

GET WET!



4H Weekend
University of Maine



Spring 2010



Geology of Maine

- History:
- Glacial activity
 - Large continental (land) ice sheets
 - thousand feet thick
 - Retreat and melting carved holes and lakes
 - Rock scratches and carves surface as glacier moved.
 - Streams under glaciers erode ground as well.
 - Glacier fully left Maine 11,000 years ago.
 - <http://www.maine.gov/doc/mrimc/mgs/explore/surficial/facts/surficial.htm>.



Geology of Maine

Maine was once home to huge glaciers that moved across the state, changing the topography significantly and depositing sediments as they moved on. The glaciers played a huge role in the formation of aquifers.



□

- **Glacial activity**

- Large continental (land) ice sheets, 1,000 ft. thick
- Glacial retreat and melting carves holes, lakes, and rivers
- Erodes mountains
- Deposits sediments
- Glacial melt feeds aquifers
- Glacier fully left Maine 11,000 years ago.
 - <http://www.maine.gov/doc/mrimc/mgs/explore/surfacial/facts/surfacial.htm>



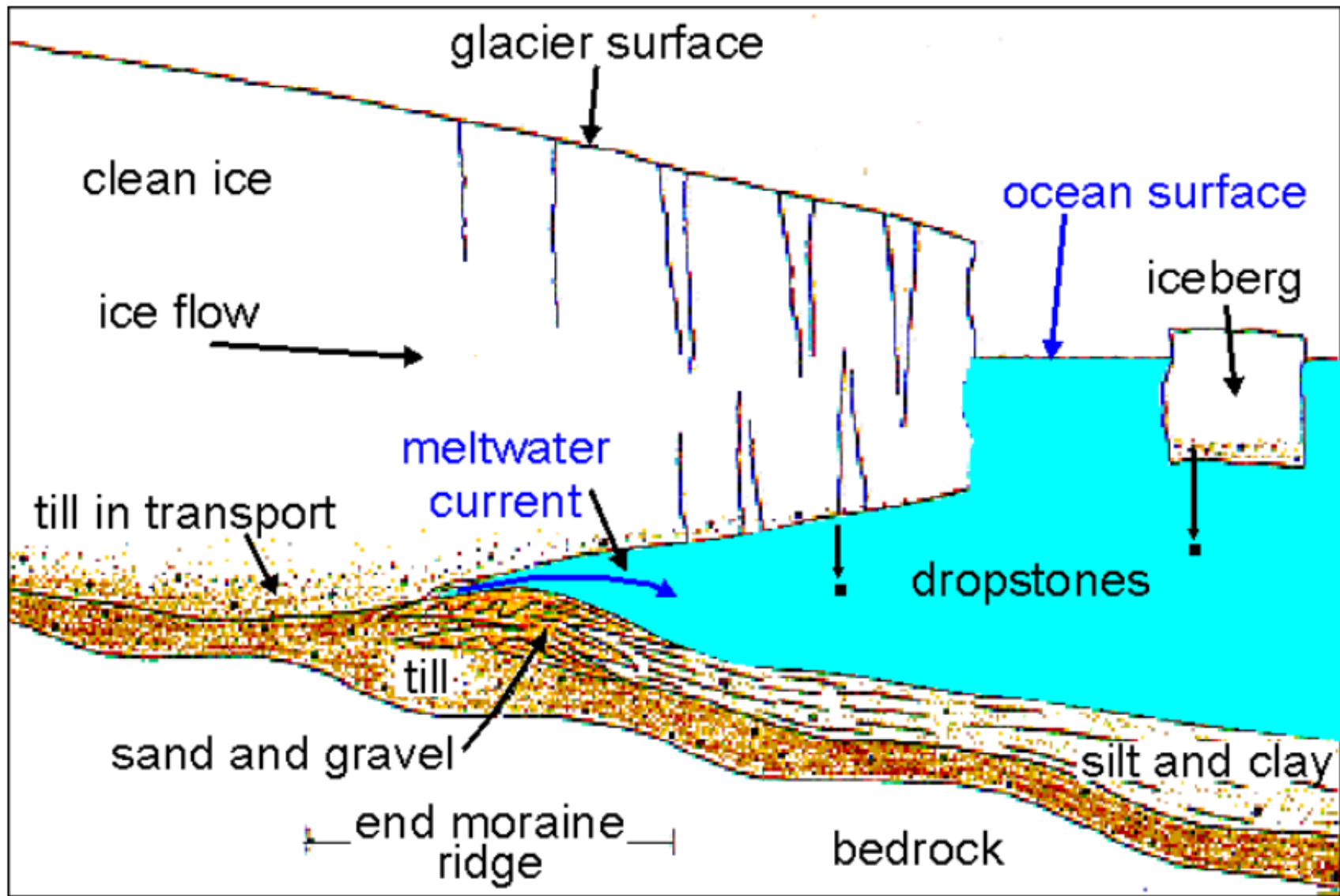


Photo credit: www.maine.gov/.../surficial/facts/jan00-4.htm

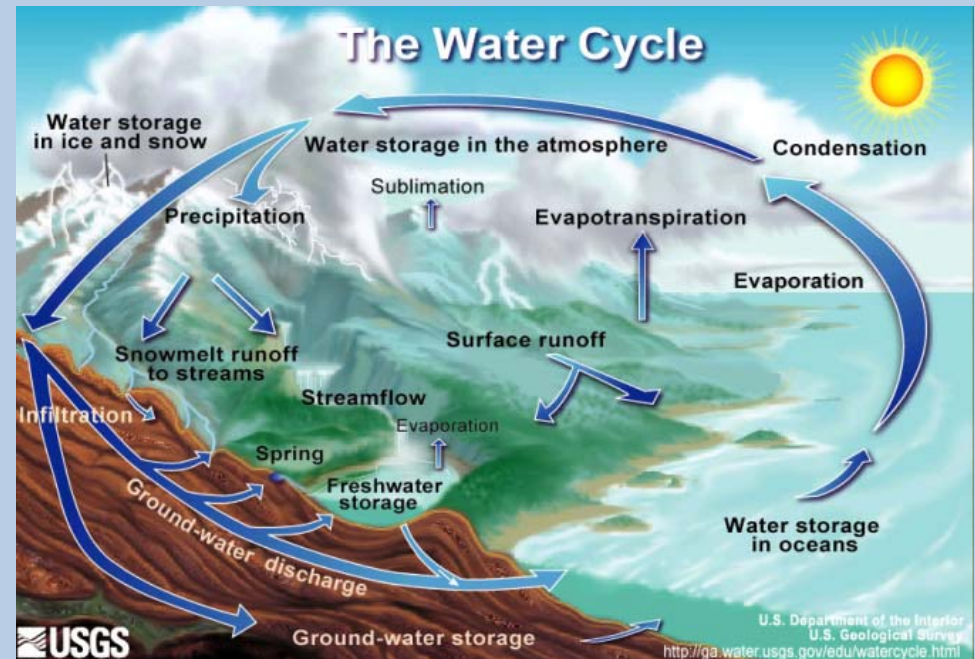
Hydrology of Maine

- Hydrology is the study of water, through its many phases in the water cycle.

- When precipitation falls on the land, it either replenishes surface waters (lakes, streams, oceans, etc), is absorbed and then transpired back into the atmosphere by plants, or seeps into and recharges the groundwater, which is in turn discharged back onto the surface.

