Michigan Geological Survey

Aggregate Mapping Grant - Committee Presentation

March 2024 Status Report

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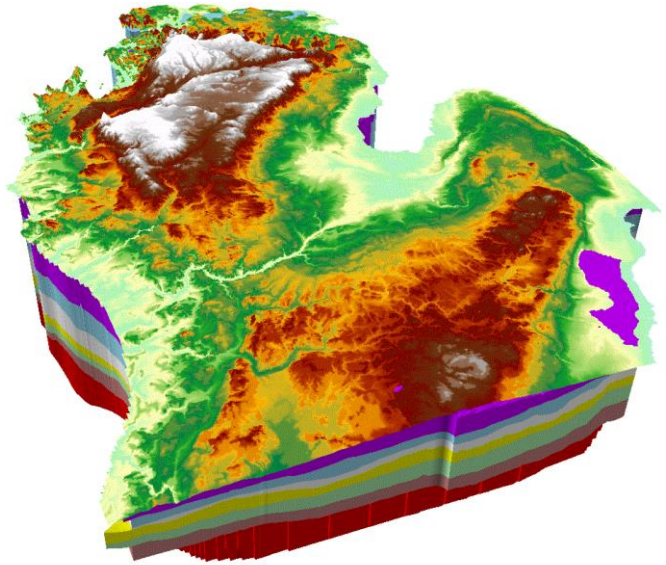
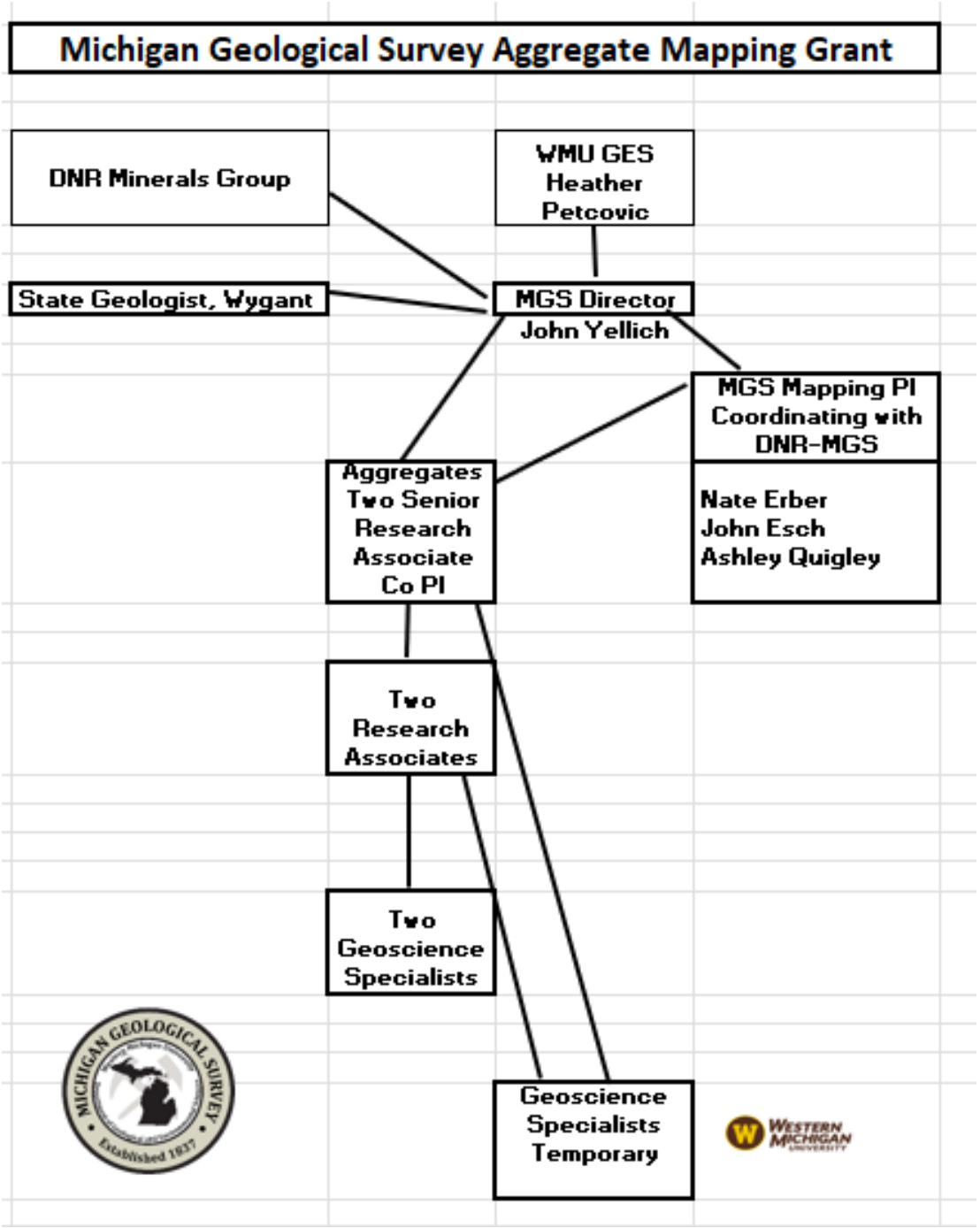


Example of presenting geologic data in a format for all to understand

Status of Agreement, data, hiring

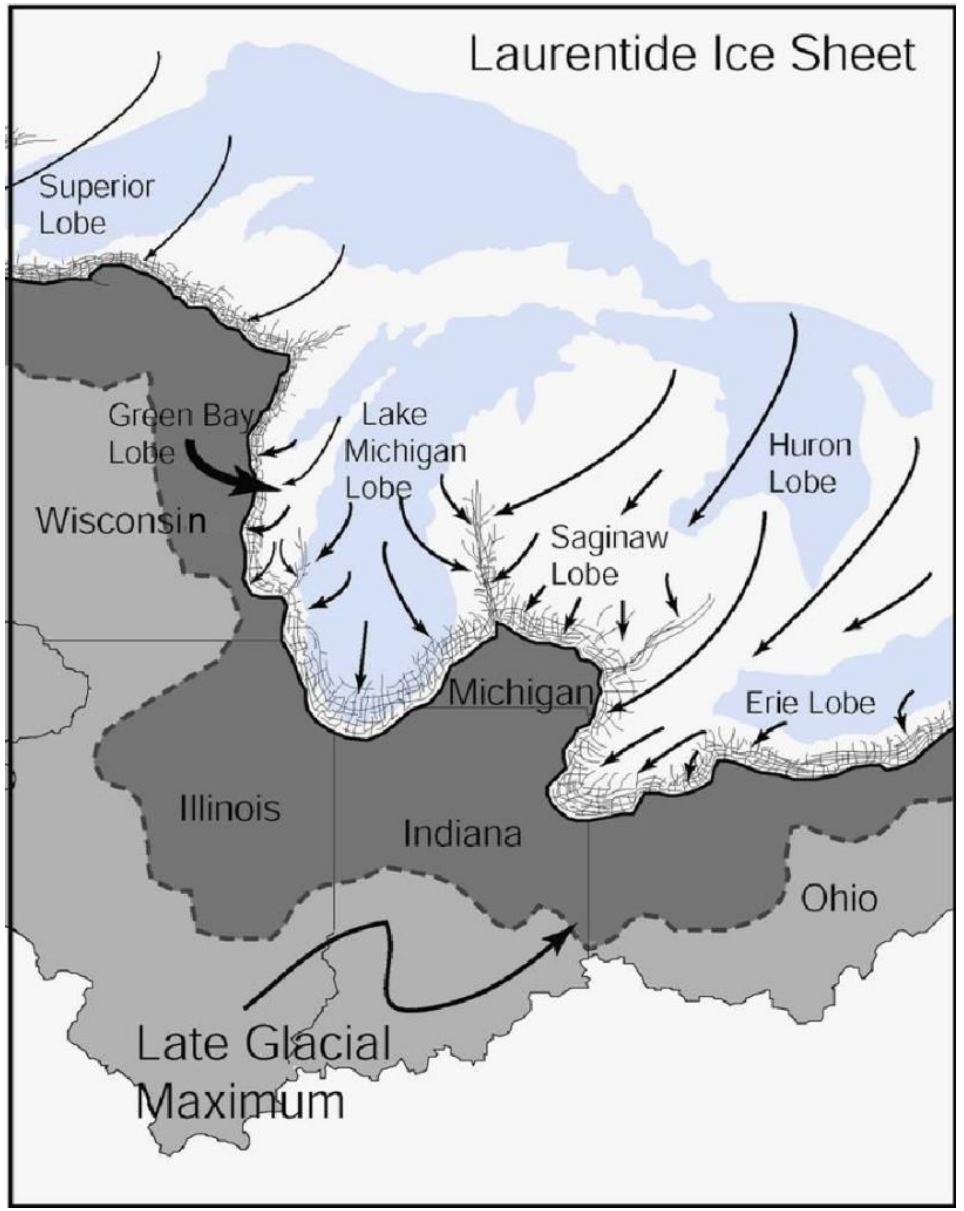
- MGS and DNR agreement signed and active, effective November 13, having update meetings ~ every 5-6 weeks.
- MGS positions posted signing Aggregate grant by DNR.
  - MGS proposes five to six FTE positions plus 3-5 students
  - MGS organization chart
- MGS has reviewed and identified current databases.
- MGS knows that some databases are local with counties or regions.
- MGS goal, compile a summary of databases and make open file.
  - Objective - prepare county maps with data in formats to be used by all.
  - **Aggregate maps are the precursor to MGS county 3D mapping products.**
  - Have public meetings to present what is known and what is needed for Michigan to make decisions.
- MGS will seek data and request priority areas from all Michigan Departments on at least an annual basis.



MGS staff summary to support data compilation and mapping statewide

Michigan glacial geology is complicated discontinuous lithologic units

- Multiple stages of ice advances and retreats having crossed Michigan (200,000 to ~10,000 years ago).
- Glacial movement has resulted in the deposition of various glacial deposits and features and they include aggregates and “water bearing sand zones”, and
- Glacial moraines, which have the most important term, glacial till in many areas, it is not in the only database, Wellogic terminology table. Till - no economic aquifers or aggregates documented.



So what is the answer to scientific data?

MICHIGAN GEOLOGICAL SURVEY
SUMMARY OF COUNTY MAPPING PRIORITIES
10-2023 PRESENTING THE % OF COMPLETED GEOLOGIC MAPPING PRODUCTS

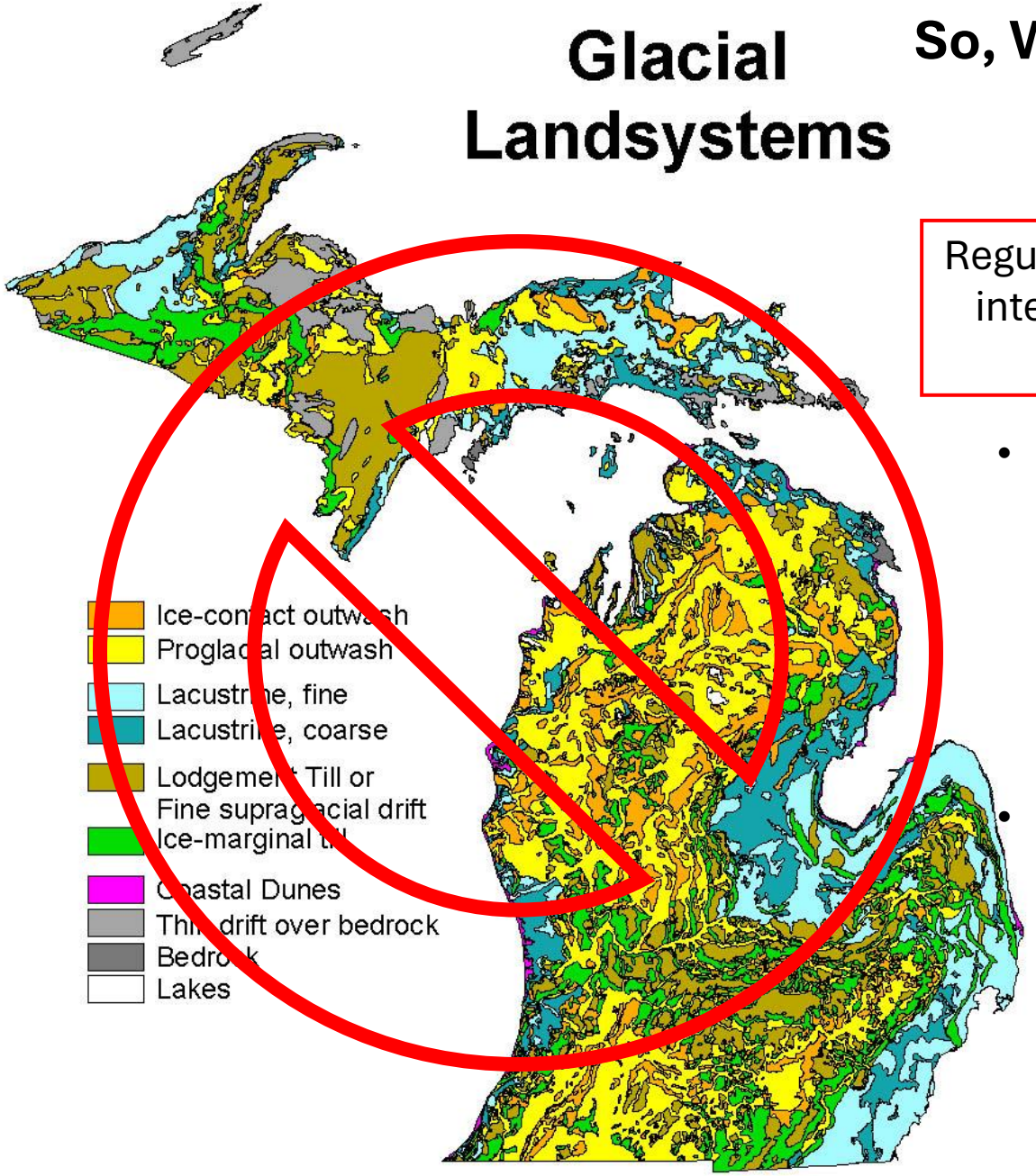
	Proposed Priority Counties (Mapping data needed)	EGLE County maps WRD Water Use Priority list	Estimate % Completed Maps	EGLE County Maps MPART PFAS Areas	Estimate % Completed Maps	MI Aggre Assoc MAA Aggregate Resources SW	MI Aggre Assoc MAA Aggregate Resources SE
1	Kalamazoo	Branch	80%	Kalamazoo	99%	**Kent**	Lapeer
2	Ottawa	Cass	100%	Muskegon	<10	Ottawa	Shiawassee
3	Allegan	St. Joseph	100%	Oakland	<10	Montcalm	Ingam
4	**Montcalm**	Calhoun	100%	**Kent**	90%	Ionia	Livingston
5	**Muskegon**	Van Buren	40%	Montcalm	<10	Allegan	Washtenaw
6	Cass	Ottawa	100%	Ottawa	100%	Barry	Oakland
7	**Kent**	Berrien	100%	Allegan	100%	Berrien	Macomb
8	**Oakland**	Allegan	100%	Calhoun	100%	Cass	Wayne
9	**Jackson**	Montcalm	<10	Ionia	<10	Kalamazoo	Jackson
10	**Branch**	Hillsdale	<10	Monroe	<10	Van Buren	Branch
11	**Washtenaw**	Jackson	<50	Livingston	60%		Hillsdale
12	St. Joseph	Gratiot	<10	Lenawee	<10		Lenawee
13	**Hillsdale**	Isabella	<10	Marquette	50%		Monroe
14	**Newaygo**			Washtenaw	<10		
15	**Livingston**			Barry	100%		
16	**Monroe**			Berrien	100%		
17	**Ionia**			Charlevoix	<10		
18	**Lenawee**			Delta	<20		
19	**Marquette**			Jackson	<50		
20	**Charlevois**			Newaygo	<10		
21	**Delta**			Branch	25%		
22	**Gratiot**			Lake	5%		
23	**Isabella**			Manistee	5%		
24	**Van Buren**	**Top Priority**		Menominee	5%		
25	**Menominee**	**Second Priority**					
26		**Mapping in Progress**					
		Surficial Geology % Done		MPART 46 COUNTIES			

NOTE: This is a specific list of priority counties requiring validated geologic mapping. These two lists were provided in 2018, 2019 & 2022 by the EGLE departments of MPART and WRD, respectively. MGS has included a statement of map % completion for each County. This list will be modified as needed after discussions and agreement with EGLE and DNR Departments and (10-2023) Michigan Aggregate Association. The United Tribes of Michigan has endorsed mapping of water resources where needed in the State.

