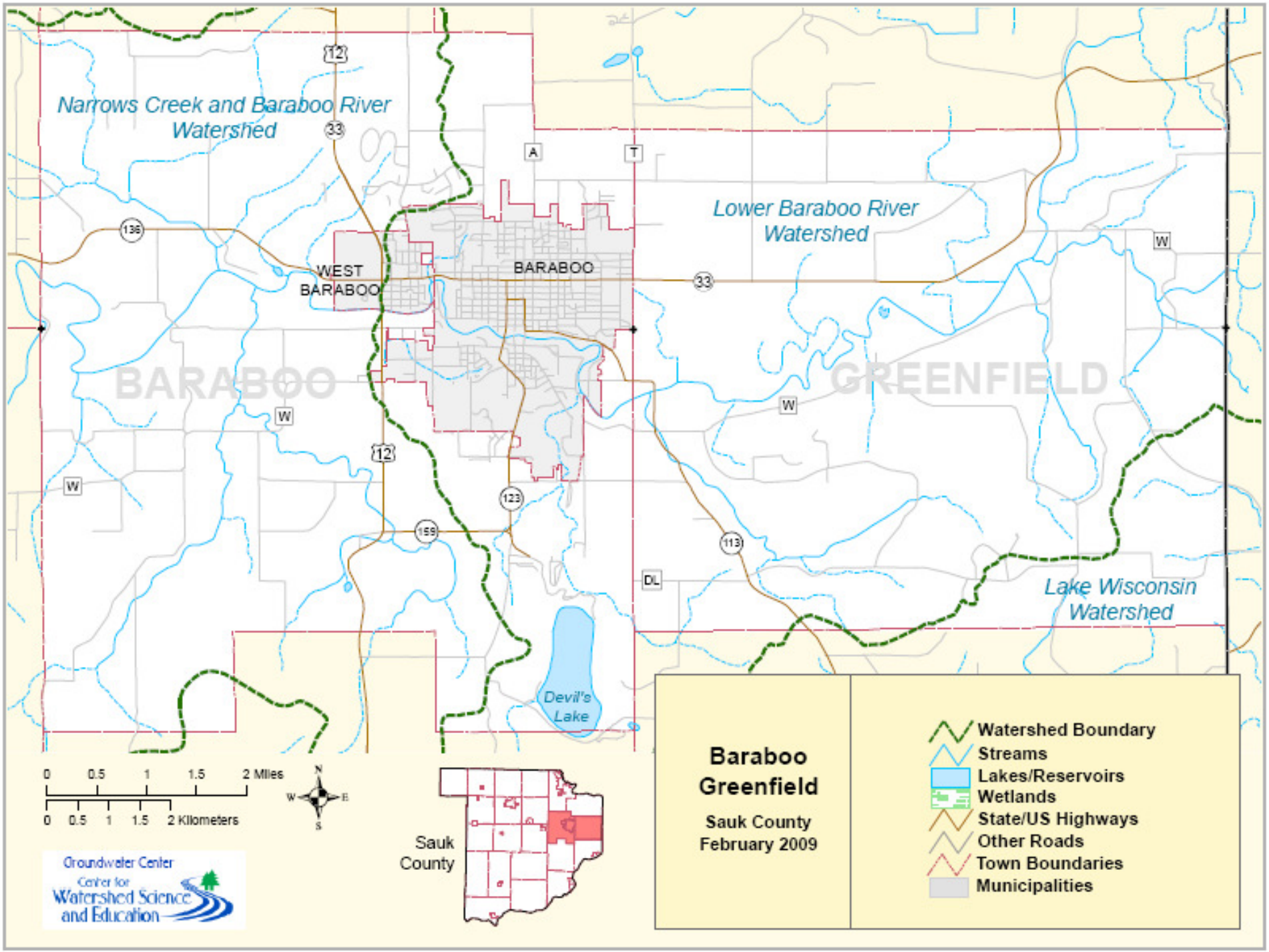
Sauk County Community Drinking Water Program

Kevin Masarik

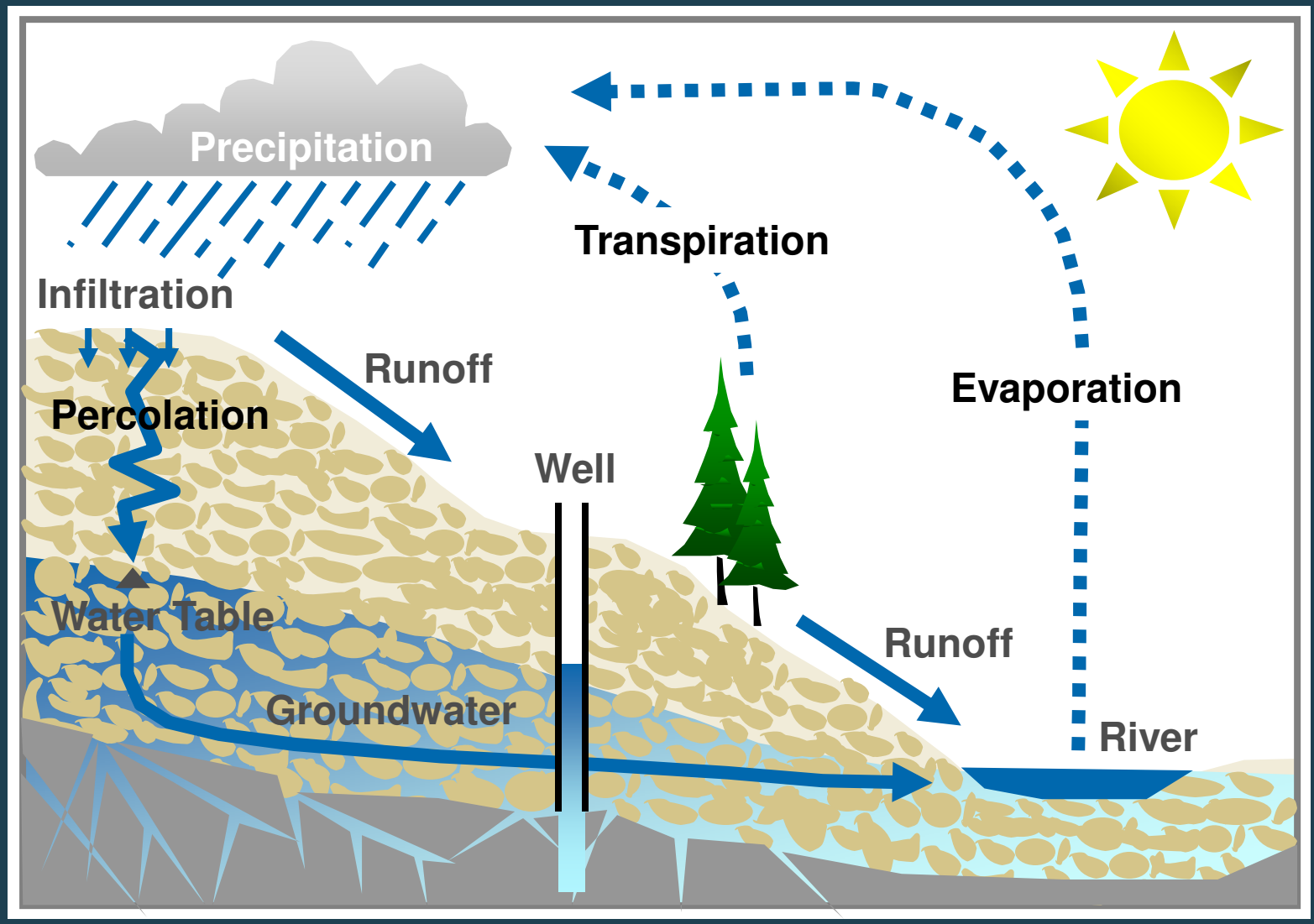
CENTER FOR WATERSHED SCIENCE AND EDUCATION ▪ UW-STEVENS POINT ▪ UW-EXTENSION

Today's presentation

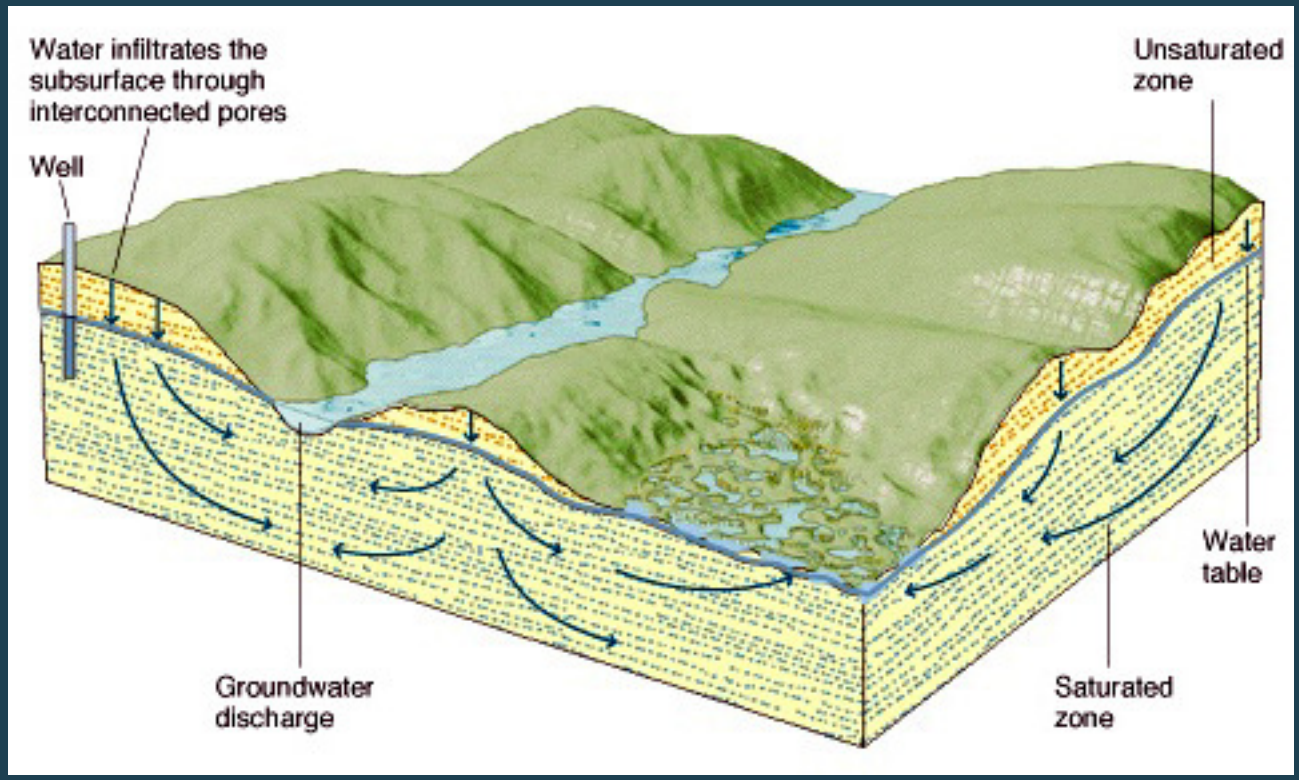
- What is groundwater and where does it come from?
- What do my individual test results mean?
- General groundwater quality in the Towns of Honey Creek, Prairie du Sac and Troy.
- Improving your water quality


Narrows Creek and Baraboo River Watershed
Lower Baraboo River Watershed
Lake Wisconsin Watershed
BARABOO
WEST BARABOO
GREENFIELD
Devil's Lake
12
33
136
A
T
W
123
159
113
DL
0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
N
W
E
S
Sauk County
Groundwater Center
Center for Watershed Science and Education
Baraboo
Greenfield
Sauk County
February 2009
Watershed Boundary
Streams
Lakes/Reservoirs
Wetlands
State/US Highways
Other Roads
Town Boundaries
Municipalities

