



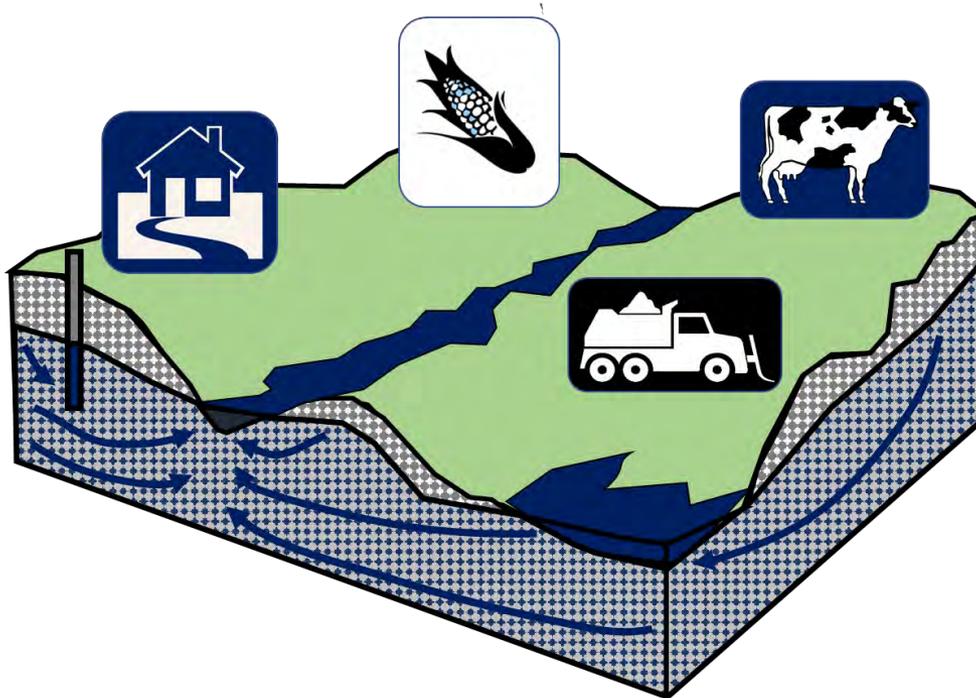
Kevin Masarik
University of Wisconsin –
Stevens Point

Afternoon Speaker August 1

Chloride in Wisconsin Private Wells



Chloride in Wisconsin Private Wells (and sodium)



- Private wells in WI
- Overview of data collection
- Demonstration of WI Well Water Viewer
- What we've learned with respect to chloride and sodium

Kevin Masarik, Groundwater Education Specialist



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



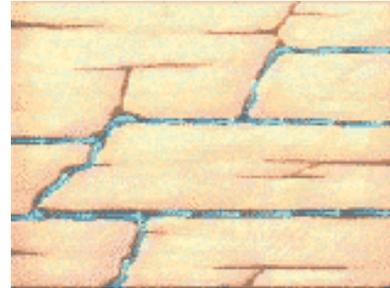
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Aquifers: Our groundwater storage units

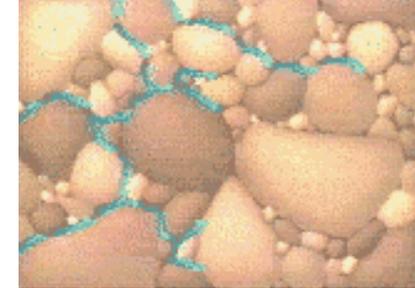
Aquifers are geologic formations that store and transmit groundwater.

The aquifer properties determine how quickly groundwater flows, how much water an aquifer can hold and how easily groundwater can become contaminated. Some aquifers may also contain naturally occurring elements that make water unsafe.

Wisconsin's geology is like a layered cake. Underneath all of Wisconsin lies the Crystalline bedrock which does not hold much water. Think of this layer like the foundation of your house. All groundwater sits on top of this foundation. Groundwater is stored in the various **sandstone, dolomite and sand/gravel** aquifers above the **crystalline bedrock** layer. The layers are arranged in the order which they formed, oldest on the bottom and youngest on top.

