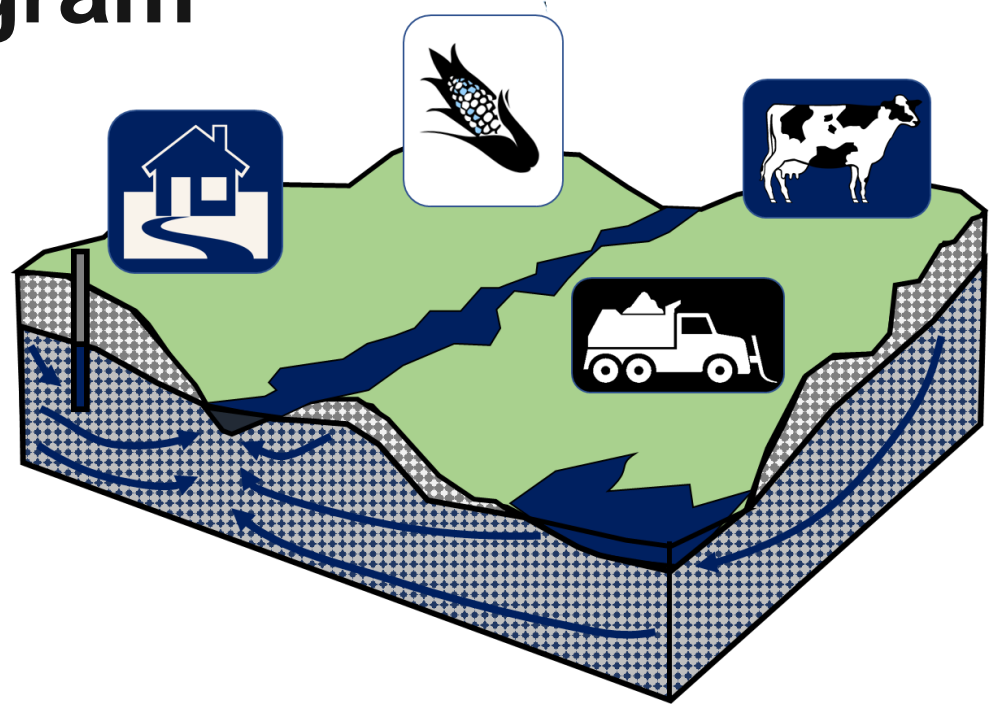


Green County Well Water Monitoring Program 2021

Year 3 of 5



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point



Extension
UNIVERSITY OF WISCONSIN-MADISON

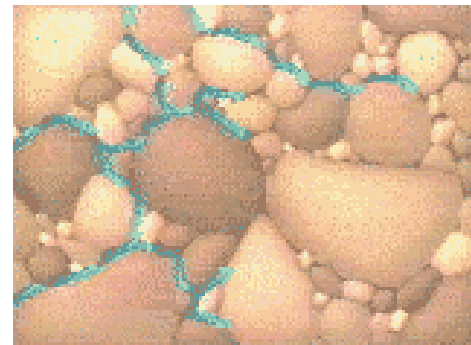
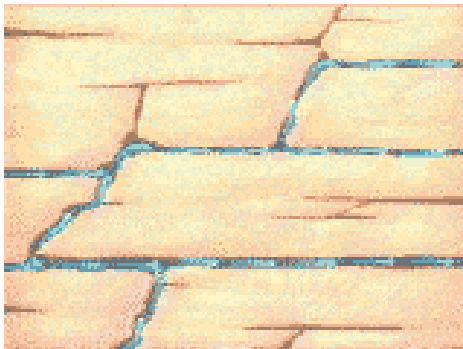
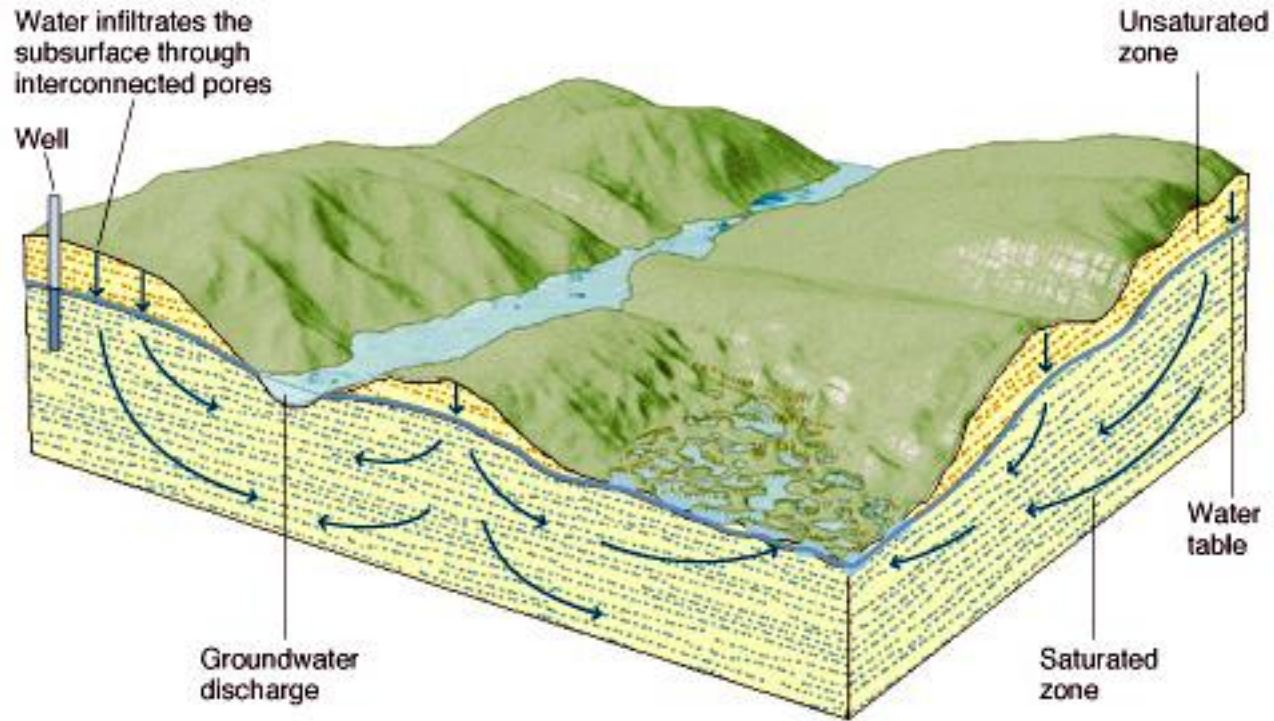
Through Extension, all Wisconsin people can access University resources and engage in lifelong learning, wherever they live and work. The Center is a partnership between the University of Wisconsin-Stevens Point and University of Wisconsin-Madison Division of Extension.

Today's presentation

- Basics of groundwater
- Overview of the project goals/process
- Which tests were performed and why
- What we've learned so far about groundwater quality in Green County
- Looking forward...what comes next?
- Q&A

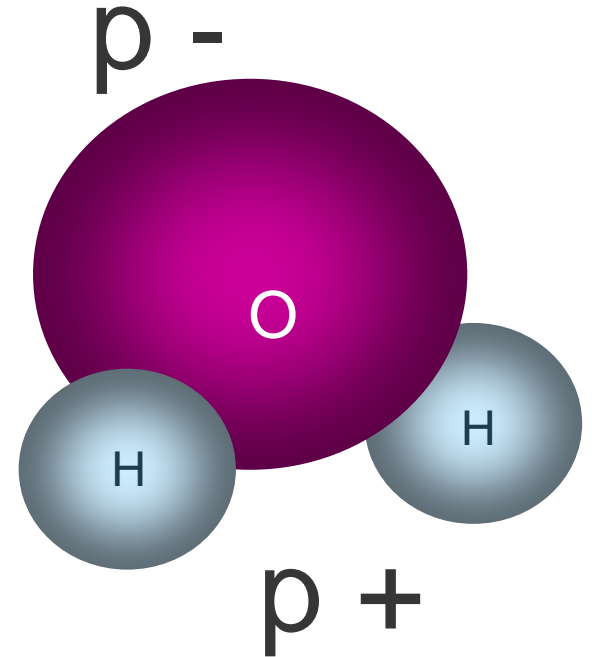


Groundwater Movement



water basics

- “Universal Solvent”
- Naturally has “stuff” dissolved in it.
 - Impurities depend on rocks, minerals, land-use, plumbing, packaging, and other materials that water comes in contact with.
- Can also treat water to take “stuff” out



GOAL: To learn how well water quality changes over time



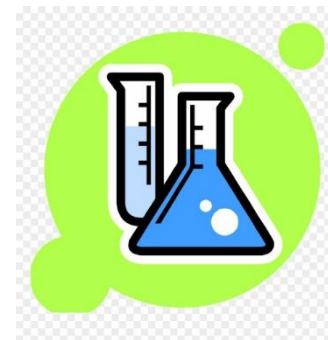
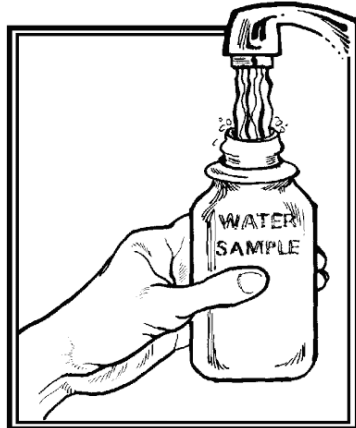
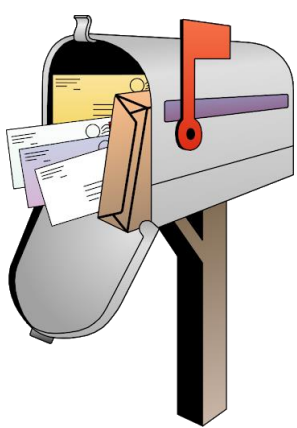
Is well water quality getting better, worse, or staying the same.