- **Prioritization by EGLE, EGLE – MPART and supported by United Tribes of Michigan, Agggregate Association, others (Priorities provided by 10-23).**
- **What counties are most important? 25 counties now identified**
- **83 counties, with mapping completed in seven Counties.**

MGS reaches out to EGLE, DNR, MDARD, MDOT, Aggregate industry, public, all

Glacial Landsystems



So, Where do we begin?

Regulatory, Consulting and Mi WWAT interpretations and decisions are made using this map.

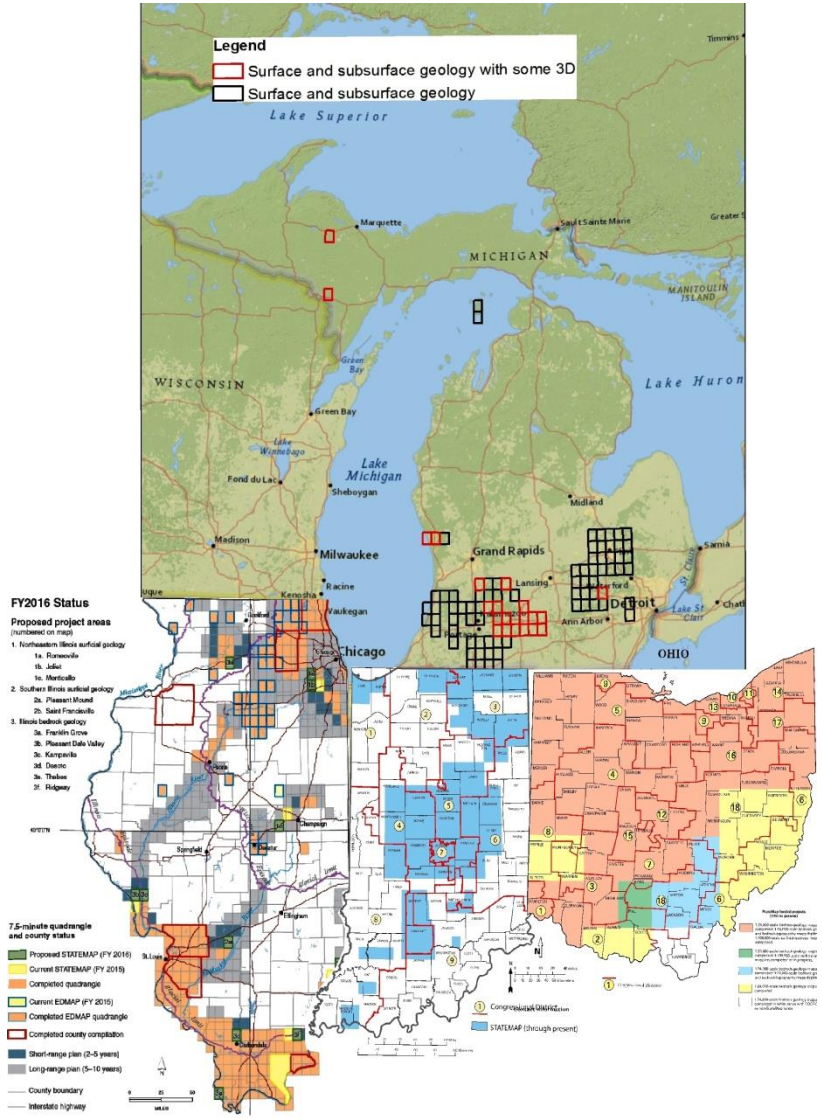
- **This surficial geology map is based on 1915 (Leverett & Taylor) data, with minimal changes in 1955 (Helen Martin), and 1982 (Farrand & Bell). This is ONLY a surficial geology map.**
- **No subsurface validation.**

The role of the Survey is to provide updated mapping in priority areas.

Mapping done to date

Mapping-Michigan versus adjoining states!

USGS Federal matching dollars, last 25 years



Michigan, no dedicated funds for 25 years, until 2014, $44,000 DEQ/OGL/DNR
< 10% mapped. $1.751 M = $72.9 K/yr

Illinois, dedicated funds - 3D mapping, high impact areas ~ 30% mapped. ($4.987M=$207.8 K/yr

Indiana, dedicated funds - 3D mapping, high impact ~ 40% mapped. $4.276 M=$178.2 K/yr

Ohio, dedicated funds geo-hazards plus Fed $ ~ 80% mapped $3.069 M=$127.9 K/yr

Wisconsin, dedicated funds, $3.762 M = $156.7k/yr

Minnesota, dedicated funds, $2.834 M = $118.3k/yr

2023 - Mapping is now priority driven with MGS annual funding

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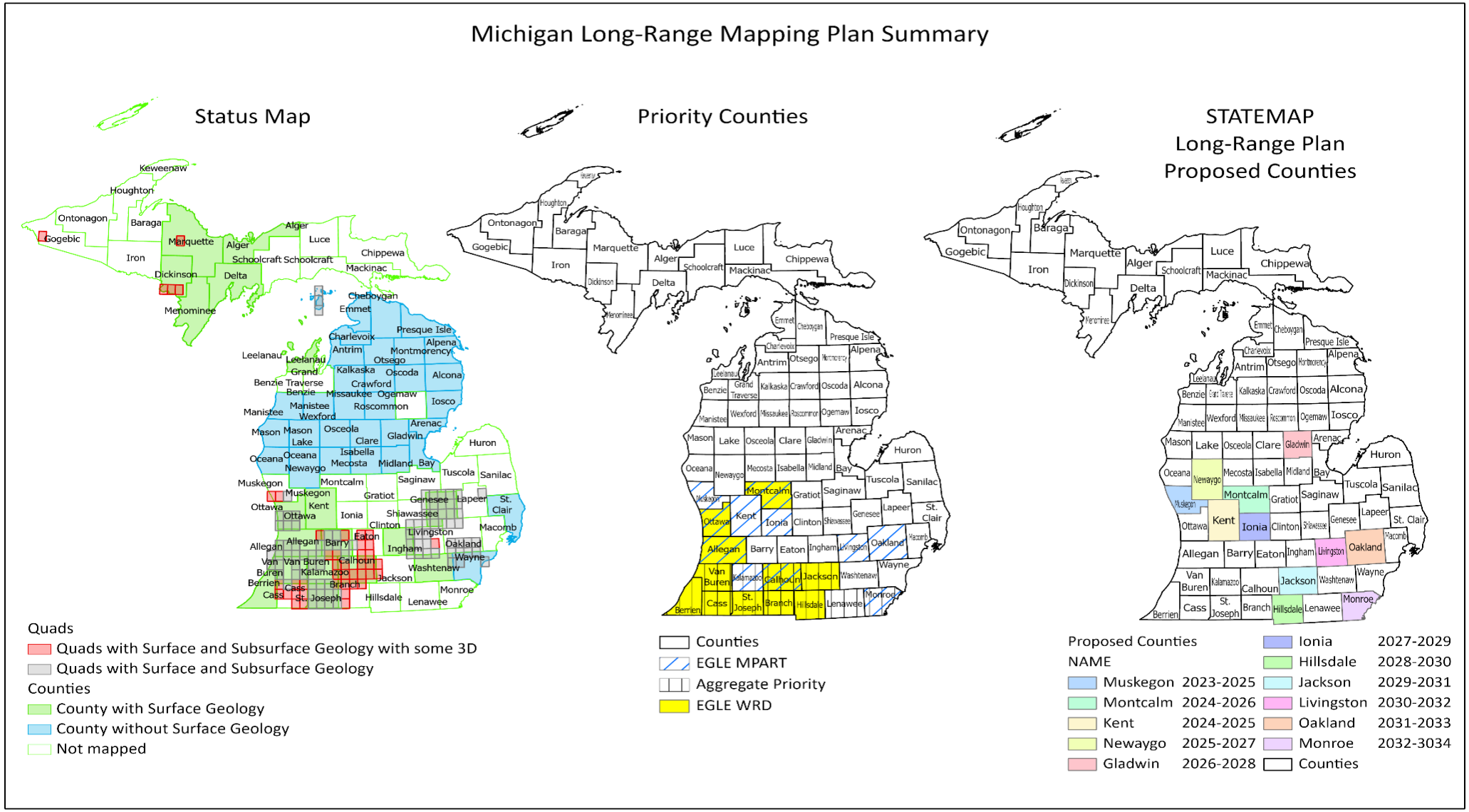


MGS long range plan submitted to USGS for matching 3D mapping plan

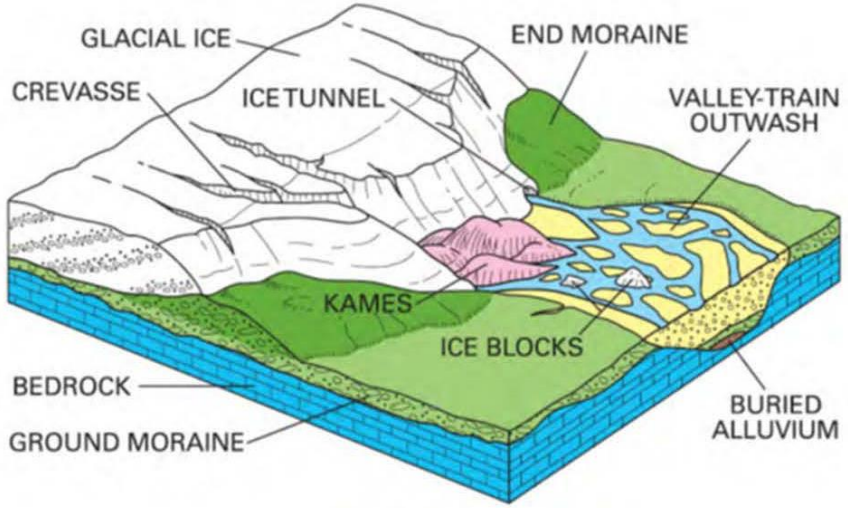
Outreach once aggregate data compilation begins

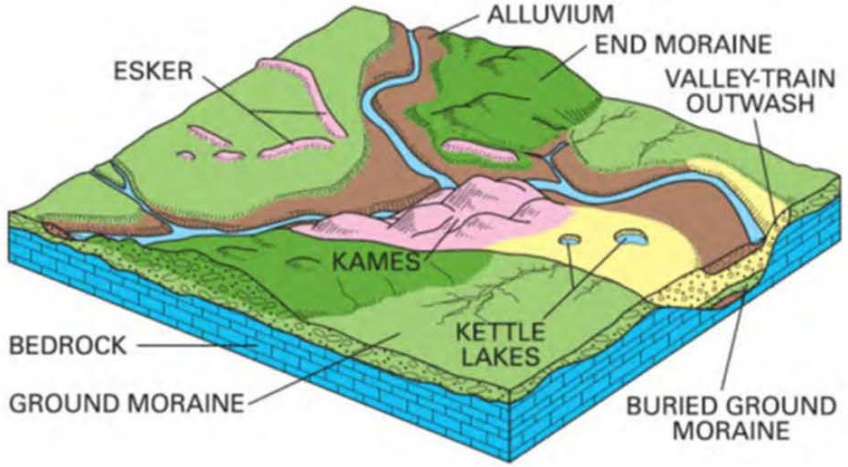
- Verify data availability with all contacts noted below.
- Public meetings to review Program goals & objectives.
- Compile surface aggregate geological maps identifying their location.
- Technical outreach, MDOT, other State agencies, Aggregate Association, mining companies, road builders, geologists, engineers.
- Public meetings with Township, County, Regional associations noting aggregate uses and needs for areas.
- Explain the process, priority areas, data, map production open file.
- Products will support, groundwater recharge, vulnerability.

