



Hubbard County Geologic Atlas (Part A and Part B)

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Minnesota's Central Sand Region County Geologic Atlases, Hubbard Co. Example



CENTRAL SANDS REGION

- Headwaters of the Mississippi River
- Many lakes, some very deep
- Abundant sand at surface and shallow depths
- Groundwater connection to lakes and streams

County Geologic Atlas (CGA)

- Geology (Part A)

UNIVERSITY OF MISSISSIPPI
MISSISSIPPI GEOLOGICAL SURVEY
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI, MISSISSIPPI

Prepared and Published with the Support of
THE CARROLL COUNTY BOARD OF COMMISSIONERS AND
THE MISSISSIPPI DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS

SURFICIAL GEOLOGY
By
Barbara A. Linnarth
2005

COMBINATION OF MAP SHEETS

STATE OF MISSISSIPPI
DEPARTMENT OF TRANSPORTATION
DIVISION OF GEOLOGICAL ENGINEERING

UNIVERSITY OF MISSISSIPPI
MISSISSIPPI GEOLOGICAL SURVEY
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI, MISSISSIPPI

Geology Atlas Part A

Plate 1, Data-Base Map
Plate 2, Bedrock Geology
Plate 3, Surficial Geology
Plate 4, Quaternary Stratigraphy and Sand Distribution Models
Plate 5, Bedrock Topography, Depth to Bedrock

- Groundwater (Part B)

STATE OF MISSISSIPPI
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HYDROGEOLOGIC CROSS SECTIONS
By
Dale A. Farnham
2005

INTRODUCTION

HYDROGEOLOGIC CROSS SECTIONS BY THE DATA AUTHOR

MISSISSIPPI GEOLOGICAL SURVEY

MNDNR

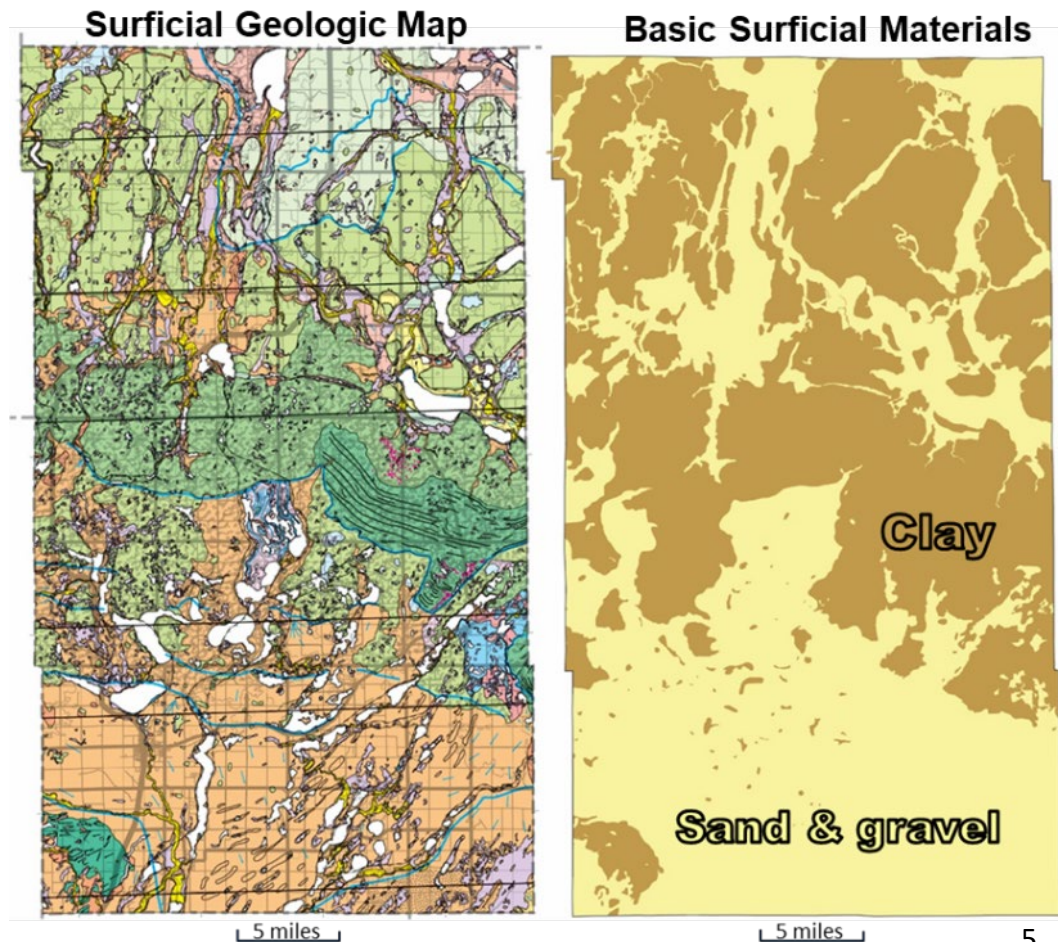
Groundwater Atlas Part B

Atlas Report
Pollution Sensitivity
Aquifer Characteristics
Groundwater Flow
Plate – Groundwater Chemistry
Plate - Hydrogeologic Cross Sections

