



UNIVERSITY OF WISCONSIN
OSHKOSH

Door County Well Monitoring Program - Fall 2024 Summary

UW OSHKOSH

ENVIRONMENTAL RESEARCH AND INNOVATION CENTER

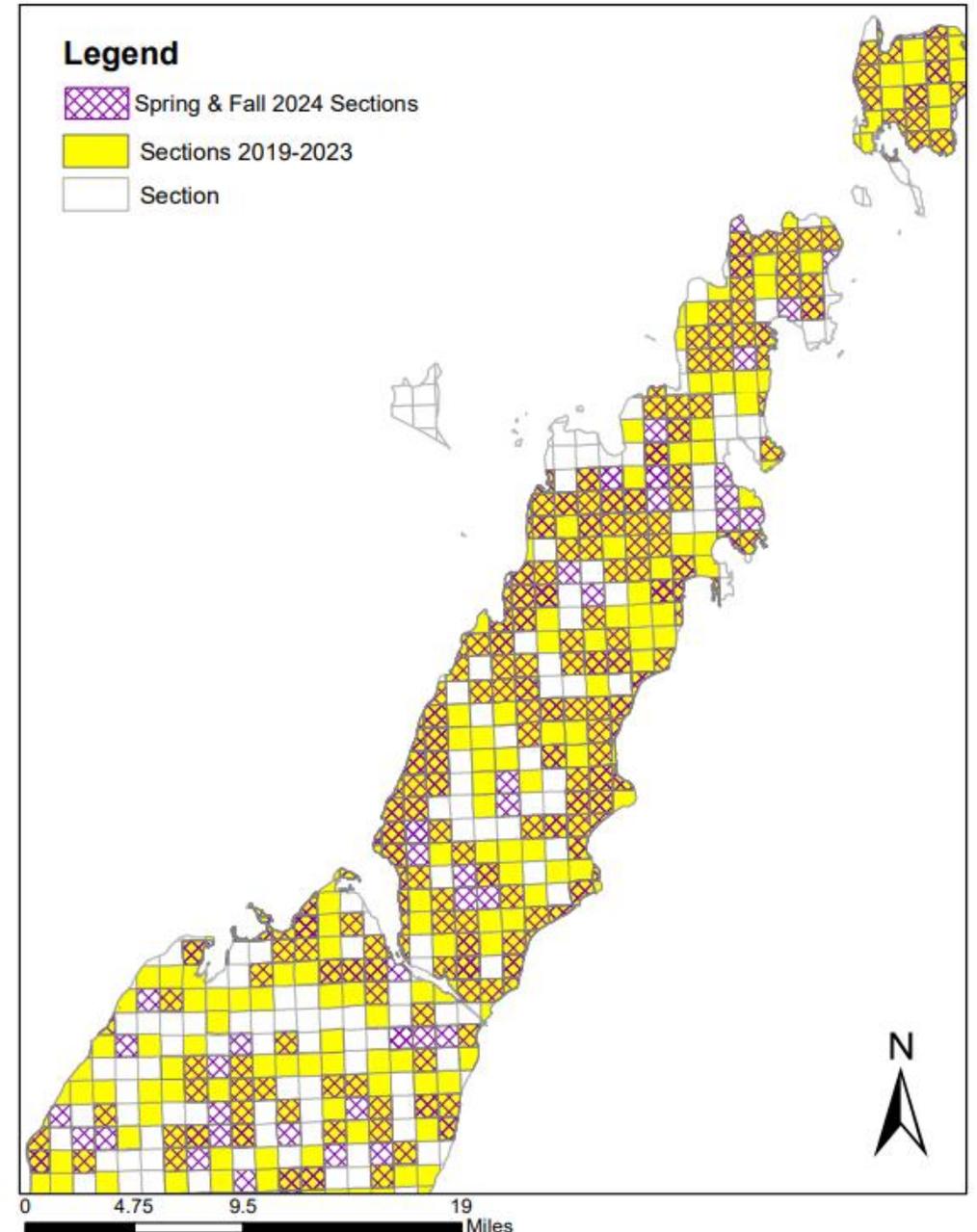
DECEMBER 2ND, 2024

Program Goals

- Provide continued education on water resources in Door County, WI
- Provide avenue for residents and guests to have the most accurate information on their drinking water quality
- Provide reliable information to guide county resources for the protection and maintenance of drinking water resources
- Be proactive with respect to drinking water resources, rather than reactive
- Create a groundwater water quality database for Door County
- Establish trends in groundwater data over time

Program Goals

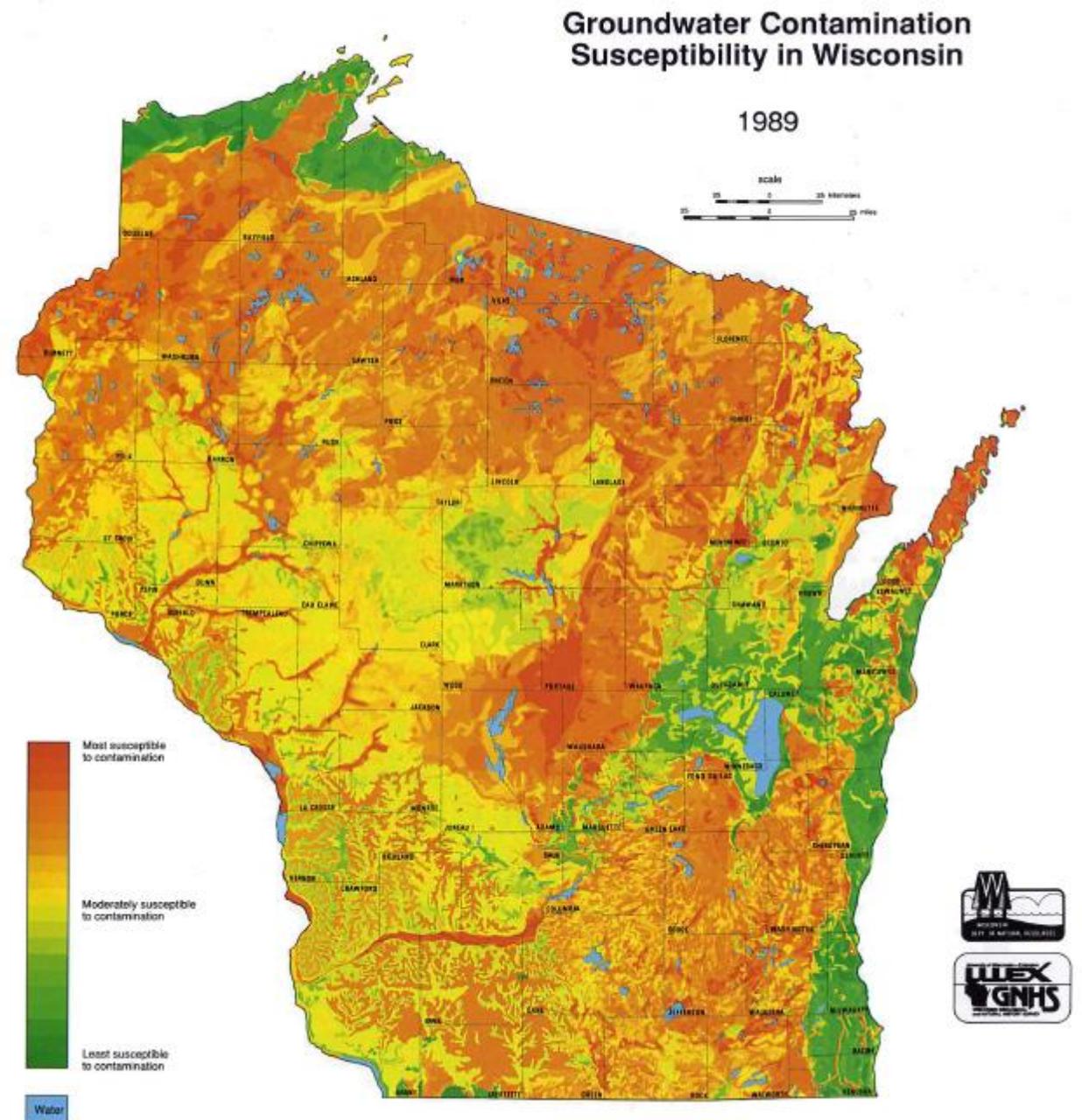
- Target is at least one well per section (square mile) of Door County
 - 40 new sections added in 2024!
 - 406 sections covered since 2019 – that's 62% of the county!
- Spatially distributed data to look for trends and relationships
 - Soil type
 - Depth to bedrock
 - Water table depth
 - Land use



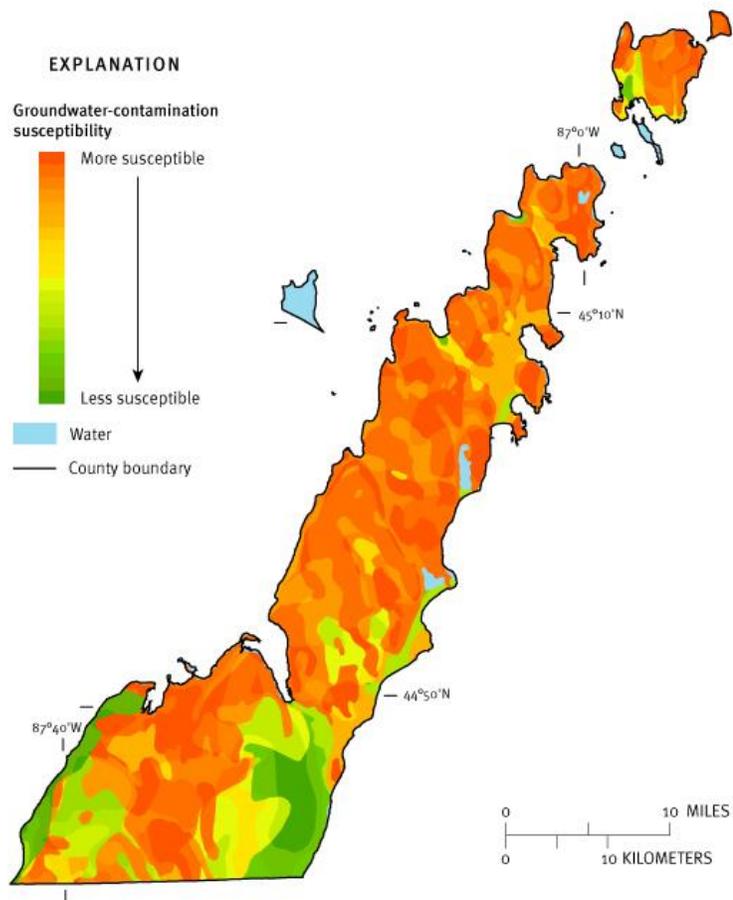
Karst Geology & Groundwater Susceptibility

Susceptibility

- Based on factors such as:
 - Bedrock depth
 - Soil type
 - Depth to water table



Door County – Groundwater-Contamination Susceptibility Analysis

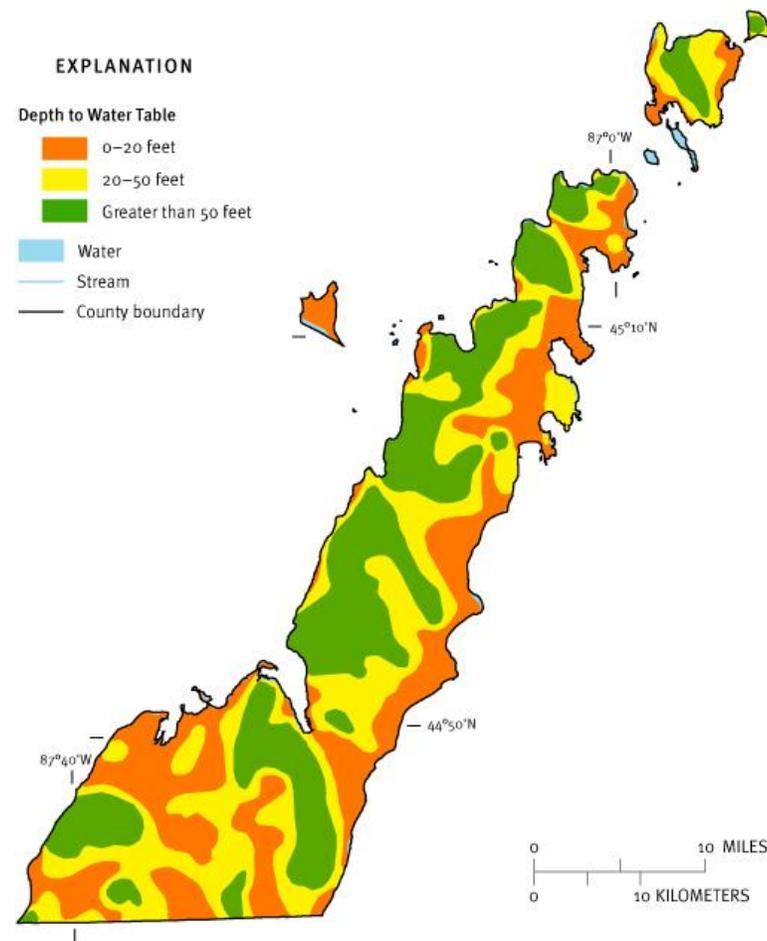


This groundwater-contamination susceptibility map is a composite of five resource characteristic maps, each of which was derived from generalized statewide information at small scales, and cannot be used for any site-specific purposes.

Map source: Schmidt, R.R., 1987, Groundwater contamination susceptibility map and evaluation: Wisconsin Department of Natural Resources, Wisconsin's Groundwater Management Plan Report 5, PUBL-WR-177-87, 27 p.

Figure created for the "Protecting Wisconsin's Groundwater Through Comprehensive Planning" web site, 2007, <http://wi.water.usgs.gov/gwcomp/>

Door County – Depth to Water Table



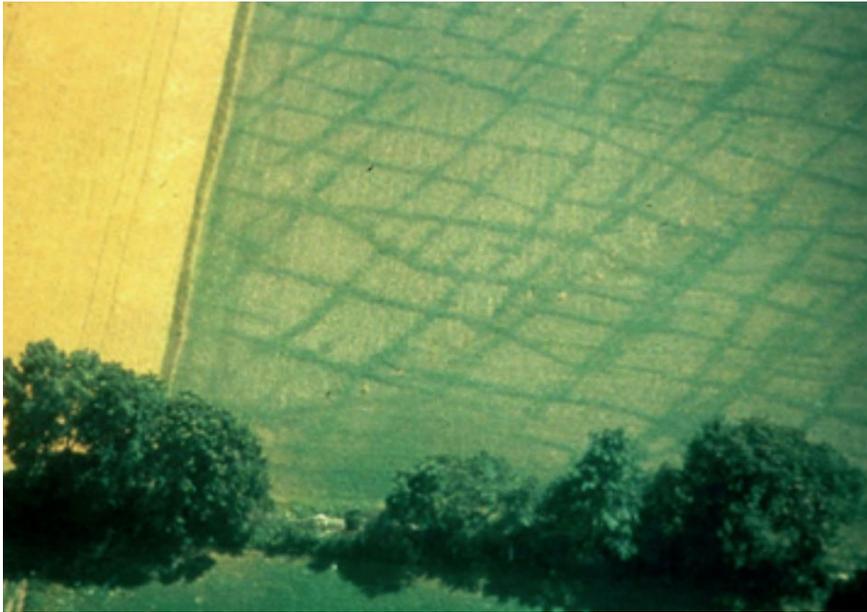
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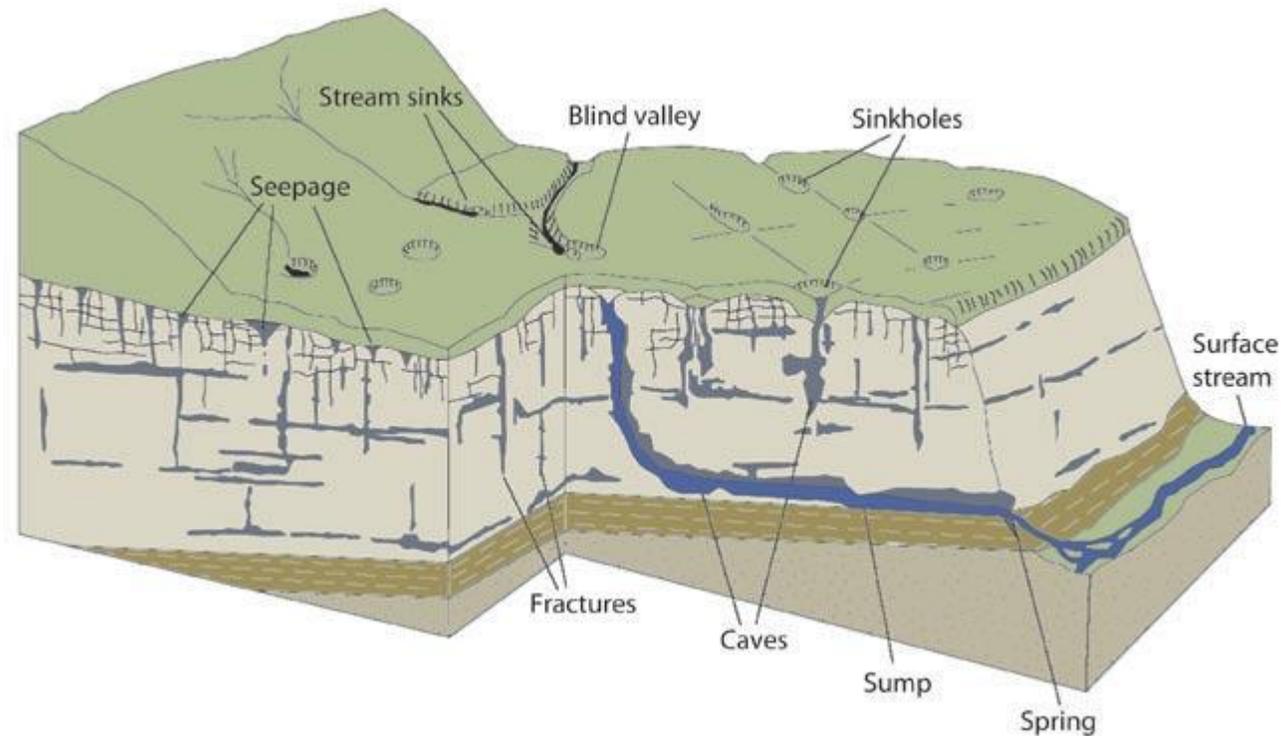
Figure created for the "Protecting Wisconsin's Groundwater Through Comprehensive Planning" web site, 2007, <http://wi.water.usgs.gov/gwcomp/>

What is Karst Geology?