If changing, what can we learn about where and why

This project works best when:

- Wells are representative of diverse geology and land use
- The same wells are sampled every year

Year 3 - Overview



October
Mailed sample kits



November-December
Participants collected samples and mailed back to lab



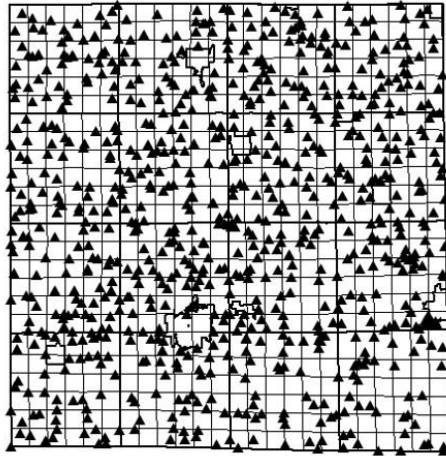
December
Lab analyzed samples



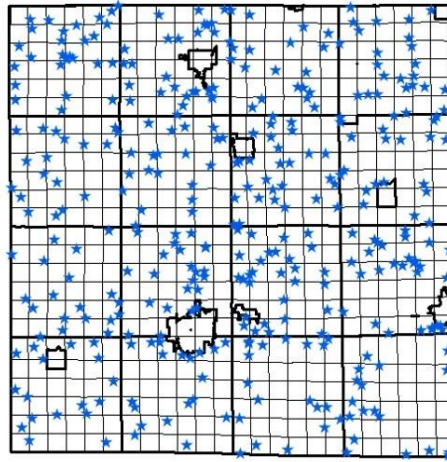
January
Mailed out results

WHERE and HOW many wells?

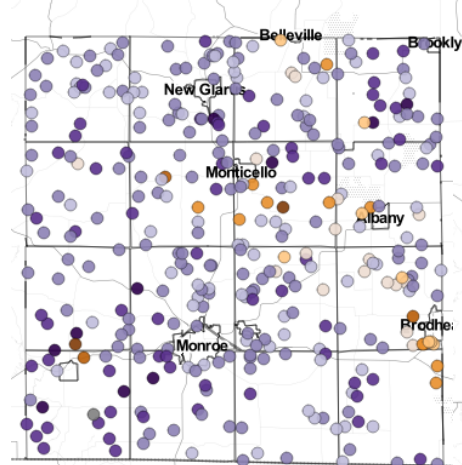
Initial Recruitment
770 Participants



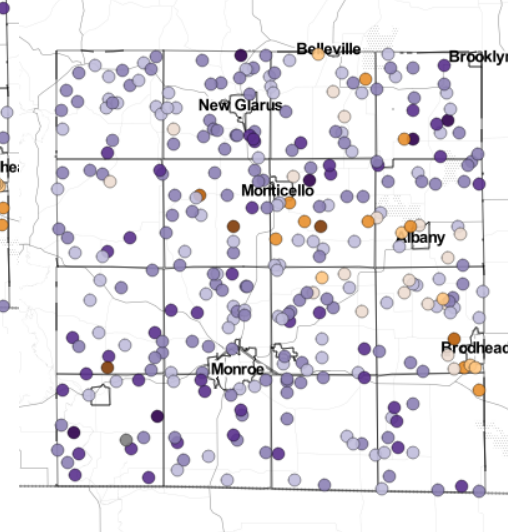
Yes Respondents
388



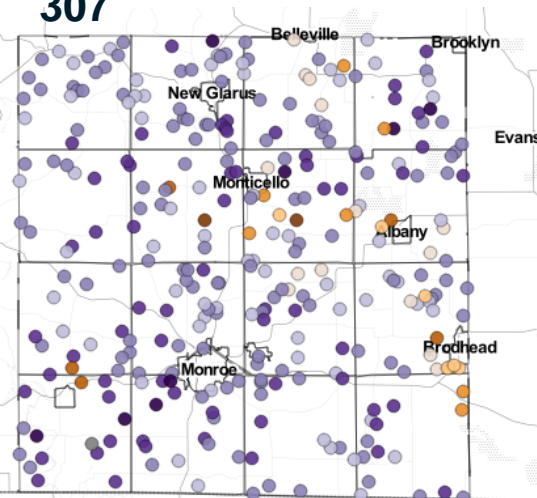
2019
Samples Received
348



2020
Samples Received
323

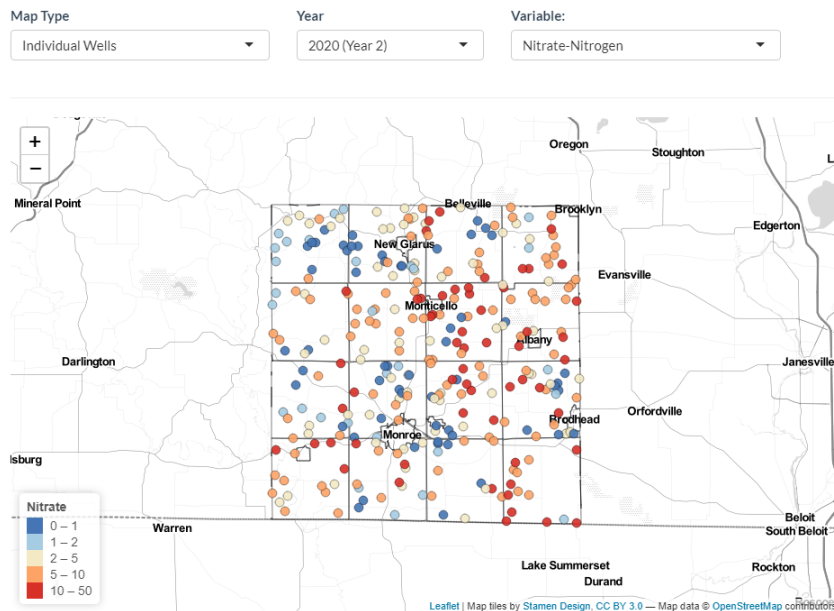


2021
Samples Received
307



Project Dashboard – Launched 2021

Green County Well Water Monitoring Project



Center for Watershed Science and Education in partnership with Green County
Created by: Grant Moser, Jennifer Dierauer, Abby Johnson, and Kevin Masarik
Last modified: March 30, 2021. [Contact us for questions](#)

ABOUT the Project

LEARN about Tests

EXPLORE project data

Overview

Green County is conducting a five-year project to gather information on well water quality. The water quality data collected is intended to understand whether groundwater quality is changing over time. This project has established a network of private well owners to perform annual testing for a period of five years.

- 2019 - 348 well owners participated in Year 1
- 2020 - 323 well owners participated in Year 2

The information collected through these efforts will be used to analyze where and what factors may be contributing to any changes in groundwater quality observed over time. The well network is intended to be representative of Green County (i.e. accounting for the wide variety of geology, soils, land-use, and well construction found throughout the area).

Using the Map

Map Type

Individual Wells: When individual wells are selected, this map view allows you to see the water quality test results for each well that was sampled. The well points are approximate locations in order to protect the privacy of participants. Clicking on the points will provide the water quality result for whichever test is selected.

Municipality: When the municipality view is selected, the map displays the average concentration for each of the water quality tests conducted. Clicking on the municipality will provide summary statistics by town.

Year

This selection allows you to see results from different years. Additional data will be made available as the project progresses.

Variable

This selection switches map to view from the different parameters that were analyzed for or various attributes associated with the wells

LEARN about tests

Samples are analyzed for nitrate-nitrogen, chloride, alkalinity, total hardness, pH, and conductivity. Nitrate and chloride are useful for understanding the degree to which groundwater has been affected by human activities. Click on the 'LEARN about tests' tab To learn more about the specific tests and what they tell us about groundwater.

