

Pierce County Well Water Education Program



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

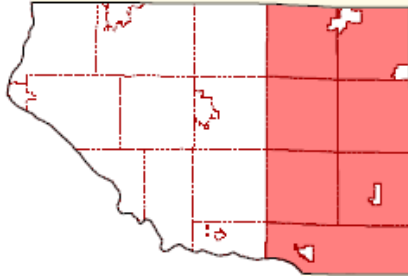


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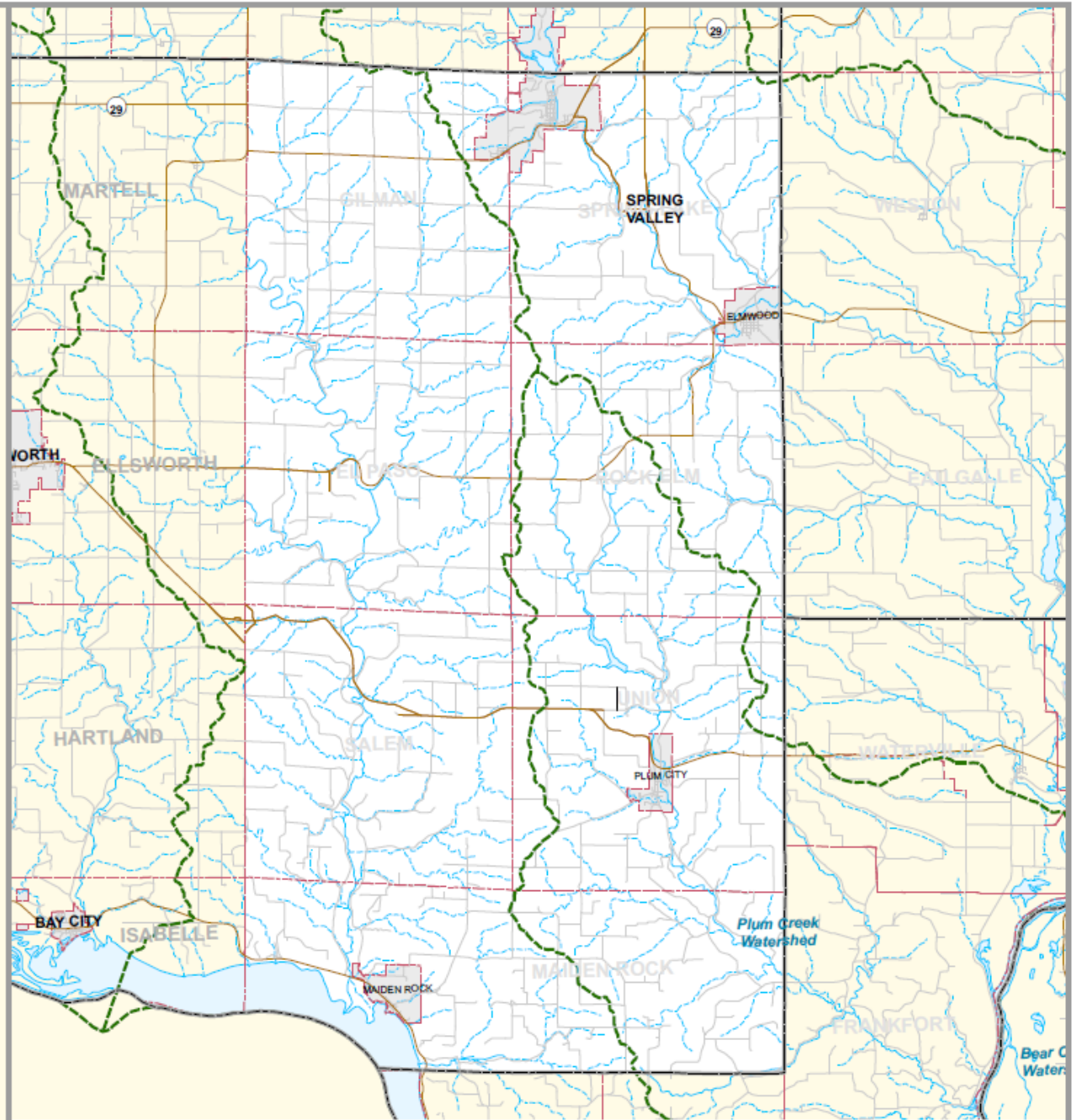
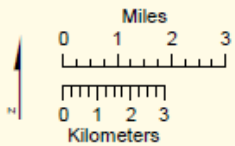
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Towns of Gilman, Spring Lake, El Paso, Rock Elm, Salem, Union and Maiden Rock

Pierce County, July 2022

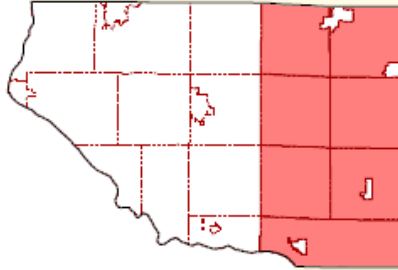


- Watershed Boundary
- Streams
- Lakes/Reservoirs
- Wetlands
- State/US Highways
- Other Roads
- Town Boundaries
- Municipalities



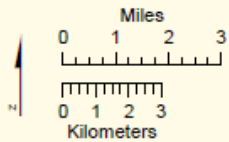
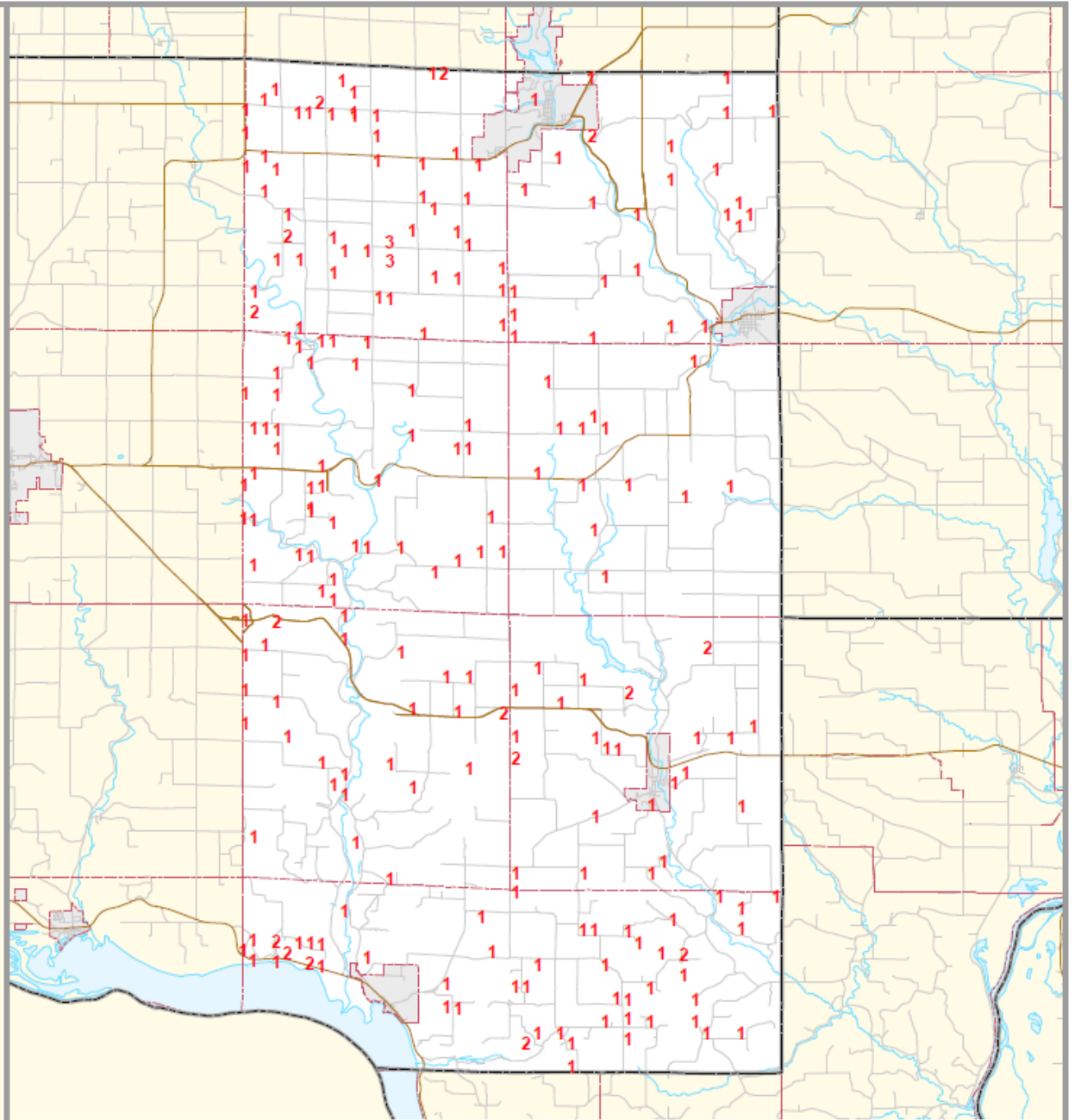
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SAMPLE DISTRIBUTION

