Interpret My Water Test Results

This section will provide information to help you interpret your water test results.

To continue, select the test package(s) that you would like interpretive information for.

Homeowner Package

Metal Package

DACT Screen

Wisconsin Well Water 101:

Helping you make decisions about your private water system

Click on the tabs to navigate through the information. Some of the links will navigate to other websites.
If you have problems with this information or have additional questions please contact Kevin Masarik.

Groundwater Basics:

Where does my water come from

How does your water quality compare? Look for data in your area

Learn About Well Construction

Interpret My Water Test Results

How to Improve My Water Quality

Who to Contact If I Need Additional Assistance

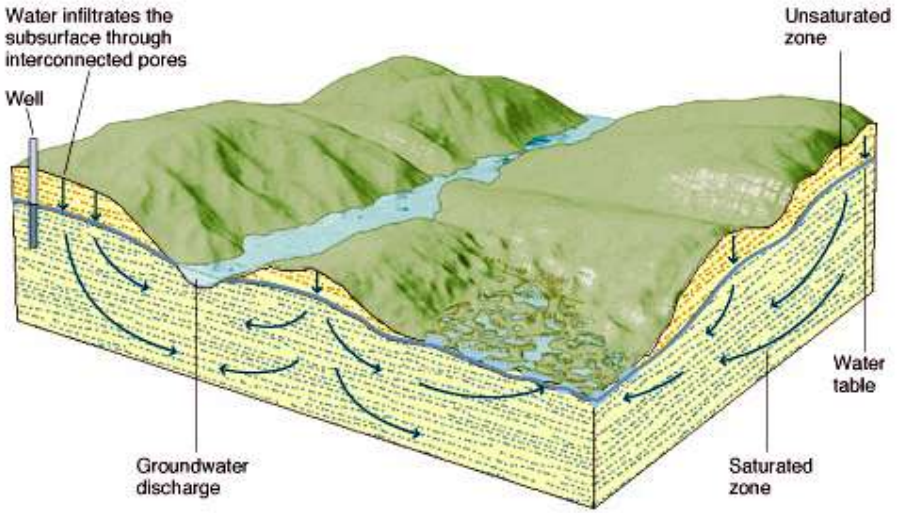
Brought to you by:

University of Wisconsin-Stevens Point
College of Natural Resources

UW Extension
University of Wisconsin-Extension

Groundwater Basics: Where does my water come from

- What is groundwater?
- Watersheds of Wisconsin
- Aquifers: Our groundwater groundwater storage units
- Factors that affect our groundwater quality
- Better Homes and Groundwater: Simple activities to protect the resource [download pdf from Wisconsin DNR]



Homeowners Package

Click on any of the tabs to help you interpret your results for a particular test:

- Coliform Bacteria
- Hardness – Total
- Alkalinity
- Conductivity
- pH
- Saturation Index
- Nitrogen – Nitrate
- Chloride

Some of these tests included in this package, such as bacteria and nitrate, are important because they deal with health related contaminants.

The other tests will tell you about important characteristics of your well water, such as how hard or corrosive it is.

Metals Package

To begin, click on any of the tabs to be taken directly to the information for a particular element.

- Arsenic
- Calcium
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Potassium
- Sodium
- Sulfate
- Zinc

Some metals are essential to humans; other have no health benefits or are toxic:

Toxic, no known benefit to human health: arsenic, lead

Beneficial to health, not normally found in groundwater or at toxic amounts: calcium, magnesium, iron, potassium

Essential to health in small amounts, but can cause negative health effects at higher concentrations: copper, manganese, sodium, sulfate, zinc

DACT Screen

Background information:

Atrazine is a common herbicide widely used in Wisconsin. Over time, atrazine breaks down into three other related chemicals. This test screens for DACT one of the breakdown components of atrazine.

What are acceptable levels?

WI has a health-based groundwater standard of 3 parts per billion (ppb) for the total of atrazine and its three breakdown products*.

**This analysis is specific to diaminochlorotriazine (DACT) a breakdown component of atrazine and other triazine type pesticides. It does not account for parent compound or other breakdown components and therefore may underestimate the amount of total atrazine in your water sample.*

Please select the range in which your DACT result falls:

- Greater than 3 ppb than 3.0 ppb
- 2.0 to 3.0 ppb
- 1.0 to 1.9 ppb
- 0.1 to 0.9 ppb
- Less than 0.1 ppb (none detected)

DACT Screen

You selected:

Greater than 3.0 ppb – Your water supply exceeds the 3.0 ppb total atrazine standard.

2.0 to 3.0 ppb – It is likely that your water supply exceeds the 3.0 ppb total atrazine standard.

1.0 to 1.9 ppb – There is a chance that your water supply exceeds the 3.0 ppb total atrazine standard.

0.1 to 0.9 ppb – Triazine herbicides were detected but it is unlikely that your water exceeds the 3.0 ppb total atrazine standard.

Less than 0.1 ppb (none detected) – No triazine herbicides were detected in your water sample.

OBJECTIONABLE –

We advise you to not consume water with greater than 3.0 ppb on a long-term basis. According to the WI Dept. of Health Services, long term exposure to atrazine and its breakdown products may cause a variety of health problems including weight loss, heart damage and muscle spasms. Do not use the water for soups, beverages, baby formula, etc. You may continue to use your water to bathe, wash foods, clothing, dishes, etc.

Additional Information:

When DACT concentrations are higher than 2 ppb, the Dept. of Ag, Trade and Consumer Protection will often perform a more detailed follow up test for you at their expense. ***If you are interested in this free follow up testing, contact Jeff Postle, Water Quality Staff at 608-224-4503.*** *At levels exceeding 3 ppb, you may be eligible for state financial assistance to obtain safe drinking water.*

Back to previous page

Next: Additional information regarding pesticides in water

DACT Screen

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Less than 0.1 ppb (none detected) – No triazine herbicides were detected in your water sample.

Back to previous page

You selected:

CAUTION

The DACT screen usually underestimates the amount of total atrazine in a water sample, more extensive testing would likely reveal that your water exceeds 3.0 ppb for total atrazine.

Potential Health Concerns:

According to the WI Dept. of Health Services, long term exposure to atrazine and its breakdown products at levels above 3.0 ppb may cause a variety of health problems including weight loss, heart damage and muscle spasms.

Because your DACT concentration is greater than 2 ppb, the Dept. of Ag, Trade and Consumer Protection would be interested in performing a more detailed follow up test at their expense.* ***If you are interested in this free follow up testing, contact Jeff Postle, Water Quality Staff at 608-224-4503.*

Next: Additional information regarding pesticides in water

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Less than 0.1 ppb (none detected) – No triazine herbicides were detected in your water sample.

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You selected:

OK – We detected breakdown components of triazine type pesticides in your water sample, but it is unlikely that your water exceeds the total atrazine standard for groundwater. Your water is considered acceptable for drinking and cooking purposes.

The DACT screen usually underestimates the amount of total atrazine in a water sample. The only way to know for sure whether the water from your well is below the health standard is to have a more thorough pesticide test performed. There may be additional pesticide analysis to consider.

Next: Additional information regarding pesticides in water

DACT Screen

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Next: Additional information regarding pesticides in water

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Less than 0.1 ppb (none detected) – No triazine herbicides were detected in your water sample.

You selected:

GOOD – Based on this test, we did not detect triazine type pesticides in your water.

Your water is considered safe for drinking and cooking purposes in regards to triazine-type pesticides.

**The DACT screen only tests for one particular type of pesticide. If you suspect other pesticides besides triazines might be in your water, you would have to consider having a more thorough pesticide analysis performed.*

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Next: Additional information regarding pesticides in water

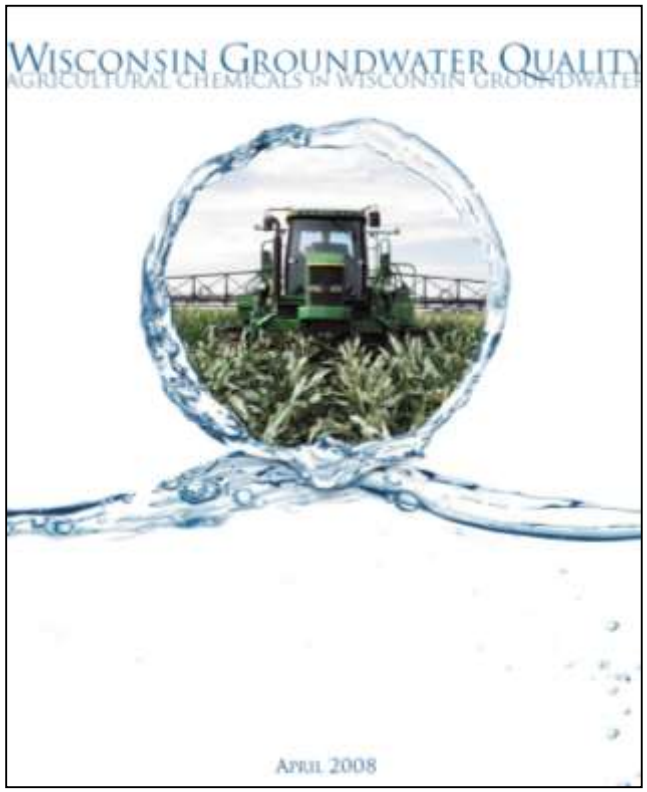
Additional information regarding pesticides in drinking water:

Triazines are only one class of pesticides used in Wisconsin. If you are concerned about pesticides, you may want to consider testing for other pesticides that you know have been applied, stored or spilled in your area.

Based on Dept. of Ag, Trade and Consumer protection well sampling surveys, **the most frequently detected pesticides in Wisconsin are the breakdown products of alachlor, metolachlor, atrazine and its breakdown products.**

Several factors affect a well's vulnerability to pesticide contamination: well location (proximity to agricultural areas or pesticide related industries), quantity of pesticide applications or size of spill, well depth and construction, soil type and geologic setting.

While concentrations may be below recommended standards, there may still be health effects to consider from each individual pesticide, pesticide breakdown products, or the combination of multiple pesticides and breakdown components.



More information regarding the extent of pesticides can be found in: "Agricultural Chemicals in Wisconsin Groundwater – 2007"

Coliform Bacteria

Information about this test:

- Most important test to perform routinely on a private well.
- This type of bacteria generally do not cause illness, but their presence may indicate a pathway for bacteria and viruses that can cause illnesses to enter your water supply.
- A sanitary water supply should not contain any coliform bacteria.

Select your Bacteria – Coliform test result:

Absent | Present

Coliform Bacteria

You Selected: **Absent**

GOOD – An absent bacteria test is desirable, it means that no bacteria were found. **Your water supply is considered bacteriologically safe for all uses including drinking and cooking.** You can be reasonably sure that your water supply is free of fecal coliform and other pathogenic bacteria.

To ensure your well remains in good sanitary condition; consider testing your well again for bacteria annually or sooner if you notice a sudden change in taste, color or odor to the water.

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Coliform Bacteria: Present

Coliform Bacteria you selected: Present

E. Coli you selected: Absent

UNDESIREABLE

You indicated that your water sample tested ***positive for coliform bacteria,*** and absent for e.coli bacteria. This means that only coliform bacteria were found in your water sample. Coliform bacteria help determine if a well is producing bacteriologically free water. Although coliform bacteria generally do not cause illness, ***the presence of coliform bacteria indicates a possible pathway for surface water, insects, soil or other pathogens that can cause illnesses to enter your water supply.*** *As a precaution we encourage you to avoid drinking and cooking with this water until the source can be identified/corrected and a safe bacteria test is obtained.*

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Recommended Next Steps

Coliform Bacteria continued

Coliform Bacteria you selected: Present

Because you indicated the presence of coliform bacteria in your water sample, we also checked for E. coli bacteria a specific type of bacteria associated with human and animal waste.