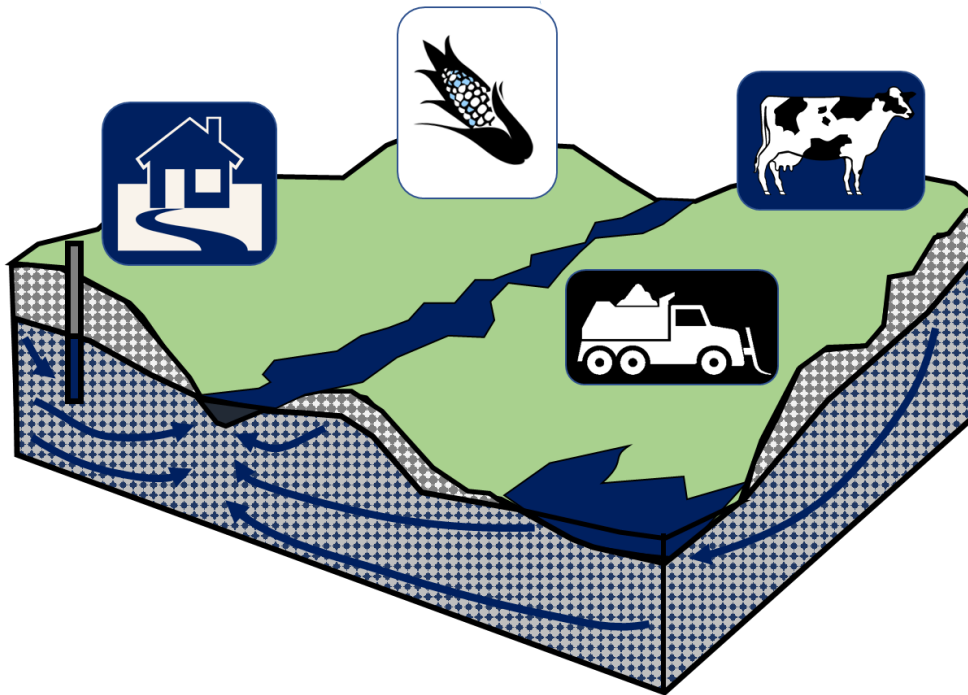
EXPLORE project data

Data can further be explored for trends over time in individual wells, municipal summaries, or county-wide. Click on the 'EXPLORE project data' tab to investigate data in more detail.

WHAT tests were performed?

Nitrate / Chloride

- Useful for understanding land-use impacts on groundwater



Conductivity

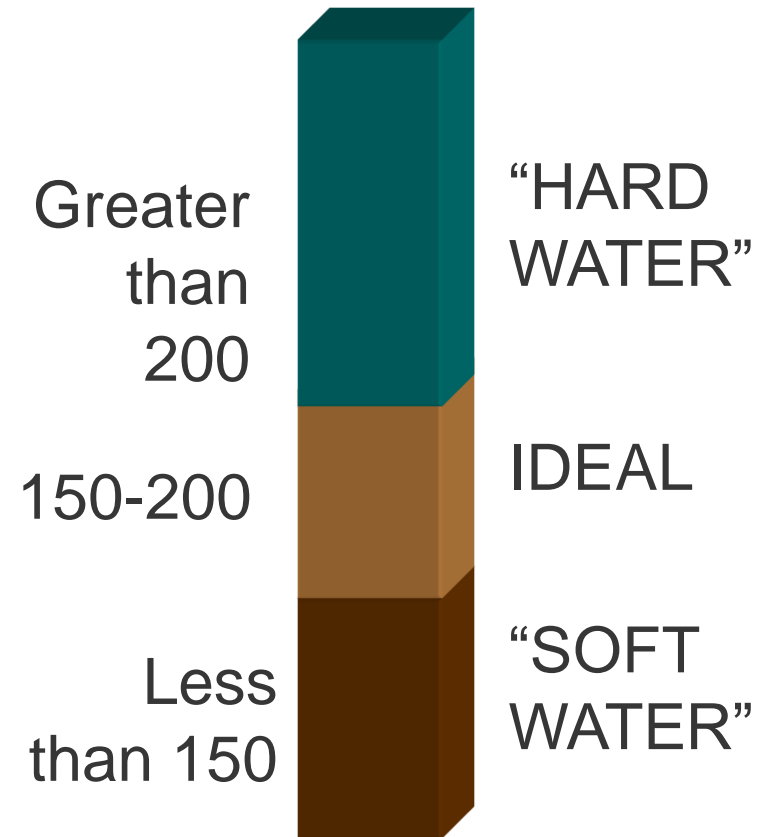
- Overall water quality, combination of both land-use, rocks, and soils

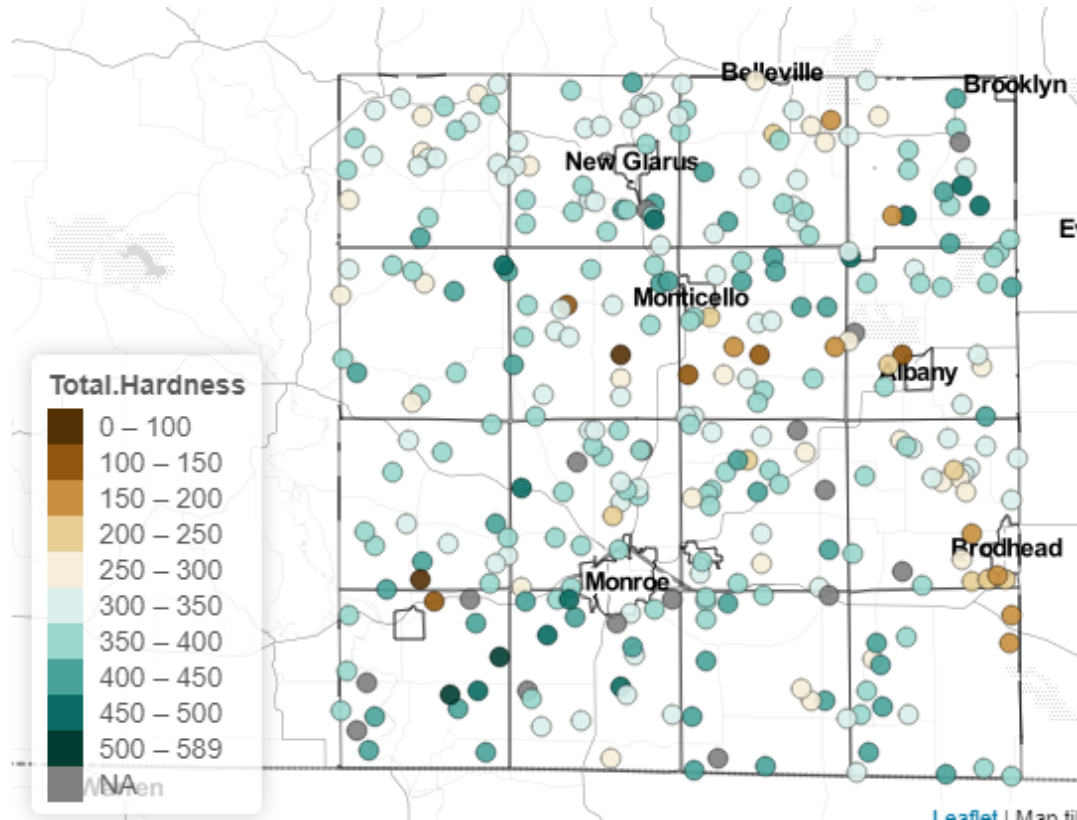
Total Hardness / Alkalinity / pH

- Help us understand how rocks and soils impact groundwater

Interpreting the Total Hardness Test

- Natural (rocks and soils)
- Primarily calcium and magnesium
- Problems: scaling, scum, use more detergent, decrease water heater efficiency
- Treatment:
 - Hard Water: water softener
 - Soft Water: Acid Neutralizer





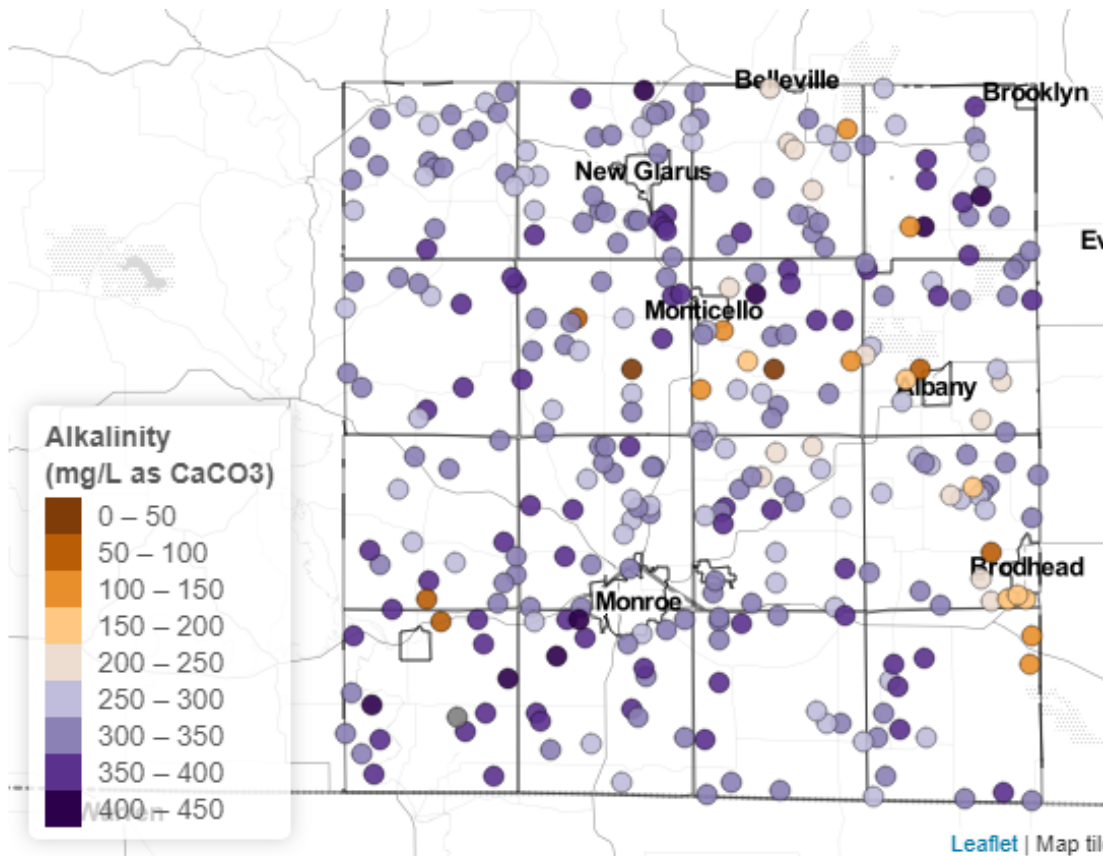
Total Hardness Summary

- **Average:** 346.3 mg/L
- **Median:** 356 mg/L
- **Maximum:** 589 mg/L
- **Minimum:** 62 mg/L

