

The County Atlas Program: Evolution of Geologic and Groundwater Atlases as Tools for Water Resource Management

Minnesota Ground Water Association
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Minnesota Geological Survey (MGS)

Tony

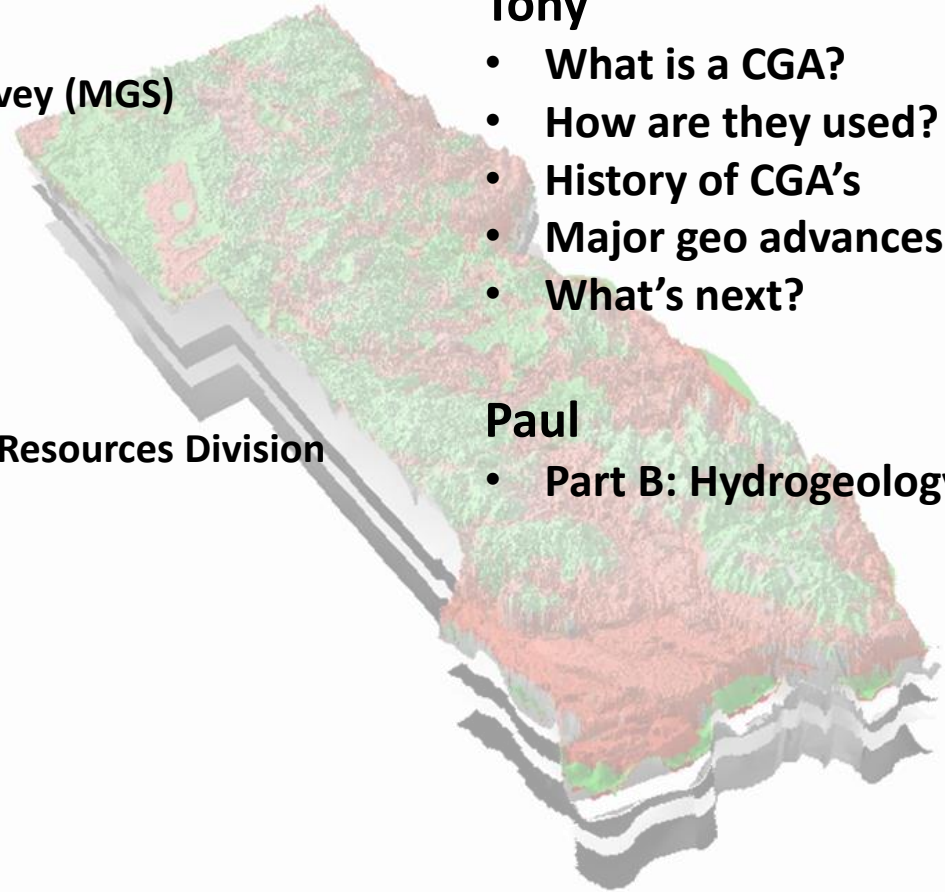
- What is a CGA?
- How are they used?
- History of CGA's
- Major geo advances
- What's next?



Paul Putzier
Ecological and Water Resources Division

Paul

- Part B: Hydrogeology

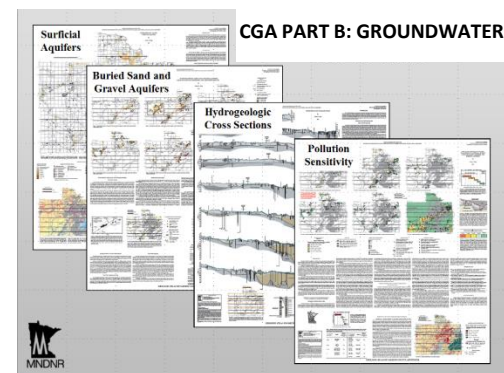
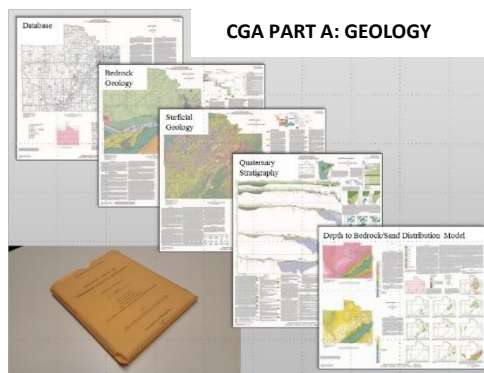