- A landscape created when water dissolves rocks
- Made of dolomite and limestone

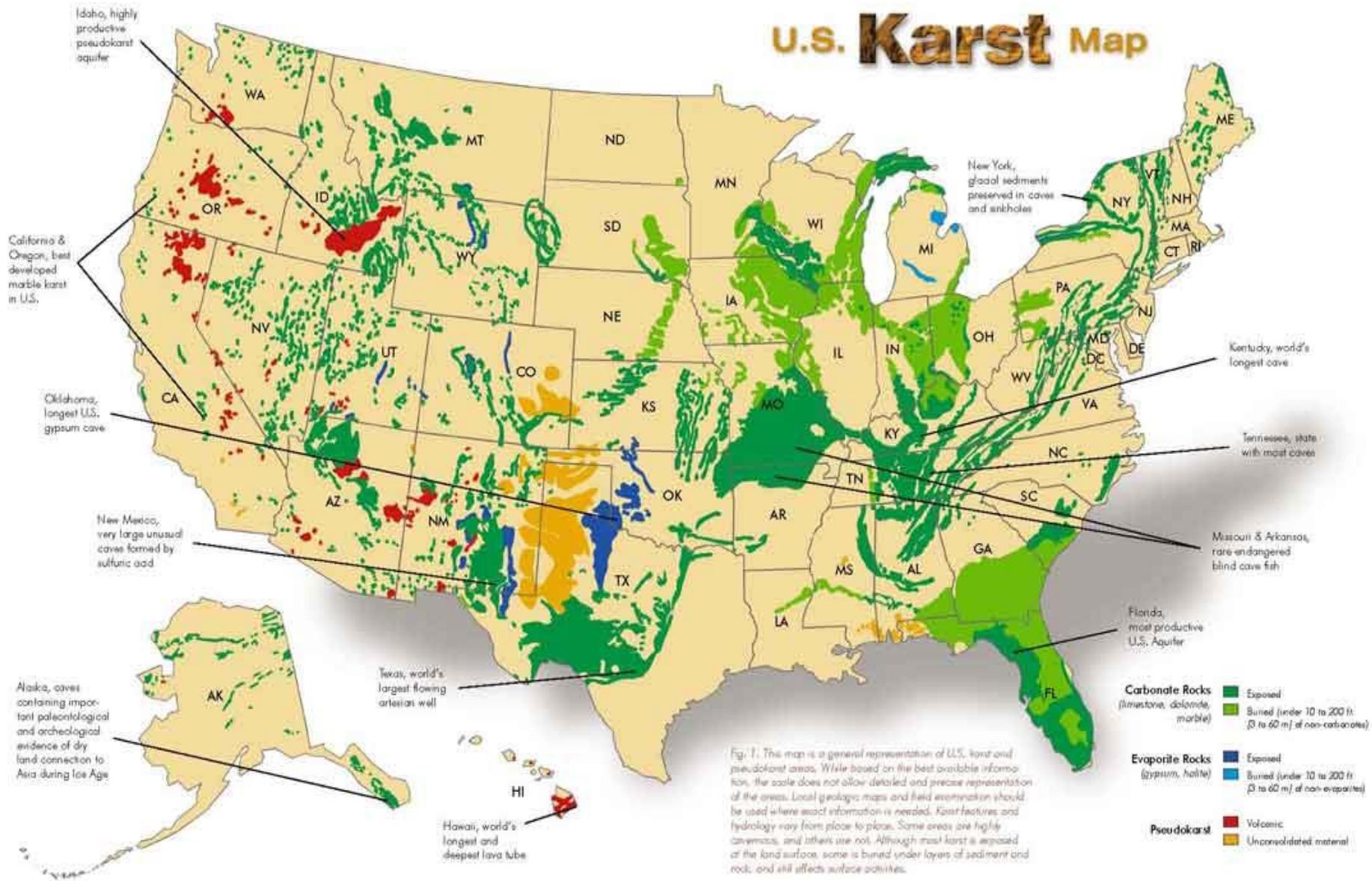


Karst Geology Impact on Groundwater



Karst Geology features as seen above create direct conduits to groundwater, where contaminants can easily make their way into our drinking water

U.S. Karst Map



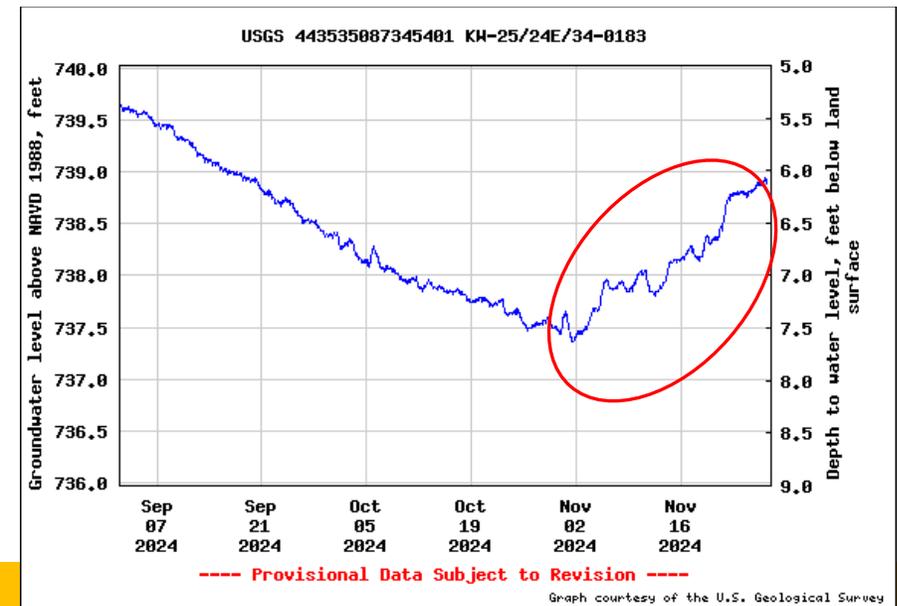


Groundwater Recharge

- Study design requires samples to be collected in a narrow window of time (within ~30 hours) – **but why?**
 - Reduce any variables in groundwater quality
 - Weather conditions
 - Groundwater conditions – dry period or recharge period
 - Greater effects with karst geology



— Groundwater level above navd 1988 — Period of provisional data
 — Period of approved data



Testing Parameters



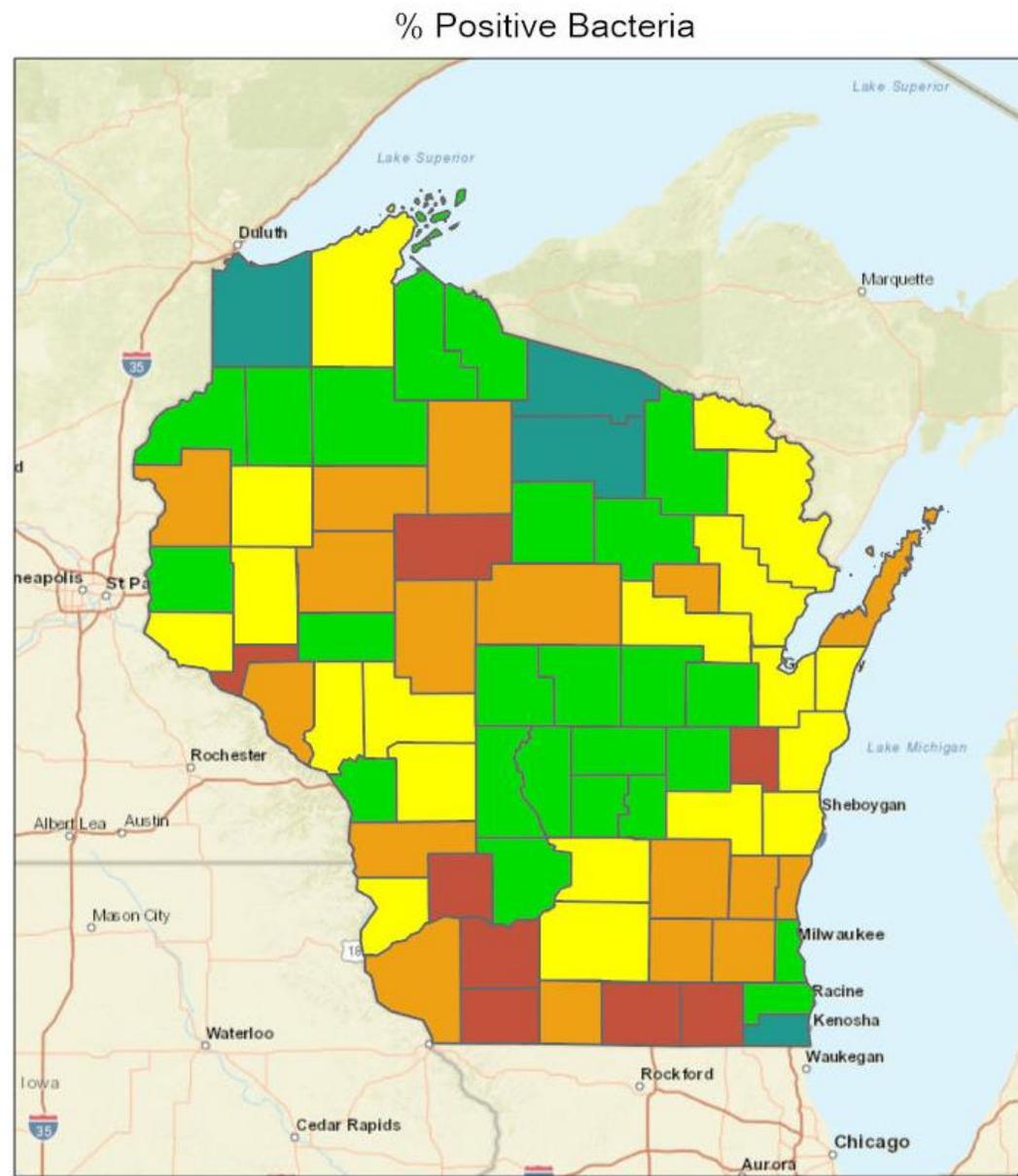
Bacteria

- Feces contain millions of microorganisms/gram
- Pathogens (disease-causing) usually found in low numbers
- Pathogens are more difficult than indicator organisms to recover and identify in the lab
- Pathogens can be bacteria (*E.coli*), viruses (Norovirus), or protozoans (*Cryptosporidium*)
- We look for fecal indicator organisms that “indicate” that a recent contamination has occurred (which suggests that pathogens also are likely present)



Bacteriological contamination in private wells throughout Wisconsin – percent positive by county

-Can be caused by several factors



November 26, 2019

Bacteria - Percent - Positive by County

5.1% - 10%

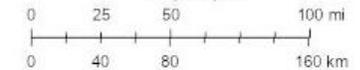
10.1% - 15%

15.1% - 20%

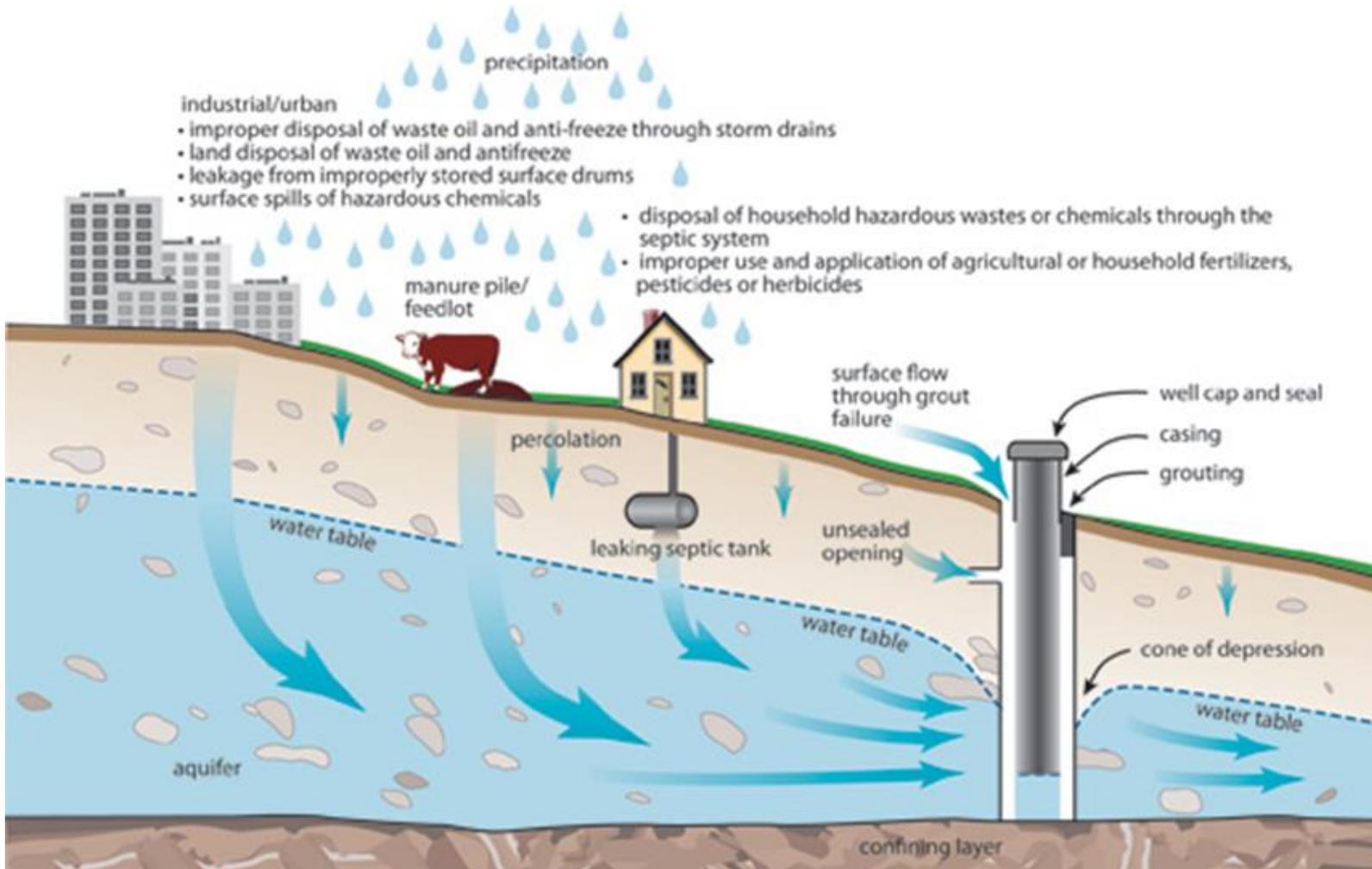
20.1% - 25%

25.1% - 30%

1:4,622,324



Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, ...

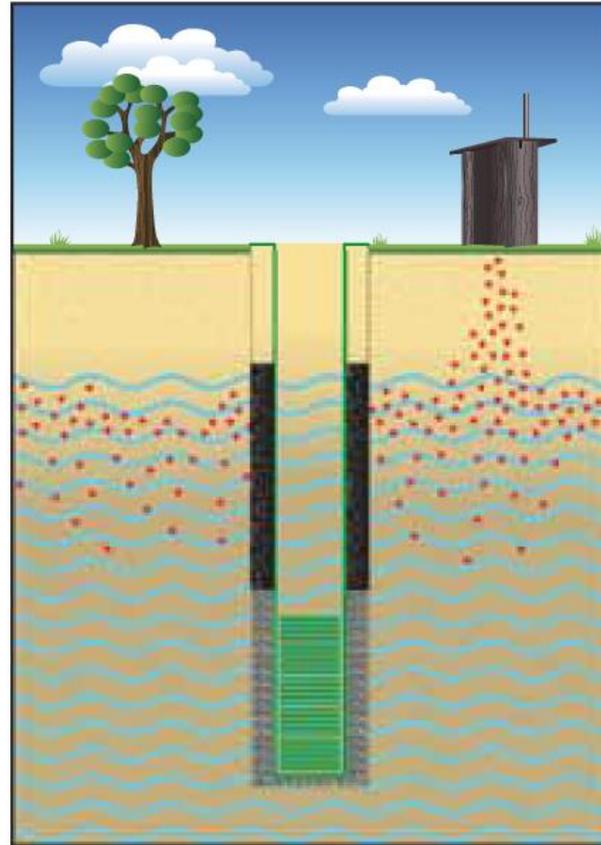


Sources of Bacteria

Sources of Bacteria

- Sources

- Improperly constructed well
- Older or damaged well
- Distribution system issue (cracked pipe, dead end, etc)
- Outside source of bacteria (agriculture, animal waste, human waste)