NUMBER OF SAMPLES
per 1/4 1/4 SECTION



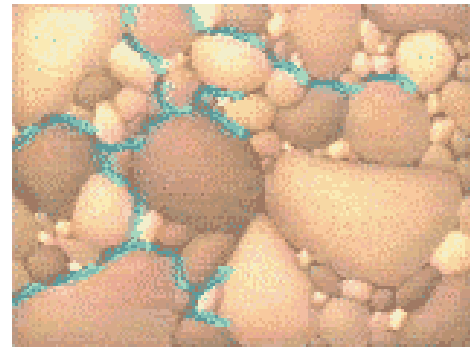
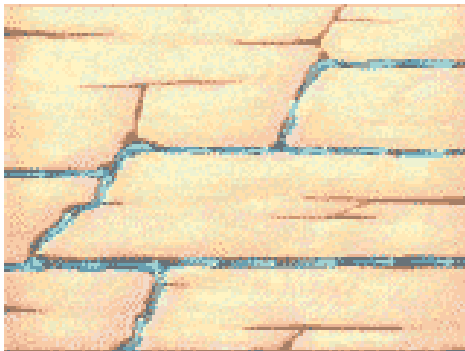
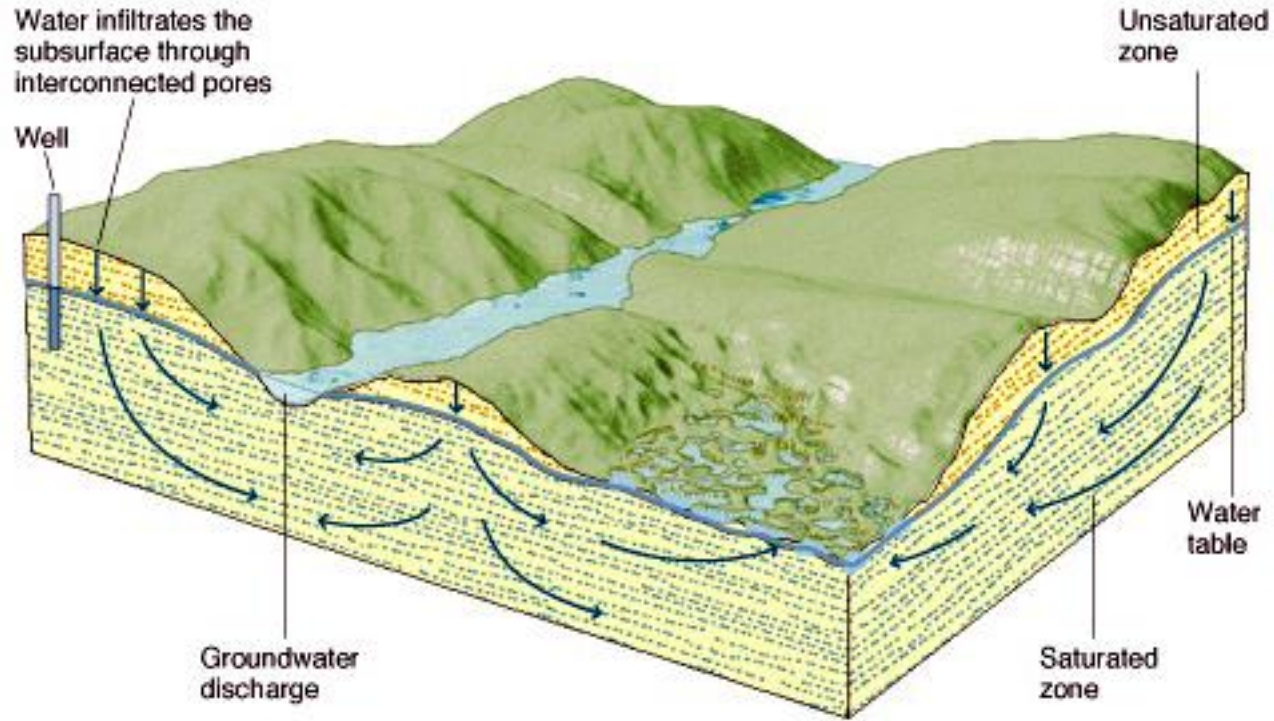
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Today's presentation

- Groundwater Basics: Where does my water come from
- Well Construction
- What do my individual test results mean?
- General groundwater quality in Pierce County
- Improving your water quality

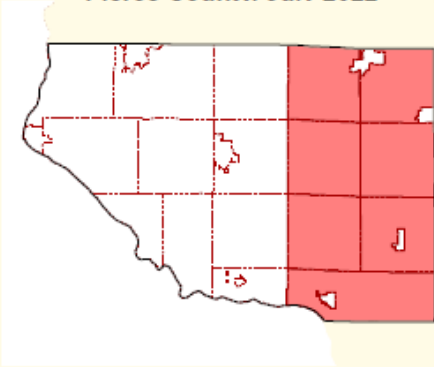


Groundwater Movement



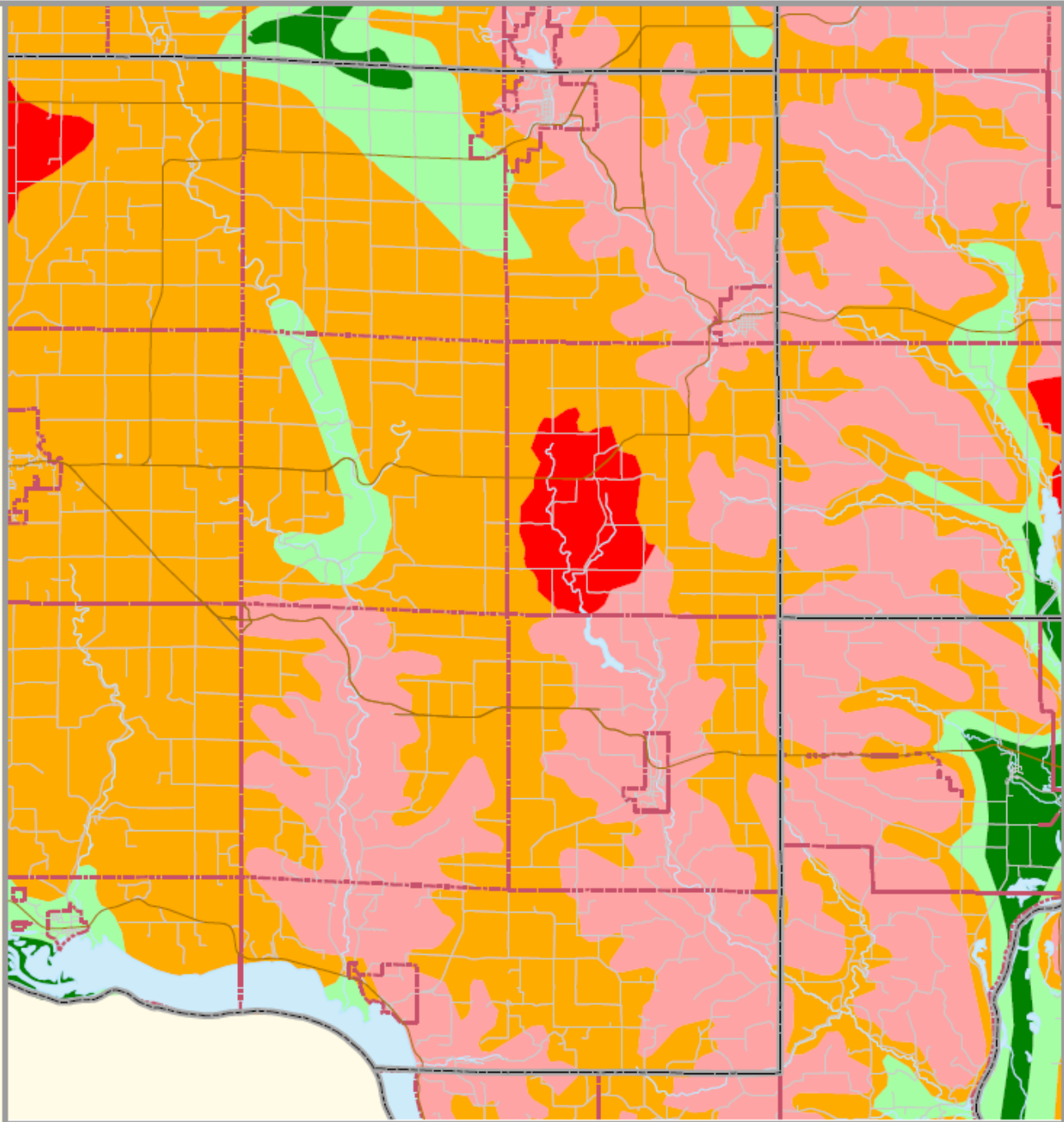
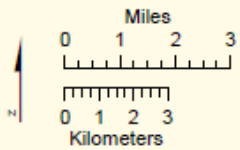
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Depth to Bedrock:

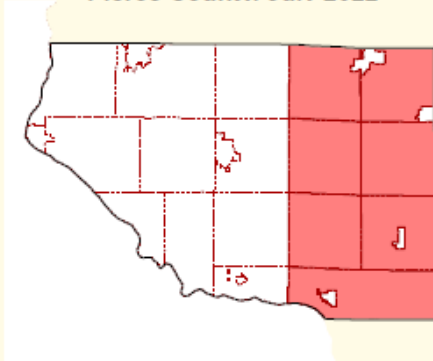
- within 5 ft - more than 70% of area
- within 5 ft - 35 to 70% of area
- 5 to 50 ft
- 50 to 100 ft
- greater than 100 ft







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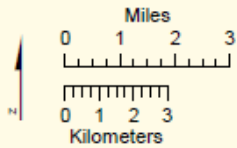
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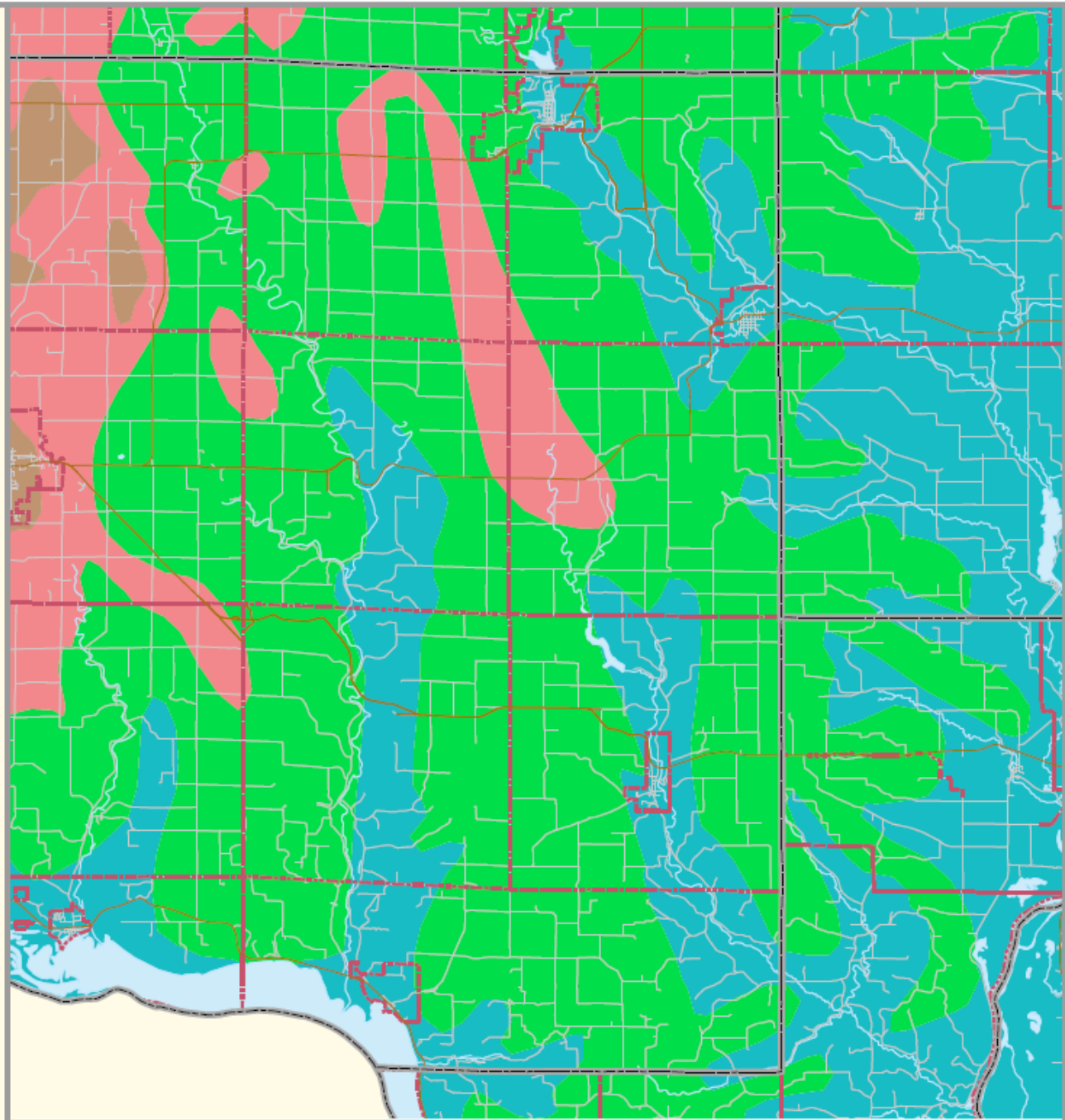