Interpreting tests for Alkalinity and pH

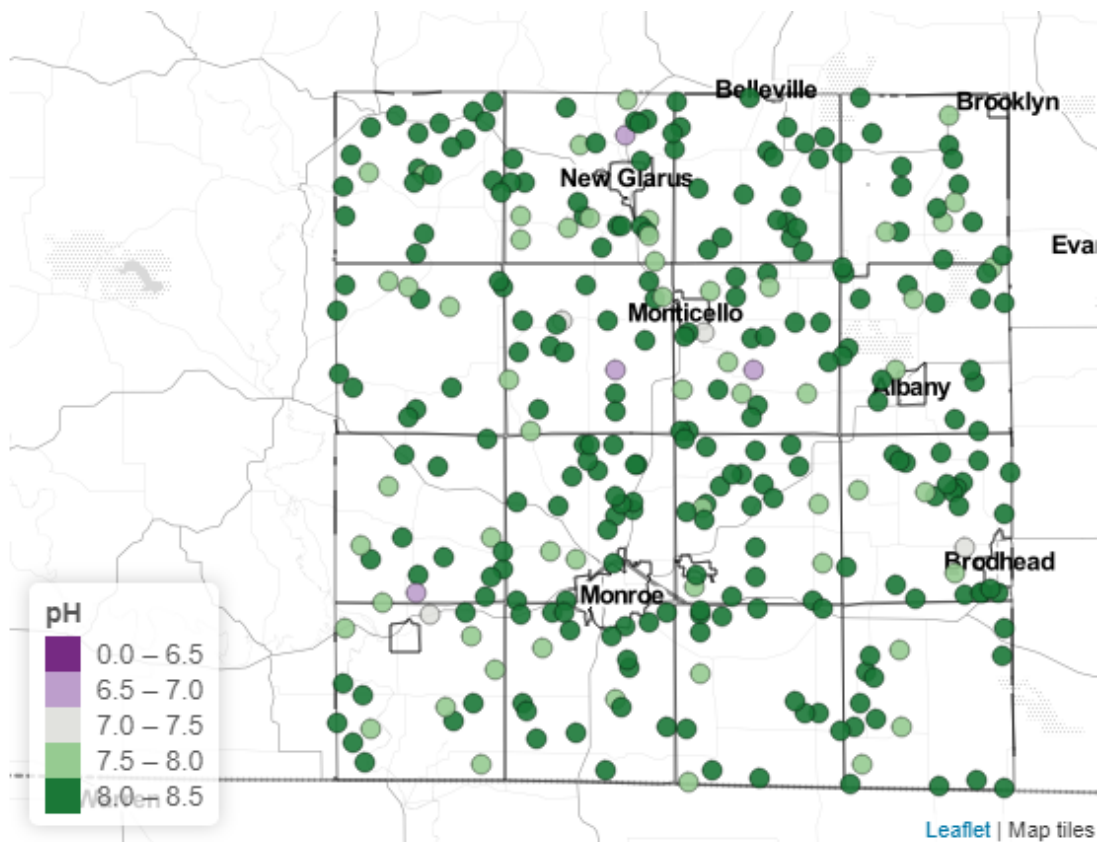
- **Alkalinity** – ability to neutralize acid, helps determine how corrosive water is likely to be
 - Less than 150 mg/L water is more likely be corrosive
 - Greater than 200 mg/L water will be more likely to form scale
- **pH** – Indicates water's acidity and helps determine if water will corrode plumbing





Alkalinity Summary

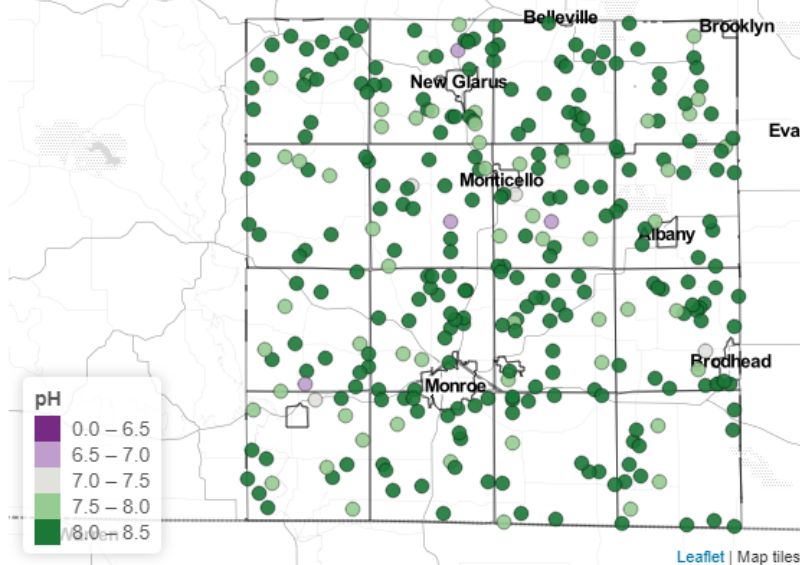
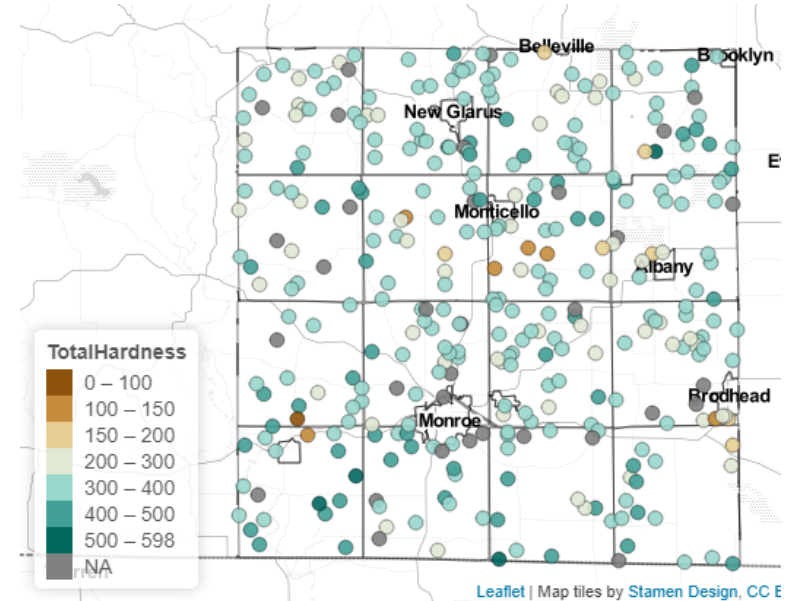
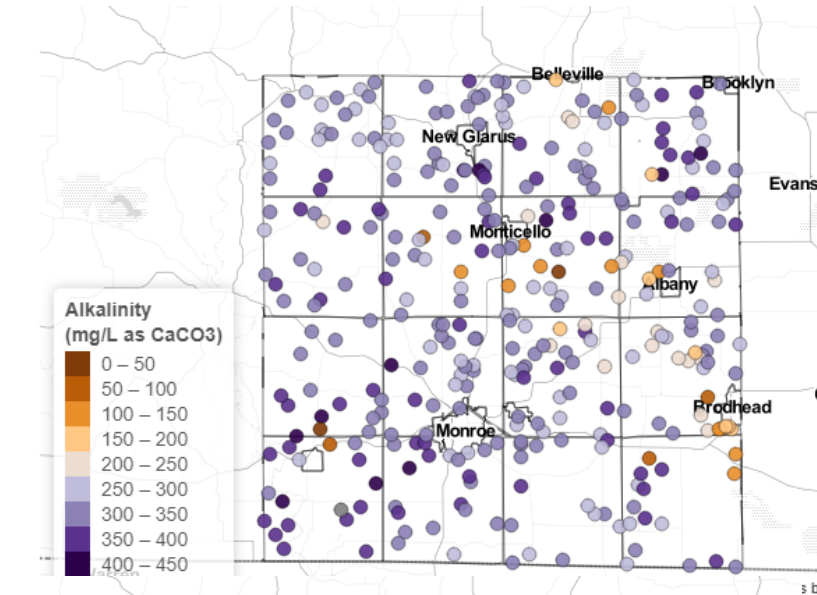
- **Average:** 307.2 mg/L
- **Median:** 315 mg/L
- **Maximum:** 479 mg/L
- **Minimum:** 32 mg/L



pH Summary

- **Average:** 8.1 mg/L
- **Median:** 8.14 mg/L
- **Maximum:** 8.5 mg/L
- **Minimum:** 6.7 mg/L

