Areas of Concern & Water Quality Risks

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Areas of Concern

Water Quality Risk Assessment

- Groundwater Pollution 101
- Point Source (PS) Pollution in Allegan County
  - Potential Sites of GW Pollution
  - Risk Analysis of PS of GW Pollution
- Non-Point Source (NPS) Pollution in Allegan County
- County-Wide Water Quality Risk Mapping

Groundwater Pollution 101

An Introduction to Groundwater Contamination

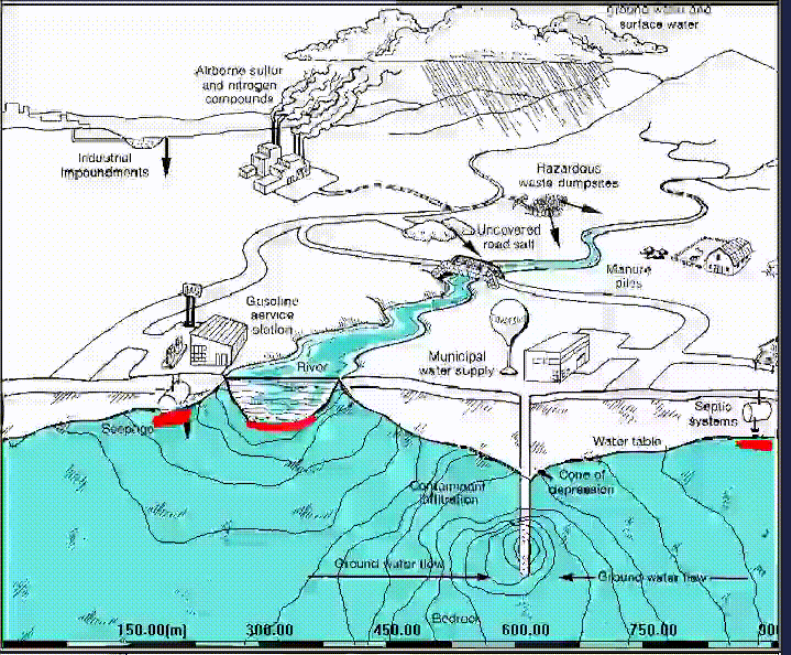
Groundwater with substances that exceed established drinking water standards related to:

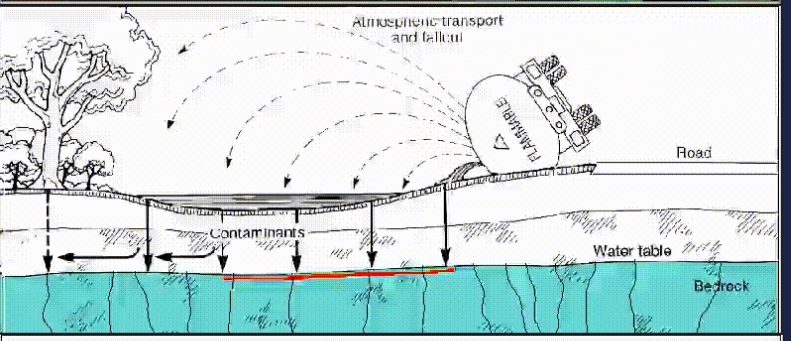
- Human health
- Aesthetic qualities, like taste, smell, or color

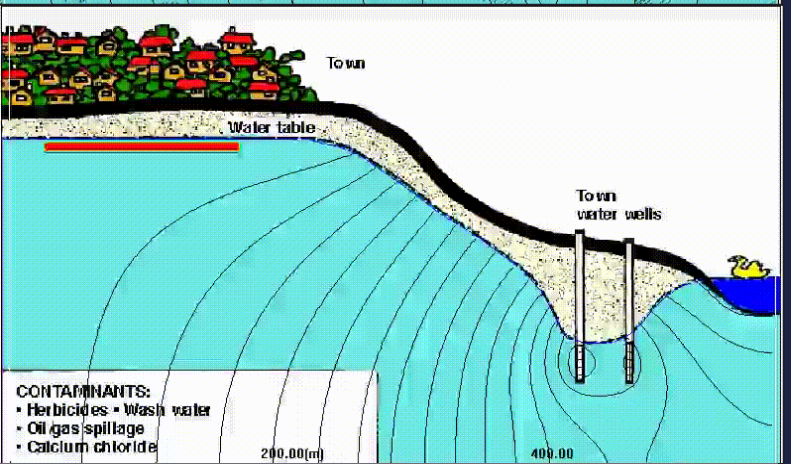
Or threaten groundwater-dependent ecosystems.

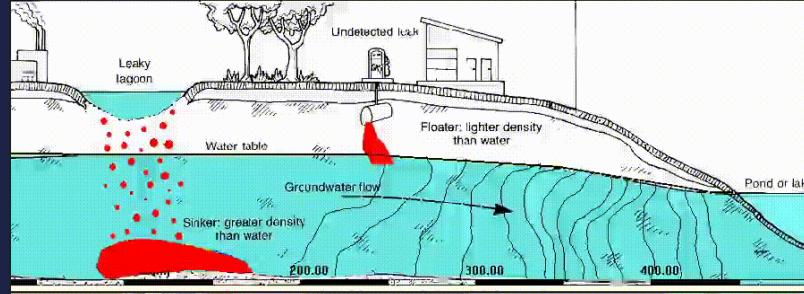
Source of pollution may be natural or cause by human activity.

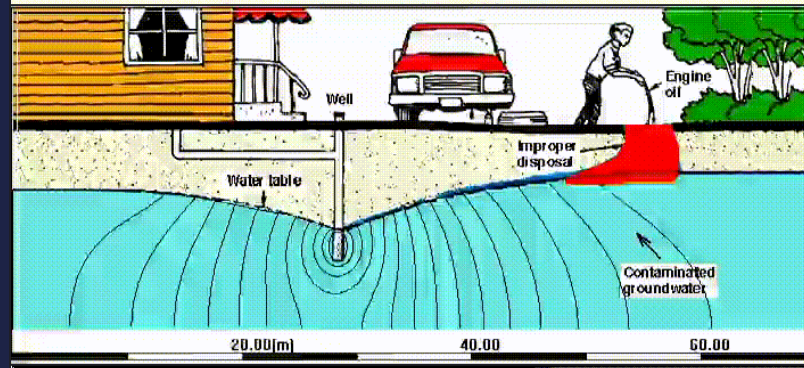
- Deep mineralized groundwater
- Agricultural fertilizers (nitrates)
- Leaky underground storage tanks
- Leaky waste lagoons
- Accidental Spills
- Improper Waste/Chemical Disposal

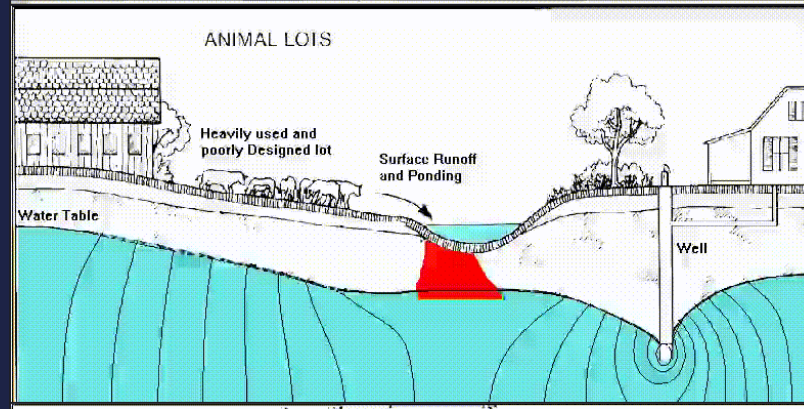


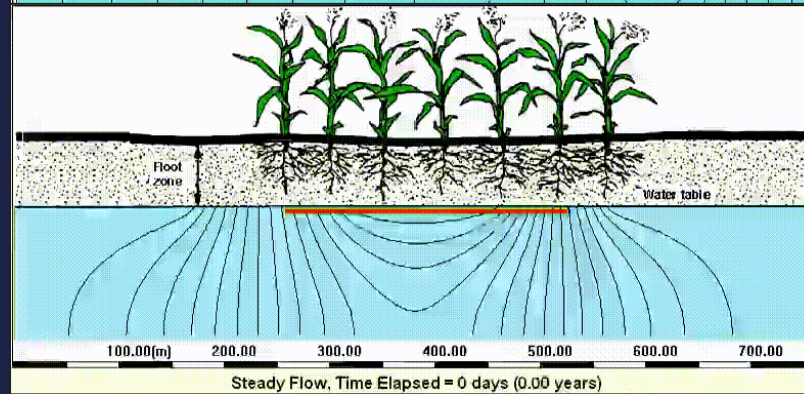












Two Types of Pollution Sources

Point Source Pollution (PS)