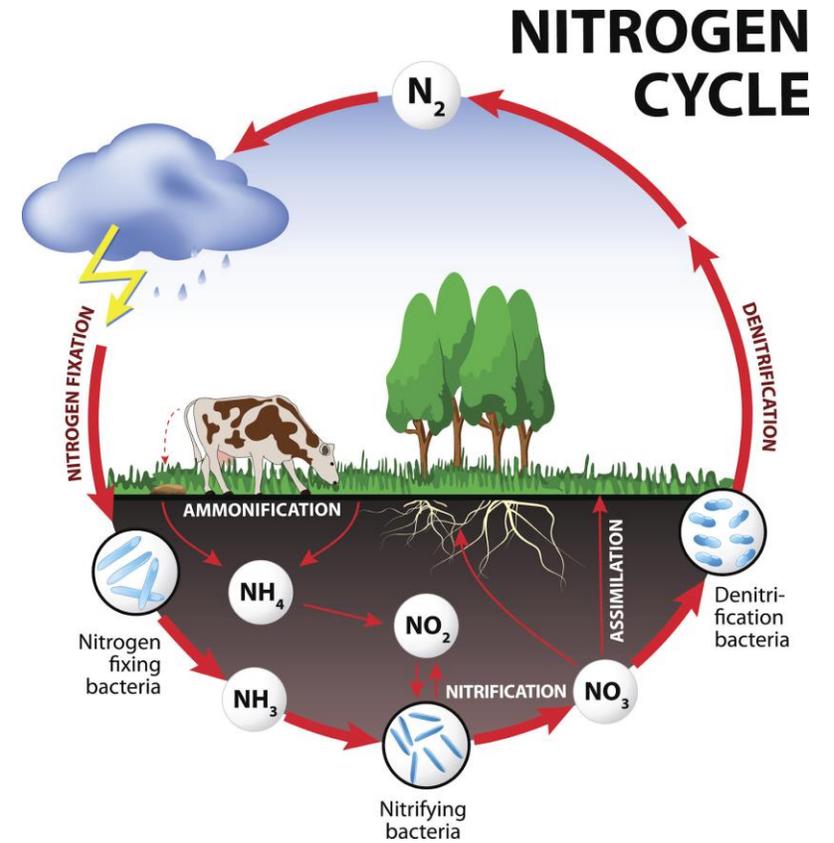


Sanitary Well



Nitrate

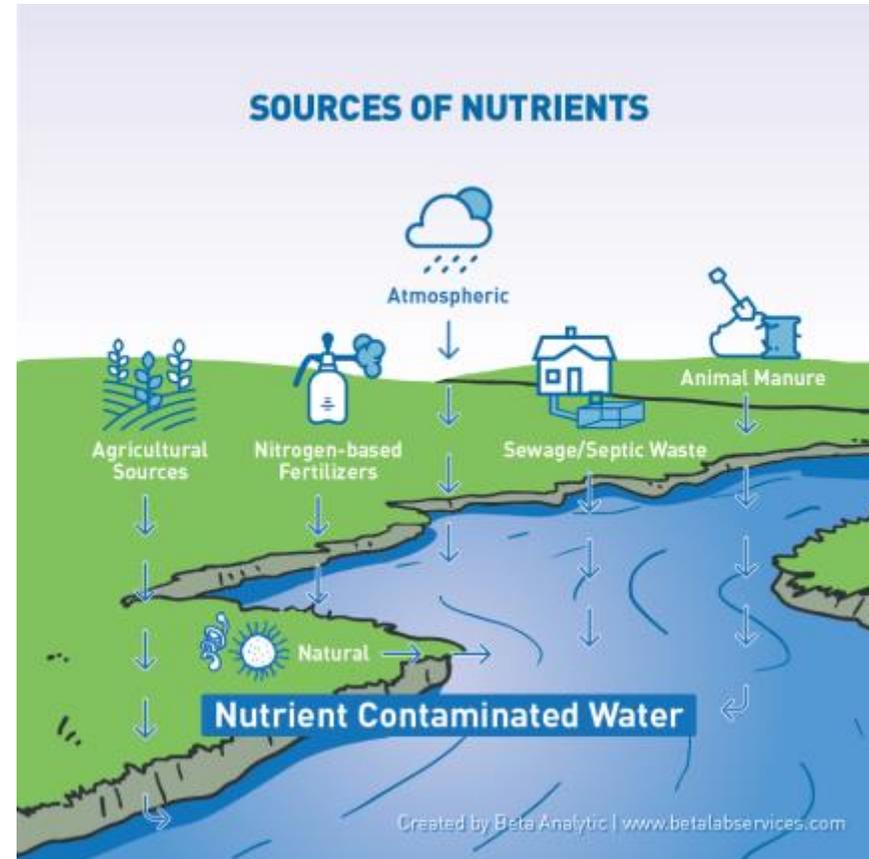
- Formed when nitrogen combines with oxygen in water
- Soluble – commonly found in runoff



Nitrate

- Sources

- Agriculture (manure and/or fertilizer)
- Sewage/Septic
- Animal waste
- Atmospheric (trace amounts)
- Lawn care (fertilizer)
- Very low naturally occurring nitrate



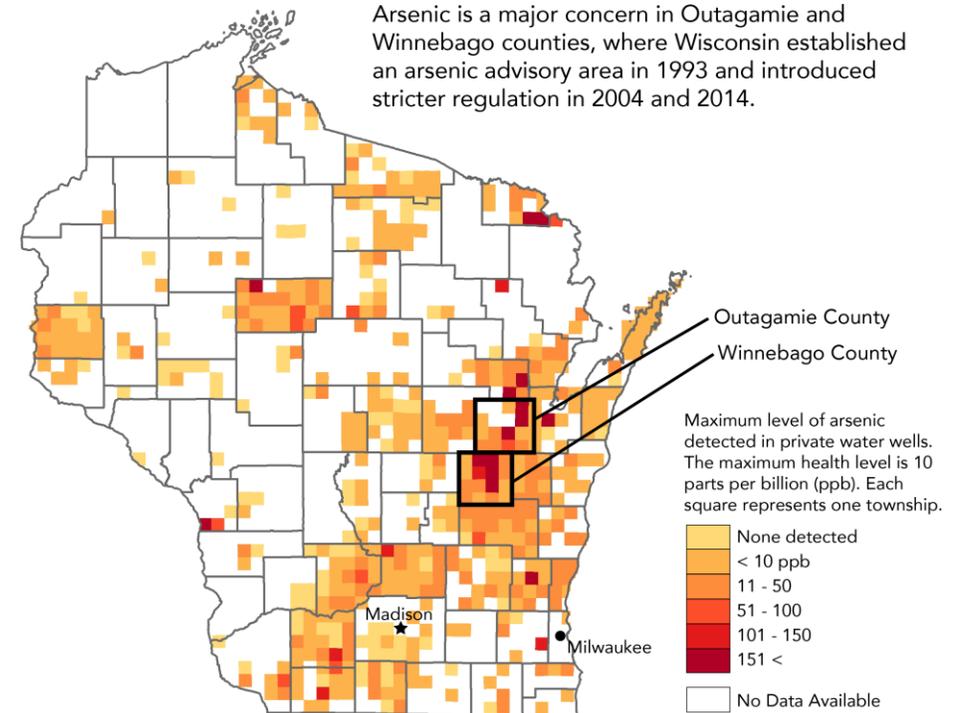
Arsenic

- Sources

- Most naturally occurring in bedrock
- Lead arsenate pesticides were used in orchards from 1890s-1960s (binds to soil, does not usually migrate into groundwater)

Arsenic contamination persists in groundwater

Arsenic is a major concern in Outagamie and Winnebago counties, where Wisconsin established an arsenic advisory area in 1993 and introduced stricter regulation in 2004 and 2014.



CREDIT: Katie Kowalsky/Wisconsin Center for Investigative Journalism

SOURCES: Well Water Quality Viewer, University of Wisconsin-Stevens Point's Center for Watershed Science and Education; Wisconsin Department of Natural Resources "Arsenic in Drinking Water" brochure.

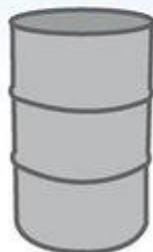
Interpreting Results



How much is one part per ...

million (ppm)

milligrams/liter (mg/L)



= three drops added to a
42-gallon barrel

billion (ppb)

micrograms/liter ($\mu\text{g/L}$)



length = 35 feet, diameter = 8 feet

= one drop added to
a large tanker truck

quadrillion (ppq)

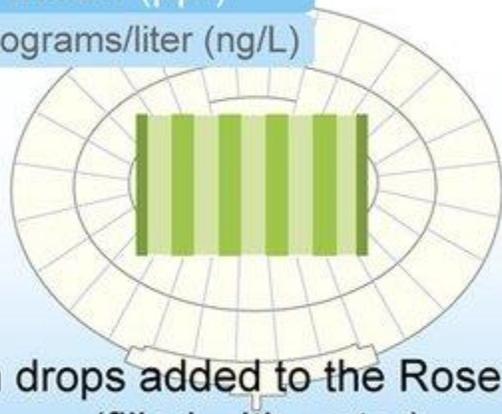
picograms/liter (pg/L)



*Area = 1000 sq mi
Average depth = 13 ft*

trillion (ppt)

nanograms/liter (ng/L)



= ten drops added to the Rose Bowl
(filled with water)

= two teaspoons added to the
Great Salt Lake of Utah

What's considered unsafe?

Parameter	Maximum Contaminant Level (MCL)	"Unsafe" Levels*
Total Coliform	0 MPN/100 mL	> 0 MPN/100 mL
<i>E. coli</i>	0 MPN/100 mL	> 0 MPN/100 mL
Nitrate	10 mg/L	> 10 mg/L
Arsenic	10 µg/L	> 10 µg/L
* "Unsafe" Levels refers to samples that exceed the MCL		

Safe Drinking Water Act (SDWA) sets these thresholds for public health.

Interpreting Results

BACTERIA

- Tested for presence of Coliform and *E. coli* bacteria
- A negative or “0” result: there is no bacteria present in the sample and it is safe to drink
- A positive or any number: bacteria is present in the sample, and it is unsafe to drink

NITRATE

- “ND”: nitrate was not detected in the sample; water is safe to drink
- Between 0-9.9 mg/L: nitrate was detected in the “safe” range
- Over 10 mg/L: nitrate was detected over the “safe” range, water is unsafe to drink

Interpreting Results

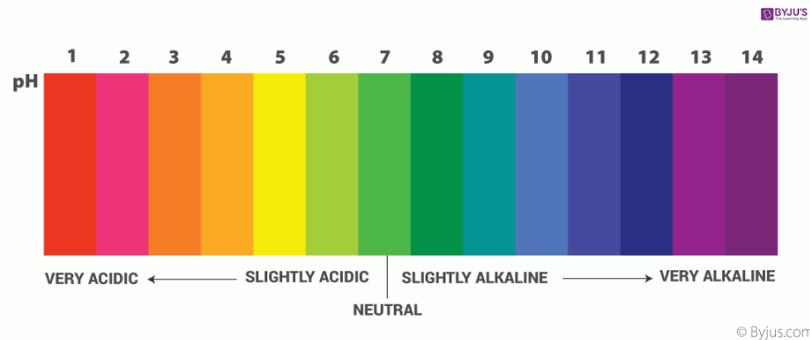
ARSENIC

- ND: arsenic was not detected in the sample
- Between 0-10 $\mu\text{g/L}$: arsenic was detected in the “safe” range
- Over 10 $\mu\text{g/L}$: arsenic was detected over the “safe” range

Interpreting Results

CUMULATIVE

pH: measure of the acid-base balance. Carbon dioxide concentration & increase in temperature can decrease pH of water.



Iron: a metal element that makes up 5% of the earth's crust. Iron is not considered hazardous to health. Recommended level is less than 0.3 mg/L

Hardness: water's ability to react with soap and produce a lather. Caused by ions such as calcium and magnesium. Not considered hazardous to health. Hard water can cause lime buildup/scaling on plumbing fixtures.

Water Hardness Scale		
Grains/Gal	mg/L & ppm	Classification
Less than 1	Less than 17.1	Soft
1 – 3.5	17.1 - 60	Slightly Hard
3.5 - 7	60 - 120	Moderately Hard
7 - 10	120 - 180	Hard
Over 10	Over 180	Very Hard

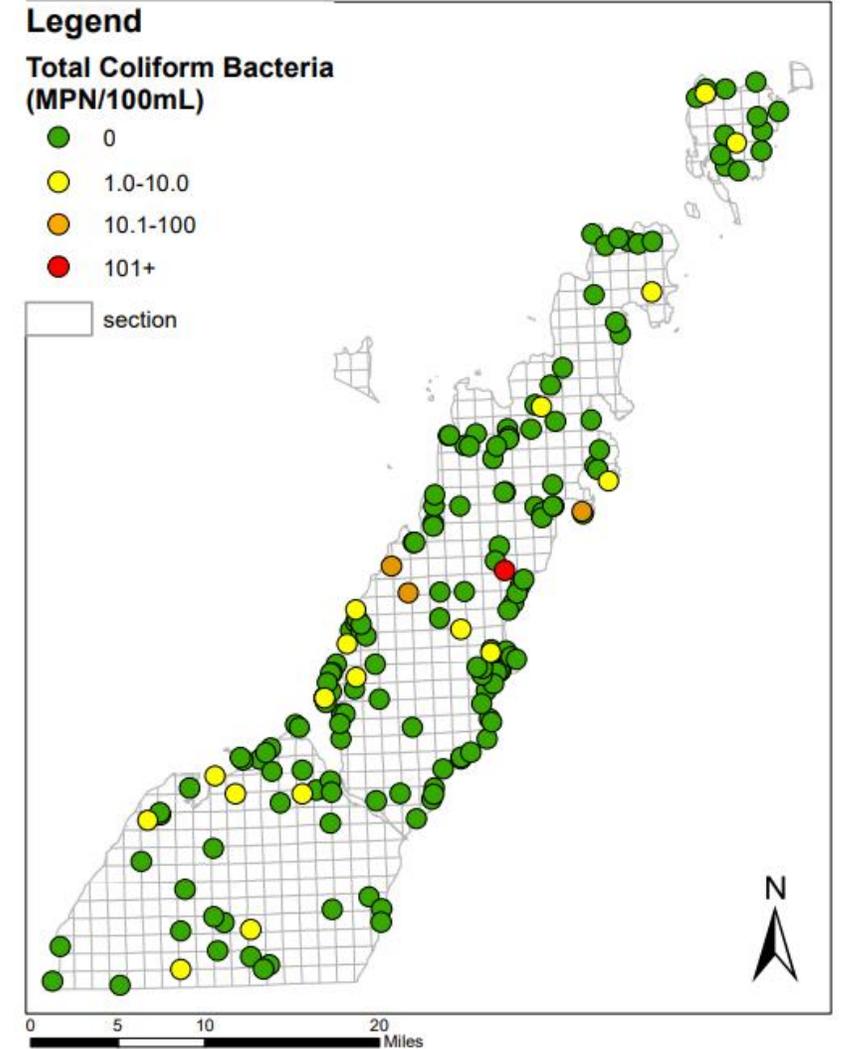
Alkalinity: water's ability to neutralize acids. Can be affected by natural deposits in the earth and industrial practices. It is not considered to be hazardous to health. Recommended level is between 75-200 mg/L

Fall 2024 Results



Coliform Bacteria

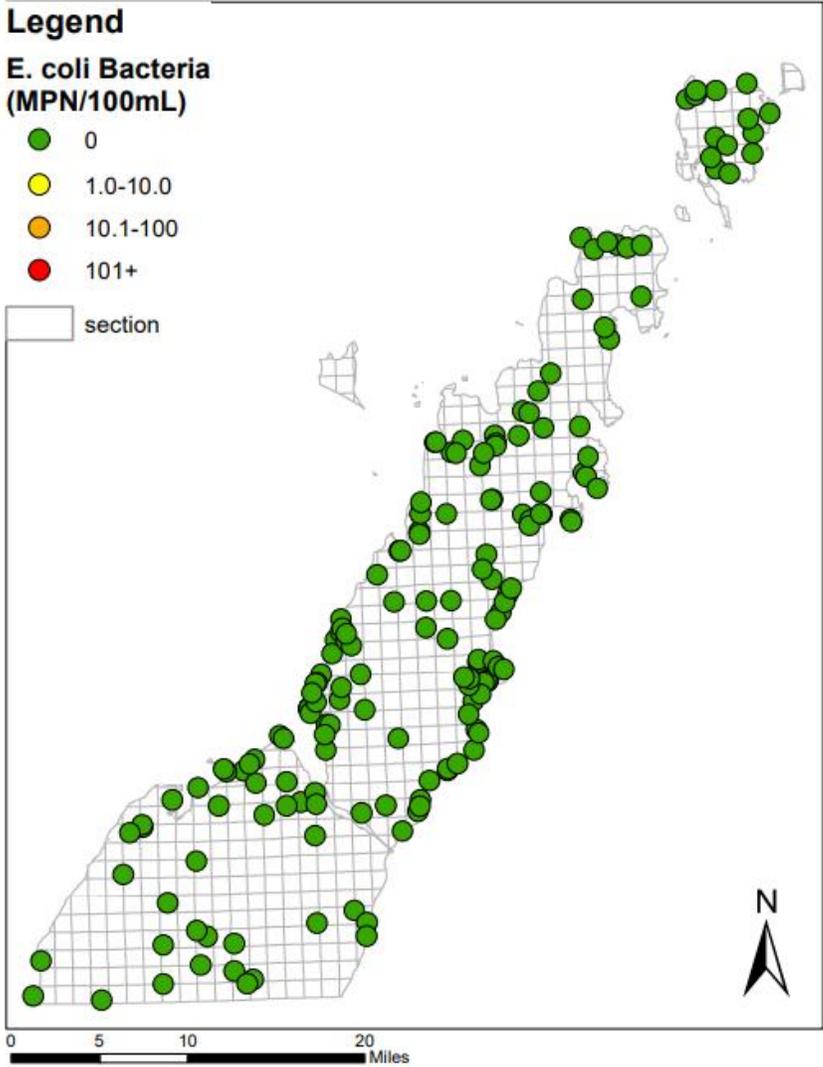
Fall 2024		
Coliform Result (MPN/100 mL)	# Samples	% Samples
0	161	88
1-10	17	9
10-100	3	2
100+	1	1
n=182		



Door County Well Program Fall 2024
 E.coli Bacteria (MPN/100mL)

E. Coli Bacteria

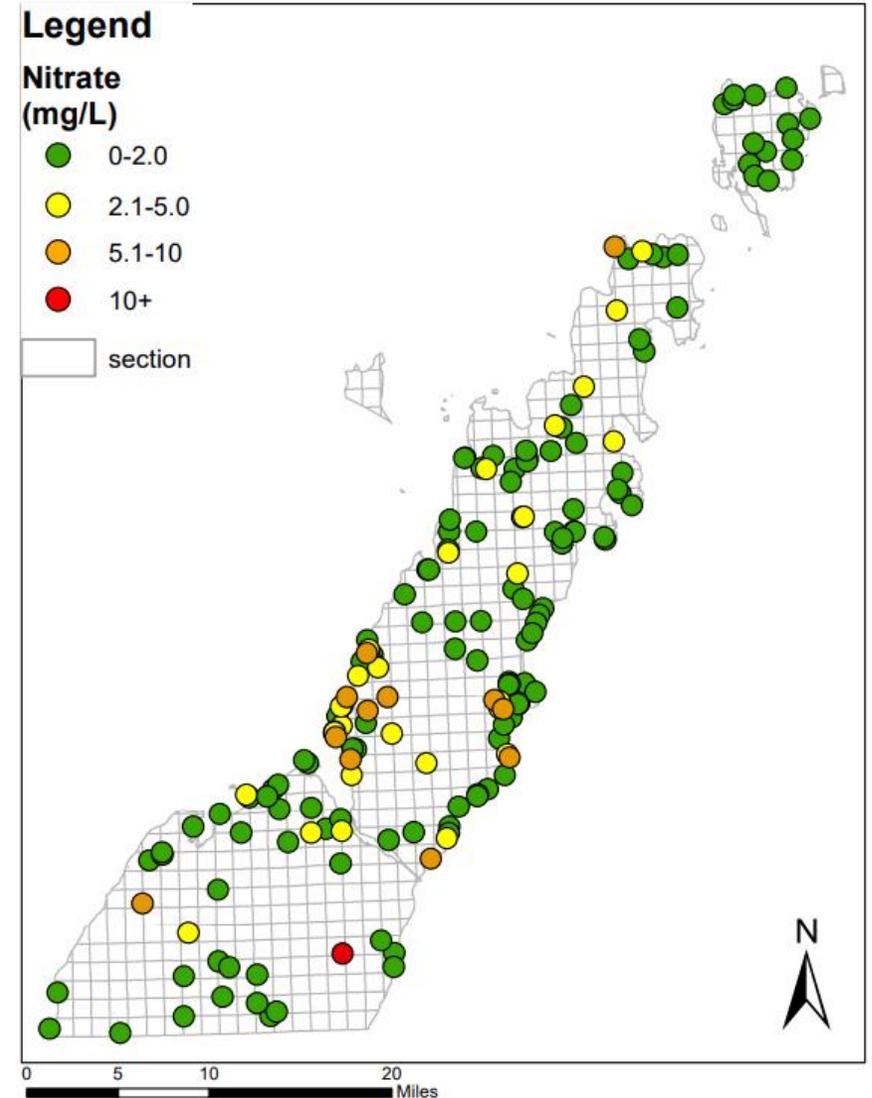
Fall 2024		
<i>E coli</i> Result (MPN/100 mL)	# Samples	% Samples
0	182	100
1-10	0	0
10-100	0	0
100+	0	0
n=182		