2021 Green County Results for: Alkalinity, Total Hardness, and pH



Averages:

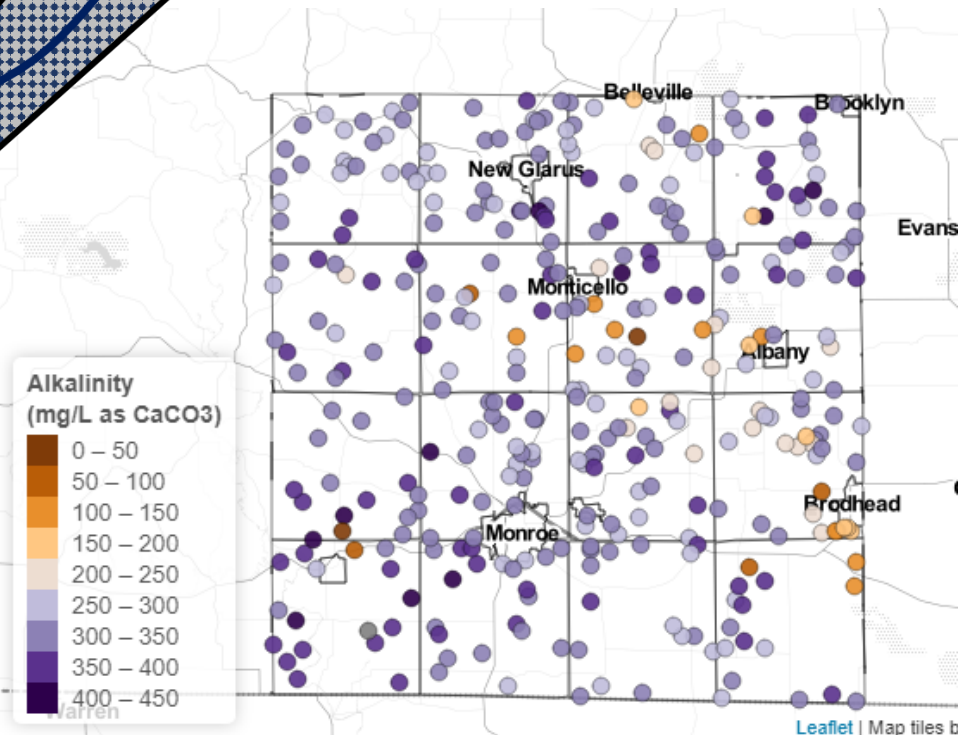
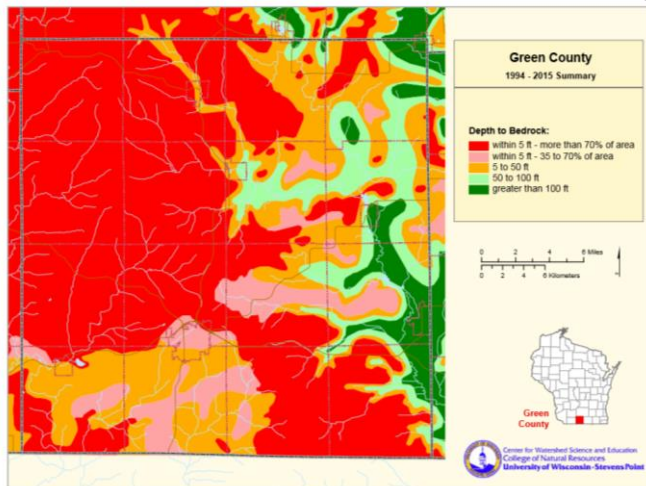
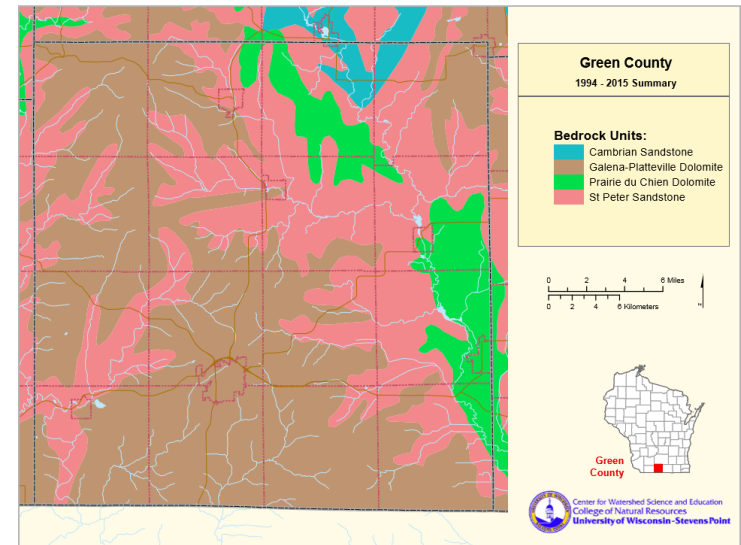
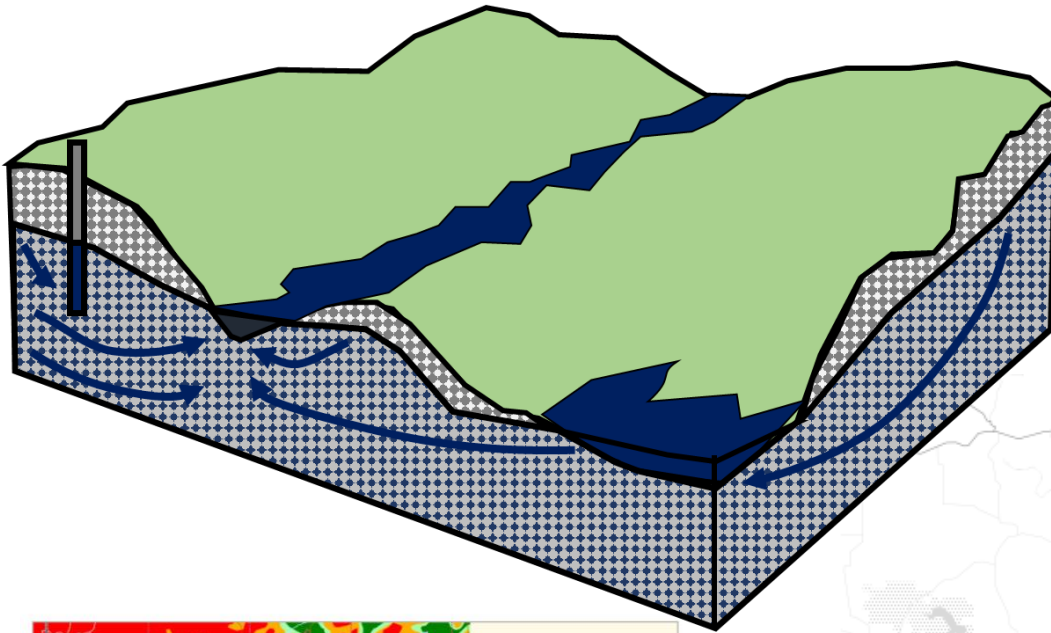
Total Hardness (mg/L as CaCO₃) – 346

Alkalinity (mg/L as CaCO₃) – 307

pH – 8.1

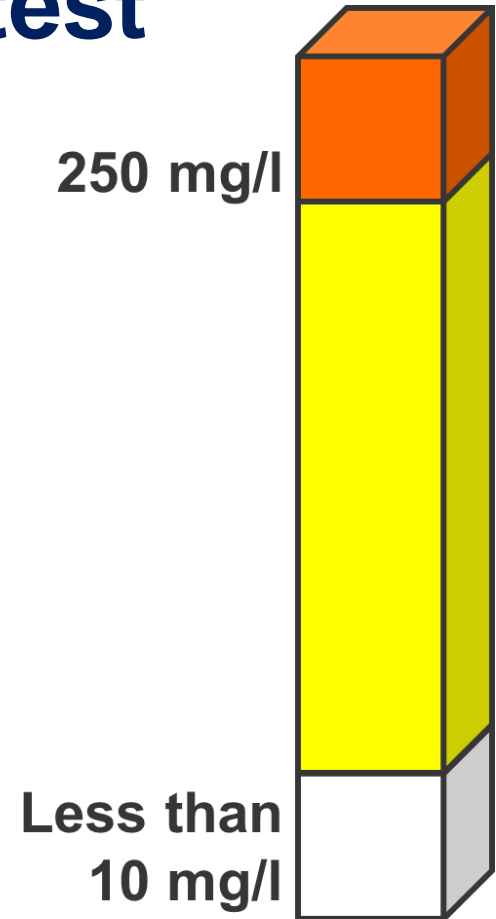
Total Hardness / Alkalinity / pH

- Help us understand how rocks and soils impact groundwater



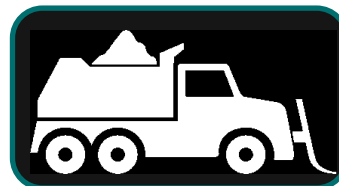
Interpreting your chloride test

- Greater than 250 mg/l
 - No direct effects on health
 - Salty taste
 - Exceeds recommended level
- Greater than 10 mg/l may indicate human impact
- Less than 10 mg/l considered “natural” in much of WI