Select your Bacteria – E. coli test result:

Absent | Present

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E.Coli Bacteria: Present

Coliform Bacteria you selected: **Present**

E. Coli you selected: **Present**

UNSAFE

Your sample tested ***positive for both E. coli and coliform bacteria.*** *The results indicate that your water is not safe for drinking.* E.coli is a specific type of fecal bacteria only found in human or animal waste. As a result, **we strongly recommend that you not consume water from your well, or to boil it for five minutes before any consumption (including making coffee, ice cubes or juice) until you solve this problem.**

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Recommended Next Steps

Coliform & E. coli Bacteria

Coliform Bacteria you selected: Present

Because coliform bacteria was detected, we also checked for E. coli bacteria a specific type of bacteria associated with human and animal waste.

Select your Bacteria – E. coli test result:

Absent | Present

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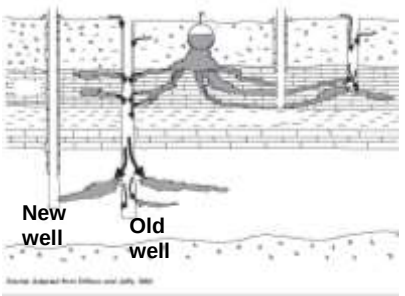
Bacteria and potential pathways

Some simple questions to ask in identifying potential pathways.

1. Did you sterilize the faucet and let the water run for at least 5 minutes prior to collecting a sample. If not, consider a retest.
2. Is your well cap loose, cracked or missing? If yes, have it repaired.
3. Do you have an old unused well nearby that may be contaminating the aquifer? If yes, consider having the old well properly abandoned.
4. Do you live in an area where the bedrock is close the surface, particularly highly fractured bedrock? If yes, does your well casing extend a sufficient depth below the water table? If not, your well casing may not extend deep enough to assure bacteria have been adequately filtered out before reaching the aquifer.
5. Is the are around your well free of tall grass, shrubs or other debris that may provide cover for insects and small animals? If not consider keeping that area clear.
6. After it rains or during spring snowmelt periods can you hear water draining if you stand next to your well? If yes, than your casing may not extend deep enough and may be allowing surface water that hasn't been adequately filtered to enter your well.
7. Do you have an old dug well, well in the basement, stove pipe cased well, or does the casing extend at least 12 inches above grade? If any of these apply than it may represent substandard or outdated well construction. A well with these defects cannot easily be repaired and should be replaced with a new code-complying well that is drilled using modern materials and methods.
8. Do you have a yard hydrant? If yes, and the yard hydrant does not have proper backflow prevention than it may be siphoning water back into the well and contaminating your well with bacteria.
9. Do you have a livestock watering tank hooked up to your well? If yes, and the livestock watering tank does not have proper backflow prevention than it may be siphoning water from the watering tank back into the well and contaminating your well with bacteria.



This diagram shows how not properly filling and sealing old wells can contaminate new wells nearby.

Cracked or poorly sealed well caps can provide insects and other organisms a pathway into your well.

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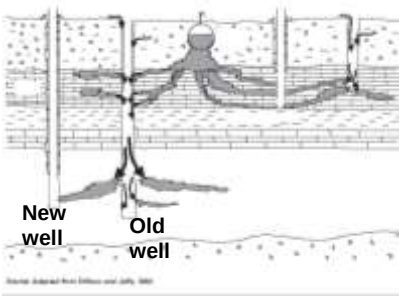

This diagram shows how not properly filling and sealing old wells can contaminate new wells nearby.

Cracked or poorly sealed well caps can provide insects and other organisms a pathway into your well.

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Next Steps:

What to do if coliform bacteria is present

1. As a first step, **we generally recommend carefully resampling** from a non-swivel metal faucet to rule out sampling error as the possible source of the coliform bacteria. *You can request another bacteria test kit from any certified testing laboratory or you may want to consider having a licensed well driller or pump installer come out to perform an inspection of your well water system and collect a second sample.*

2. **If the retest is also positive,** than it is likely a problem with your well. **Any potential pathways for bacteria to enter the well should be identified, corrected.** *If you are unsure of what to do a licensed well driller or pump installer can be hired to perform a well inspection to attempt to identify the problem.*

3. Next, **the well water system must be disinfected.** Homeowners can perform this procedure using the method outlined by the Dept. of Natural Resources, or you can also hire a licensed well driller or pump installer to perform the procedure for you.

4. Following the well disinfection, **perform another bacteria test on your well to ensure that the procedure was effective and your water is bacteriologically safe.** The test should take place a week or two after the disinfection procedure to ensure that any residual chlorine is not influencing the test results.

Find a certified testing lab

Find a licensed contractor

Identify potential bacteria pathways

Click here for more information

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Next Steps:

What to do if e.coli bacteria is present

1. **Avoid using the water for drinking and cooking purposes.** E.coli are a type of fecal bacteria only found in human and/or animal waste.

2. **The source of the e.coli bacteria and/or sanitary defects that are allowing the bacteria into your water supply should be identified and corrected.** *Consider having a licensed well driller or pump installer come out to inspect your system and help with this.*

3. After the source of the bacteria has been eliminated, **the well water system must be disinfected.** *Homeowners can choose to perform this procedure using the method outlined by the Dept. of Natural Resources, or you can may want to consider hiring a licensed well driller or pump installer to perform the procedure for you.*

4. Following the well disinfection, **perform another bacteria test on your well to ensure that the procedure was effective and your water is bacteriologically safe.** The test should take place a week or two after the disinfection procedure to ensure that any residual chlorine is not influencing the test results.

Find a certified testing lab

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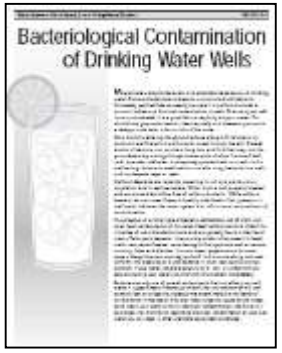

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Hardness - Total

General Information:

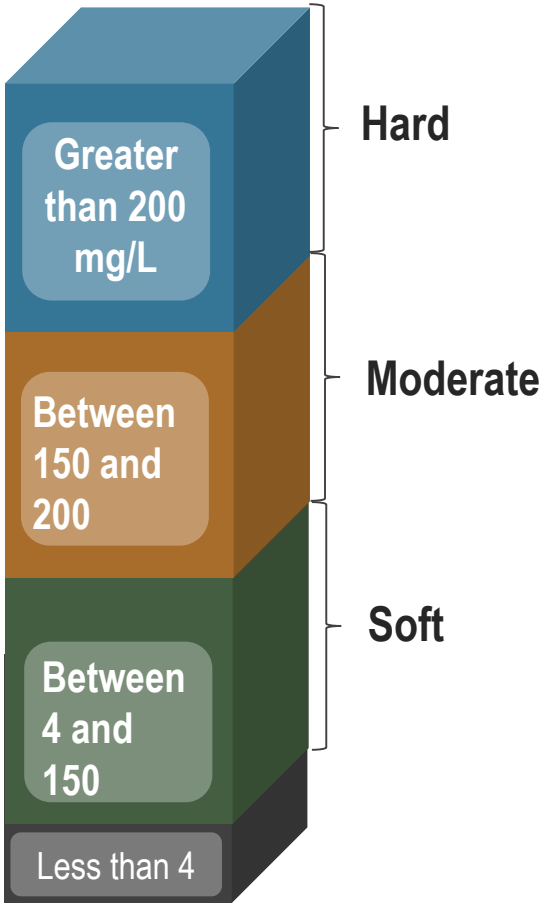
Total hardness measures the amount of calcium and magnesium in water. Hardness is caused by water slowly dissolving rocks that contain calcium and magnesium.

Health Concerns: None

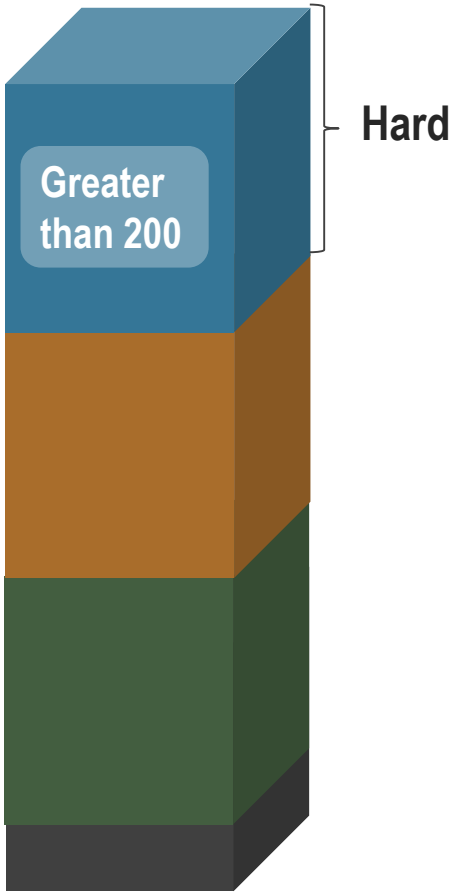
Total hardness is a test for overall water quality

Additional Information: Water with high levels of hardness is often undesirable because it can cause lime buildup (scaling) in pipes and water heaters. Some people that use hard water for showering may notice problems with dry skin. Water that is low in hardness may be corrosive.

Click on your result for interpretation:



Hardness - Total



You Selected Greater than 200 mg/L: **Your water is considered to be Hard**

Potential Issues:

- Water with this level of hardness is more likely to cause lime buildup (scaling) in pipes.
- Scale buildup in the water heater may cause a decrease in water heater efficiency over time.
- Some people that use hard water for showering may notice problems with dry skin.
- Water may cause build up of soap scum and/or graying of white laundry over time.

If you are experiencing problems with hard water:

- Consider softening the water using a water softener. Softened water removes calcium and magnesium that contributes to the issues above. Many people choose not to soften the cold water tap used for drinking and cooking. Do not soften water for outdoor use either.

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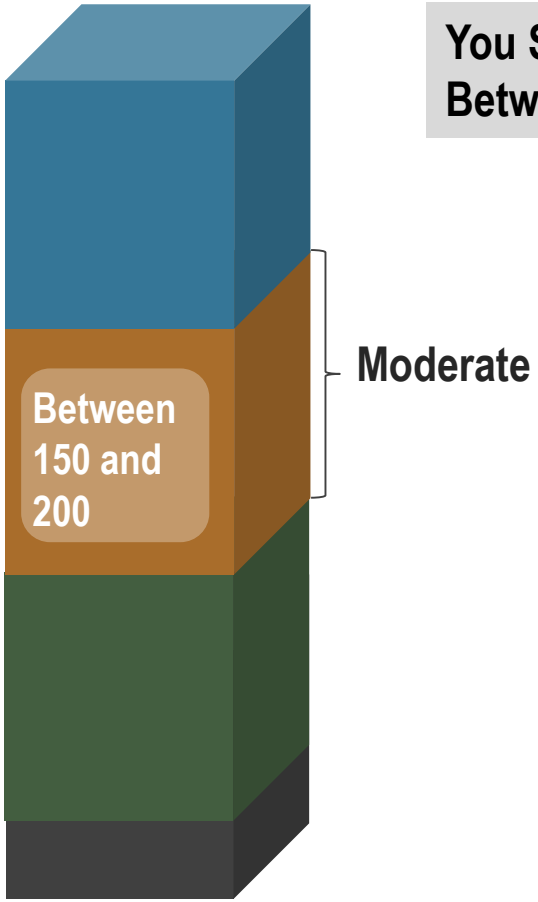
Hardness - Total



You Selected: Between 150 and 200

This is generally considered to be an ideal range of hardness.

If you are experiencing problems with hard water you may consider using a water softener, although it may not be necessary with this level of hardness.