County Geologic Atlases are a set of maps and reports that show the distribution of rock, sediment and groundwater in a county

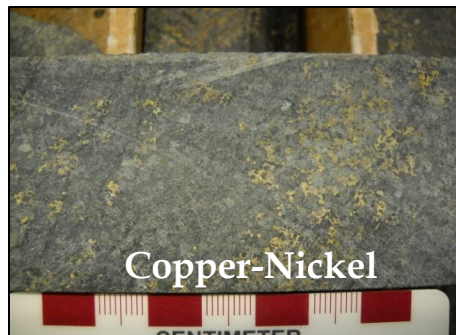
This information is CRITICAL to

- Predict
- Plan
- Protect

Minnesota's natural resources including:



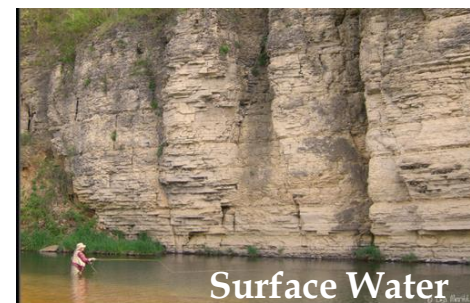
Minerals



Aggregate

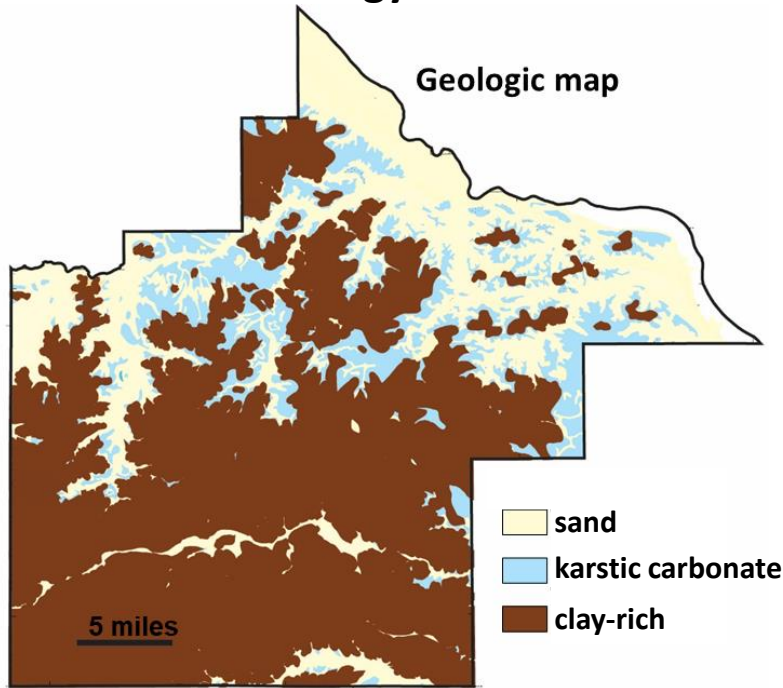


Water



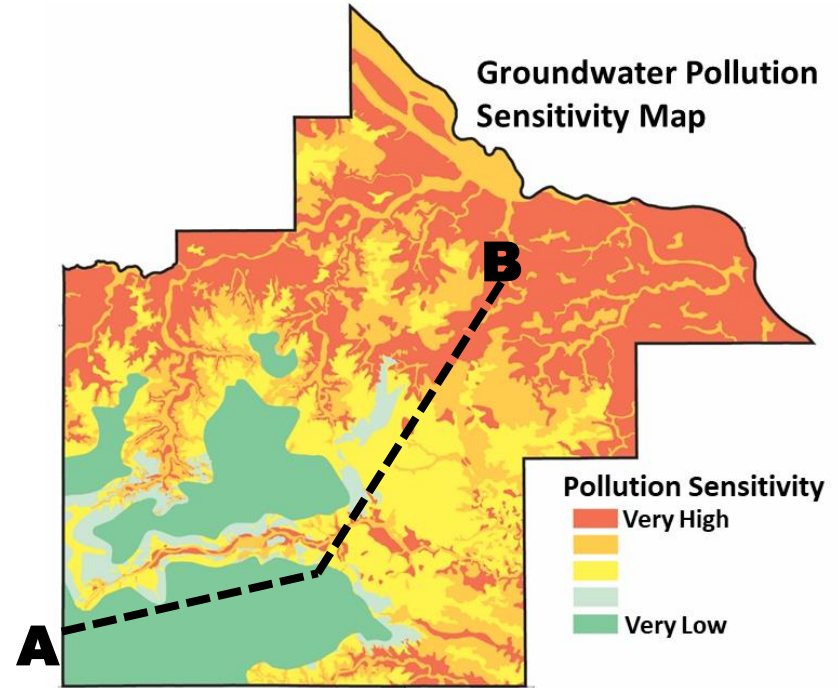
How do County Geologic Atlases help us protect groundwater?