Common Glacial Features-Contain Aggregates

- Moraines
- Kames
- Outwash –Fans and Valleys
- Eskers
- Drumlins
- Kettle Lakes
- Tunnel Channels

ODNR, 2020, The Ice Age In Ohio





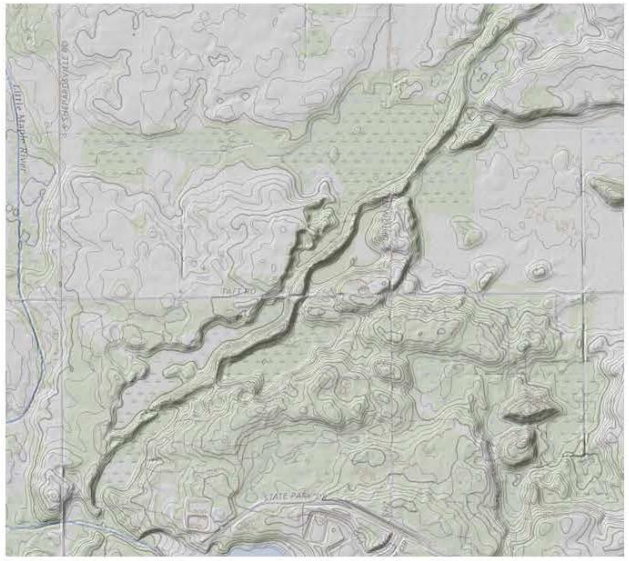
Aggregate Inventory Main Datasets

- Inventories of past and current aggregate pits
  - Several inventories by the Michigan Geological Survey, MDOT, DNR and USGS
- LiDAR elevation data
- Wellogic Water Well Log Data
- USDA Soil Survey - SSURGO Digital Soils Data
- Previous geologic maps
- Literature
- Aerial Photos - many types and vintages
- Environmental borings/monitoring well logs and geotechnical borings
- Field work- boots on the ground, traditional surficial geological mapping methods
- Information and data from stakeholder groups: MDOT, other state agencies, County road commissions, consultants, commissions, Michigan Aggregates Association, aggregate mining companies, Michigan Road Builders Association, MITA, the geological and engineering community

LiDAR presentation of landforms

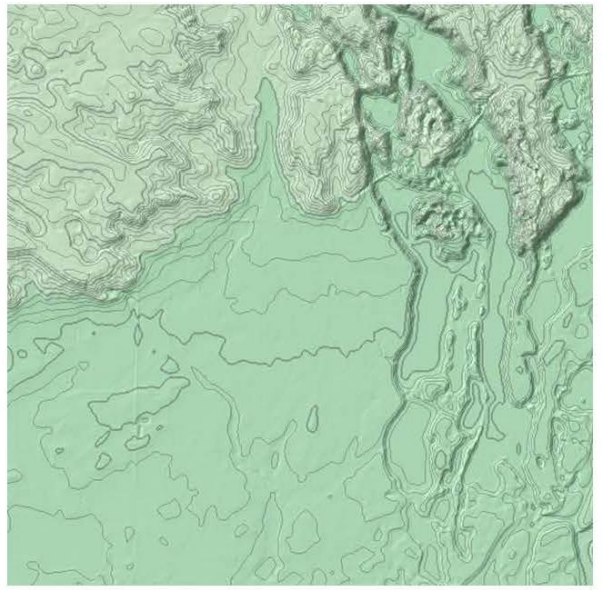
Glacial Landforms that can be Aggregate Sources

Inland Sand Dunes and Sand Sheets



Esker

Pitted Outwash Plain



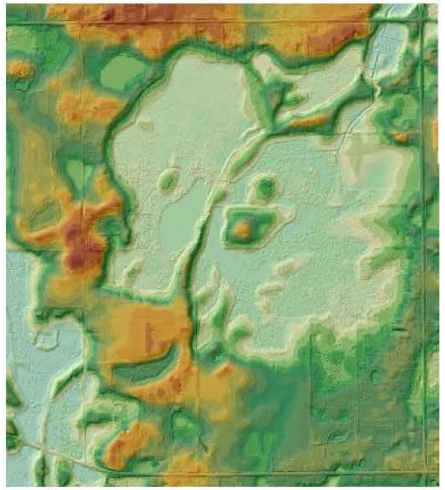
Outwash Fan

LiDAR examples for surface features

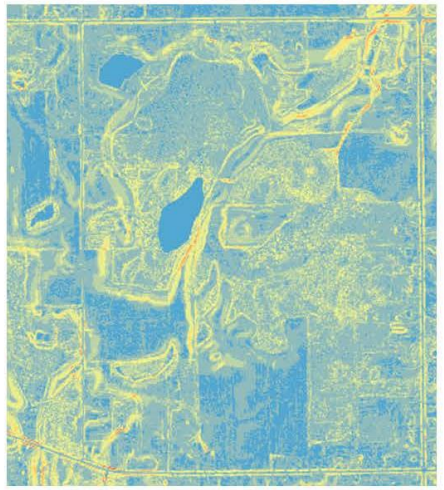
Typical Topographic Map

LiDAR Hillshade

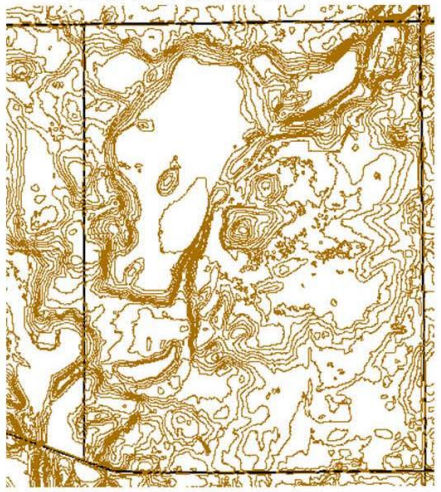
LiDAR Shaded Relief



LiDAR Slope

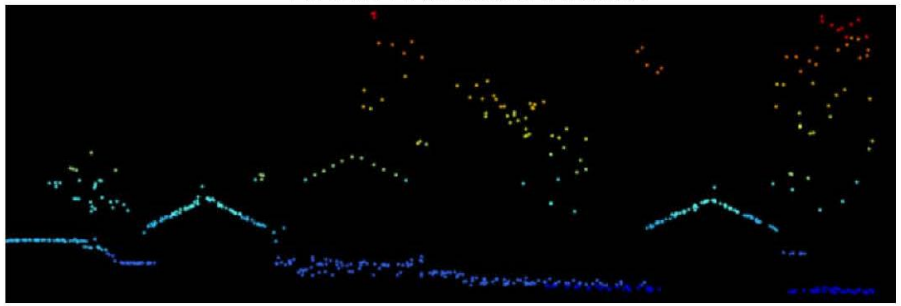


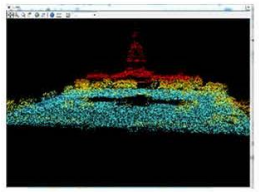
LiDAR Contours



LiDAR Intensity

LiDAR Elevation Profile





LIDAR

LiDAR has revolutionized how MGS staff and others view Michigan's topography, hydrology, geology, and land use.

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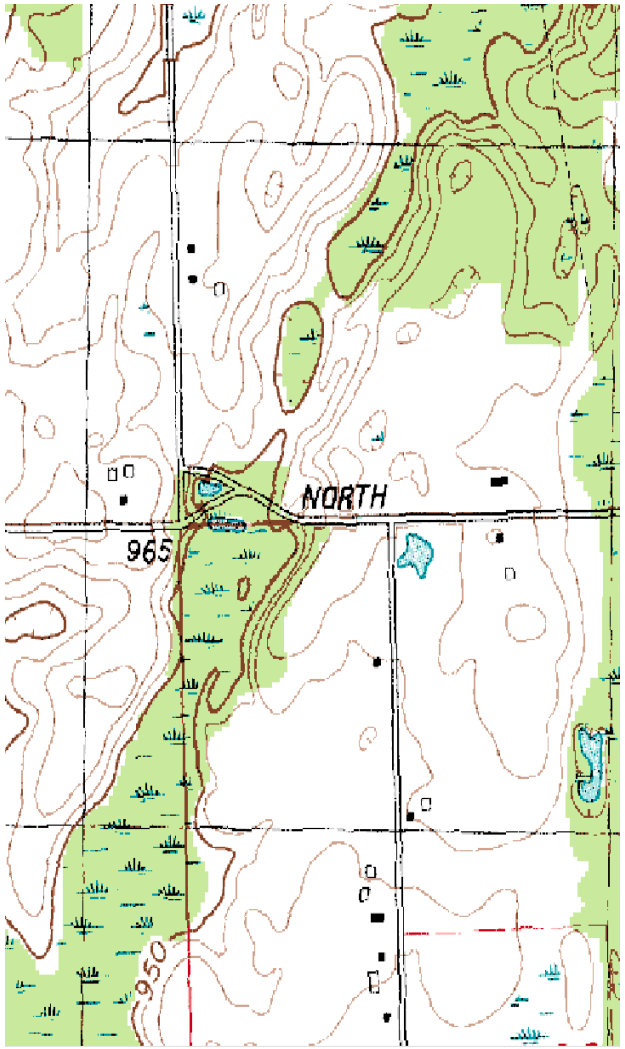
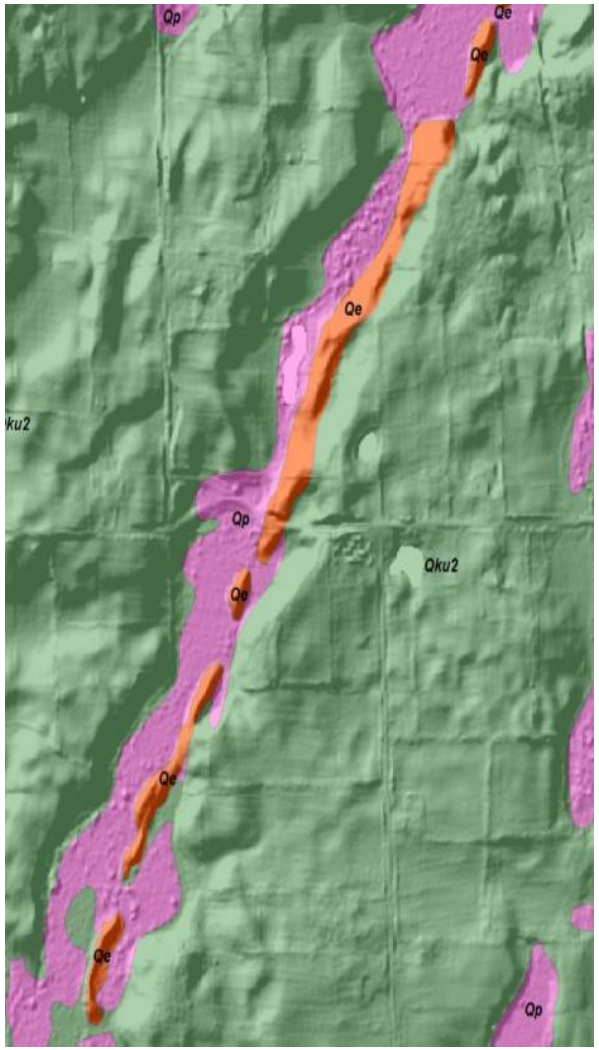
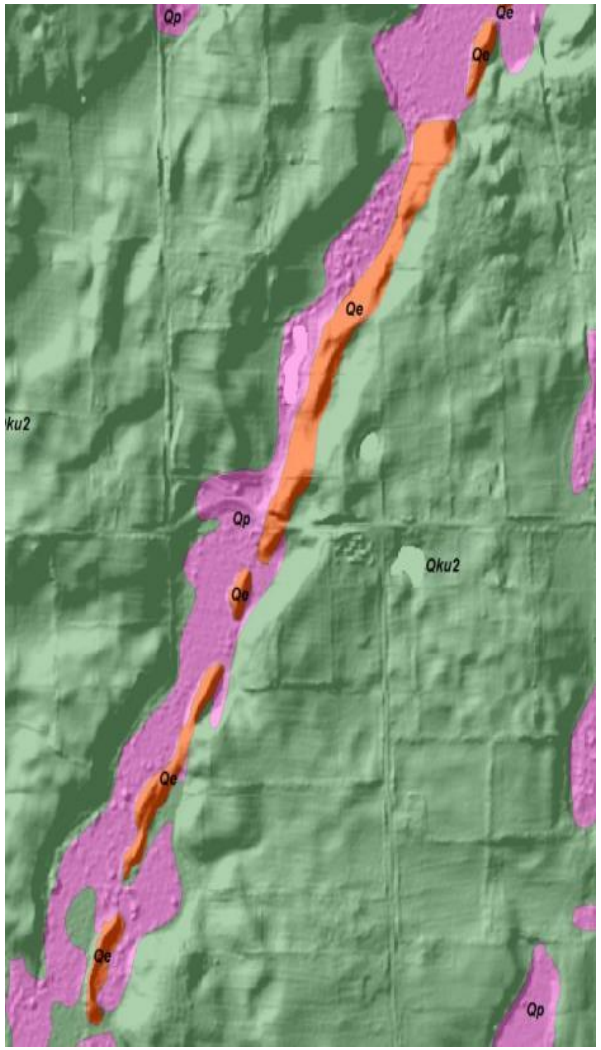


Northwest Albion, Michigan, 7.5 Minute Topographic Map, USGS 1980. 10 Foot Contour Interval



Northwest Albion Area, Calhoun County LIDAR Shaded Relief Map, clearly indicating esker trending SW-NE across map



Northwest Albion Surficial Geology Map overlying LIDAR Hillshade with interpreted esker

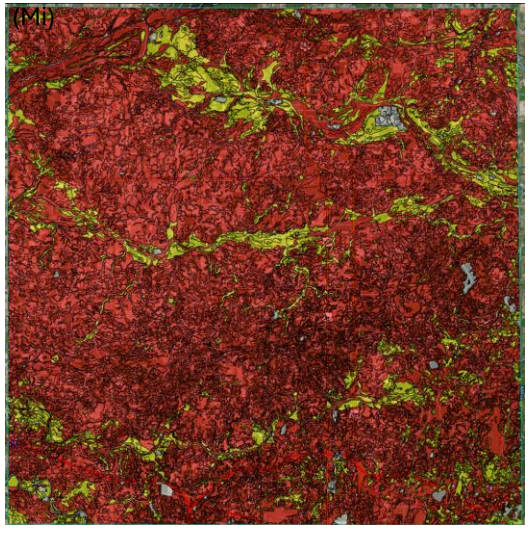
Esch, J. M., 2013 ,Surficial Geology of the Northwest Albion 7.5 Minute Quadrangle, Calhoun County, Michigan, Michigan Geological Survey - Western Michigan University, Surficial Geologic Map Series SGM-13-02

Published this map, open file

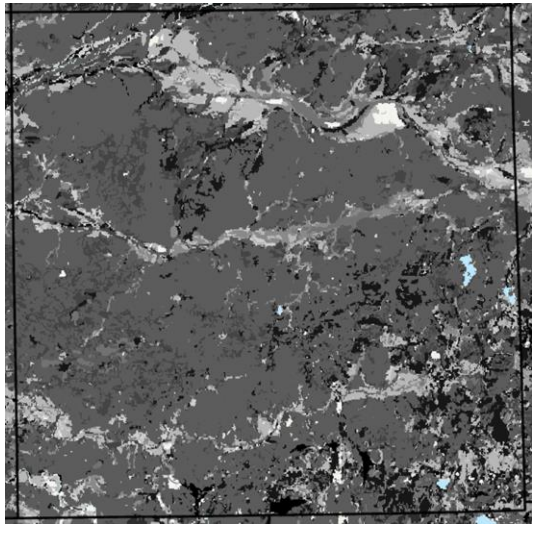
Soil Survey Data is a Critical Dataset for the Aggregate Inventory