Bedrock Units:

-  Cambrian Sandstone
-  Galena-Platteville Dolomite
-  Prairie du Chien Dolomite
-  St Peter Sandstone

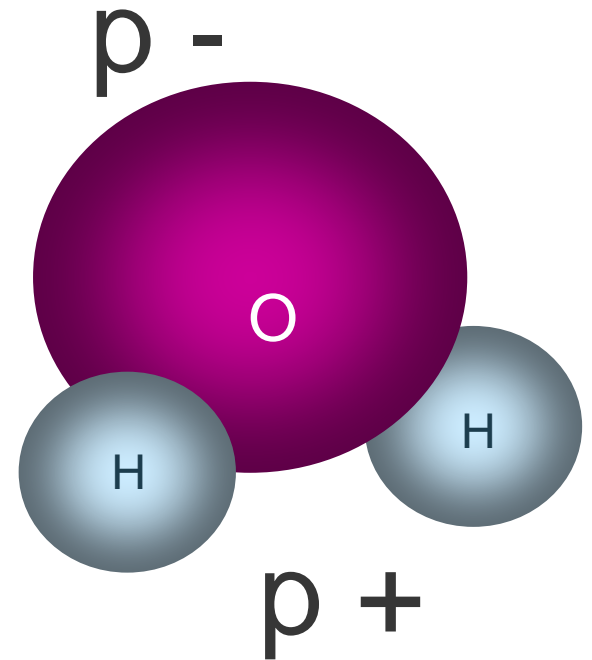


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water basics

- “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



Interpreting Drinking Water Test Results

Tests important to health:

- Bacteria
- Sodium
- Nitrate
- Copper
- Lead
- Triazine
- Zinc
- Sulfate
- Arsenic

Tests for aesthetic (taste,color,odor) problems:

- Hardness
- Iron
- Manganese
- Chloride

Other important indicator tests:

- Saturation Index
- Alkalinity
- Conductivity
- Potassium

Red = human-influenced **Blue** = naturally found

Health Concern Categories

Acute Effects

- Usually seen within a short time after exposure to a particular contaminant or substance.

(ex. Bacteria or viral contamination which may cause intestinal disease)

Chronic Effects

- Result from exposure to a substance over a long period of time.
- Increase risk of developing health complications later in life.

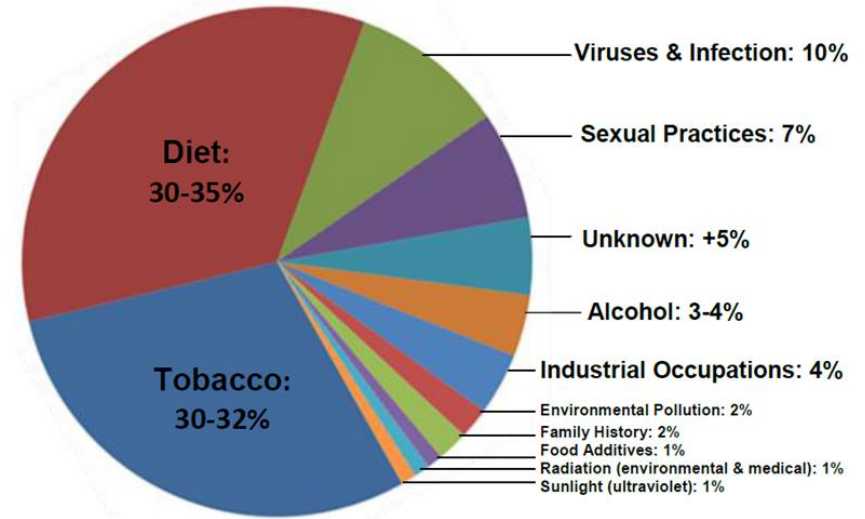
(ex. Arsenic or pesticides can increase the risk of developing certain cancers)



Chronic related health concerns are generally about risk management

National Cancer Risk Factors with Percentages

Adapted from *Everyone's Guide to Cancer Therapy*



Being struck by lightning	0.16 in 1,000 chance.
0.010 mg/L of arsenic in drinking water.	3 out of 1,000 people likely to develop cancer.
2 pCi of indoor radon level.	4 out of 1,000 people likely to develop lung cancer. ¹
2 pCi of indoor radon combined with smoking.	32 out of 1,000 people could develop lung cancer. ¹

Drinking water quality is only one part of an individual's total risk.

¹<http://www.epa.gov/radon/healthrisks.html>

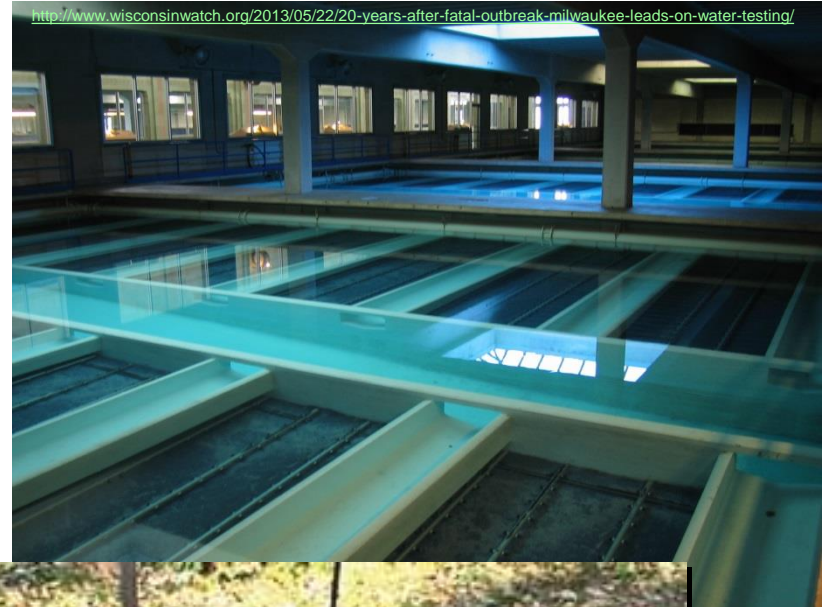
Private vs. Public Water Supplies

Public Water Supplies

- Regularly tested and regulated by drinking water standards.

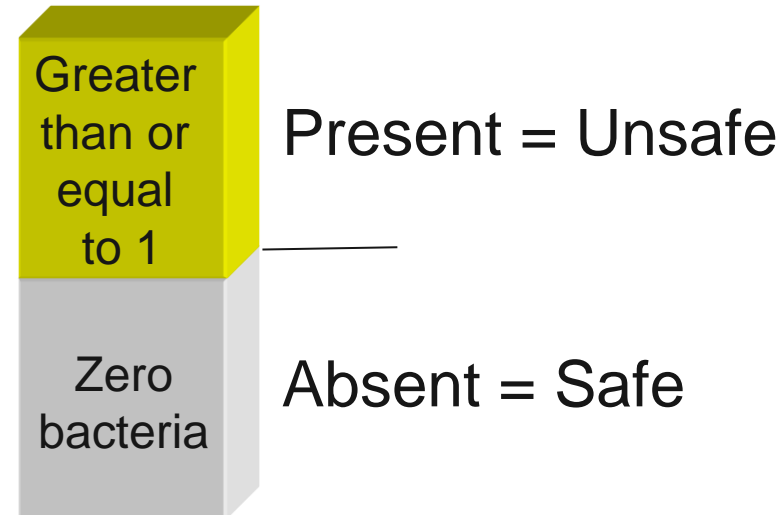
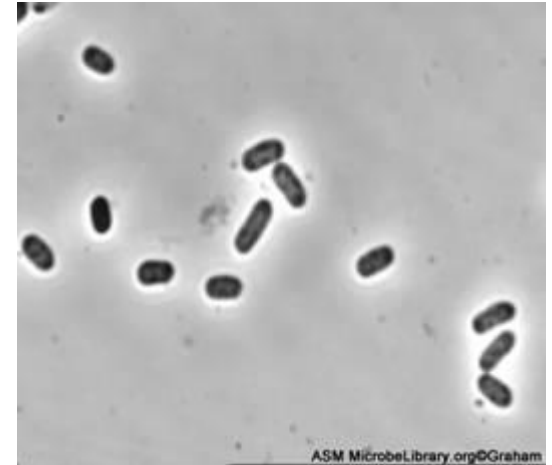
Private Wells

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



Coliform bacteria

- Generally do not cause illness, but indicate a pathway for potentially harmful microorganisms to enter your water supply.
 - Harmful bacteria and viruses can cause gastrointestinal disease, cholera, hepatitis
- Well Code: “Properly constructed well should be able to provide bacteria free water continuously without the need for treatment”
- Recommend using an alternative source of water until a test indicates your well is absent of coliform bacteria
- Sources:
 - Live in soils and on vegetation
 - Human and animal waste
 - Sampling error



If coliform bacteria was detected, we also checked for e.coli bacteria test

- Confirmation that bacteria originated from a human or animal fecal source.
- E. coli are often present with harmful bacteria, viruses and parasites that can cause serious gastrointestinal illnesses.
- Any detectable level of E.coli means your water is unsafe to drink.