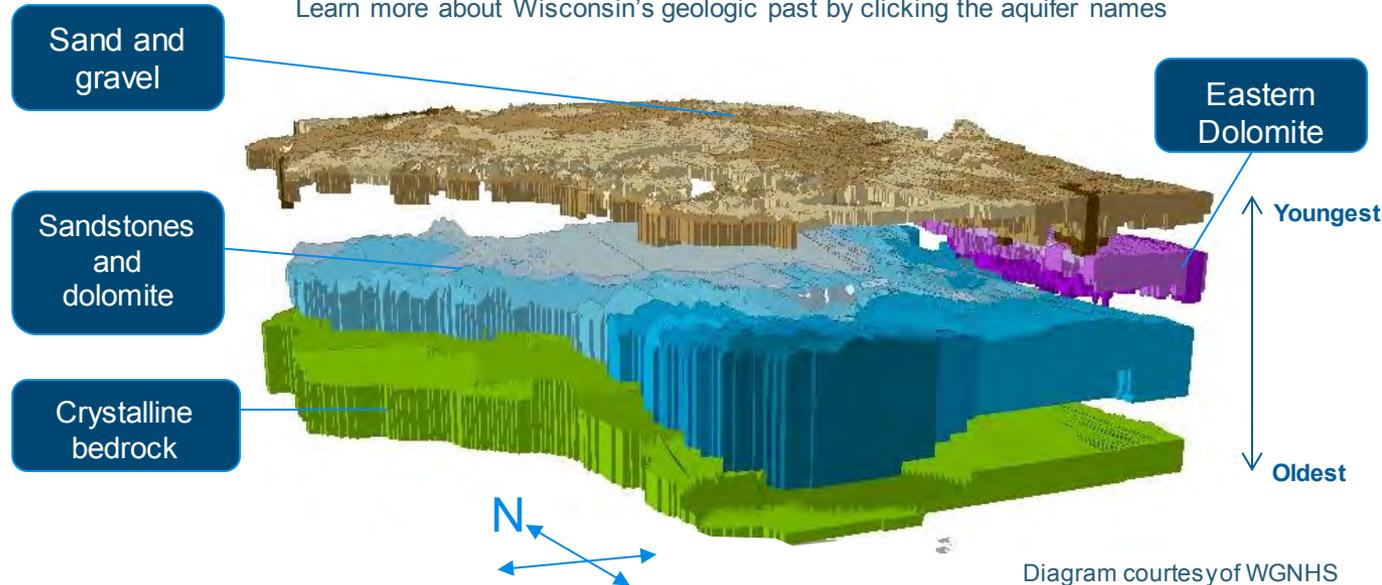


Water and contaminants can move quickly through cracks and fractures.

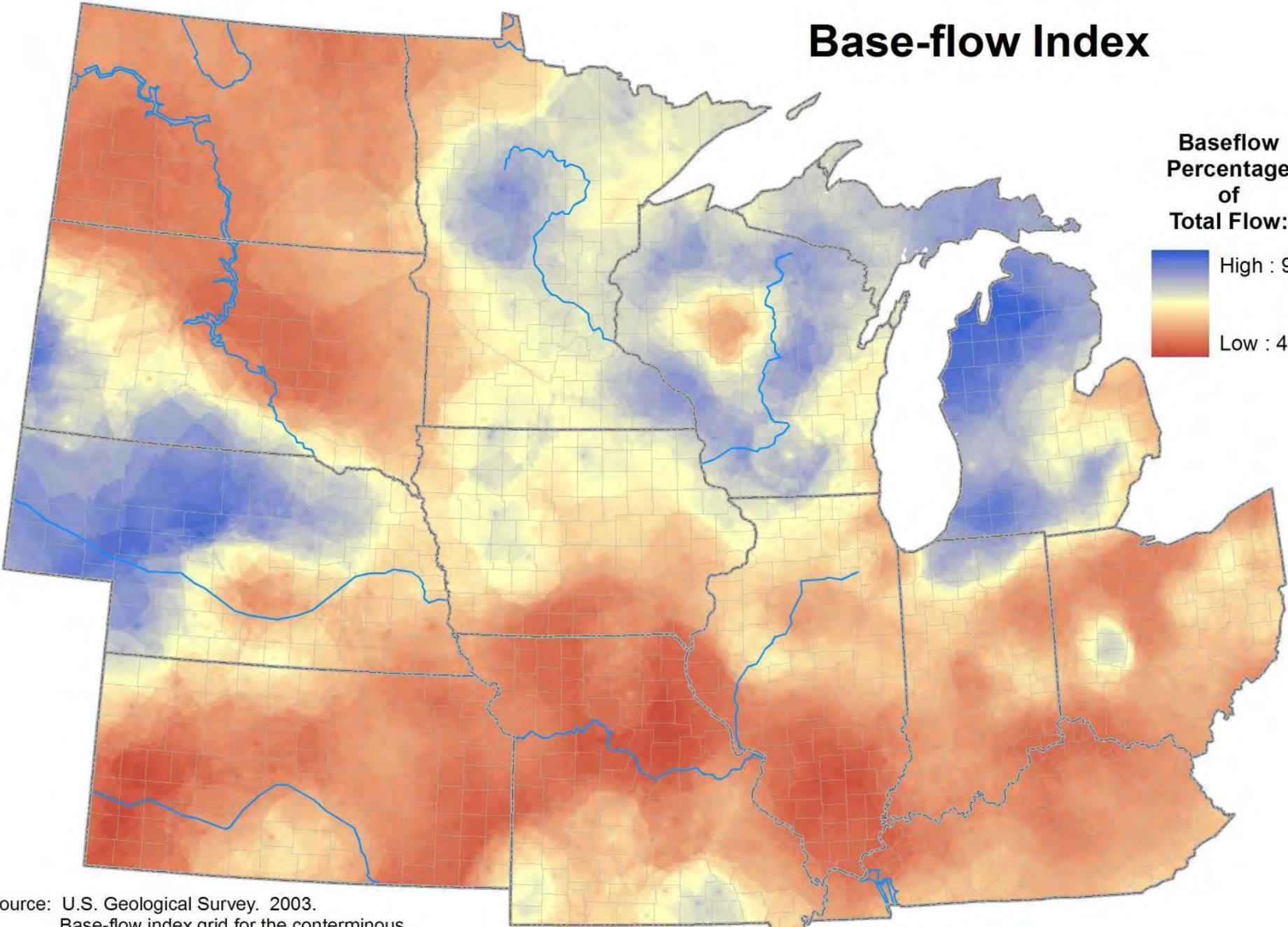


Water moving through tiny spaces in between sand particles or sandstone moves slower and allows for filtration of some contaminants.