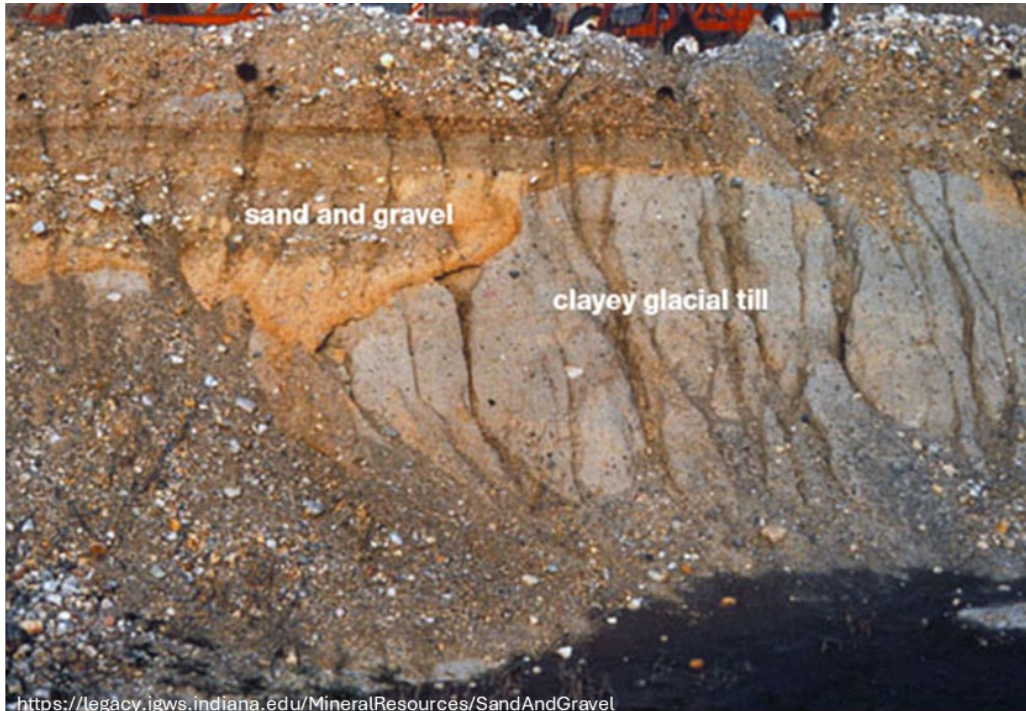
Geologic Maps (CGA Part A)

- **Geologic Maps Show:**
 - Roads
 - Lakes and Rivers
 - **Rocks or Sediments**

Hubbard County Surficial Geology (sediment immediately below topsoil)

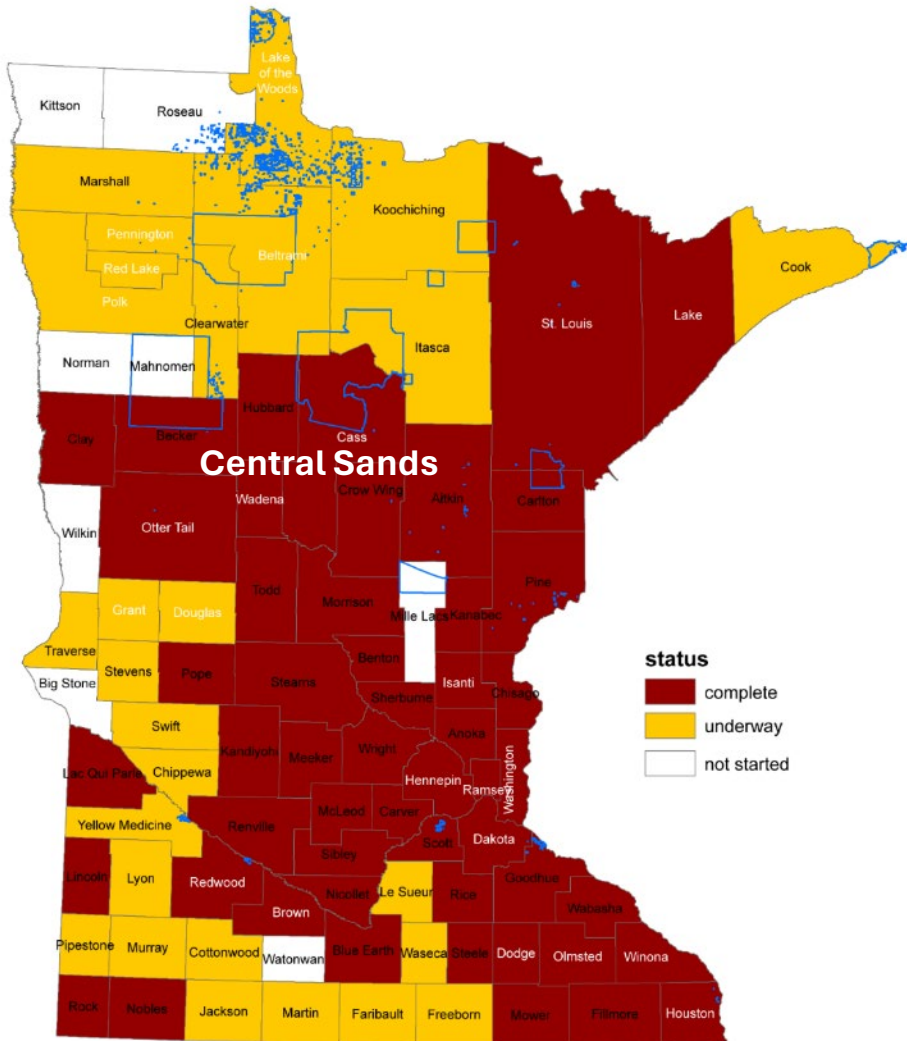


Geologic Resources



- Geology is the “container”
- It holds all our natural resources including: minerals, aggregate, and water
- Maps show the distribution of rocks, sediment, and resources.
- This distribution allows us to predict where to find, plan how to use, and protect groundwater and surface water.

