



# Environment and Natural Resources Trust Fund

M.L. 2020 Approved Work Plan

## General Information

**ID Number:** 2020-074

**Staff Lead:** Corrie Layfield

**Date this document submitted to LCCMR:** August 13, 2021

**Project Title:** Geologic Atlases For Water Resource Management

**Project Budget:** \$2,000,000

## Project Manager Information

**Name:** Barbara Lusardi

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## Project Reporting

**Date Work Plan Approved by LCCMR:** August 13, 2021

**Reporting Schedule:** July 1 / January 1 of each year.

**Project Completion:** June 30, 2024

**Final Report Due Date:** August 14, 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? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and 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	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	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	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 thick 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	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 Resources	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 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
<b>Personnel</b>								
16 Geologists		Create geologic maps; collect and interpret data, draw map, write text, draft figures , present results			32%	18.9		\$1,067,500
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		\$183,000
2 field assistants		Assist geologists with collection and processing of geologic information in the laboratory, field and office			32%	1.08		\$61,000
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%	2.7		\$152,500
1 editor		Edit maps, text, and figures for publication; coordinates printing			32%	1.08		\$61,000
							<b>Sub Total</b>	<b>\$1,525,000</b>
<b>Contracts and Services</b>								
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
TBD	Professional or Technical Service Contract	Laboratory analyses not relating to geochemistry project outlined 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.				0		\$15,000
TBD	Professional or Technical	Rotary sonic test hole drilling (competitive bid). Generally 3-6 holes per county. Rotary sonic				0		\$210,000

	Service Contract	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.						
							<b>Sub Total</b>	<b>\$260,000</b>
	<b>Equipment, Tools, and Supplies</b>							
	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					\$45,000
							<b>Sub Total</b>	<b>\$45,000</b>
	<b>Capital Expenditures</b>							
							<b>Sub Total</b>	-
	<b>Acquisitions and Stewardship</b>							
							<b>Sub Total</b>	-
	<b>Travel In Minnesota</b>							
	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.					\$120,000
							<b>Sub Total</b>	<b>\$120,000</b>
	<b>Travel Outside Minnesota</b>							
							<b>Sub Total</b>	-
	<b>Printing and Publication</b>							

	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)					\$50,000
							<b>Sub Total</b>	<b>\$50,000</b>
	<b>Other Expenses</b>							
							<b>Sub Total</b>	-
							<b>Grand Total</b>	<b>\$2,000,000</b>

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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## Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
<b>State</b>				
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	Potential	\$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)	Pending	\$900,000
			<b>State Sub Total</b>	<b>\$1,250,000</b>
<b>Non-State</b>				
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 utilized in geologic atlas work. The figure provided is an estimate based on pending proposals.	Secured	\$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
			<b>Non State Sub Total</b>	<b>\$242,000</b>
			<b>Funds Total</b>	<b>\$1,492,000</b>

