas, and Lake of the Woods counties. This project continues an effort to complete county geologic atlas coverage statewide. The current spending rate of about $2 million per year (all sources) would allow about 5 new starts each year—a plan in which we start the 87th county in 2025 and completing the entire state in this format in 2029.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

A complete geologic atlas consists of Part A constructed by the Minnesota Geological Survey (MGS) and focused on geology and the County Well Index, and Part B constructed by the DNR Eco-Waters Division (funded separately) and focused on groundwater. Atlases enhance natural resource management and regulation, and facilitate wise use of water resources. They support: permitting, land use planning, wellhead protection, remediation, nutrient management, monitoring, modeling, and well construction. Atlas information is used by citizens, local government, counties, and state agencies (SWCDs, MDH, DNR, MPCA, Ag).

Atlases begin with compilation of a database of subsurface information including well records. The county establishes accurate digital locations for these wells. Concurrently, geologists visit the project area to describe and sample landforms, and exposures of rock or sediment.

An initial assessment of the geologic data is then completed to focus additional data gathering including shallow and deep drilling programs and geophysical, geochemical, and geochronologic surveys. Analysis of the data set is then completed and maps and associated databases are formalized and prepared for use in geographic information systems and distribution via DVD and web. Most of the products are also printed for use in the field, and by users who prefer this format.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

This proposal will complete current projects and start new projects to equal about 5 complete atlases. Specific outcomes are as follows:

1. Create database of well construction records to support the mapping, to document water use in specific aquifers, and to help resolve well problems
2. Complete any unfinished ENRTF supported County Geologic Atlas projects in progress (ex; from 2019/2020 appropriations)
3. Make progress on maps of bedrock geology, surficial geology, subsurface Quaternary geology, bedrock topography, and thickness of glacial deposits

Atlases support: permitting, land use planning, wellhead protection, remediation, nutrient management, monitoring, modeling, and well construction.

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

In the Future

Activities and Milestones

Activity 1: Initiate about 2 new county geologic atlases; continue existing projects—equivalent of about 5 atlases total

Activity Budget: $1,665,000

Activity Description:
Atlases begin with compilation of a database of subsurface information including well records. The local project partner establishes accurate digital locations for these wells. Concurrently, geologists visit the project area to describe and sample landforms, and exposures of rock or sediment.

An initial assessment of the geologic data is then completed to focus additional data gathering including shallow and deep drilling programs and geophysical, geochemical, and geochronologic surveys. Analysis of the data set is then completed and maps and associated databases are formalized and prepared for use in geographic information systems and distribution via DVD and web. Most of the products are also printed for use in the field, and by users who prefer this format. The number of counties we can map with these funds will be affected by the size, geologic complexity, and data availability of the counties that are chosen.

The milestones associated with this activity will help track the progress on the various CGA products including: bedrock geology, surficial geology, subsurface geology, bedrock topography, and drift thickness maps. Pending any delays, it is possible that all of the counties named below will be completed by June 2024. Budget figures are estimated.

Activity Milestones:

Description	Approximate Completion Date
Conduct field work for counties in years 1 and 2 (surficial and bedrock) (~2 counties)	June 30, 2024
Drill and log cores for counties in years 2 and 3 (subsurface and bedrock) (~2)	June 30, 2024
Collect bedrock data (seismic, drill logs, etc) (topography, depth to bedrock) (~4 counties)	June 30, 2024
Compile and draft surficial, bedrock, topography and thickness maps (years 2-4)(~5 counties)	June 30, 2024
Compile, draw, and process cross sections and sand models (subsurface geology; Sand Distribution models)(~5)	June 30, 2024

Activity 2: Compile, edit, and print atlas plates

Activity Budget: $240,000

Activity Description:
In order to convey the meaning of the data we've collected, geologists must write text that describes the geologic framework of the county and why certain materials are important to map and identify. The associated text and figures help to add context to the map and associated data. Once all of the pieces for a particular plate are assembled (map, text, figures, data, etc.) they are submitted for internal and external review. Upon revision and acceptance, the pieces are edited and formatted to fit the page. Professional printing and posting the digital files are the final steps.

Activity Milestones:

Description	Approximate Completion Date
Draft text and figures for plates (~5 counties)	June 30, 2024
Submit materials for peer review, editing, and production (~5 counties)	June 30, 2024
Print final CGA plates and process files for DVD and digital posting (~5 counties)	June 30, 2024

Activity 3: Create database of well construction records and other data to support the mapping.

Activity Budget: $60,000

Activity Description:
Geologists compile all of the data that has been gathered in a certain region in order to make the best map. Drilling records are by far the most numerous data available. Water-well records are required by the state and include a description of the materials that were drilled through. This information is vital to our geologists as they try to interpret the sediment and rock layers that may be buried and out of reach to sample.