Learn more about Wisconsin's geologic past by clicking the aquifer names



Base-flow Index



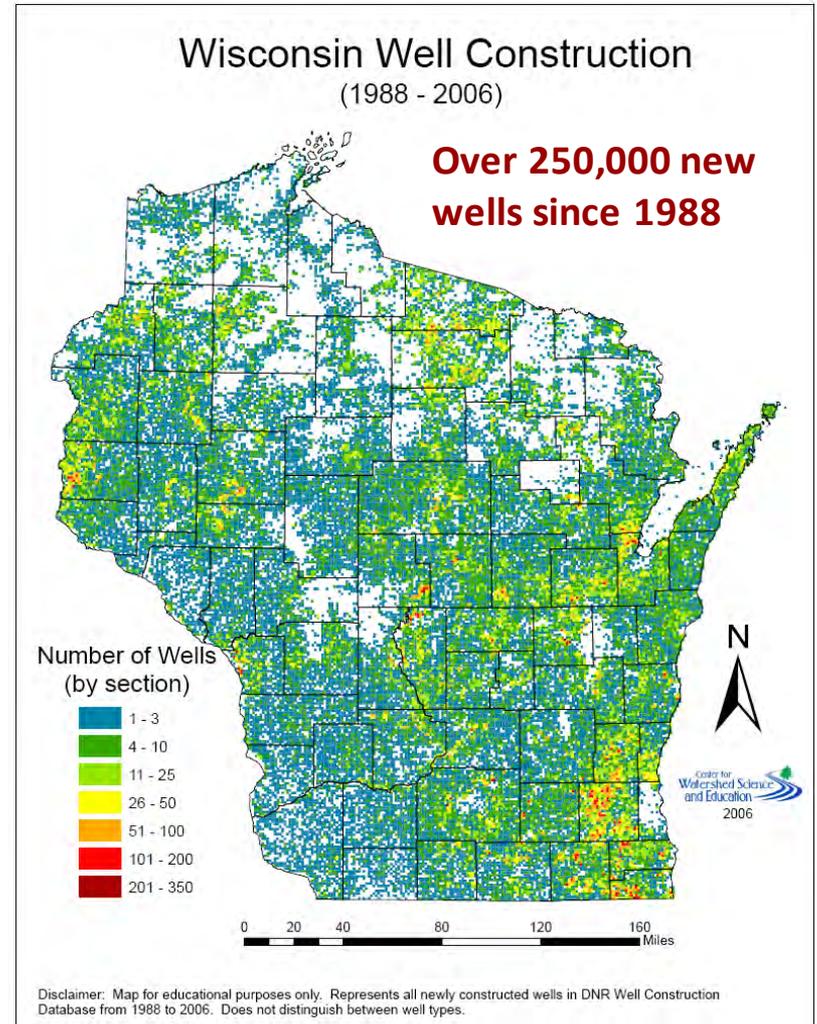
Source: U.S. Geological Survey. 2003. Base-flow index grid for the conterminous United States. U.S. Geological Survey Open-File Report 03-263. Reston, Virginia.



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Groundwater is Valuable to Wisconsin

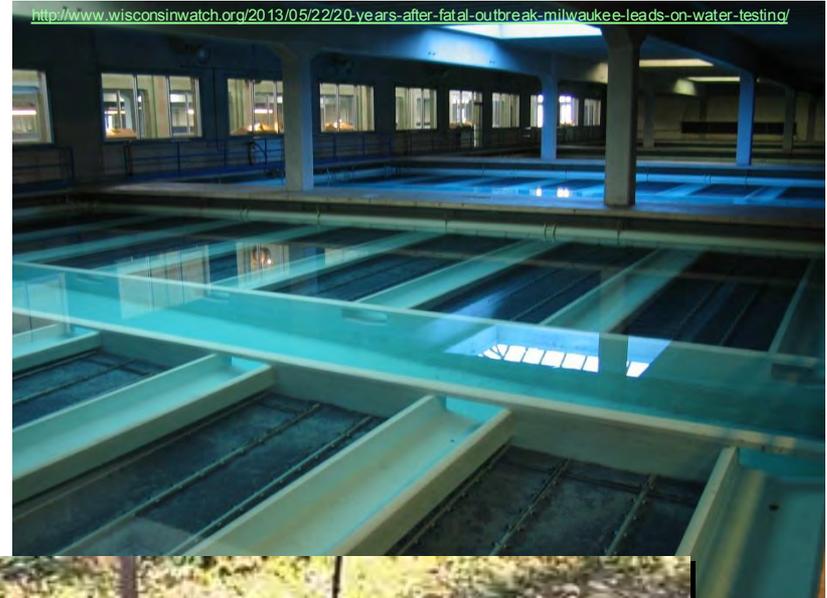
- 95% of Wisconsin Communities
- 900,000 Private Wells (1/3 of WI population)
- 75% of Wisconsin Citizens rely on it to meet their daily water needs
- Supplies almost all water for agriculture – livestock, irrigation, dairy operations
- 1/3 of industrial water use
- 1/2 of commercial water use



Private vs. Public Water Supplies

Public Water Supplies

- Regularly tested and regulated by drinking water standards.



Private Wells

- Not required to be regularly tested.
- Not required to take corrective action
- Owners must take special precautions to ensure safe drinking water.



Why do people test their water?

- Installed a new well*
- Licensed professional performs work on well*
- Change in taste or odor
- Buying or selling their home
- Plumbing issues
- Pregnant or just had a baby
- *Want to know if it's safe to drink.*

* Required to be tested for limited number of things.