Former County Hard Copy Soil Surveys
–Now Digital & in GIS Format - SSURGO

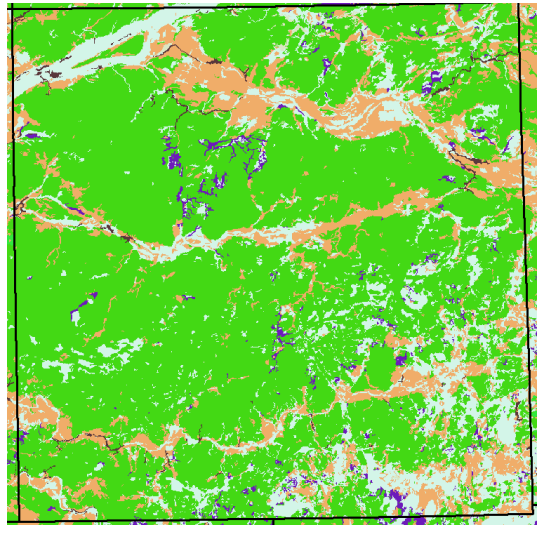
Construction Materials> Gravel Source (Mi)



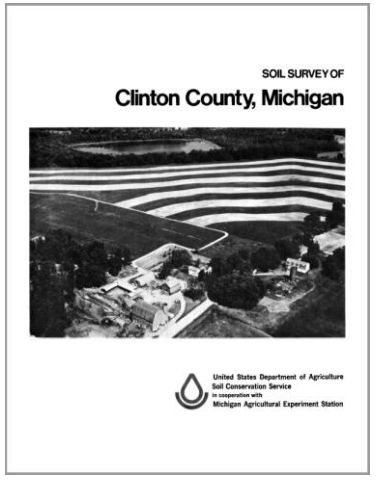
Gravel Source Potential 3-6 feet Depth



Soil Parent Material



1978



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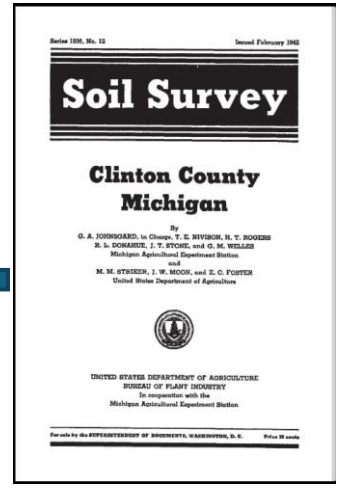
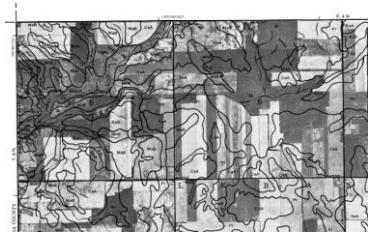
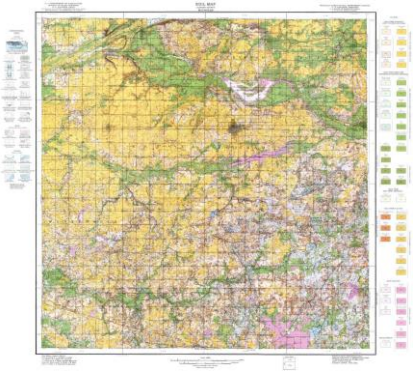
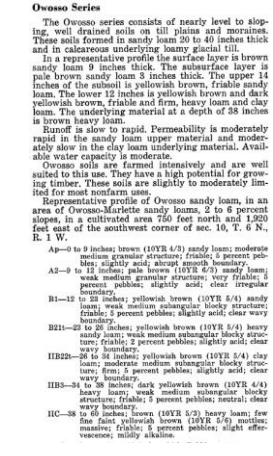


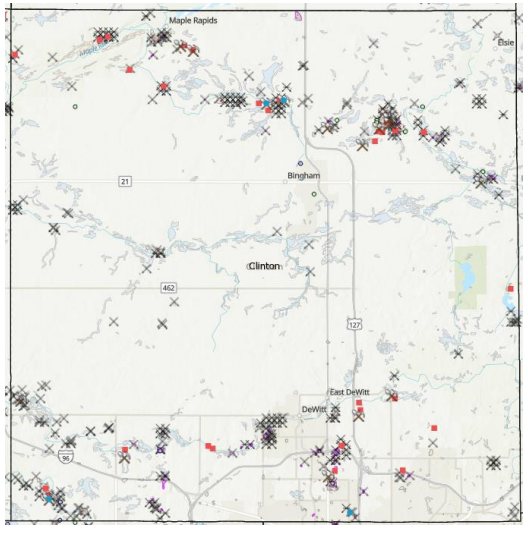




Clinton County Soil Survey 1942



Clinton County Initial Inventory of gravel pits over gravelly textured soils



This doesn't include surface glacial features not recognized by SSURGO:

- eskers and kames – common source of gravel
- Ice-walled lake plains – common on clay rich morainal uplands-often not gravel sources

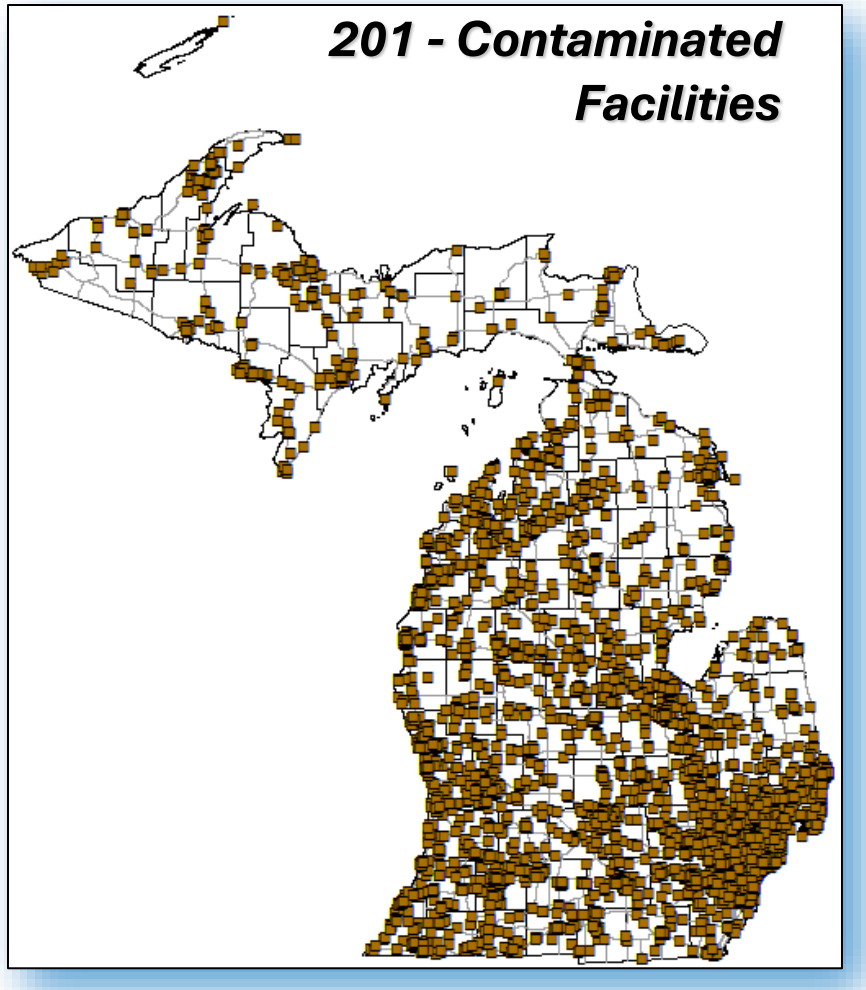
Note how most of the existing gravel pits in Clinton County are along broadly E>W trends of the former glacial sluiceways of the Looking Glass, Stony Grand and Maple River Valleys, which will be field checked.

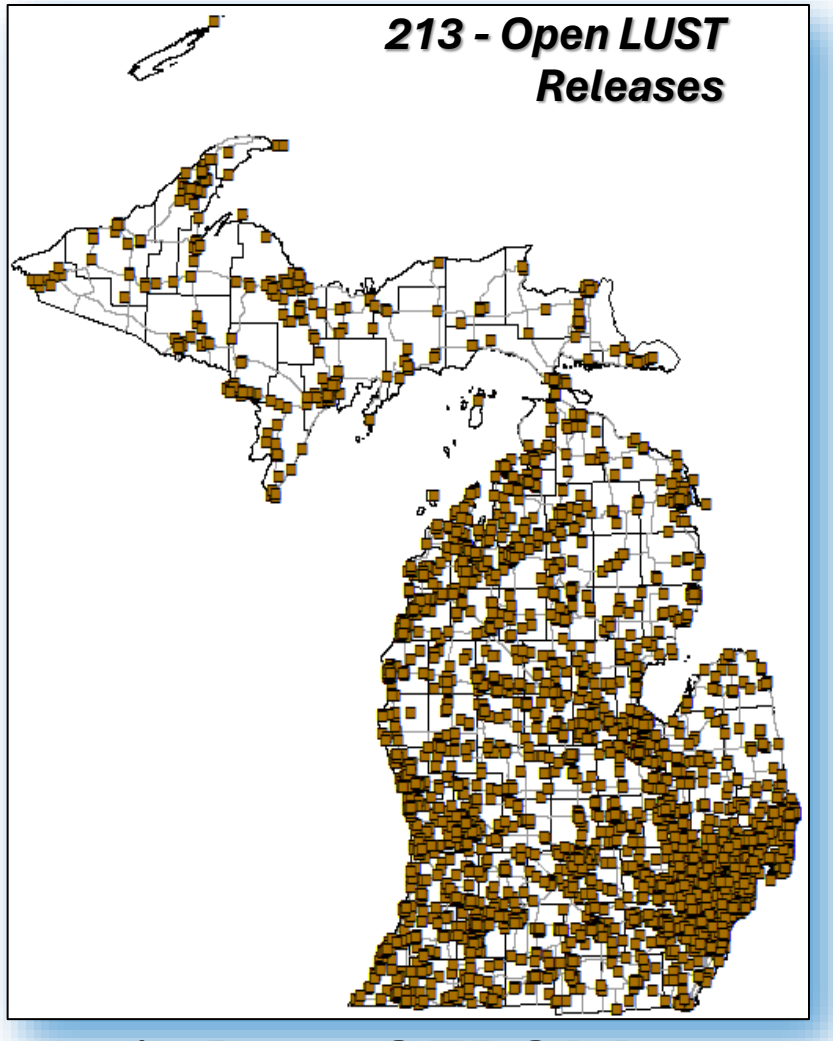
Let's review the history of Data!