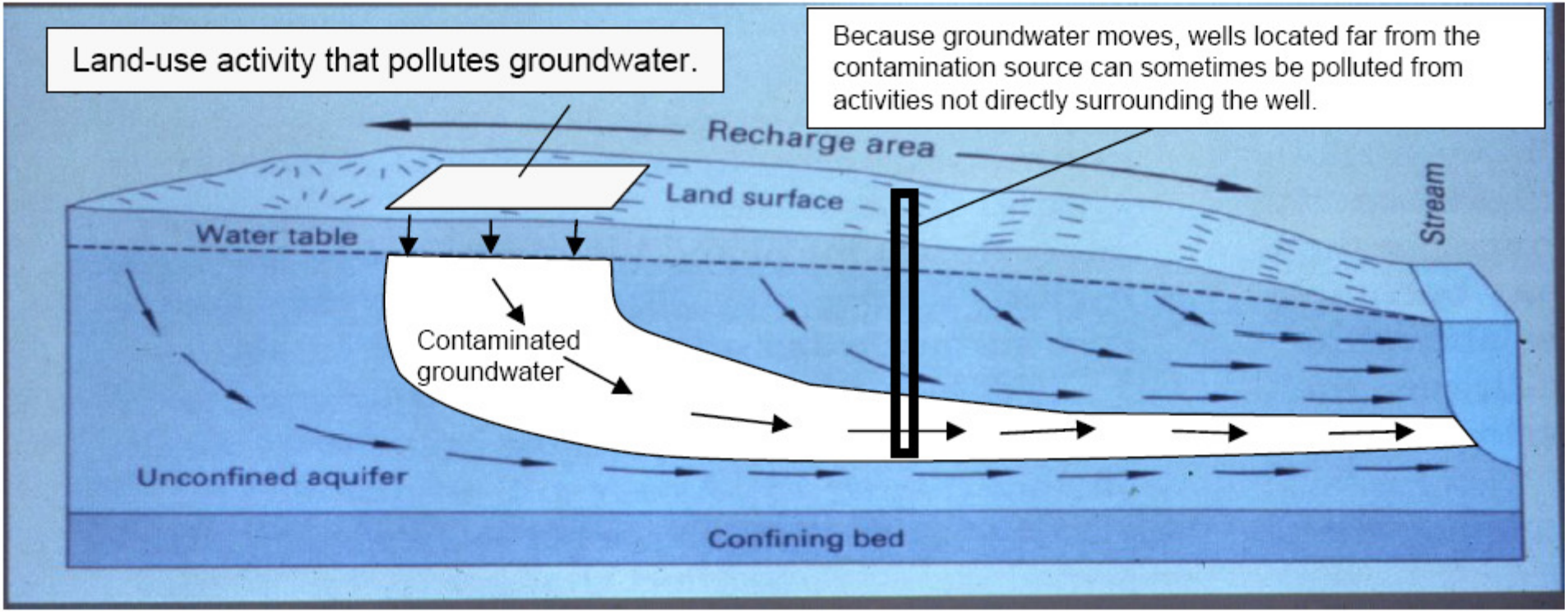
The Water Cycle

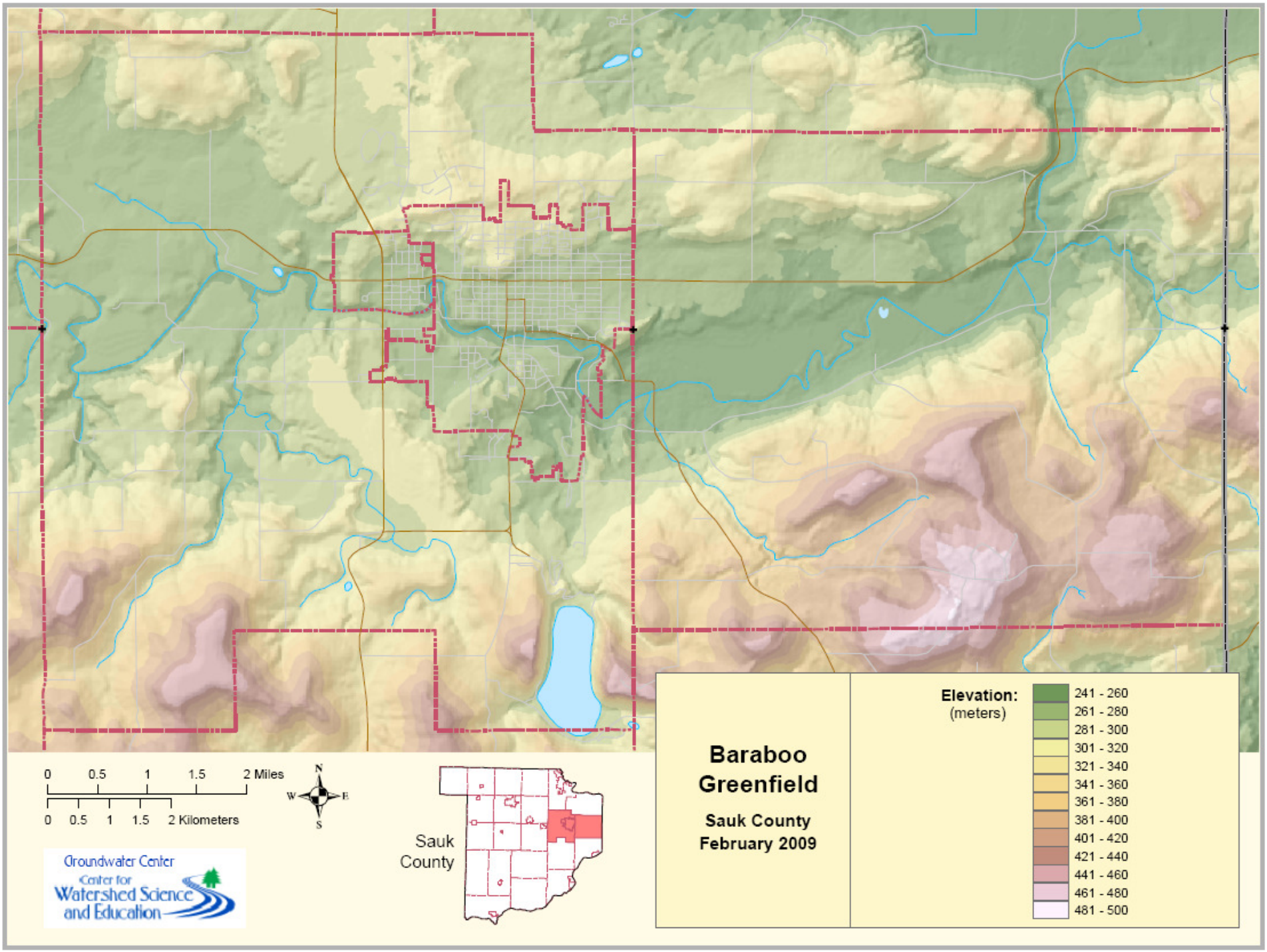


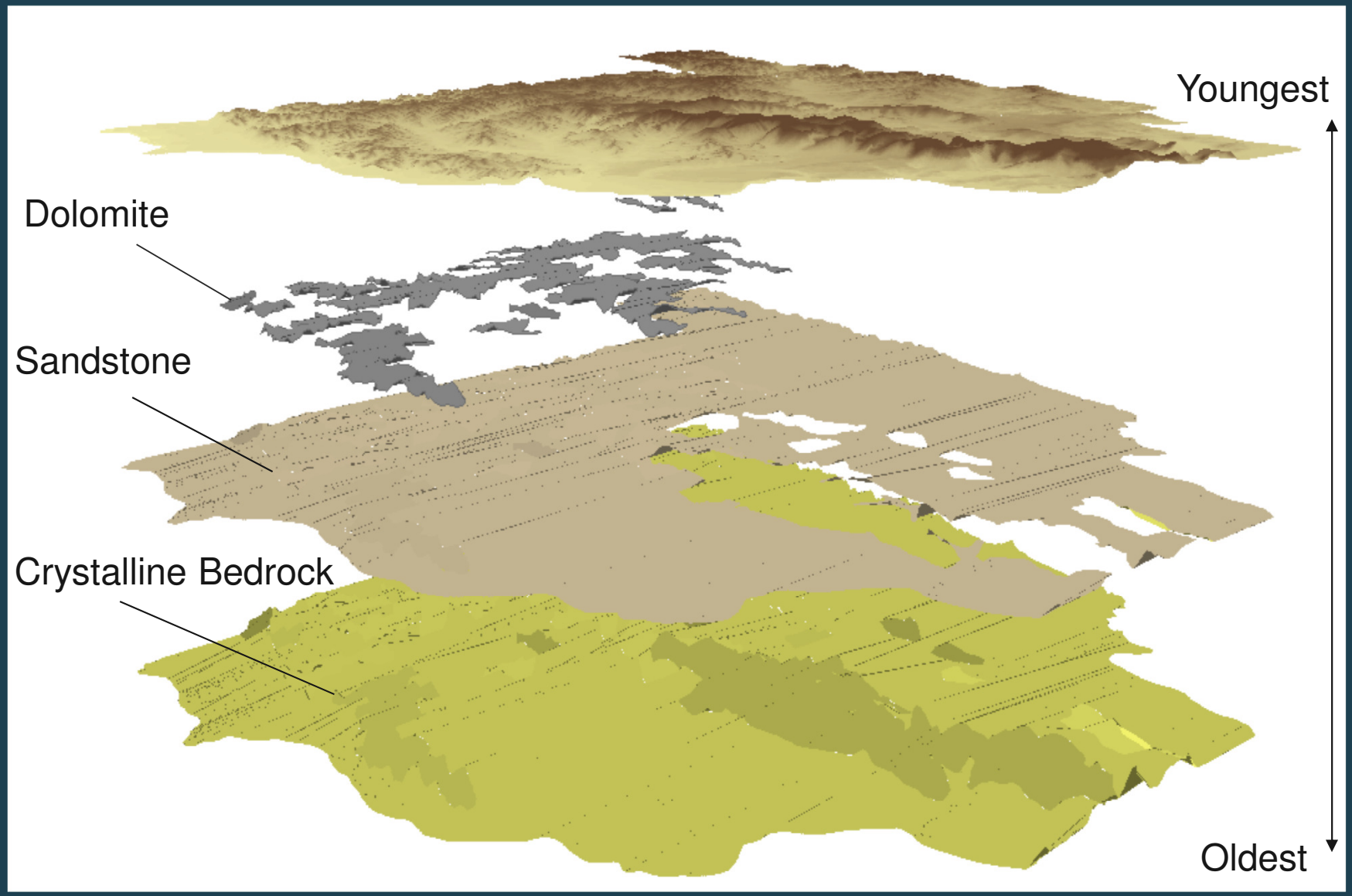
Groundwater Movement

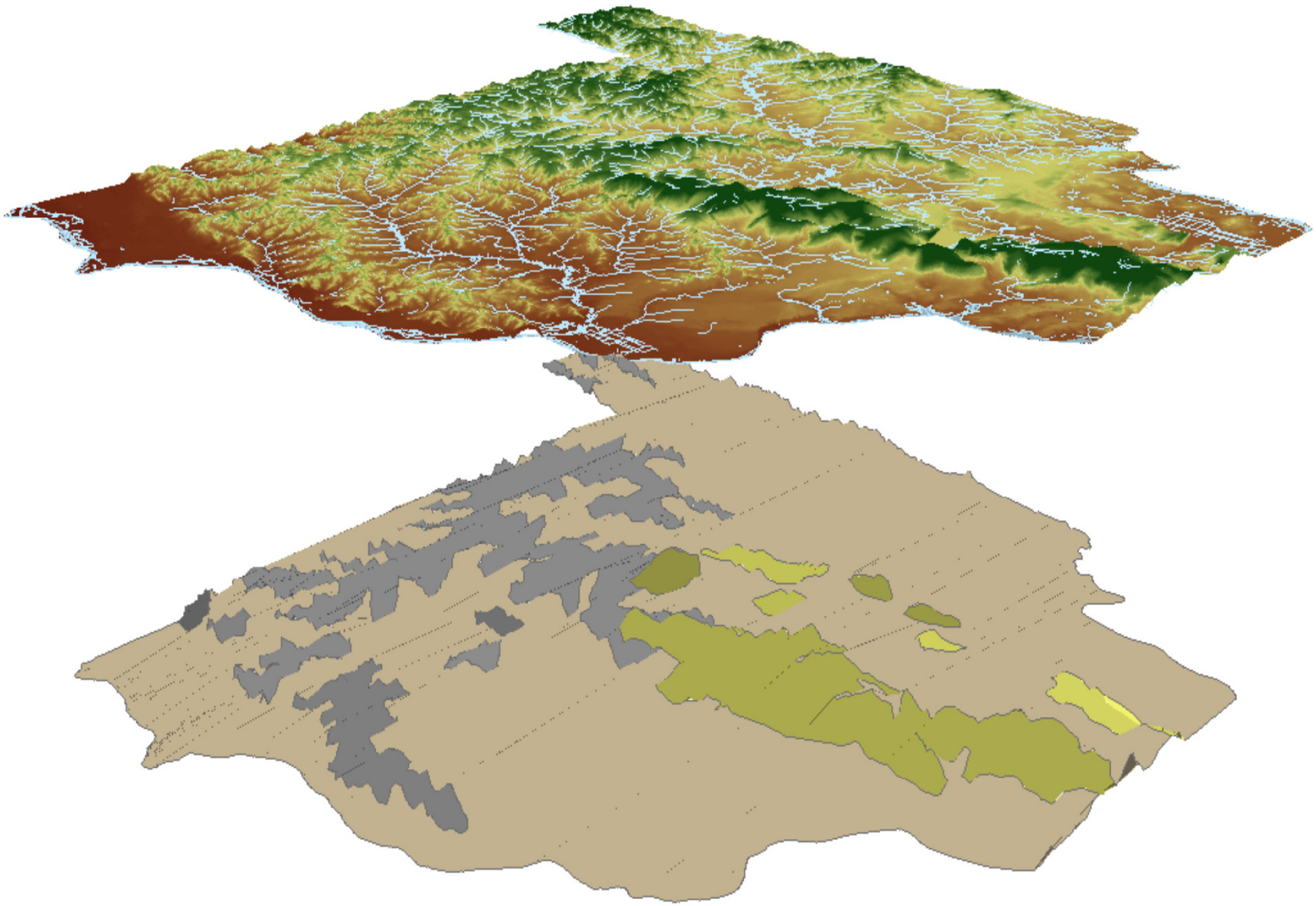


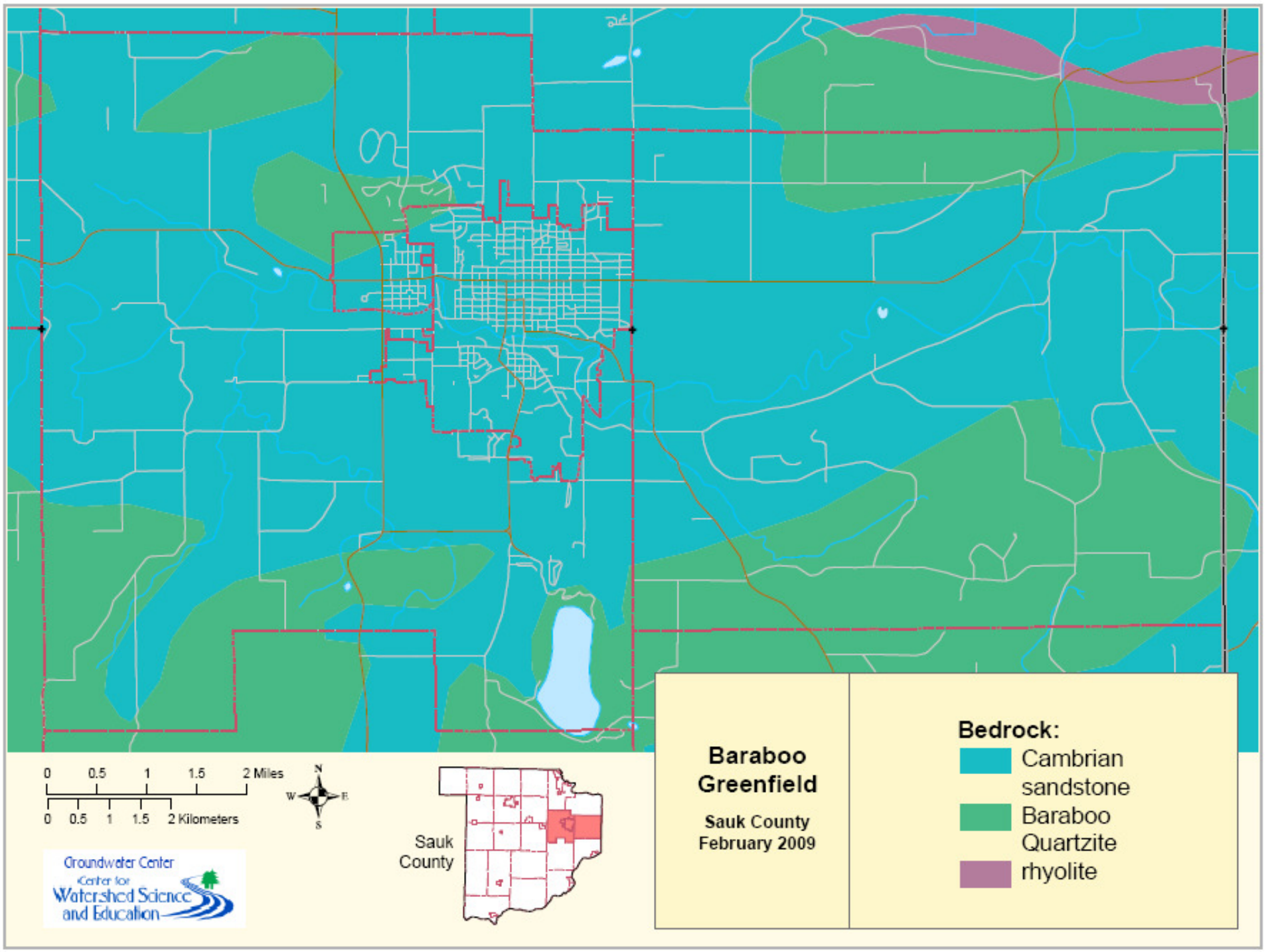
OIL
OIL
OIL
Soil


Land-use activity that pollutes groundwater.
Because groundwater moves, wells located far from the contamination source can sometimes be polluted from activities not directly surrounding the well.
Recharge area
Land surface
Water table
Stream
Contaminated groundwater
Unconfined aquifer
Confining bed