Geologic Atlas Part A Progress

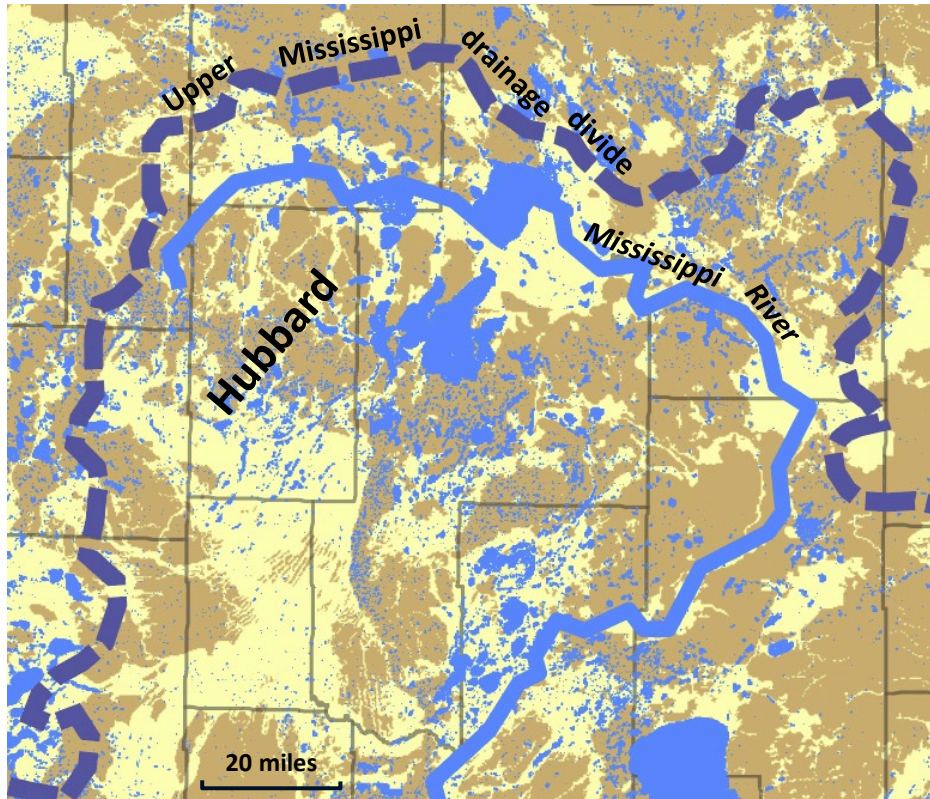


- 52 counties have complete Part A (maroon)
- 27 counties in progress (gold)
- 8 counties have not started (white)
- 23 counties supported all or in part by Clean Water Funds (shown with white labels)

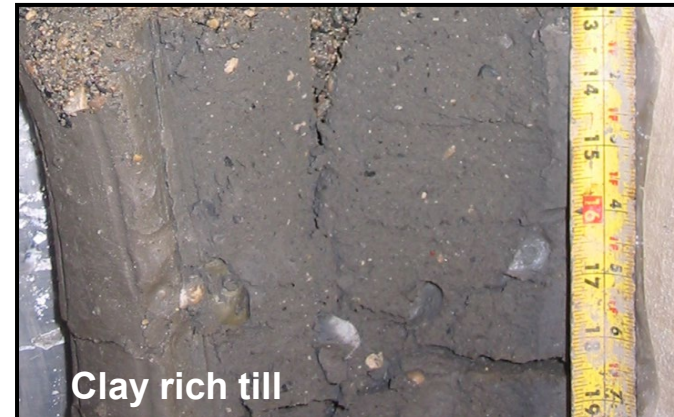
*Status as of 5/17/24
Minnesota counties are labeled
Tribal government boundaries (blue outlines)*

Central Sands Surficial Geology (Shallow Sediment)