Pollution that originates from a single, identifiable source. Examples of point source groundwater pollution include:

- Leaky underground storage tanks (LUSTs)
- Landfills and waste handlers
- Accidental spills
- Improper disposal at industrial/commercial sites
- Legacy disposal at industrial/military sites

Non-Point Source Pollution (NPS)

Pollution that originates from many scattered sources rather than from a single, identifiable point.

- Runoff from agricultural fields
- Naturally occurring underground minerals or metals like iron or arsenic
- Road deicing
- Seawater intrusion / brine upwelling

Once groundwater is polluted, it is difficult and very expensive to clean up. Remediation can take years, if at all possible.

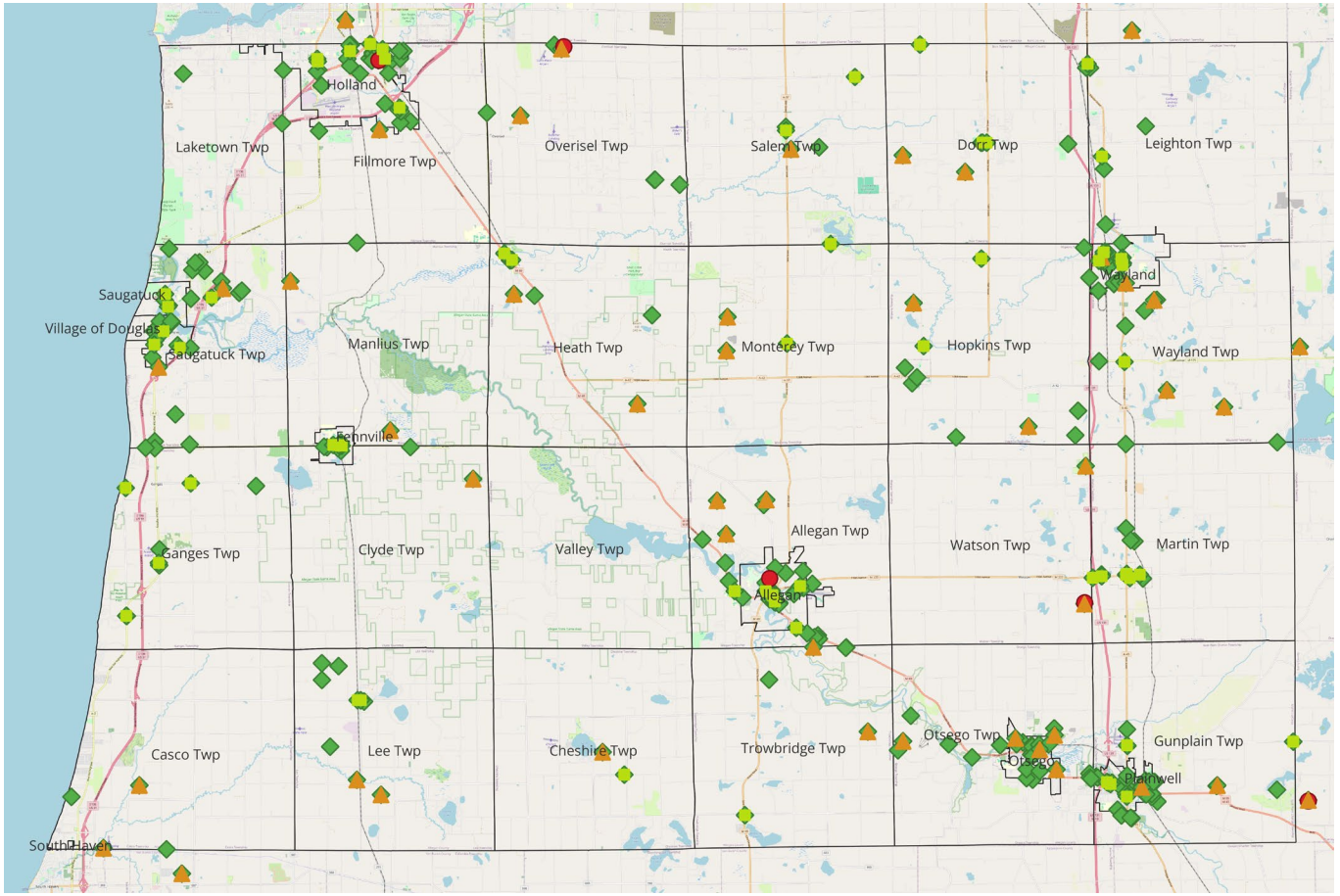
Point Source Pollution

351

Potential Point Source Pollution Sites

- Sites of Environmental Concern = 237
- Landfills / Waste Handlers = 46
- Leaky Underground Storage Tanks = 63
- Emerging PFAS Sites = 5

Source: From State of Michigan GIS Database Portals



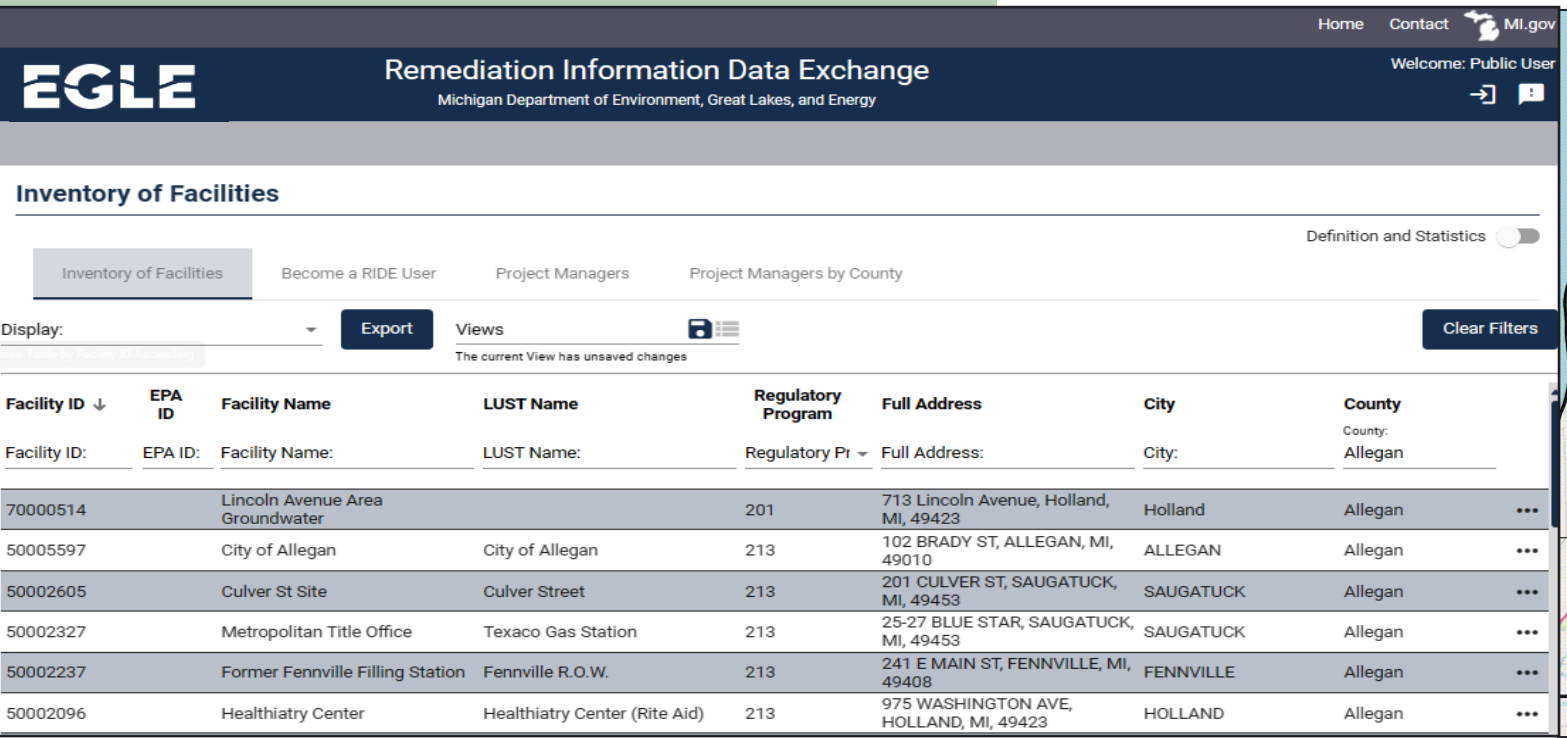
Potential Point Sources of Groundwater Pollution