Door County Well Program Fall 2024
Nitrate (mg/L)

Nitrate

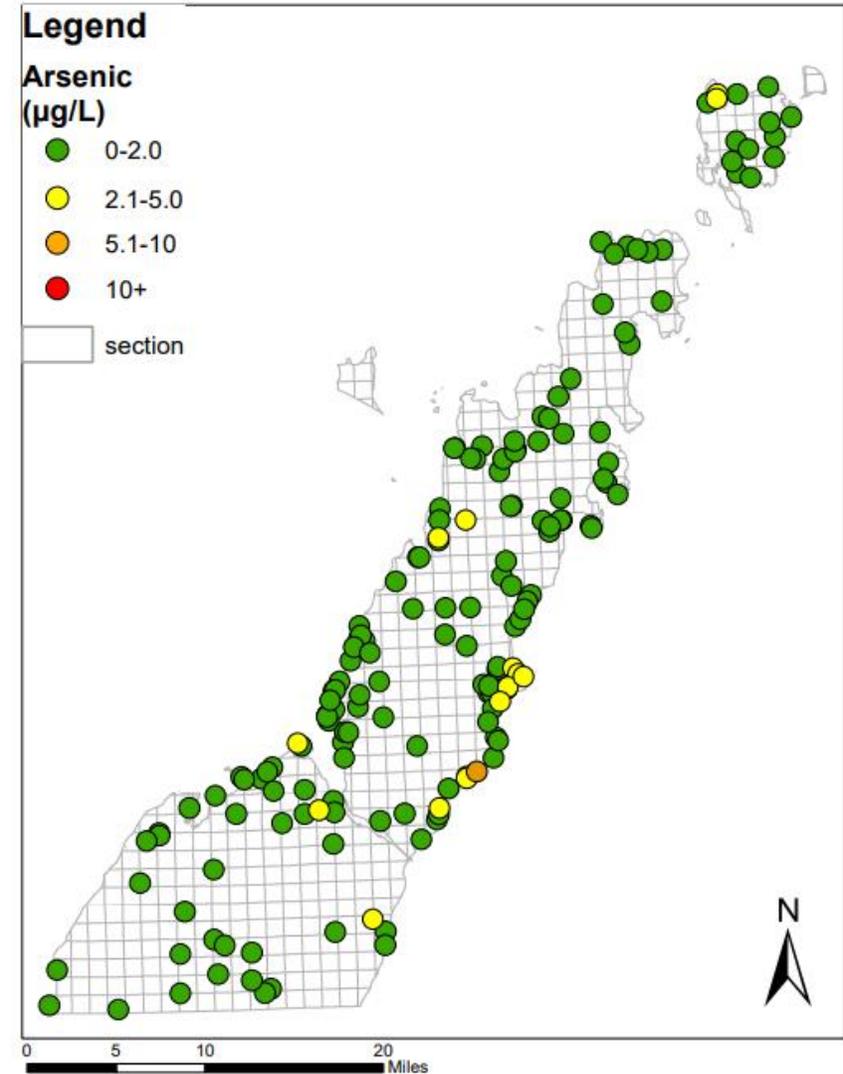
Fall 2024		
Nitrate Result (mg/L)	# Samples	% Samples
Less than 2	136	76
2-5	31	17
5-10	12	7
10+	1	1
n=180		



Arsenic

Fall 2024		
Arsenic Result ($\mu\text{g/L}$)	# Samples	% Samples
Less than 2	126	89
2-5	15	11
5-10	1	1
10+	0	0
n=142		

Door County Well Program Fall 2024
Arsenic ($\mu\text{g/L}$)



Previous Data - Coliform



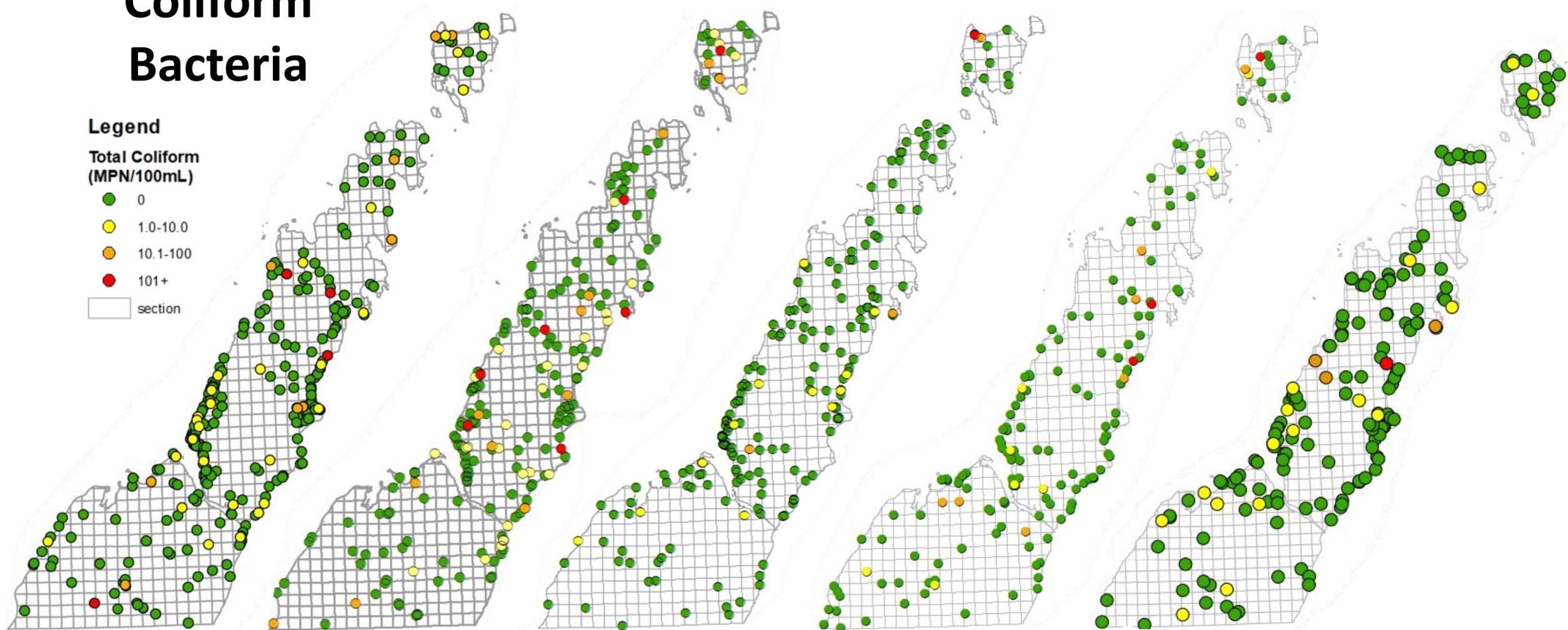
Fall 2020- 2024 Coliform Bacteria

Legend

Total Coliform
(MPN/100mL)

- 0
- 1.0-10.0
- 10.1-100
- 101+

□ section



2020

2021

2022

2023

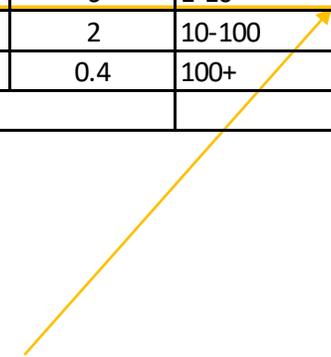
2024

Coliform Bacteria

2019			2020			2021			2022 (Spring + Fall)			2023 (Spring + Fall)		
Coliform Result (MPN/100 mL)	# Samples	% Samples	Coliform Result (MPN/100 mL)	# Samples	% Samples	Coliform Result (MPN/100 mL)	# Samples	% Samples	Coliform Result (MPN/100 mL)	# Samples	% Samples	Coliform Result (MPN/100 mL)	# Samples	% Samples
0	125	84	0	254	86	0	166	76	0	414	91	0	328	92
1-10	15	10	1-10	28	9	1-10	30	14	1-10	28	6	1-10	18	5
10-100	6	4	10-100	9	3	10-100	14	6	10-100	11	2	10-100	7	2
100+	2	1	100+	4	1	100+	7	3	100+	2	0.4	100+	4	1
n=148			n=295			n=217			n=456			n=357		

Spring 2024			Fall 2024		
Coliform Result (MPN/100 mL)	# Samples	% Samples	Coliform Result (MPN/100 mL)	# Samples	% Samples
0	216	96	0	161	88
1-10	5	2	1-10	17	9
10-100	3	1	10-100	3	2
100+	0	0	100+	1	1
n=224			n=182		

Potential sampling errors? (Sample faucets must be properly disinfected)



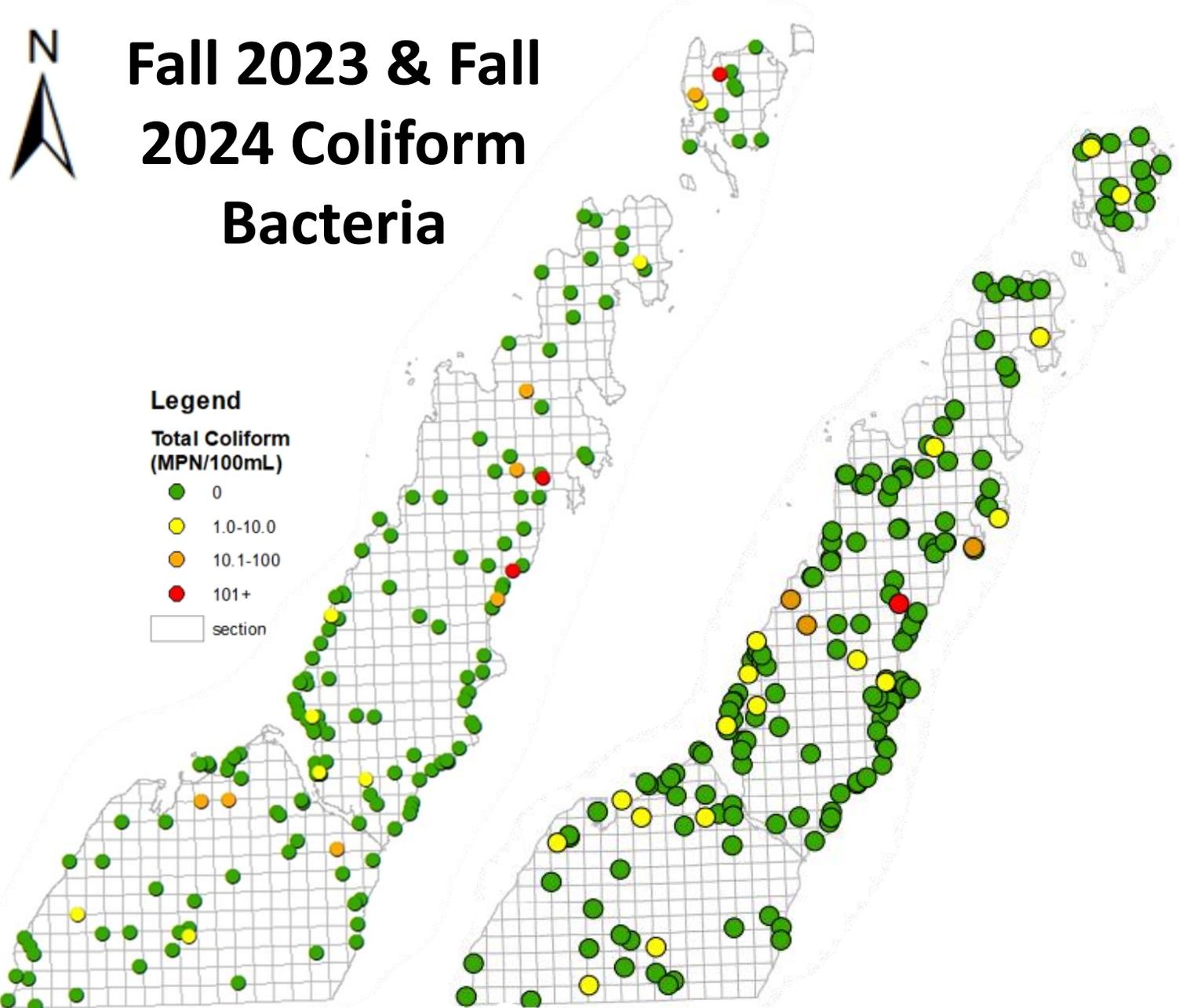


Fall 2023 & Fall 2024 Coliform Bacteria

Legend

Total Coliform (MPN/100mL)

- 0
- 1.0-10.0
- 10.1-100
- 101+
- section



Fall 2023		
Coliform Result (MPN/100 mL)	# Samples	% Samples
0	143	88
1-10	9	6
10-100	7	4
100+	3	2
n=162		

Fall 2024		
Coliform Result (MPN/100 mL)	# Samples	% Samples
0	161	88
1-10	17	9
10-100	3	2
100+	1	1
n=182		

Fall 2023

Fall 2024

Previous Data – *E. coli*



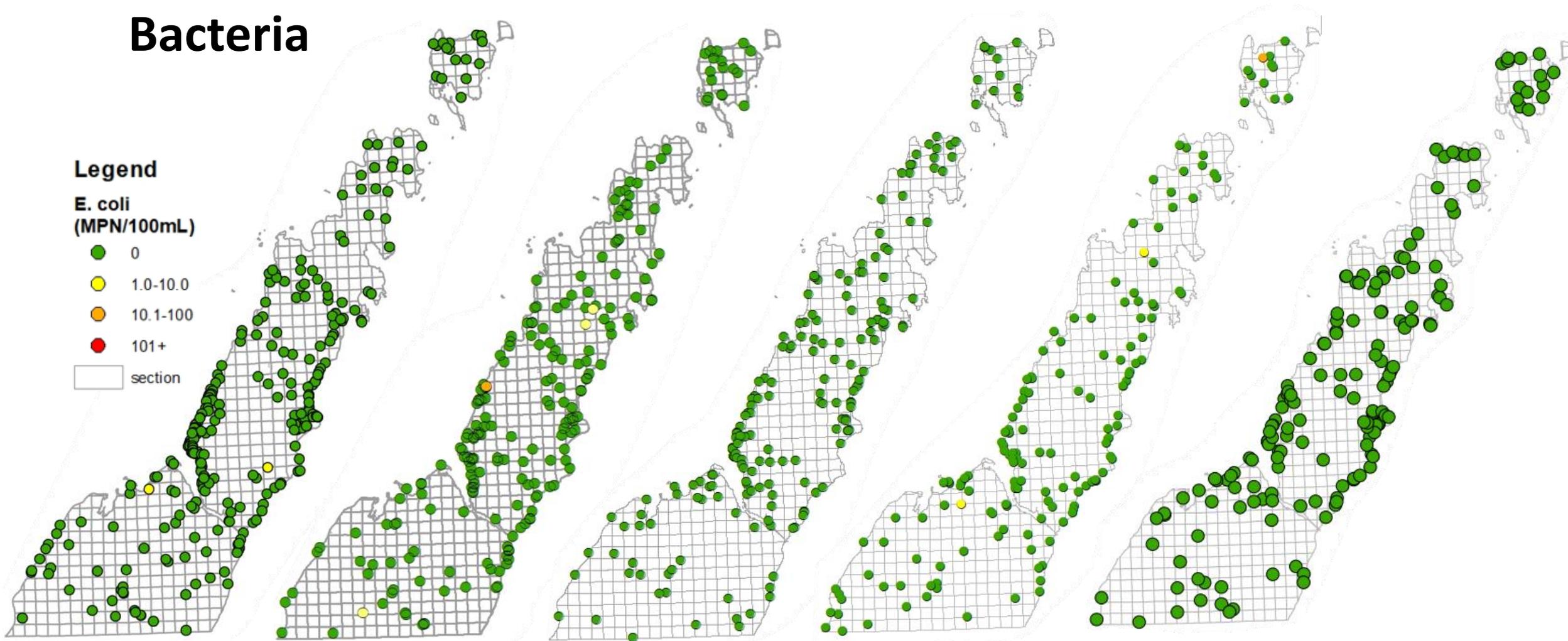
Fall 2020- 2024 *E. coli* Bacteria

Legend

E. coli
(MPN/100mL)

- 0
- 1.0-10.0
- 10.1-100
- 101+

□ section



2020

2021

2022

2023

2024

E. coli Bacteria

2019			2020			2021			2022 (Spring + Fall)			2023 (Spring + Fall)		
<i>E coli</i> Result (MPN/100 mL)	# Samples	% Samples	<i>E coli</i> Result (MPN/100 mL)	# Samples	% Samples	<i>E coli</i> Result (MPN/100 mL)	# Samples	% Samples	<i>E coli</i> Result (MPN/100 mL)	# Samples	% Samples	<i>E coli</i> Result (MPN/100 mL)	# Samples	% Samples
0	148	100	0	293	99	0	213	98	0	454	100	0	354	99
1-10	0	0	1-10	2	1	1-10	3	1	1-10	2	0.4	1-10	2	1
10-100	0	0	10-100	0	0	10-100	1	<1	10-100	0	0	10-100	1	<1
100+	0	0	100+	0	0	100+	0	0	100+	0	0	100+	0	0
n=148			n=295			n=217			n=456			n=357		

Spring 2024			Fall 2024		
<i>E coli</i> Result (MPN/100 mL)	# Samples	% Samples	<i>E coli</i> Result (MPN/100 mL)	# Samples	% Samples
0	222	99	0	182	100
1-10	1	0	1-10	0	0
10-100	1	0	10-100	0	0
100+	0	0	100+	0	0
n=224			n=182		