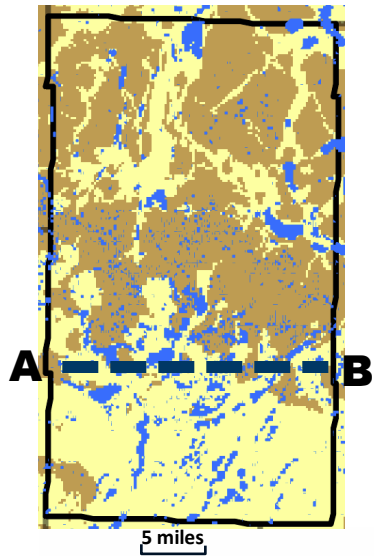
Upper Mississippi/Central Sands Region



-  Sand & Gravel
-  Clay-rich





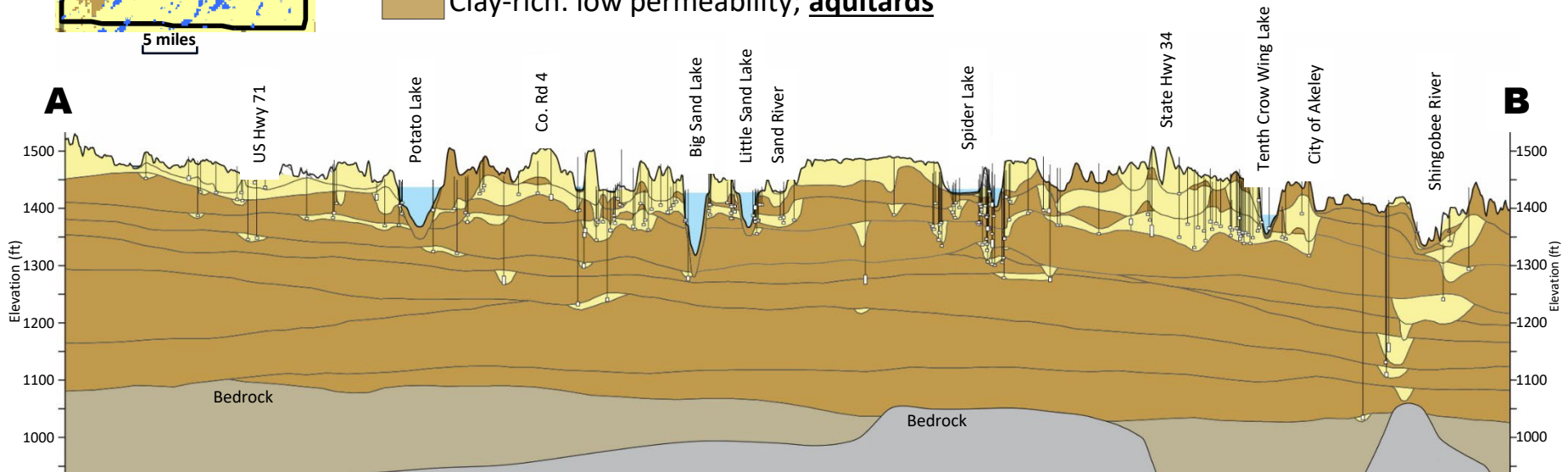
Geologic mapping is used for the Groundwater Atlas



Part A geologic mapping also extends to depths of hundreds of feet

Cross section: profile of Hubbard County geology at depth

-  Sand & Gravel: high permeability; **potential aquifers**
-  Clay-rich: low permeability; **aquitards**



Groundwater Atlas of Hubbard County (Part B): DNR

Groundwater Atlas of Hubbard County, Minnesota

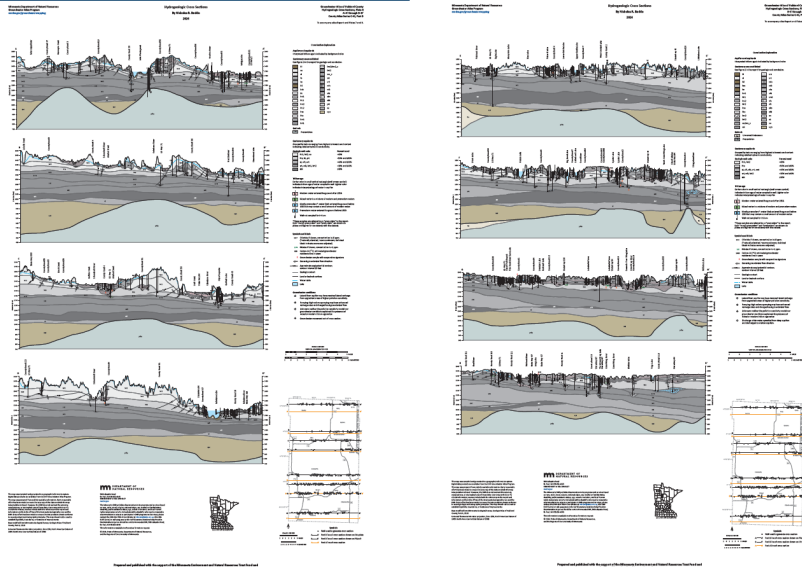
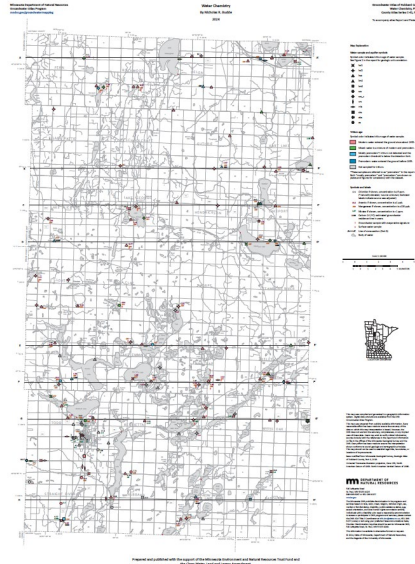
County Atlas Series C-41, Part B - Hydrogeology



Report

To accompany these atlas components:
Plate 7, Water Chemistry
Plates 8-9, Hydrogeologic Cross Sections

mn DEPARTMENT OF
NATURAL RESOURCES
St. Paul 2024
mn.dnr.gov/groundwatermapping



Report

- Hydrogeology and Groundwater Flow
- Water Chemistry
- Groundwater Pollution Sensitivity
- Groundwater Use