- Part A: Geology

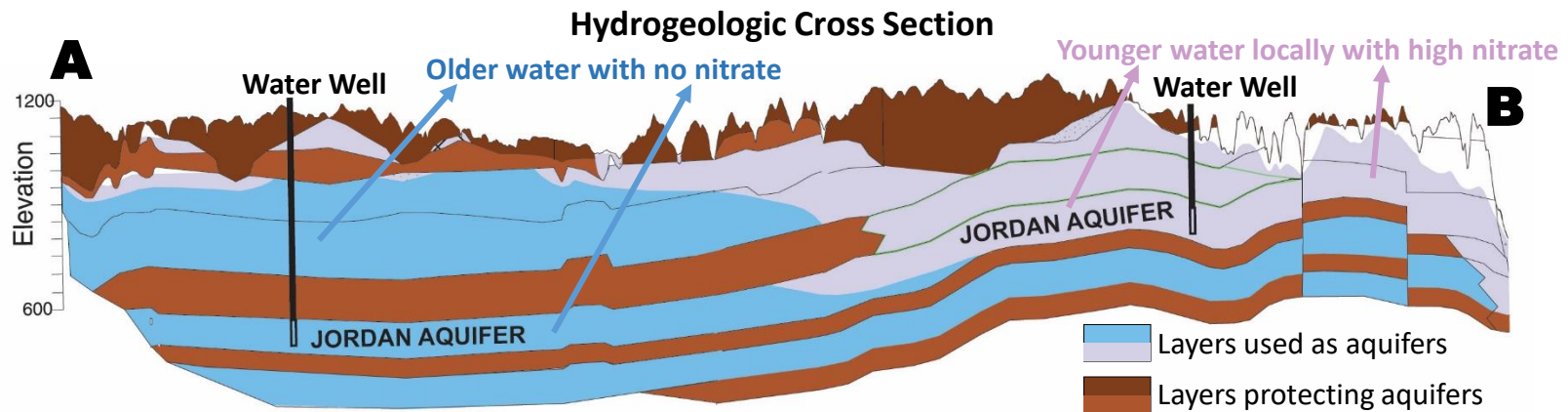


Modified from Hobbs and Setterholm, 1998

- Part B: Groundwater

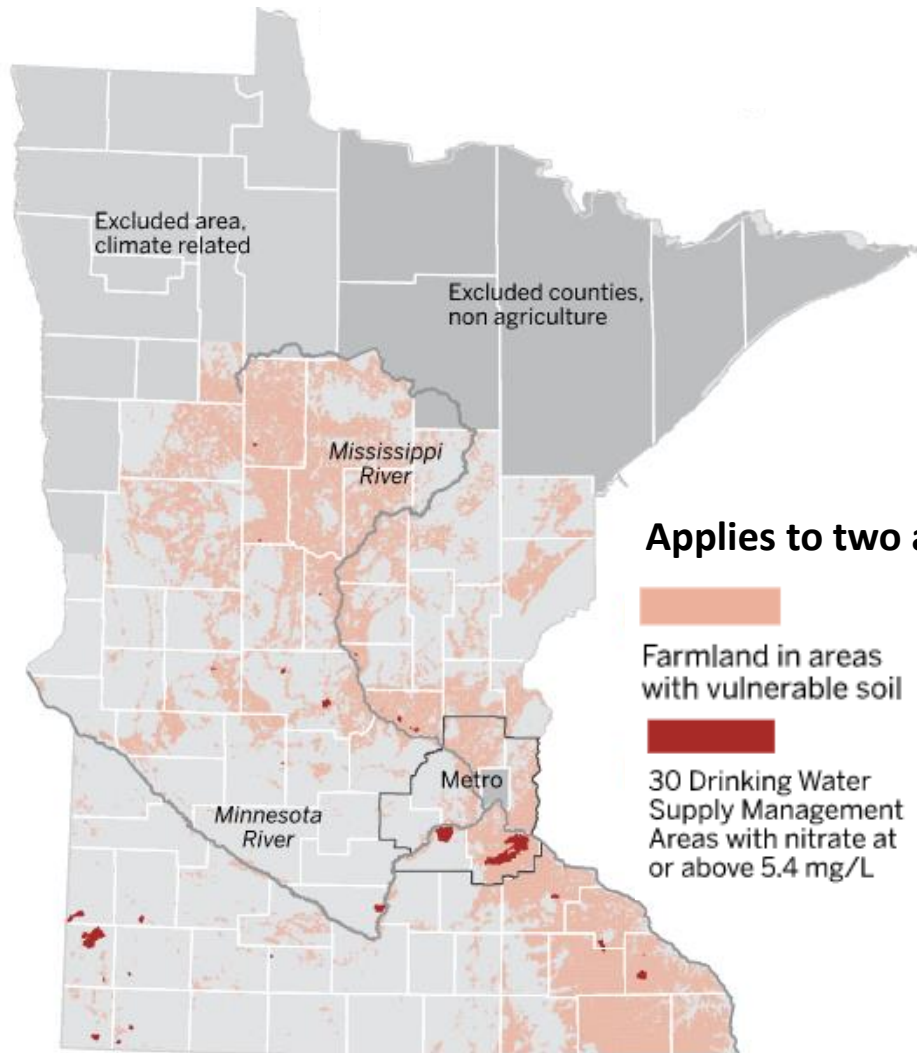


Modified from Berg, 2003




How do County Geologic Atlases help protect groundwater?

- Example: MGS/DNR mapping is a key part of Minnesota's recent Groundwater Protection Rule



Applies to two areas

 Farmland in areas with vulnerable soil

 30 Drinking Water Supply Management Areas with nitrate at or above 5.4 mg/L

- Limits use of nitrogen fertilizer in vulnerable areas
- “Vulnerable” based in part on CGA mapping

Source: Minnesota Department of Agriculture RAY GRUMNEY • Star Tribune



Historical Highlights of the CGA Program

- 1970's MGS transitions from hard rock dominated to soft rock and GW
- ~ 1980 Matt Walton and Bruce Olsen, MGS, primarily responsible for initiating CGAs
- First CGA was 1982, Scott County (traditional paper maps)
- Early CGAs required partial county funding



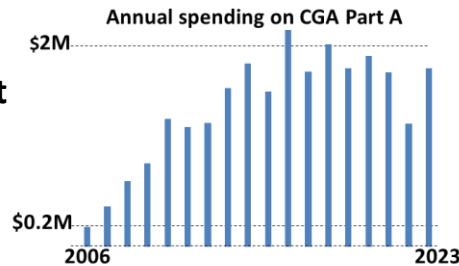
Matt Walton



Bruce Olsen

- Hydrogeologic content moved from MGS to DNR in 1990s (becoming much more comprehensive)