EGLE -Estimated 30,000 sites

Hazardous Substances

Released to the Environment





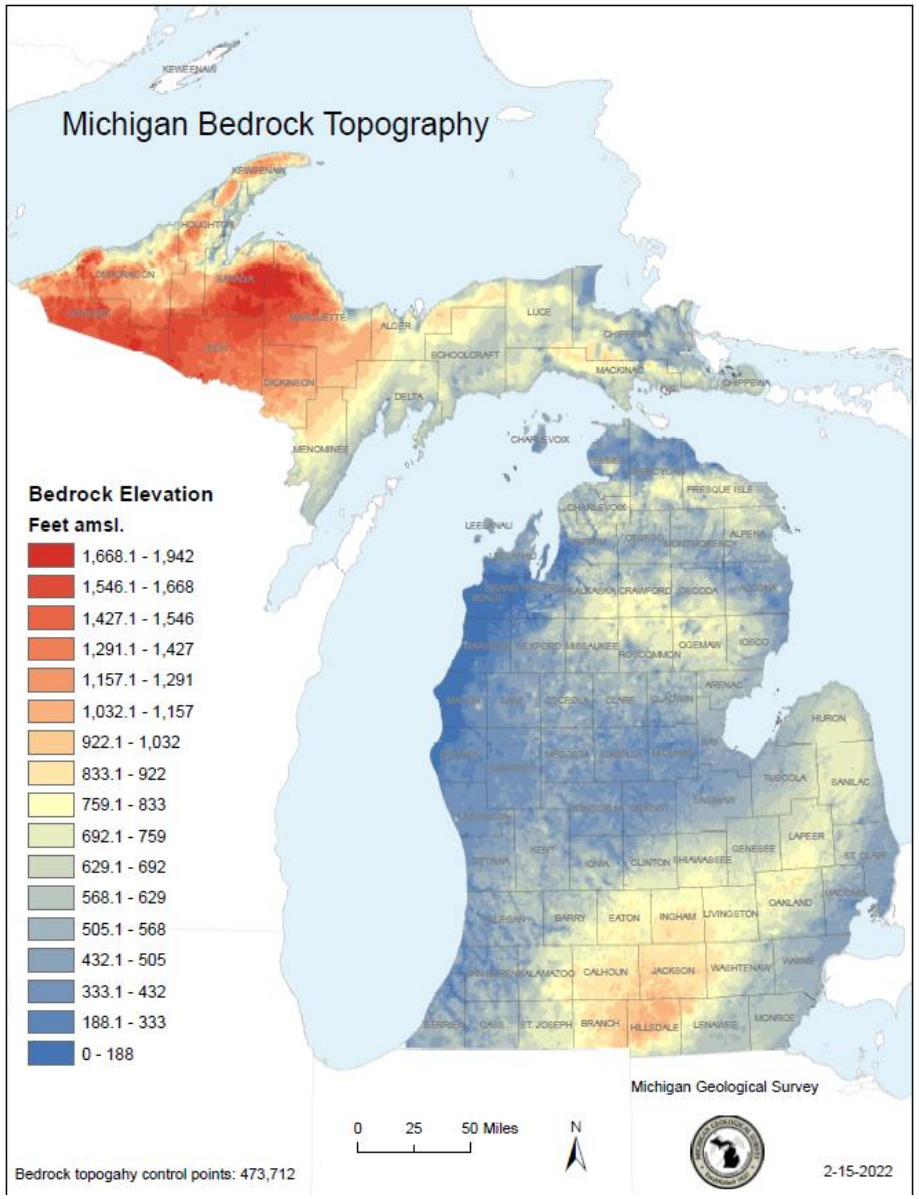
1980's Pre – CERCLA

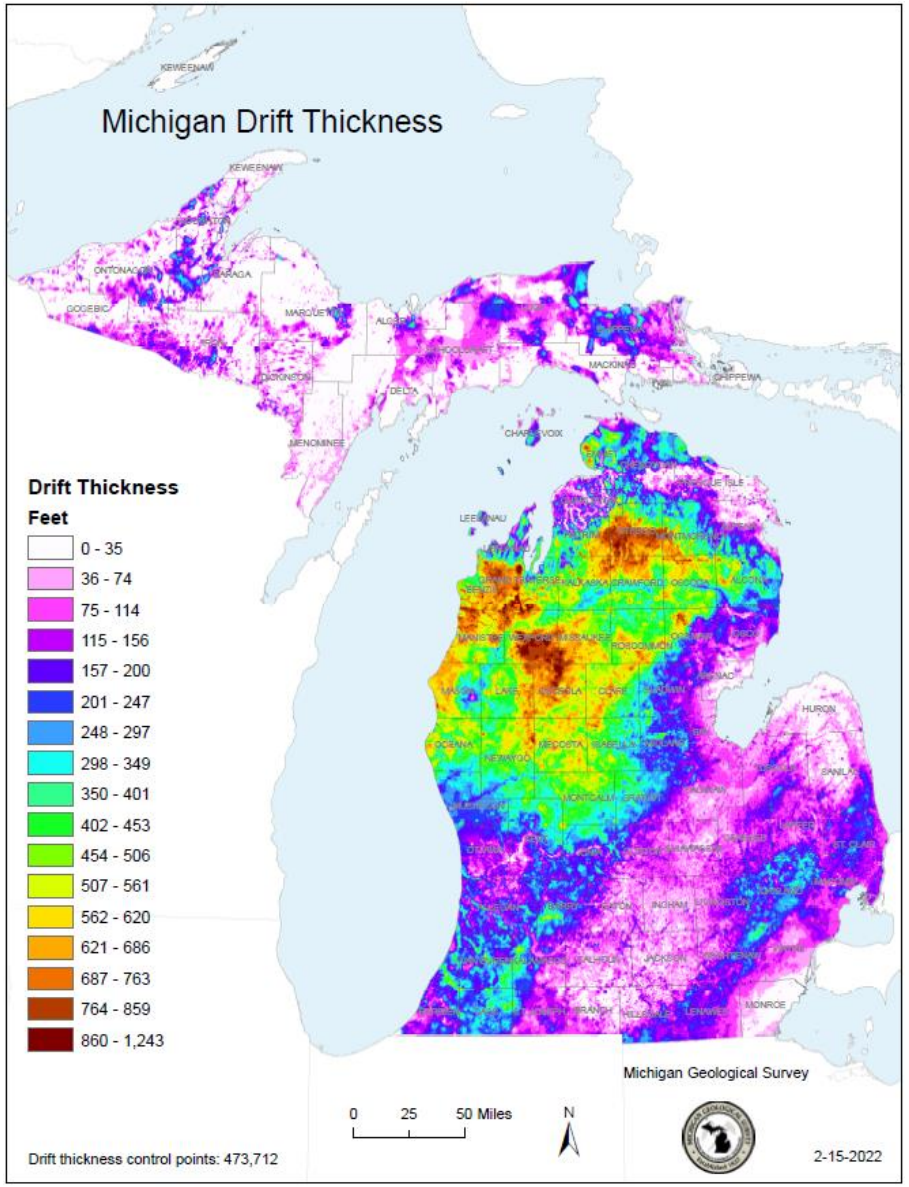
to present-geologic data

No geologic data compilation-

Until now- EGLE developing database!

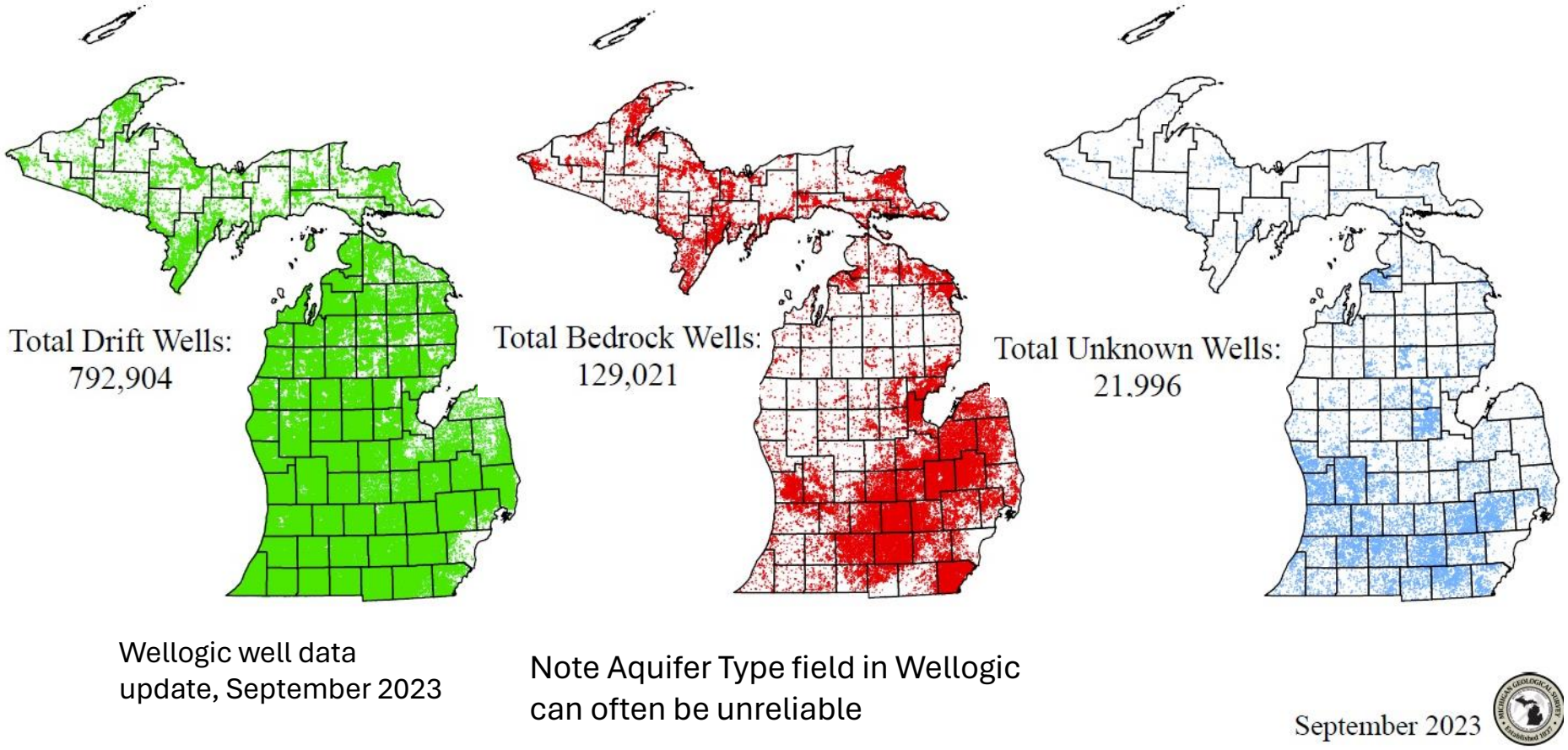
Need to compile data from all sources





Water well data- Wellogic Summary, Drift vs Bedrock

2019-MGS was contracted to validate and correct locations of all Wellogic wells > 40% of Wellogic wells not on the correct location.



Wellogic well data update, September 2023

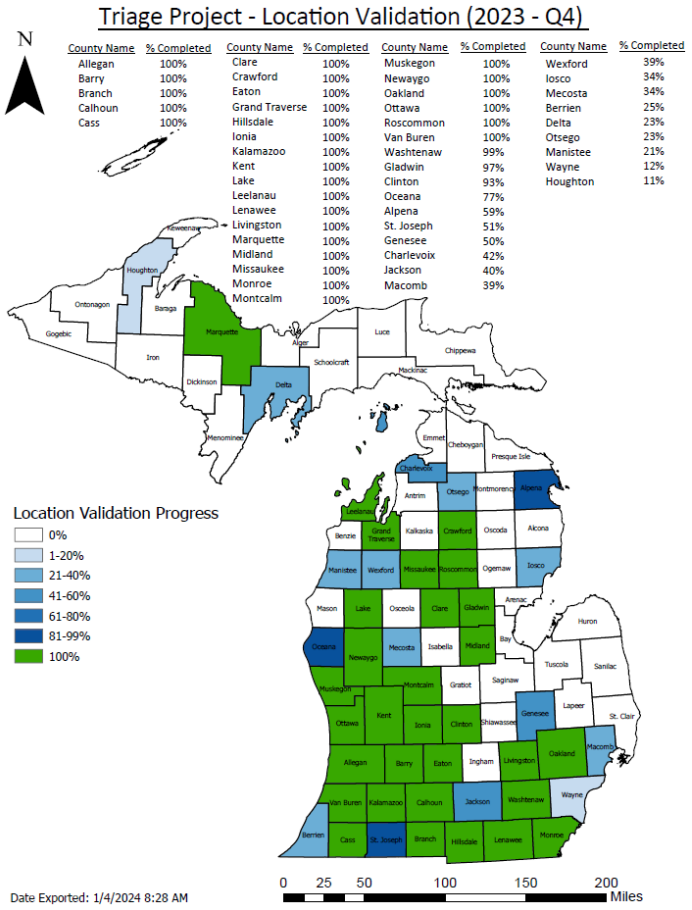
Note Aquifer Type field in Wellogic can often be unreliable

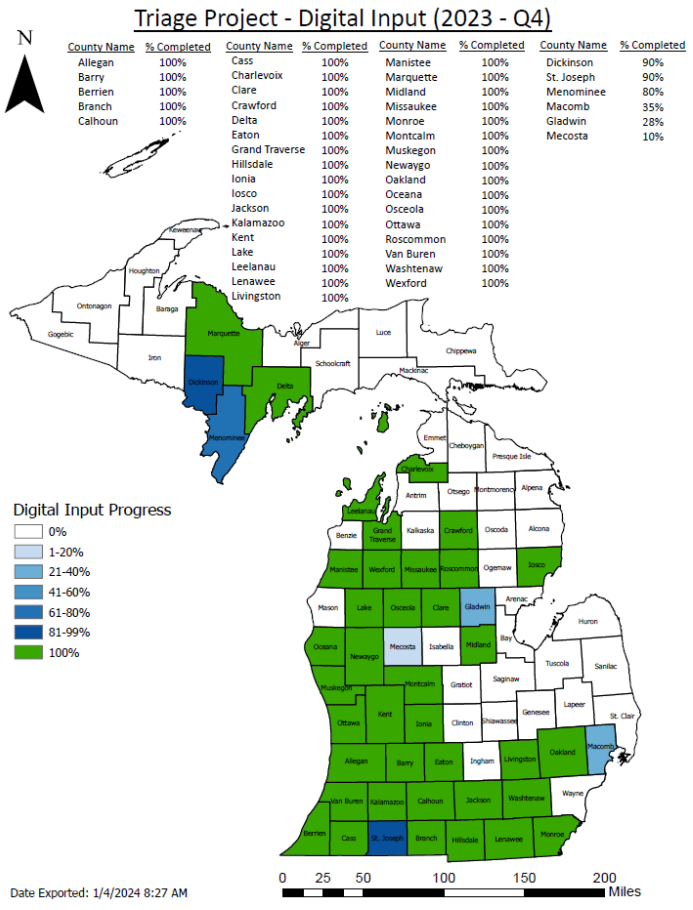
MGS inputting ~700,000+ scanned logs 1950's to 2003 to Wellogic (~1.2+M total # of wells)
MGS, 2015, annual training of well drillers how to log consistently into Wellogic.

19

Wellogic validation & input by MGS

- **MGS is validating Wellogic locations ~40% have the wrong locations, and also inputting scanned logs. 869,687 complete =72% project completed**