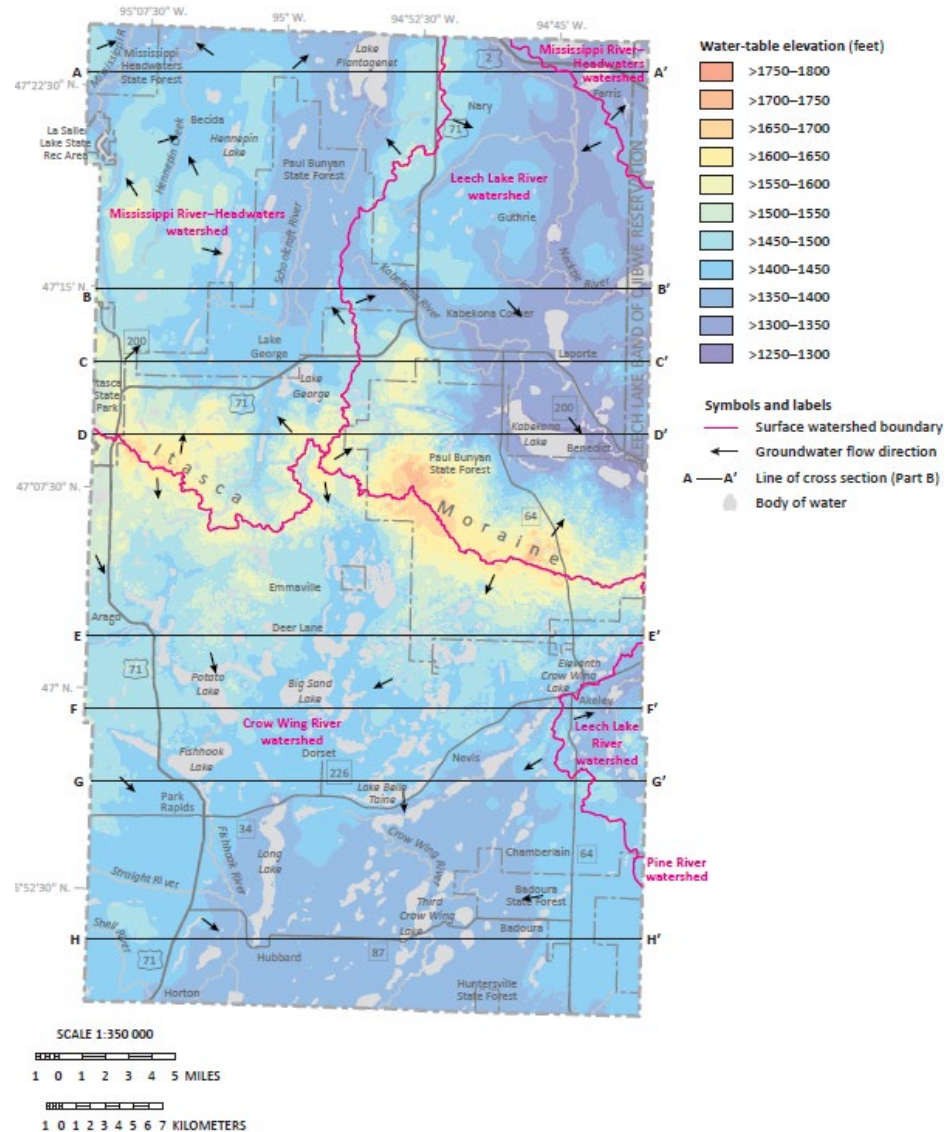
3 Plates

- Water Chemistry
- Hydrogeologic Cross Sections

Electronic Files

- Report and Plates
- GIS files

Groundwater Flow - Water Table Elevation

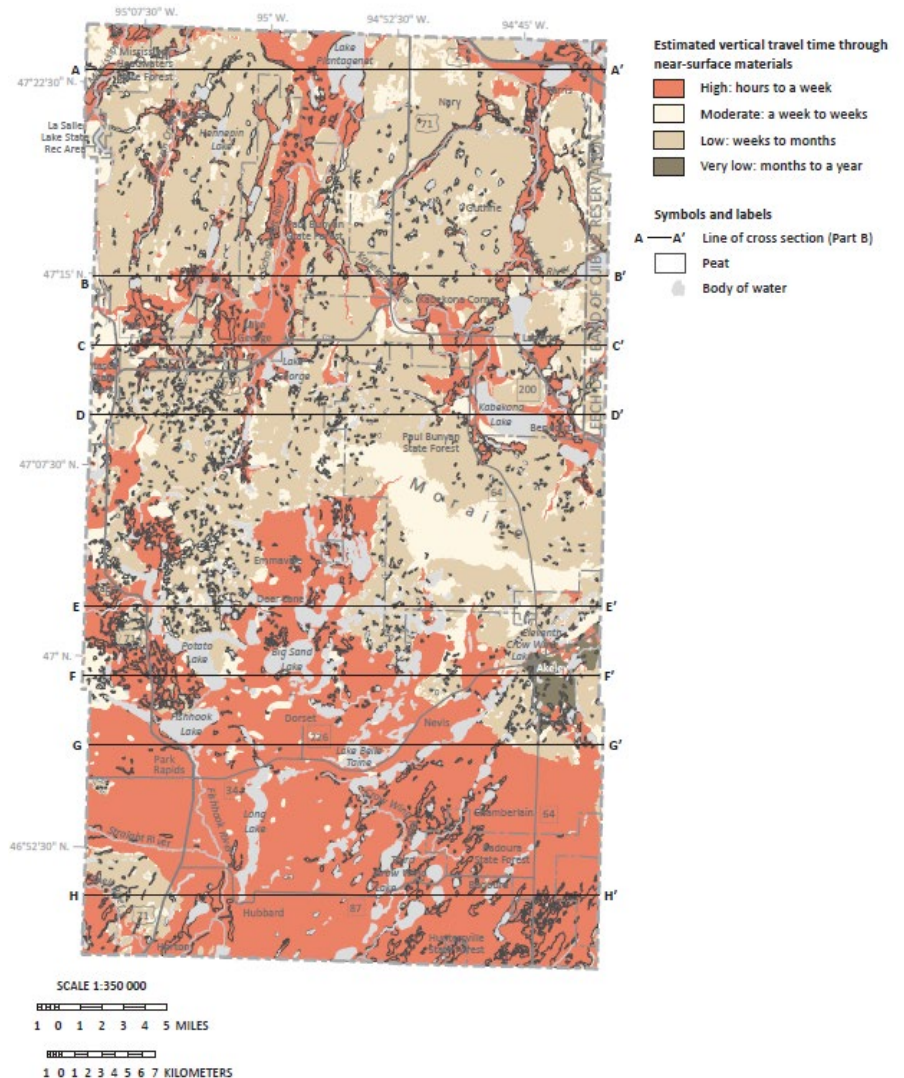
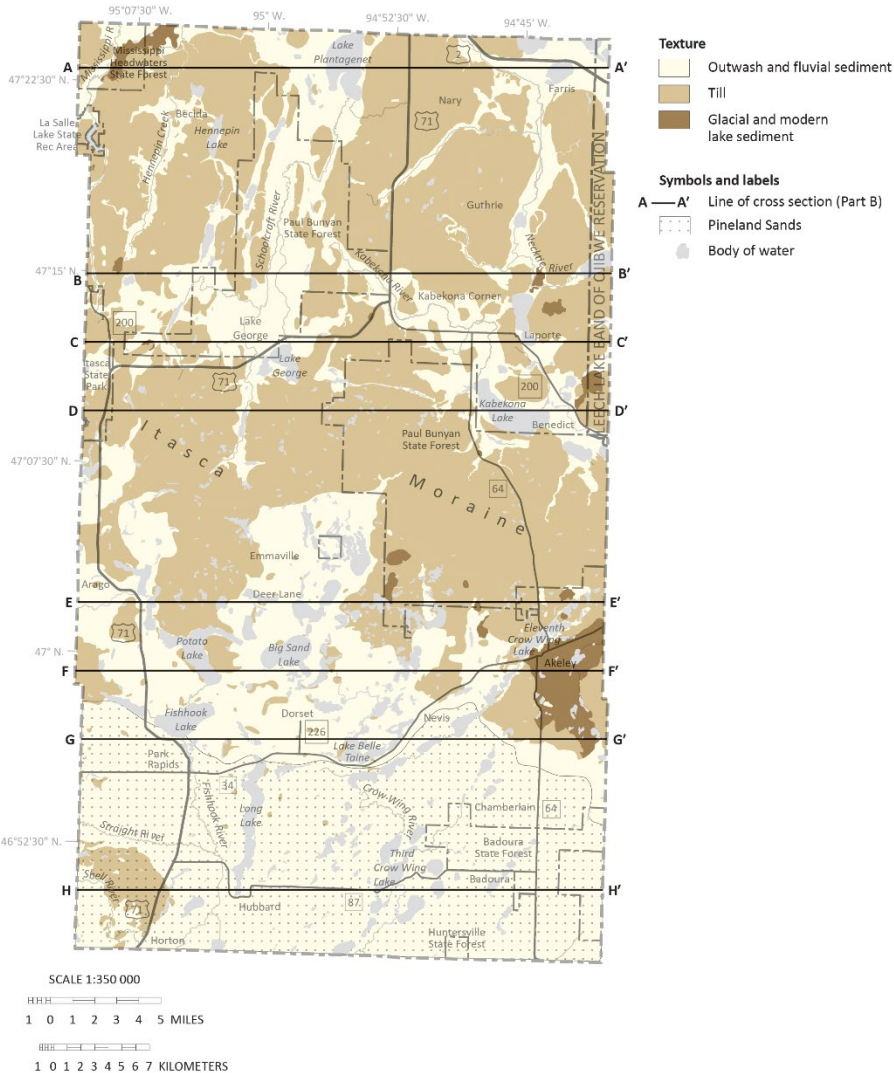