Information Sources: United States Department of Health and Human Services – Centers for Disease Control and Prevention (www.cdc.gov) and United States Environmental Protection Agency (www.epa.gov)

Contaminants	Sources	Symptoms
BACTERIA		
<p><i>Escherichia coliform (E. coli)</i> <i>Salmonella</i> <i>Campylobacter</i> <i>E. coli O157</i> (Requires a special water test for detection. Causes similar, but more serious illness than other E.coli strains. Requires medical treatment.)</p>	<ul style="list-style-type: none"> • Infected human and animal feces • Manure • Septic systems • Sewage 	<ul style="list-style-type: none"> • Gastrointestinal illness • Low-grade fever • Begins 12 hrs - 7 days after exposure
<p><i>Leptosporidia</i></p>	<ul style="list-style-type: none"> • Urine of livestock, dogs and wildlife • Manure 	<ul style="list-style-type: none"> • High fever, severe headache and red eyes • Gastrointestinal illness • Begins 2-28 days after exposure
MICROSCOPIC PARASITES		
<p><i>Cryptosporidia</i> <i>Giardia</i></p>	<ul style="list-style-type: none"> • Infected human and animal feces • Manure • Septic systems • Sewage 	<ul style="list-style-type: none"> • Gastrointestinal illness • Begins 2-14 days after exposure
VIRUSES		
<p>Norovirus</p>	<ul style="list-style-type: none"> • Infected human feces and vomit • Septic systems • Sewage 	<ul style="list-style-type: none"> • Gastrointestinal illness • Low-grade fever & headache • Begins 12-48 hrs after exposure
CHEMICALS		
<p>Nitrate</p>	<ul style="list-style-type: none"> • Fertilizers • Manure • Bio-solids • Septic systems 	<p>Methemoglobinemia or "Blue Baby Syndrome" – No documented cases in Door County, but elevated nitrate levels in well water may indicate risk of contamination by additional pathogens.</p>
<p>Atrazine (trade-name herbicide for control of broadleaf and grassy weeds)</p>	<p>Estimated to be most heavily used herbicide in the U.S. in 1987/89, with its most extensive use for corn and soybeans in the Midwest, including WI. In 1993, it became a restricted-use herbicide nationally. U.S. EPA set a max. contaminant level (MCL) at 3 parts per billion for safe drinking water.</p>	<p>Short-term exposure above the MCL may cause: congestion of heart, lungs and kidneys; low blood pressure; muscle spasms; weight loss; damage to adrenal glands.</p> <p>Long-term exposure above MCL may cause: weight loss, cardiovascular damage, retinal and some muscle degeneration; cancer.</p>

Well Construction Defects



- Is the well cap or casing cracked?

Well Construction Defects



- Does your well have a vermin-proof cap?



Well Construction Defects

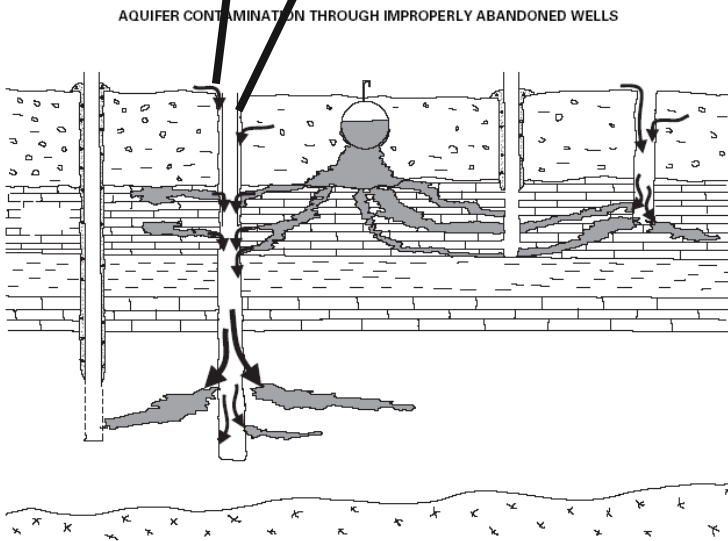


- Non-vermin proof cap
- Electrical conduit not installed correctly
- Don't leash pets within 10 feet of the well
- Avoid bird feeders and other decorations directly above the well

Well Construction Defects



- Are there old wells on the property?
 - Wells are a direct conduit to groundwater
 - Consider having them properly filled and sealed



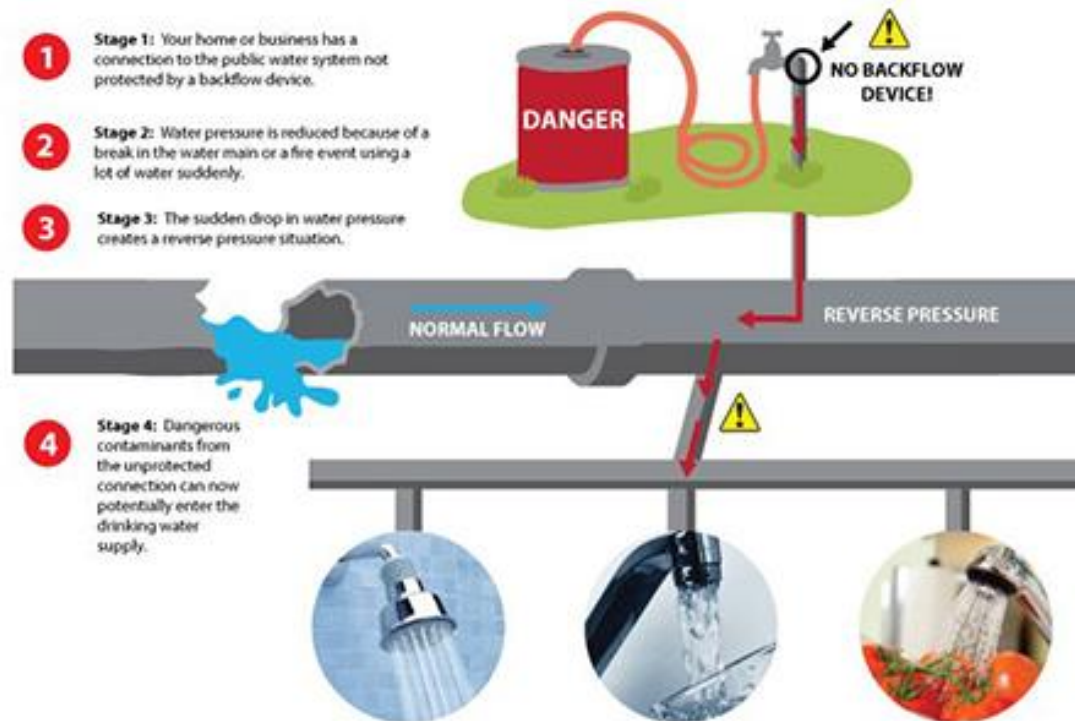
Well Construction Defects



- Do yard hydrants, livestock waterers, and service to outbuildings have proper backflow prevention?

HOW BACKFLOW CAN HAPPEN

- 1** Stage 1: Your home or business has a connection to the public water system not protected by a backflow device.
- 2** Stage 2: Water pressure is reduced because of a break in the water main or a fire event using a lot of water suddenly.
- 3** Stage 3: The sudden drop in water pressure creates a reverse pressure situation.



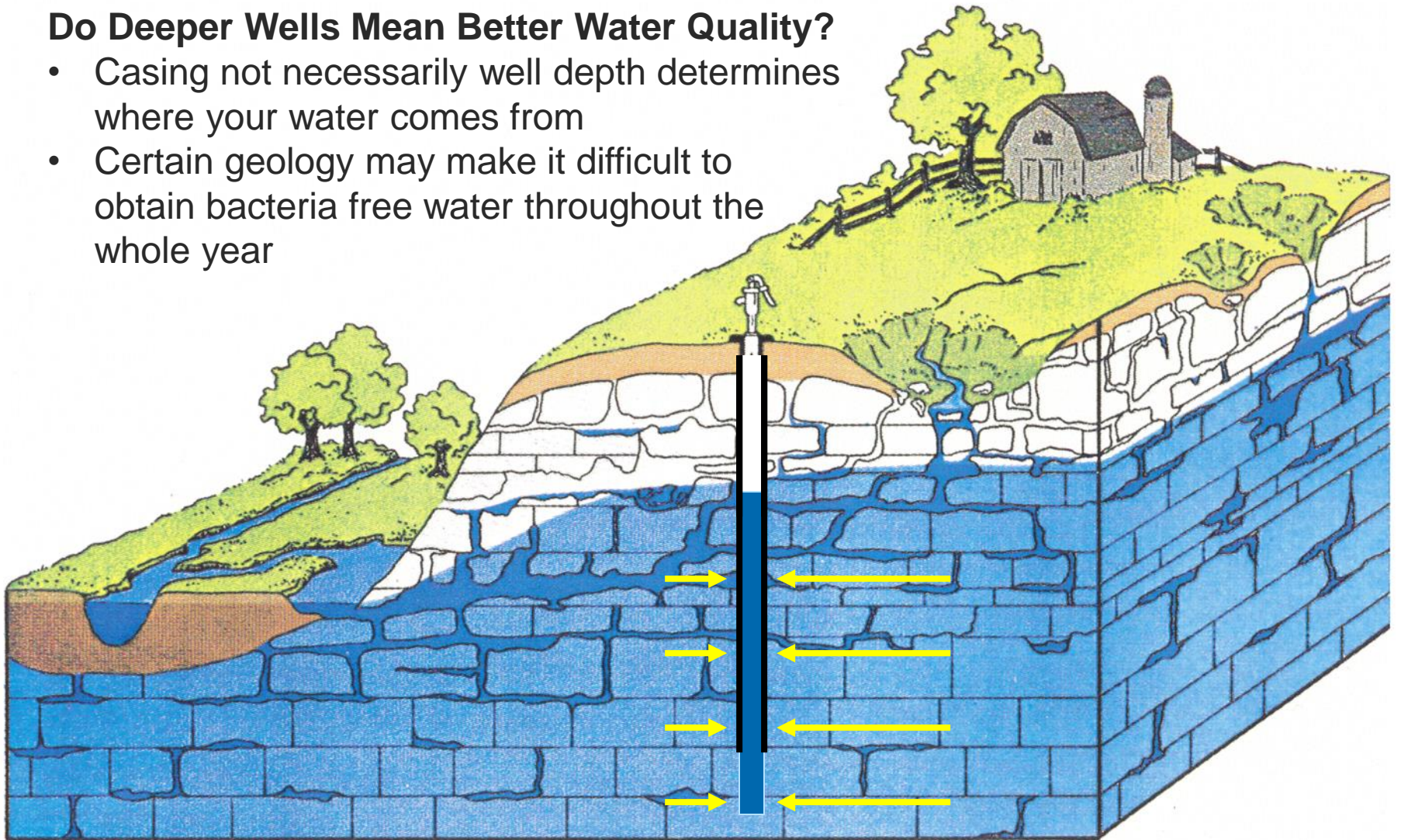
What makes a good well.....



- Vermin proof cap
- Casing extends at least 12" above grade
- Area around well free and clear of debris or other obstructions
- Down spouts or runoff from driveways/other surfaces not directed towards the well

Do Deeper Wells Mean Better Water Quality?