Activity Milestones:

Description	Approximate Completion Date
Mentor County staff to locate water wells (pre-MGS field work) (~2 counties)	June 30, 2024
Compile location data and collect subsurface data from other agencies; Enter stratigraphic interpretations (~4 counties)	June 30, 2024
Update water well (CWI) database and compile CGA database plate (~5 counties)	June 30, 2024

Activity 4: Construct statewide geochemistry database

Activity Budget: $35,000

Activity Description:
Identification of the glacial sediment layers is a key step to correlating those layers from place to place. This is important because geologic contaminants may be associated with specific sediments. In an effort to mitigate the effect of these contaminants in drinking water a driller needs to know the provenance of the glacial sediment, and how think is the unit. Geochemical analyses of the sediments will help correlate the aquifers and delineate their extent. This is an ongoing effort whereby we analyze samples from current drilling and compare with samples from other parts of the state.

Activity Milestones:

Description	Approximate Completion Date
Collect samples from new or existing drill cores for analyses (ongoing)	June 30, 2024
Compile and interpret results county by county stratigraphy (part of completed CGA)(~2 counties)	June 30, 2024
Compile and interpret regional/statewide stratigraphy (ongoing)	June 30, 2024

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
MN Counties	MN Counties	The counties are required to provide funds or in-kind service to help us build our database. Counties establish accurate well locations and identify specific project needs.	No
Paul Putzier	MN Dept. of Natural Resources-Ecological and Water Recources	A complete geologic atlas consists of Part A constructed by the Minnesota Geological Survey (MGS) and focused on geology and the County Well Index, and Part B constructed by the DNR Eco-Waters Division (funded separately) and focused on groundwater--water levels, water chemistry, and sensitivity.	Yes

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
Every atlas is produced in portable document format (PDF), as geographic information system files (GIS), and in printed form. The digital files are available as a DVD, and are also available from the University of Minnesota Digital Conservancy, and via link from the MGS web page https://cse.umn.edu/mgs/county-geologic-atlas. Funding support by Environment and Natural Resources Trust Fund is acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications. Each project culminates with a meeting held in the project area to present the results to the county staff, and any other interested parties. At these meetings the products are described, access to the products is explained, and examples of applications of the products to common resource management situations are demonstrated. The printed copies are shared with the county, who in turn can distribute them to libraries, schools, townships, and other agencies. They are also distributed by the MGS map sales office. Products are also made available to earth science teachers and other educators for classroom exercises. Atlas products are also displayed and explained at educational events for agencies and organizations such as SWCD staff, sewage treatment system contractors, well drillers, and even hazmat responders. In addition, the MGS hosts an Open Data Portal on which many of our county geologic atlases are presented as "Story Maps" that allow for direct access of the data without any special software or interface. Representatives from MGS and DNR participated in various field trips, meetings, and strategic planning sessions highlighting aspects of the CGA program and discussing geology and groundwater issues.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?
Most atlases require 3 to 4 years to complete, so some projects started in this proposal may not be finished and will require additional funding. The funding level of this proposal is sized to continue the overall funding of geologic atlases (Part A) that are currently underway while initiating about 2 new atlases for an equivalent of about 5 atlases total. At this pace, we estimate that we will complete statewide coverage by about 2029. Funds from this proposal may be applied, but are not limited to, the following counties: Lyon, Murray, Swift, Stevens, Freeborn, Koochiching, Marshall, and Roseau.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded

County Geologic Atlases - Part A	M.L. 2015, Chp. 76, Sec. 2, Subd. 03a	$2,040,000
County Geologic Atlases - Continuation	M.L. 2017, Chp. 96, Sec. 2, Subd. 03a	$2,000,000
County Geologic Atlases - Part A	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 03a	-
County Geologic Atlases - Part A, Mapping Geology	M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 03n	$2,000,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount	$ Amount Spent	$ Amount Remaining
Personnel										
16 Geologists		Create geologic maps; collect and interpret data, draw map, write text, draft figures , present results			32%	18.9		$961,000	-	-
3 GIS/computer/web development specialists		Create GIS products leading to final print and digital versions of maps, cross sections and sand distribution models; finalize and archive GIS data; develop web accessible content			32%	3.24		$166,000	-	-
2 field assistants		Assist geologists with collection and processing of geologic information in the laboratory, field and office			32%	1.08		$55,000	-	-
3 Database specialists		Database development and support: database development for existing and new projects; train and supervise internal and external staff in well location; data collection of downhole geophysical data			32%	3		$139,186	-	-
1 editor		Edit maps, text, and figures for publication; coordinates printing			32%	1.08		$55,000	-	-
							Sub Total	**$1,376,186**	**$1,376,186**	**-**
Contracts and Services										
TBD	Professional or Technical Service Contract	Geochemical and geochronological analyses to support aquifer correlation and delineation; laboratories will be evaluated based on cost and capabilities in accordance with U of M purchasing rules Includes $500 for sample shipping.				0		$35,000	$35,000	-
TBD	Professional or Technical	Laboratory analyses not relating to geochemistry project outlined				0		$14,852	$14,852	-