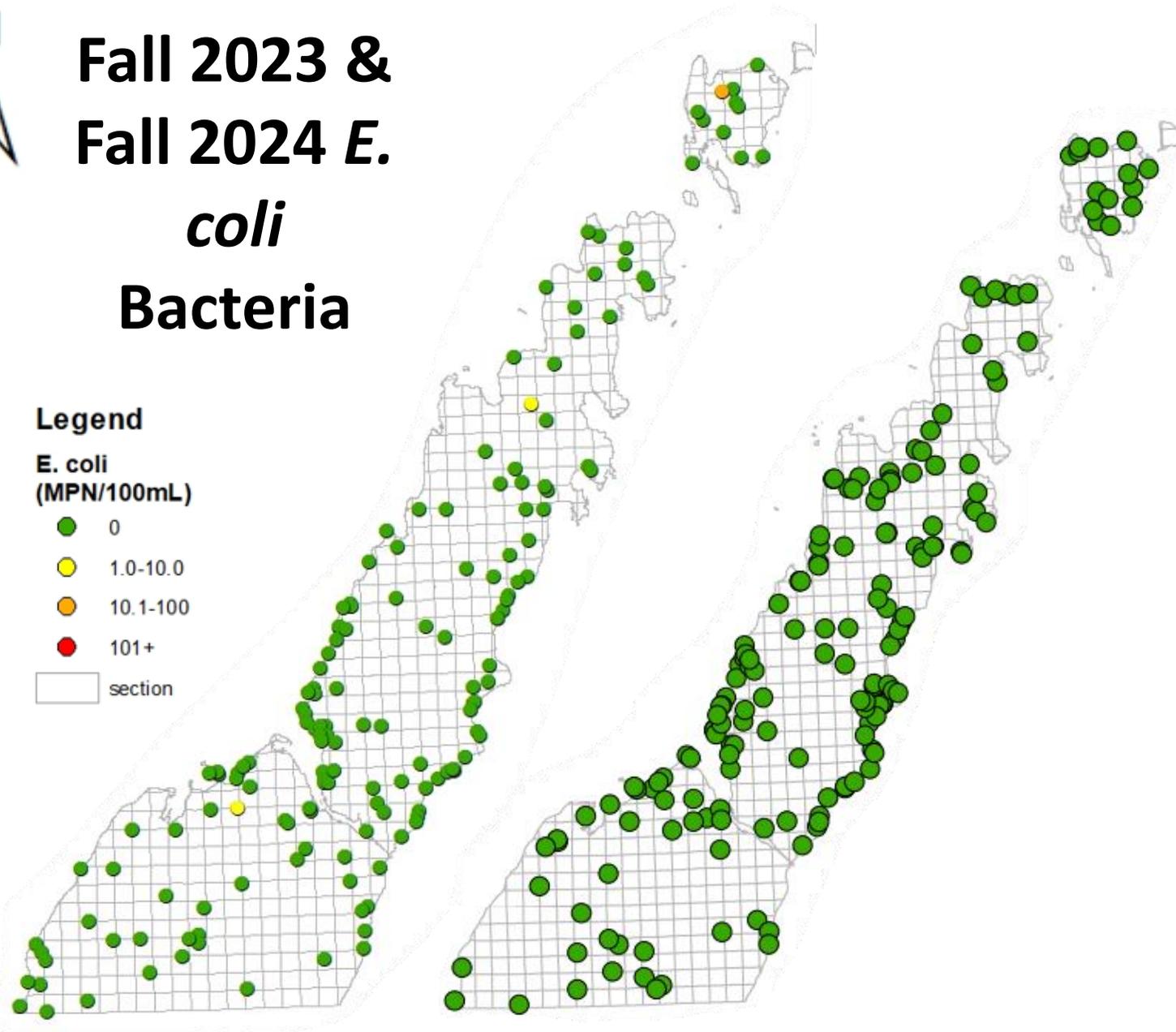


Fall 2023 & Fall 2024 *E. coli* Bacteria

Legend

E. coli
(MPN/100mL)

- 0
- 1.0-10.0
- 10.1-100
- 101+
- section



Fall 2023

Fall 2024

Fall 2023		
<i>E. coli</i> Result (MPN/100 mL)	# Samples	% Samples
0	159	98
1-10	2	1
10-100	1	1
100+	0	0
n=162		

Fall 2024		
<i>E. coli</i> Result (MPN/100 mL)	# Samples	% Samples
0	182	100
1-10	0	0
10-100	0	0
100+	0	0
n=182		

Previous Data – Nitrate



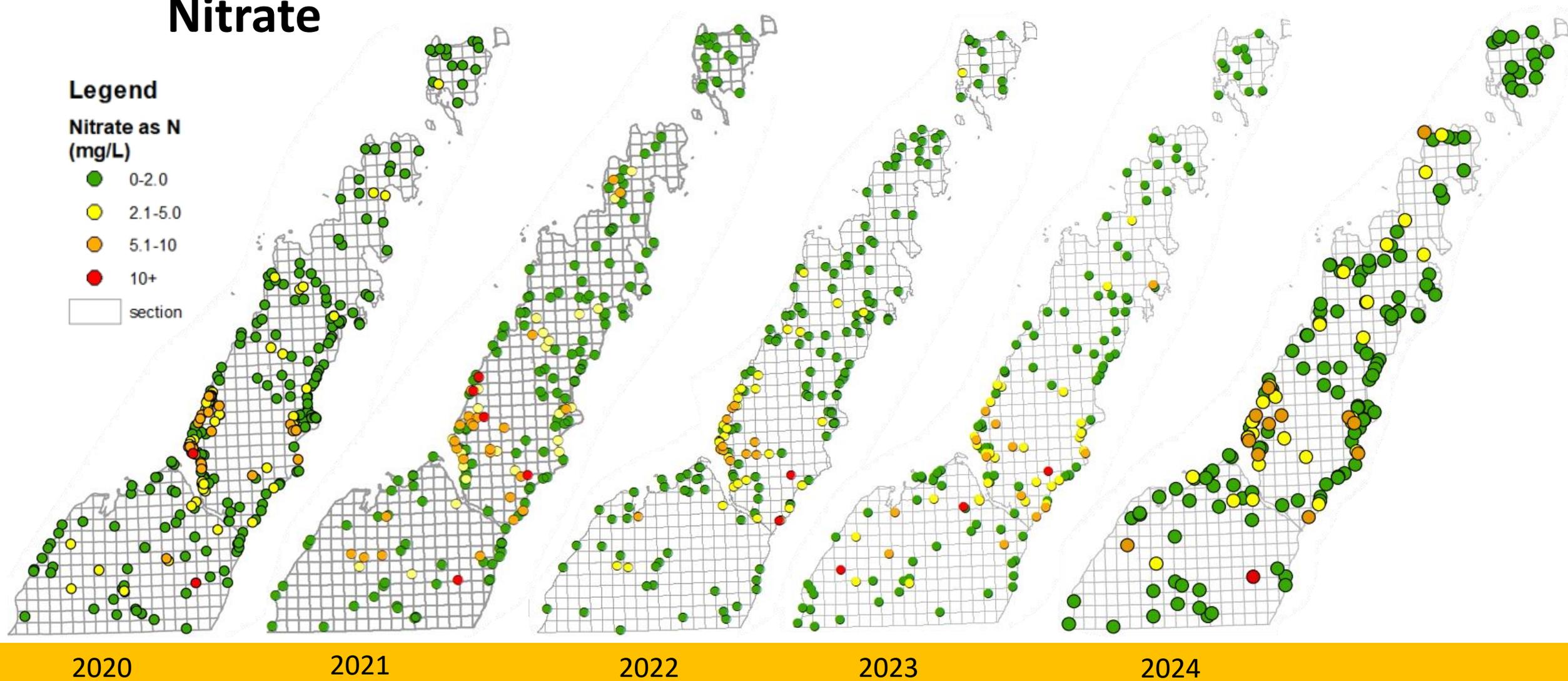
Fall 2020- 2024 Nitrate

Legend

Nitrate as N
(mg/L)

- 0-2.0
- 2.1-5.0
- 5.1-10
- 10+

section



Nitrate

2019			2020			2021			2022 (Spring + Fall)			2023 (Spring + Fall)		
Nitrate Result (mg/L)	# Samples	% Samples	Nitrate Result (mg/L)	# Samples	% Samples	Nitrate Result (mg/L)	# Samples	% Samples	Nitrate Result (mg/L)	# Samples	% Samples	Nitrate Result (mg/L)	# Samples	% Samples
Less than 2	104	71	Less than 2	206	72	Less than 2	157	75	Less than 2	347	77	Less than 2	261	75
2-5	23	16	2-5	46	16	2-5	23	11	2-5	76	17	2-5	58	17
5-10	16	11	5-10	34	12	5-10	25	12	5-10	25	6	5-10	23	7
10+	3	2	10+	2	1	10+	5	2	10+	2	<1	10+	8	2
n=146			n=288			n=210			n=450			n=350		

Spring 2024			Fall 2024		
Nitrate Result (mg/L)	# Samples	% Samples	Nitrate Result (mg/L)	# Samples	% Samples
Less than 2	151	69	Less than 2	136	76
2-5	51	23	2-5	31	17
5-10	17	8	5-10	12	7
10+	0	0	10+	1	1
n=219			n=180		

Concentrations of nitrate greater than 3 mg/l generally indicate contamination.



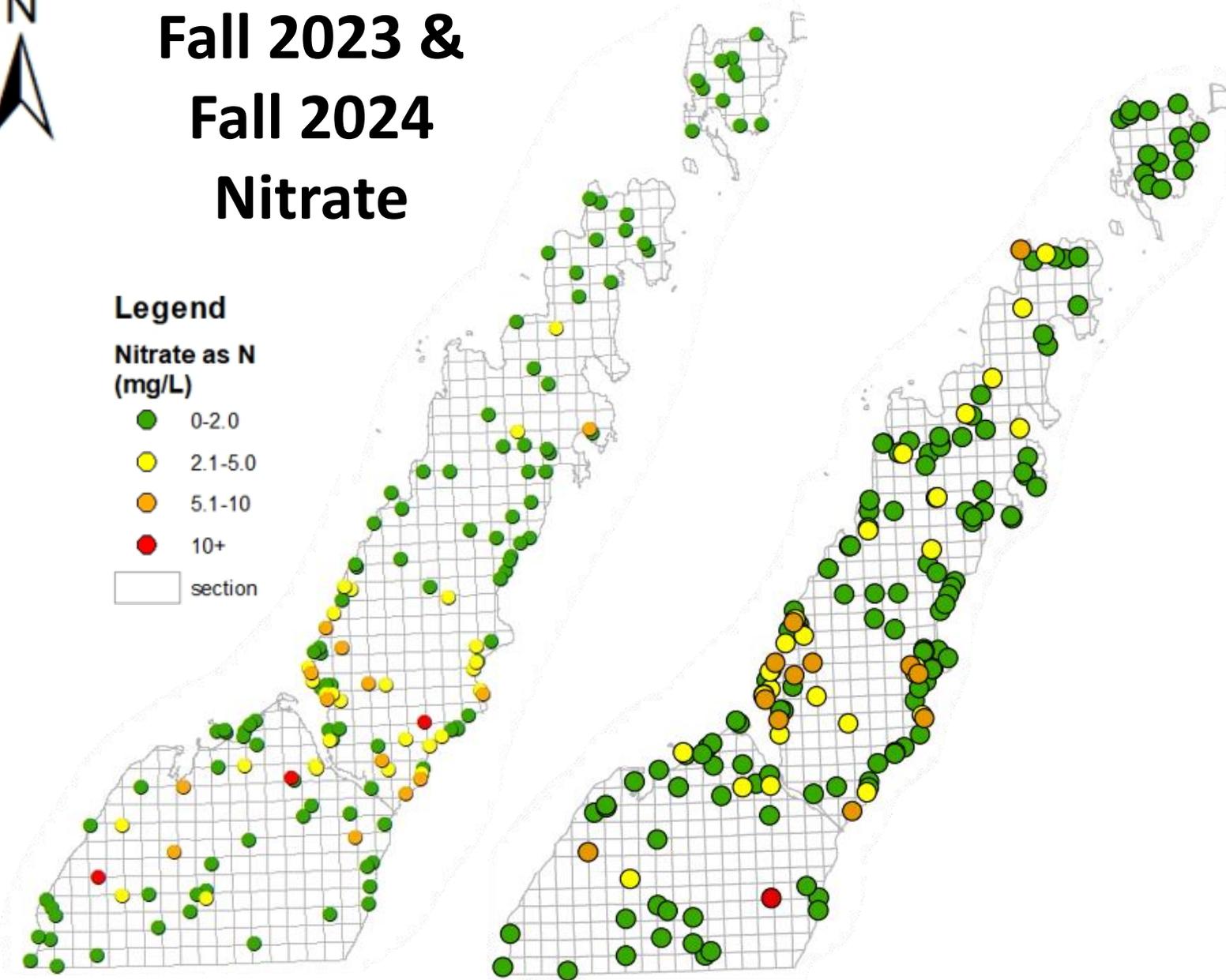
Fall 2023 & Fall 2024 Nitrate

Legend

Nitrate as N
(mg/L)

- 0-2.0
- 2.1-5.0
- 5.1-10
- 10+

section



Fall 2023		
Nitrate Result (mg/L)	# Samples	% Samples
Less than 2	114	72
2-5	28	18
5-10	13	8
10+	3	2
n=158		

Fall 2024		
Nitrate Result (mg/L)	# Samples	% Samples
Less than 2	136	76
2-5	31	17
5-10	12	7
10+	1	1
n=180		

Fall 2023

Fall 2024

Previous Data – Arsenic



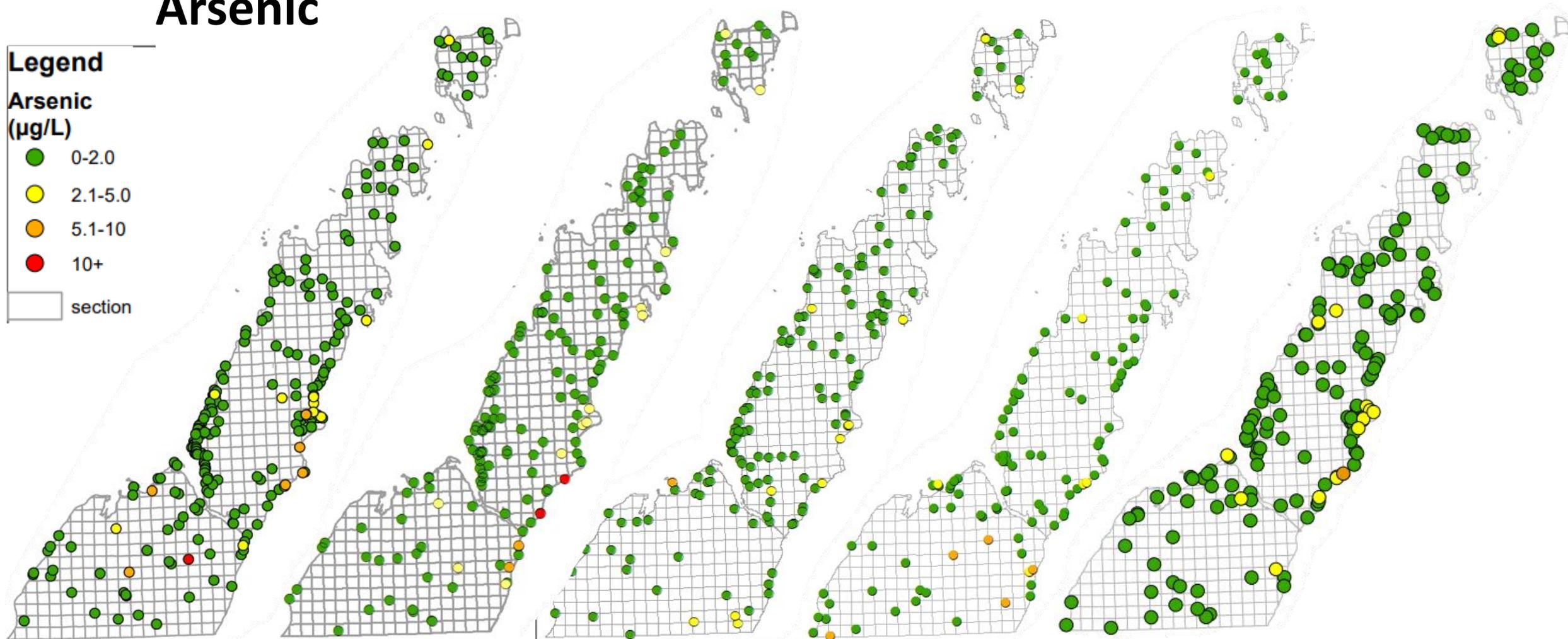
Fall 2020- 2024 Arsenic

Legend

Arsenic
($\mu\text{g/L}$)