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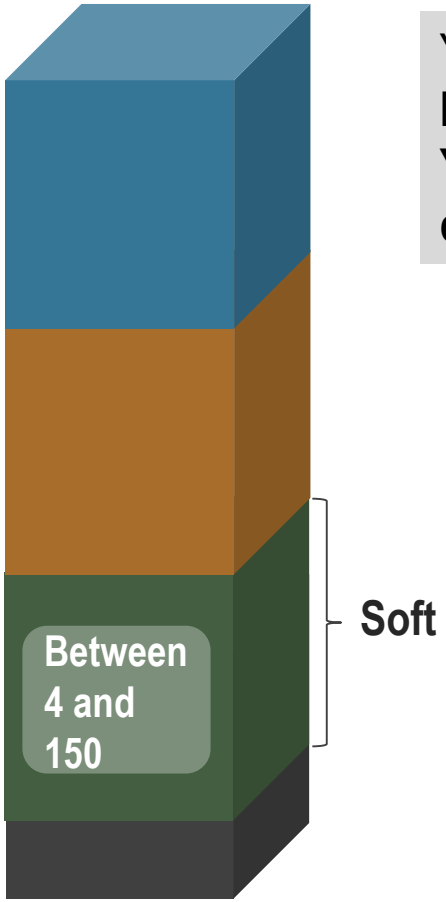
Hardness - Total



You Selected Between 4 and150: **Your water is considered soft**

Potential Issues:

- Water with this level of hardness is considered soft water and may contribute to corrosivity problems.
- If your plumbing has copper or lead components, possibility of elevated levels of copper/lead.
- Blue-green staining of fixtures caused by corrosion of copper plumbing.
- Potential for the development of pinhole leaks.

If you experience any of the problems above you may want to try:

- Installing an acid neutralizer to make water less corrosive.
- Install plastic plumbing which will not corrode or leach copper or lead.

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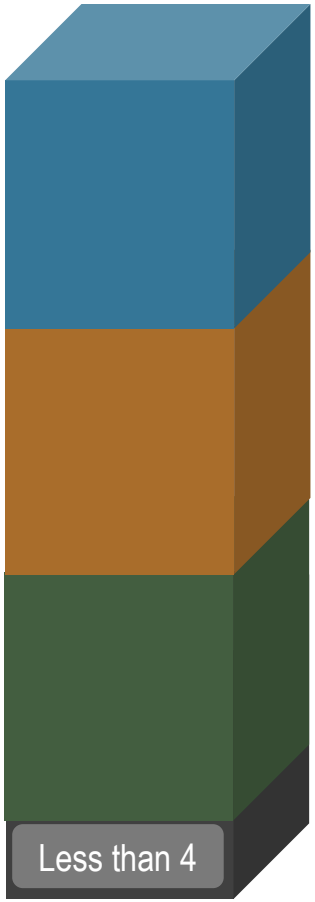
Hardness - Total



You Selected Less than 4 mg/L:
Your water likely passed through a water softener

- ***Water with a total hardness level this low almost certainly indicates that it passed through a water softener.***

Additional Information:

- Hardness and alkalinity generally occur in equal amounts, therefore your alkalinity result which is not affected by the softening process can be used to estimate the actual total hardness of your well water prior to softening.
- If you are using this water for drinking purposes, you may find elevated levels of sodium in the water as a result of the softening process.

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Alkalinity

General Information:

Alkalinity is a measure of water's ability to neutralize acids. It results primarily from dissolving limestone or dolomite minerals in the aquifer.

Health concerns:

None. Alkalinity is a test for overall water quality.

Additional Information:

Alkalinity values are roughly 75-100% of the total hardness value. If your alkalinity is a much larger value than your hardness, than it likely indicates that your water sample has passed through a water softener.

Conductivity

General Information:

Conductivity is a measure of the amount of dissolved substances (or ions) in water, but does not give an indication of which minerals are present. It is usually twice the hardness value in an unsoftened water sample.

Health concerns:

None. Conductivity is a test for overall water quality.

Additional Information:

Changes in conductivity over time may indicate changes to your overall water quality.

pH

General Information:

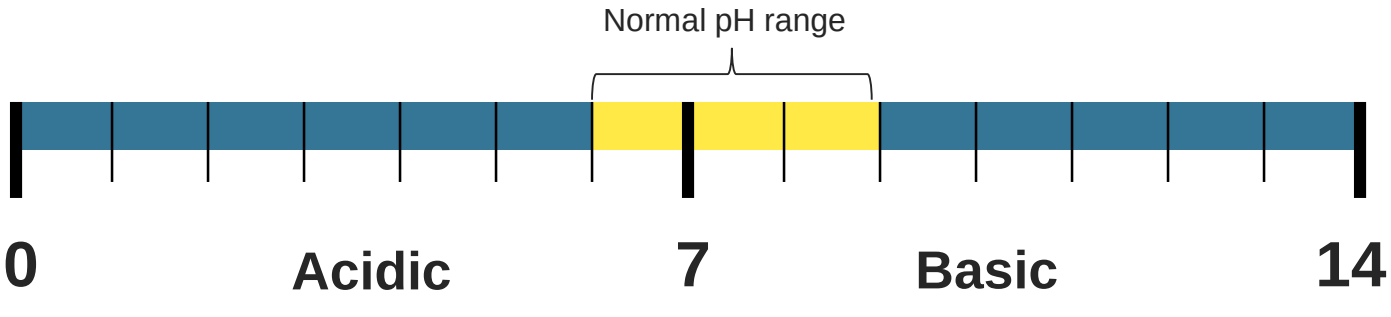
pH is a measure of water acidity. A pH of 7 is neutral. Less than 7 is acidic and greater than 7 is basic. Water that is acidic tends to be more corrosive.

Health concerns:

None, although water with low pH does tend to be more corrosive. Corrosive water is more likely to develop unsafe levels of copper and lead.

Additional Information:

Groundwater in Wisconsin generally ranges between 6 and 9. If it is lower than 6 you may want to consult a water specialist that can recommend other tests.



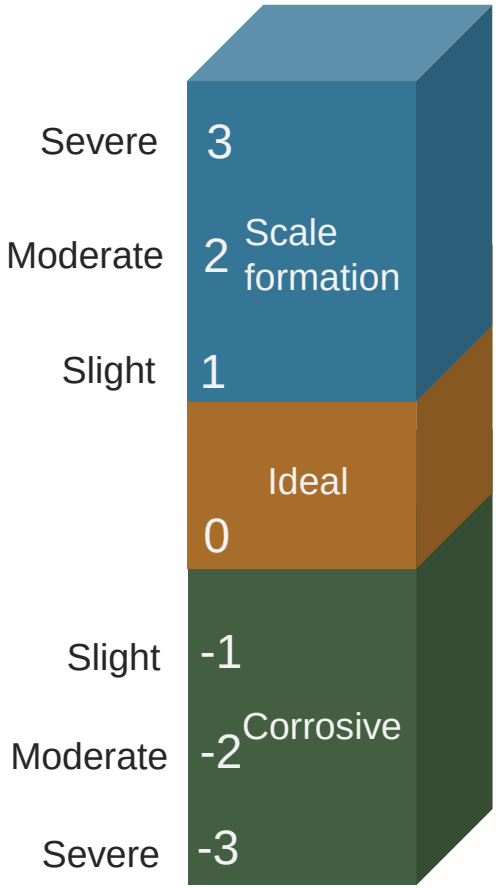
Saturation Index

General Information:

The saturation index is an overall water quality test that calculates corrosivity of the water or the ability of the water to form scale.

Health Concerns: None, although corrosive water may have a greater ability to dissolve copper and lead from plumbing systems. If your saturation index is negative, consider testing for copper and lead.

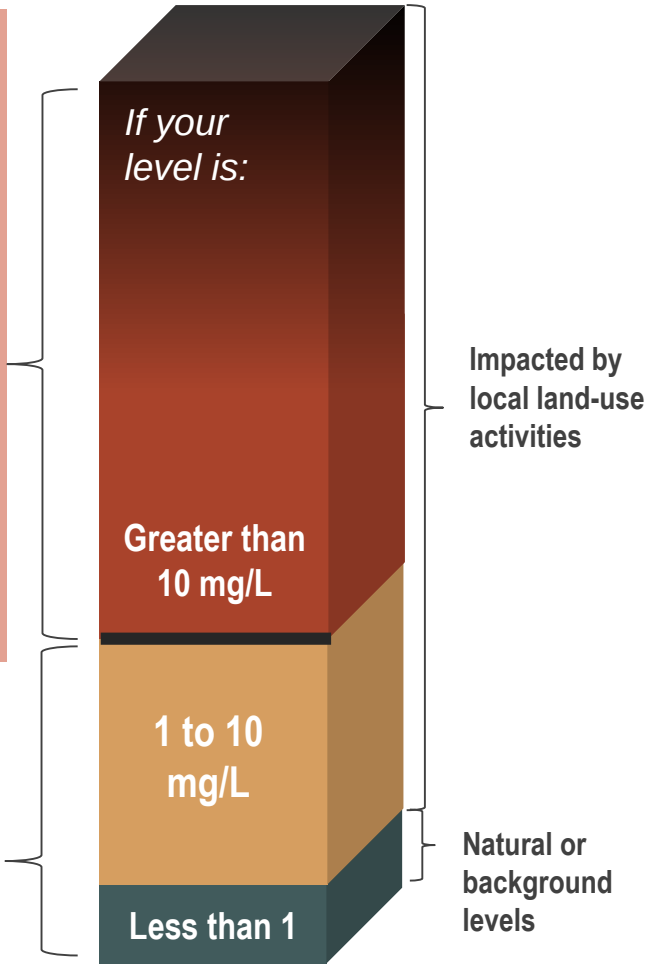
Additional Information: The saturation index is calculated from the pH, total hardness and alkalinity values. Values range from 3 to -3. A saturation index between 0 and 1 is ideal because the water isn't likely to corrode or cause much problems with scaling.



Nitrogen - Nitrate

Exceeds Drinking Water Standard:
Water greater than 10 mg/L should **not** be consumed by infants less than 6 months of age or pregnant women. All persons should avoid long term consumption of water above 10 mg/L.

Click here for information on reducing exposure to nitrate



Acceptable – meets recommended drinking water standard for nitrate

General Information:

Nitrogen from fertilizers, animal wastes, septic systems, and other bio-solids breaks down into nitrate, a very mobile form of nitrogen. Nitrate is a health concern but is also a good indicator of whether nearby land-uses are impacting your well water quality.

Health Concerns:

Methemoglobinemia in infants. Possible links to birth defects, miscarriages and various cancers.

Additional Information:

Every well should have their water tested for nitrate at least once, more often if levels are elevated and regularly if you live within ¼ mile of a agricultural field where fertilizers, animal wastes or other bio-solids are applied.

How to reduce your exposure to nitrate

- Investigate the possibility that a drilling a new well would result in lower nitrate concentrations.
- Install a water treatment device on the faucet where you obtain your drinking water.
  - The only types of treatment capable of reducing nitrate are: Reverse Osmosis (RO), anion exhange, or distillation.
  - Always choose a device approved by the Wisconsin Dept. of Professional Services.
- Switch to using bottled water or another safe water source for drinking and cooking.

Improving Your Private Well Water Quality

What's in your water?

What to do if you have water quality problems

Eliminate sources of contamination

Repair or replace the existing system

For more information download Improving your private well water quality (300KB pdf).