	Service Contract	elsewhere; includes but not limited to thin sections, pollen counts, radiocarbon dates; laboratories will be evaluated based on cost and capabilities in accordance with U of M purchasing rules. Contracts or bids as necessary.								
TBD	Professional or Technical Service Contract	Rotary sonic test hole drilling (competitive bid). Generally 3-6 holes per county. Rotary sonic method yields 4" undisturbed core of unconsolidated deposits. Average hole cost is $16,500 but varies with depth. Depth corresponds to depth of bedrock surface. Drilling costs are shared with support from DNR contract.				0		$182,500	$182,500	-
							Sub Total	**$232,352**	**$232,352**	**-**
Equipment, Tools, and Supplies										
	Tools and Supplies	Field and lab expendables (batteries, sample bags, distilled water); Giddings probe repairs and parts; maps, core boxes	These items are needed to collect, process, and store samples					$6,057	$6,057	-
							Sub Total	**$6,057**	**$6,057**	**-**
Capital Expenditures										
		Geophysical logging equipment package (including: winch, cable, software, FWF sonic, Acoustic televiewer, replacement tools, accessories, and adapters for current tools, training, travel expenses for Mount Sopris geophysicist, and installation (UMN Fleet services).	Geophysical logging equipment is used to collect geologic data from water wells and scientific drill holes from which we cannot get samples of the rock and/or sediment. This information is vital for geologic mapping to help determine the depth of the bedrock surface as well as to characterize the	X				$199,003	$199,003	-

			geologic layers beneath the glacial sediment. In particular, it provides data about deep water-bearing rock layers that provide drinking water for many communities and homeowners. These data are also used to determine the proper method needed to seal older water wells so that contamination cannot make its way into the groundwater from the land surface. Information from newer wells and boreholes is referenced when making decisions about potential new wells and for land-use decision making. This new equipment, not only provides us additional tools to collect even more data, the updated software will better interface with all of our mapping and GIS software. We currently have 24 County Geologic Atlases in progress, and 16 left to start. Purchase of this equipment will contribute to Activities 1 and 3 of this program.							
							Sub Total	**$199,003**	**$199,003**	**-**
Acquisitions and Stewardship										
							Sub Total	**-**	**-**	**-**

Travel In Minnesota										
	Miles/ Meals/ Lodging	Vehicle rental as needed (weekly and mileage); meals; lodging; amounts cannot be calculated until specific project locations are known	Geologists must travel to each county in order to collect samples, identify rocks and sediment, interpret landforms, drill and log core, and to train county staff. In order to be most efficient, geologists may spend several days to weeks in the field.					$85,651	$85,651	-
							Sub Total	**$85,651**	**$85,651**	**-**
Travel Outside Minnesota										
							Sub Total	**-**	**-**	**-**
Printing and Publication										
	Printing	Offset printing; awarded by price comparison; typically 500 copies of each of 6 plates (each 3' by 3' and four color) per county, current prices about $14,000 per county. Print run has been lowered as there are more online users.	Map plates are best viewed on a printed page. Digital files are also made available (PDF, GIS, web browser)					$100,751	$100,751	-
							Sub Total	**$100,751**	**$100,751**	**-**
Other Expenses										
							Sub Total	**-**	**-**	**-**
							Grand Total	**$2,000,000**	**$2,000,000**	**-**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Capital Expenditures		Geophysical logging equipment package (including: winch, cable, software, FWF sonic, Acoustic televiewer, replacement tools, accessories, and adapters for current tools, training, travel expenses for Mount Sopris geophysicist, and installation (UMN Fleet services).	The slight increase in this amount is due to the selection of specific equipment that was generalized in the initial quote. For example, we purchased the longer winch cable that will allow us to log deeper holes and collect valuable data from the deeply buried strata. **Additional Explanation :** Our current logging equipment was purchased in 1991 and has lasted over 30 years with careful use and maintenance. This new equipment, not only provides us additional tools to collect even more data, the updated software will better interface with all of our mapping and GIS software. We currently have 24 County Geologic Atlases in progress, and 16 left to start. Purchase of this equipment will contribute to Activities 1 and 3 of this program. Activity 1—Initiate mapping: Collecting geophysical data is part of our daily field work and is required to accurately characterize sediment and rock layers for mapping and groundwater protection. In addition to logging water wells, we also collect downhole data from our drill sites where we have good samples with which to compare to the collected geophysical data. This allows us to make better interpretations in other locations where we don't have access to samples. Activity 3- Create database of data to support the mapping: Geologists compile all of the data that has been gathered in a certain region in order to make the best map. Drilling records are by far the most numerous data available. Water-well records are required by the state and include a description of the materials that were drilled through. This information is vital to our geologists as they try to interpret the sediment and rock layers that may be buried and out of reach to sample. In addition, MGS responds to inquiries from the Health Dept and the Pollution Control Agency to collect data for proper well abandonment and aquifer characterization. Our geologists have been asked to log bridge borings when the I35W bridge was being rebuilt, and we have logged dozens of water wells as part of the 3M contamination remediation.