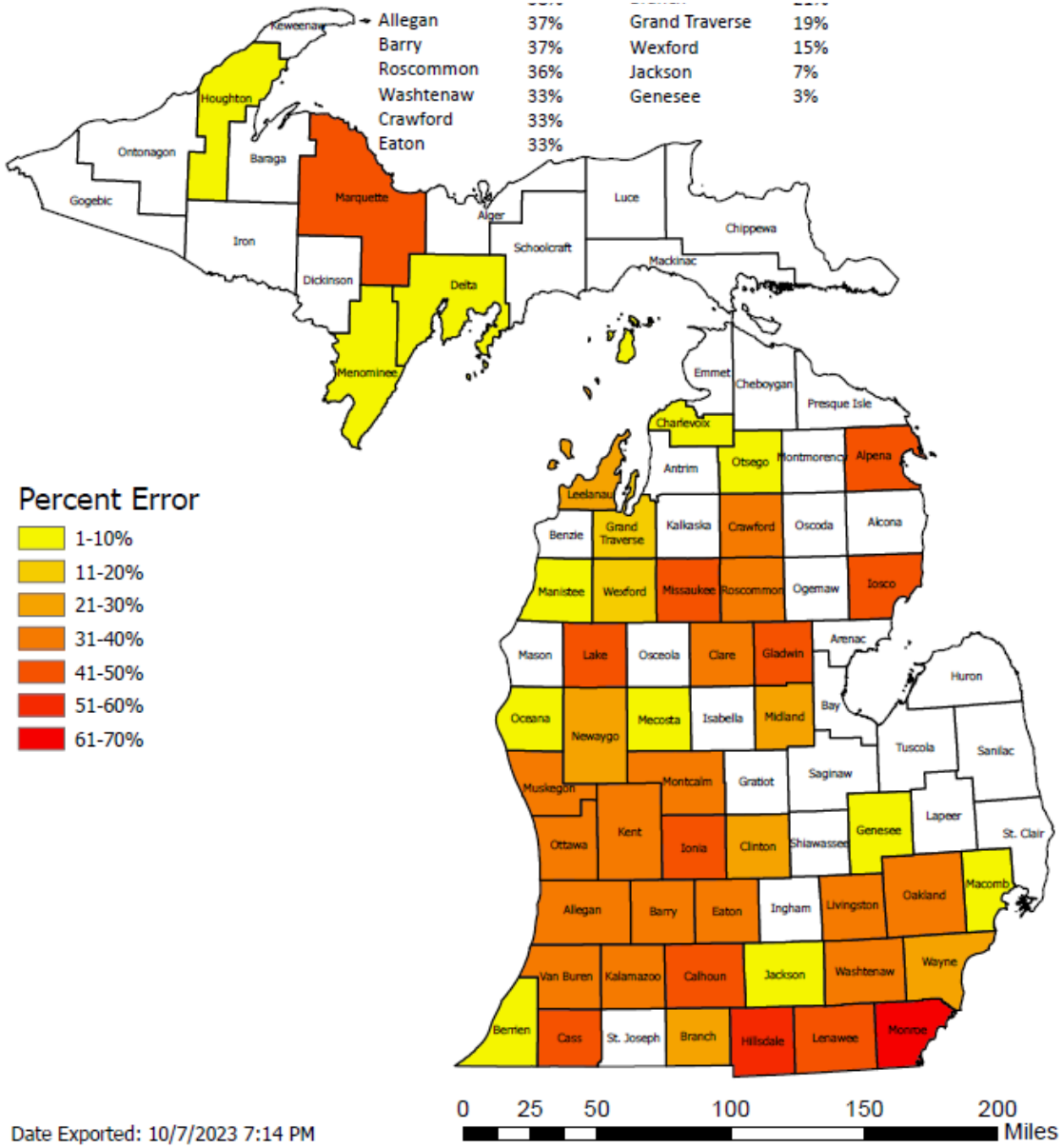




560,000 system~ 473,684 input

700,000 system - ~ 396,003 input

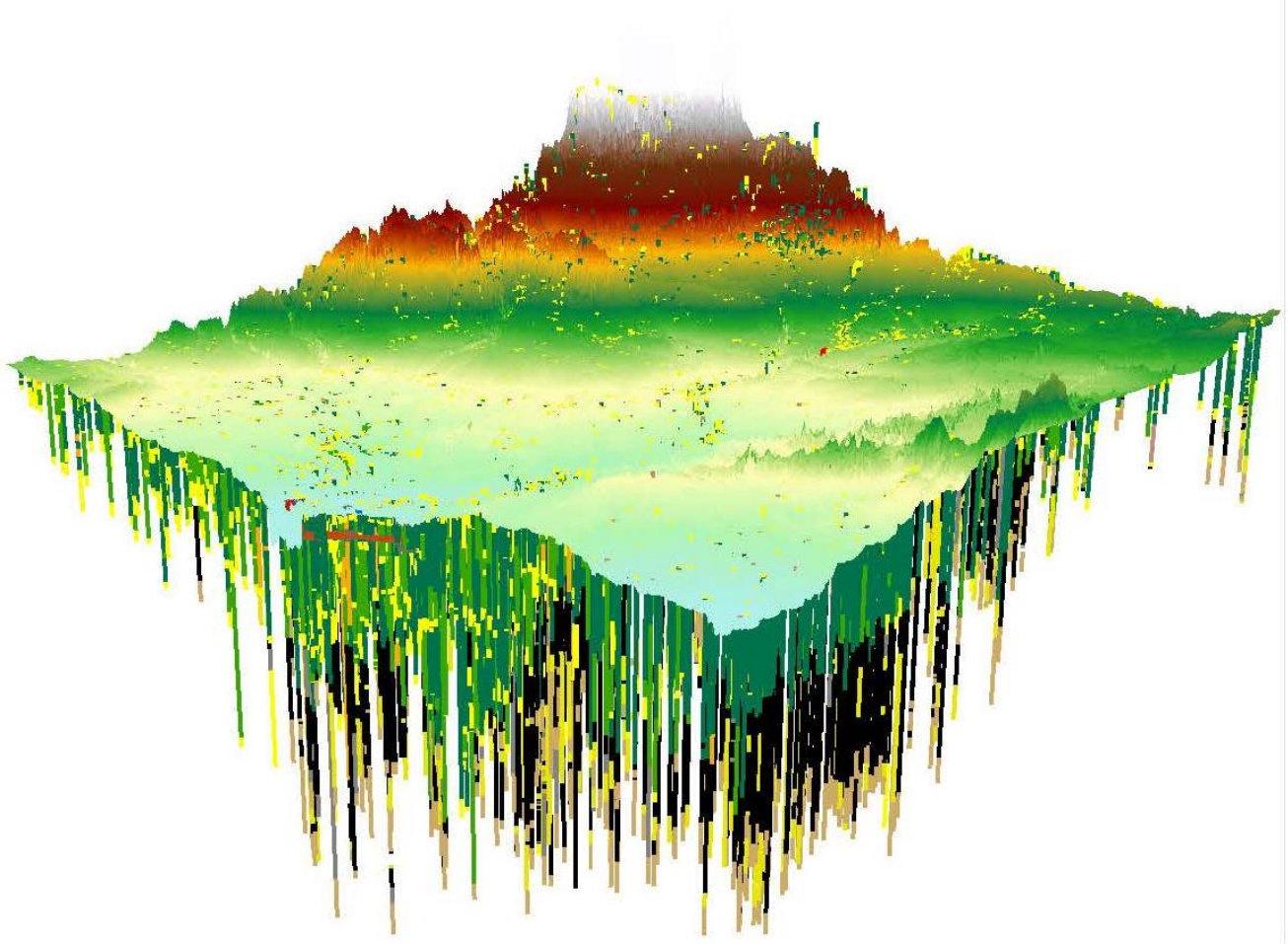
MGS documented Wellogic correction errors by County



Triage Project - Wellogic Location Error (2023 - Q3)

County Name	% Completed	County Name	% Completed	County Name	% Completed
Monroe	65%	Gladwin	44%	Oakland	33%
Hillsdale	54%	Marquette	44%	Clare	32%
Alpena	49%	Cass	43%	Kalamazoo	32%
Iosco	49%	Ionia	43%	Van Buren	32%
Lenawee	45%	Missaukee	42%	Ottawa	31%
		Calhoun	41%	Wayne	28%
		Lake	41%	Clinton	27%
		Livingston	40%	Leelanau	26%
		Montcalm	40%	Newaygo	26%
		Muskegon	40%	Midland	23%
		Kent	38%	Branch	21%
		Allegan	37%	Grand Traverse	19%
		Barry	37%	Wexford	15%
		Roscommon	36%	Jackson	7%
		Washtenaw	33%	Genesee	3%
		Crawford	33%		
		Eaton	33%		

3D Rendering of data-Gladwin County



3D well data Presentation

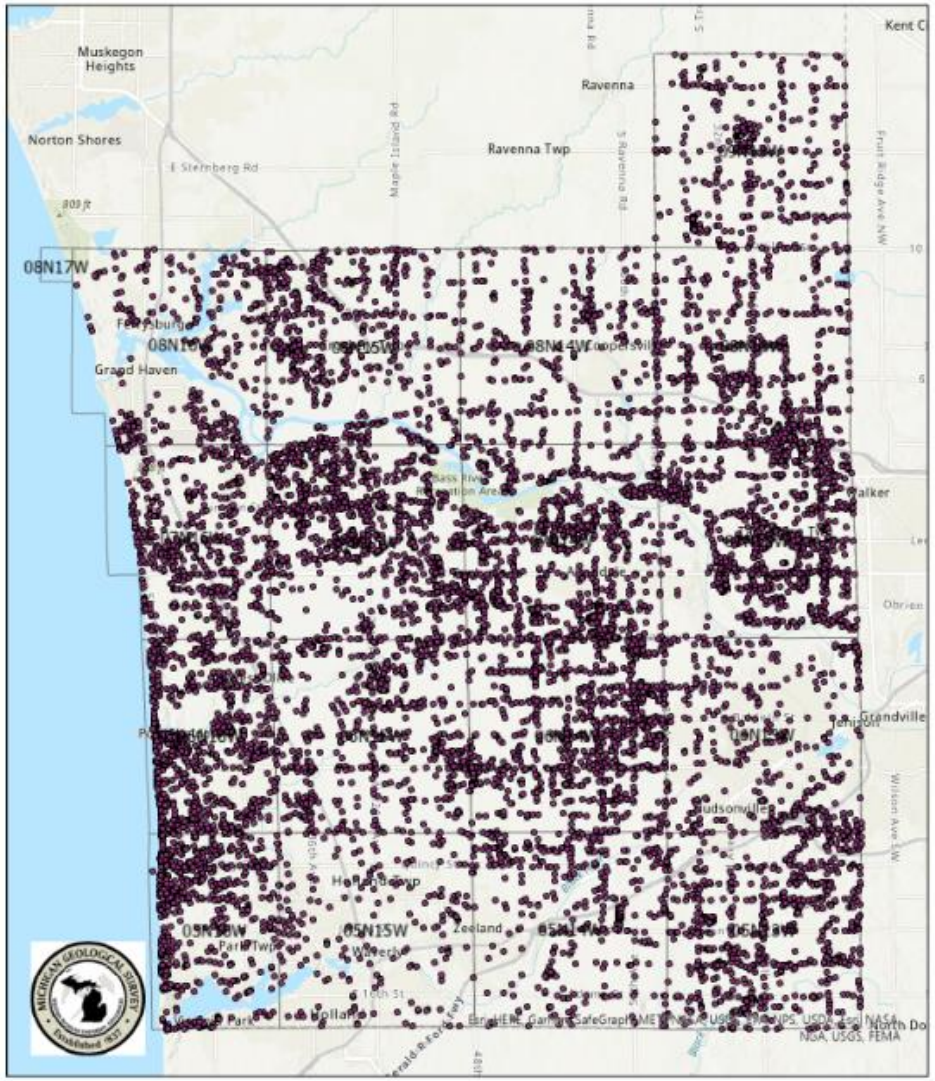
- Showing subsurface geology-8000 wells.
- Green glacial till and lacustrine clay, confining units.
- Yellow sand and gravel aquifers.
- Bedrock Saginaw Fm. Shales and Sandstone aquifers

- Looking Northwest

- This is an example of data outreach

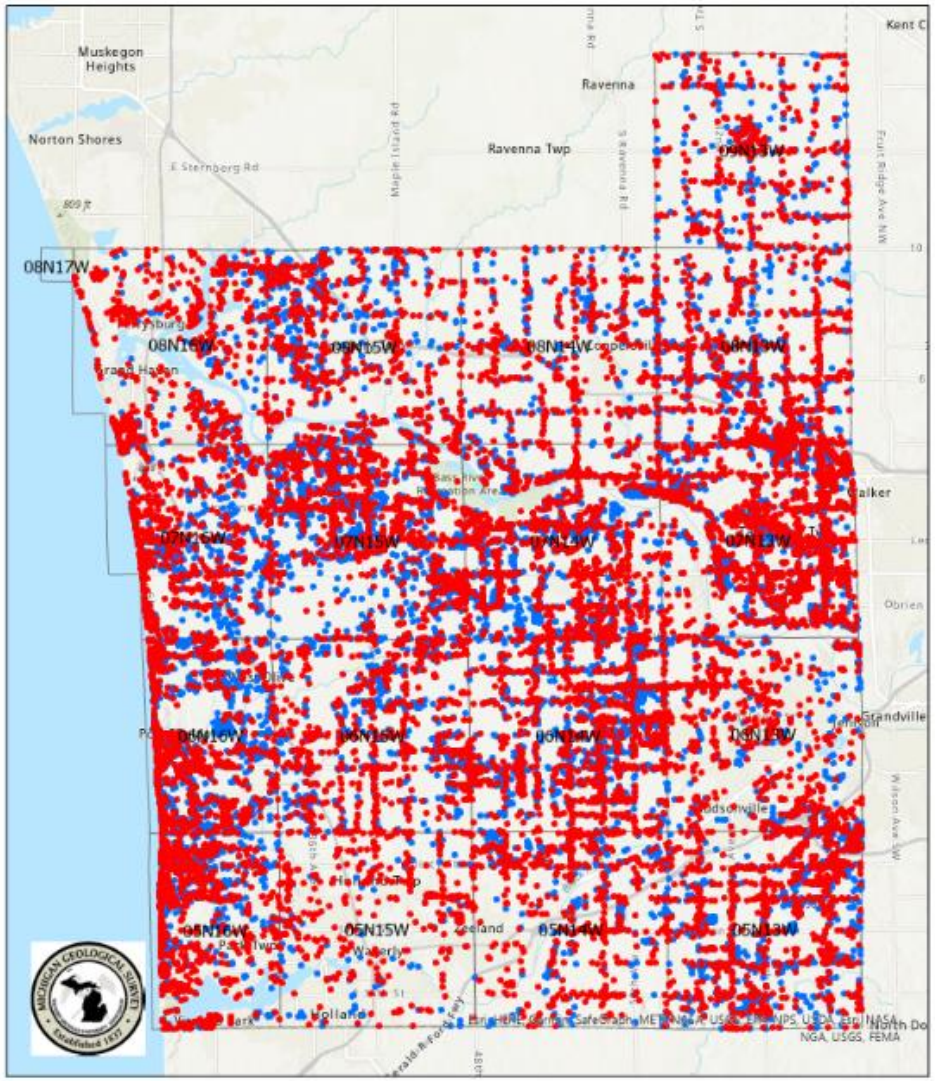
Ottawa County Wellogic Database before and after validation & input of scanned logs

Ottawa County Wellogic Wells May 2021 11,615 Wells



Prior to location cleanup and Scanned Well Log data entry

Ottawa County Wellogic Wells July 2022 22,615 Wells

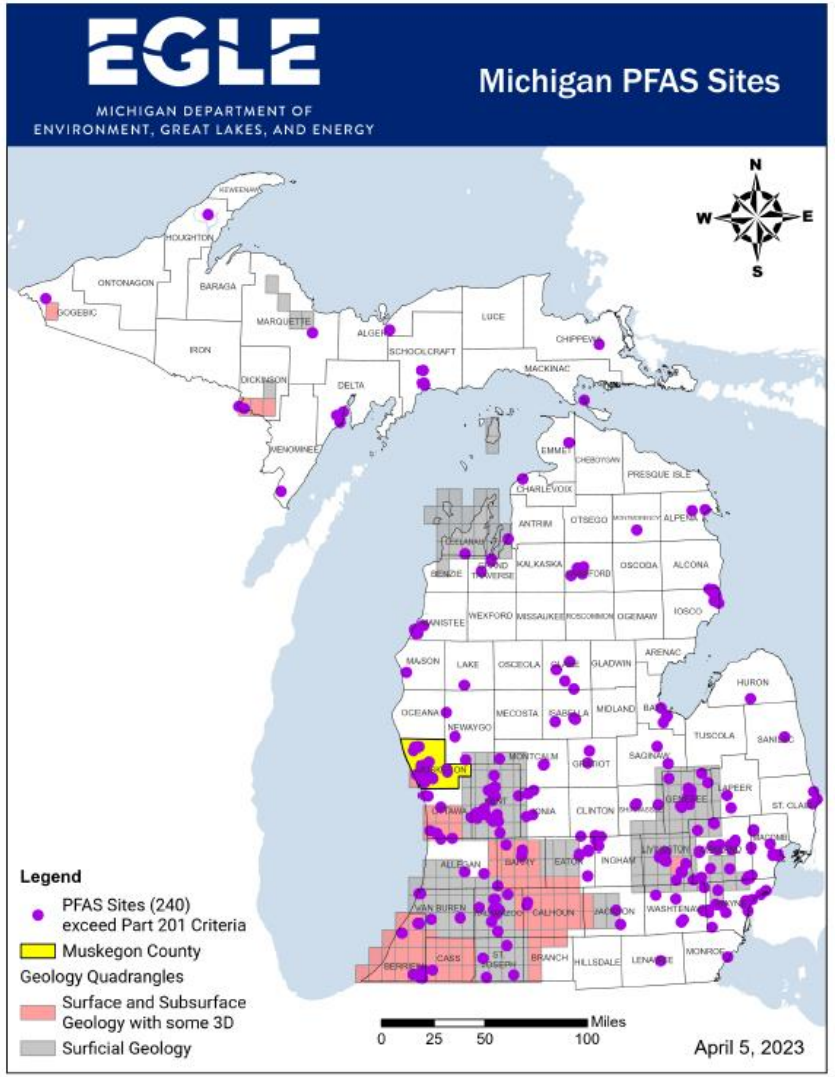


A new Michigan contaminant crisis?