Water Chemistry

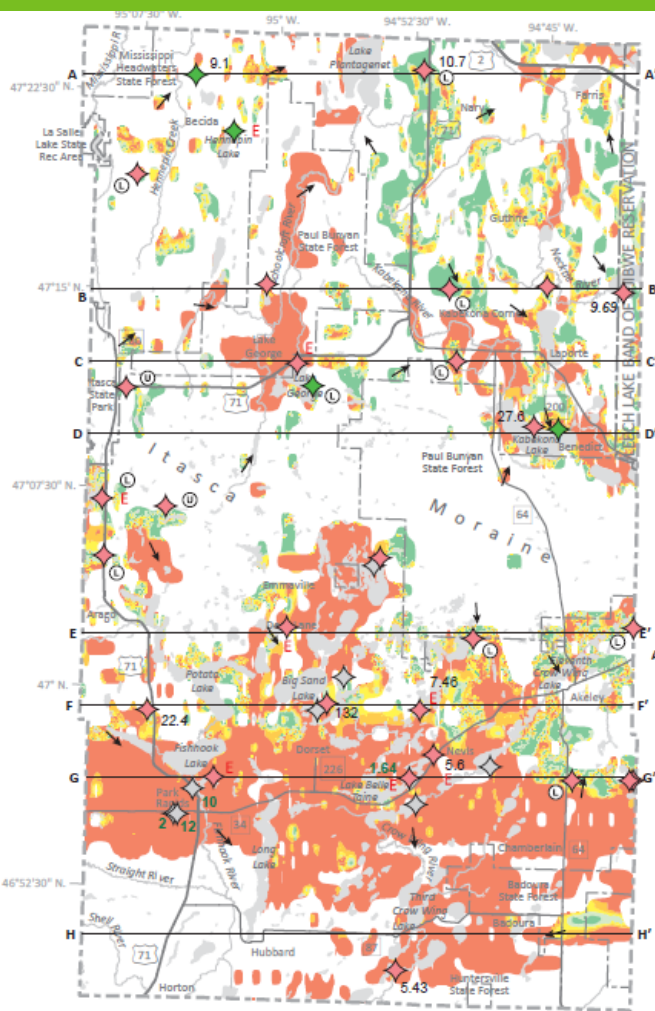
- General Chemistry:
 - Introduced by humans (e.g. Chloride and Nitrate)
 - Naturally-sourced (e.g. Arsenic and Manganese)
- Surface Water Connections
- Time since the water was at the surface (residence time)