- Only ~1 CGA/yr up to early 2000's
- Greatly accelerated in mid 2000's under management of Dale Setterholm (MGS) and Jan Falteisek (DNR)



Dale Setterholm



Jan Falteisek



County Well Index



Bruce Bloomgren & Bruce Olsen



Tim Wahl

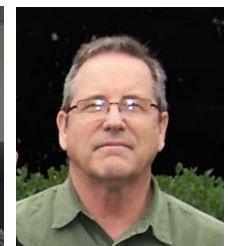


Brian Johnson et al.

3D mapping



Bob Tipping



Gary Meyer

Digital 3D GIS data

- Esp. late 90's onward
- MGS, DNR, MDH



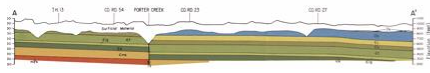
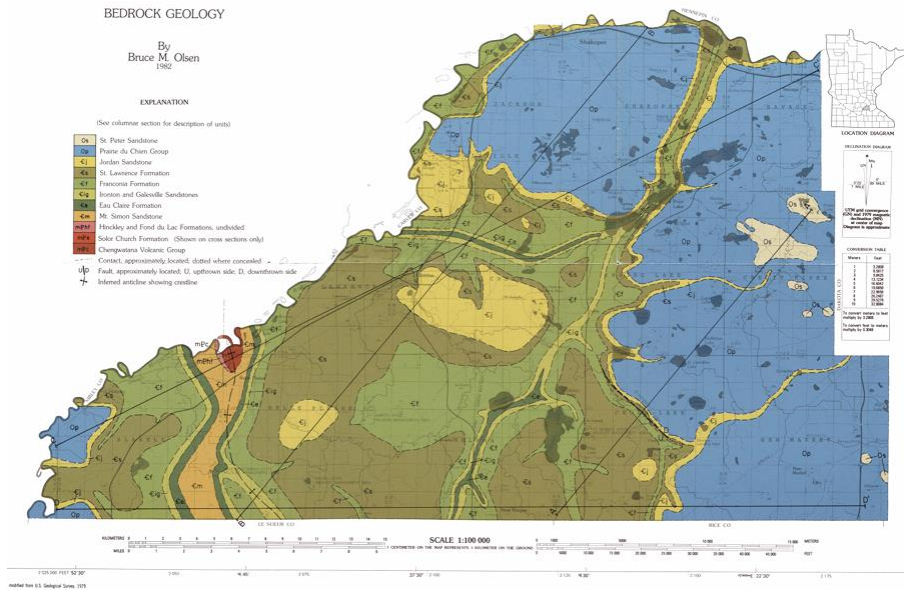
The First CGA: 1982, Scott County Geologic Atlas

- Plate 1 Modern Physiography and Data Base
- Plate 2 Surficial Geologic Map
- Plate 3, Surficial Geologic Cross Sections
- Plate 4, Bedrock Topography
- Plate 5, Bedrock Geology
- Plate 6, Hydrogeology

- All paper
- No electronic databases
- Subsurface represented by 2D cross sections
- Hydrogeology included only potentiometric and transmissivity maps (v. limited water chemistry)