Recommendations for testing of your private well

Test	Which wells or homes should be tested?	How often should I test?
Coliform Bacteria	Every well	Annually, or when there is a change in taste, color or odor
Nitrate	All newly constructed wells or when you first move into a new home.	Test initially, and once every 5-10 years if levels are less than 2 mg/L.
	Wells within ¼ mile of an agricultural field or animal feed lot or if initial test measures above 2 mg/L	Test annually to understand if your water quality is changing over time
Arsenic	Well used by pregnant women and infants	Test before pregnancy and at time of birth.
	Every well	Consider one time test, retest if iron levels increase
Pesticides	Wells that have detected arsenic in previous tests.	Test again in a year to see if levels have increased
	Wells within ¼ mile of agricultural fields or areas where pesticides are manufactured, stored or mixed.	Test once every 5-10 years.
Lead	Homes with copper plumbing installed before 1985 or containing brass components	Consider one time test
Copper	Homes with copper plumbing.	Consider one time test
	Homes where residents experience repeated symptoms of nausea, diarrhea or abdominal cramps.	Two tests, one first draw sample in the morning and one after flushing faucet for 2-3 minutes.
Fluoride	Wells used by infants and/or preschool-aged children	Test when infant is born or when first moving into new home with a well
VOCs (solvents, gasoline or fuel oil)	Wells within ¼ mile of a landfill, underground fuel tank; or wells within ¼ mile of where solvents have been used or spilled (dry-cleaners, automotive garage, etc.)	Test once every 5-10 years or if solvent or gasoline taste or odor is noticed.

Community Drinking Water Programs



1. Advertising and bottle distribution



2. Sample collection and drop off.



3. Samples are analyzed at WEAL

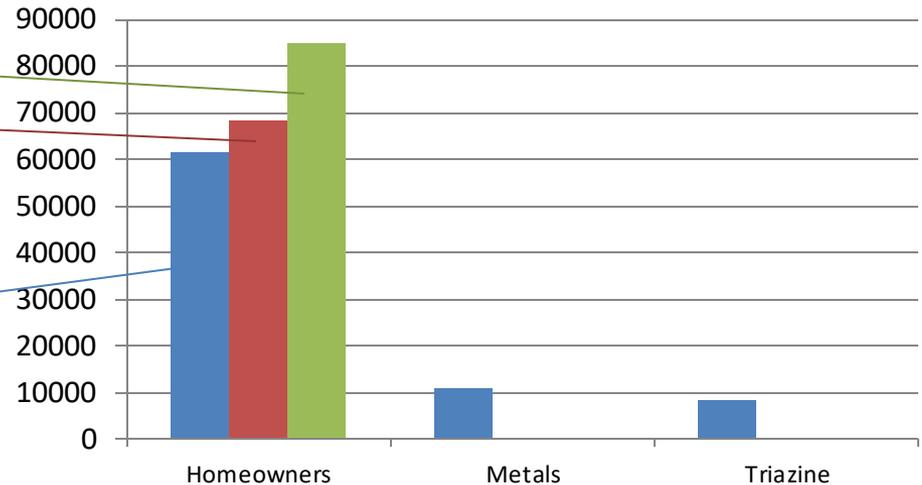


4. Hold educational program for community.

Water Testing Offered through UW-Extension since late-1980's.

■ Homeowners Package:

- Coliform Bacteria*
- Nitrate*
- Chloride
- Alkalinity
- Conductivity
- Hardness
- pH
- Saturation Index



■ Metals Package – added in late 90's

- Arsenic*, lead*, copper*, zinc, iron, manganese, sodium, calcium, magnesium, potassium, sulfate

■ Triazine* Screen added in late 90's (switched to diaminochlorotriazine in 2008)

- Quick and dirty method to measure the amount of some common corn herbicides

Tests packaged in a way that contributes to our understanding of: 1) sanitary condition of the water supply, 2) degree to which land-use is impacting well water, and 3) likelihood of naturally occurring contaminants.

***Health related contaminant**

Evolution of private well data collection



Data entry begins
(most from mid-80's – Present)

Water quality testing performed by multiple entities:

- UW-Extension/UWSP - Water and Environmental Analysis Lab
- State Lab of Hygiene
- Local Health Departments
- WI Dept. of Agriculture Trade and Consumer Protection (DATCP)
- Private Laboratories
- Others

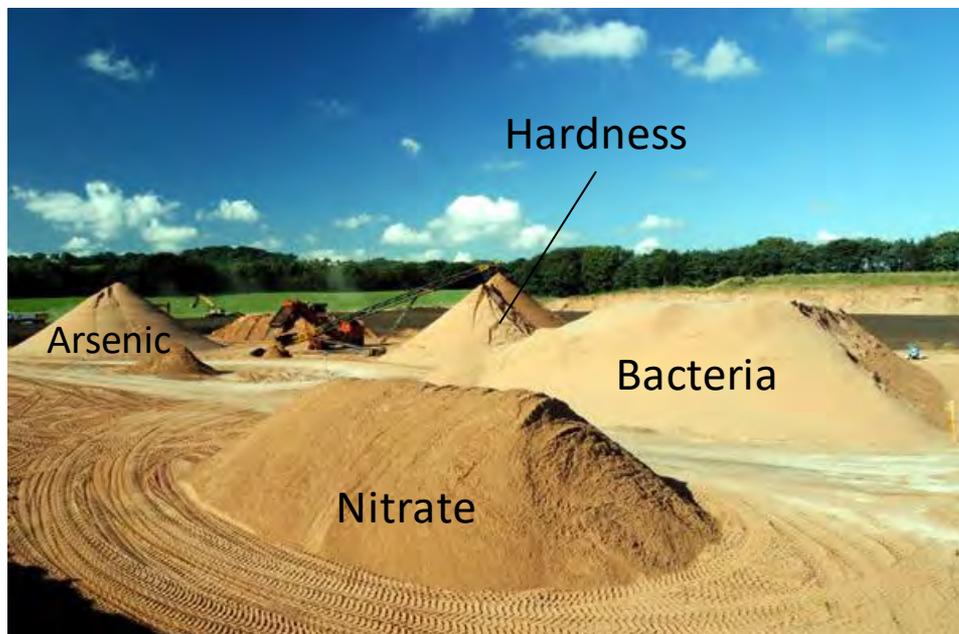
Evolution of private well data collection