- Casing not necessarily well depth determines where your water comes from
- Certain geology may make it difficult to obtain bacteria free water throughout the whole year



What should I do if coliform bacteria was present?

1. Use alternative source of water for drinking
2. Retest (recommend retesting using bacteria count)
3. Try to identify any sanitary defects
 - Loose or non-existent well cap
 - Well construction faults
 - A nearby unused well or pit
 - Inadequate filtration by soil
4. Disinfect the well
5. Retest to ensure well is bacteria free.

For reoccurring bacteria problems may investigate the potential that a new well may help



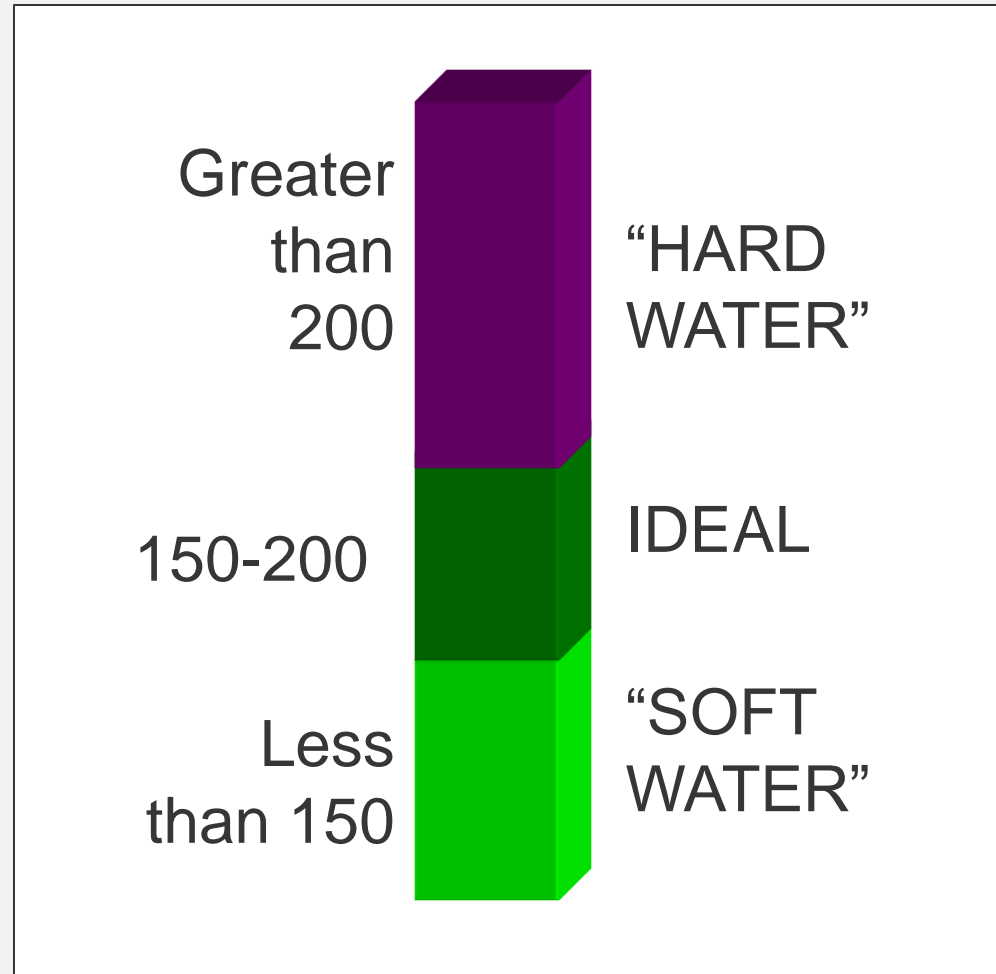
Rock and Soil Impacts on Water Quality

Tests for Aesthetic Problems

Hardness

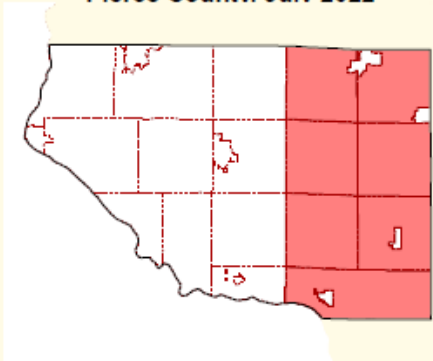
- Natural (rocks and soils)
- Primarily calcium and magnesium

- Problems: scaling, scum, use more detergent, decrease water heater efficiency



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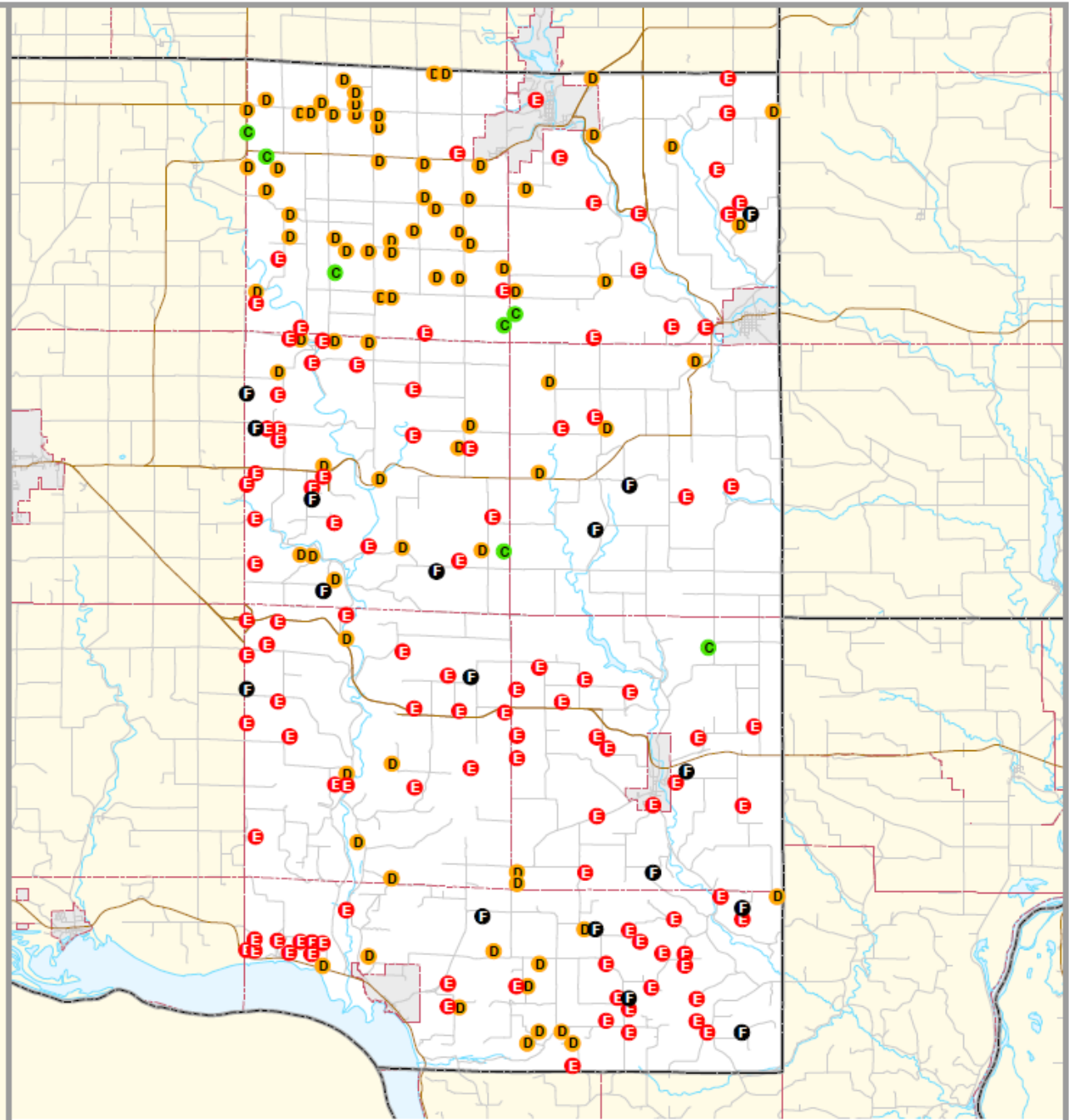
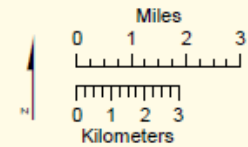
Pierce County, July 2022



TOTAL HARDNESS (ppm CaCO₃)

A	... 50	25	10%
B	51 - 100	0	0%
C	101 - 200	6	2%
D	201 - 300	87	34%
E	301 - 400	120	47%
F	401 ...	17	7%

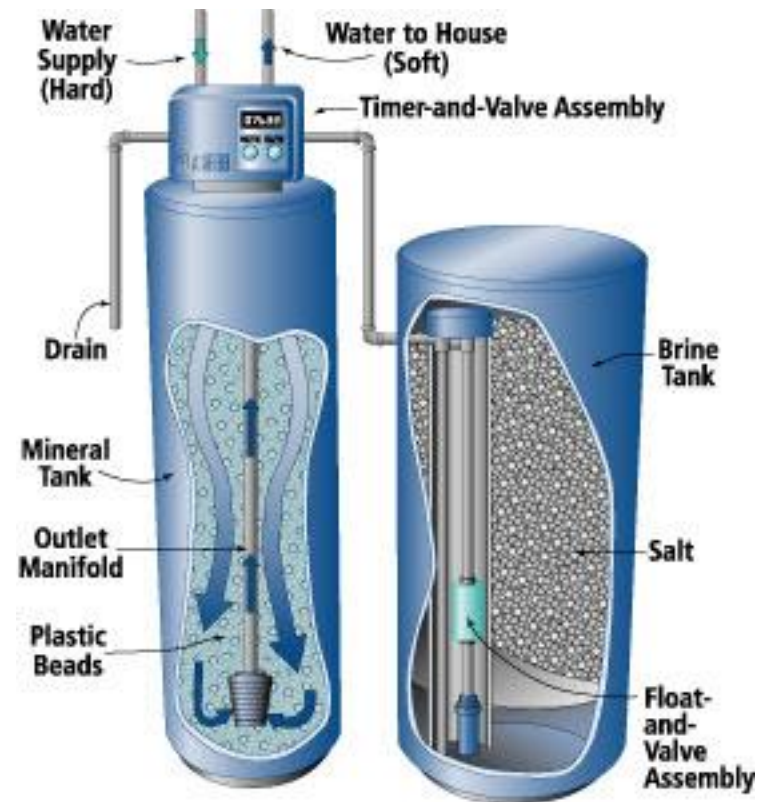
Mapped value is the average for the 1/4 1/4 section
Treated samples not mapped



Water Softening

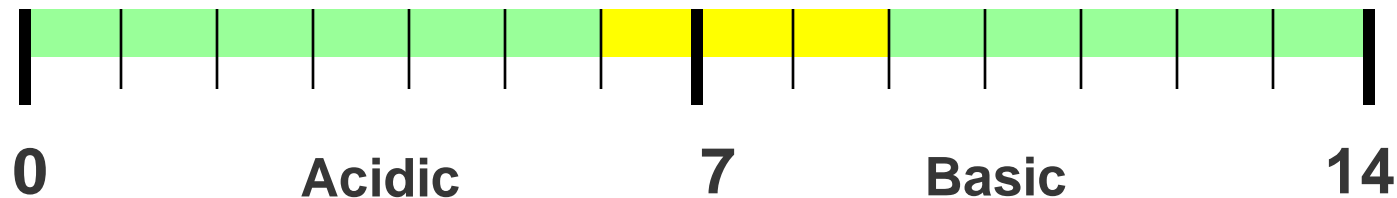
Water softeners remove calcium and magnesium which cause scaling and exchange it for sodium (or potassium).