Bedrock Geology

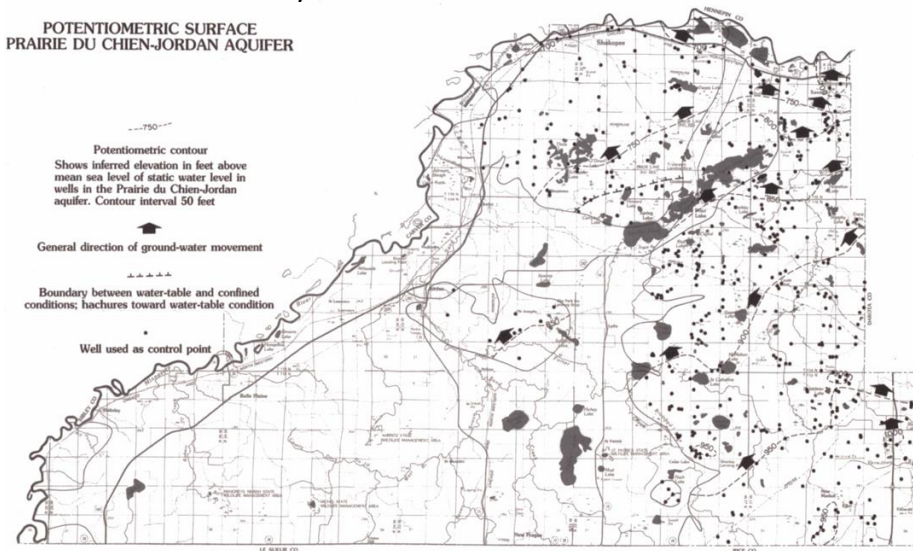
Olsen, 1982



Hydrogeology

Kanivetsky and Palen 1982

POTENTIOMETRIC SURFACE PRAIRIE DU CHIEN-JORDAN AQUIFER

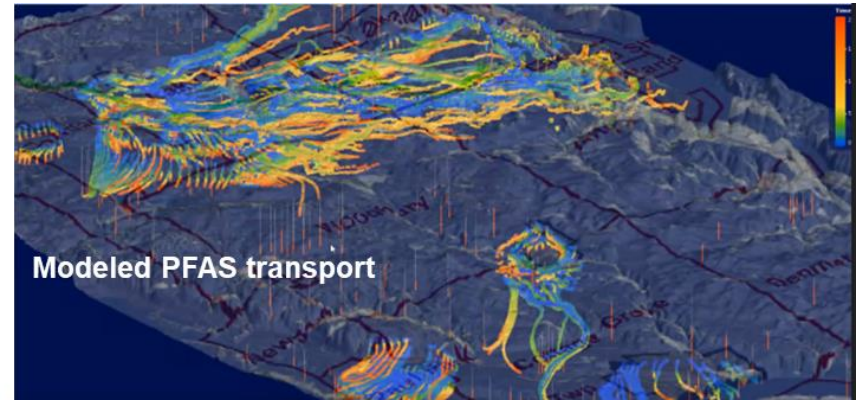
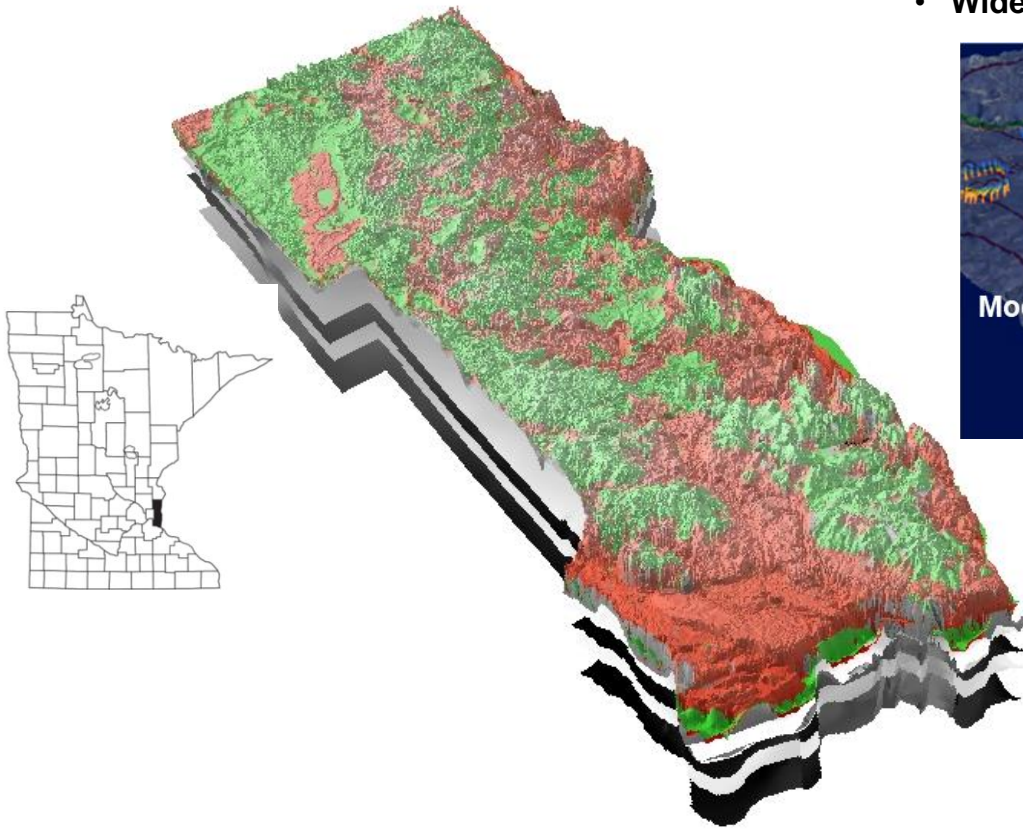