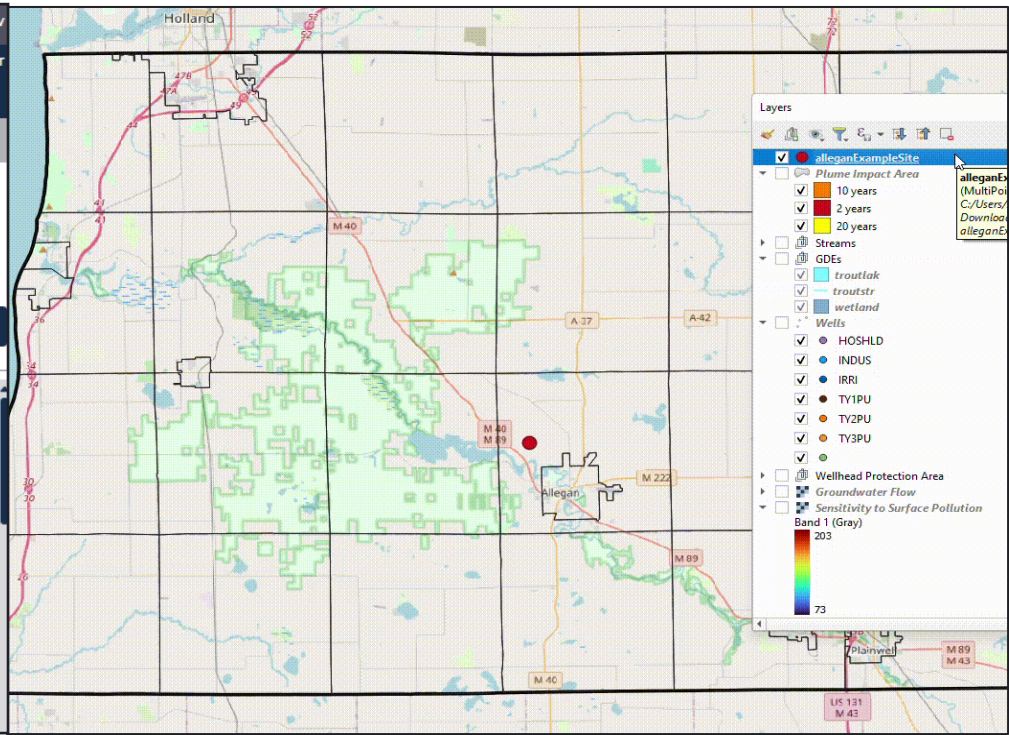
Risk-based Analysis of Point Sources

“On-site” and “Off-site” Contamination Risk Analysis at all 351 Sites

Off-Site Risk Analysis: Estimation of risk to “downstream” groundwater receptors based on plume migration pathways

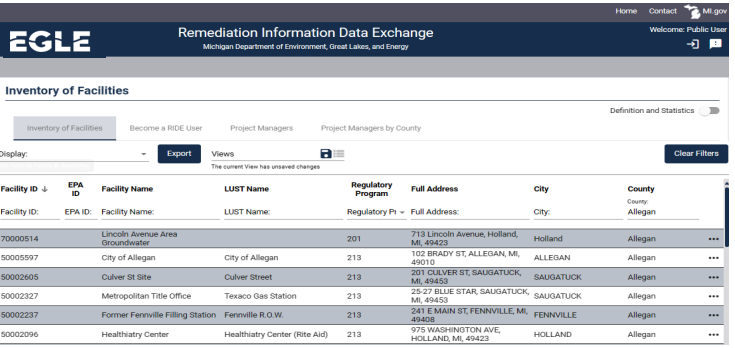
On-site Risk Analysis: Review of site history, documentation of substances present, pathways for groundwater contamination, and soil & groundwater quality data

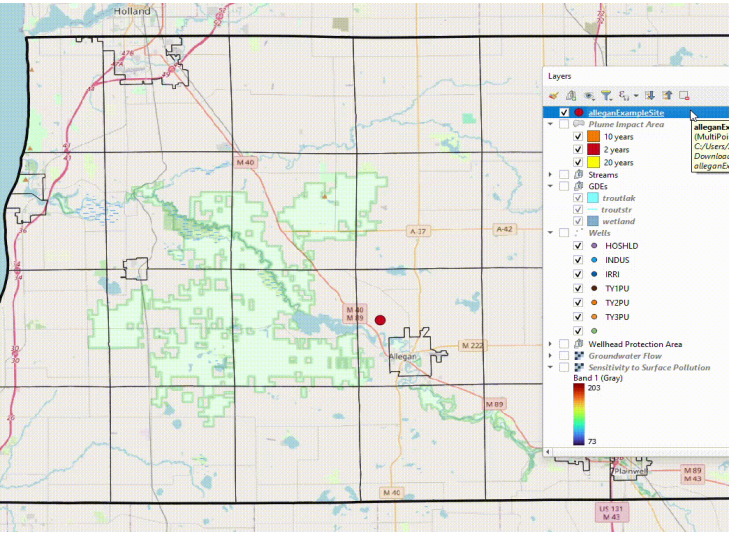




Point Source Pollution Risk Analysis Work-Flow

Coming on-site and off-site risk factors
- Potential plume migration and downstream groundwater wells
- Nature of the pollution source (chemicals, concentrations, etc.)