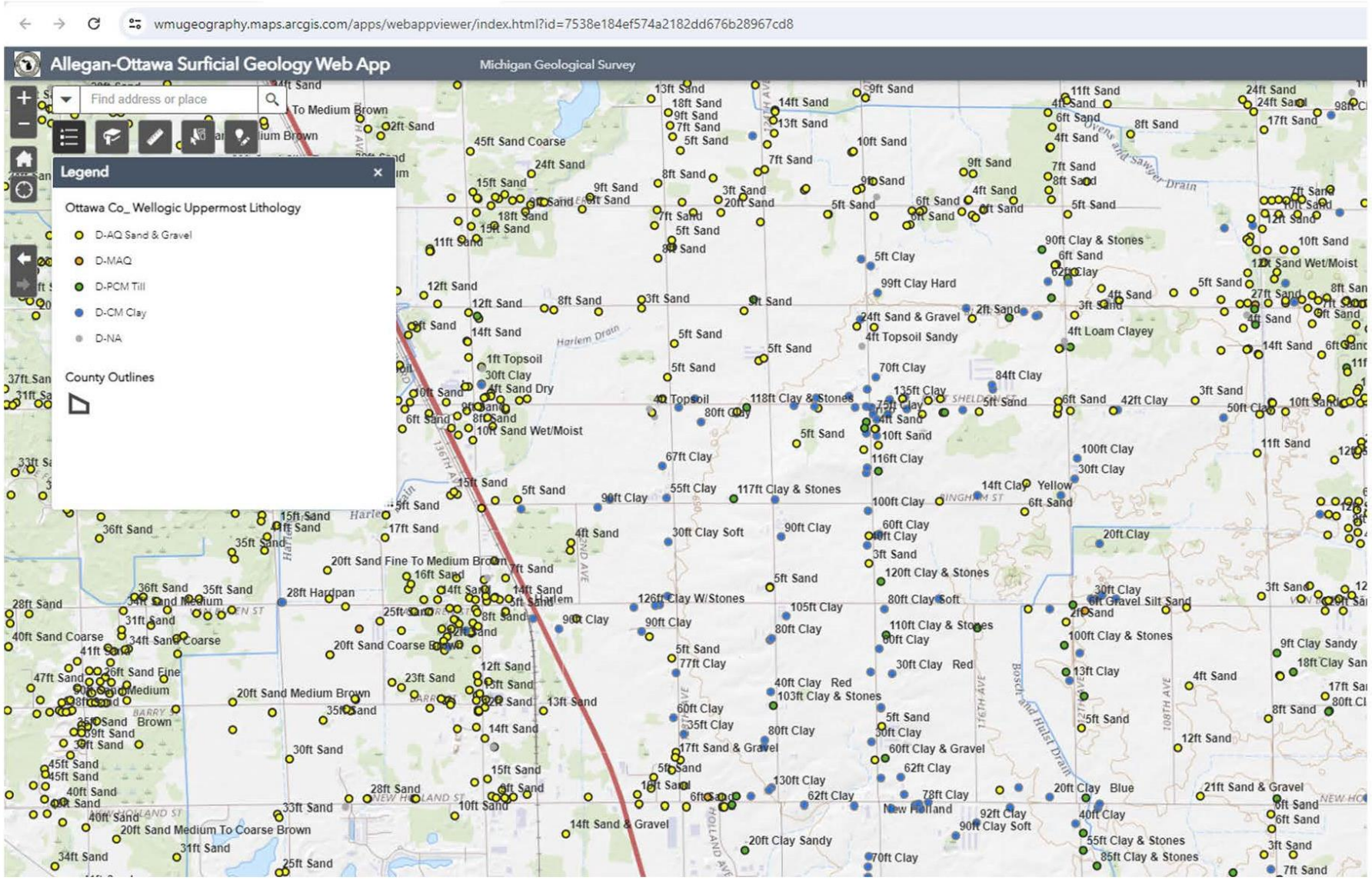
Michigan

Water Wonderland!

- Perfluorinated Alkyl Substances (PFAS) – Soils and water.
- Multiple locations throughout Michigan and there may be more.
- Where Michigan has open file subsurface geologic data.



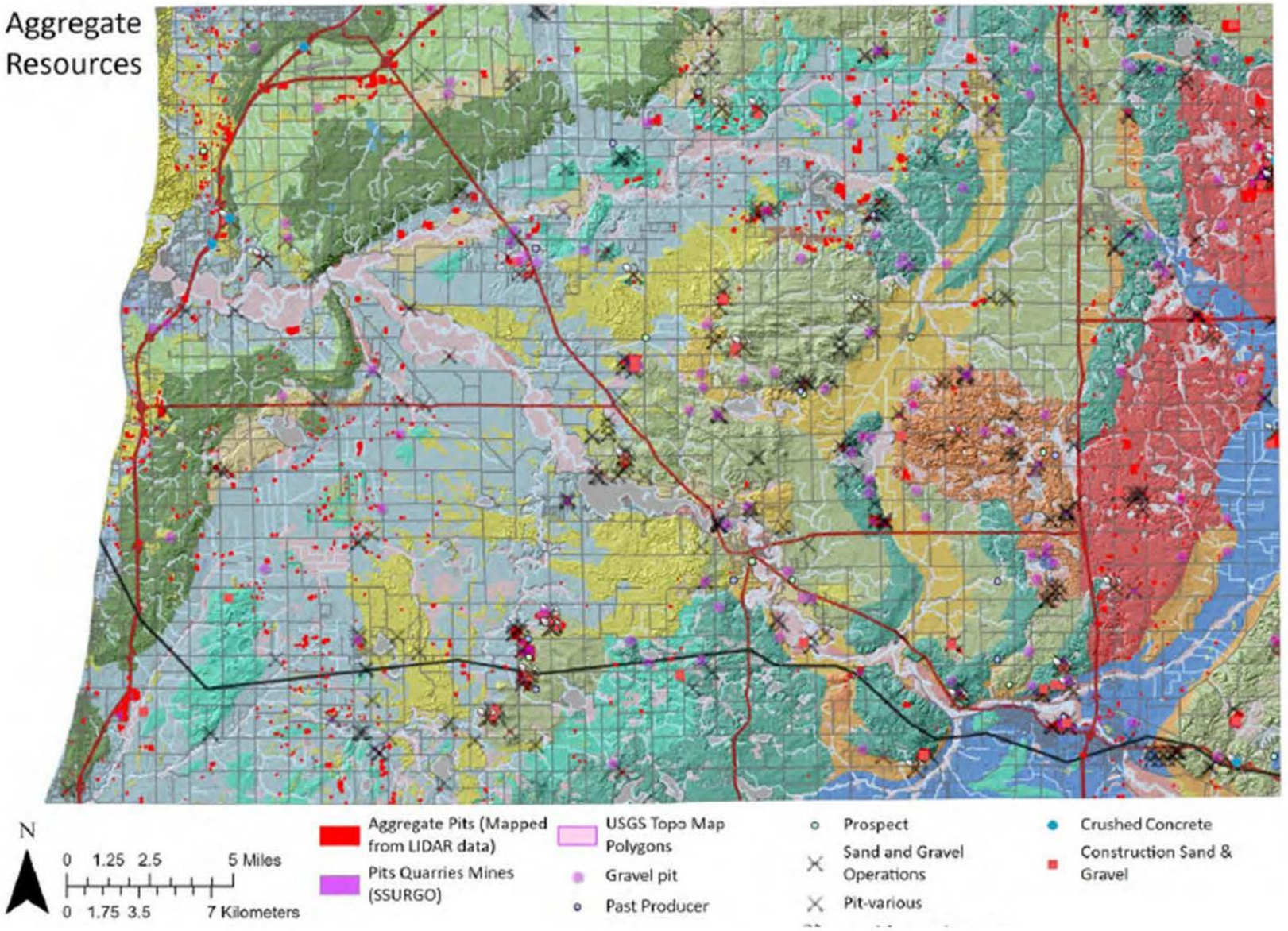
Wellogic data, top 15’ soil and geology = Aggregate?



Note area center of map the uppermost geology is significantly different- showing all clay, while all around it is sand

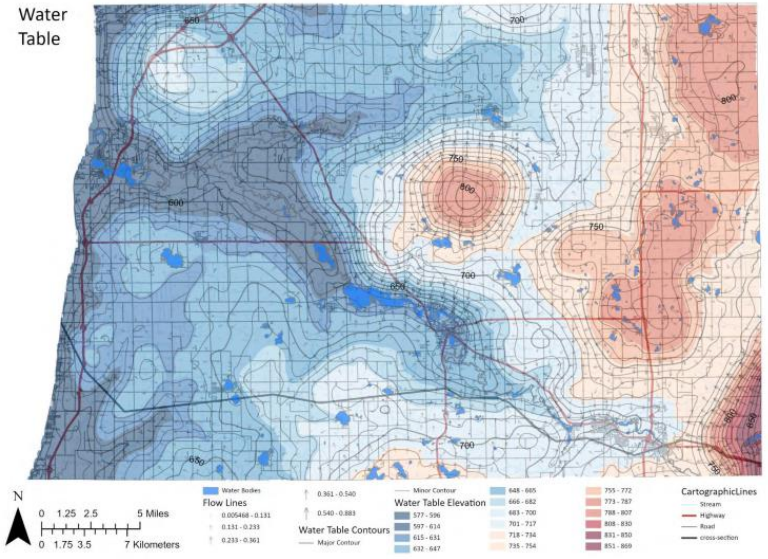
West-central Ottawa County

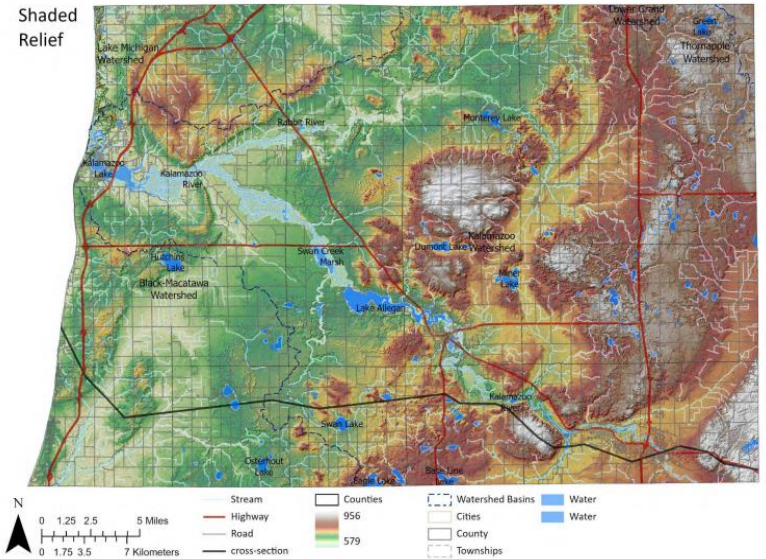
Allegan County Preliminary Aggregate Inventory

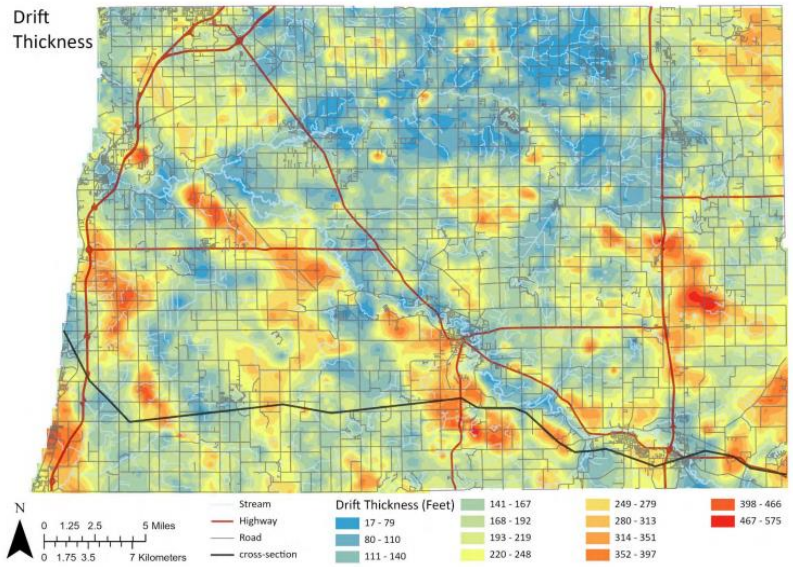


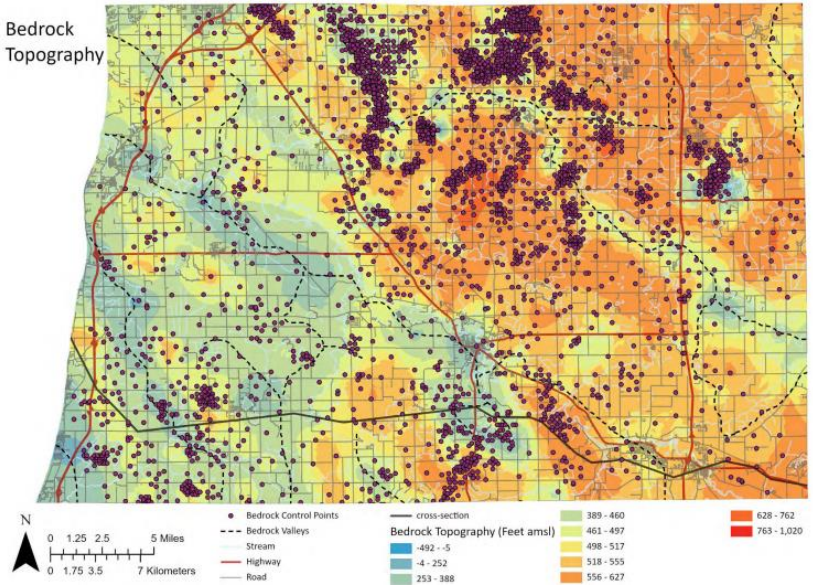
- **Summary of sand, gravel and aggregate data in state and local files.**
- **These will be validated with remote sensing methods and then field checked.**