0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
N
W
E
S
Sauk County
Groundwater Center
Center for Watershed Science and Education
Baraboo
Greenfield
Sauk County
February 2009
Elevation:
(meters)
241 - 260
261 - 280
281 - 300
301 - 320
321 - 340
341 - 360
361 - 380
381 - 400
401 - 420
421 - 440
441 - 460
461 - 480
481 - 500


Youngest
Dolomite
Sandstone
Crystalline Bedrock
Oldest




0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
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Groundwater Center
Center for
Watershed Science
and Education
Sauk
County
Baraboo
Greenfield
Sauk County
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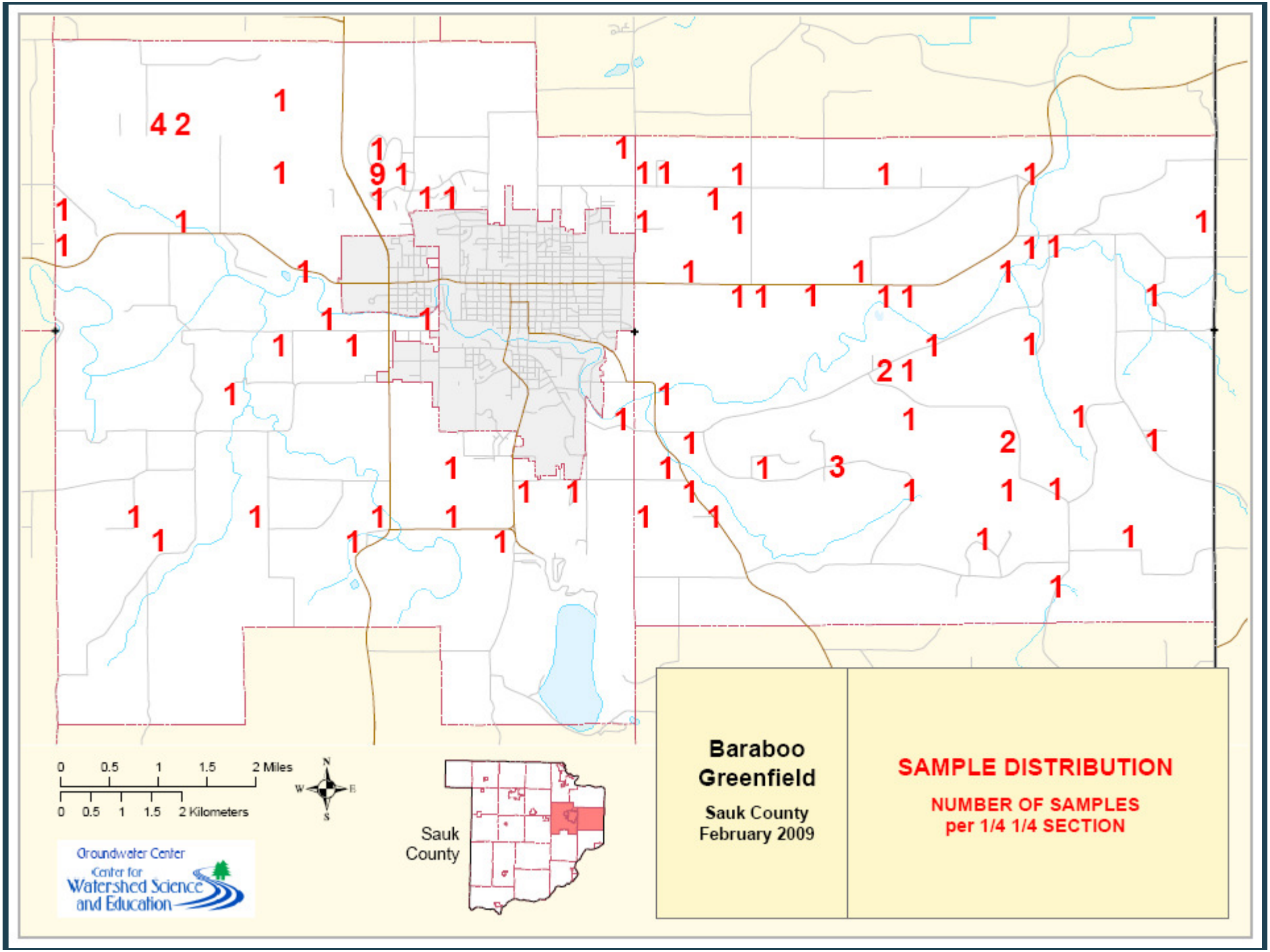
Bedrock:
Cambrian
sandstone
Baraboo
Quartzite
rhyolite


Baraboo
Greenfield
Sauk County
February 2009
SAMPLE DISTRIBUTION
NUMBER OF SAMPLES
per 1/4 1/4 SECTION
0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
N
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Sauk
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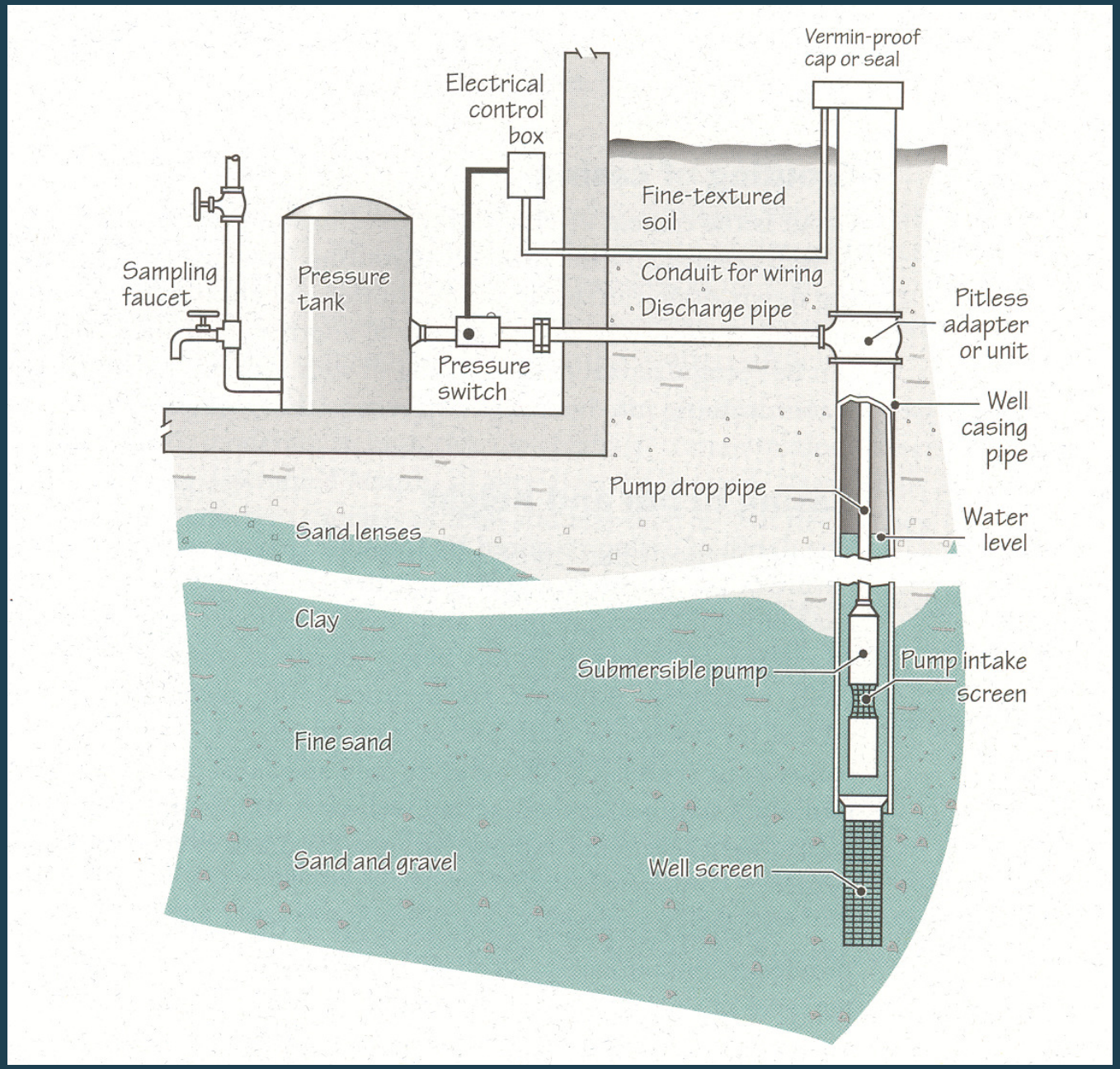
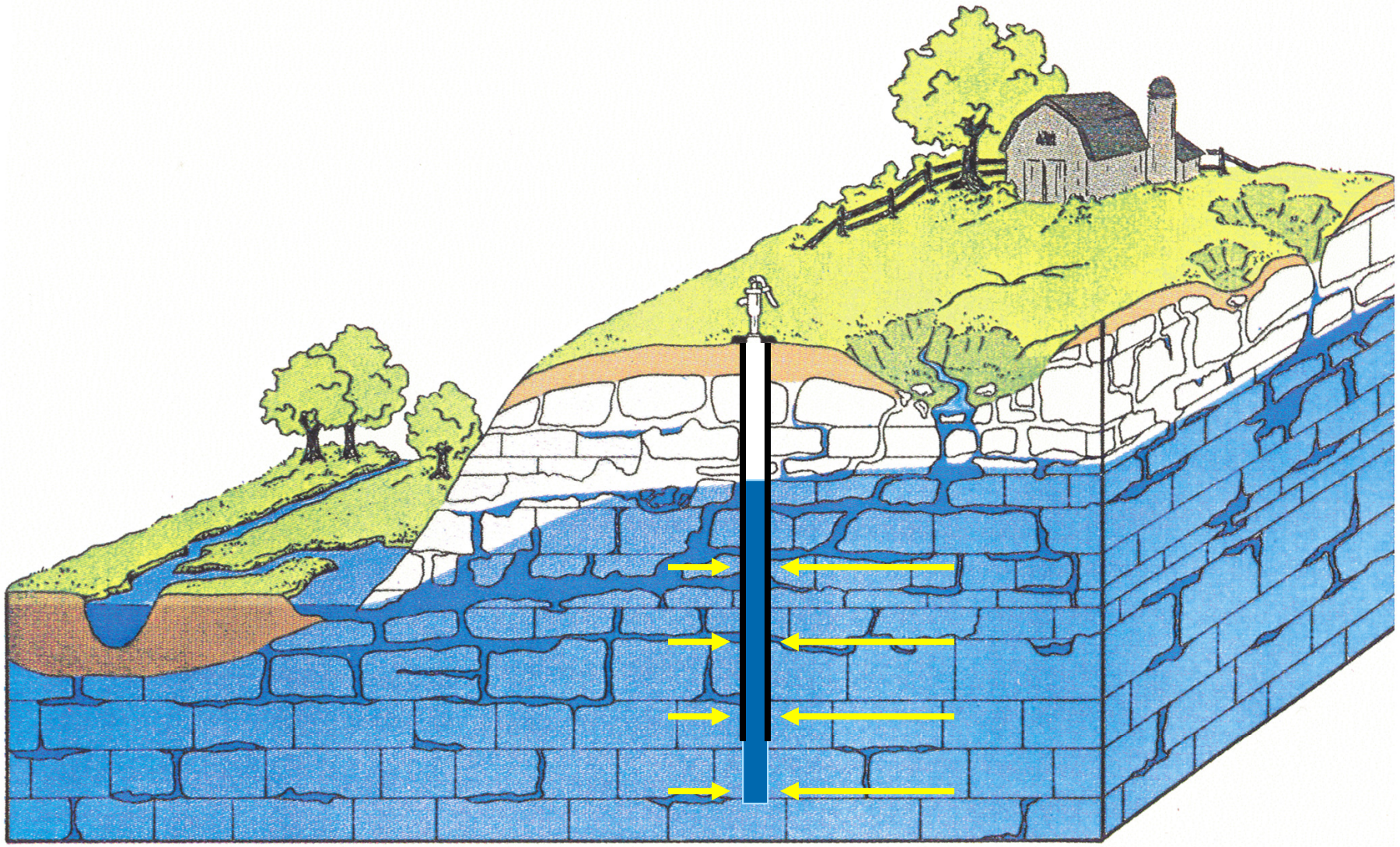

Vermin-proof cap or seal
Electrical control box
Fine-textured soil
Sampling faucet
Pressure tank
Conduit for wiring
Discharge pipe
Pitless adapter or unit
Pressure switch
Well casing pipe
Pump drop pipe
Water level
Sand lenses
Clay
Submersible pump
Pump intake screen
Fine sand
Sand and gravel
Well screen



Well Construction Report For WISCONSIN UNIQUE WELL NUMBER CC 566

SAMPLE

Department of Natural Resources
Private Water Supply — WS/2
Box 7921
Madison, WI 53707

Property Owner: Clyde Nuenfeldt — Telephone Number: ( )
Mailing Address: Rt 4
City: Oshkosh — State: WI — Zip Code:
County of Well Location: Winnebago — County Well Location Permit No.: W — Well Completion Date: 9 / 2 / 69 (M M / D D / Y Y)

Well Constructor (Business Name): Wallace Clark — Registration #:
Address: 5411 Ripon Rd
City: Oshkosh — State: WI — Zip Code:

2. Mark well location in correct 40-acre parcel of section.

1. Location (Please type or print using a black pen.)
☑ Town ☐ City ☐ Village — Fire # (if available)
of Oshkosh
Grid or Street Address or Road Name and Number (if available)
Subdivision Name — Lot # — Block #
Gov't Lot # ____ or NE ¼ of NE ¼ of Section 26; T 19 N; R 16 ☑ E ☐ W

3. Well Type ☑ New ☐ Replacement ☐ Reconstruction
of unique well # ____ constructed in 19 ____
Reason for new, replaced or reconstructed well?