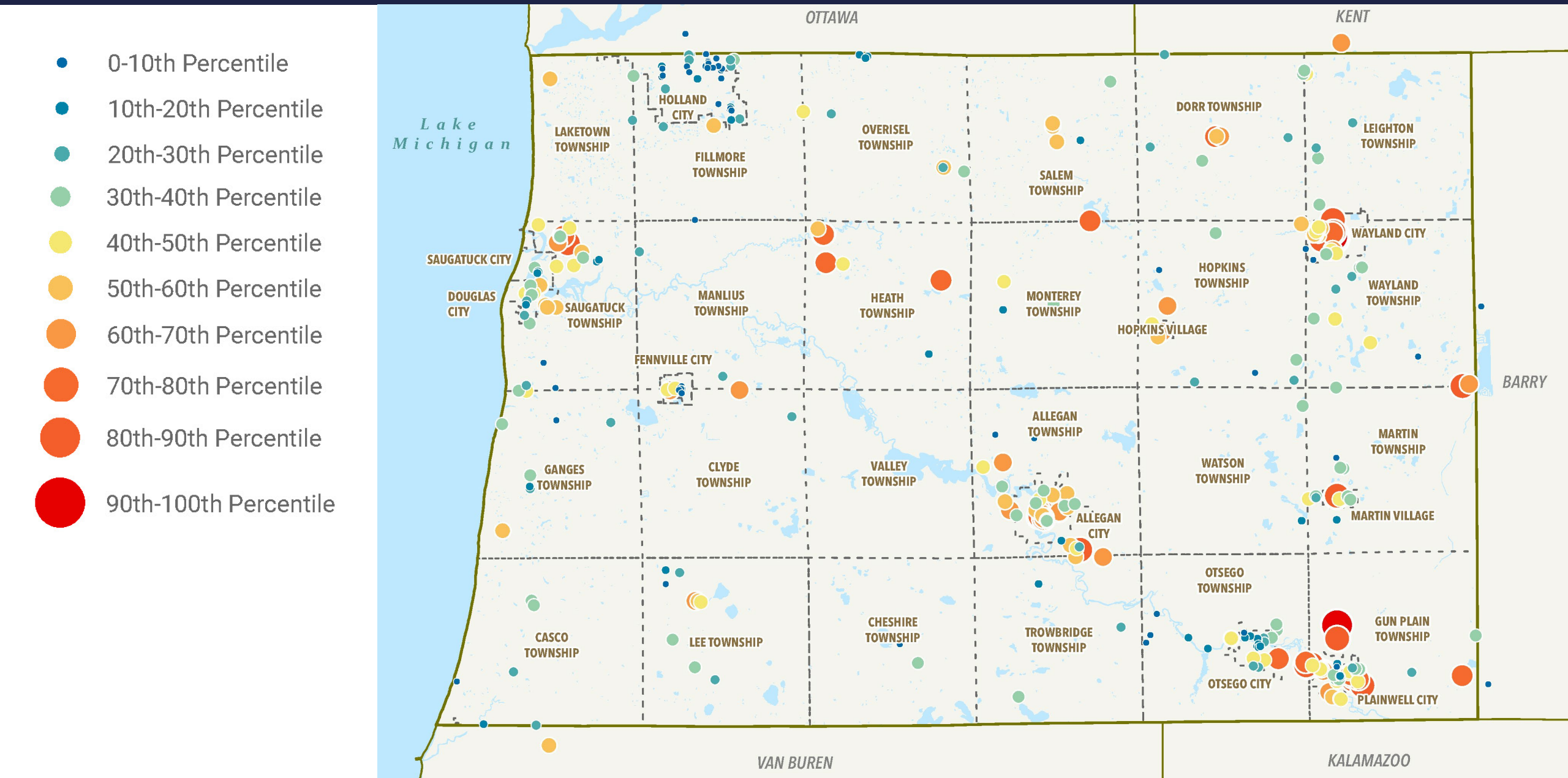
RIDE Inventory Analysis → Risk Based on Site-specific Conditions and EGLE Criteria

Plume Migration Simulators → Risk Based on Downstream Groundwater Wells and Surface Water

Risk Based on Site-specific Conditions and EGLE Criteria → Combined Risk Ranking & Site Prioritization Map/List

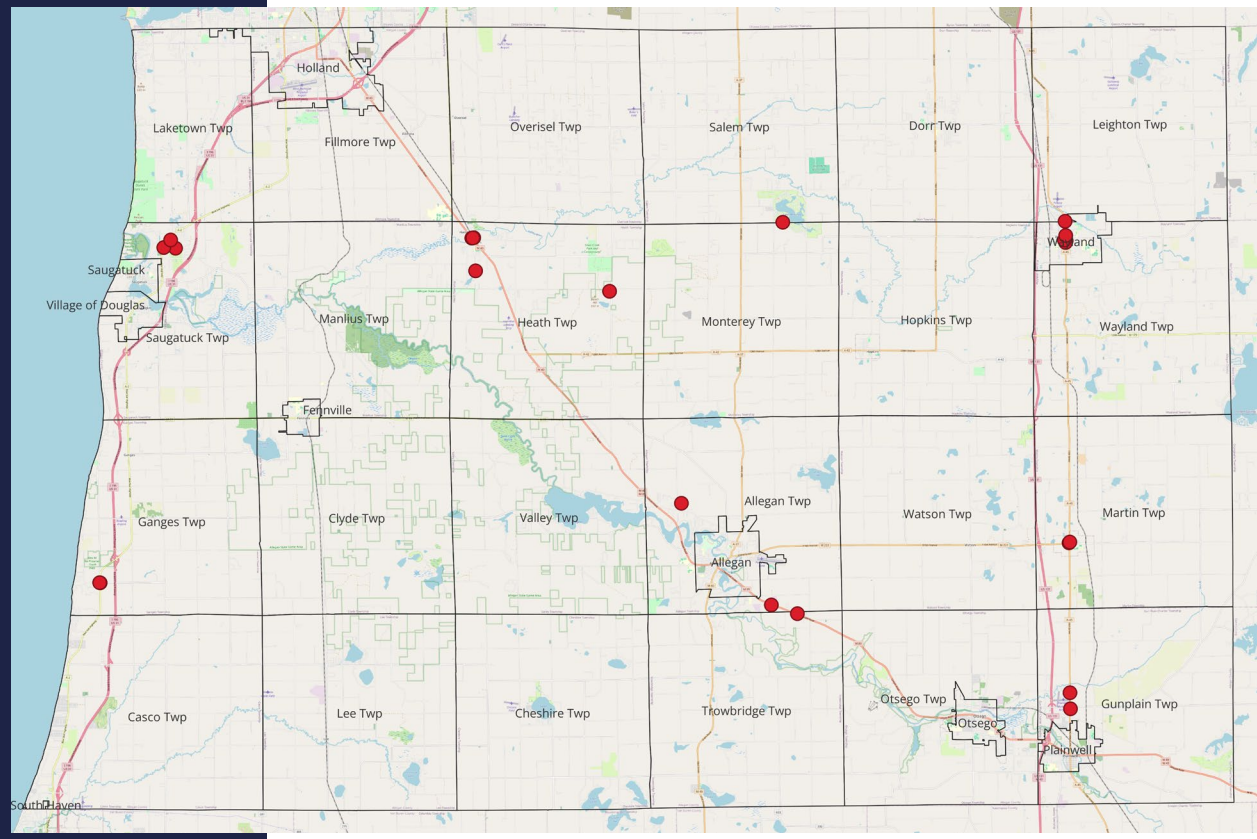
Risk Based on Downstream Groundwater Wells and Surface Water → Combined Risk Ranking & Site Prioritization Map/List