Data stored in various locations:

- WI DNR – Groundwater Retrieval Network
- WI DATCP – Ag Chemical Monitoring
- UWEX– Drinking Water Programs
- County Health Dept.
- Others – not easily accessible

Evolution of private well data collection



How do you bring those sources of data together?*

- Multiple database formats
- Different levels of data management quality (WUWN, location, etc.)
- Varying detection limits

Evolution of private well data collection



Use the data to create a detailed visual of water quality:

- **Nitrate** – DNR, DATCP, *UWSP/Extension*
- **Bacteria** – *UWSP/Extension*
- **Hardness** – *UWSP/Extension*
- **Arsenic** – *UWSP/Extension*, DNR, Eau Claire
- **Chloride** – *UWSP/Extension*





[Use the Interactive Well Water Quality Viewer](#)

Homeowners and local units of government can use this tool to:

- See what we know about general well water quality in Wisconsin.
- Compare water quality in your area to nearby towns or counties.
- Raise awareness of local groundwater quality issues.
- Promote testing and outreach efforts.
- Encourage well testing in areas where little data exists.
- Highlight the importance of testing well water on a regular basis.

Disclaimer: The viewer summarizes private well water quality data from the Center for Watershed Science and Education, the WI Dept. of Ag, Trade and Consumer Protection, and the WI Department of Natural Resources Groundwater Retrieval Network. It is not considered a scientific study and does not represent well water quality information for all known private wells.

This information is not intended to be a substitute for well water testing and does not provide site specific information for an individual well or property. The Center for Watershed Science and Education is not responsible for misuse or misinterpretation of the data.

Direct questions on using and interpreting this information to [Kevin Masarik](#).

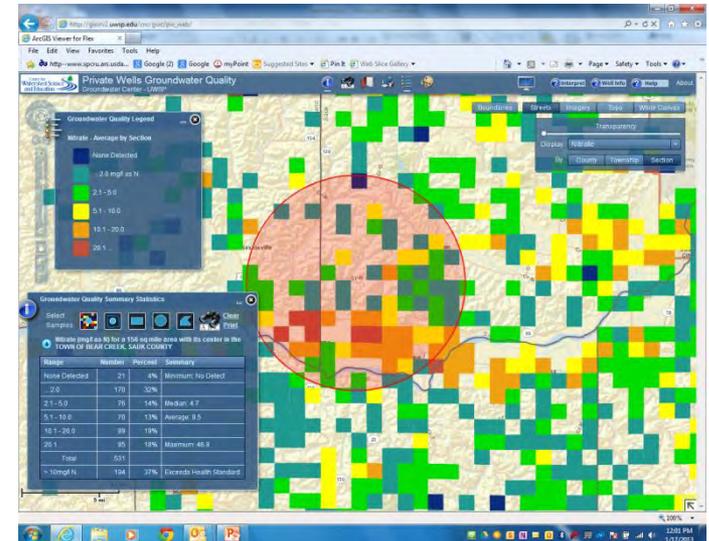
Interactive Well Water Quality Viewer 1.0 created by David Mechenich, Center for Watershed Science and Education

WI Well Water Quality Viewer

Nearly 900,000 households rely on private wells as their primary water supply. Homeowners with private wells are encouraged to have wells tested on a regular basis to determine the safety of the water supply for purposes such as drinking and cooking. While testing is the only way to determine the types and amount of contaminants in a well water system, homeowners, health professionals and local officials often want to know more about water quality issues in their community.

Features

- Search for information on 14 different water quality parameters
 - Health related contaminants:
 - Nitrate
 - Arsenic
 - Atrazine
 - Lead
 - Copper
- View water quality information at a county, town or section level detail
- Generate groundwater quality summaries by county, town or any user defined area greater than 1 sq. mile



Available online at:

<http://www.uwsp.edu/cnr-ap/watershed/Pages/wellwaterviewer.aspx>

Chloride in Wisconsin's groundwater

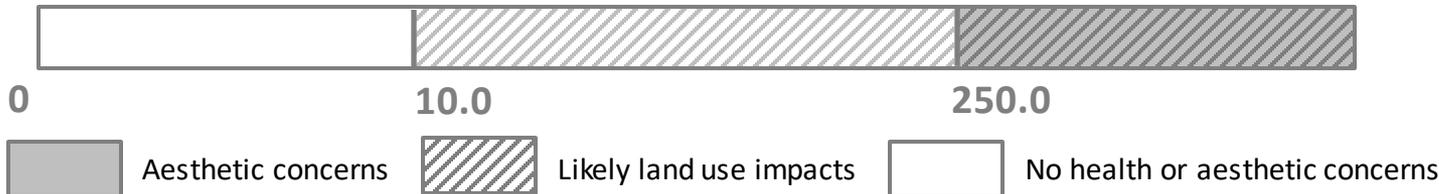
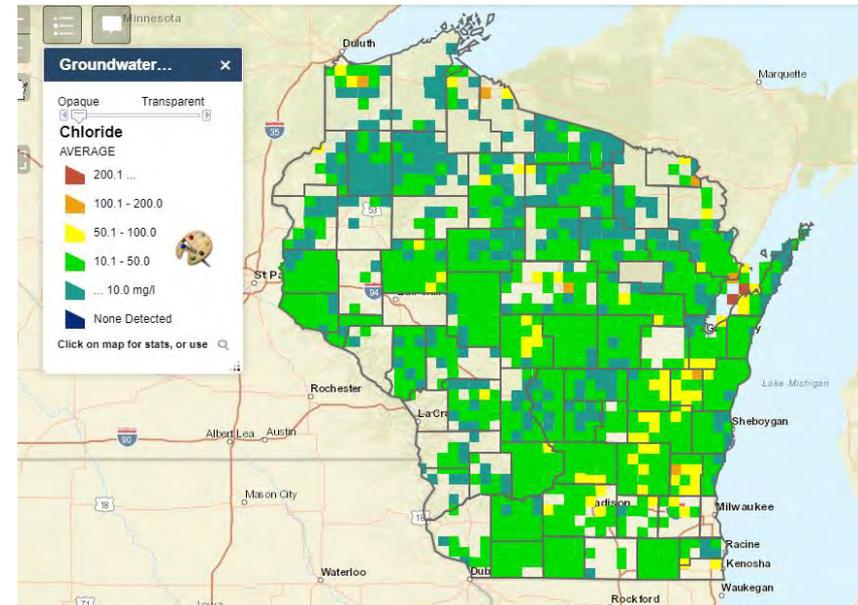
Natural levels generally <10 mg/L

Sources:

- Fertilizer (potash or potassium chloride)
- Septic system effluent
- Road salt

Aesthetic Level:

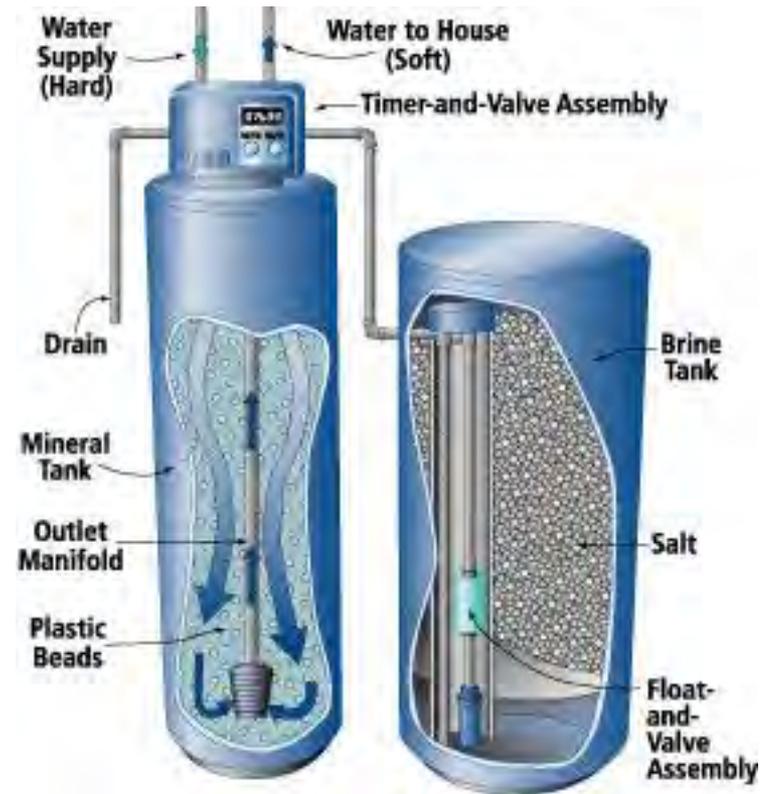
- Levels greater than 250 mg/L:
 - May make water taste salty
 - Cause corrosion of some metals particularly stainless steel