Near-surface pollution sensitivity (Upper 10 feet of subsurface)



Buried sand aquifer pollution sensitivity (10 figures)



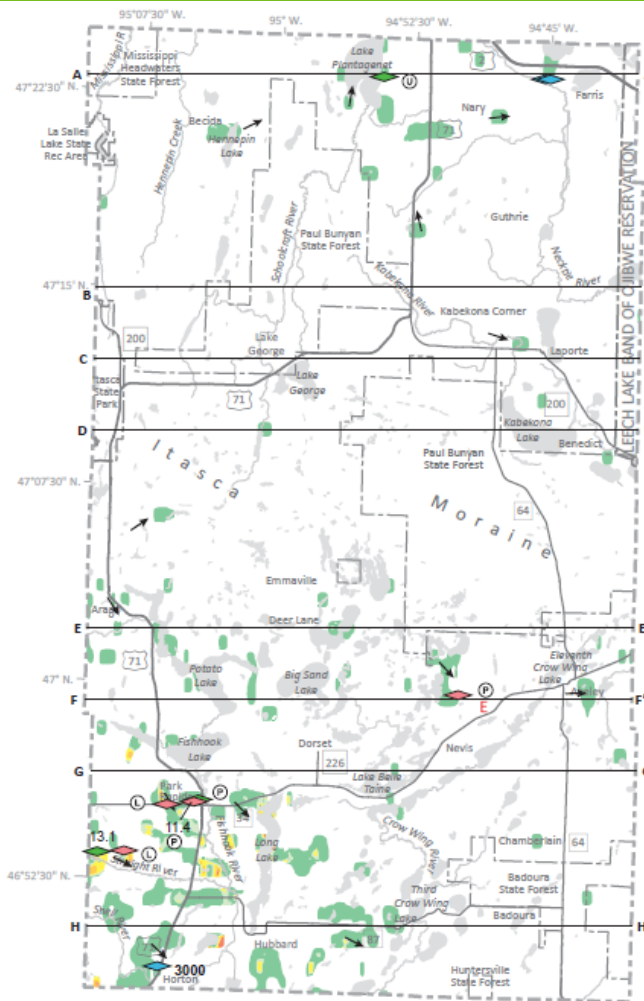
- Pollution sensitivity rating**
 Estimated vertical travel time.
- Very high: hours to months
 - High: weeks to years
 - Moderate: years to decades
 - Low: decades to a century
 - Very low: a century or more
- Tritium age**
 Symbol color indicates tritium age of water sample.
- Modern
 - Mixed
 - Not sampled for tritium
- Symbols and labels**
- 9.69 Chloride: if shown, concentration is ≥ 25 ppm. (*naturally elevated, *source unknown; italicized labels indicate source was adjusted)
 - 1.64 Nitrate: if shown, concentration is >1 ppm.
 - E Groundwater sample with evaporative signature
 - ← Groundwater flow direction
 - A—A' Line of cross section (Part B)
 - Body of water
- Groundwater conditions**
- L Lateral flow
 - U Unknown

SCALE 1:350 000

1 0 1 2 3 4 5 MILES

1 0 1 2 3 4 5 6 7 KILOMETERS

Shallowly buried



- Pollution sensitivity rating**
 Estimated vertical travel time.
- Very high: hours to months
 - High: weeks to years
 - Moderate: years to decades
 - Low: decades to a century
 - Very low: a century or more
- Tritium age**
 Symbol color indicates tritium age of water sample.
- Modern
 - Mixed
 - Mostly premodern
- Symbols and labels**
- 11.4 Chloride: if shown, concentration is ≥ 25 ppm. (*naturally elevated, *source unknown; italicized labels indicate source was adjusted)
 - 3000 Carbon-14 (^{14}C): estimated groundwater residence time in years
 - E Groundwater sample with evaporative signature
 - ← Groundwater flow direction
 - A—A' Line of cross section (Part B)
 - Body of water
- Groundwater conditions**
- L Lateral flow
 - P Pumping
 - U Unknown