Non ENRTF Funds

Category	Specific Source	Use	Status	$ Amount	$ Amount Spent	$ Amount Remaining
State						
Cash	MN Department of Natural Resources No commitment for the next biennium Estimate is based on previous contracts	The MGS will work on the following program elements and associated activities during the biennium: 1) Completion and printing of the Part A portion of current atlas projects. 2) Continuation of current and new CGAs. 3) Initiation of preliminary work on new county geologic atlases, if funds are available. 4) Scientific drilling to augment county geologic atlas projects. Funds are distributed as follows: Items 1-3: $150,000 FY20 and $100,000 FY21: Total $250,000 Item 4: $100,000 FY20 and $0 FY21: Total $100,000	Secured	$350,000	$350,000	-
Cash	Clean Water Funds (FY22 distribution): $450,000 Clean Water Funds (FY23 distribution): $450,000	Used to supplement other funding sources to complete County Geologic Atlases (Part A) for the entire state; funding to continue ongoing atlases and to start new atlas projects (including but not limited to database development, mapping, drilling, sample analyses, editing and production (print and digital files)	Secured	$900,000	$661,212	$238,788
			State Sub Total	**$1,250,000**	**$1,011,212**	**$238,788**
Non-State						
Cash	USGS Statemap program (secured FY22) $172,000 USGS Great Lakes Geologic Mapping Coalition (secured FY22) $45,000 Funds listed are for CGA related work.	MGS competes for federal cost-sharing of geologic mapping through the STATEMAP Program, the Great Lakes Geologic Mapping Coalition, and the USGS Data Preservation Program. Each requires a 1:1 match of federal dollars with non-federal dollars. MGS has used these programs to fund map elements of geologic atlases, or improvement of databases utilzed in geologic atlas work. The figure provided is an estimate based on pending proposals.	Secured	$217,000	$217,000	-
In-Kind	Individual counties; value varies with the number of records and the size of the county; estimated to be $10,000 to $50,000	Individual counties are required to establish accurate locations for water wells with construction records. This helps MGS build a database of geologic information that is vital to our mapping process.	Secured	$25,000	$25,000	-

			Non State Sub Total	**$242,000**	**$242,000**	**-**
			Funds Total	**$1,492,000**	**$1,253,212**	**$238,788**

Attachments

Required Attachments

Visual Component

File: b2ce9fdc-a9b.pdf

Alternate Text for Visual Component

Status map showing the counties for which CGA is complete (45) or underway (21) and which counties have not yet been started (21).

Funding graph showing 12-year spending history from 2010-2021. Current-year spending is estimated through June. Spending amounts are indicated by sponsor (ENRTF, CWF, DNR, and Fed). In addition, the graph shows the funding required to complete CGA's for the rest of Minnesota counties in the next 9 years including estimated carry forward, pending, and proposed...

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Background Check	692ca3bd-9c6.pdf

Media Links

Title	Link
Minnesota Geological Survey	https://cse.umn.edu/mgs
MGS County Geologic Atlas page	https://cse.umn.edu/mgs/county-geologic-atlas
County Geologic Atlas Storymaps	https://mngs-umn.opendata.arcgis.com/apps/UMN::county-geologic-atlas-story-maps/explore
St. Louis County Geologic Atlas	https://conservancy.umn.edu/items/1cea310b-ca8d-4345-acfa-450ab8ca17e6
Steele County Geologic Atlas	https://conservancy.umn.edu/items/88184f6b-3e92-42b4-ad53-ba5d9dc1fe61
Aitkin County Geologic Atlas	https://conservancy.umn.edu/items/98db1cdb-0d31-49c4-bb4e-323680dd6f5f
Lake County Geologic Atlas	https://conservancy.umn.edu/items/015940d8-5119-4460-902b-05fcefd02d7a
Ottertail County Geologic Atlas	https://conservancy.umn.edu/items/cb74bca6-926b-490d-8237-0c46c0b76a10
Lac Qui Parle County Geologic Atlas	https://conservancy.umn.edu/items/7c81059b-9953-44b7-bf0b-0627cf868297
Dakota County Geologic Atlas	https://conservancy.umn.edu/items/5d8d0fa7-2cc7-4db5-ba02-e33702bf3573
Lincoln County Geologic Atlas	https://conservancy.umn.edu/items/35e1b155-583b-46a4-b628-d4c2113f48d5