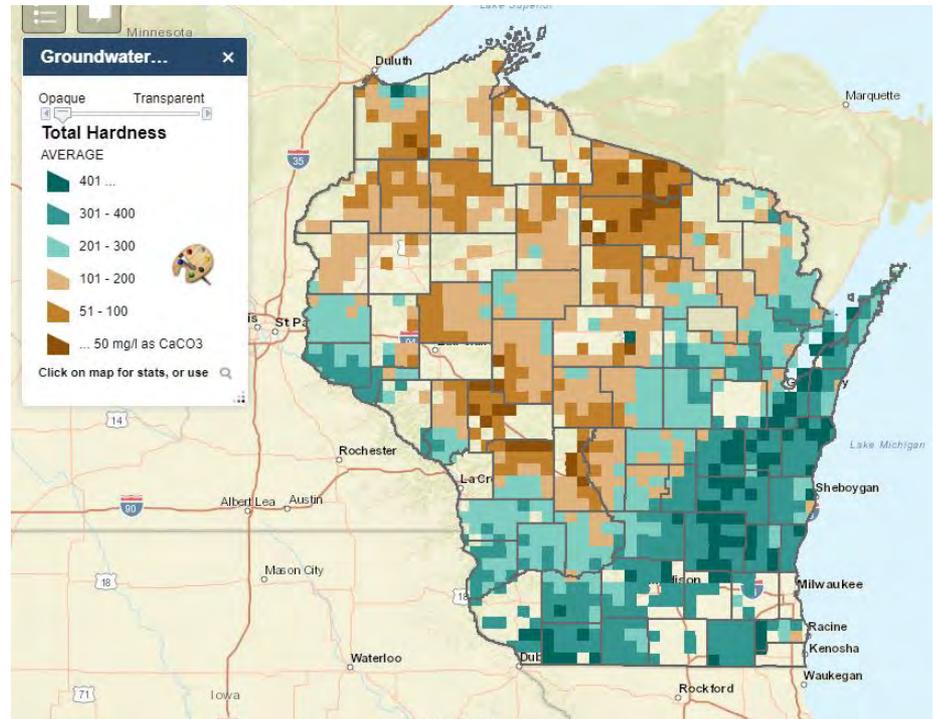
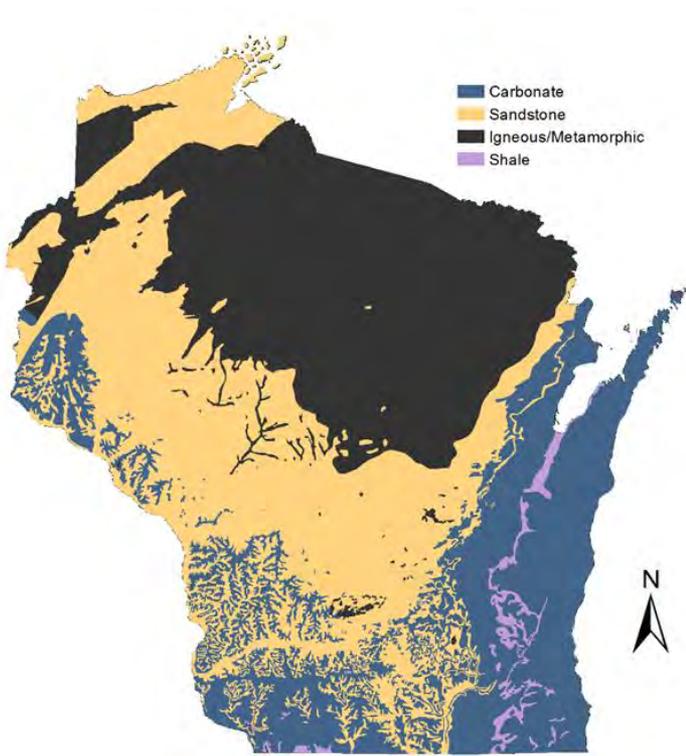
Water Softening

Water softeners remove calcium and magnesium which cause scaling and exchange it for sodium (or potassium).

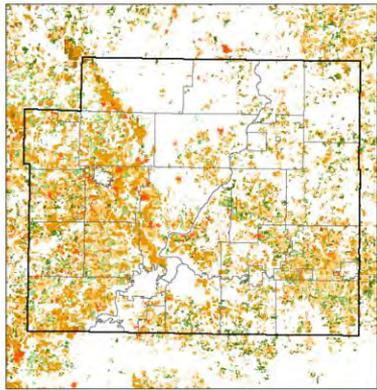
- Increases sodium content of water.
- Suggestions:
 - Bypass your drinking water faucet.
 - Do not soften water for outdoor faucets.
 - If you are concerned about sodium levels – use potassium chloride softener salt.



Wisconsin Bedrock and Total Hardness



Landcover + Soil Drainage = Chloride

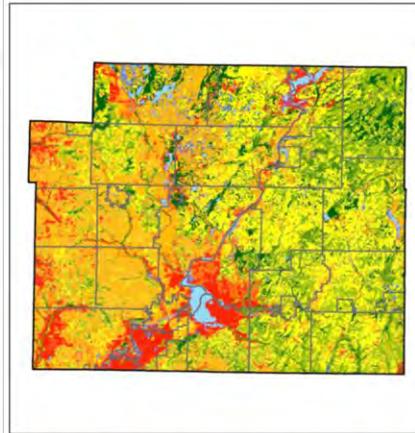


Chippewa County Well Water Sampling Project

- Agricultural Landcover Classification**
- Potatoes/vegetable
 - Pasture
 - Hay
 - Dairy Rotation
 - Cranberries
 - Continuous Corn
 - Cash Grain



Source: Wetland 2.0
Created: Elizabeth Belmont, February 28, 2022

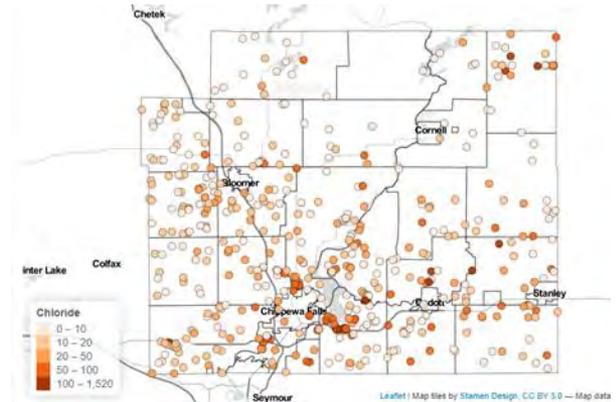


Chippewa County Well Water Sampling Project

- Drainage Classification**
- Excessively drained
 - Somewhat excessively drained
 - Well drained
 - Moderately well drained
 - Somewhat poorly drained
 - Poorly drained
 - Very poorly drained
 - Water



Source: Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture
Soil Survey Geographic (SSURGO) Database
Created: Elizabeth Belmont, February 28, 2022