Point Sources - Contamination Risk Map



Point Sources: Top 25 Sites

Ranking	Site Name	Local Government Unit
1	687 North 10th Street	Gunplain Twp. (Plainwell)
2	203 South Main Street	City of Wayland
3	Wayland Self Serve	City of Wayland
4	114 Pine Street	City of Wayland
5	585 10th St. Plainwell	Gunplain Twp. (Plainwell)
6	3603 N. Main Street	Leighton Twp. (Wayland)
7	712 East Bridge Street	City of Plainwell
8	798 E. Bridge Street Fmrly 760 E. Bridge	City of Plainwell
9	1258, 1260 Lincoln Road & Village EMH Pk	Allegan Twp.
10	150 North Main Street	City of Wayland
11	101 124th Avenue	Wayland Twp. (Shelbyville)
12	236 Hubbard Street	City of Allegan
13	1218 M-89 Highway	Allegan Twp.
14	637 West Sycamore Street, Wayland	City of Wayland
15	Ridderman Card -OP	Gunplain Twp. (Plainwell)
16	Martin (LUST Site)	Village of Martin
17	6494 Clearbrook Drive & 6402 and 6500 13	Saugatuck Twp.
18	558, 520, and 512 Water Street	City of Allegan
19	1185 M-89 Highway	Allegan Twp.
20	1227 M-89, Plainwell MI 49080	Otsego Twp.
21	East 1/2 of SE 1/4 Section 29	Gunplain Twp. (Plainwell)
22	Friendly 66 (Martin Pacific Pride)	Village of Martin
23	Angle Steel Div (Kewaunee Scientific)	City of Plainwell
24	101 Brady Street, Allegan	City of Allegan
25	111 Hubbard Street	City of Allegan



Non-Point Source Pollution

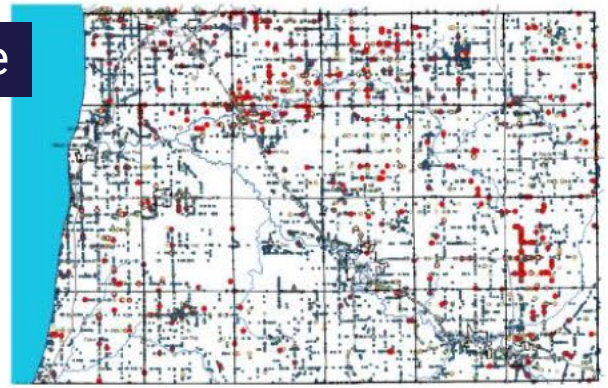
Risk-based Analysis of Non-Point Sources

Analysis of the "Impact" (resulting groundwater concentrations) from non-point source pollution

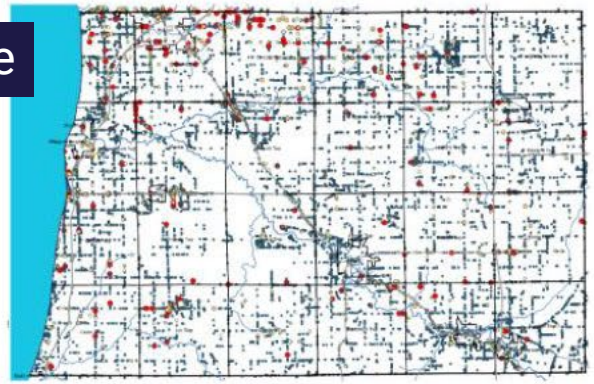
Interpretation of WaterChem Data

- Groundwater quality samples from 1983-2014
- Township-by-township statistical analysis and ranking of "average" and "elevated" concentrations (primary and secondary substances)
- Spatial mapping of elevations concentrations (point data)

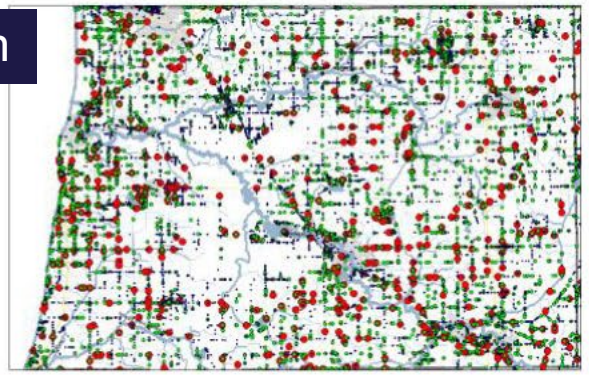
Nitrate



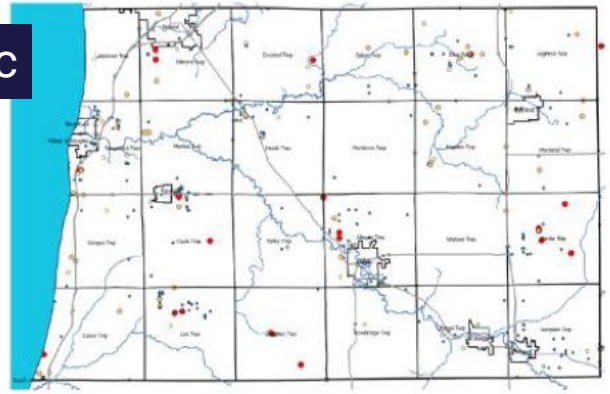
Chloride



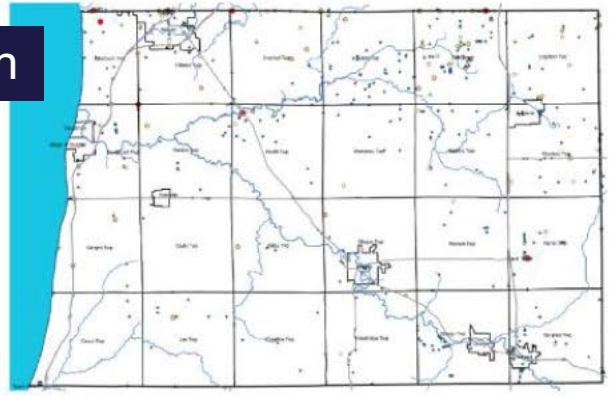
Iron



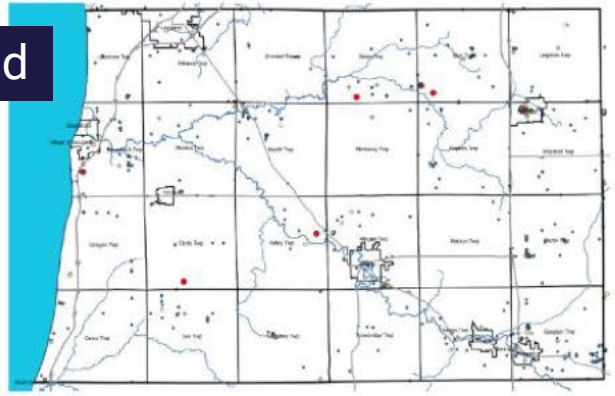
Arsenic



Sodium



Lead



Non-Point Source Pollution Indexes

Primary NPS Pollution Index

Non-Point Source contaminants known to adversely impact human health.

- **Nitrate** (+10 mg/L)
- **Lead** (+0.015 mg/L)
- **Arsenic** (+0.010 mg/L)