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

This is essentially the same workplan that was submitted and approved during the 2020 proposal year. The information has been transferred into the online system. The section outlining non-ENRTF funding has been updated to reflect awards that are secured or pending for FY22. In addition, the original visual aid (status map and funding trends graphic)

has been replaced with the same file that was submitted earlier this year as part of the 2022 request for proposals. I have also requested to be able to submit progress reports in December and June instead of April/October.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

Yes

Do you understand that travel expenses are only approved if they follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I understand the UMN Policy on travel applies.

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Work Plan Amendments

Amendment ID	Request Type	Changes made on the following pages	Explanation & justification for Amendment Request (word limit 75)	Date Submitted	Approved	Date of LCCMR Action
1	Amendment Request	• Budget - Personnel • Budget - Professional / Technical Contracts • Budget - Capital, Equipment, Tools, and Supplies • Budget - Travel and Conferences • Budget - Printing and Publication • Budget - Non-ENRTF Funds Contributed	We have an urgent need to replace our geophysical logging equipment which is over 30 years old. MGS collects downhole geophysical data from water wells and scientific drill holes for bedrock and aquifer characterization and proper well abandonment. These data are essential to our mapping functions and to protect groundwater from contamination. Therefore, we seek permission to shift funds from other categories to cover this unexpected equipment expense.	December 21, 2022	Yes	December 28, 2022
2	Amendment Request	• Budget • Budget - Personnel • Budget - Professional / Technical Contracts • Budget - Capital, Equipment, Tools, and Supplies • Budget - Travel and Conferences • Budget - Printing and Publication	We spent less on drilling and field expendibles, but more on travel, laboratory analyses, and printing. The workplan indicates printing for about 4 counties. Coming out of the pandemic, we have now printed 7 counties. In order to accommodate these changes, I have reduced the totals in categories that will likely see no additional spending. Salaries will be spent down as we transistion from this funding to our LCCMR_21 award.	January 22, 2024	Yes	March 1, 2024
3	Amendment Request	• Budget - Personnel • Budget - Professional / Technical Contracts • Budget - Capital, Equipment, Tools, and Supplies • Budget - Travel and Conferences • Budget - Printing and Publication • Budget - Non-ENRTF Funds Contributed	It's always difficult to hit our estimated budget figures exactly. We ended up overspending slightly (less than $900) in each of several categories including: Personnel, Printing, Laboratory Analyses, Equipment/Tools/Supplies, and Travel expenses. On the other end, we underspent on rotary sonic drilling and geophysical logging equipment. This amendment request seeks to adjust the	June 17, 2024	Yes	August 23, 2024

			final budget figures as this award has ended.			

Status Update Reporting

Final Status Update August 14, 2024

Date Submitted: June 17, 2024

Date Approved: August 23, 2024

Overall Update
Lake, Otter Tail, and Lac Qui Parle counties have been printed and posted to our website. Paper atlases have been delivered and presentations for Lake and Lac Qui Parle were hosted this past spring. We are still working with representatives in Otter Tail county to schedule a presentation.

Ongoing counties have been transitioned to other funding—Pipestone, Yellow Medicine, Cook and Chippewa will now be reported under LCCMR_21. Pipestone will be printed within the coming weeks. Yellow Medicine, Cook and Chippewa still have a ways to go.

Pennington and Polk counties are nearing their conclusion and have been transitioned to Clean Water Funding for the remainder of the work yet to be done.

Activity 1
As part of this 2020 award, we printed Aitkin, Steele, St. Louis, Lake, Lac Qui Parle, Lincoln, and Otter Tail counties, and continued working in 6 other counties. Based on the time spent, this is equivalent to "completing" about 5 atlases. Pipestone county is almost ready to print. The final cost for printing this atlas will be on a subsequent award.

As of the May 2024, work on Yellow Medicine, Cook, and Chippewa counties has been transferred to the M.L 2021 award. Polk and Pennington counties have been transferred to Clean Water Funding.
(This activity marked as complete as of this status update)

Activity 2
Digital files for all counties that have been printed are now posted and available on the MGS website. These include: St. Louis, Steele, Aitkin, Lac Qui Parle, Otter Tail, Lake, Dakota (CWF) and Lincoln.