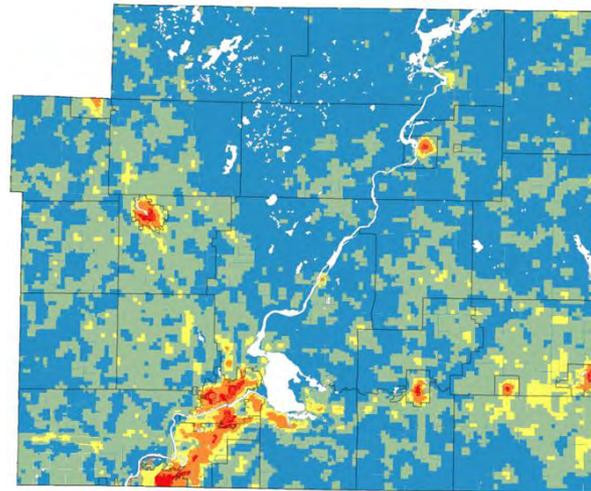


- Chloride**
- 0 - 10
 - 10 - 20
 - 20 - 50
 - 50 - 100
 - 100 - 1,520

Inter Lake
Coffax

Chetek
Cornell
Sloomer
Chippewa Falls
Seymour
Stanley

Leaflet | Map tiles by Stamen Design, CC BY 3.0 — Map data



Chippewa County



Chloride Risk

- Low
- Medium
- High



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Source Tracers

Parameter	Samples	Limit of Detection	Samples with detections		Health value*	Min	Median	Mean	Max
	n	ug/L	n	%	ug/L or parts per billion				
Alachlor OA ¹	24	0.08	0	0		NA	NA	NA	NA
Alachlor ESA ¹	24	0.08	10	42		0.13	0.49	0.53	1.28
Metolachlor OA ¹	24	0.08	2	8		0.12	0.17	0.17	0.22
Metolachlor ESA ¹	24	0.08	21	88		0.12	0.61	0.95	6.01
	n	ng/L	n	%	ng/L or parts per trillion				
Acesulfame ²	24	5	10	42		5.6	10.8	1,500	13,100
Sucralose ²	24	25	11	46		27	43	1934	16,100
Caffeine ²	24	12	3	13		12	12.3	14	18.7
Paraxanthine ²	24	5	0	0		NA	NA	NA	NA
Carbamazepine ²	24	2	1	4		7.6	7.6	7.6	7.6
Sulfamethoxazole ²	24	5	2	8		64	117.5	117.5	171
Acetamiprid ³	24	1.7	0	0		NA	NA	NA	NA
Clothianidin ³	24	1.5	4	17	1,000,000	2.5	18.1	18.2	34.1
Dinotefuran ³	24	0.7	0	0		NA	NA	NA	NA
Imidacloprid ³	24	2.4	1	4	200	18.7	18.7	18.7	18.7
Thiamethoxam ³	24	1.5	1	4	1,200,000	47.9	47.9	47.9	47.9

¹Common pesticides

²Pharmaceuticals and personal care products (PPCPs)

³Neonicotinoid compounds

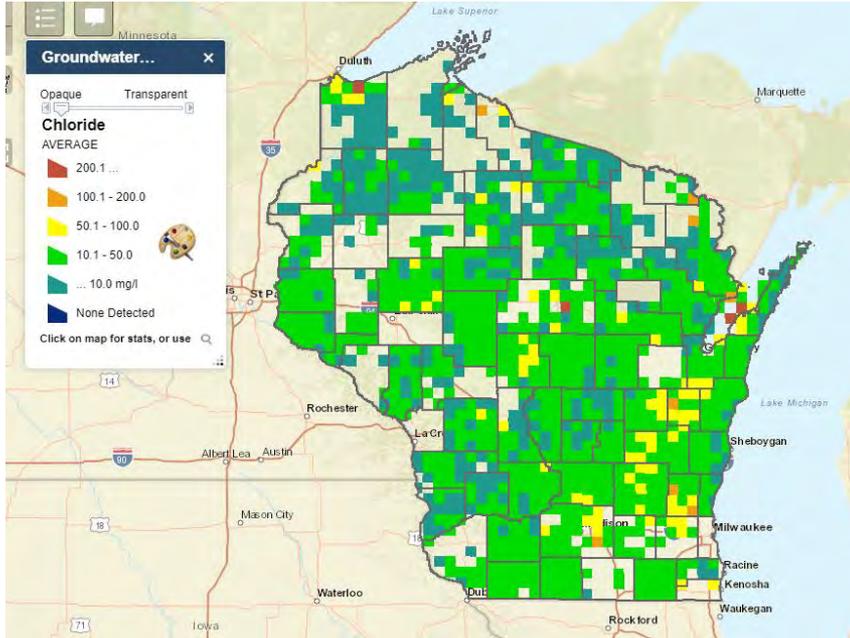
*If this column is absent it means that there is no recommended health value available due to low risk or lack of health/toxicity research on those compounds.

		Nitrate-Nitrogen	Chloride
	n	mg/L	
Agricultural Tracers	21	9.8(5.1)	20.4(13.8)
PPCPs	17	8.8(5.4)	35.8(60.1)
Only Agricultural Tracers	6	10.0(5.2)	19.2(14.9)
Only PPCP	3	4.7(5.2)	105(137)

Take aways:

- Agriculture has greater influence on nitrate concentrations
- Developed areas have greater influence on chloride concentrations

Questions?



Contact Info:
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Most used search terms to access the viewer



Extension
UNIVERSITY OF WISCONSIN-MADISON