From paper maps to digital 2D/3D GIS data

2016, Washington County Geologic Atlas

And there is much more that goes with the maps

- Textural data
- Associated hydro research, e.g. K values
- Part B potentiometric and water chemistry data
- Widely used for GW models

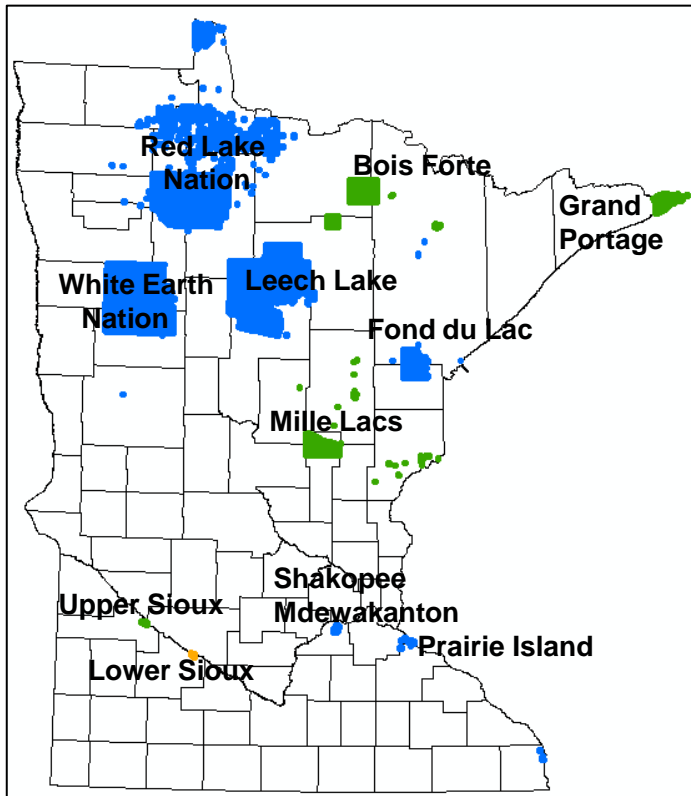


- Sand & Gravel
- Diamicton (Till)

Another Advance: Honoring rights of Tribal Nations

MGS maps will include no geologic information across tribal land without permission

Status of permission



- Grand Portage Band of Lake Superior Chippewa (permission denied)
- Bois Forte Band of Chippewa (permission denied)
- Fond du Lac Band of Lake Superior Chippewa (permission granted)
- Prairie Island Indian Community (permission granted)
- Red Lake Band of Chippewa (permission granted)
- Shakopee Mdewakanton Sioux Community (permission granted)
- Mille Lacs Band of Ojibwe (permission denied)
- Upper Sioux Community (permission denied)
- White Earth Nation (permission granted)
- Leech Lake Band of Ojibwe (permission granted)
- Lower Sioux Indian Community– no active mapping