Pipestone county is nearing completion and should be printed in the coming weeks.
(This activity marked as complete as of this status update)

Activity 3
Database work continues on all of the counties that are currently being funded under this award. For those counties that are nearing completion (Pipestone), the database plate is already finalized. No additional data will be added to these counties (to be published as part of the atlas products). Water well data are continuously updated as time and funding allows.
(This activity marked as complete as of this status update)

Activity 4
So far we have geochemistry data on 3213 samples. All samples are collected from cores that are part of ongoing CGA's and published CGA's. We have analyzed 86 cores across the state. MGS will be posting an open-file report of recently received data in the coming months.

Samples from recently logged cores will be sent for analysis later this year. This is an ongoing project along with our

geologic mapping.
(This activity marked as complete as of this status update)

Dissemination

No additional counties have been printed since the previous update. Dakota (CWF) County has been delivered and presented. The project manager is working with Lincoln County contacts to arrange for delivery of printed County Geologic Atlas maps. A presentation of our findings as well as a demonstration of the digital files will be scheduled later this year.

Status Update Reporting

Status Update January 1, 2024

Date Submitted: December 18, 2023

Date Approved: March 1, 2024

Overall Update
Two more counties have been printed—Dakota and Lincoln. The only task that remains is to compile all the digital files for DVD and online applications. Pipestone County should be printed within the coming months.
Lake, Otter Tail and Lac Qui Parle counties are complete. Digital files have been compiled and posted to our website. We are working to schedule a presentation of our findings to interested parties in each of these counties.
Work continues on the remaining counties on this award including: Pennington, Polk, Yellow Medicine, Cook, and Chippewa. In addition, we are cost-sharing funds with two USGS projects which cover a portion of mapping in Lyon, Waseca, Faribault, and Lake of the Woods counties.
As this award draws down, we will transition any active projects to our other LCCMR awards or alternative funding sources.

Activity 1
Field work continues for Cook County for which we are leveraging our LCCMR funding with USGS funding as part of the STATEMAP program. MGS staff spend 6 weeks canoeing in the Boundary Waters this summer collecting data on bedrock outcrops.
Drilling is complete in Swift, Lyon and Murray (LCCMR_21) counties with partial support from the USGS Great Lakes Geologic Mapping Coalition. Cores are currently being logged and sampled. Samples will be analyzed and interpreted for texture, lithology, and geochemistry.
Data on the bedrock topography is being compiled for several counties including Polk, Pennington, Yellow Medicine, Cook and Chippewa. These data will be compiled into topography and depth to bedrock maps within the coming months.
Surficial maps are nearly complete for Pipestone, Cook, Polk, Pennington, and Chippewa counties. Cross sections are underway in these counties as well. Sand distribution models are the last stage before completion.

Activity 2
Dakota (CWF) and Lincoln (this award) counties are now printed and will be available for distribution upon delivery. Digital files are being compiled and will be written to DVD and posted on our website in the coming weeks.
Pipestone county is nearing completion and should be printed in the coming months.

Activity 3
Database work continues on all of the counties that are currently being funded under this award. For those counties that are nearing completion (Pipestone), the database plate is already finalized. No additional data will be added to these counties (to be published as part of the atlas products). Water well data are continuously updated as time and funding allows.

Activity 4
We recently received results from the samples that we sent for processing earlier this fall. The sample data will be compiled and interpreted in light of the other samples that we have analyzed. This will help our geologists determine if there is a specific geochemical footprint that can be used to identify and correlate between glacial units.

Dissemination
Dakota and Lincoln counties are now printed and will be distributed in the coming weeks. Digital files are being compiled and will be written to DVD and posted on our website. Project managers are working with County contacts to

arrange for delivery of printed County Geologic Atlas maps. A presentation of our findings as well as a demonstration of the digital files will be scheduled later this year.

Status Update Reporting

Status Update July 1, 2023

Date Submitted: June 23, 2023

Date Approved: June 26, 2023

Overall Update

The MGS County Geologic Atlas Program has active projects in 25 counties. Atlases are just getting underway in Beltrami, Martin, Cottonwood, LeSueur, and Itasca counties. Funding accounts for these counties has not yet been assigned (currently on LCCMR_21 New Projects). Locating has started or will start in the coming months but MGS work will not start until sometime in the next two years.

Three counties on this award (Lake, Otter Tail and Lac Qui Parle) have been printed. The only task that remains is to compile all the digital files for DVD and online applications. We will make good progress on several additional counties that are nearing completion including Dakota (CWF), Lincoln and Pipestone (this award).