4. Well serves 1 # of homes and/or ____ (ex: barn, restaurant, church, school, industry, etc.)
High Capacity Well? ☐ Yes ☑ No
High Capacity Property? ☐ Yes ☑ No

☑ Drilled ☐ Driven Point ☐ Jetted ☐ Other ____

5. Well Located on Highest Point of Property, Consistent with the General Layout and Surroundings? ☐ Yes ☐ No If no, explain on back side.
Well Located in Floodplain? ☐ Yes ☐ No
Distance In Feet From Well To Nearest:

____ 1. Landfill	____ 9. Downspout/Yard Hydrant	____ 17. Wastewater Sump
50 2. Building Overhang	____ 10. Privy	____ 18. Paved Animal Barn Pen
110 3. Septic or Holding Tank	100 11. Foundation Drain to Clearwater	____ 19. Animal Yard or Shelter
150 4. Sewage Absorption Unit	____ 12. Foundation Drain to Sewer	____ 20. Silo — Type ____
____ 5. Nonconforming Pit	____ 13. Building Drain ☐ Cast Iron or Plastic ☐ Other	____ 21. Barn Gutter
____ 6. Buried Home Heating Oil Tank	____ 14. Building Sewer ☐ Gravity ☐ Pressure ☐ Cast Iron or Plastic ☐ Other	____ 22. Manure Pipe ☐ Gravity ☐ Pressure ☐ Cast Iron or Plastic ☐ Other
____ 7. Buried Petroleum Tank	____ 15. Collector or Street Sewer	____ 23. Other Manure Storage ____ Other NR 112 Waste Source
____ 8. Shoreline/Swimming Pool	____ 16. Clearwater Sump	____ 24. ____

6. Drillhole Dimensions

Dia. (in.)	From (ft.)	To (ft.)
10	surface	66
6	66	140

Method of constructing upper enlarged drillhole only.
☐ 1. Rotary — Mud Circulation
☐ 2. Rotary — Air
☐ 3. Rotary — Foam
☐ 4. Reverse Rotary
☐ 5. Cable-tool Bit ____ in. dia.
☐ 6. Temp. Outer Casing ____ in. dia. Removed? ☐ Yes ☐ No If no, explain ____
☐ 7. Other ____

7. Casing, Liner, Screen

Dia. (in.)	Material, Weight, Specification Mfg. & Method of Assembly	From (ft.)	To (ft.)
6	New Black 18.95	surface	66

Dia. (in.)	screen type and material	From	To

8. Grout or Other Sealing Material

Method / Kind of Sealing Material	From (ft.)	To (ft.)	# Sacks Cement
Slurry clay + drillings	surface	66	

DNR USE ONLY

9. Geology

Type, Caving/Noncaving, Color, Hardness, Etc.	From (ft.)	To (ft.)
Clay	surface	18
Sandy clay	18	66
Lime rock	66	100
Sand Stone	100	140
Water bearing		

10. Static Water Level
____ ft. above ground level
10 ft. below ground surface

11. Pump Test
Pumping Level 13 ft. below surface
Pumping at 20 GPM for 2 hours

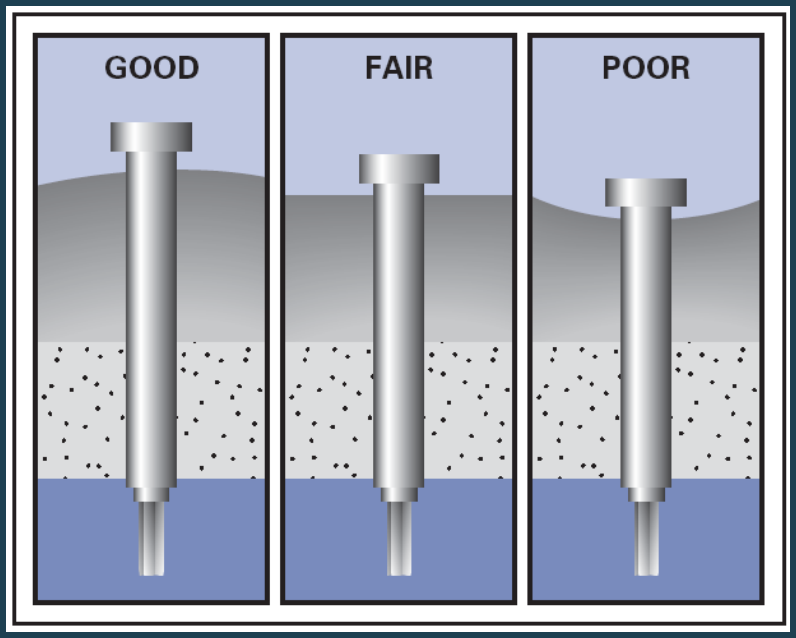
12. Well Is:
☑ Above ☐ Below Grade
10 in.
Developed? ☐ Yes ☐ No
Disinfected? ☑ Yes ☐ No
Capped? ☑ Yes ☐ No

13. Did you permanently seal all unused, noncomplying, or unsafe wells?
☐ Yes ☐ No If no, explain ____

14. Signature of Point Driver or Registered Driller — Date Signed
Signature of Drill Rig Operator — Date Signed

Make additional comments on reverse side about geology, etc.

WELL CONSTRUCTION REPORT



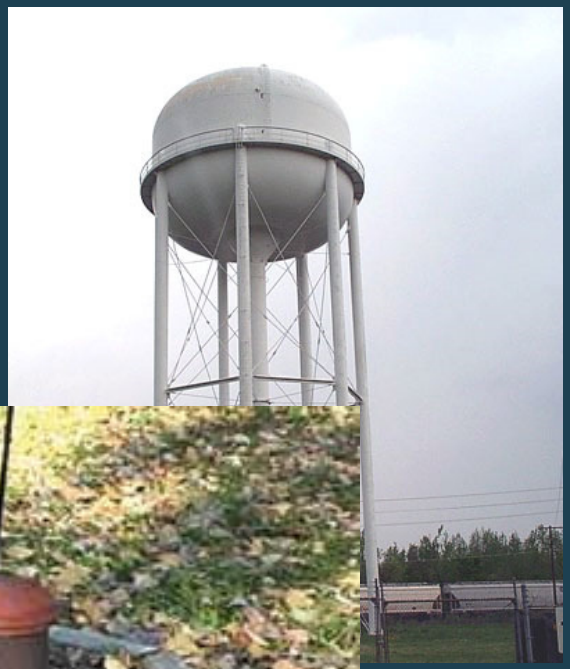
Private vs. Public Water Supplies

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
- Change in taste or odor
- Buying or selling their home
- Plumbing issues
- Want to know if it's safe to drink.

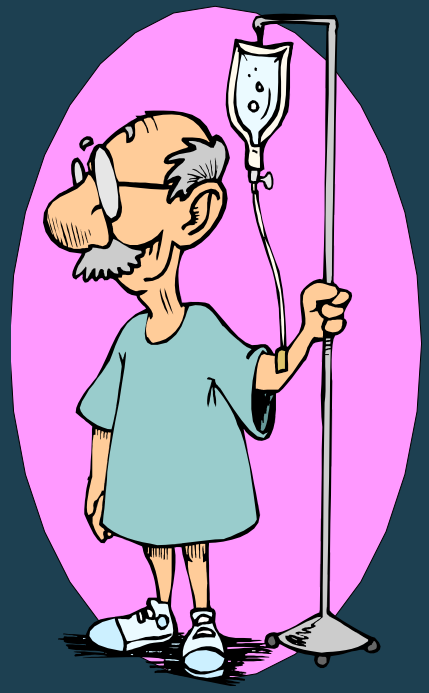
What are the Health Concerns?

- Acute Effects – Usually seen within a short time after exposure to a substance.

  (ex. Bacterial contamination may cause intestinal disease)

- Chronic Effects – Results from exposure to a substance over a long period of time.

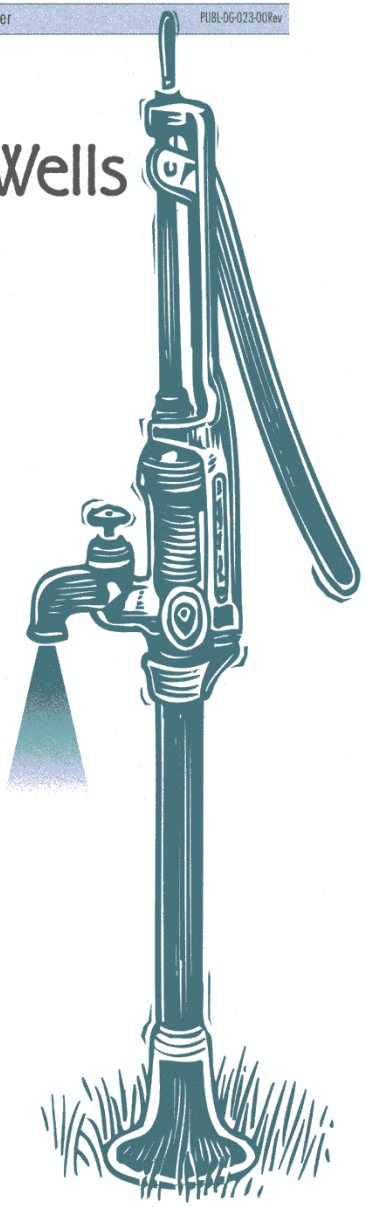
  (ex. Arsenic or pesticides can increase the chance of developing certain types of cancer)



No one test tells us everything we need to know about the safety and condition of a water supply

Wisconsin Department of Natural Resources, Bureau of Drinking Water and Groundwater PUBL-DG-023-00Rev

Tests for Drinking Water from Private Wells



Why should I test my well?

As one of Wisconsin's 700,000 private well owners or private well water consumers, you probably use groundwater for doing your family's laundry, drinking, cooking, bathing and watering your garden. Municipalities are required to test their water supplies regularly to ensure the water is safe to drink. Since there is no requirement to test a private well except for bacteria when it is first drilled or the pump is changed, you are responsible for making sure your water is safe.

Most private wells provide a clean, safe supply of water; however, contaminants can pollute private wells, and unfortunately you cannot see, smell or taste most of them. Consequently, you should test your water on a regular basis. The decision on what to test your water for should be based on the types of land uses near your well.

This brochure gives information about several common contaminants found in private wells. It should help you decide when to sample your well and how often, how to find a certified laboratory and who to call for help.

What tests should be done on my water?

Total Coliform Bacteria and E.coli

Coliform bacteria live in soil, on vegetation and in surface water. Coliform bacteria found in the intestines of warm-blooded animals and their feces are called E.coli. Some strains of coliform bacteria can survive for long periods in soil and water and can be carried into well casings by insects. Bacteria washed into the ground by rainwater or snowmelt are usually filtered out as the water seeps through the soil, but they sometimes enter water supplies through cracks in well casings, poorly sealed caps, fractures in the underlying bedrock, and runoff into sinkholes. Coliform bacteria are the most common contaminants found in private water systems. A 1994 Wisconsin survey found them in 23% of the wells tested and E.coli in 2.4% of the wells.

Most coliform bacteria do not cause illness, but indicate a breach in the water system. However, since E.coli bacteria are found in fecal material, they are often present with bacteria, viruses and parasites that can cause flu-like symptoms such as nausea, vomiting, fever and diarrhea. Private wells should be tested at least once a year for

PRINTED ON RECYCLED PAPER

Interpreting Drinking Water Test Results

Tests important to health:

- Coliform bacteria
- Sodium
- Nitrate
- Copper
- Lead
- Triazine
- Zinc
- Sulfate
- Arsenic

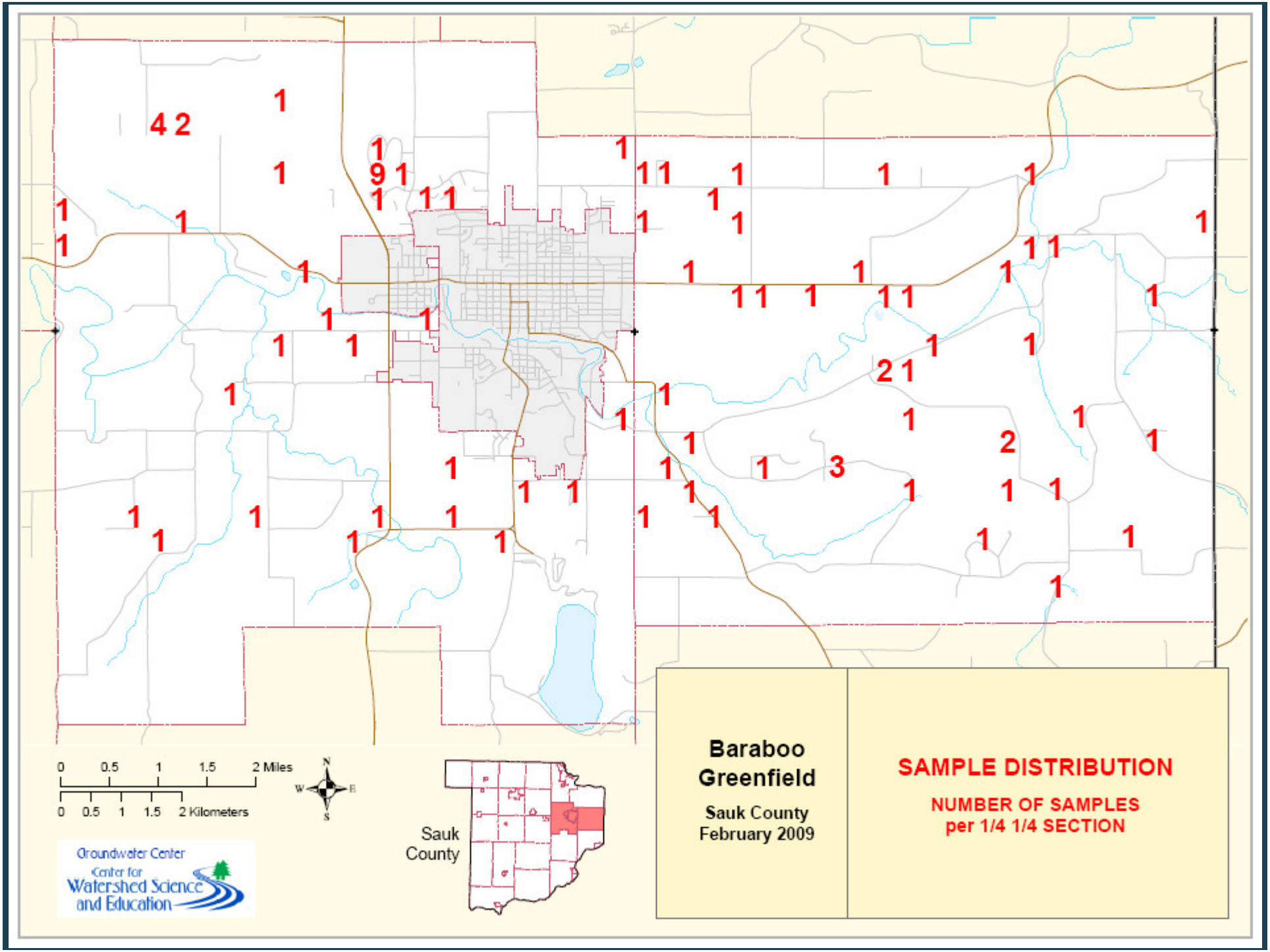
Tests for aesthetic (taste,color,odor) problems:

- Hardness
- Iron
- Manganese
- Chloride

Other important indicator tests:

- Saturation Index
- Alkalinity
- Conductivity
- Potassium

Red = human-influenced, Blue = naturally found


Baraboo
Greenfield
Sauk County
February 2009
SAMPLE DISTRIBUTION
NUMBER OF SAMPLES
per 1/4 1/4 SECTION
0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
N
W
E
S
Sauk
County
Groundwater Center
Center for
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and Education

Laboratory Results:

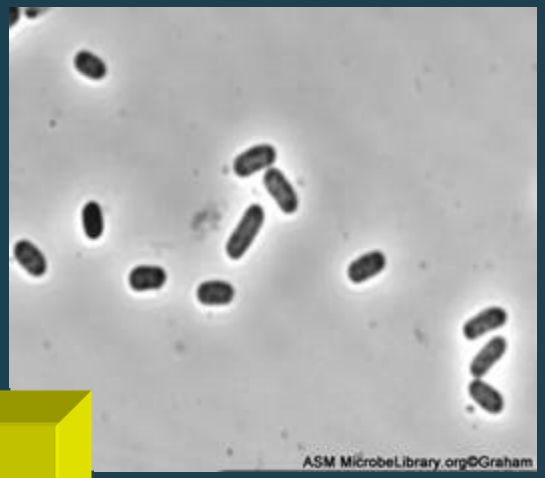
Homeowners Package:		
Bacteria-Coliform	Absent	
Hardness-Total	357	mg/l CaCO3
Alkalinity	326	mg/l CaCO3
Conductivity	724	umhos/cm
Homeowners Metal Package:		
Arsenic (VISTA-ICP)	Less Than 0.005	mg/l (None Detecte
Calcium	0.5	mg/l
Copper (VISTA-ICP)	0.031	mg/l
Iron (VISTA-ICP)	0.065	mg/l
Lead (VISTA-ICP)	0.016	mg/l
Pesticides:		
Triazine Screen	0.2	ppb

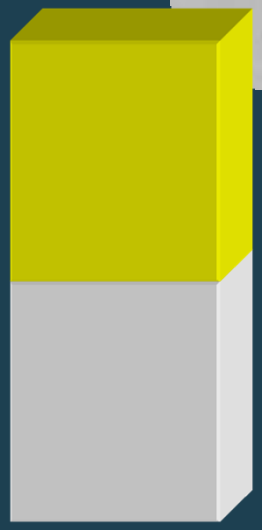
milligrams per liter (mg/l) = parts per million (ppm)

1 mg/l = 1000 parts per billion (ppb)

Coliform bacteria

- Coliform bacteria may indicate the presence of more harmful bacteria with similar life cycles.
- Harmful bacteria can cause gastrointestinal disease, cholera, hepatitis
- If any is present assume that the water is unsafe
- Sources:
  - Live in soils and on vegetation
  - Human and animal waste
  - Sampling error



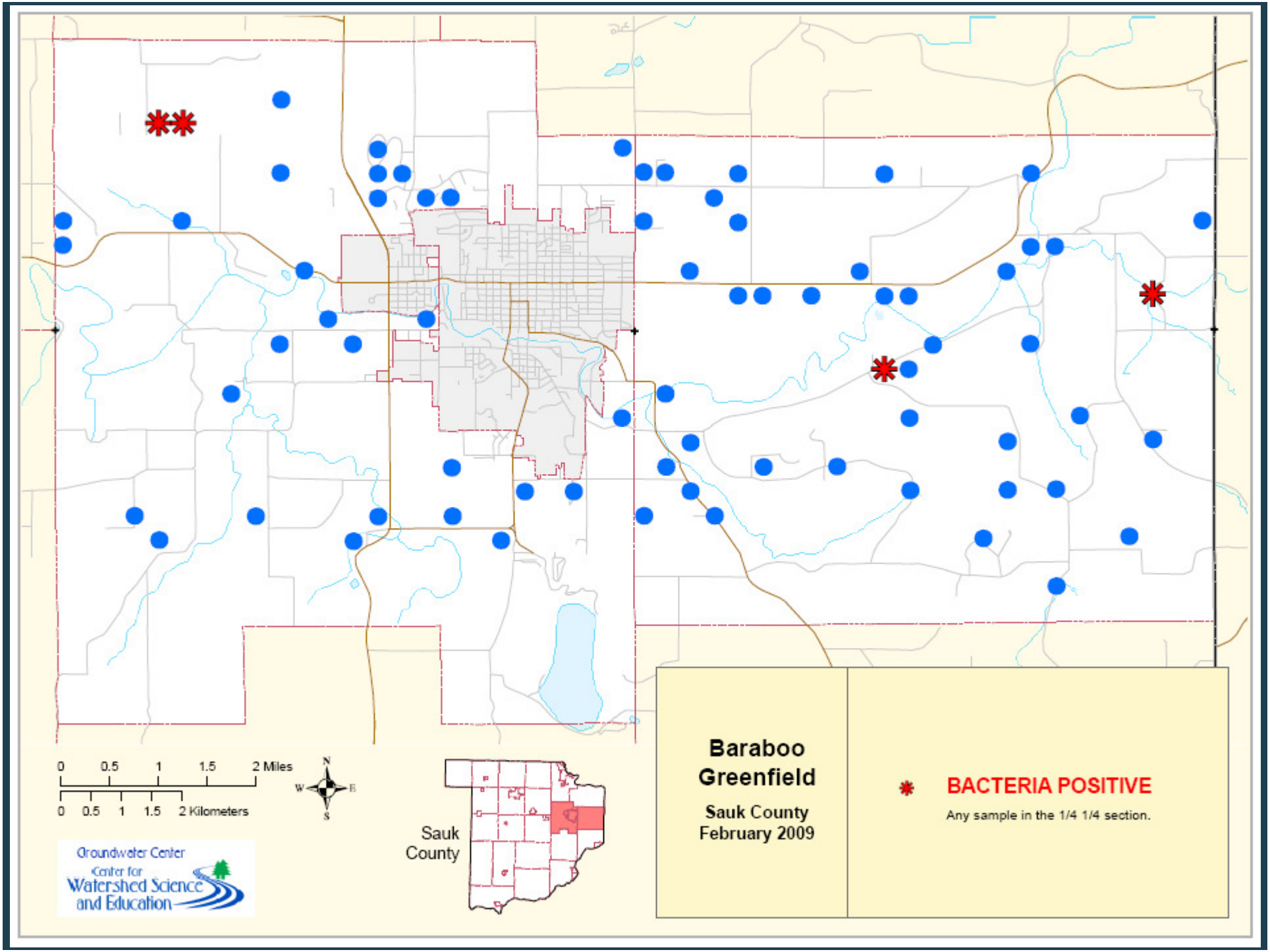


Present =Unsafe

Absent = Safe

E.coli bacteria

- Type of bacteria found in the intestines of warm-blooded animals and their feces are called E.coli.
- 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.


Baraboo
Greenfield
Sauk County
February 2009
BACTERIA POSITIVE
Any sample in the 1/4 1/4 section.
0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
N
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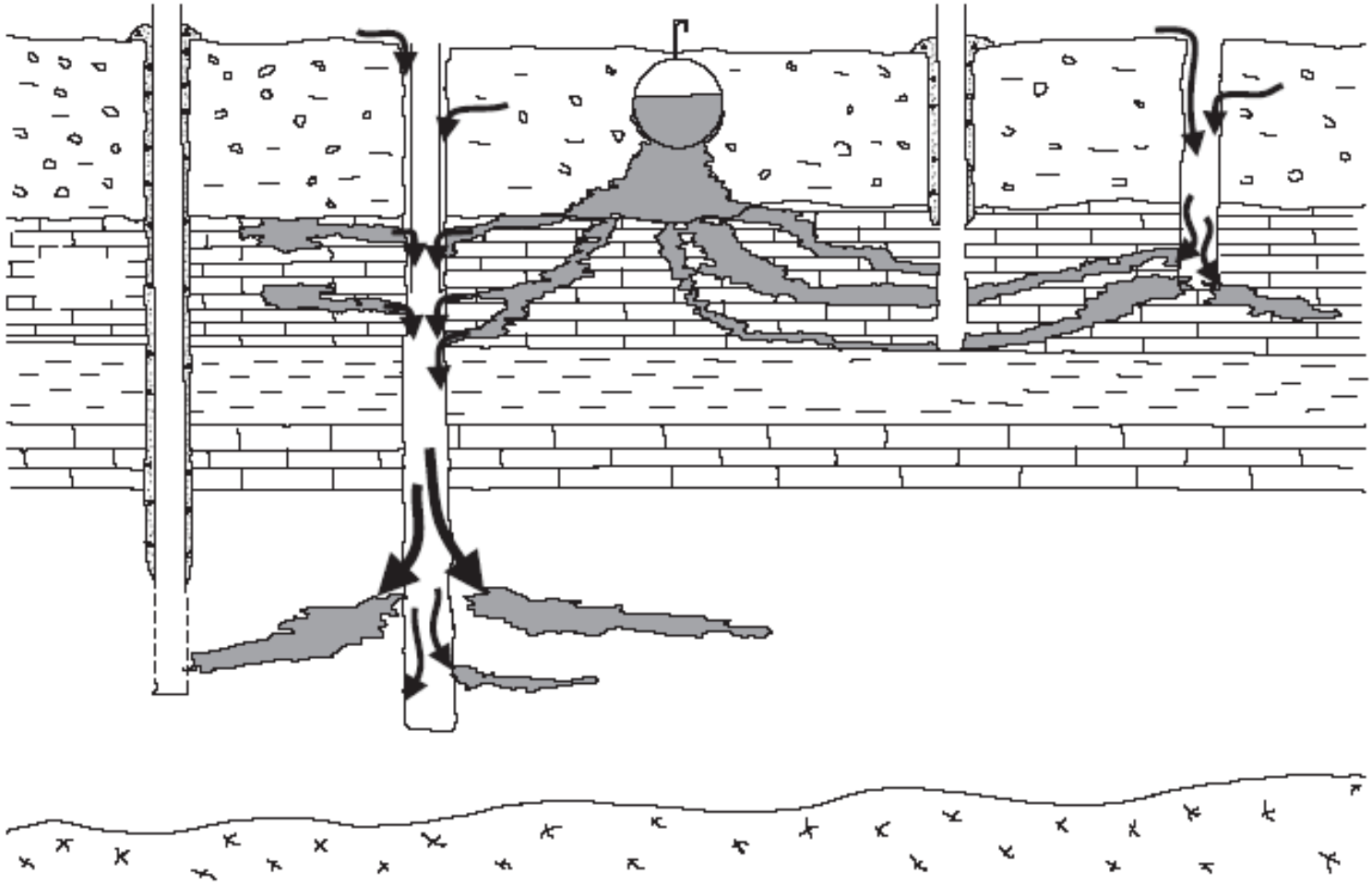
AQUIFER CONTAMINATION THROUGH IMPROPERLY ABANDONED WELLS



Source: Adapted from DiNovo and Jaffe, 1984.

What should I do if I have Bacteria Problems?

1. Use alternative source of water for drinking
2. Retest
3. Try to identify any sanitary defects
   - Loose or non-existent well cap
   - Well construction faults
   - Abandoned well
   - Inadequate filtration by soil
4. Disinfect the well
5. Retest to ensure well is bacteria free.

➢ For reoccurring bacteria problems it may be necessary to look into drilling a new well.

Rock and Soil Impacts
on Water Quality

Tests for Aesthetic Problems

Hardness

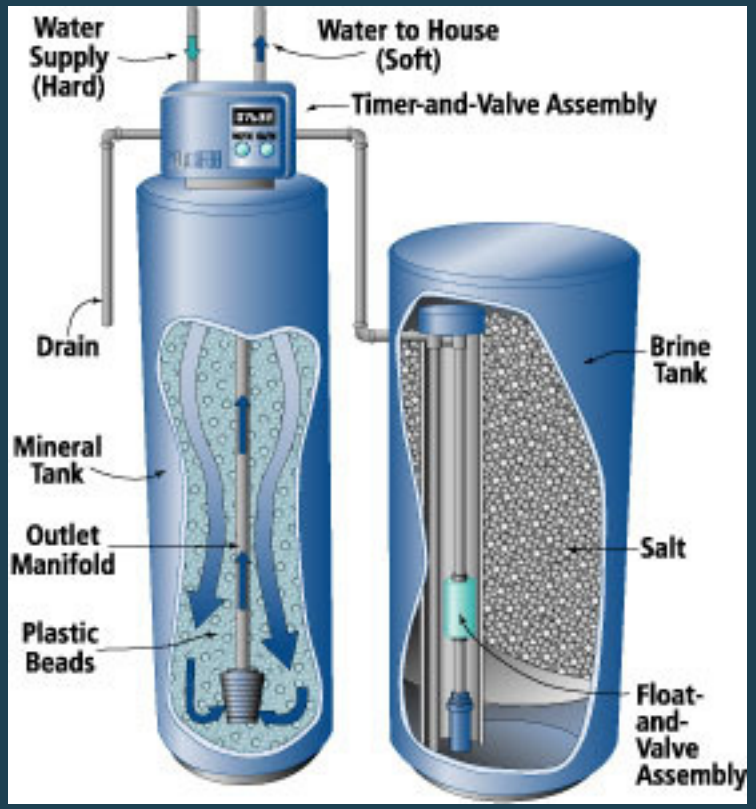
- **Natural (rocks and soils)**
- **Primarily calcium and magnesium**