- Negative: 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.



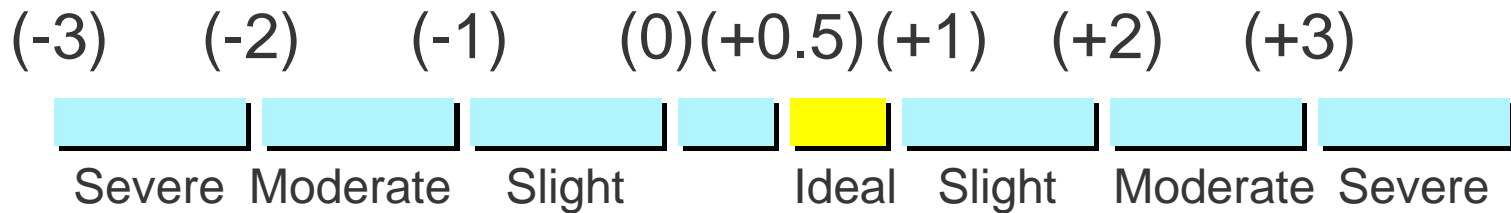
Tests for Overall Water Quality

- **Alkalinity** – ability to neutralize acid
- **Conductivity** –
 - Measure of total ions
 - can be used to indicate presence of contaminants (~ twice the hardness)
- **pH** – Indicates water's acidity and helps determine if water will corrode plumbing



Tests for Overall Water Quality

Saturation Index



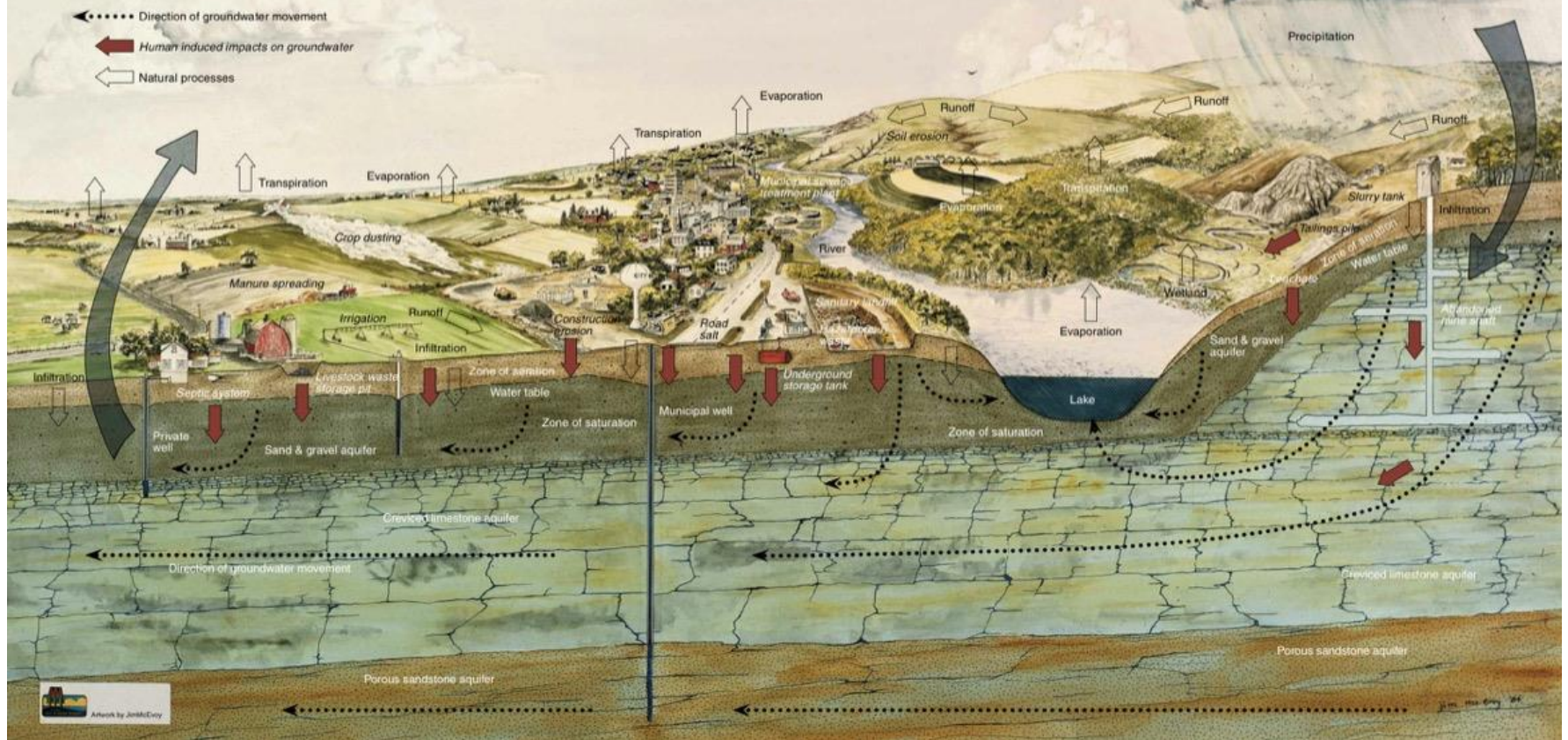
Corrosion occurs



Scaling occurs



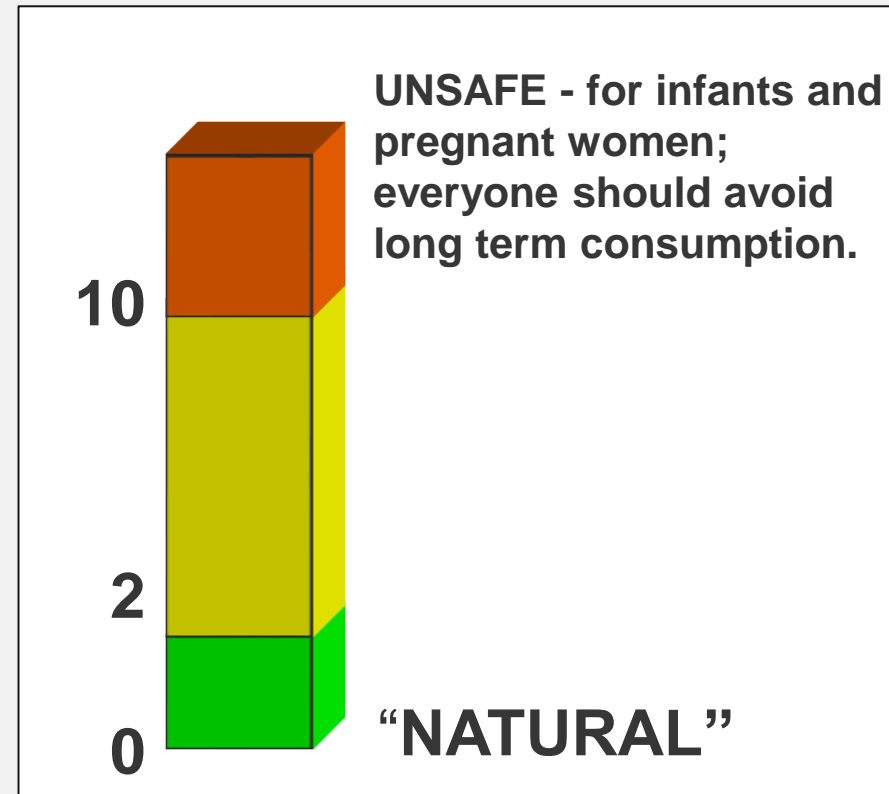
Groundwater and land use in the water cycle



Test Important to Health

Nitrate Nitrogen

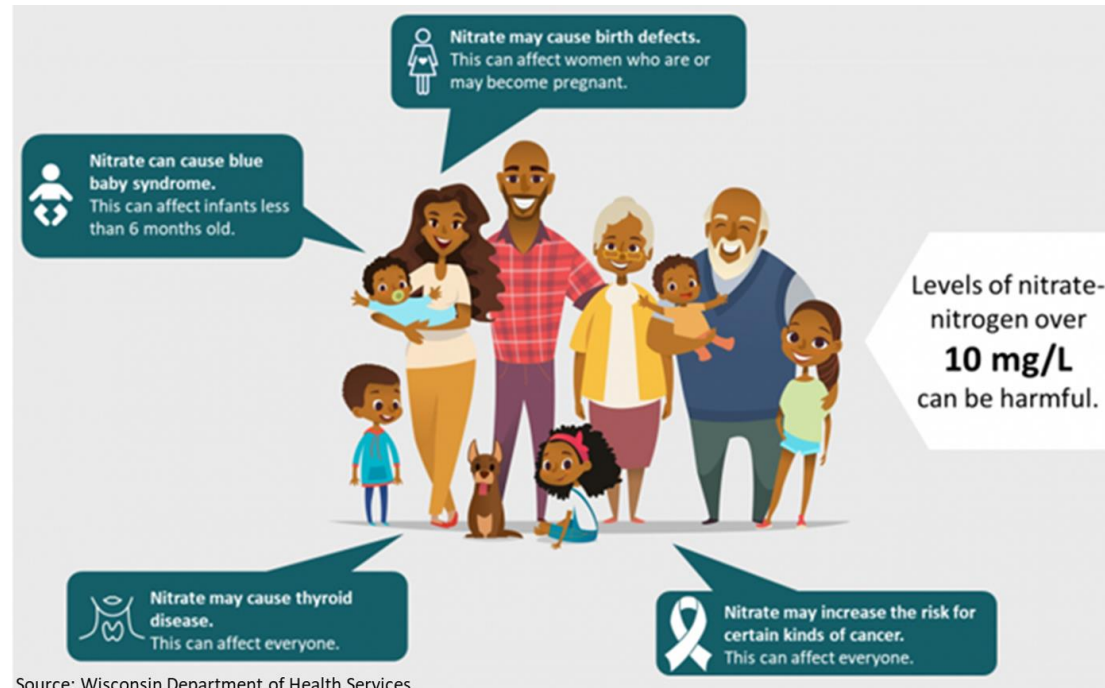
- **Greater than 10 mg/L**
Exceeds State and Federal Limits for Drinking Water
- **Between 2 and 10 mg/L**
Some Human Impact
- **Less than 2.0 mg/L**
“Transitional”
- **Less than 0.2 mg/L**
“Natural”