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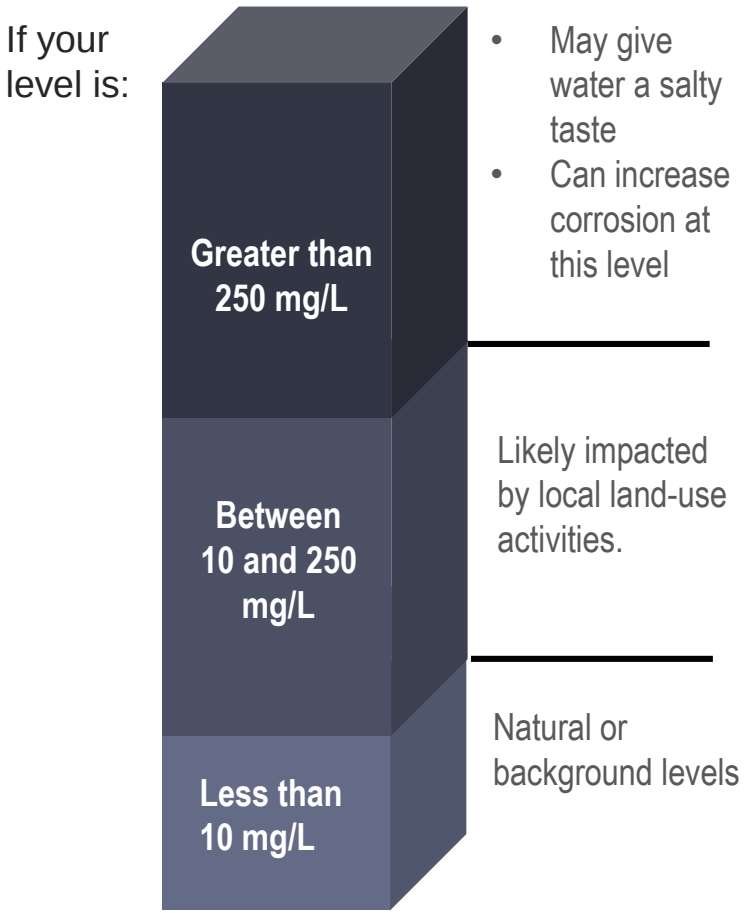
Chloride

General Information:
In most groundwater chloride levels are naturally low. Higher concentrations usually indicate contamination from septic systems, road salt, fertilizer, animal waste or other bio-solid waste spreading. There are some parts of the state where chloride is naturally high.

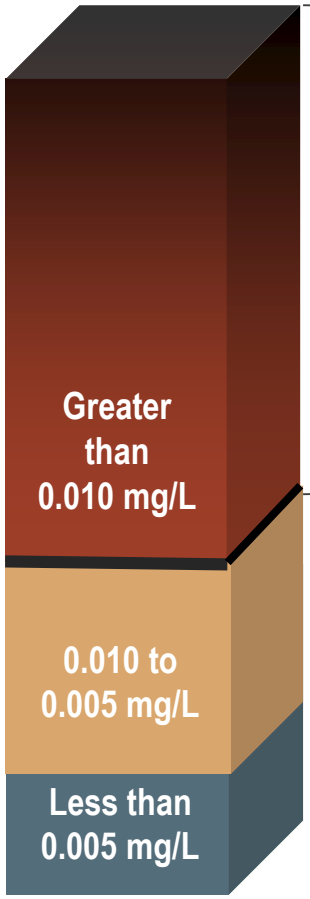
Health Concerns:
None. There is no health standard for chloride.

Additional Information:
Some people can detect a salty taste when high chloride levels are present. High chloride levels may also speed up corrosion in plumbing (much like road salt can do to your car).



Arsenic

If your level is:



Exceeds Drinking Water Standard:
Drinking water with greater than 0.010 mg/L of arsenic for an extended period of time may result in negative health consequences.

Click here for information on reducing exposure

If measured between 0.005 and 0.010 mg/L, considering testing again in a year to see if levels have changed.

Acceptable – meets recommended drinking water standard for arsenic

*Note: Some labs report arsenic as parts per billion (ppb).
0.010 mg/L = 10 ppb

General Information:

Naturally occurring element. Can be found at levels of concern when groundwater dissolves arsenic containing mineral deposits in the soil and bedrock of some aquifers.

Health Concerns:

Long term exposure to arsenic in drinking water can increase the likelihood of developing certain cancers such as skin, liver, kidney and bladder. ***The larger the concentration the greater the risk.***

Additional Information:

Recommend that every well be tested for arsenic at least once, more often if initial test reveals arsenic to be present.

Calcium

General Information:

Naturally occurring in groundwater from the dissolution of calcium from dolomite and limestone rock formations.

Health Concerns:

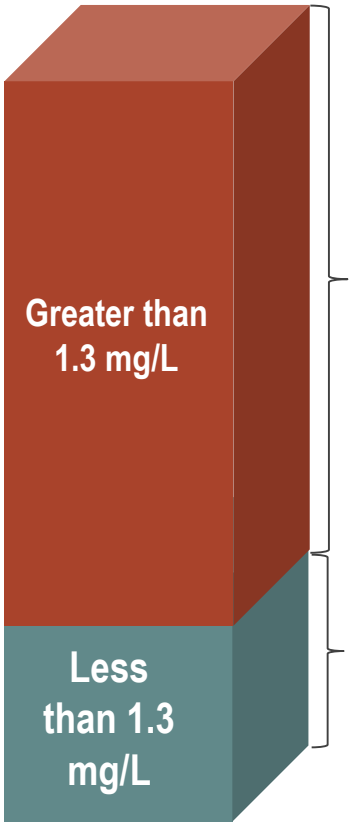
None. Calcium is essential for a variety of human health functions, although the amount obtained through drinking water is generally small compared to intake through food consumption.

Additional Information:

Along with magnesium, calcium contributes to hard water. Hard water can caused scale buildup and other issues. Is removed through the water softening process.

Copper

If your level is:



Exceeds Drinking Water Standards –
Water greater than 1.3 mg/L of copper can cause health problems. Let water run for a minute or two before using water for drinking or cooking to reduce exposure.

Acceptable – meets recommended drinking water standard for copper.

General Information:

Not naturally occurring in Wisconsin groundwater at levels of health concern.
Can be found in toxic amounts when naturally corrosive or acid water comes in contact with copper pipes. Elevated levels may also indicate other problems with corrosion.

Health Concerns:

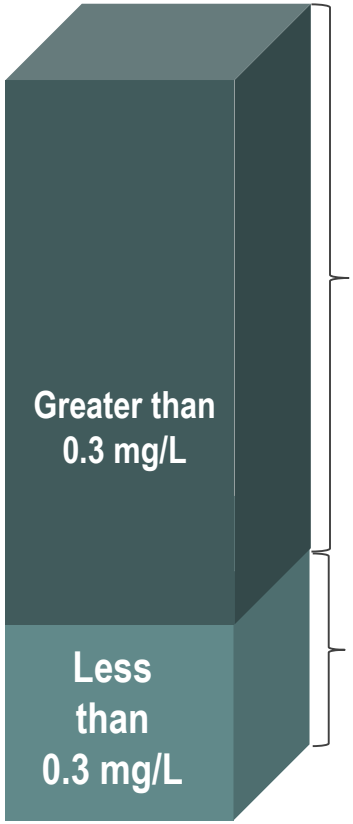
Some copper is needed for good health. Too much may cause health problems such as stomach cramps, diarrhea, vomiting, nausea, and formula intolerance in infants.

Additional Information:

To minimize exposure to copper, run faucet for two minutes first thing in the morning and after being gone more than six hours to flush water that has been standing in pipes. Blue-green stains also indicate copper corrosion.
If experiencing pin hole leaks in plumbing system consider installing plastic plumbing or a neutralizer.

Iron

If your level is:



Exceeds the Aesthetic Standard for drinking water: At this level, water is more likely to cause staining and taste issues.

Not likely to cause aesthetic problems at this level.

General Information:

Iron is a common element found in minerals, rocks and soil. It is naturally occurring in groundwater. Can cause taste problems and discoloration of water and clothing washed in it. High values associated with water low in oxygen, common near lakes and wetlands.

Health Concerns:

None known at levels typically found in drinking water.

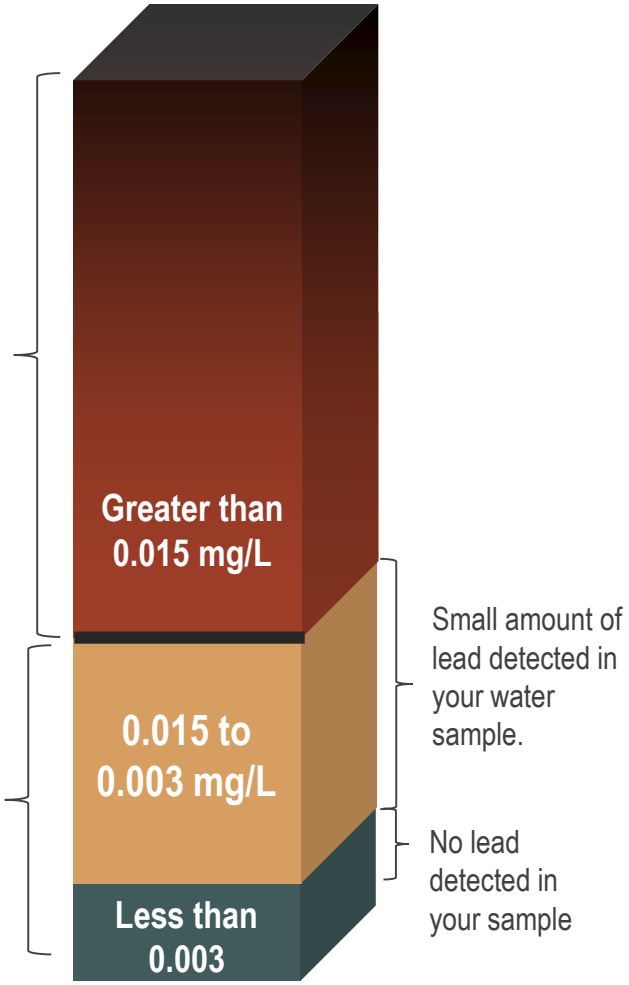
Additional Information:

Small amounts of iron can be removed by water softeners. Larger concentrations of iron may require special iron treatment. Taste and odor problems associated with iron may be magnified by iron bacteria.

Lead

If your level is:

Exceeds Drinking Water Standards – Water greater than 0.015 mg/L of lead is considered unsafe, particularly for children. Let water run for a minute or two before using water for drinking or cooking.



Acceptable – meets recommended drinking water standard for lead

**Note: Some labs report arsenic as parts per billion (ppb). 0.015 mg/L = 15 ppb*

General Information:

Not naturally occurring in Wisconsin groundwater at levels of health concern.
Found in water systems with brass fixtures, lead pipes or lead solder. Occurs at elevated levels when water sits in contact with plumbing system for extended periods of time, especially when water is soft or corrosive.

Health Concerns:

Lead is toxic, there are no known health benefits to lead. Infants, unborn children and young children are particularly vulnerable. Lead may damage the brain, kidneys, nervous system, red blood cells and the reproductive system.

Additional Information:

Amounts are usually lower after water runs for several minutes. This flushes out older water and replaces it with newer water that has not been in the plumbing system as long; generally considered an effective strategy for reducing exposure.

Magnesium

General Information:

Naturally occurring in groundwater from the dissolution of magnesium from dolomite rock formations.

Health Concerns:

None. Magnesium is essential for a variety of human health functions, although the amount obtained through drinking water is generally small compared to intake through food consumption.

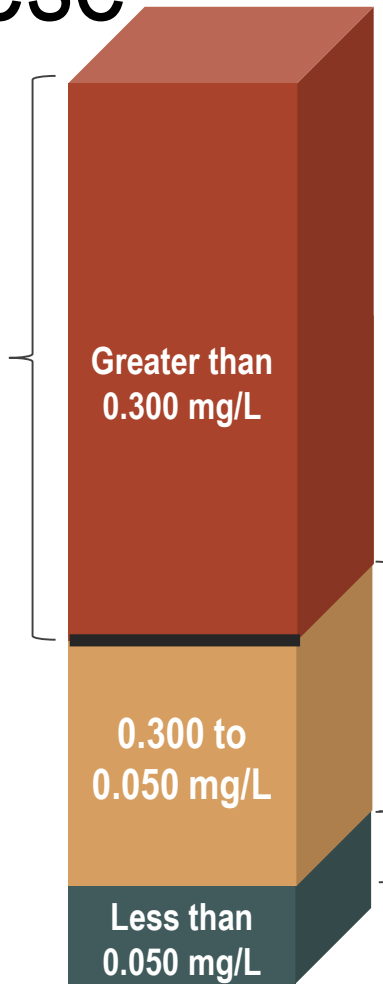
Additional Information:

Along with magnesium, calcium contributes to hard water. Hard water can caused scale buildup and other issues. Is removed through the water softening process.