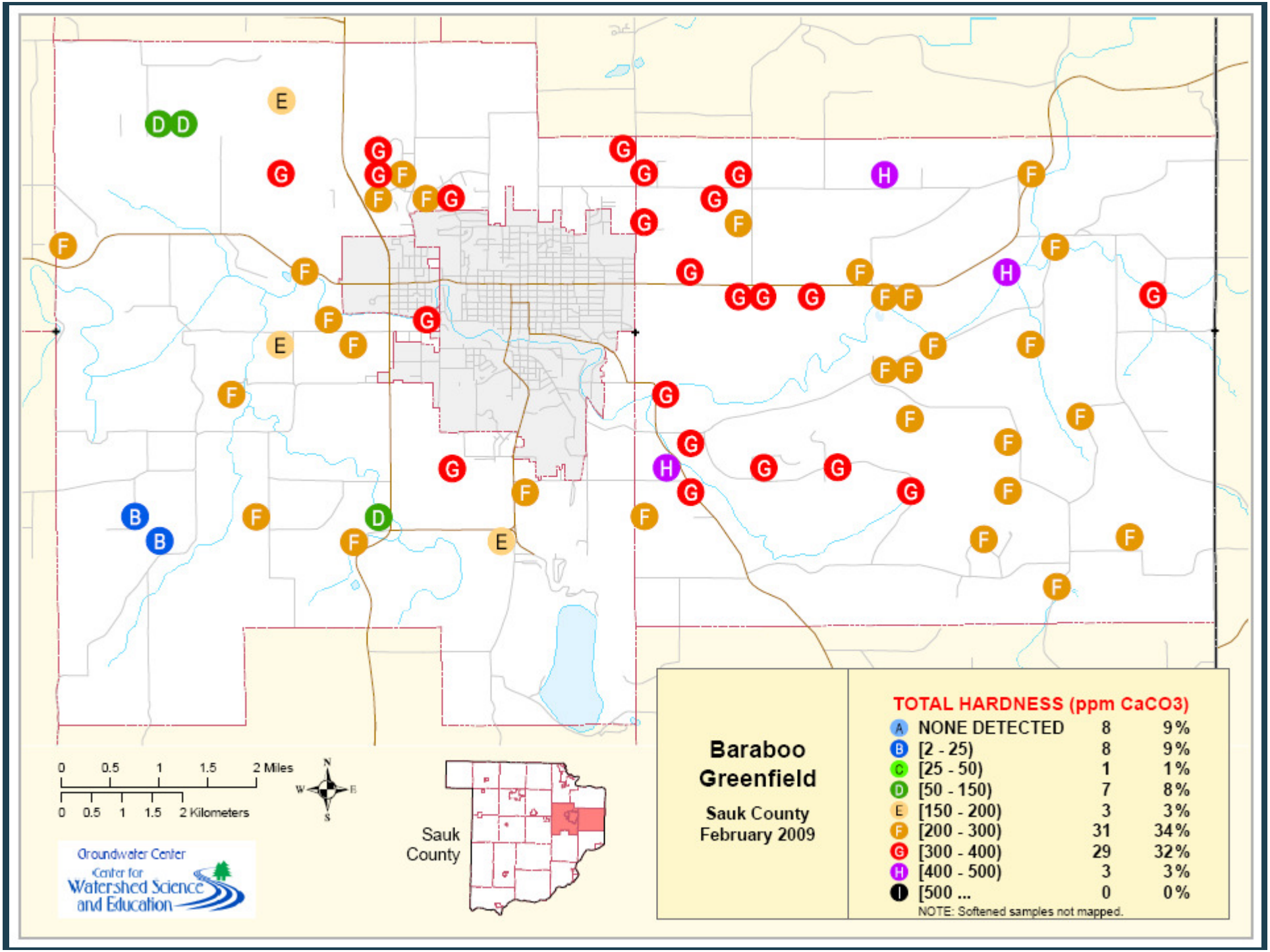
- Problems: scaling, scum, use more detergent, decrease water heater efficiency

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.**




Baraboo
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TOTAL HARDNESS (ppm CaCO3)
A NONE DETECTED 8 9%
B [2 - 25) 8 9%
C [25 - 50) 1 1%
D [50 - 150) 7 8%
E [150 - 200) 3 3%
F [200 - 300) 31 34%
G [300 - 400) 29 32%
H [400 - 500) 3 3%
I [500 ... 0 0%
NOTE: Softened samples not mapped.
0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
N
W
E
S
Sauk County
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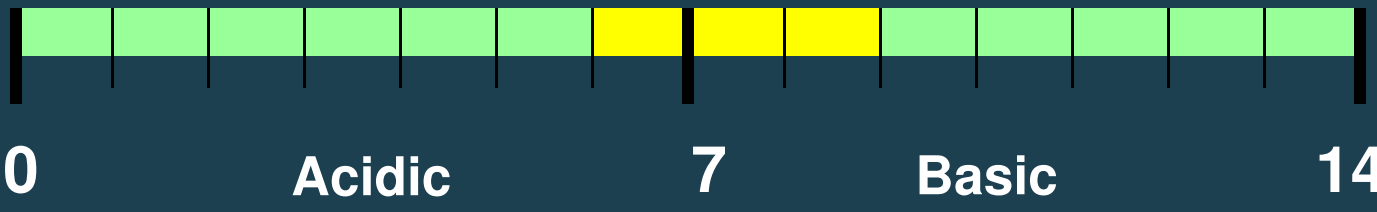
Center for Watershed Science and Education

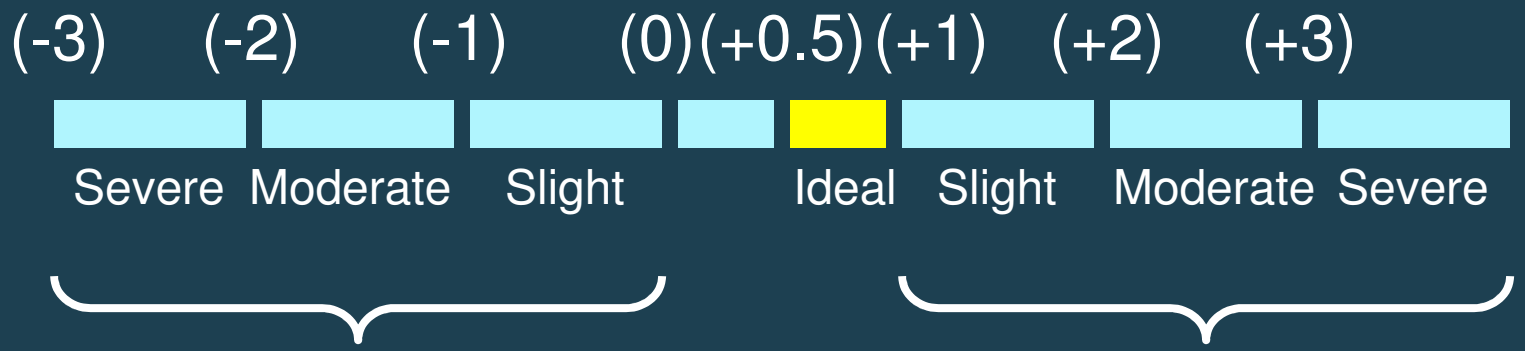
Tests for Overall Water Quality

- 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



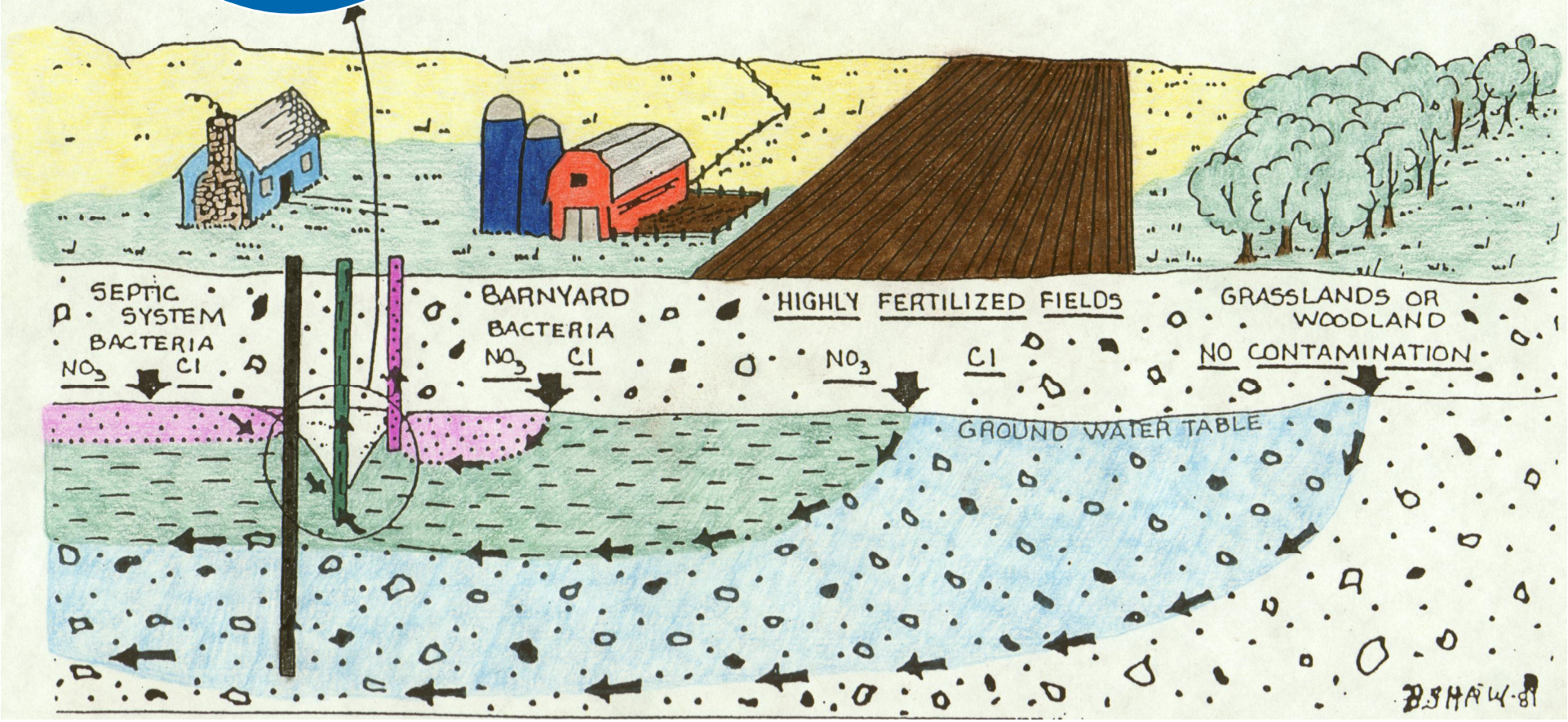
Tests for Overall Water Quality

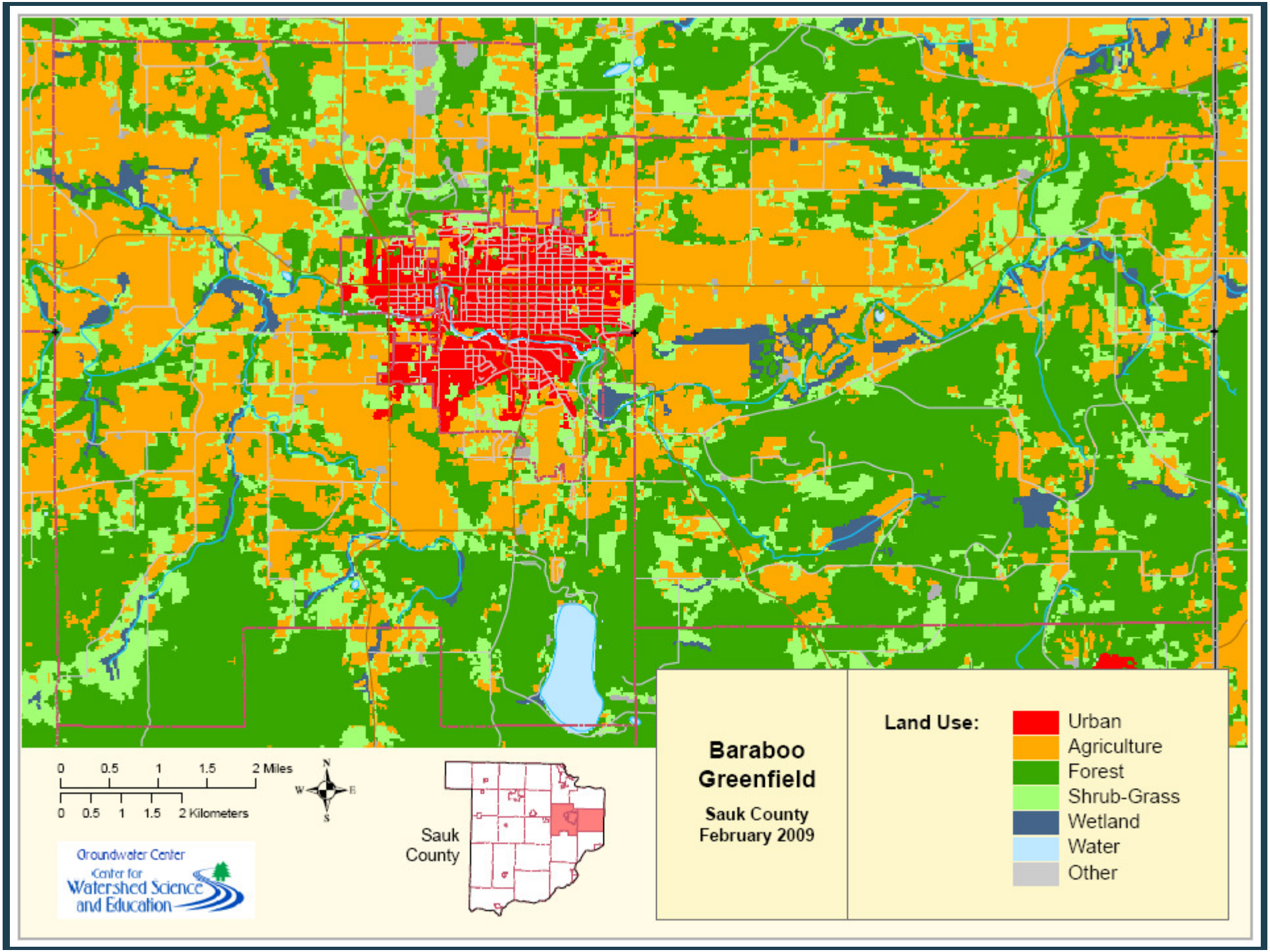
Saturation Index



Land Use and Water Quality

Well pumping water

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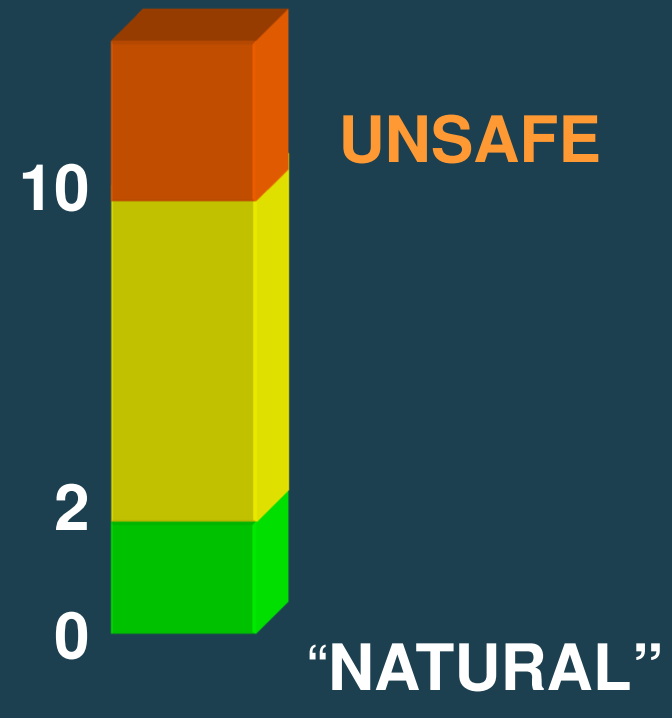
Land Use:
Urban
Agriculture
Forest
Shrub-Grass
Wetland
Water
Other