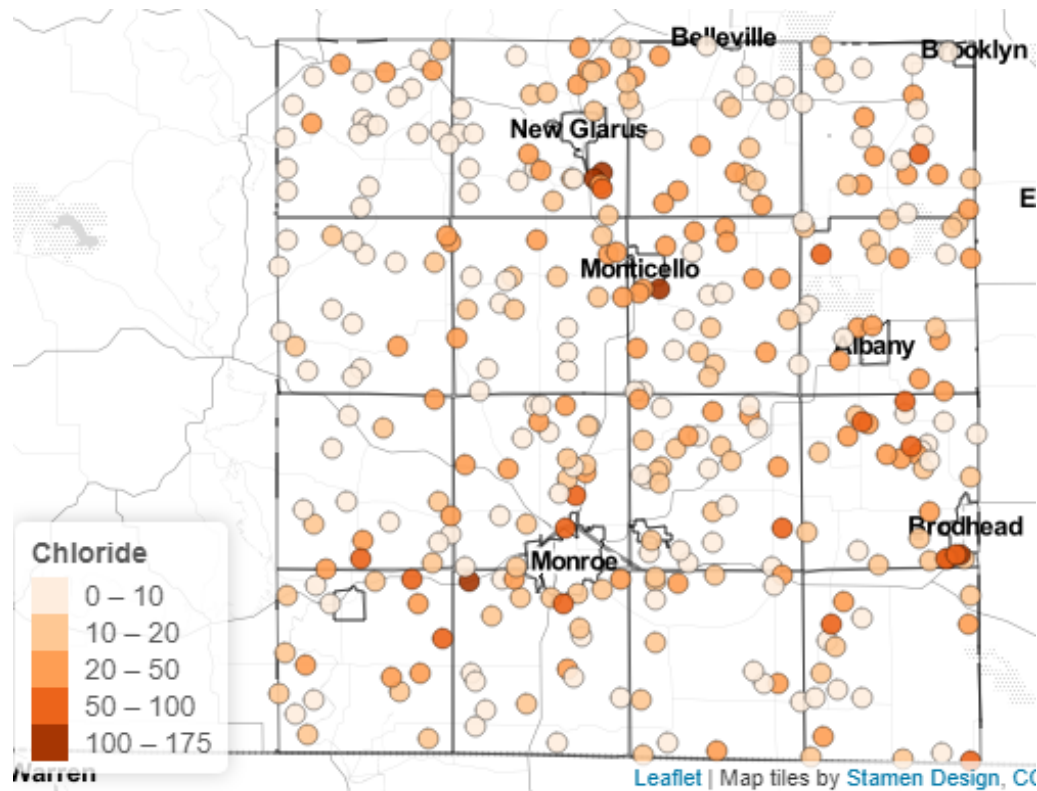


Sources:

Fertilizers / Septic Systems / Road Salt



2021 Green County Chloride Results

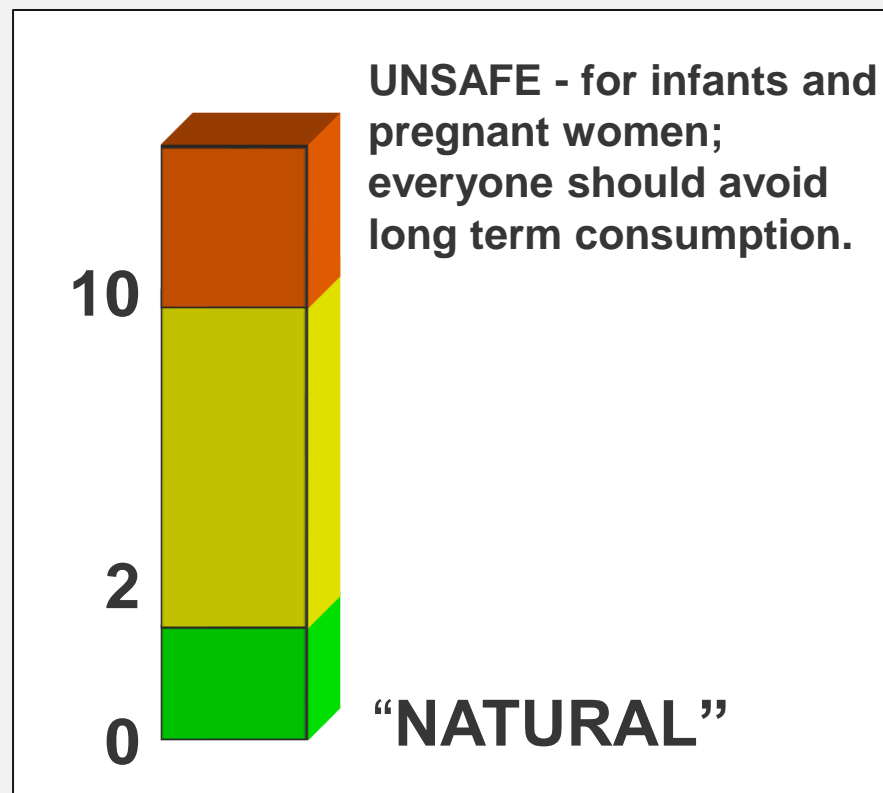


Chloride Summary

- 1% of wells tested greater than 100 mg/L
- 37% of wells tested less than 10 mg/L
- **Average:** 18.9 mg/L
- **Median:** 15.0 mg/L
- **Maximum:** 190 mg/L
- **Minimum:** 0.6 mg/L

Interpreting your nitrate-nitrogen test

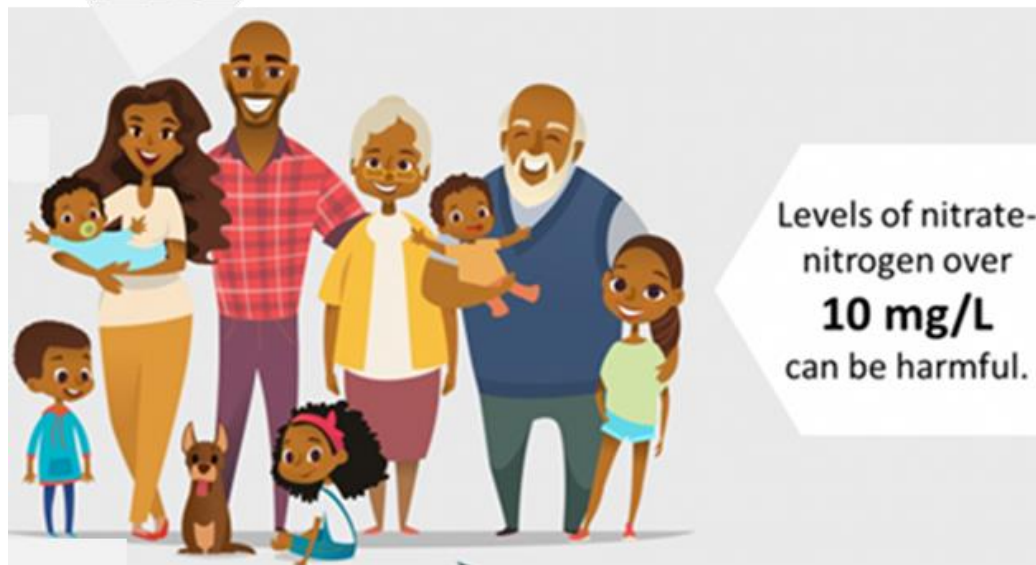
- **Greater than 10 mg/L**
Exceeds State and Federal Limits for Drinking Water
- **Between 2 and 10 mg/L**
Some Human Impact
- **Less than 2.0 mg/L**
“Transitional”
- **Less than 0.2 mg/L**
“Natural”



Nitrate-Nitrogen

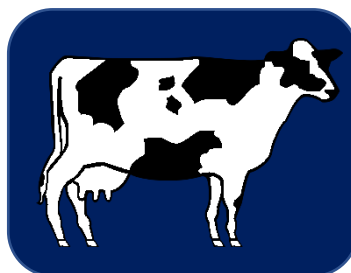
Health Effects:

- **Infants Less than 6 months:**
 - Methemoglobinemia (blue baby disease)
- **Women who are or may become pregnant:**
 - Possible links to birth defects and miscarriages (humans and livestock)
- **Everyone:**
 - Thyroid disease
 - Increase risk of certain types of cancers



Sources:

Agricultural fertilizer / Animal Waste or other bio-solids / Septic Systems / Lawn fertilizer



What can I do to reduce my nitrate levels?