- 0-2.0
- 2.1-5.0
- 5.1-10
- 10+

section



2020

2021

2022

2023

2024

Arsenic

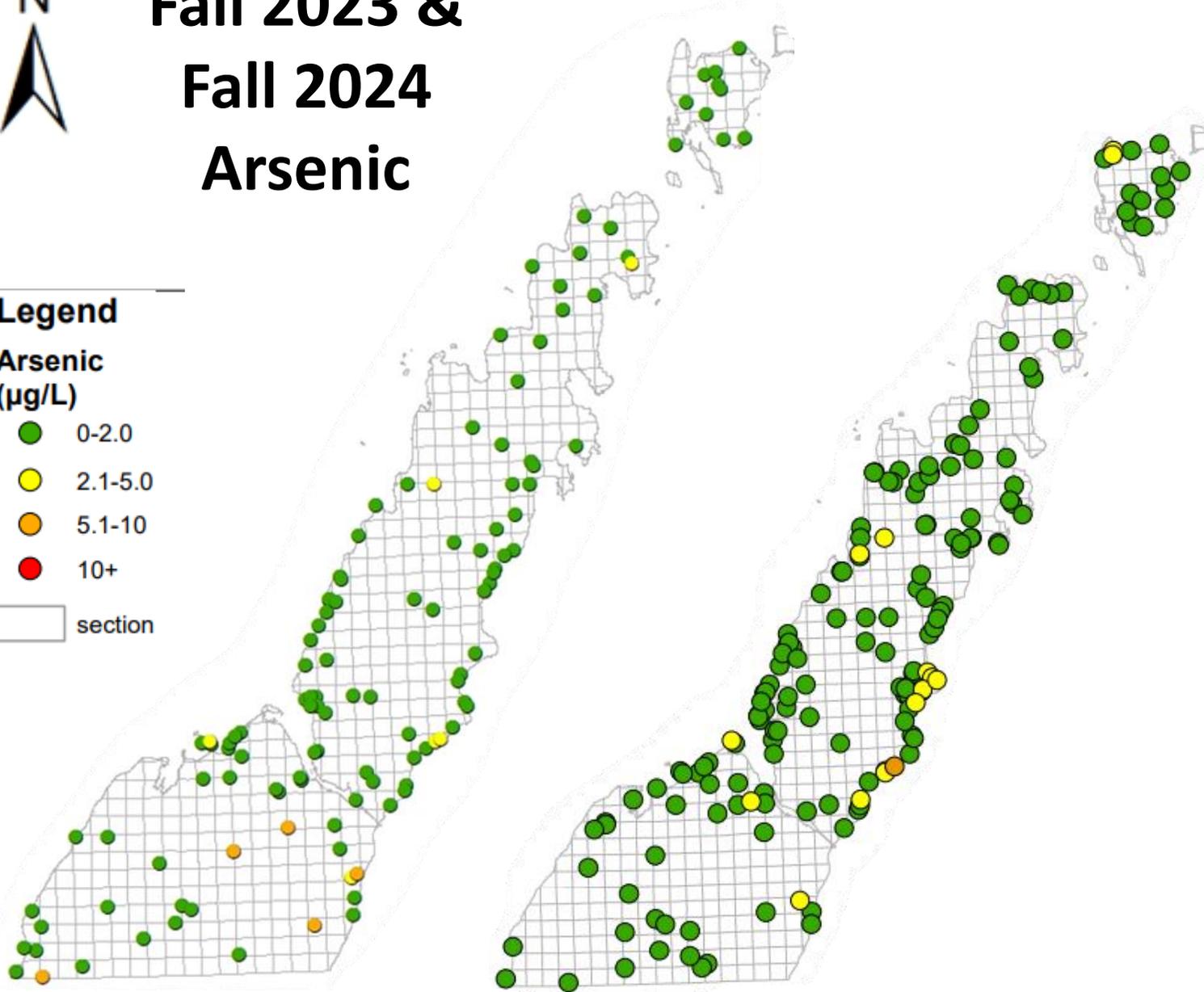
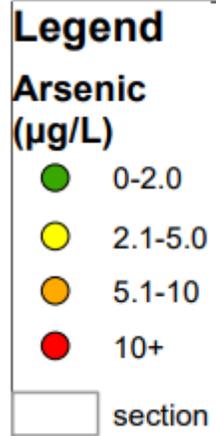
2019			2020			2021			2022 (Spring + Fall)			2023 (Spring + Fall)		
Arsenic Result (µg/L)	# Samples	% Samples	Arsenic Result (µg/L)	# Samples	% Samples	Arsenic Result (µg/L)	# Samples	% Samples	Arsenic Result (µg/L)	# Samples	% Samples	Arsenic Result (µg/L)	# Samples	% Samples
Less than 2	70	99	Less than 2	214	90	Less than 2	149	89	Less than 2	328	90	Less than 2	235	90
2-5	1	1	2-5	15	6	2-5	15	9	2-5	33	9	2-5	20	8
5-10	0	0	5-10	7	3	5-10	2	1	5-10	4	1	5-10	5	2
10+	0	0	10+	1	<1	10+	2	1	10+	1	0.3	10+	1	0
n=71			n=237			n=168			n=366			n=261		

Spring 2024			Fall 2024		
Arsenic Result (µg/L)	# Samples	% Samples	Arsenic Result (µg/L)	# Samples	% Samples
Less than 2	156	91	Less than 2	126	89
2-5	12	7	2-5	15	11
5-10	4	2	5-10	1	1
10+	0	0	10+	0	0
n=172			n=142		

Generally low arsenic concentrations from sampling events.



Fall 2023 & Fall 2024 Arsenic



Fall 2023

Fall 2024

Fall 2023		
Arsenic Result (µg/L)	# Samples	% Samples
Less than 2	113	91
2-5	6	5
5-10	5	4
10+	0	0
n=124		

Fall 2024		
Arsenic Result (µg/L)	# Samples	% Samples
Less than 2	126	89
2-5	15	11
5-10	1	1
10+	0	0
n=142		

County-Wide Sampling Efforts

Percentage Exceeding Safe Water Quality Standards

Water Quality Standard	Fall 2024 Door County Results	Spring 2024 Door County Results	Fall 2023 Door County Results	Spring 2023 Door County Results	Fall 2022 Door County Results	Spring 2022 Door County Results	Fall 2021 Door County Results	Fall 2020 Door County Results	Fall 2019 Door County Results	Previous Door County Results* (Average)	Wisconsin**
Total Coliform (> 0 MPN/100 ml)	12%	4%	12%	5%	8%	10%	24%	14%	16%	18%	17%
<i>E. coli</i> (> 0 MPN/100 ml)	0%	1%	2%	0%	0%	1%	2%	1%	0%	6%	5%
Nitrate (> 10 mg/L)	1%	0%	3%	3%	1%	0%	2%	1%	2%	2%	8%
Arsenic (> 10 µg/L)	0%	0%	0%	<1%	0%	<1%	1%	<1%	0%	3%	5%

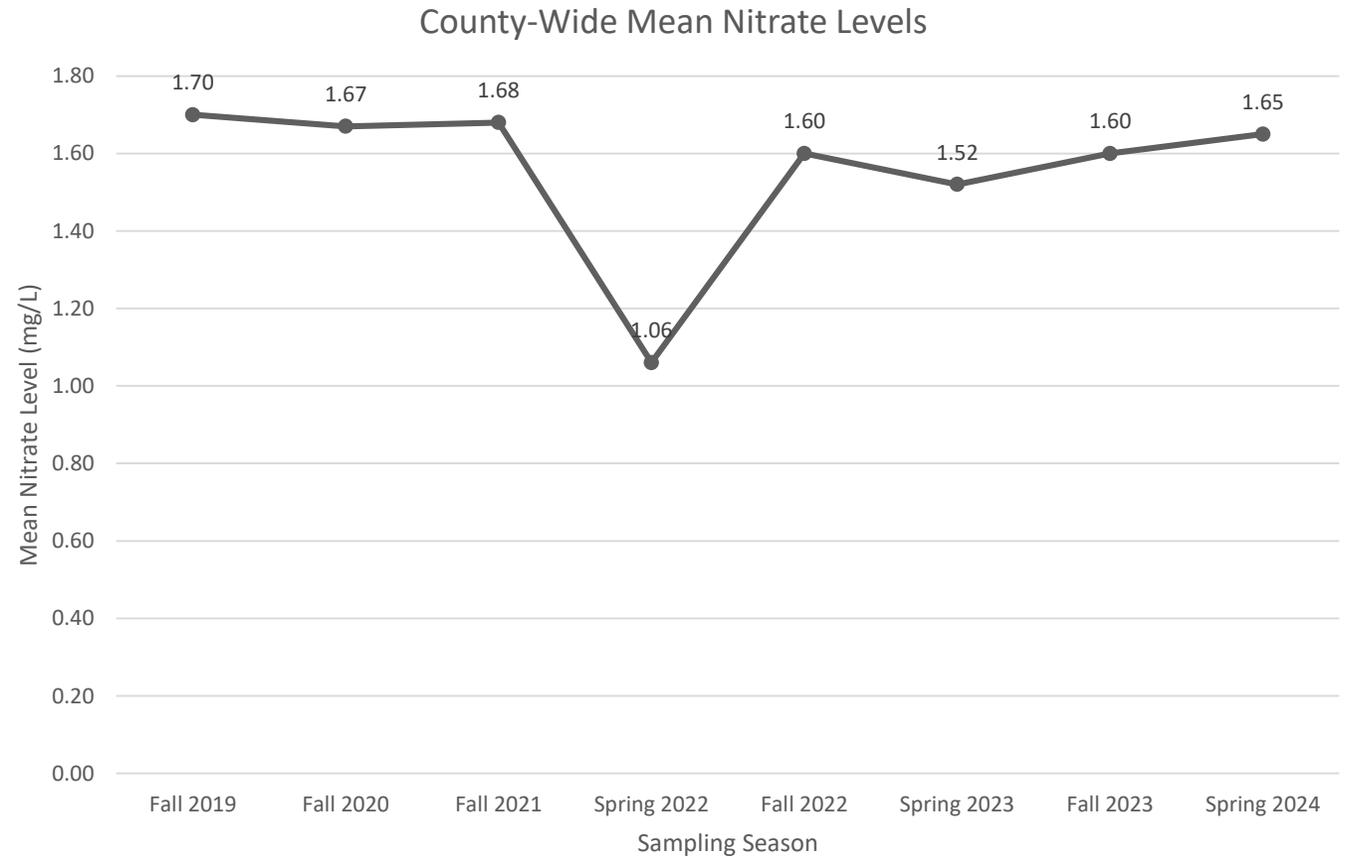
*Data derived from UWSP Well Viewer, UWO 2015 (480 samples) & 2016 (392 samples) community program, 2011-2015 UWEx Private Well Program (582 samples)

**Data derived from the Wisconsin Groundwater Coordinating Council Report & UWSP Well Viewer

County-Wide Mean Nitrate Levels

County-Wide Mean Nitrate Levels		
Sampling Season	Mean Nitrate Level (mg/L)	Number of Samples
Fall 2019	1.70	n = 145
Fall 2020	1.67	n = 288
Fall 2021	1.68	n = 211
Spring 2022	1.06	n = 256
Fall 2022	1.60	n = 194
Spring 2023	1.52	n = 193
Fall 2023	1.60	n = 157
Spring 2024	1.65	n = 217

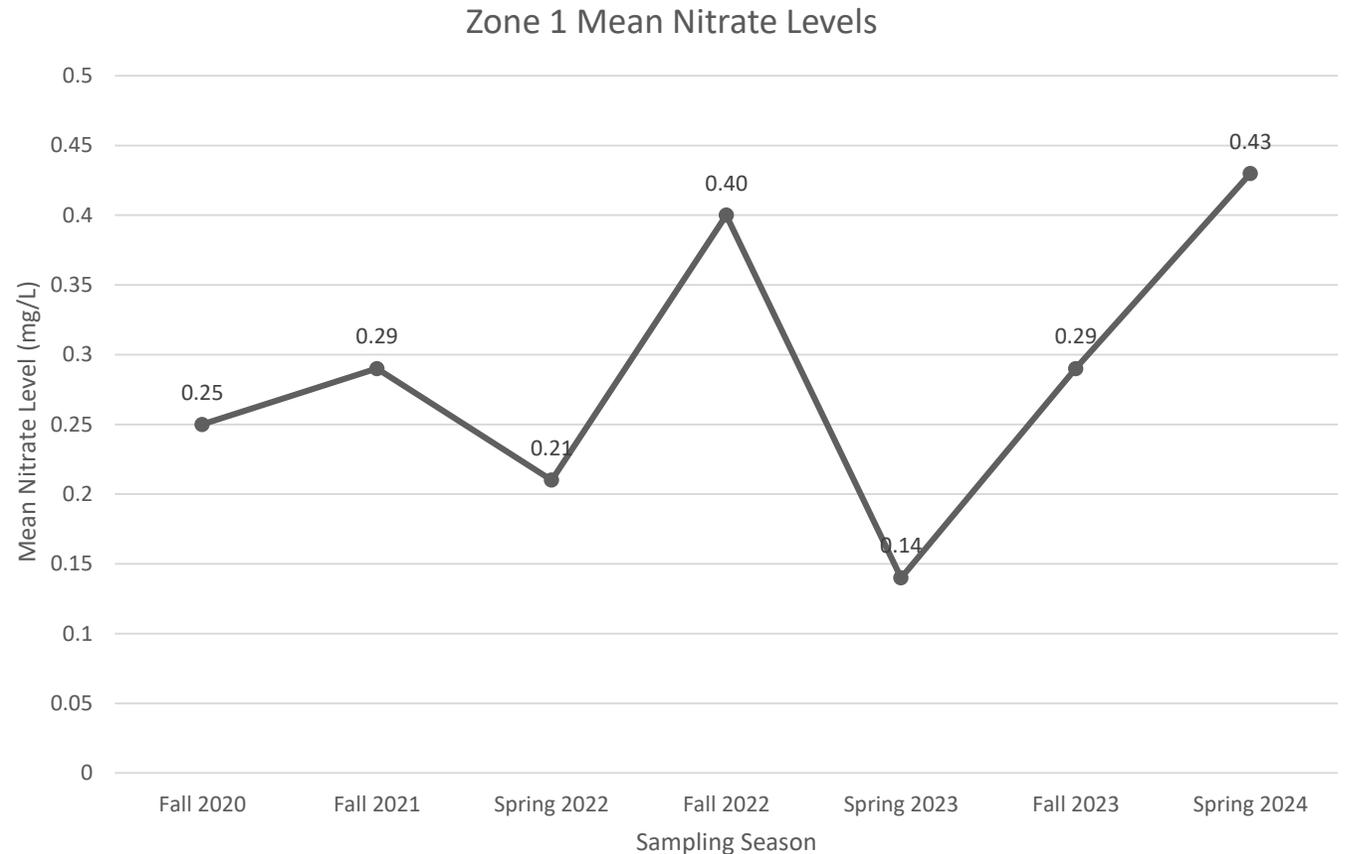
- Aside from the dip in Spring 2022, the trend is fairly stable
- County nitrate concentrations are consistently below the MCL and not showing any increasing trend.



Zone 1 Mean Nitrate Levels

Zone 1 Mean Nitrate Levels		
Sampling Season	Mean Nitrate Level (mg/L)	Number of Samples
Fall 2020	0.25	n = 15
Fall 2021	0.29	n = 17
Spring 2022	0.21	n = 23
Fall 2022	0.40	n = 11
Spring 2023	0.14	n = 15
Fall 2023	0.29	n = 10
Spring 2024	0.43	n = 8

- No samples were received from this zone in Fall 2019
- Consistently has the lowest nitrate concentrations of the whole county
- Smallest range of values out of all zones

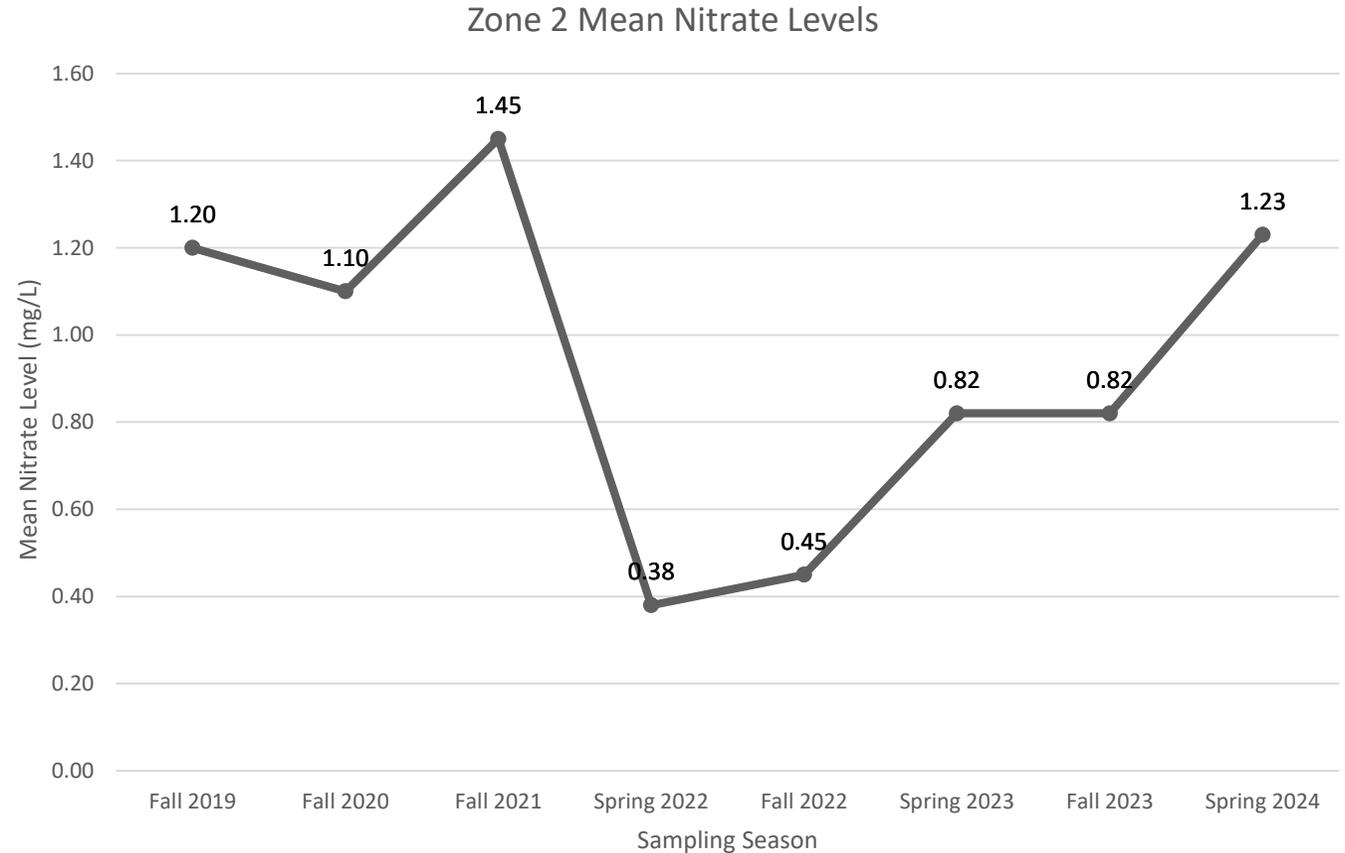


Zone 2 Mean Nitrate Levels

Zone 2 Mean Nitrate Levels

Sampling Season	Mean Nitrate Level (mg/L)	Number of Samples
Fall 2019	1.20	n = 13
Fall 2020	1.10	n = 17
Fall 2021	1.45	n = 21
Spring 2022	0.38	n = 18
Fall 2022	0.45	n = 20
Spring 2023	0.82	n = 16
Fall 2023	0.82	n = 13
Spring 2024	1.23	n = 24