Projects in Pennington (this award), Red Lake (CWF), Polk, Chippewa, Yellow Medicine, Douglas and Grant (CWF) counties are getting to the later stages, with some counties further along than others. The focus is on map compilation, cross sections, and sand distribution models. Waseca and Faribault (this award), Lake of the Woods and Ramsey (CWF) counties completed drilling, logging and sampling of core this past winter. Data from those samples will be analyzed and compiled into maps and cross sections over the next several months.

Activity 1

Field work continues for Cook County for which we are leveraging our LCCMR funding with USGS funding as part of the STATEMAP program.

Drilling is complete in Lake of the Woods (CWF), Waseca, Faribault, and Ramsey (CWF) counties with partial support from the USGS Great Lakes Geologic Mapping Coalition and the DNR. Cores have been logged and sampled. Samples are currently being analyzed and interpreted for texture, lithology, and geochemistry.

Data on the bedrock topography is still being compiled for several counties including Polk, Pennington, Yellow Medicine, Cook and Chippewa. These data will be compiled into topography and depth to bedrock maps within the coming year.

Surficial maps are nearly complete for Lincoln, Pipestone, Cook and Chippewa counties. Cross sections are underway in these counties as well. Sand distribution models are the last stage before completion.

Activity 2

Lake, Otter Tail and Lac Qui Parle counties are now printed and available for distribution. Digital files are being compiled and will be written to DVD and posted on our website in the coming weeks.

Dakota (CWF) Lincoln, and Pipestone counties are nearing completion. Of the 18 plates that comprise these three atlases, 9 are complete, and 1 is in production, and 3 are in review.

Activity 3

Database work continues on all of the counties that are currently being funded under this award. For those counties that are nearing completion (Dakota, Lincoln, Pipestone), the database plate is already finalized. No additional data will be added to these counties (to be published as part of the atlas products). Water well data are continuously updated as time and funding allows.

Activity 4

So far we have geochemistry data on 2604 samples. All samples are collected from cores that are part of ongoing CGA's and published CGA's. We have analyzed 76 cores across 32 counties. We anticipate submitting 600 samples this year from 10 cores across 10 counties spanning from Lake of the Woods and Pennington counties to Waseca and Faribault counties.

Geochemistry data has been used to better understand the geochemical makeup of the sediments. This information allows us to further differentiate till units (and therefore, different aquifers) based on varying elemental concentrations. One example of how this information is useful is to better determine provenances of sediments where other methods may not be as helpful. Till derived from the Northwest is often elevated in Arsenic concentrations, which is a contaminant monitored in drinking water.

Dissemination

Lake, Otter Tail and Lac Qui Parle counties are now printed and available for distribution. Digital files are being compiled and will be written to DVD and posted on our website in the coming weeks. Project managers are working with County contacts to arrange for delivery of printed County Geologic Atlas maps. A presentation of our findings as well as a demonstration of the digital files will be scheduled later this year.

Status Update Reporting

Status Update January 1, 2023

Date Submitted: December 21, 2022

Date Approved: December 28, 2022

Overall Update

Projects that are funding under this award are well underway. Ottertail and Lac Qui Parle counties are nearly complete. Field work Polk, Pennington, Lincoln, and Pipestone is complete, with one field season remaining for bedrock mapping in Cook, Yellow Medicine, and Chippewa counties.

The FY22 USGS programs that shared funding with our other LCCMR award finished in June and September. This included rotary sonic drilling in Scott (LCCMR_21), Red Lake (Clean Water Funds), Polk (this award), Douglas and Grant (CWF) counties, as well as mapping portions of the bedrock and surficial geology in Cook (this award), Faribault (LCCMR_21), Red Lake, Polk, Douglas and Grant counties.

New FY23 USGS programs started in July and October of this year continue to fund portions of this work and is being reported and expensed on this award. This work includes surficial and bedrock mapping in Waseca (LCCMR_21) and Lake of the Woods (CWF) counties; surficial mapping in Faribault and Lyon (LCCMR_21) counties; and rotary sonic drilling in Waseca, Lake of the Woods, Faribault, and Ramsey (CWF) counties.

Printed copies of Aitkin, Steele, and St. Louis counties are now available. Digital files of these counties will be posted to our website

Activity 1

Field work continues for Cook County for which we are leveraging our LCCMR funding with USGS funding as part of the STATEMAP program.

Drilling is underway with partial support from the USGS Great Lakes Geologic Mapping Coalition. Counties drilling this year include Lake of the Woods, Waseca, Faribault, and Ramsey.

Data on the bedrock topography is still being compiled for several counties including Polk, Pennington, Lac Qui Parle, Lincoln, Pipestone, Ottertail, Yellow Medicine, Cook and Chippewa. These data will be compiled into topography and depth to bedrock maps within the coming year.