Nitrate-Nitrogen

Health Effects:

- Methemoglobinemia (blue baby disease)
- Possible links to birth defects and miscarriages (humans and livestock)
- Indicator of other contaminants



Source: Wisconsin Department of Health Services

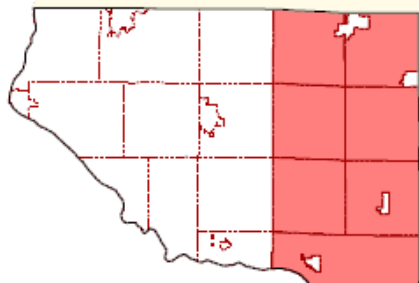
Sources:

- Agricultural fertilizer
- Lawn fertilizer
- Septic systems
- Animal wastes



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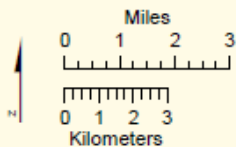
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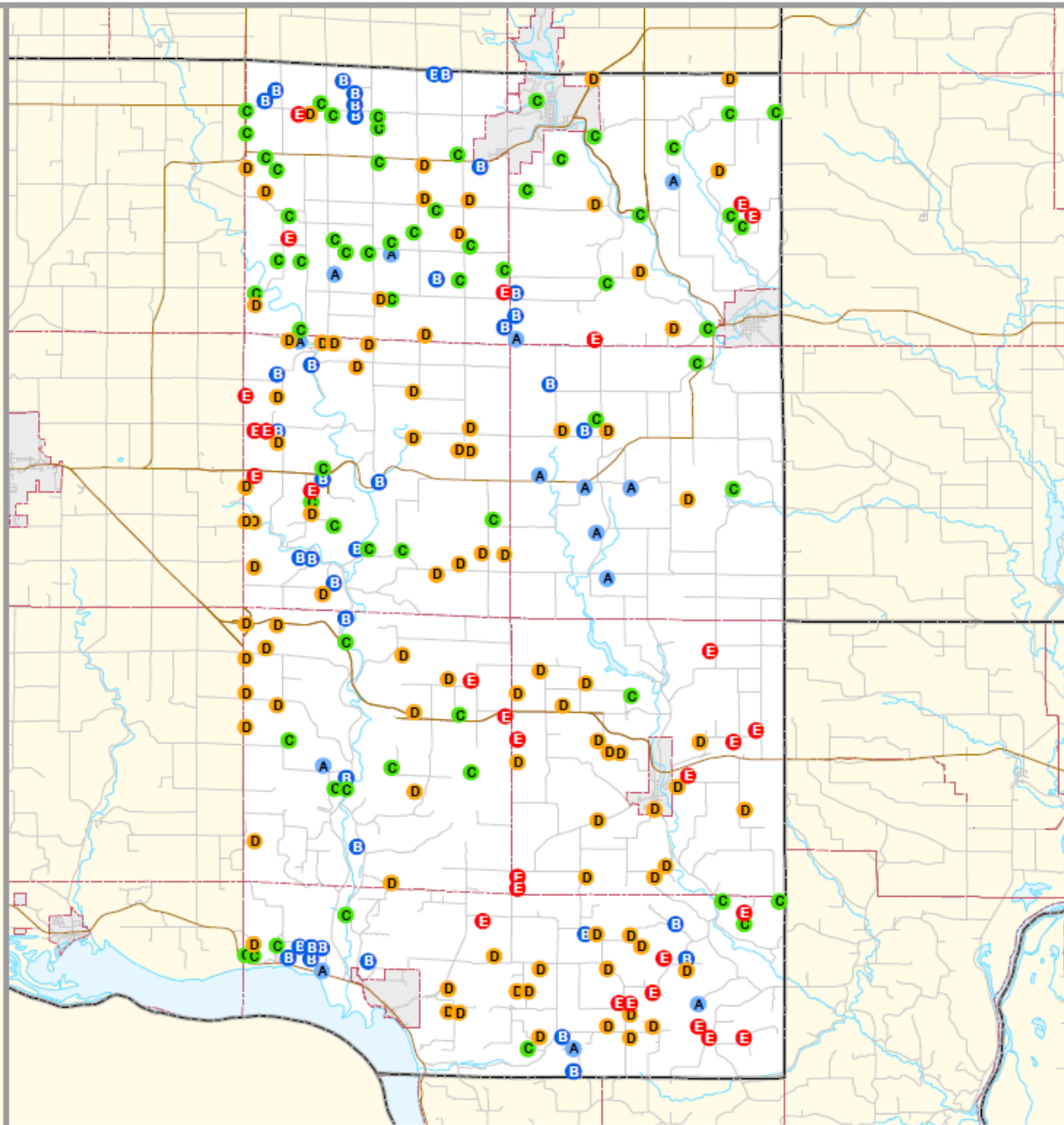
NITRATE-NITRITE (ppm N)

A None Detected	18	7 %
B ... 2.0	41	16 %
C 2.1 - 5.0	75	29 %
D 5.1 - 10.0	91	36 %
E 10.1 - 20.0	31	12 %
F 20.1 ...	0	0 %

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Treated samples not mapped

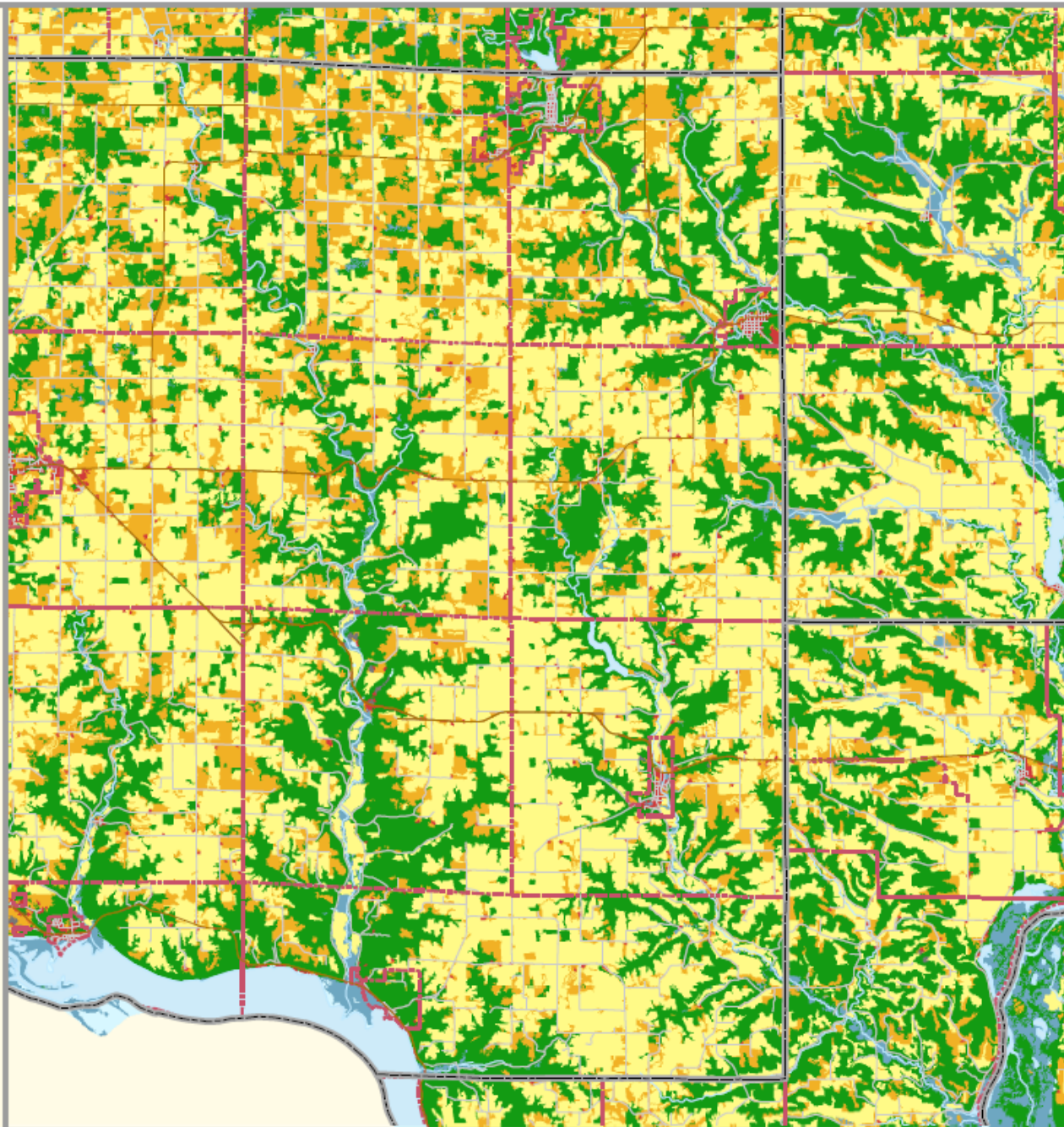
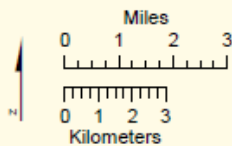
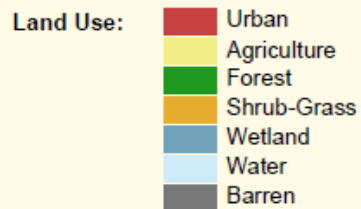
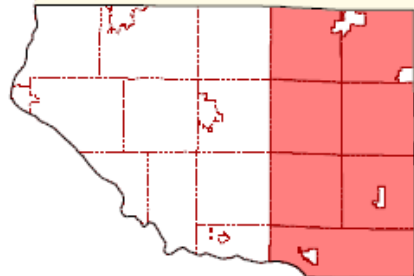


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What can I do to reduce my nitrate levels?