Manganese

If your level is:

Exceeds Health Advisory Level –
Many years of exposure to high levels of manganese can cause harm to the nervous system. A disorder similar to Parkinson's disease can result. This type of effect is most likely to occur in the elderly. The federal health advisory level is intended to protect against this effect.



Exceeds the Aesthetic Standard for water: At this level water is more likely to have a brown color, black precipitates or cause dark stains on fixtures. Not likely to cause health problems at this level

Not likely to cause aesthetic or health problems at this level.

**Note: Some labs report manganese as parts per billion (ppb).*
0.300 mg/L = 300 ppb

General Information:

Manganese is a common element found in minerals, rocks and soil as a result it is naturally occurring in groundwater.

Health Concerns:

Manganese is part of a healthy diet, but can be harmful if consumed in excess. Some studies suggest manganese can have effects on learning and behavior in children. Also suspected to cause harm to the nervous system. Infants and people who drink more than 8 cups of water a day and have a liver disease are most at risk.

Additional Information:

If your water has an off taste, color, or odor and causes staining in sinks or on laundry you should consider testing for manganese.

Potassium

General Information:
Normally less than 5 mg/L in Wisconsin groundwater.

Health Concerns:
None. Potassium is essential for a variety of human health functions, although the amount obtained through drinking water is generally small compared to intake through food consumption.

Additional Information:
Potassium may be elevated in softened water if you are using potassium chloride as a softener salt.

Sodium

General Information:

Natural levels are generally less than 5 mg/L in Wisconsin groundwater, except in some areas of eastern Wisconsin where groundwater is drawn from deep sandstone layers. May be elevated from water softeners, road salt or septic effluent.

Health Concerns:

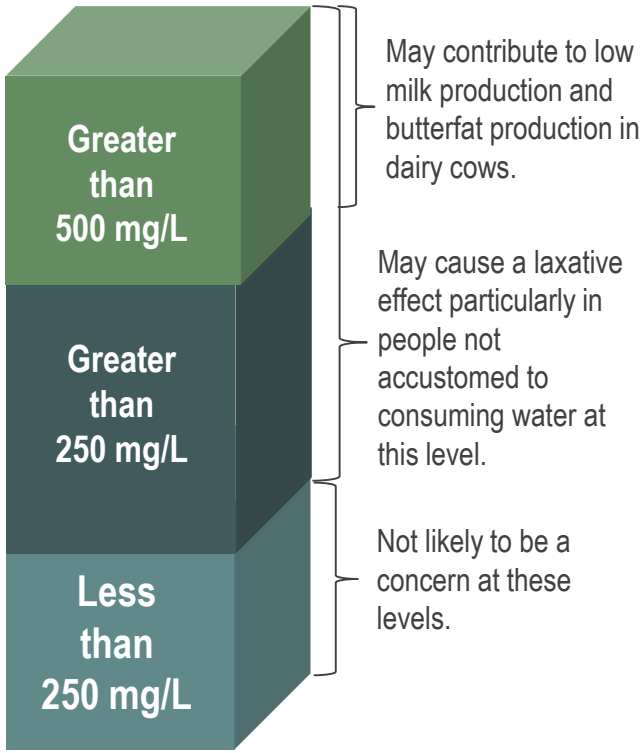
Sodium is associated with increased blood pressure in susceptible populations. The USEPA and American Health Association recommend less than 20 mg/L in drinking water for those individuals on a physician described “no salt diet”.

Additional Information:

Sodium is also part of the salt commonly added to a water softener. The sodium level in water after softening will be approximately half of the total hardness level (e.g. removing 200 mg/L of total hardness with a water softener will add approximately 100 mg/L of sodium). For this reason most people bypass their drinking water faucet when softening their water.

Sulfate

If your level is:



General Information:

Naturally occurring in groundwater in some parts of Wisconsin.

Health Concerns:

Concentrations over 250 mg/L may give water an off taste and cause diarrhea in people not accustomed to consuming the water. Sulfate over 500 mg/L may lower milk production and butterfat production in dairy cows.

Additional Information:

Sulfate is not the same as hydrogen sulfide.

Zinc

General Information:
Normally less than 1 mg/L in Wisconsin groundwater. Concentrations greater than 1 mg/L usually occurs because water is in contact with galvanized pipes or other plumbing components that contain zinc.

Health Concerns:
None at levels typically found in drinking water.

Additional Information:
Because zinc is associated with the plumbing system, allowing the water to run for a period of time will lower levels of zinc in your water.

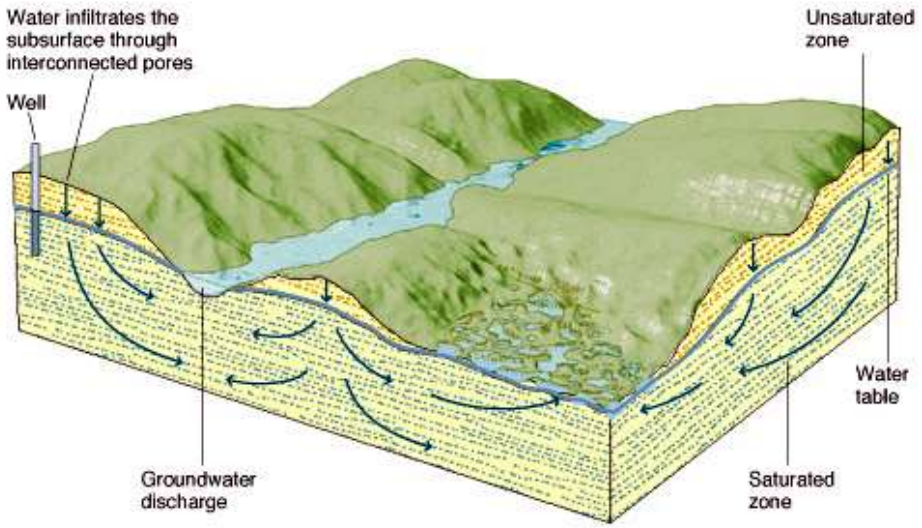
If your level is:

What is groundwater?

Rainfall or snowmelt that infiltrates into the subsurface will eventually reach a point where all the empty spaces in either the soil or rock are completely filled with water. This area is sometimes referred to as the saturated zone.

The water in the saturated zone is our groundwater. Groundwater is always moving very slowly through the interconnected pores and fractures in the rock beneath the land surface.

Groundwater typically flows from recharge areas, to discharge areas. Discharge areas occur in areas where the top of the saturated zone (the water table) intersects the land surface. Rivers, streams, lakes, springs and wetlands are all examples of groundwater discharge features.

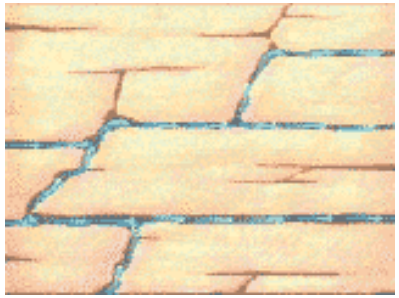


Take a 3-D look at a water table

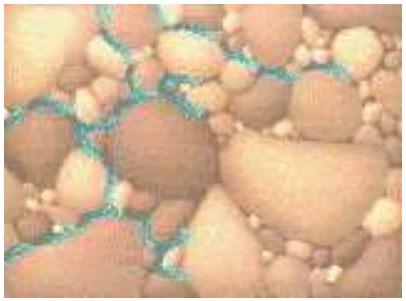
Aquifers: Our groundwater storage units

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.



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.

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.

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

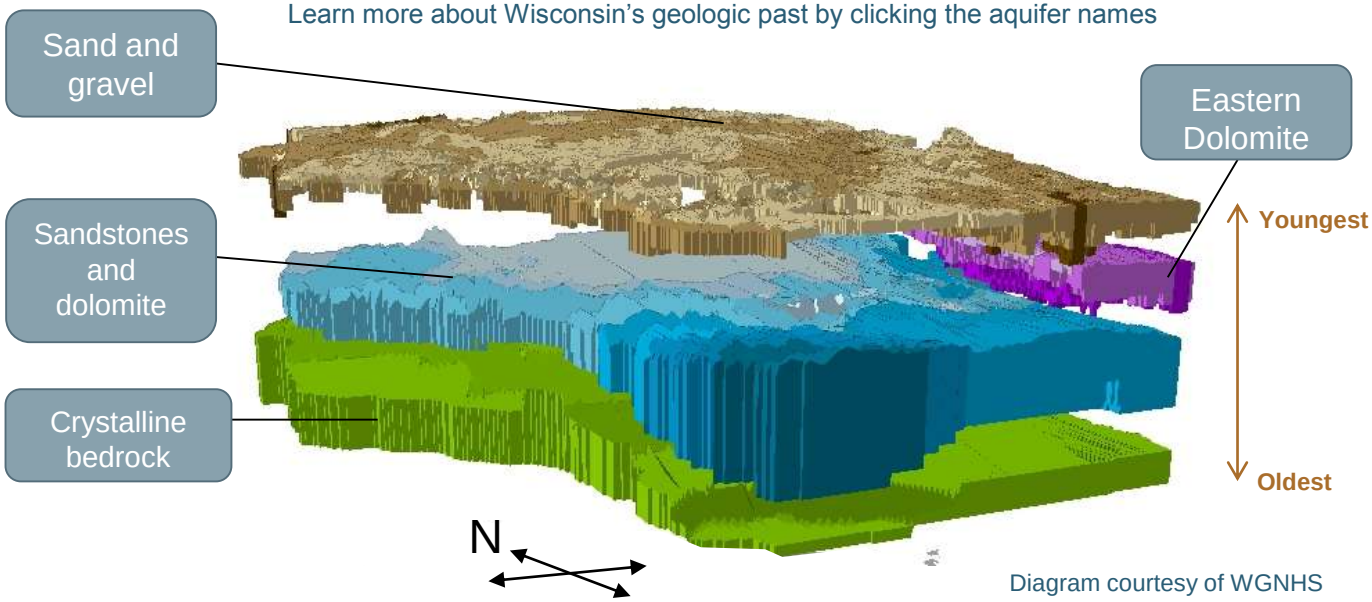


Diagram courtesy of WGNHS

Sand and Gravel

The sand and gravel aquifer is the surface material covering most of the state except for parts of southwest Wisconsin. It is made up mostly of sand and gravel deposited from glacial ice or in river floodplains. The glacial deposits are loose, so they're often referred to as soil — but they include much more than just a few feet of topsoil. These deposits are more than 300 feet thick in some places in Wisconsin.

The glaciers, formed by the continuous accumulation of snow, played an interesting role in Wisconsin's geology. The snow turned into ice, which reached a maximum thickness of almost two miles. The ice sheet spread over Canada, and part of it flowed in a general southerly direction toward Wisconsin and neighboring states. This ice sheet transported a great amount of rock debris, called glacial drift.

As the ice melted, large amounts of sand and gravel were deposited, forming "outwash plains." Pits formed in the outwash where buried blocks of ice melted; many of these pits are now lakes. The sand and gravel aquifer was deposited within the past million years.

The sand and gravel outwash plains now form some of the best aquifers in Wisconsin. Many of the irrigated agricultural lands in central, southern and northwestern Wisconsin use the glacial outwash aquifer. Other glacial deposits are also useful aquifers, but in some places, large glacial lakes accumulated thick deposits of clay. These old lake beds of clay do not yield or transmit much water.