Map products in Allegan Technical Report









Traditional field work – Using latest technology

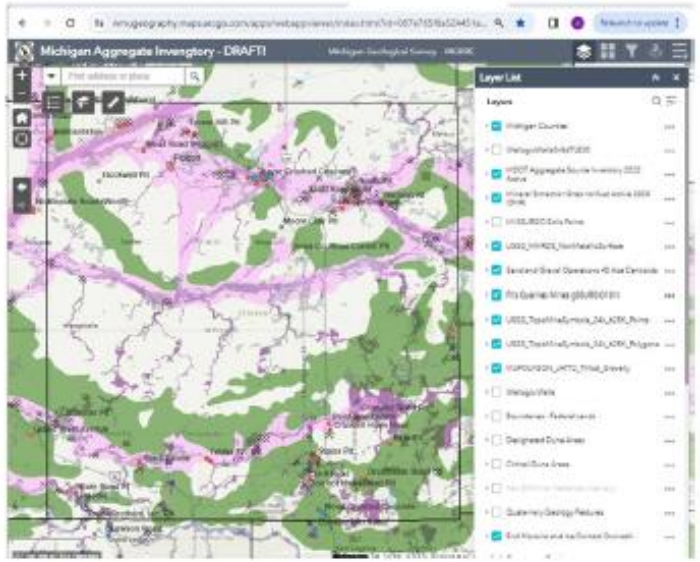
All data Born Digital:

- Field>Tablet>Cloud>Web App
- All data publicly available

All sand to 10'

Typical Gravel Pit

MEC-HAB-01 HAB 5.5'

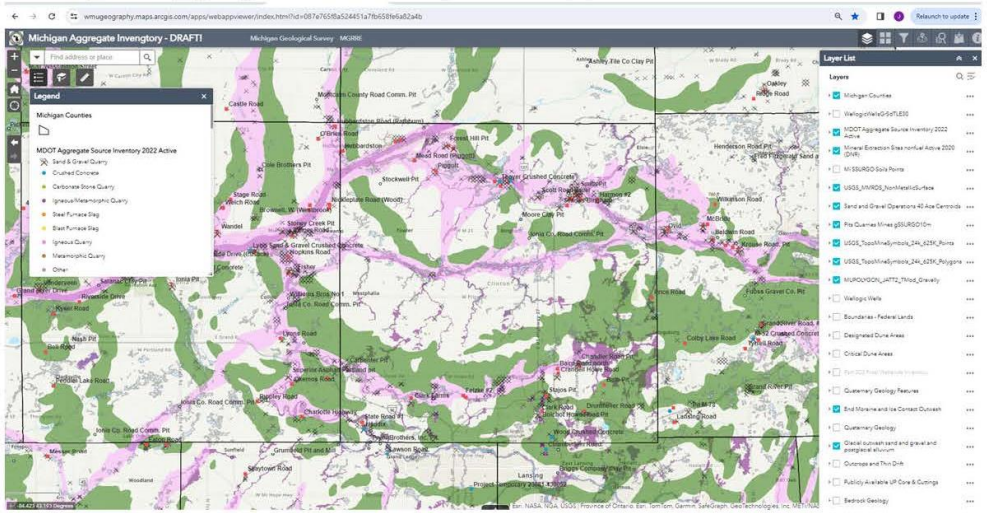


Michigan Aggregate Inventory Web App

Examples of easy access deliverable products

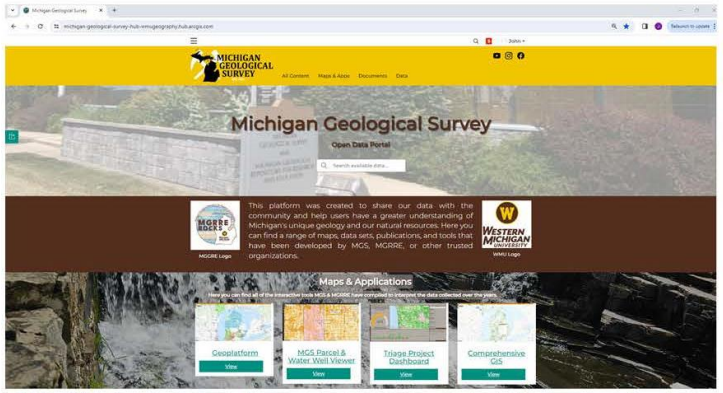
Aggregate Inventory Deliverables

Michigan Aggregate Inventory Web App



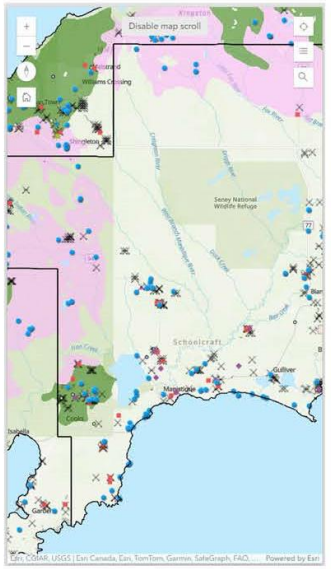
GIS data downloads and live link to the GIS services through the MGS Open Data Hub Site

MGS will produce technical reports and Story Maps of how the data was gathered and suggestion on how to use the data

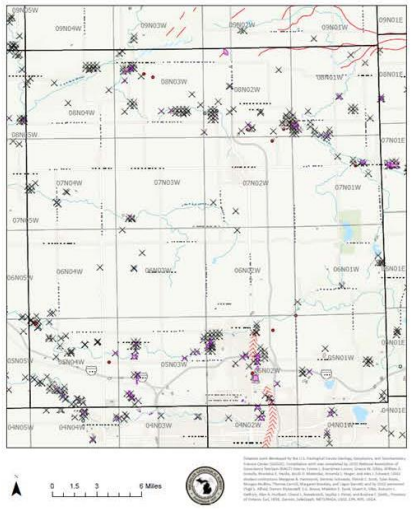


https://michigan-geological-survey-hub-wmugeography.hub.arcgis.com/

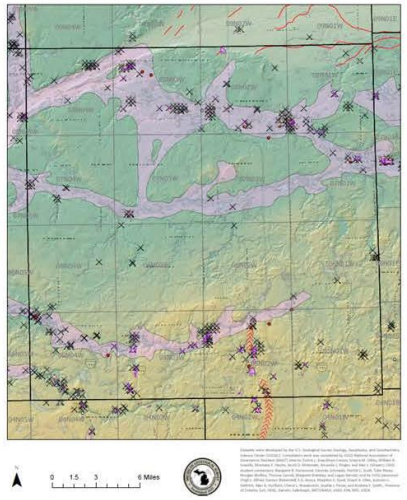
For Mobile devices



Aggregate Inventory: Clinton County Phase I

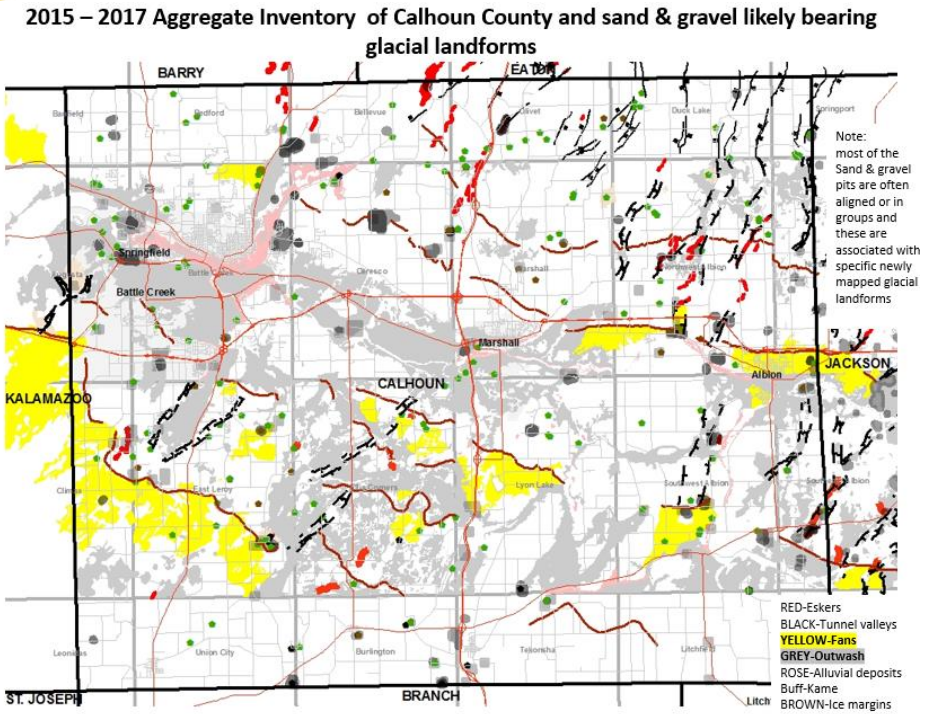


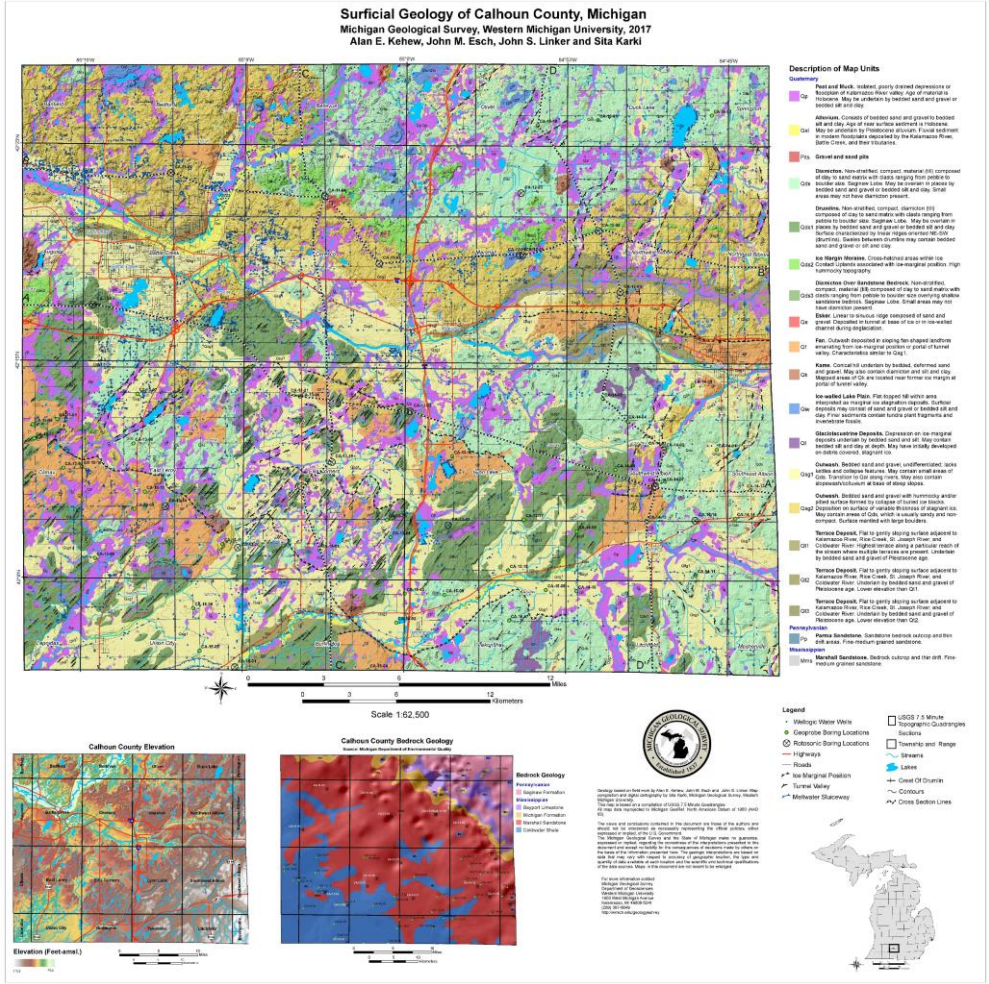
Aggregate Inventory: Clinton County Phase II



County Aggregate Inventory Maps for each phase as layered PDF maps

Example of Calhoun County completed





2015- 2017 Compiling geology and geologic surface features which shows potential aggregate locations, then publish the Geologic map product in 2017.

Summary of Aggregate deliverables

- Once data is compiled, MGS will begin field verification of the data, using the data generated or compiled, as noted above.
- Data will be presented in county wide data formats as examples that citizens, engineers and geologists can access in phone apps or on computer.
- This could be: databases, data maps, publish County detailed maps.
- For computers, these could be GIS or PDF layers of information and data.
- MGS will prepare data in summary format that can be easily accessed by phones or computers.
- As more data is compiled, more data can be added to a county data set.
- Take feedback on what is a favorable presentation going forward.

Summary of Aggregate Year 1 project

- Hire staff
- Contact all data stakeholders to confirm access to all data.
  - State, county, townships, Universities, bibliographies, public.
- Contact all state departments and legislature to determine priority areas.
- Develop standard mapping and data products that will meet MGS/USGS mapping standards and State database programs.
- Once databases have been identified, prepare examples of data output in preparation for regional public meetings to explain Aggregate data and mapping program, the deliverables.
- Regional public meetings to present statewide mapping plan.
- After public meetings, MGS Aggregate team will proceed to field verification and validation of data.
- MGS will also determine if surface or drone geophysical surveys will enhance the timeframe to complete the mapping products.
- Contact MDOT to determine if funding available for sample testing of material.

Michigan Geological Survey

Aggregate Mapping Grant

Thank you for the opportunity to support mapping the surficial geology for aggregates and water.

Questions?

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260-387-8611

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