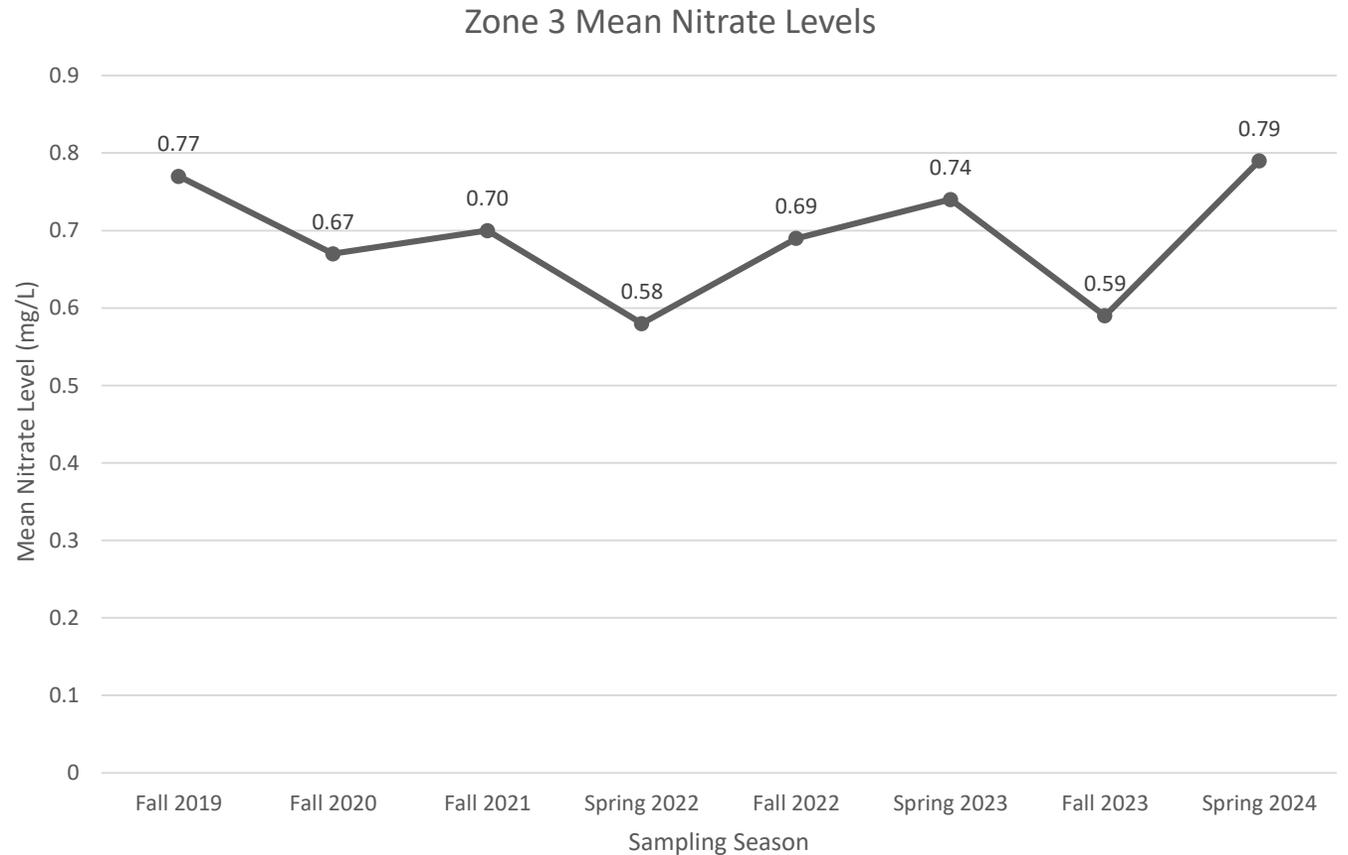
- Decrease from Fall 2021 to Spring 2022 likely contributes to the dip observed in the county-wide trends



Zone 3 Mean Nitrate Levels

Zone 3 Mean Nitrate Levels		
Sampling Season	Mean Nitrate Level (mg/L)	Number of Samples
Fall 2019	0.77	n = 42
Fall 2020	0.67	n = 57
Fall 2021	0.70	n = 51
Spring 2022	0.58	n = 51
Fall 2022	0.69	n = 56
Spring 2023	0.74	n = 42
Fall 2023	0.59	n = 29
Spring 2024	0.79	n = 60

- Fairly stable trend with low nitrate concentrations.



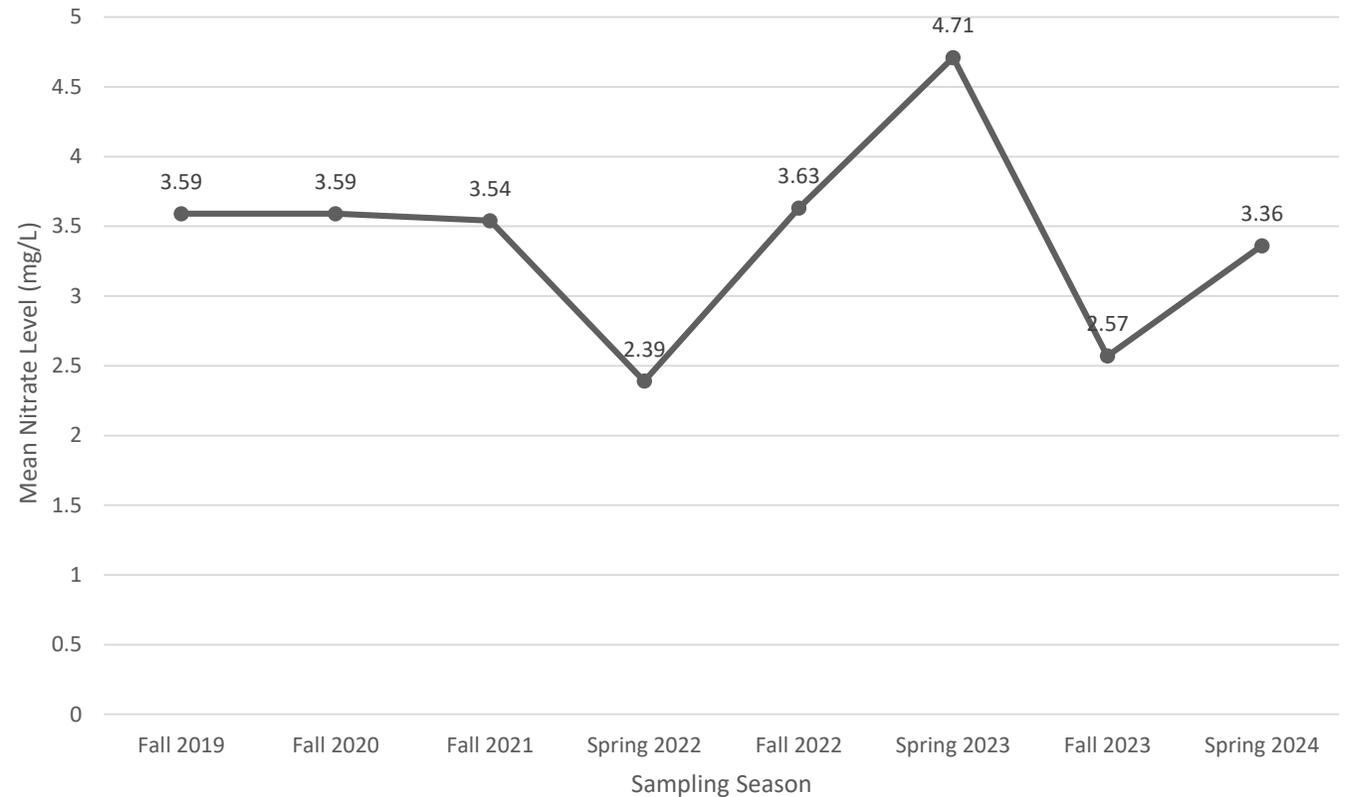
Zone 4a Mean Nitrate Levels

Zone 4a Mean Nitrate Levels

Sampling Season	Mean Nitrate Level (mg/L)	Number of Samples
Fall 2019	3.59	n = 14
Fall 2020	3.59	n = 78
Fall 2021	3.54	n = 40
Spring 2022	2.39	n = 37
Fall 2022	3.63	n = 41
Spring 2023	4.71	n = 30
Fall 2023	2.57	n = 29
Spring 2024	3.36	n = 35

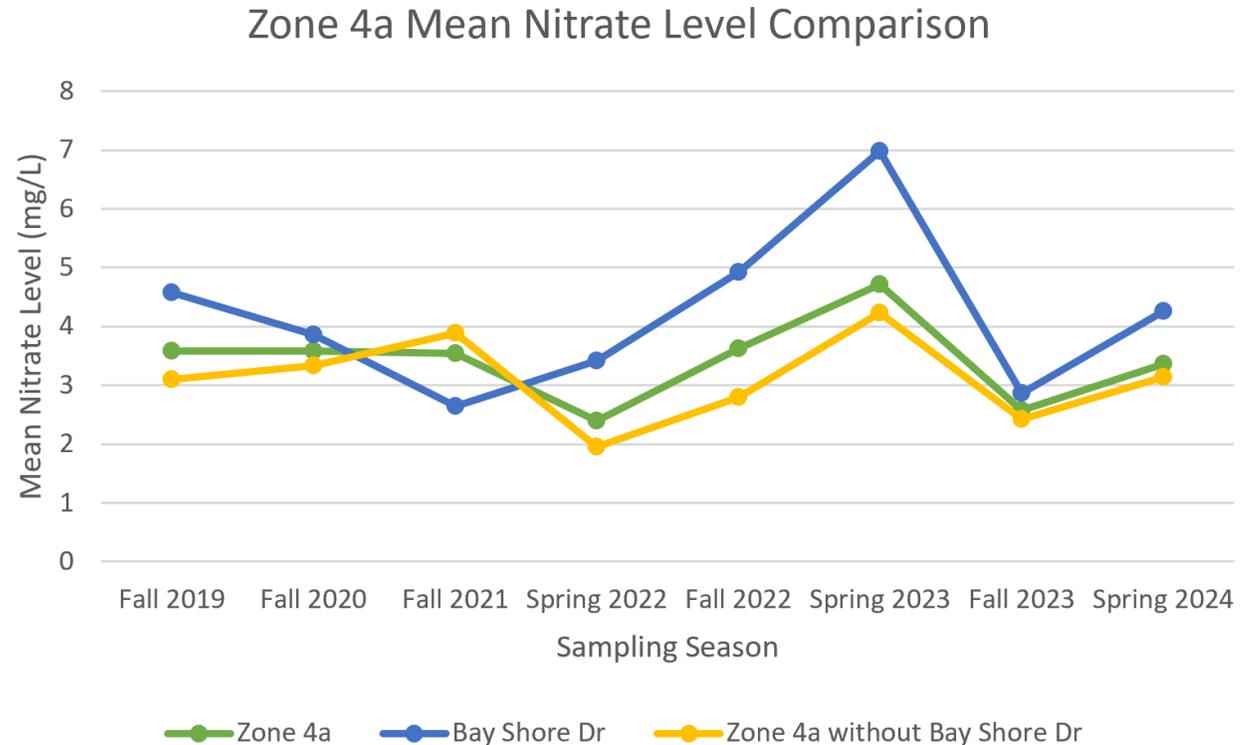
- Highest nitrate concentrations in the whole county
- Mean of 4.71 mg/L from Spring 2023 in this zone is the greatest zone mean from all sampling seasons.

Zone 4a Mean Nitrate Levels



Zone 4a Comparison

Zone 4a Mean Nitrate Level Comparison			
Sampling Season	Zone 4a	Bay Shore Dr	Zone 4a without Bay Shore Dr
Fall 2019	3.59	4.58	3.10
Fall 2020	3.59	3.86	3.34
Fall 2021	3.54	2.64	3.89
Spring 2022	2.39	3.42	1.96
Fall 2022	3.63	4.93	2.80
Spring 2023	4.71	6.98	4.24
Fall 2023	2.57	2.87	2.42
Spring 2024	3.36	4.26	3.14



- Many of the Zone 4a samples were from Bay Shore Dr, and so these nitrate means aim to show how samples from that street contribute to the overall concentration of that zone

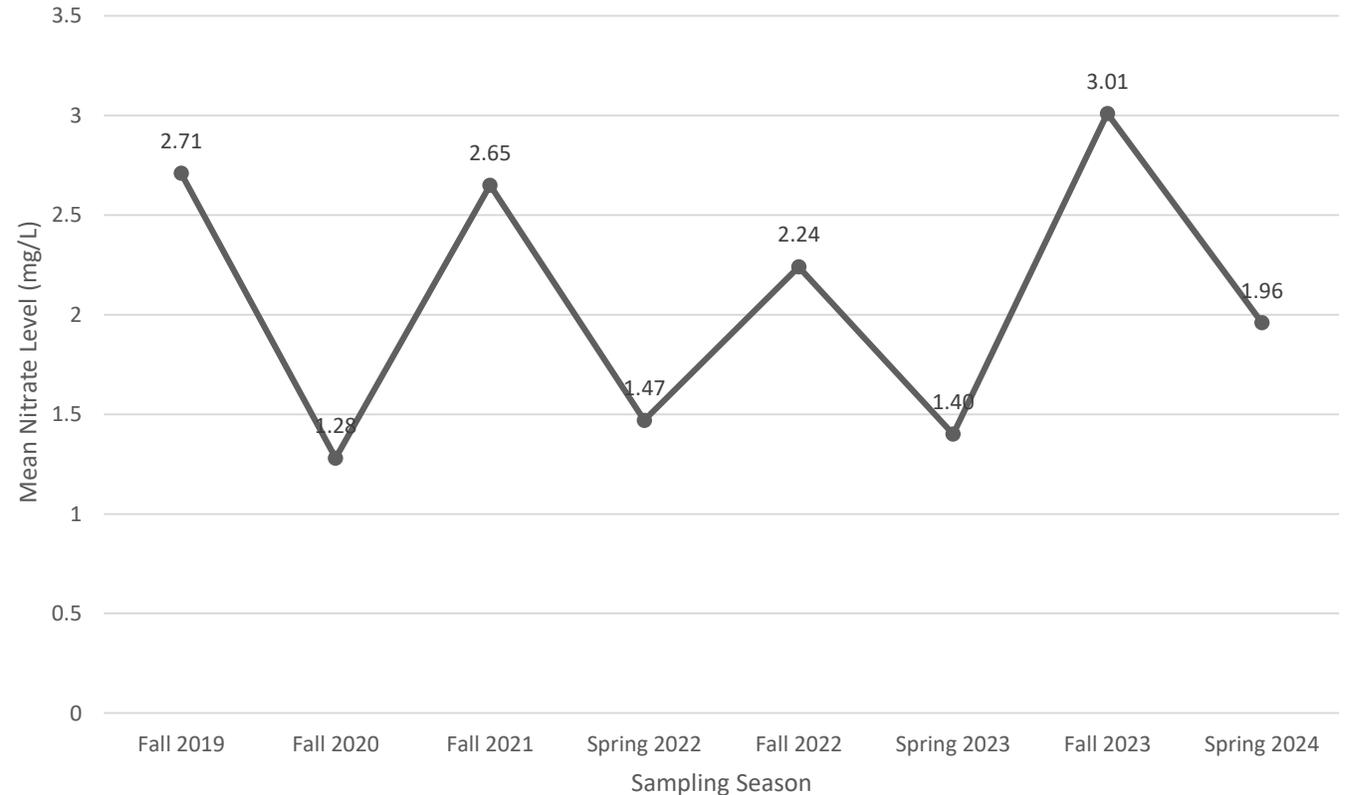
Zone 4b Mean Nitrate Levels

Zone 4b Mean Nitrate Levels

Sampling Season	Mean Nitrate Level (mg/L)	Number of Samples
Fall 2019	2.71	n = 28
Fall 2020	1.28	n = 58
Fall 2021	2.65	n = 33
Spring 2022	1.47	n = 67
Fall 2022	2.24	n = 25
Spring 2023	1.40	n = 37
Fall 2023	3.01	n = 25
Spring 2024	1.96	n = 44

- Values tend to fluctuate around approximately 2 mg/L and don't settle or level out
- Inconsistent trend could in part be due to the sampling sizes which are also inconsistent

Zone 4b Mean Nitrate Levels



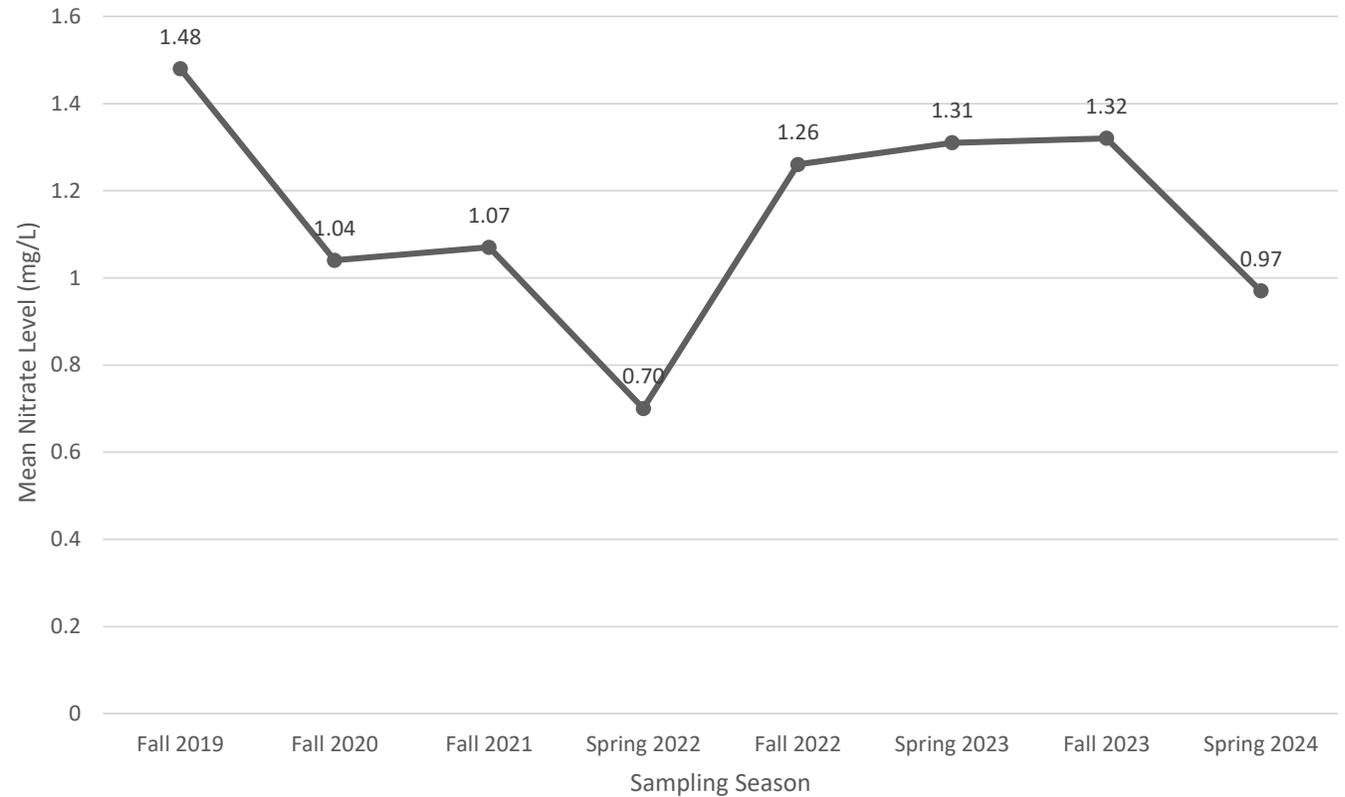
Zone 5 Mean Nitrate Levels

Zone 5 Mean Nitrate Levels

Sampling Season	Mean Nitrate Level (mg/L)	Number of Samples
Fall 2019	1.48	n = 48
Fall 2020	1.04	n = 63
Fall 2021	1.07	n = 49
Spring 2022	0.70	n = 53
Fall 2022	1.26	n = 45
Spring 2023	1.31	n = 42
Fall 2023	1.32	n = 48
Spring 2024	0.97	n = 46