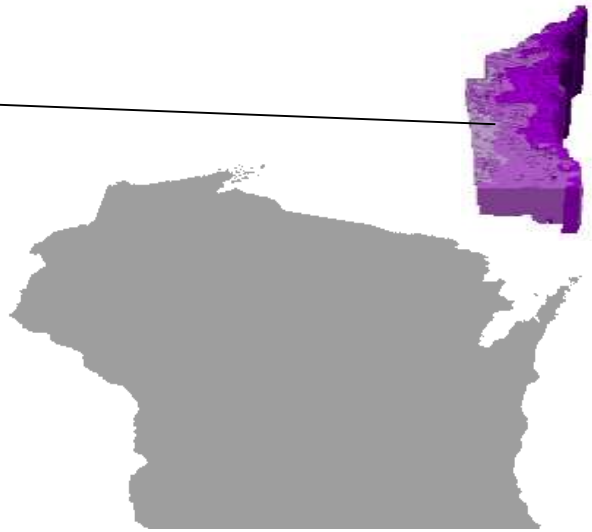
Because the top of the sand and gravel aquifer is also the land surface for most of Wisconsin, it is highly susceptible to human-induced and naturally occurring pollutants.

- Wisconsin's Buried Treasure, WDNR

Photo: Ken Bradbury

Photo credit: Tom Riewe

Eastern Dolomite



The eastern dolomite aquifer occurs in eastern Wisconsin from Door County to the Wisconsin-Illinois border. It consists of Niagara dolomite underlain by Maquoketa shale.

These rock formations were deposited 400 to 425 million years ago. Dolomite is a rock similar to limestone; it holds groundwater in interconnected cracks and pores. The water yield from a well in this aquifer mostly depends on the number of fractures the well intercepts. As a result, it's not unusual for nearby wells to vary greatly in the amount of water they can draw from this layer.

Groundwater in shallow portions of the eastern dolomite aquifer can easily become contaminated in places where the fractured dolomite bedrock occurs at or near the land surface. In those areas (such as parts of Door, Kewaunee and Manitowoc counties), there is little soil to filter pollutants carried or leached by precipitation. Little or no filtration takes place once the water reaches large fractures in the dolomite. This has resulted in some groundwater quality problems, such as bacterial contamination from human and animal wastes. Special care is necessary to prevent pollution.

The Maquoketa shale layer beneath the dolomite was formed from clay that doesn't transmit water easily. Therefore, it is important not as a major water source, but as a barrier or shield between the eastern dolomite aquifer and the sandstone and dolomite aquifer.

- Wisconsin's Buried Treasure, WDNR

Photo: Ken Bradbury

Sandstones and Dolomite

The sandstone and dolomite aquifer consists of layers of sandstone and dolomite bedrock that vary greatly in their water-yielding properties. In dolomite, groundwater mainly occurs in fractures. In sandstone, water occurs in pore spaces between loosely cemented sand grains. These formations can be found over the entire state, except in the north central portion.

In eastern Wisconsin, this aquifer lies below the eastern dolomite aquifer and the Maquoketa shale layer. In other areas, it lies beneath the sand and gravel aquifer. These rock types gently dip to the east, south and west, away from north central Wisconsin, becoming much thicker and extending to greater depths below the land surface in the southern part of the state.

The rock formations that make up the sandstone and dolomite aquifer were deposited between 425 and 600 million years ago. The sandstone and dolomite aquifer is the principal bedrock aquifer for the southern and western portions of the state. In eastern Wisconsin, most users of substantial quantities of groundwater, such as cities and industries, tap this deep aquifer to obtain a sufficient amount of water.

- Wisconsin's Buried Treasure, WDNR

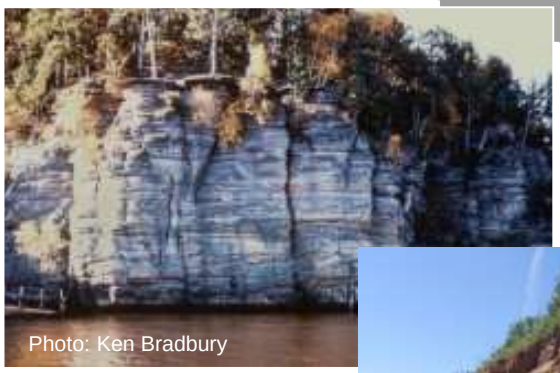
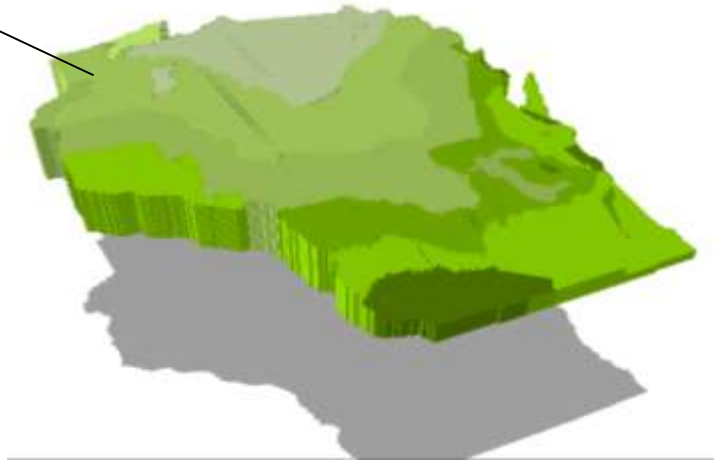


Photo: Ken Bradbury

Photo: Kevin Masarik

Crystalline Bedrock



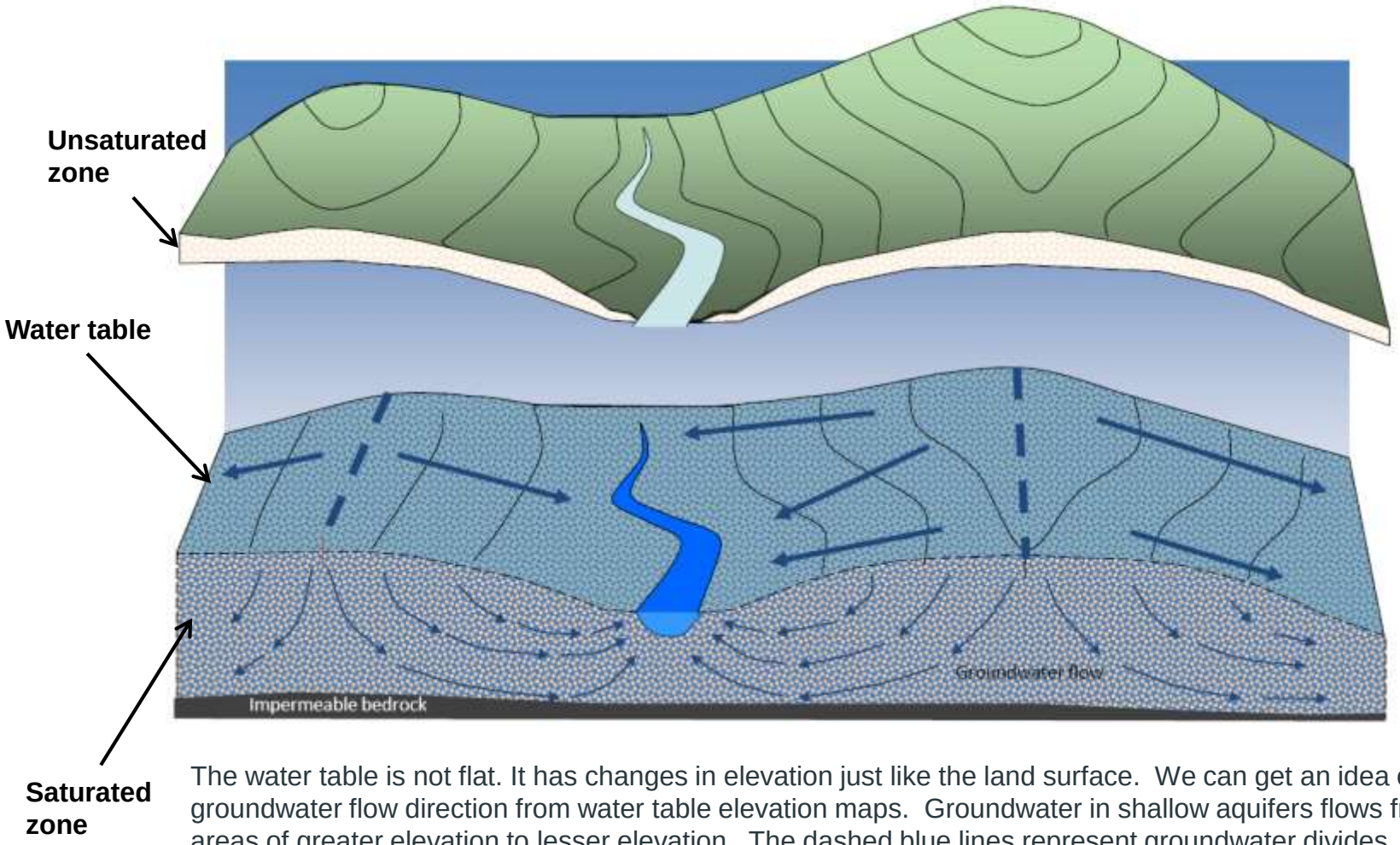
The crystalline bedrock aquifer is composed of various rock types formed during the Precambrian Era, which lasted from the time the Earth cooled more than 4,000 million years ago, until about 600 million years ago, when the rocks in the sandstone and dolomite aquifer began to be formed. During this lengthy period, sediments, some of which were rich in iron and now form iron ores, were deposited in ancient oceans; volcanoes spewed forth ash and lava; mountains were built and destroyed, and molten rocks from the earth's core flowed up through cracks in the upper crust.

The rocks that remain today have a granite-type crystalline structure. These are the "basement" rocks that underlie the entire state. In the north central region, they are the only rocks occurring beneath the sand and gravel aquifer.

The cracks and fractures storing and transmitting water in these dense rocks are not spaced uniformly. Some areas contain numerous fractures while others contain very few. To obtain water, a well must intersect some of these cracks; the amount of water available to a well can vary within a single home site. The crystalline bedrock aquifer often cannot provide adequate quantities of water for larger municipalities, large dairy herds, or industries.

Many wells in the crystalline bedrock aquifer have provided good water. However, most of these wells do not penetrate deeply into the rock. Water samples from deep mineral exploration holes near Crandon and deep iron mines near Hurley have yielded brackish water.

- Wisconsin's Buried Treasure, WDNR



The water table is not flat. It has changes in elevation just like the land surface. We can get an idea of groundwater flow direction from water table elevation maps. Groundwater in shallow aquifers flows from areas of greater elevation to lesser elevation. The dashed blue lines represent groundwater divides.

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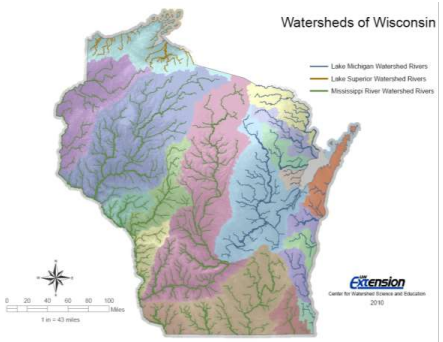
What is a Watershed?

A watershed is the land area where water originates for a particular river or stream. Some of the water will reach the surface water body from overland flow, much of it however will come from groundwater that recharged somewhere within the watershed. Large regional watersheds are made up of many small local watersheds that are tributaries of a larger river system.