Solution:

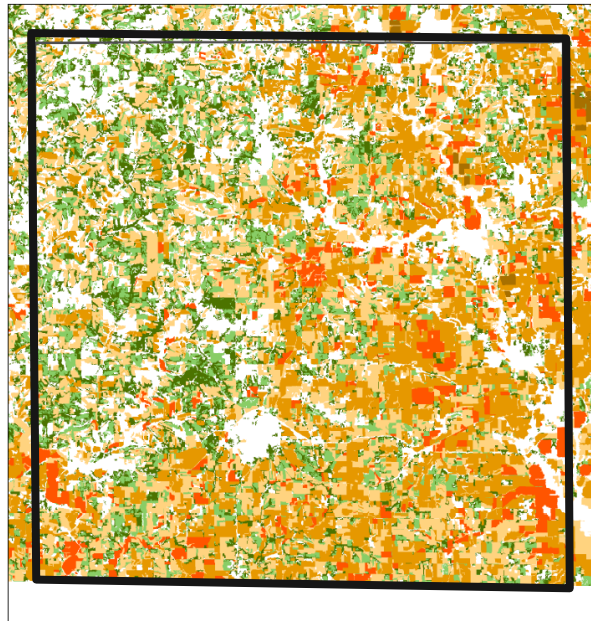
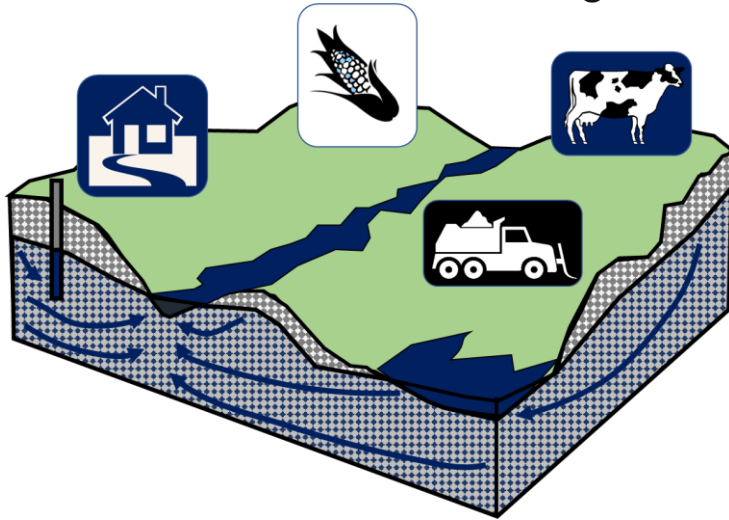
- Eliminate contamination source or reduce nitrogen inputs

Short term:

- Change well depth or relocate well
- Carry or buy water
- Water treatment devices
 - Reverse osmosis
 - Distillation
 - Anion exchange

Nitrate / Chloride

- Useful for understanding land-use impacts on groundwater



Green County
Well Water Sampling Project

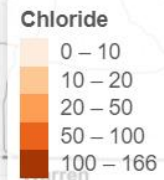
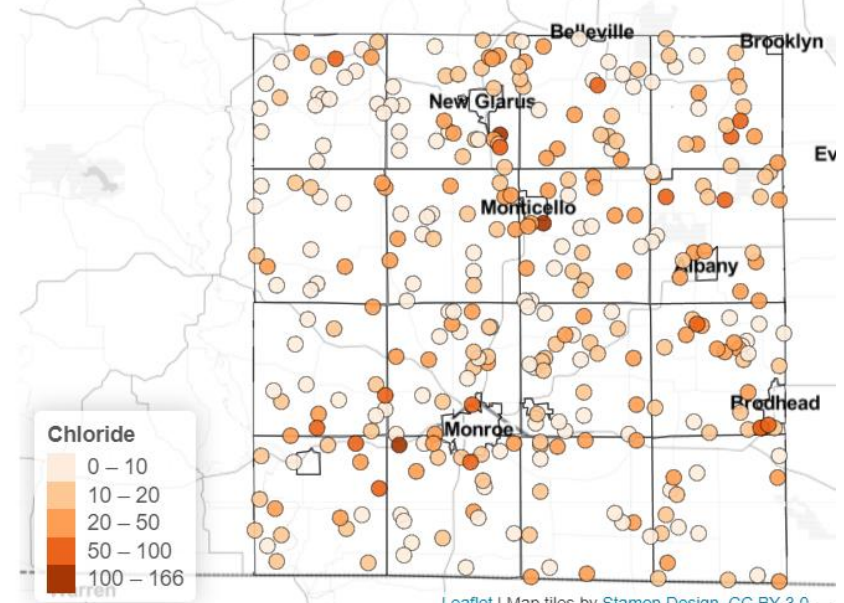
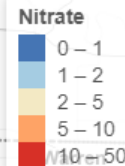
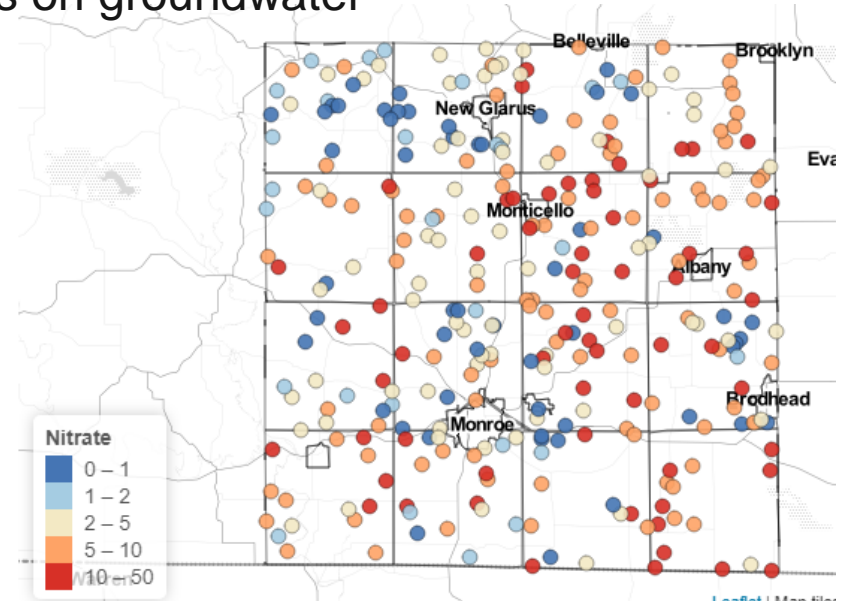
Agricultural Landcover Classification

- Potato/Vegetable
- Pasture
- Hay
- Dairy Rotation
- Cranberries
- Continuous Corn
- Cash Grain