Secondary NPS Pollution Index

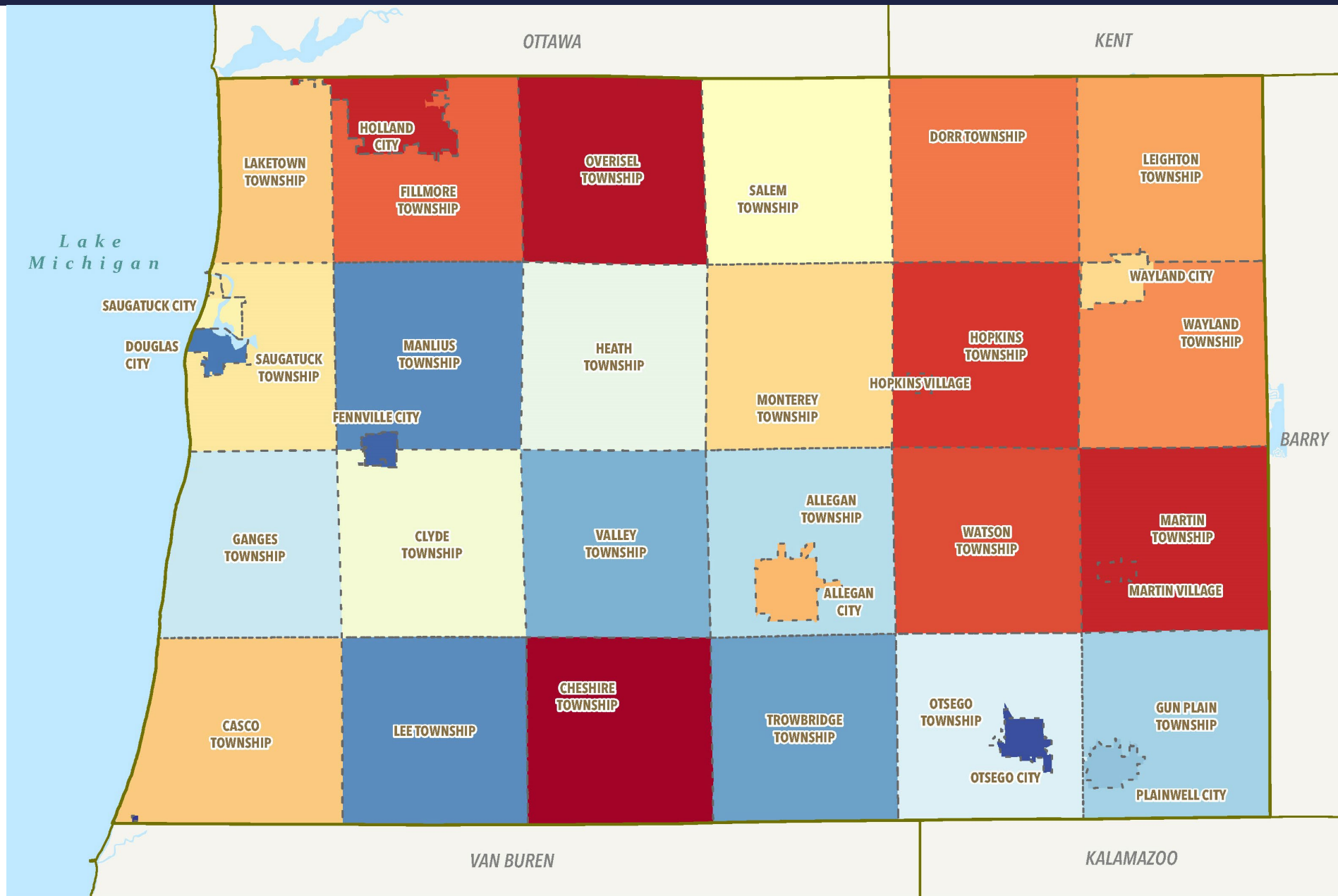
Non-Point Source contaminants with non-mandatory water quality standards, typically only influencing things like color, taste, and odor.

- **Chloride**: 250 mg/L
- **Iron**: 0.3 mg/L

Primary Non-Point Sources - Contamination Risk Map

Pollution Risk Index:
Sum of 50th and 75th percentiles normalized by substance specific MCL (nitrate, arsenic, lead)

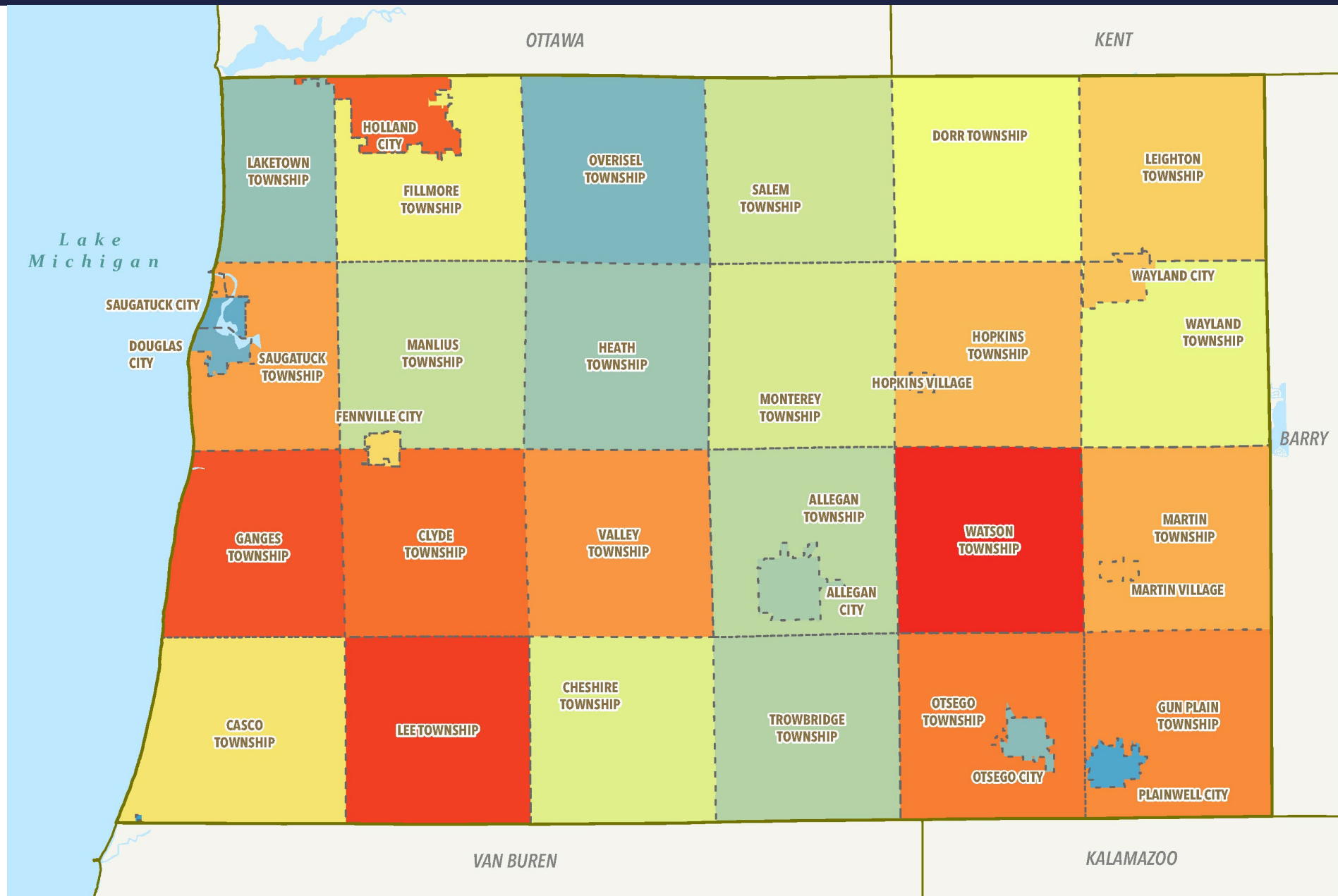
0	0.63
0.1	0.7
0.18	0.83
0.19	0.91
0.2	1
0.21	1.04
0.28	1.05
0.33	1.07
0.35	1.13
0.41	1.2
0.48	1.21
0.5	1.25
0.52	1.3
0.54	2.57
0.6	



Secondary Non-Point Sources - Contamination Risk Map

Pollution Risk Index:
Sum of 50th and 75th percentiles normalized by substance specific SMCL (chloride and iron)