Click here to enlarge the Watersheds of Wisconsin

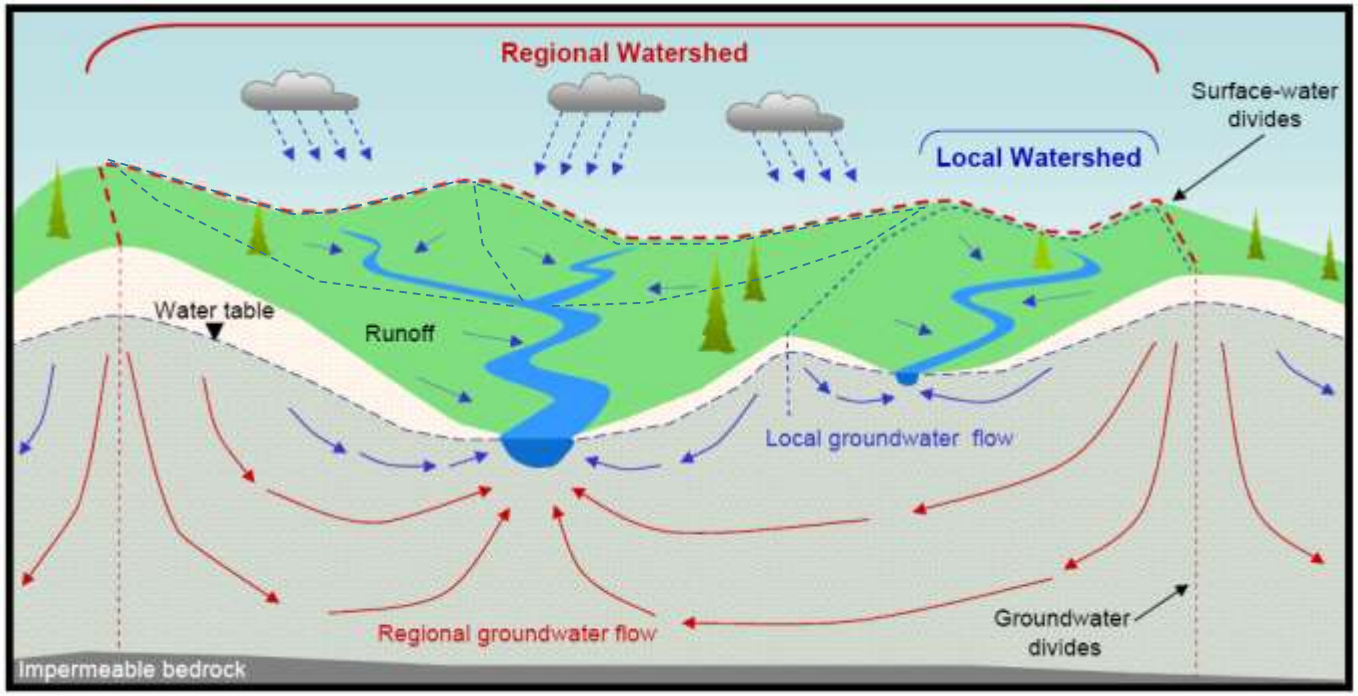
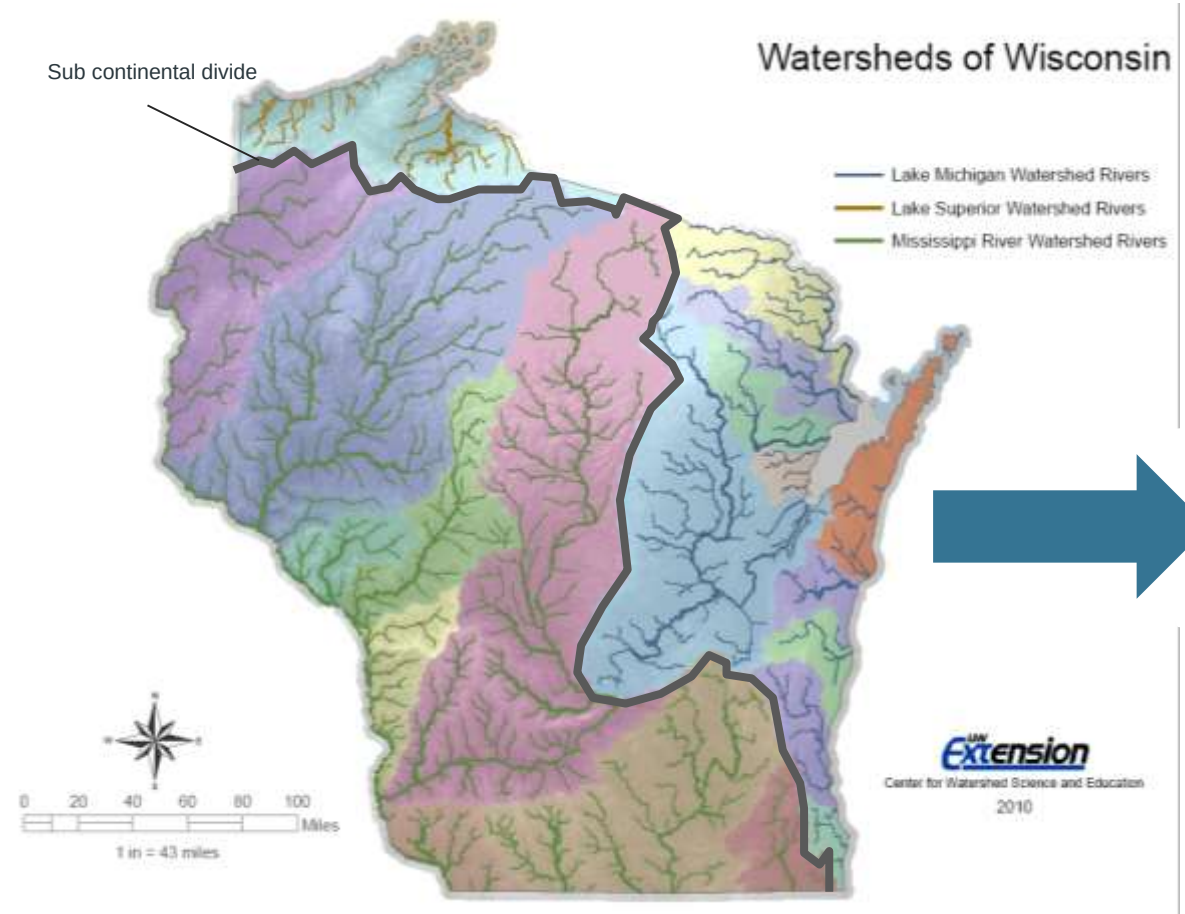


Figure by Kevin Masarik, CWSE

Wisconsin's Watersheds

Wisconsin has three primary watersheds or drainage basins. Rivers in the Lake Michigan Watershed are indicated by blue lines, rivers in the Lake Superior Watershed are indicated by orange lines, and rivers in the Mississippi River Watershed are indicated by green lines. The primary watersheds are further subdivided into the 21 regional watersheds that you see below on the left, represented by the different colors.



These regional watersheds are further subdivided into the local watersheds you see outlined here. Groundwater is a local resource. It is at this scale or even smaller that most groundwater recharges and travels to a nearby discharge feature.

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How to improve my water quality*

Diagnose your water quality symptoms* using the WDNR What's wrong with my Water? tool:

Symptoms about smell and appearance.

My Water Smells	My Water Appears	My Water Stains
Like Gasoline Like Rotten Eggs Like Manure Like Sewage Like Natural Gas Musty Like a Bog or Swamp Like Solvents or Paint Thinner Like Fuel Oil or Diesel Fuel	Rusty or Red To Have Black Particles Cloudy To Have White Flakes Sandy or Gritty Yellow Foamy Brown Bubbly To Have an Oily or Rainbow Sheen	Plumbing Fixtures Red or Brown Plumbing Fixtures Blue or Green Plumbing Fixtures Black or Brown Laundry Black Laundry Red or Brown

Symptoms about taste and feel.

My Water Tastes	My Water Feels	My Water
Metallic Salty	Slippery Gritty As If It Burns Like Soap Won't Lather	Spots My Dishes Etches My Dishes Leaves Slime in Toilet Tank Has Changed in Color, Taste or Odor Leaves White Material on Humidifier Leaves Scum in the Bath/Shower

Note: Many health-related contaminants have no taste, color or odor associated with water and can only be detected through testing.
Click here for more information on locating a lab for testing of water

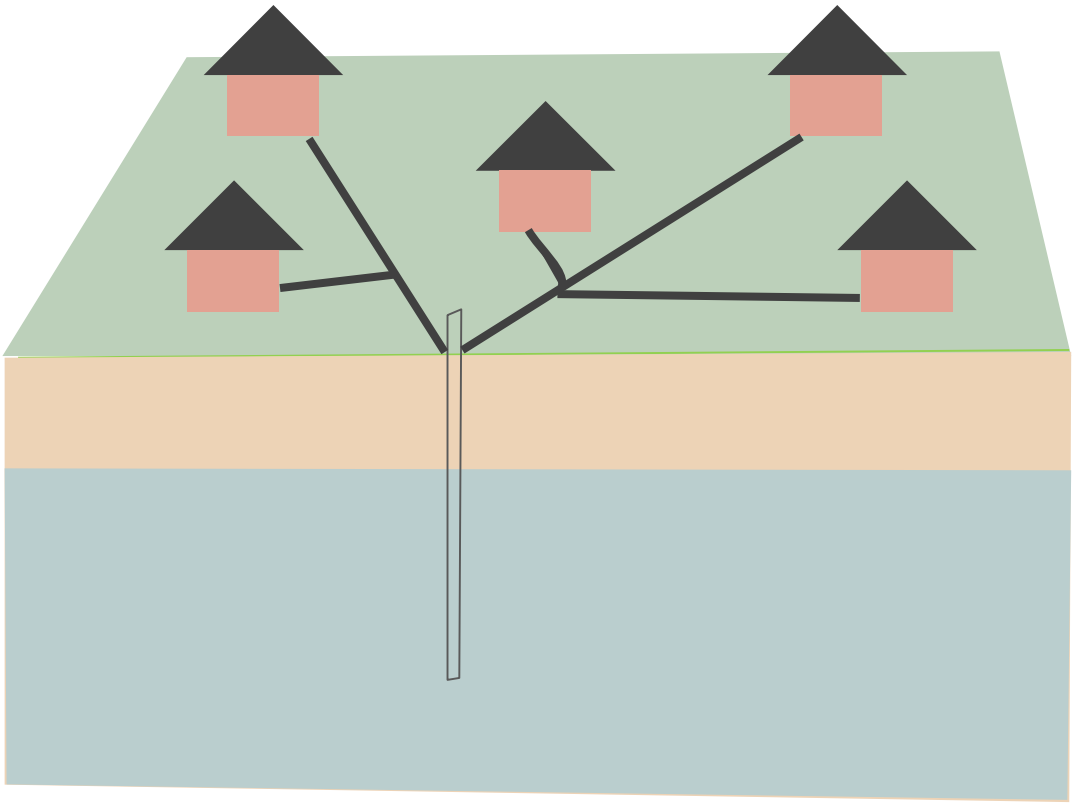
For an overview of the various options available to private well owners download the brochure
or
select from the various options below:


Improving Your Private Well
Water Quality
W
What's in your water?
What to do if you have water quality problems
Eliminate sources of contamination
Repair or replace the existing system

- Install a water treatment system
- Eliminate sources of contamination
- Repair or replace the existing system
- Connect to a public water system
- Develop a community water system

Develop a community water system

If a cluster of private wells develops water quality problems, homeowners may find it less expensive to drill a single new well for all the homes rather than have each homeowner pursue an individual solution. This option should contain some sort of legal arrangement among homeowners in case of property transfer, well testing or problems that require maintenance.