## 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...

### Optional Attachments

#### *Support Letter or Other*

Title	File
Background Check	<a href="#">692ca3bd-9c6.pdf</a>

## 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?**

N/A

**Do you agree travel expenses must 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 agree to the UMN Policy.

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

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

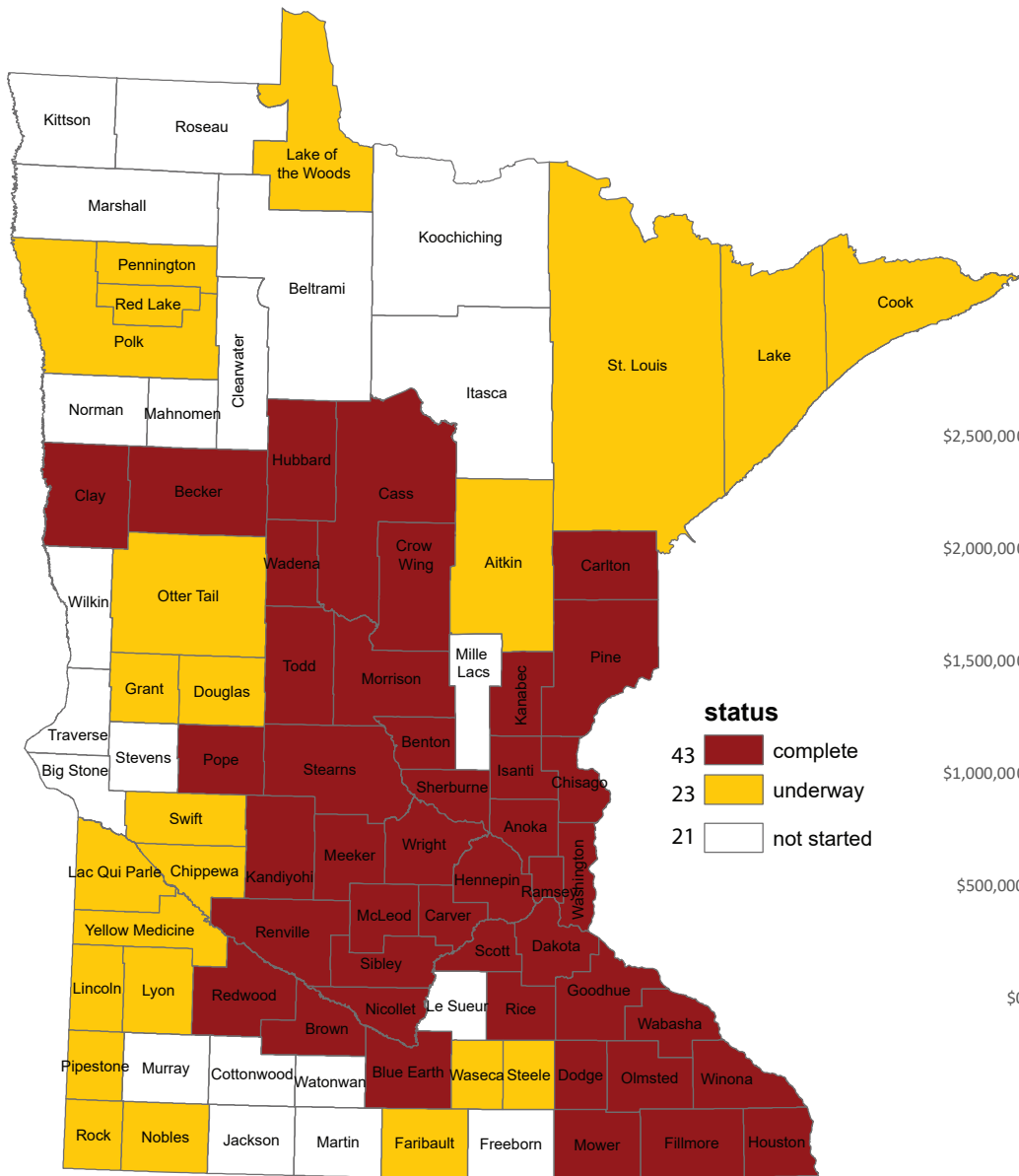
**Does your project include original, hypothesis-driven research?**

Yes

**Does the organization have a fiscal agent for this project?**

Yes, Sponsored Projects Administration

# Status of County Geologic Atlas Part A

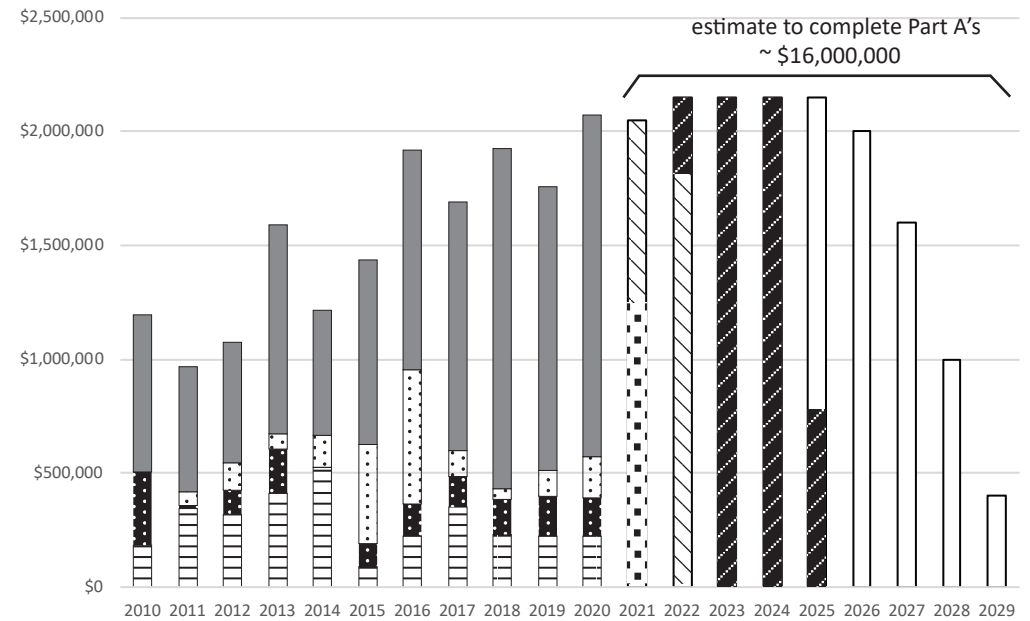


03/31/2020



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### County Geologic Atlas Part A Funding History and Projection



Spending History (2010-2020\*)

- ENRTF
- Clean Water Funds
- Federal Cost Share
- Dept. Natural Resources

\*FY20 spending estimated

Funding projection (2021-2029^)

- Carry Forward
- Pending awards FY22
- Proposed FY23
- Additional funds

^Future funding is not shown in the time-frame during which it will likely be spent