Surficial maps are nearly complete for Lac Qui Parle, Lincoln, Pipestone, Ottertail, Cook and Chippewa counties. Cross sections are underway in these counties as well. Sand distribution models are the last stage before completion.

Activity 2

St. Louis, Steele, and Aitkin counties are now printed and available for distribution. Digital files are being compiled and will be written to DVD and posted on our website in the coming weeks.

Lac Qui Parle, Ottertail, and Lake counties are nearing completion. Of the 18 plates that comprise these three atlases, 10 are complete, 5 are in production, and 3 are in review.

Activity 3

Database work continues on all of the counties that are currently being funded under this award. For those counties that are nearing completion (Lake, Lac Qui Parle, Ottertail), the database plate is already finalized. No additional data will be added to these counties (to be published as part of the atlas products). Water well data are continuously updated as time and funding allows.

Activity 4

494 samples of glacial sediment from 10 counties were sent out earlier this summer for geochemical analyses. As we are still processing data from previous drill cores, and drilling is currently underway in several counties, we will be selecting and shipping a second batch of samples sometime in the spring. Data from these laboratory analyses appears

on the Quaternary stratigraphy plate (plate 4) along with the detailed log and sediment data from the various cores. Some samples are selected from older cores in key locations, or containing specific glacial units so that we can characterize the stratigraphy across the entire state.

Dissemination

St. Louis, Steele, and Aitkin counties are now printed and available for distribution. Digital files are being compiled and will be written to DVD and posted on our website in the coming weeks. Project managers are working with County contacts to arrange for delivery of printed County Geologic Atlas maps. A presentation of our findings as well as a demonstration of the digital files will be scheduled sometime in the new year.

Status Update Reporting

Status Update July 1, 2022

Date Submitted: June 1, 2022

Date Approved: July 1, 2022

Overall Update
This is the first of two major awards from the ENRTF that were received at the beginning of FY22. Most of our in-progress atlases including, Polk, Pennington, Lac Qui Parle, Lincoln, Pipestone, Ottertail, Yellow Medicine, Cook, and Chippewa, are being funded on this award (LCCMR_20). Much of our current effort is directed to finishing up these atlases. Progress ranges from about 40 to 89 percent complete. Otter Tail County is leading the way with all plates ready for review. Lincoln, Pipestone, and Lac Qui Parle counties each have several plates ready for review. The remaining counties started more recently and are only about halfway through the process.

Activity 1
As we received this award a year past the original date and in conjunction with the 2021 award, we have not yet added any new atlases to this funding. All new projects have been assigned to the 2021 award. Instead, we have transitioned projects that are nearing completion from the LCCMR19 award which has been spent (final report due June 2022). These projects include St. Louis, Lake, Steele, and Aitkin counties. These counties are all in final stages (editing and production) and should be complete within the next several months.
As to the activity milestones listed above, field work continues for Cook County for which we are leveraging our LCCMR funding with USGS funding as part of the STATEMAP program.
Drilling was completed for Polk County this winter. Other counties were drilled in previous years on other awards.
Data on the bedrock topography is being compiled for several counties including Polk, Pennington, Lac Qui Parle, Lincoln, Pipestone, Ottertail, Yellow Medicine, Cook and Chippewa. These data will be compiled into topography and depth to bedrock maps within the coming year.
Surficial maps are nearly complete for Lac Qui

Activity 2
We have transitioned projects that are nearing completion from the LCCMR19 award which has been spent (final report due June 2022). These projects include St. Louis, Lake, Steele, and Aitkin counties. These counties are all in final stages (editing and production) and should be complete within the next several months.
In the time that this award has been in effect, 6 plates which make up parts of Steele, Aitkin, Ottertail, Lincoln and Pipestone counties have started the review/editing process. Four of these are complete and ready for production. At the same time, 4 plates for Dakota County, funded by the Clean Water Council, have also completed the review and editing process and are ready for publication.

Activity 3
Database work has continued on all of the counties that are currently being funded under this award (Polk, Pennington, Lac Qui Parle, Lincoln, Pipestone, Ottertail, Yellow Medicine, Cook, Chippewa). For those counties that are nearing completion, the database is being compiled into the final database plate. No additional data will be added to these counties (to be published as part of the atlas products).

Activity 4
Drilling is still underway for several counties. Once these cores are collected, logged, and interpreted, samples will be selected for geochemical analyses. This is an ongoing project whereby we continue to add data to the statewide database which will enable us to correlate the glacial stratigraphy between counties and regions.

Dissemination

No CGA's have been published on this award as of this reporting date.