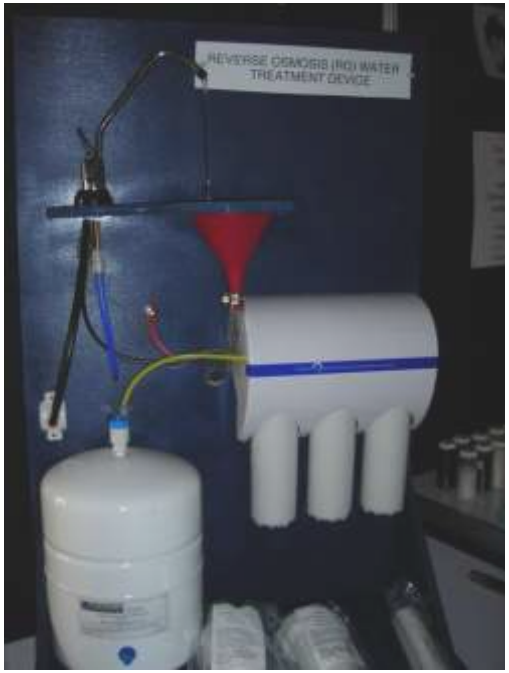


Install a water treatment system

No single water treatment system is capable of treating all water quality problems, and that all systems have limitations. Match the treatment system to the specific water quality problem(s) you want to remove. Before buying a treatment system, have a chemical analysis of your water performed at a state certified laboratory and then ask several dealers for estimates on systems to remove the ***type*** and ***amount*** of contaminant(s) found in your water.

Proper care and routine maintenance are critical to ensuring the device continues to work properly. Weigh all the costs, including that of electricity to operate the device and maintenance costs associated with upkeep or replacement of filters. Remember that the claims of manufacturers and dealers may not always accurately describe what the system will do. In addition, some systems may require pretreatment of the water for the device to function properly. You can often lease a unit initially to determine whether it performs properly.

Wisconsin has established a product approval program for home water treatment devices. Be certain that the unit you purchase or lease has been approved by the Wisconsin Department of Safety and Professional Services. If you are not sure, click here to check out their website to see all approved devices.

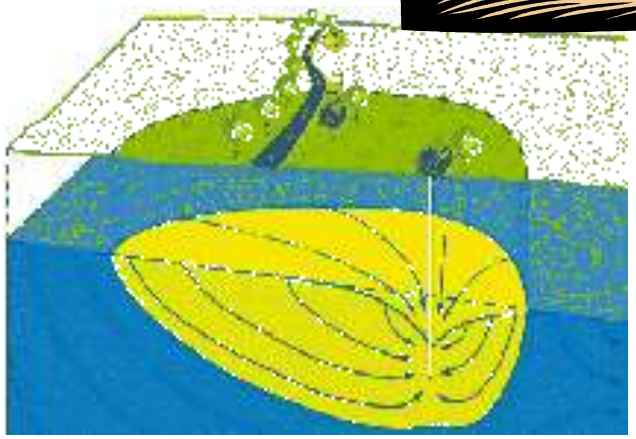


Example of a reverse osmosis (RO) water treatment technology. It is a point of use method commonly used to treat water for drinking and cooking.

Connect to a public water supply

In some cases, connecting to a public water system is less expensive in the long run than installing a new well. Public wells generally are located and drilled in aquifers where contamination is less likely. New municipal wells must submit a wellhead protection plan to protect the well's recharge area. In addition, municipal water supplies are required to be regularly tested and to meet state and federal water quality standards.

This is only an option if you are on the fringe of an existing public water supply. Not practical for most rural homes.



Eliminate sources of contamination

When water quality problems are due to human activities, the ideal solution is to eliminate or reduce the contaminants of concern. Sometimes the source is local, such as a septic system, an unused well, fertilizers or pesticides, sink holes, a chemical spill, leaking storage tank, or seepage from a barnyard.

If you are able to eliminate the source, water quality should eventually improve through filtration, breakdown of the contaminants, dilution and movement of the contaminants away from your well.

Depending on the local geology and type of pollutant, however, the improvement may take far too long—years or decades—and an additional solution may still be required to provide a safe source of water.

Repair or replace existing system

Correct construction faults.
Making sure that your well has a vermin-proof cap and diverting surface water drainage away from the well may both help in some cases. Persistent bacterial contamination or cloudy water may indicate problems such as a cracked casing, poor grout and seals, or rock fractures that allow rapid movement of surface water into the well. Your plumber, well installer, county sanitarian or Wisconsin Department of Natural Resources water supply specialist can help diagnose and correct such problems.

Install a new private well or reconstruct an existing well.
Constructing a new well or reconstructing an existing one may improve drinking water quality when problems are related to land use or limited to a certain part of an aquifer. You may have to change the well location. More likely, you will need to drill and case the existing well to a different depth where the aquifer is less contaminated, or drill into a different, uncontaminated aquifer. It is important to point out that installing a new well does not guarantee better water quality. While you solve one water quality problem, you may exchange it for another. Deeper wells, for instance, may be less influenced by local land-use activities but are more likely to contain higher concentrations of substances such as iron and manganese, which can cause aesthetic problems.

Learn about well construction

The **Well Code** is based on the premise that if a well and water system is properly located, constructed, installed and maintained the well should provide bacterialogically safe water continuously without the need for treatment.

- Wells are required to test for coliform bacteria at the time it is drilled. Generally it is not required to be tested for anything else although homeowners are encouraged to test for other contaminants at this time.
- Learn more about your well construction by downloading the publication You and Your Well.
- Locate a copy of your well construction report.

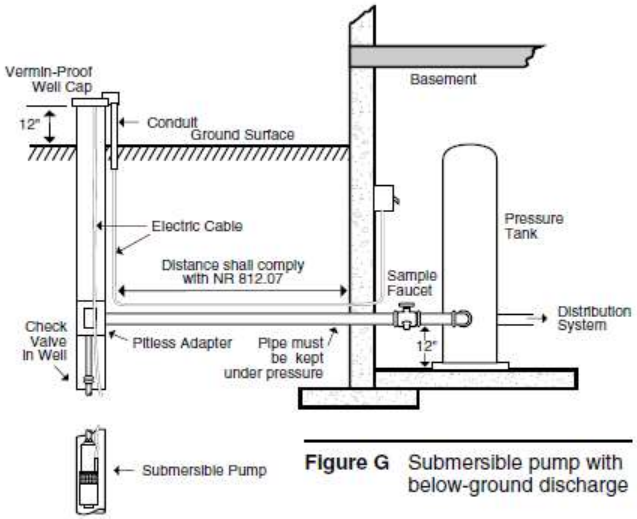


Figure G Submersible pump with below-ground discharge

Reference: You and Your Well, WDNR

Some general DOs and DON'Ts

DO Make certain the well constructor extends the well casing pipe at least 12 inches above the finished ground surface and two feet above a floodplain. (Future landscaping must be taken into account.)

DO Properly install a vermin-proof well cap and electrical conduit to prevent entrance of insects into the well.

DO Make certain any underground connection to the well is made with an approved pitless adapter or unit. Properly installed, this will provide a water tight connection to the well and allow easy pump repair or well cleaning.

DO Completely fill and seal any unused wells (a DNR brochure on well abandonment is available).

DO Collect a water sample for bacteriological analysis at least once each year and anytime you notice a change in taste, odor, color or appearance. Also sample for nitrate if the water is to be used for an infant or a pregnant woman.

DO Construct your driven point well to a depth of at least 25 feet (not including the screen), or, 10 feet below the static water level, whichever is the greater depth.

DO Install an accessible downward-facing, non-threaded sampling faucet between the pump and the pressure tank at least 12 inches above the floor to allow for sampling water directly from the well.

DO Use only code-complying well casing pipe. (see NR 812.17).

DON'T Install a well in the basement or in a crawl space of your home. (The well would not be accessible for repair.) If the basement is of the walk-out type, installation is permissible. (Offset pumps may be installed in dry basements.)

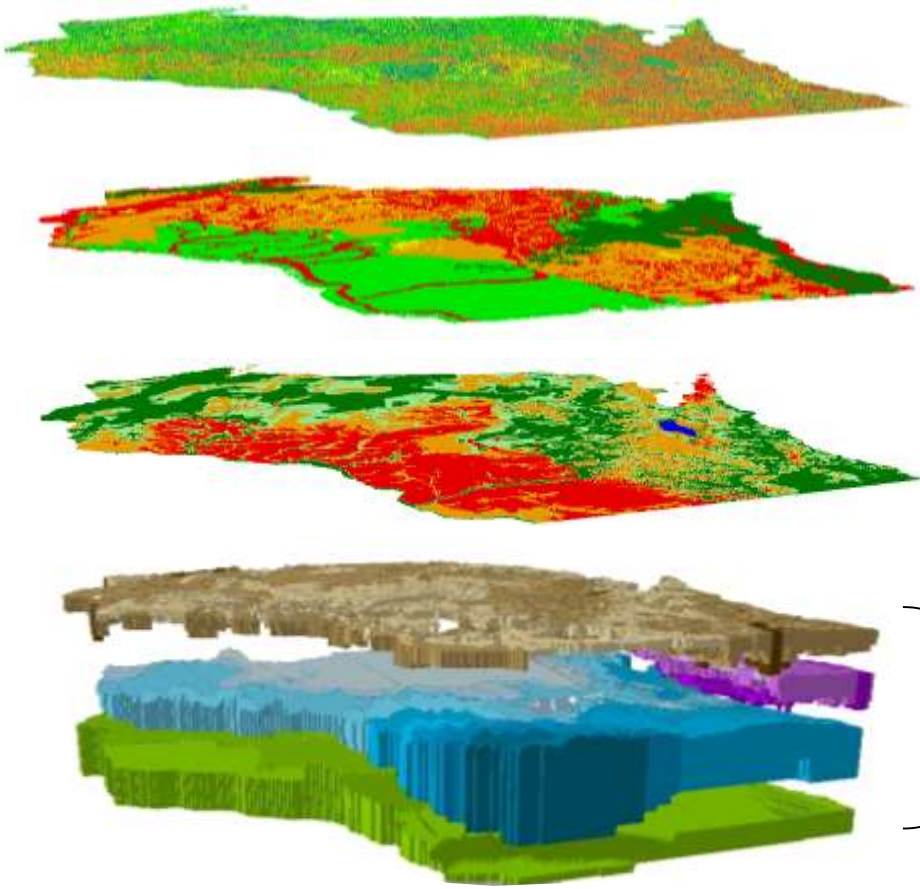
DON'T Construct a well, pump, or pressure tank pit. A well may not terminate in a pit or an alcove. The DNR *does not* allow pits because of the potential for flooding and subsequent contamination of the water supply. (Pitless adapters have made pits obsolete.)

DON'T Install unprotected buried suction line between a well and a pump or pressure tank in a basement. If the pipe were to develop a hole or crack, it could allow surface water to get into the water supply. Instead use a pitless adapter or unit with a pressurized piping arrangement. Do not install a non-pressure conduit to enclose the suction piping between a well and a basement.

DON'T Use a well for disposal or drainage of solid wastes, sewage, surface water or wastewater. This can contaminate an aquifer.

DON'T Develop a spring as a drinking water source without obtaining advance approval from DNR. The DNR does *not* recommend the use of a spring as a source of water for drinking.

Factors that affect groundwater quality



The type of land-use and how carefully those activities are carried out ultimately determines the extent of contamination by human activity.

The type of surficial deposit is important in determining how easily water and contaminants can be transported to groundwater. Clay deposits (dark green) offer more protection than sand and gravel deposits (orange).

The depth to bedrock is a major determining factor in how susceptible an area is to contamination. Areas with very shallow soils (red) mean less filtering ability than areas with very deep surficial deposits (dark green).

The geology is a major factor in determining how susceptible aquifers are to contamination. In parts of the state the type of aquifer material makes groundwater more susceptible to contamination. The geologic makeup of aquifers may also contain naturally occurring contaminants such as arsenic or manganese.

Learn more about groundwater quality, sources of contamination and susceptibility in your county

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Other useful sources of information:

What's wrong with my water – WDNR
Department of Health Services
Wisconsin Geological and Natural History Survey
United States Geological Survey
Wisconsin Water Well Association

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