SCALE 1:350 000

1 0 1 2 3 4 5 MILES

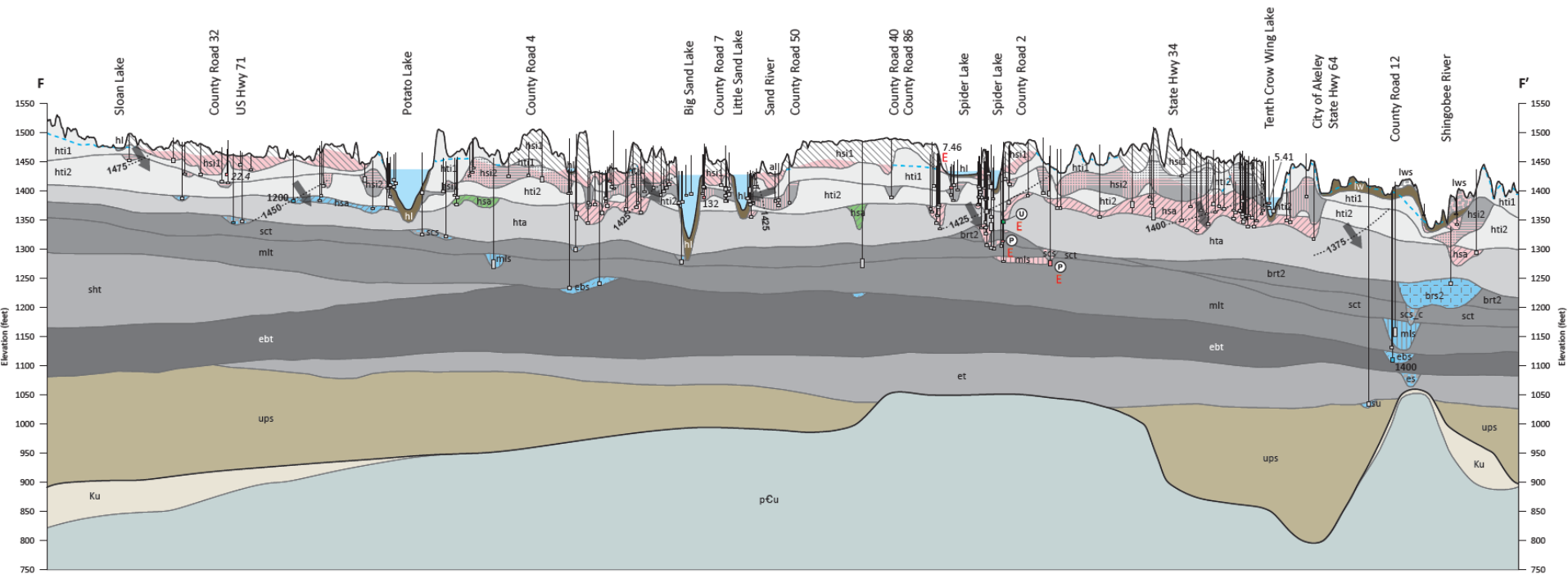
1 0 1 2 3 4 5 6 7 KILOMETERS

More deeply buried

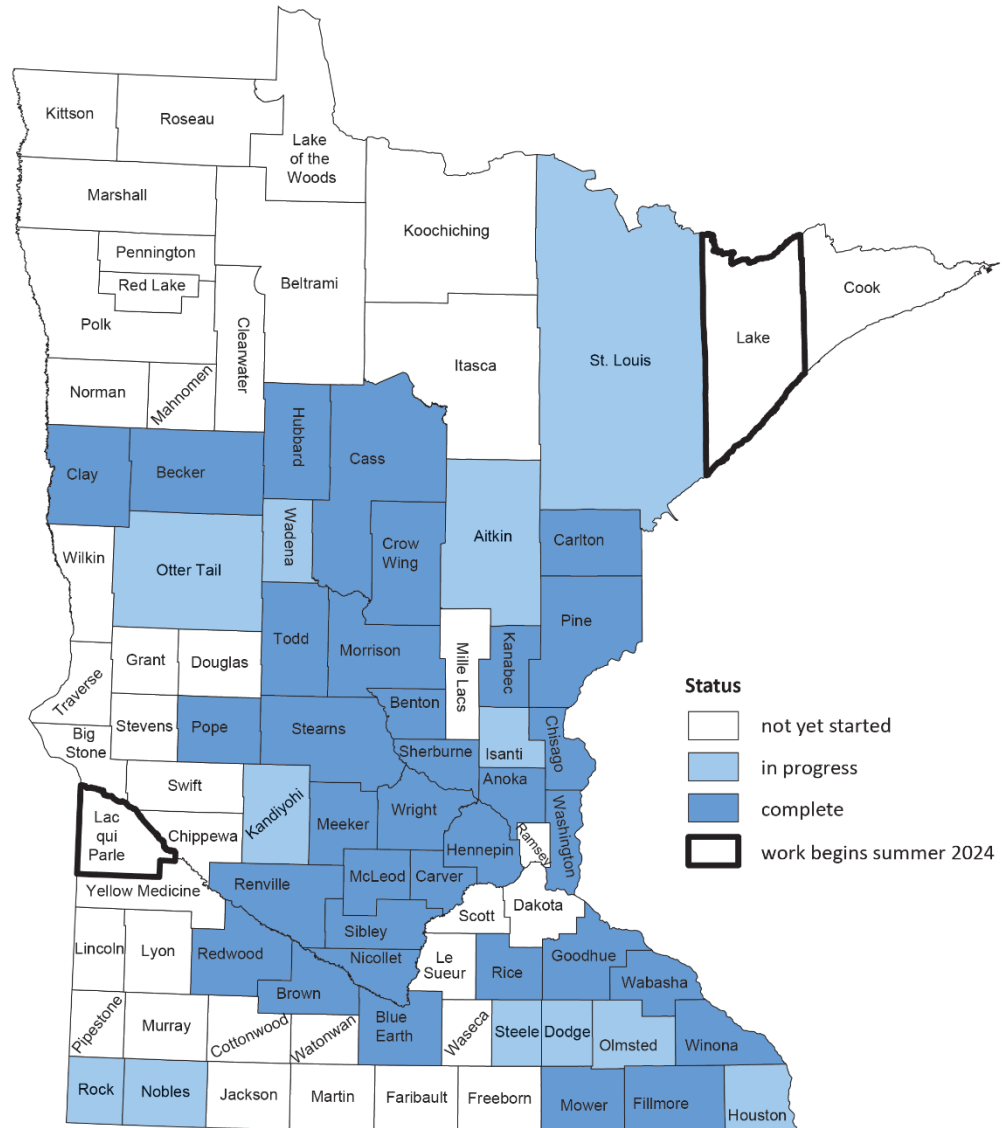
Figure 21. Pollution sensitivity of the hsl2 aquifer and groundwater flow directions

Figure 27. Pollution sensitivity of the mls aquifer and groundwater flow directions

Hydrogeologic Cross-Sections



County Geologic Atlas (CGA) Part B Status



Thank You! Questions?

<https://cse.umn.edu/mgs/county-geologic-atlas>
mndnr.gov/groundwatermapping