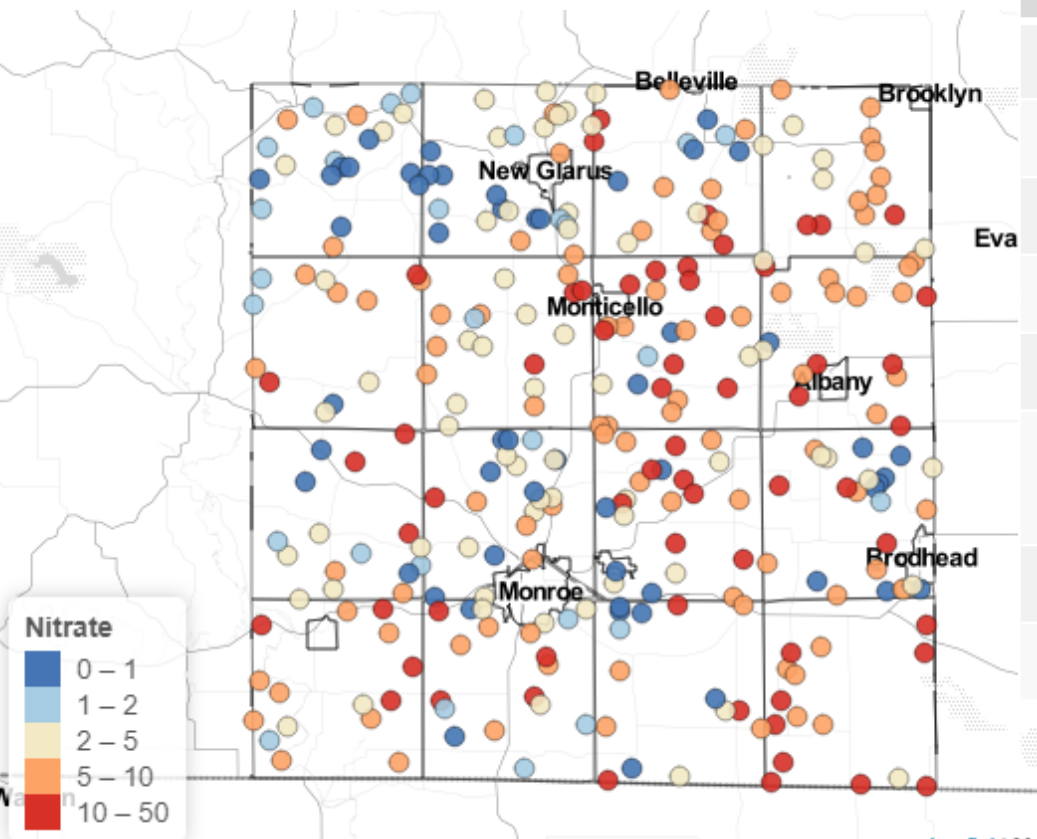
Source: Wiscland 2.0

Created: Elizabeth Belmont, February 28, 2022



Leaflet | Map tiles by Stamen Design, CC BY 3.0

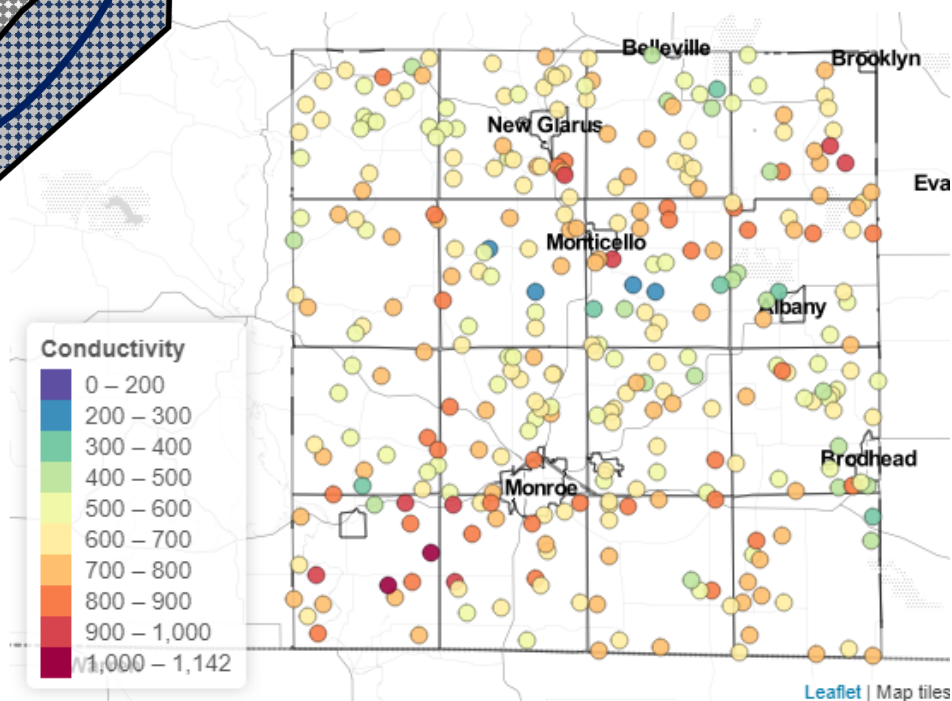
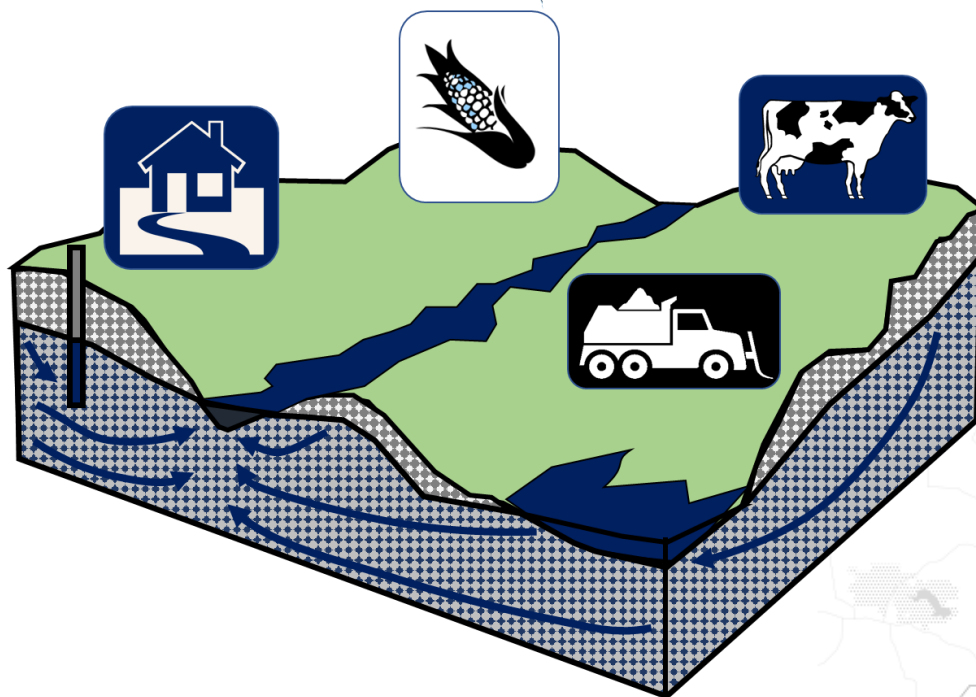
Nitrate-Nitrogen Results



	2019	2020	2021
	Nitrate-N (mg/L)		
Average	5.4	5.7	5.8
Median	5.0	5.0	5.0
Minimum	<0.1	<0.1	<0.1
Maximum	26.8	27.3	27.1
Greater than 10	15%	18%	19%
Less than 2	28%	27%	27%
N	348	323	307

Conductivity

- Overall water quality, combination of both land-use, rocks, and soils
 - Measure of total ions
 - Generally twice the hardness, if much greater may signify land-use impacts

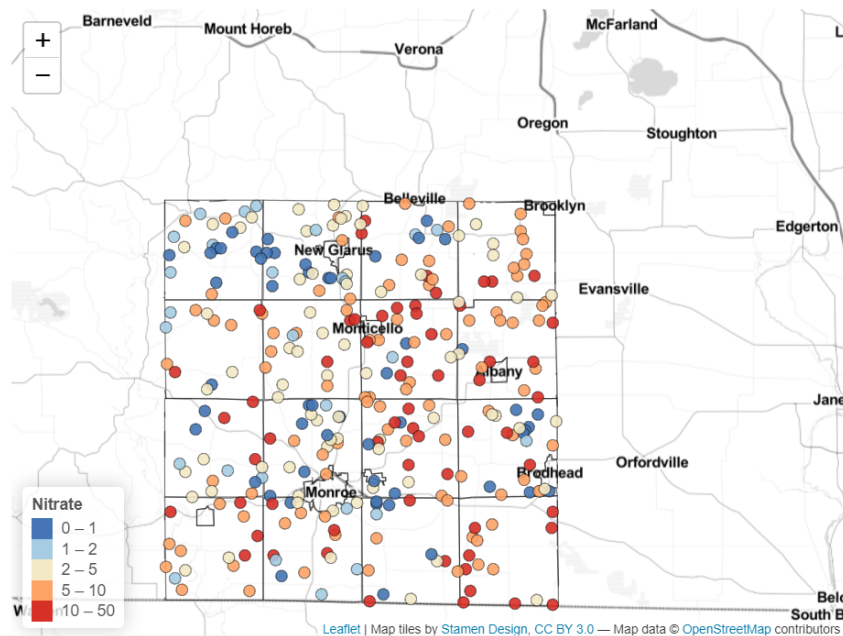


What's next for the project?

- Test kits for Year 4 will be sent sometime in October/November
- **Coming in Year 4:**
 - Add new functionality to dashboard:
 - Land use, well construction, trends, etc.
 - Will work to investigate relationships between land-use, soils, geology, well depth, etc. on water quality results
 - Develop statistical models to better predict water quality risk for wells that are not part of the project

Green County Well Water Monitoring Project

Map Type: Individual Wells
Year: 2021 (Year 3)
Variable: Nitrate-Nitrogen



[ABOUT the Project](#)

[LEARN about Tests](#)

[EXPLORE project data](#)

[Nitrate-Nitrogen](#)

[Chloride](#)

[Alkalinity](#)

[Total Hardness](#)

[pH](#)

[Conductivity](#)

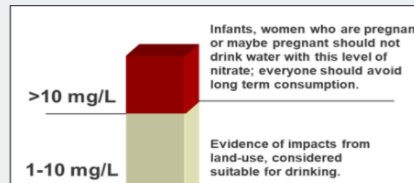
What is Nitrate

This test measures the amount of nitrate-nitrogen in your well. Nitrate is a form of nitrogen, commonly found in agricultural and lawn fertilizer, that easily dissolves in water. It is also formed when waste materials such as manure or septic effluent decompose. The natural level of nitrate in Wisconsin's groundwater is less than 1 mg/L. Levels greater than this suggest groundwater has been impacted by various land-use practices.

Why Test for Nitrate

Nitrate is an important test for determining the safety of well water for drinking. Nitrate is a test that allows us to understand the influence of human activities on well water quality. Because it moves can come from a variety of sources and moves easily through soil, it serves as a useful indicator of certain land-use activities. An annual nitrate test is useful for better understanding whether water quality is getting better, worse, or staying the same with respect to certain land-uses (see Sources).

Interpreting Nitrate-Nitrogen Concentrations



https://shiny.theopenwaterlog.com/wellwaterquality_greencounty/

Questions?

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kmasarik@uwsp.edu

www.uwsp.edu/cnr/watersheds

Thanks to you and the following for helping sponsor this program:

- Green County
- University of Wisconsin-Madison, Division of Extension – Green County
- Green County Health Department
- Green County Land Use and Zoning Department
- Green County Land and Water Conservation



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