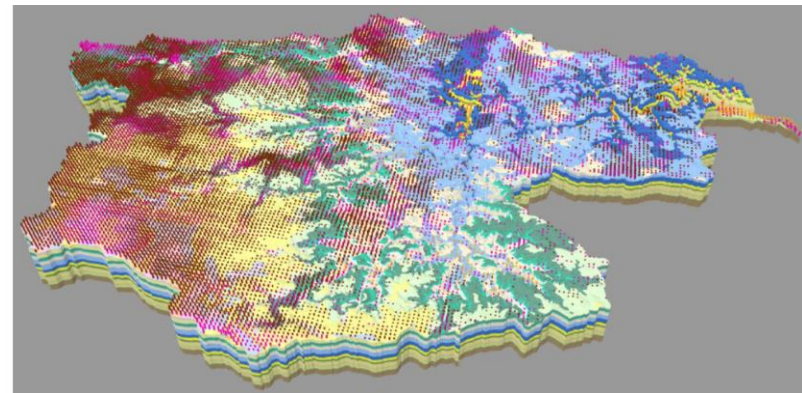
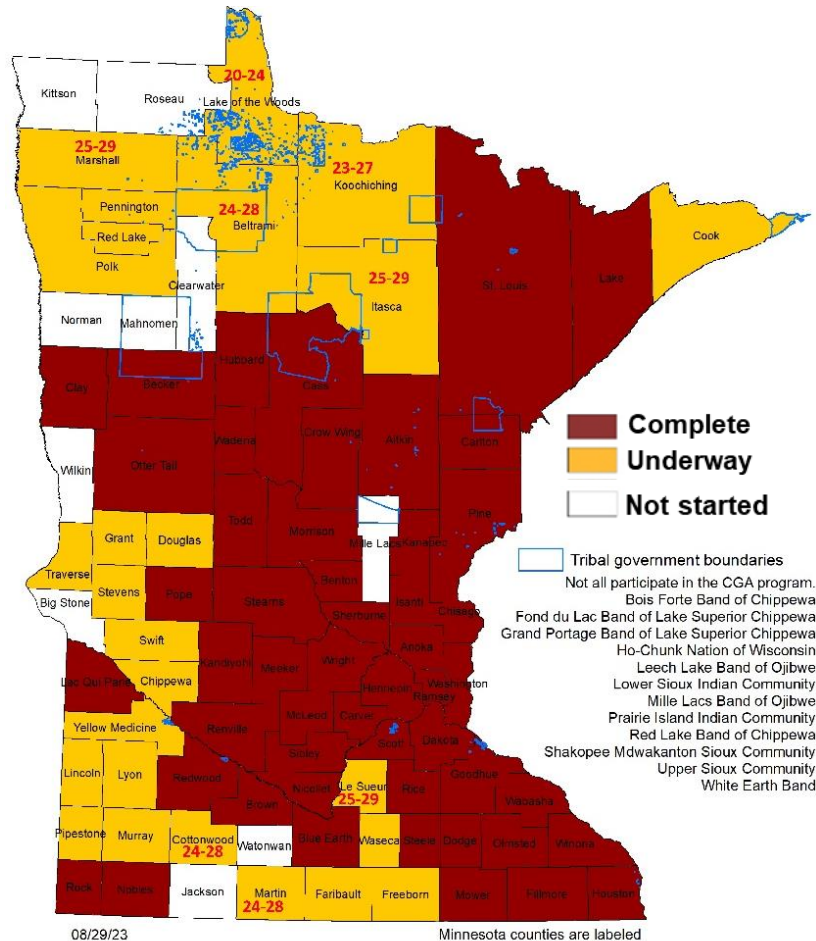


Where are we going with the CGA Part A's.....?

County Geologic Atlas Program: Status

- 51 completed
- 26 currently underway
- Only 10 counties not yet in queue

- Complete all counties (~10 years)
- Updated CGAs for some counties
- Improved 3D maps (Quat deposits difficult!)
- Seamless 3D watershed-scale geologic maps (with integrated water chemistry)



- More accessible and user friendly (e.g. mobile apps, “story maps”, YouTube tutorials)
- Suggestions?