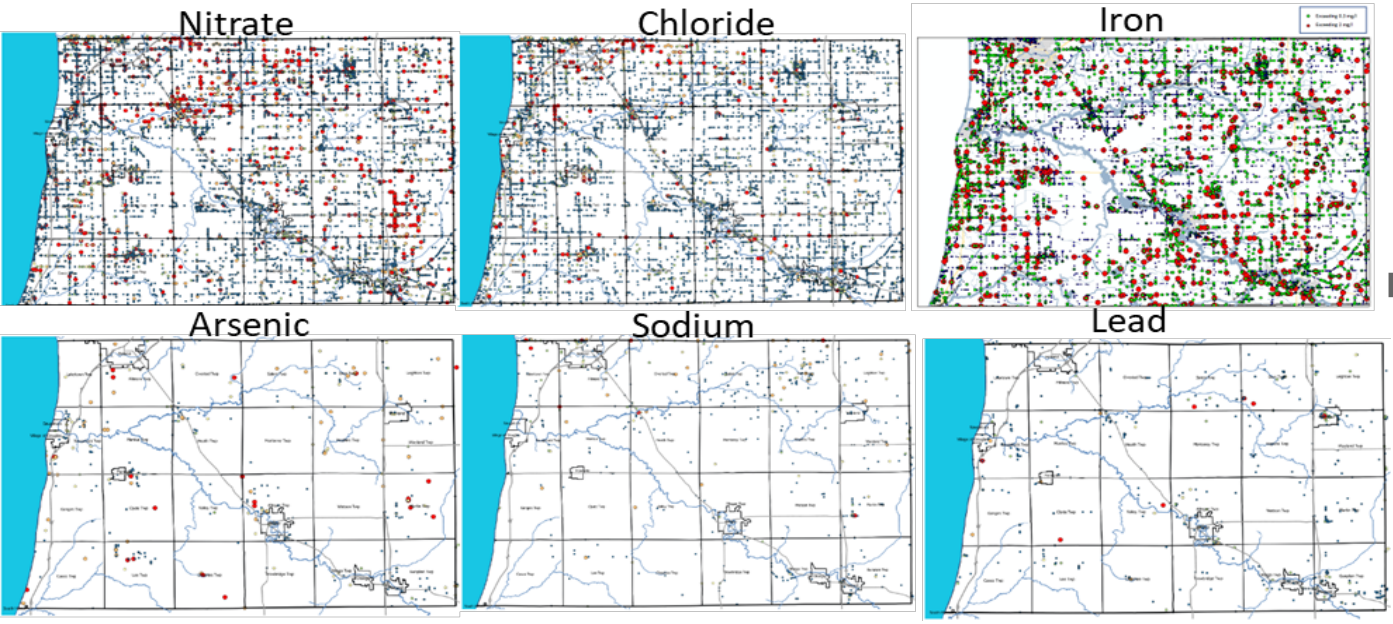
0	1.56	3.61
0.29	1.84	4.09
0.47	1.92	4.28
0.58	2.05	4.76
1.04	2.08	4.77
1.13	2.31	5.22
1.19	2.52	5.86
1.2	2.71	6.09
1.28	3.31	6.46
1.46	3.33	6.9
1.48	3.57	8.18



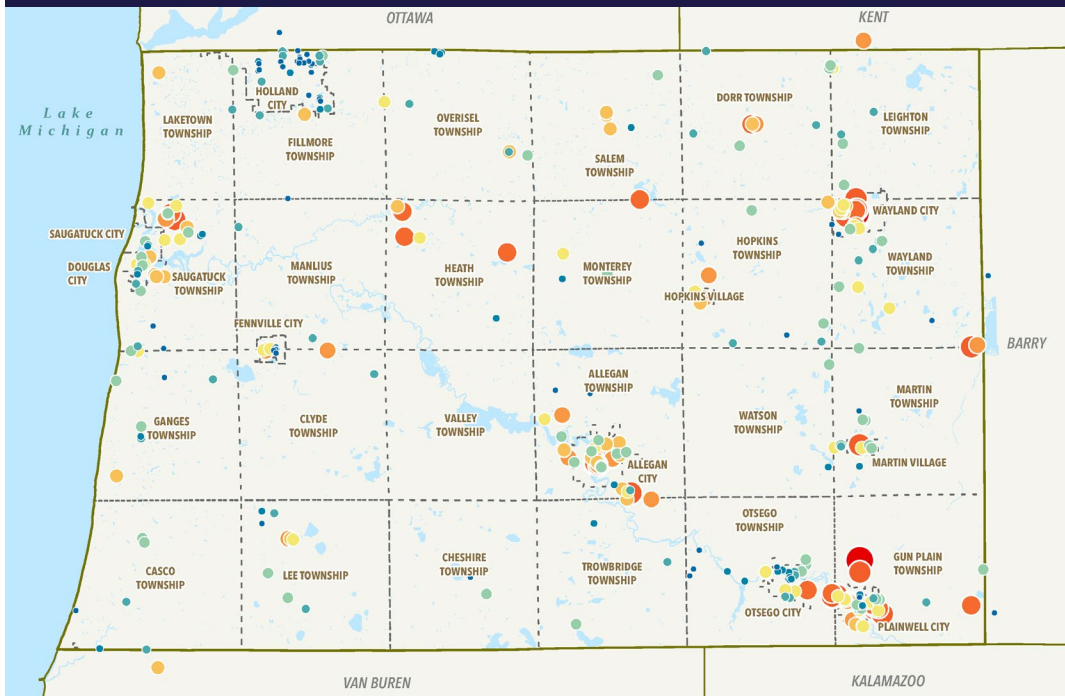
Groundwater Quality Risk Map

Composite Water Quality Risk Map Elements

Elevated Non-Point Source Concentrations



Point Source Risk Ranking Map



Composite Water Quality Risk Map Elements

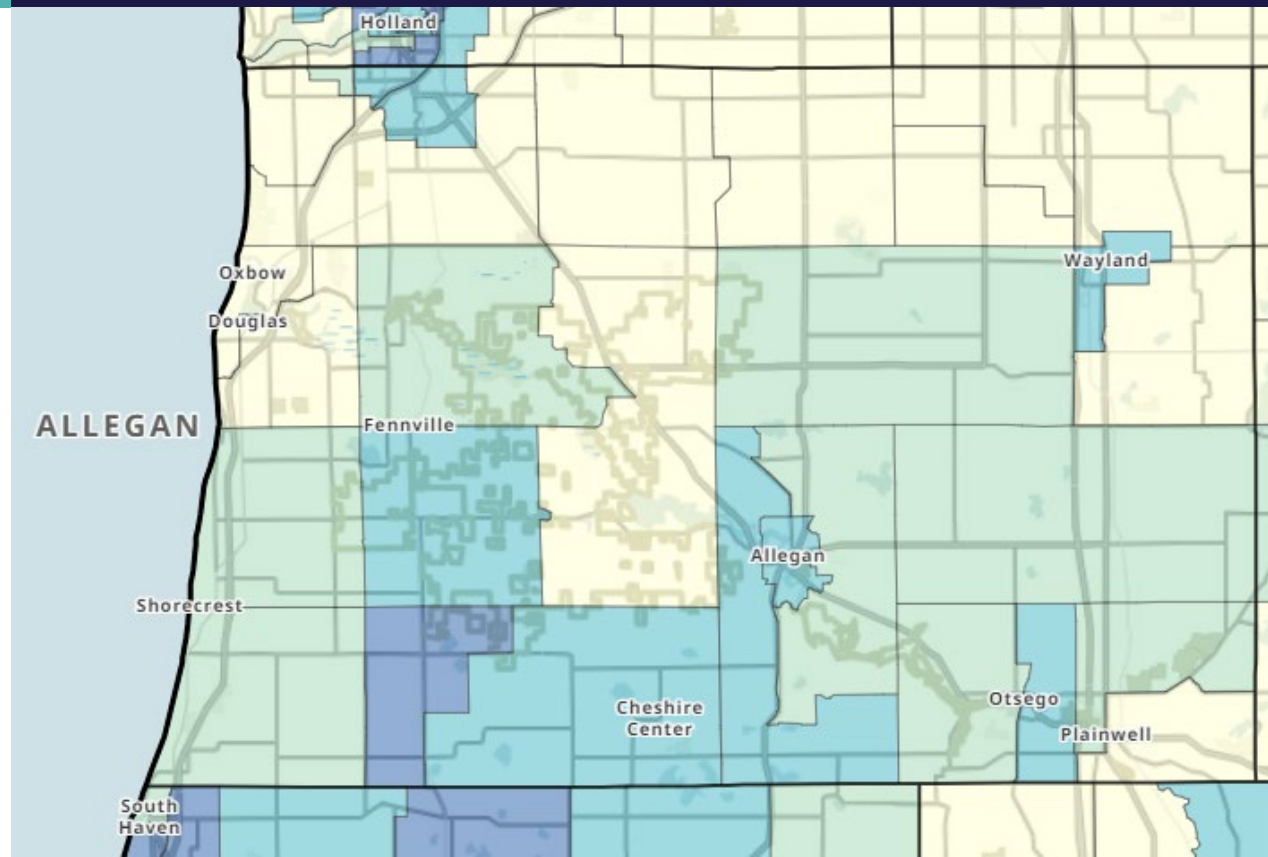
Assesses the potential negative effects on communities caused by external stresses on human health based on four themes:

- Socioeconomic Status
- Household Characteristics
- Racial & Ethnic Minority Status
- Housing Type & Transportation

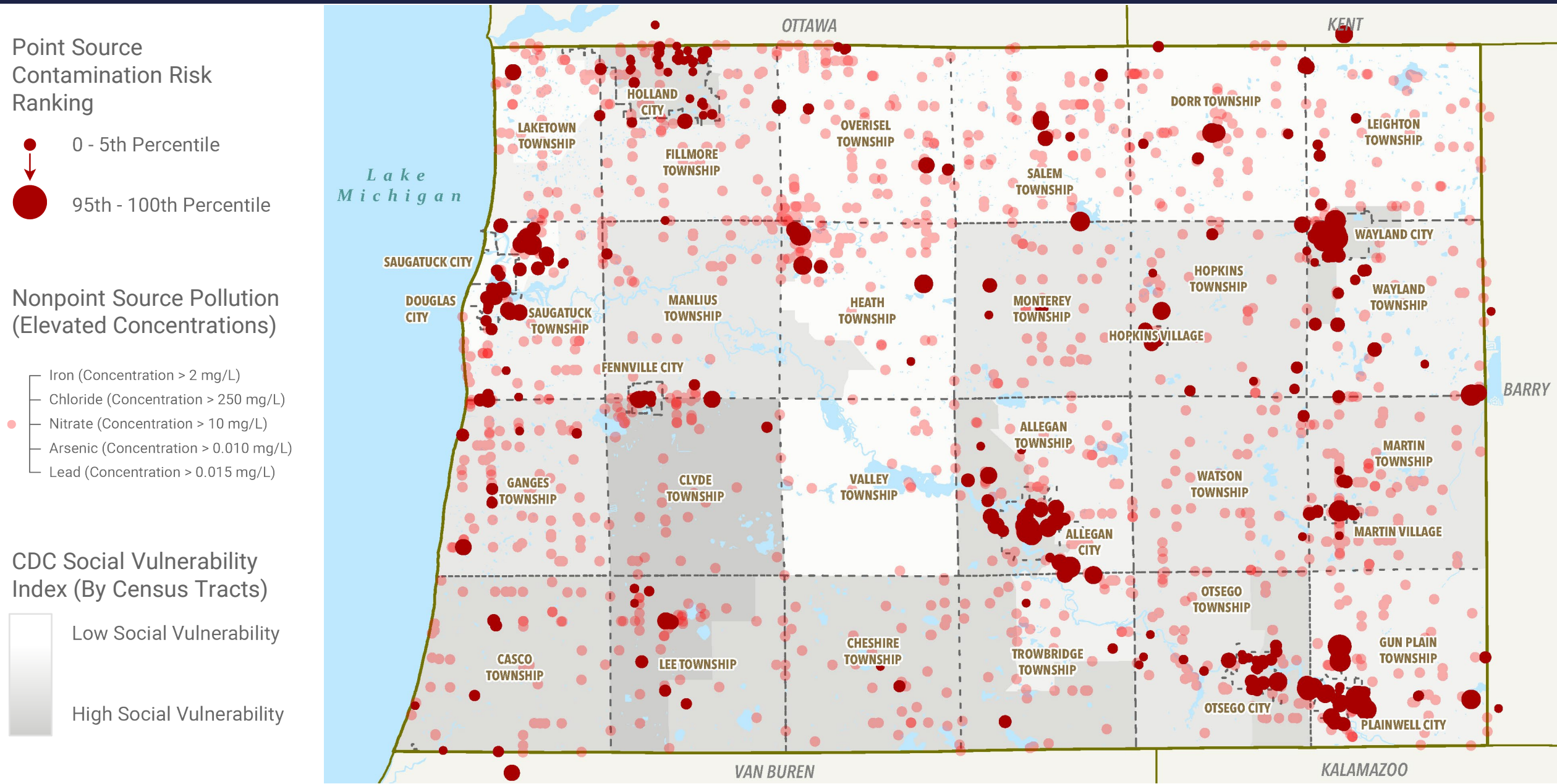
Level of Vulnerability

- Low
- Low-Medium
- Medium-High
- Med-High

CDC Social Vulnerability Index Overlay



Composite Water Quality Risk Map



Areas of Concern

Water Quality Risk Analysis

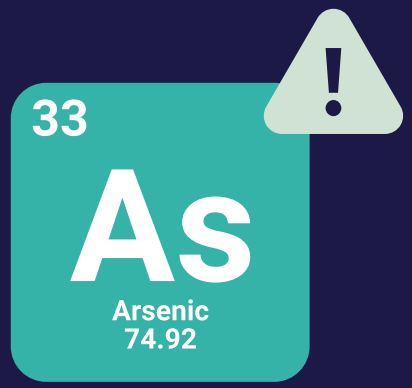
Point Source Pollution Risk

“Hot-spots” of point source water quality risk include:

The Cities of Wayland, Plainwell, Otsego, Saugatuck, Douglas, Allegan, and Allegan Township.

Areas of Concern

Water Quality Risk Analysis



Primary Non-Point Source Pollution Risk

(pollutants with adverse impacts to human health)

- Cheshire Township ranks highest in terms of Primary NPS Pollution Risk due to high arsenic concentrations, followed by Overisel Twp., City of Holland, Martin Twp., and Hopkins Twp.
- The townships of Watson, Fillmore, and Dorr also have high ranking Primary NPS Pollution Risk.

Areas of Concern

Water Quality Risk Analysis

Secondary Non-Point Source Pollution Risk

(pollutants influencing quality - color, taste, odor)

- Watson Township ranks highest in terms of secondary water quality severity index due to high iron concentrations followed by Lee, Ganges, City of Holland (relatively high iron and chloride concentrations), Clyde Township, and Otsego Township (high iron concentrations).
- The townships of Valley, Gunplain, Saugatuck, and Martine also have high ranking secondary water quality severity indexes.

Areas of Concern

Water Quality Risk Analysis

Monitoring and Testing

Water quality risk does not necessarily mean the water is contaminated today.

Given the prevalence of water quality risk across the County, routine testing is recommended.

HEALTH Department

Importance of Water Quality Testing

Routine testing is critical, given the risks identified throughout the County.

- Public suppliers test quarterly; private wells typically only tested before they are put into use (old or new wells)
- Contact local health department for help getting your groundwater tested (if private well owner)

HEALTH Department

Importance of Water Quality Testing

Options when a “bad” test result happens:

- Well treatment (e.g., chlorinating for bacteria)
- Consider additional treatment (at-home carbon filter, RO system)
- Change well location/depth
- Consider multi-source water use at home, for example:
    - Bottled water for drinking
    - Well water for bathing/washing