Solution:

- **Eliminate contamination source or reduce nitrogen inputs**

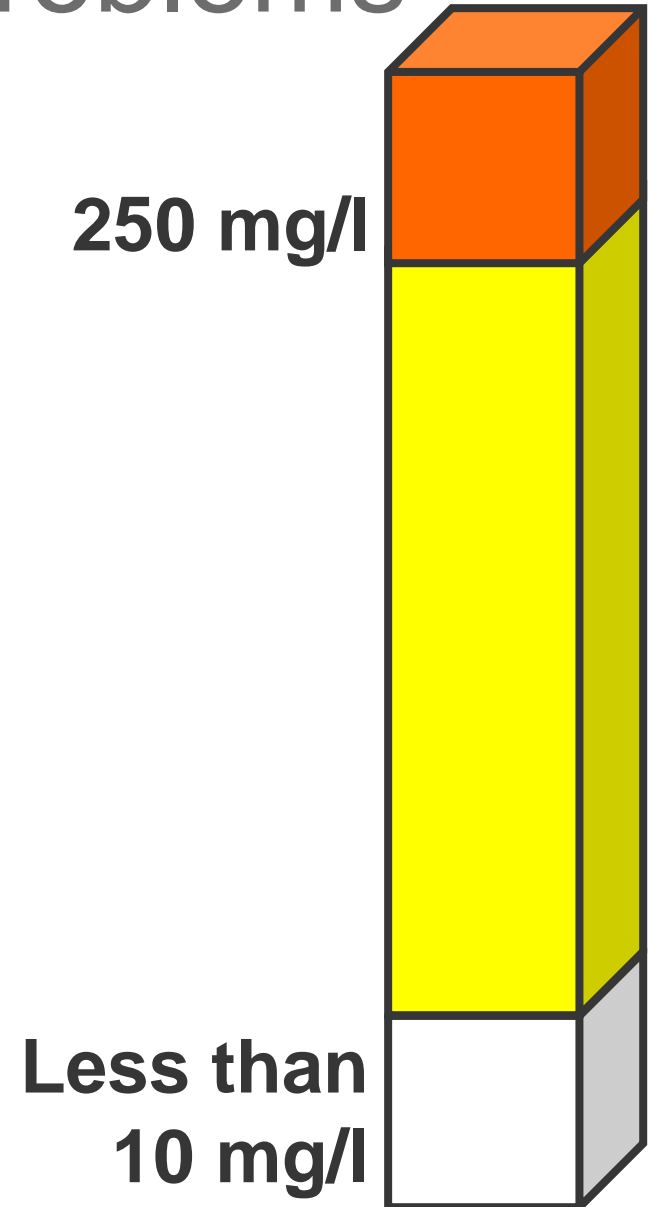
Short term:

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

Tests for Aesthetic Problems

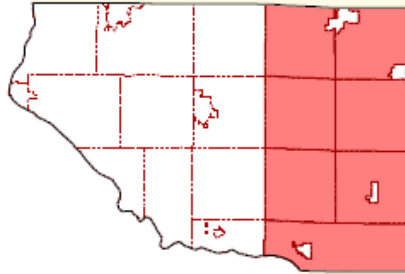
Chloride

- 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 and Road Salt



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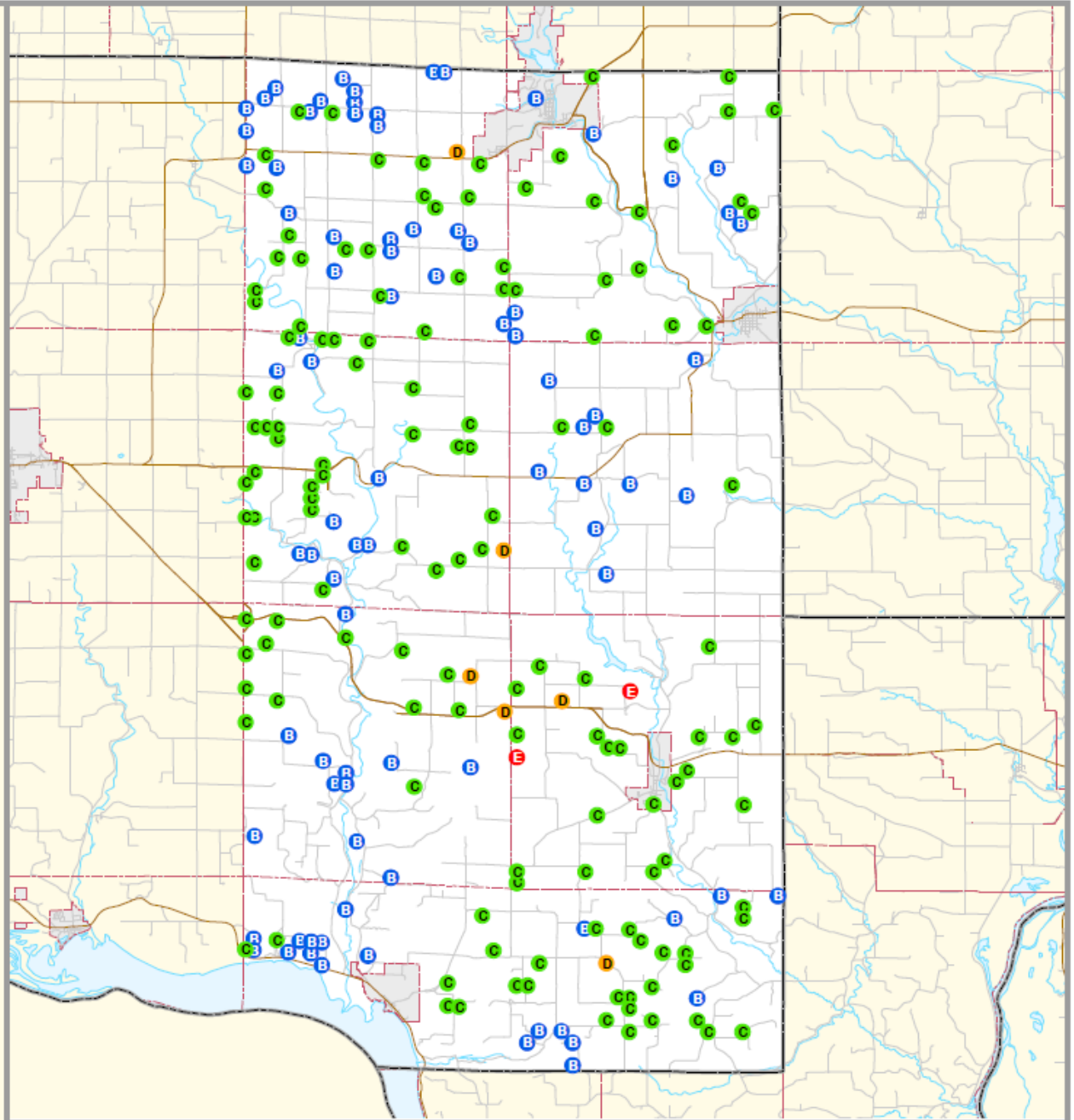
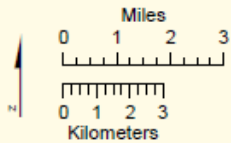
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CHLORIDE (ppm)

A None Detected	2	<1%
B ... 10	100	39%
C 11 - 50	145	57%
D 51 - 100	7	3%
E 101 - 200	0	0%
F 201 ...	2	<1%

Mapped value is the average for the 1/4 1/4 section
Treated samples not mapped

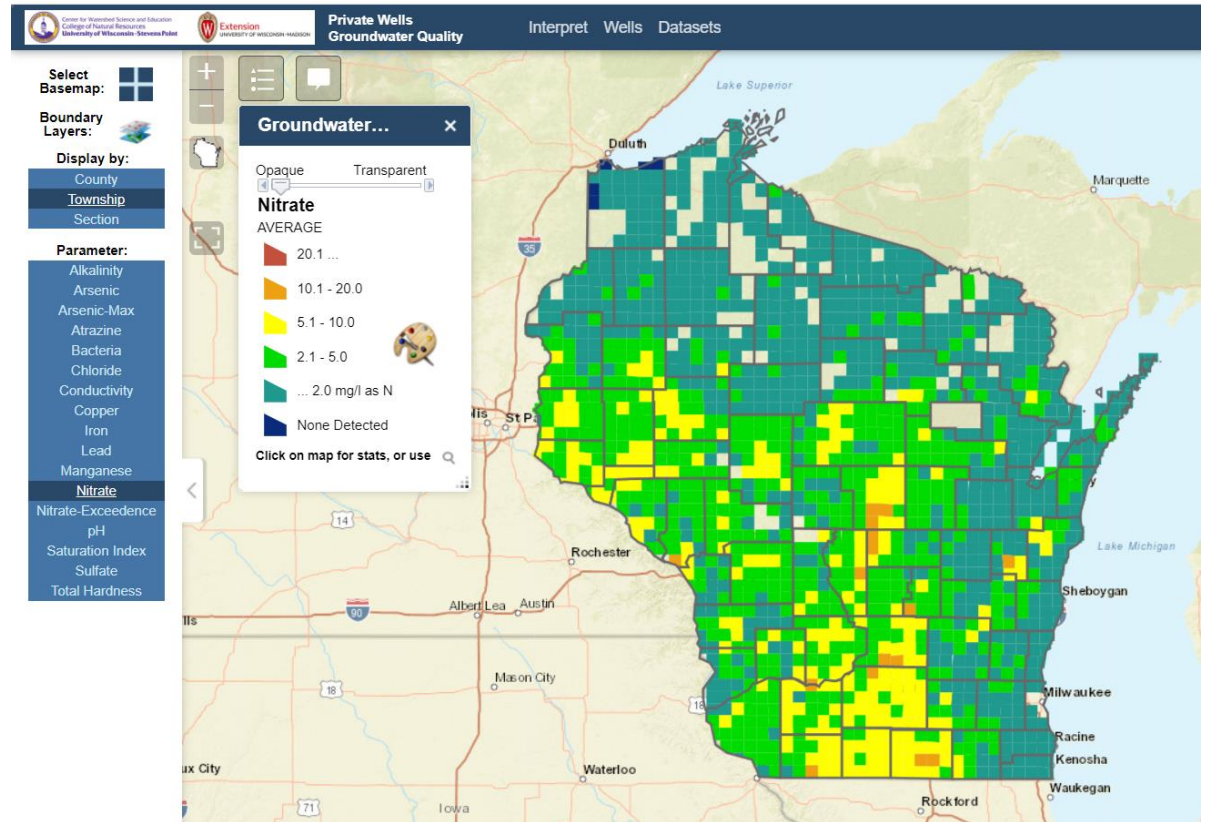


Where do you go from here: Recommended next steps

- Test well annually for bacteria, or if water changes color or clarity
- Consider testing annually for nitrate, particularly if your levels are approaching 10 mg/L
- If your nitrate level was greater than 5 mg/L consider testing for pesticides
- If you have never tested for arsenic or manganese, consider testing for these at least once

WI Well Water Viewer

- Find out more about well water quality in your area
- Interactive online dashboard



Contact Info:

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715-346-4276
kmasarik@uwsp.edu

www.uwsp.edu/cnr/watersheds

- Thank the Pierce County Land Conservation Department for sponsoring and arranging the well testing program.



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