- Decrease from Fall 2021 to Spring 2022 likely contributes to the dip seen in the county-wide trends
- Zone 5 is the largest geographic zone

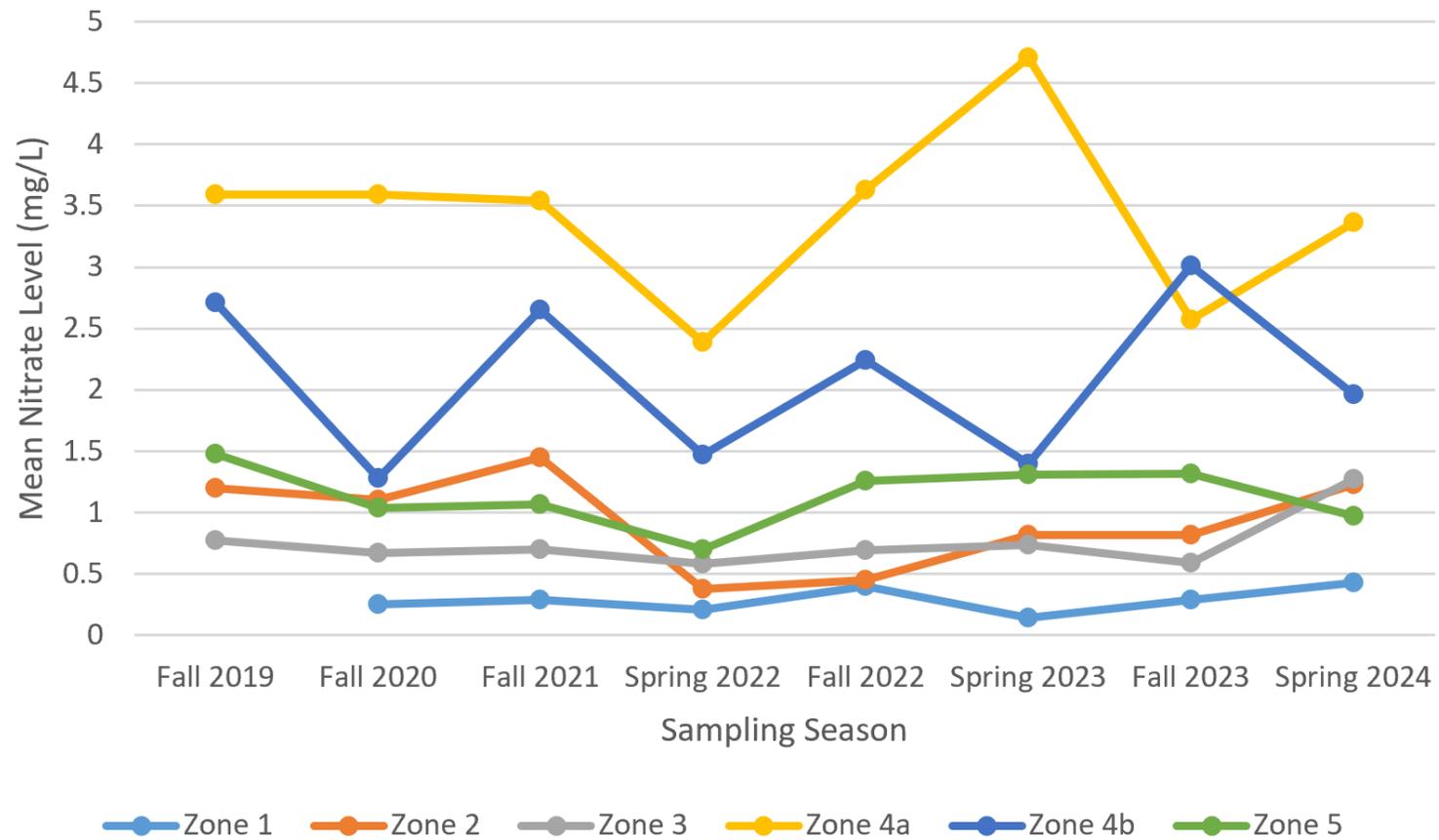
Zone 5 Mean Nitrate Levels



Zone Comparison

Mean Nitrate Levels by Zone						
Sampling Season	Zone 1	Zone 2	Zone 3	Zone 4a	Zone 4b	Zone 5
Fall 2019	--	1.2	0.77	3.59	2.71	1.48
Fall 2020	0.25	1.1	0.67	3.59	1.28	1.04
Fall 2021	0.29	1.45	0.7	3.54	2.65	1.07
Spring 2022	0.21	0.38	0.58	2.39	1.47	0.7
Fall 2022	0.4	0.45	0.69	3.63	2.24	1.26
Spring 2023	0.14	0.82	0.74	4.71	1.4	1.31
Fall 2023	0.29	0.82	0.59	2.57	3.01	1.32
Spring 2024	0.43	1.23	1.27	3.36	1.96	0.97

Zone Comparison



Zone Comparison

Mean Nitrate Levels (mg/L) from All Sampling Seasons (2019-2024)

Zone 1	Zone 2	Zone 3	Zone 4a	Zone 4b	Zone 5
0.25	0.94	0.77	3.43	1.91	1.13

- Combines the individual means from all sampling seasons to find an overall nitrate level for each zone since the beginning of the Well Monitoring Program

Septic Tracer Study

- Evaluate the possible movement of human septage to ground water by use of tracers that indicate human impact.
- Concentrate on areas of significant development and high septic densities.
- Initial 12 sites sampled at the same time as the Fall sampling. Results are TBD as of Dec 2nd.
- Continue during 2025 and 2026 at different locations throughout the County.

What will we be looking for?

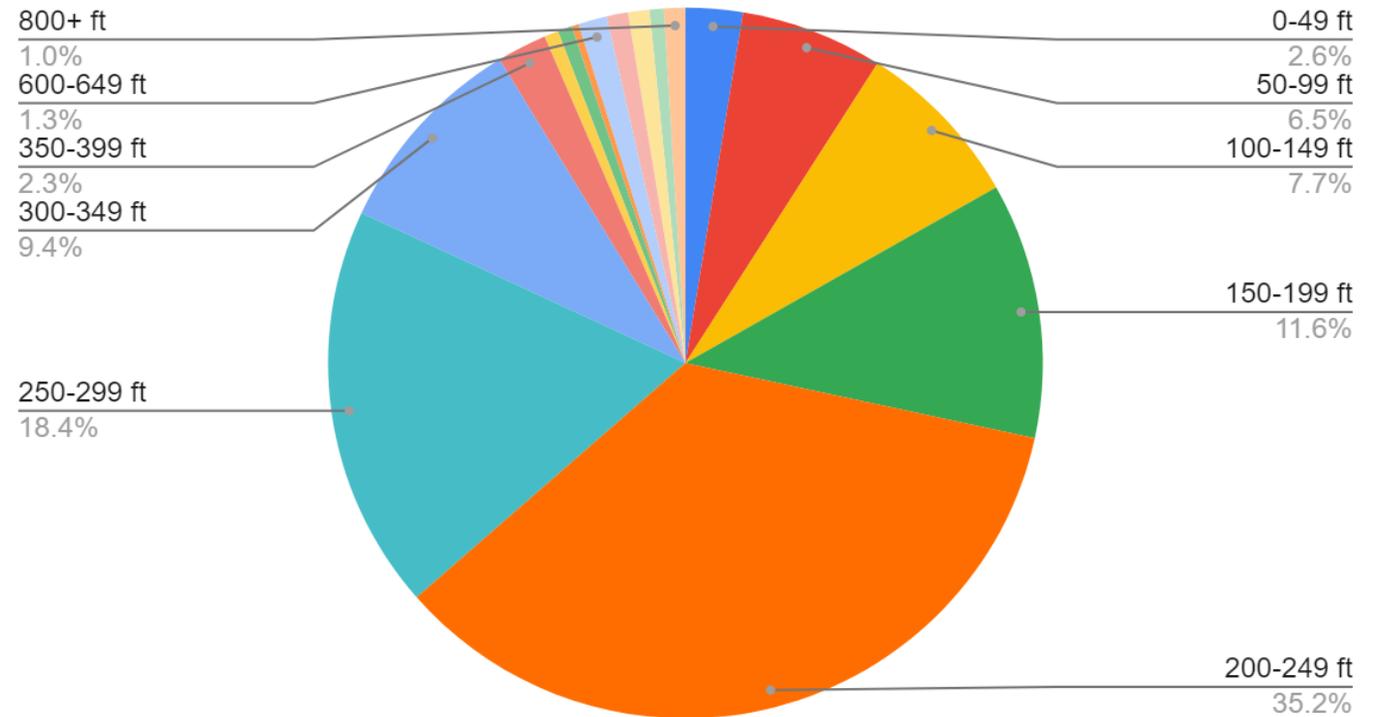
- **Acesulfame** (artificial sweetener)
- **Sucralose** (artificial sweetener)
- **Caffeine** (do I need to say more?)
- **Paraxanthine** (metabolite of caffeine)
- **Sulfamethoxazole** (antibiotic)
- **Carbamazepine** (prescription medication)
- **Coliform** (fecal indicator of septic and ag)
- ***E.coli*** (fecal indicator of septic and ag)
- **Nitrate** (fecal indicator of septic and ag)

Additional Data

The Door County Well Monitoring Program asks that participants provide some pieces of qualitative data along with their water sample if they are known. These include:

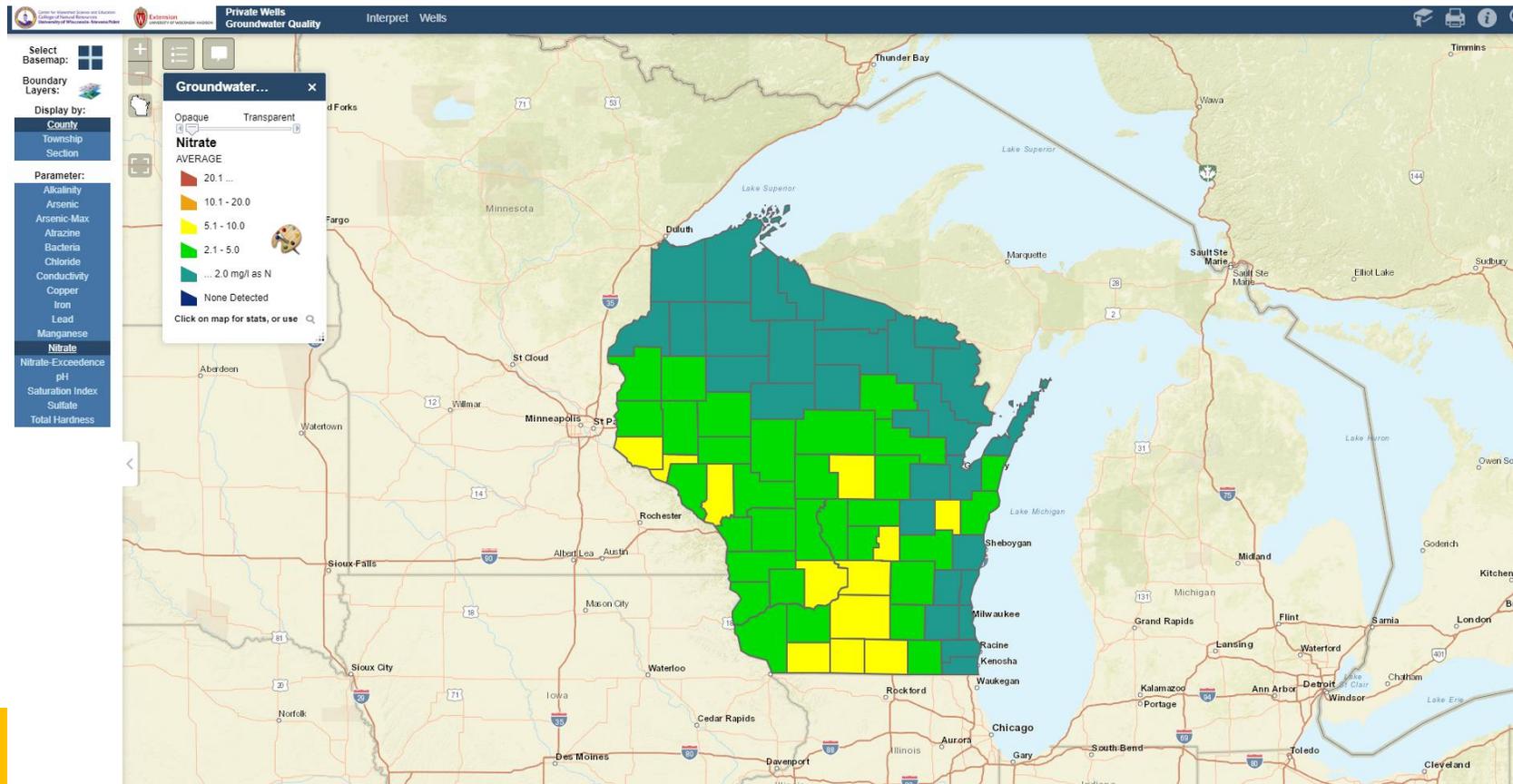
- Well Type
 - Only 7 respondents have driven/sand point wells, while the rest that responded all have drilled wells. Considering the geography of Door County, these results are to be expected.
- Well Construction Date
- Well Depth
 - From the people that provided the depth of their well, we have modelled the range of well depths across the entire county here:

Range of Well Depths



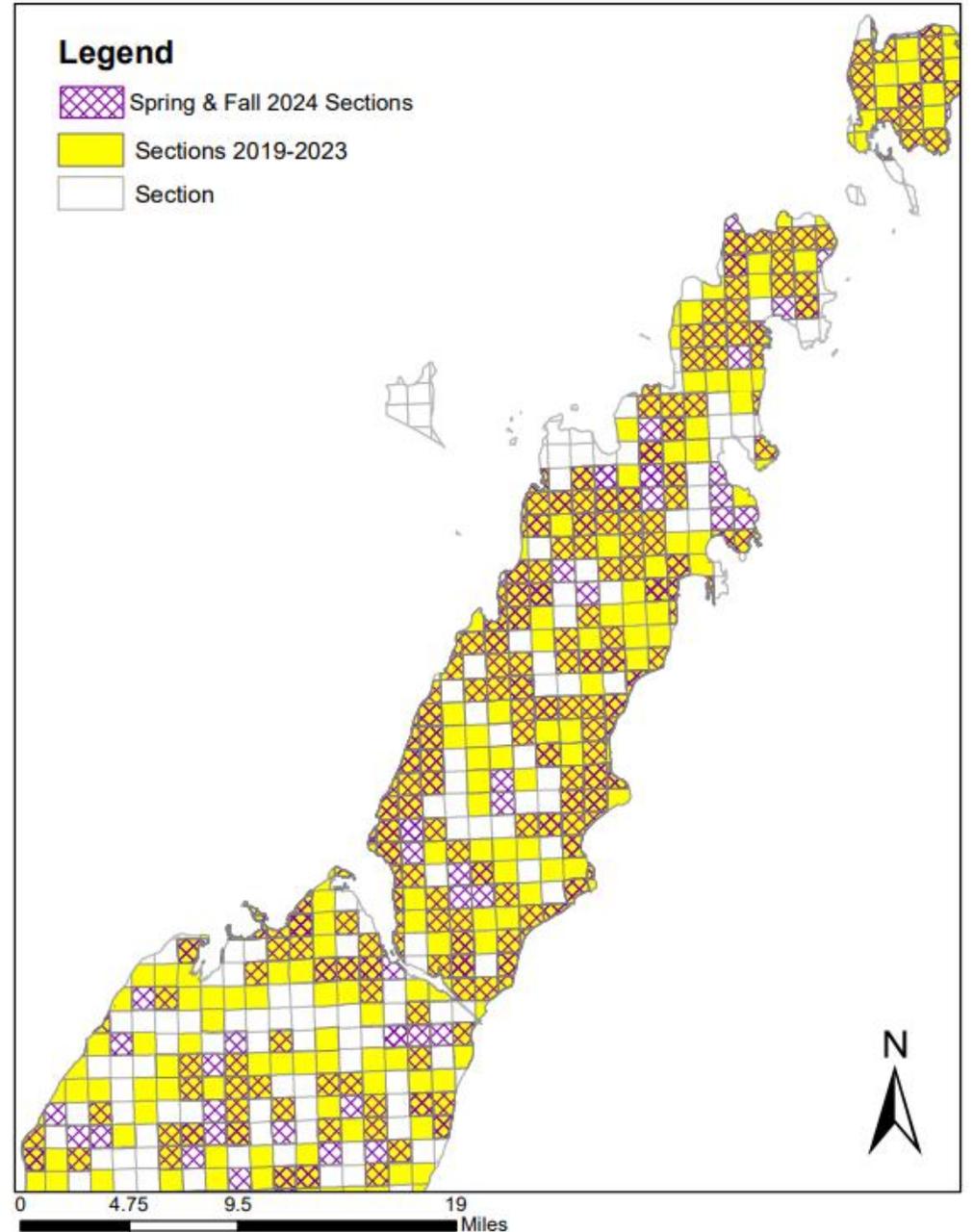
Where is the data going?

- Long-term goal is to upload all data onto UWSP Well Water Data Viewer <https://www.uwsp.edu/cnr-ap/watershed/Pages/WellWaterViewer.aspx>



Further Research & Plans

- Continue targeted sampling in spring, summer, and/or fall (seasonal)
- Recruiting same volunteers from previous years plus additional wells in other sections across county
- Continuation as a long-term study (ongoing annual program)



Take Home Messages

- Karst geology makes Door County groundwater highly vulnerable to contamination and causes high variability in water quality results
- Sample your well at least annually for bacteria and nitrate, or more often if changes or problems observed (recommended)
- Do not hesitate to use your resources if you have questions or concerns about Door County groundwater quality
 - Wisconsin DNR
 - Door County Soil & Water Conservation Department
 - Door County Public Health

Special Thanks

- Thank you to Door County Soil & Water Department and Door County Public Health for your support throughout the last 5 years of sampling

QUESTIONS? CONTACT
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ERIC@UWOSH.EDU OR
(920) 424-3148

PRESENTATION &
RECORDING AVAILABLE
ONLINE

**Thank you – we
can't do this
without you!**