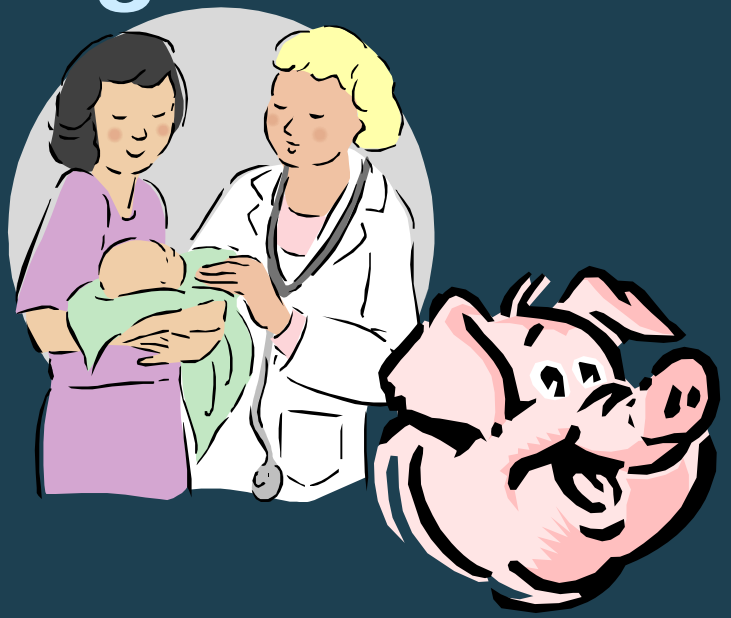
Test Important to Health

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

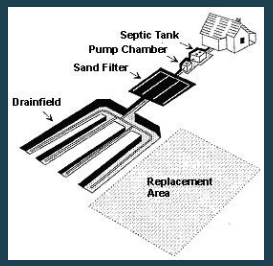


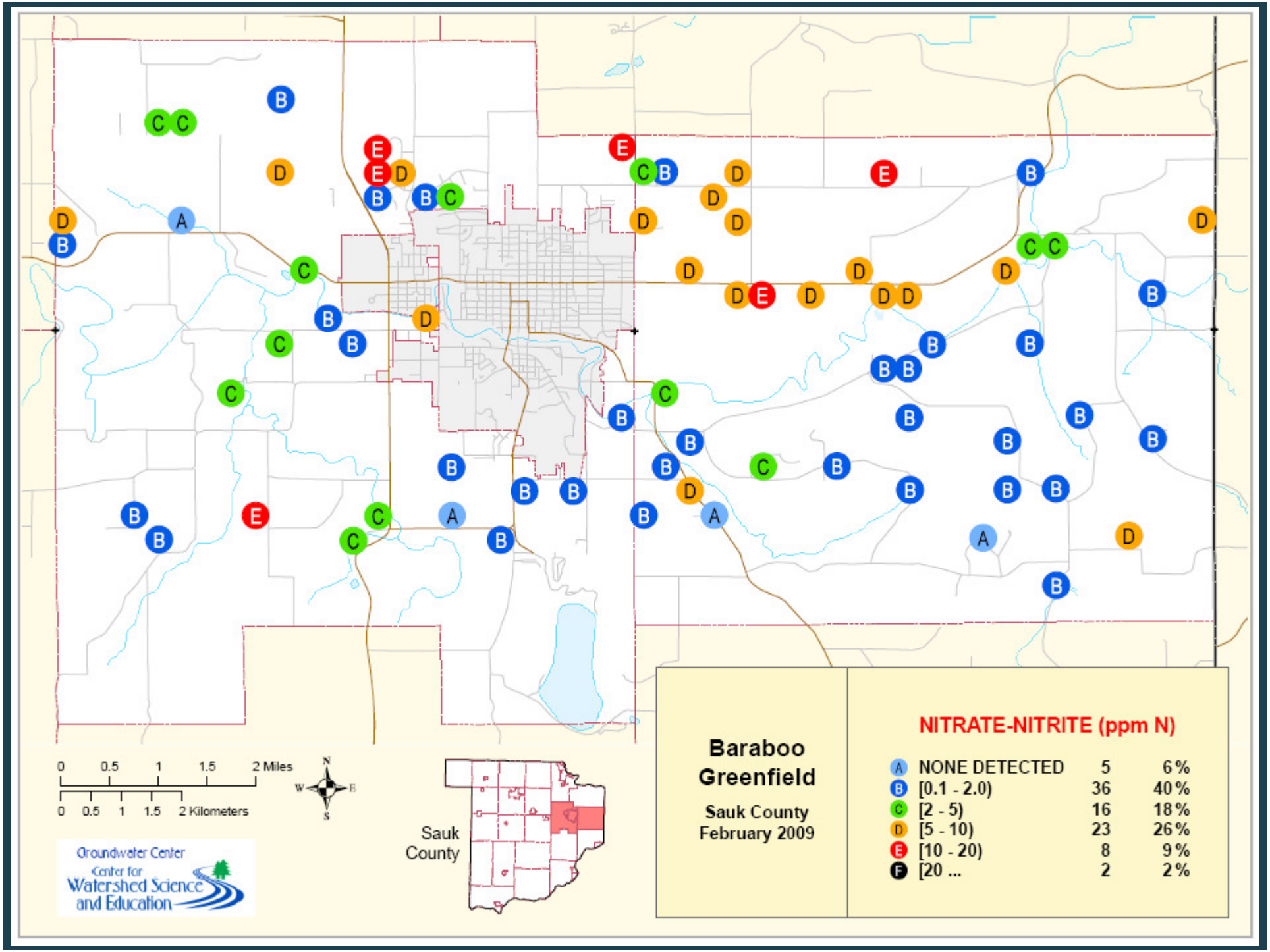
Health Effects:

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

Sources:

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




Baraboo
Greenfield
Sauk County
February 2009
NITRATE-NITRITE (ppm N)
A NONE DETECTED 5 6 %
B [0.1 - 2.0) 36 40 %
C [2 - 5) 16 18 %
D [5 - 10) 23 26 %
E [10 - 20) 8 9 %
F [20 ... 2 2 %
0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
N
W
E
S
Sauk County
Groundwater Center
Center for Watershed Science and Education

What can I do to reduce my nitrate levels?

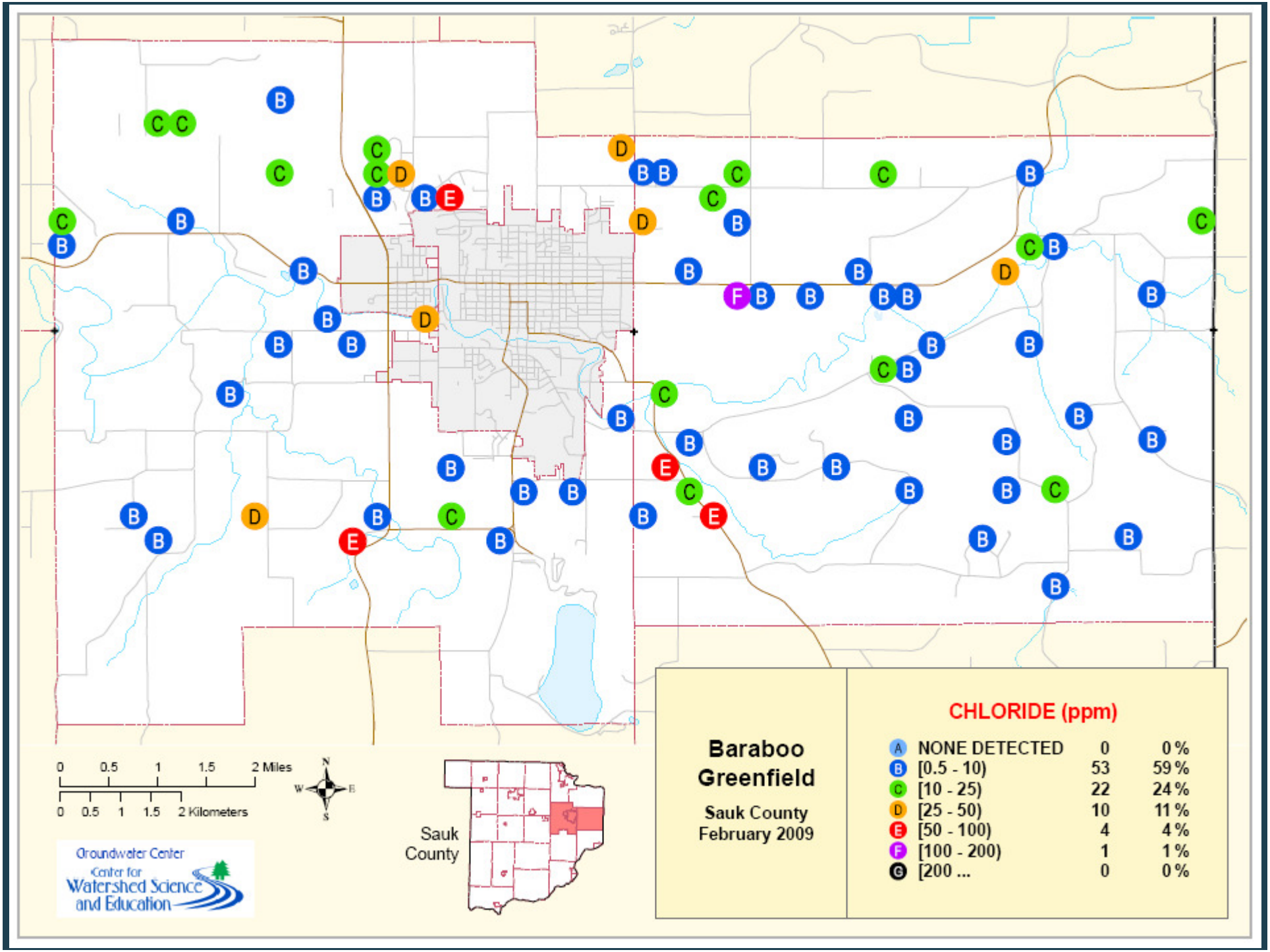
- Eliminate contamination source or reduce nitrogen inputs
- Change well depth or relocate well
- Carry or buy water
- Water treatment devices
  - Reverse osmosis
  - Distillation
  - Anion exchange

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

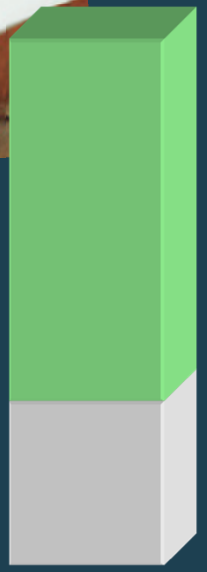
  "Natural" in much of WI


Baraboo
Greenfield
Sauk County
February 2009
CHLORIDE (ppm)
A NONE DETECTED 0 0 %
B [0.5 - 10) 53 59 %
C [10 - 25) 22 24 %
D [25 - 50) 10 11 %
E [50 - 100) 4 4 %
F [100 - 200) 1 1 %
G [200 ... 0 0 %
0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
N
W
E
S
Sauk County
Groundwater Center
Center for Watershed Science and Education

Tests for Aesthetic Problems

Iron

- Natural (rocks and soils)
- May benefit health
- Red and yellow stains on clothing, fixtures



0.3 mg/L

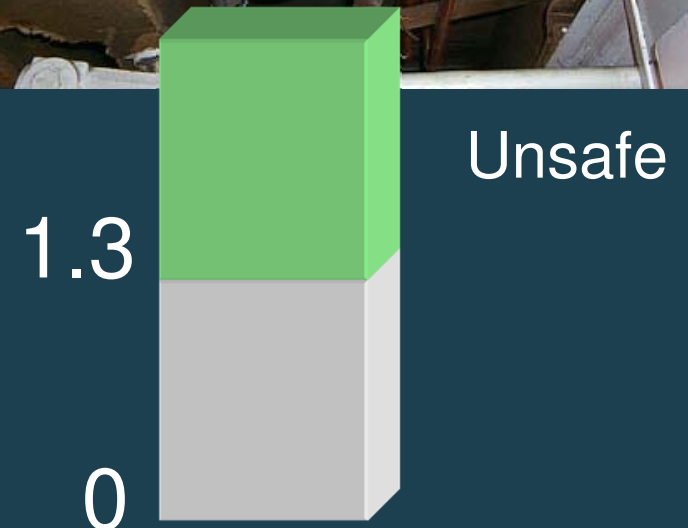
0

- Potential for iron bacteria
  - Slime, odor, oily film

Test Important to Health

Copper

- **Sources: Copper water pipes**
- **Standard: 1.3 mg/L**



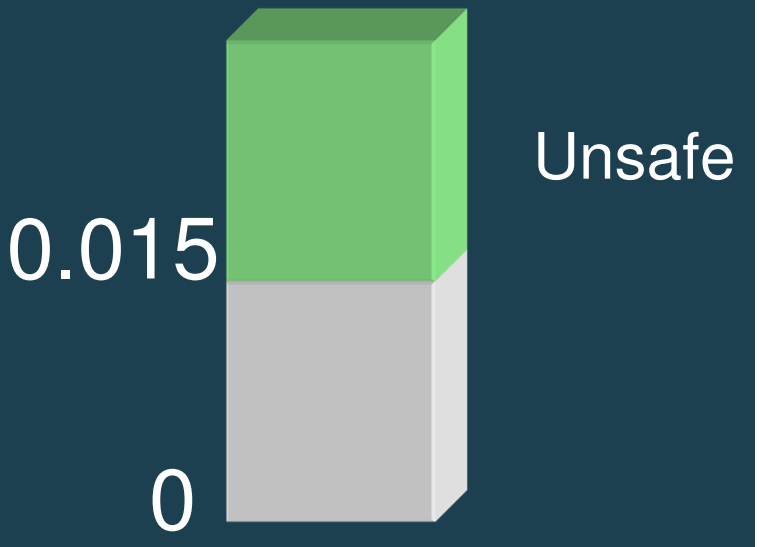
Health Effects:

- **Some copper is needed for good health**
- **Too much may cause problems:**
  Stomach cramps, diarrhea, vomiting, nausea
  Formula intolerance in infants

Test Important to Health

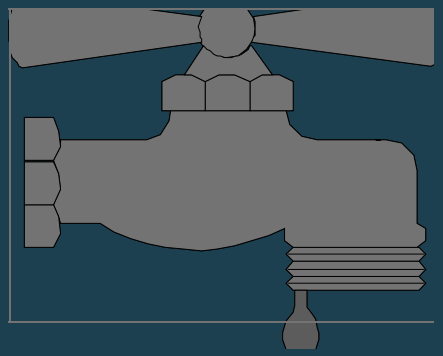
Lead

- **Sources: Lead solder joining copper pipes (pre-1985)**
- **Standard: 0.015 mg/L (15 ppb)**



Health Effects:

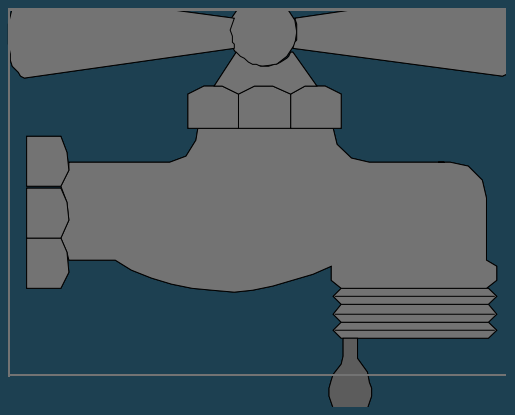
- **Young children, infants and unborn children are particularly vulnerable.**
- **Lead may damage the brain, kidneys, nervous system, red blood cells, reproductive system.**



Lead and Copper

Solutions:

- **Run water until cold before drinking.**
- **Use a treatment device.**



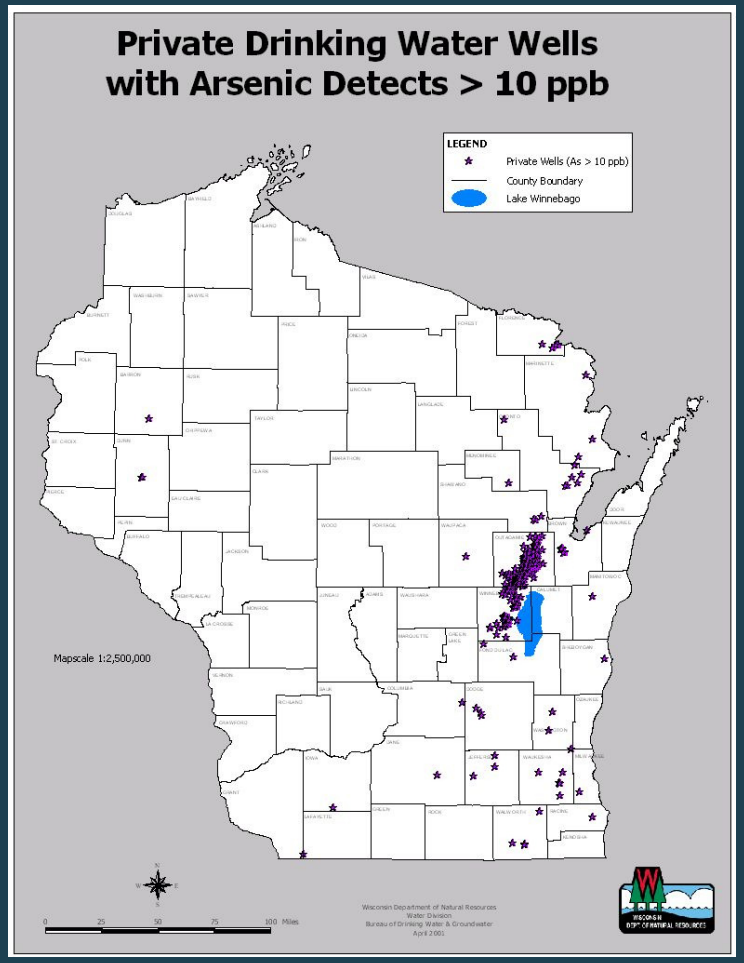
Test Important to Health

Arsenic

- Sources: Naturally occurring in mineral deposits
- Standard: 0.010 mg/L (10 ppb)

Health Effects:

- Increased risk of skin cancers as well as lung, liver, bladder, kidney, and colon cancers.
- Circulatory disorders
- Stomach pain, nausea, diarrhea
- Unusual skin pigmentation

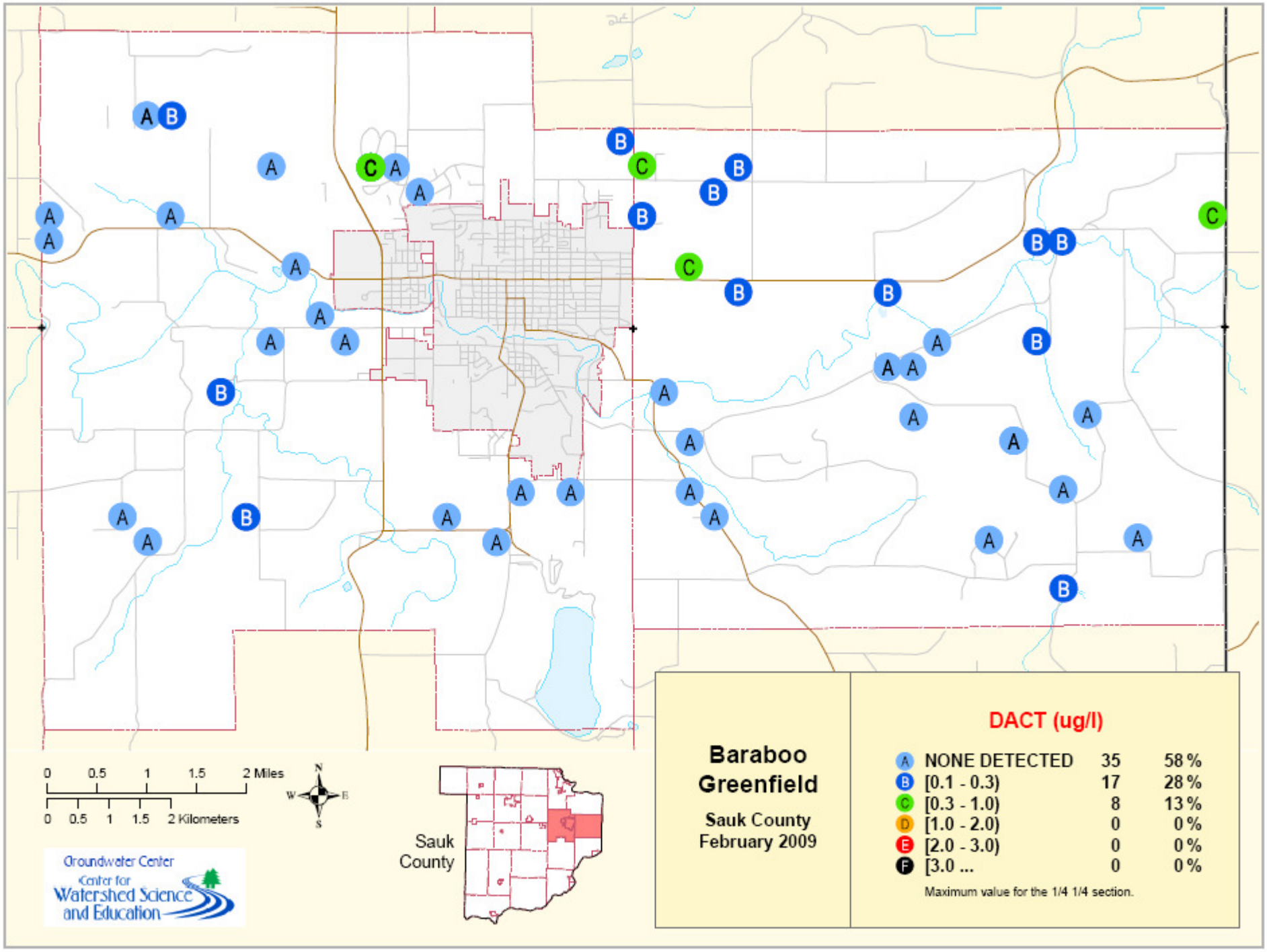


Tests Important to Health

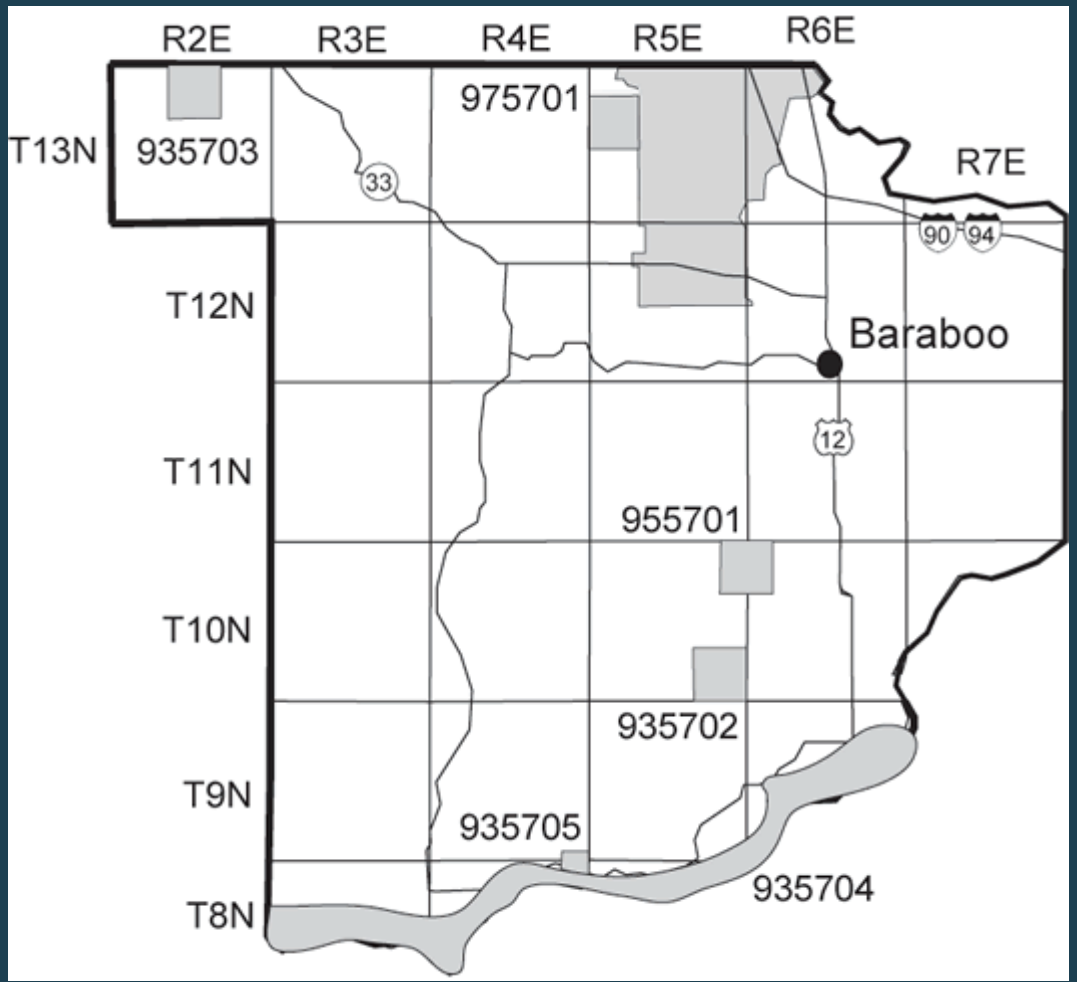
DACT Screen

- **Measures the levels of triazine pesticides (atrazine, simazine, propazine, cyanazine, etc)**
- **Sources: Triazine pesticides (mainly atrazine used on corn crops)**
- **Drinking water limit:**

  3 ppb


Baraboo
Greenfield
Sauk County
February 2009
DACT (ug/l)
A NONE DETECTED 35 58 %
B [0.1 - 0.3) 17 28 %
C [0.3 - 1.0) 8 13 %
D [1.0 - 2.0) 0 0 %
E [2.0 - 3.0) 0 0 %
F [3.0 ... 0 0 %
Maximum value for the 1/4 1/4 section.
0 0.5 1 1.5 2 Miles
0 0.5 1 1.5 2 Kilometers
N
W
E
S
Sauk County
Groundwater Center
Center for Watershed Science and Education

Atrazine Prohibition Areas in Sauk County



A word about water treatment…

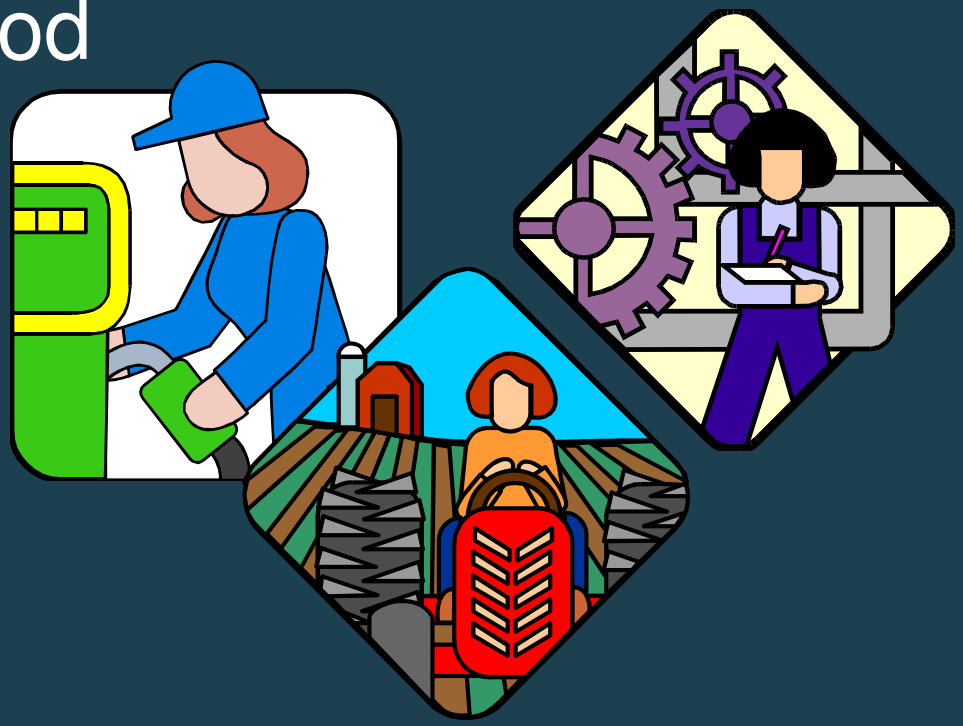
- Test water at a certified lab
- Know the types and amounts of contaminants you need to remove
- Choose a device approved by the Wisconsin Department of Commerce for the problems found in your water
- Maintenance is necessary to ensure proper treatment.

Next Steps

- Test well annually for bacteria, or if water changes color or clarity.
- If levels are elevated, test again in 15 months for nitrate.

Next Steps

- Test for known or potential contaminants in your neighborhood
  - Gasoline?
  - Pesticides?
  - Solvents?



Check for known contamination sites in St.Croix County at:
http://dnr.wi.gov/org/aw/rr/gis/index.htm

Thanks to the following for helping sponsor this program:

- Town of Honey Creek
- Town of Prairie du Sac
- Town of Troy
- Sauk County Land and Water Conservation Department
- Sauk County UW-Extension
- Center for Watershed Science and Education

Questions?

Through the University of Wisconsin-Extension, all Wisconsin people can access University resources and engage in lifelong learning, wherever they live and work.