- This happens either by feeding streams, lakes, kettle ponds (shallow ponds created by retreating glaciers) etc., directly through the soil, or through springs, geysers, and such.

- Frozen water can stay on the land surface for months or years in the form of snow and ice. Once it does melt, the water is evaporated or transpired through plants into the atmosphere, condensed, and temporarily stored in clouds before being rained back down onto the earth.



Groundwater

What is groundwater?

Groundwater is water that is stored underground in spaces and cracks in rock, soil, and sand. These areas of stored water are called aquifers. Aquifers usually consist of sand, gravel, or fractured rock like limestone; whatever the material is, it has to have spaces in it big enough for water to pass through.

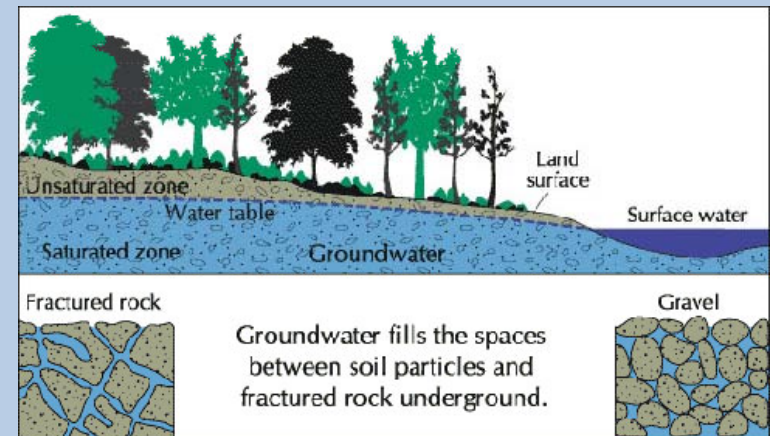


Image compliments of US Geological Survey, adapted by The Groundwater Foundation.

They are fed by precipitation and snowmelt that infiltrates from the surface. In turn, they feed streams, rivers, lakes, etc.

The area underground the aquifer fills up is called the saturated zone; the top of this is the water table. The water table can be from one to several hundred feet below ground.

More than half of the people in the US use groundwater as their source for drinking water. It is also used extensively in agriculture. Because of this, you can see why it's important to do our part to help keep the groundwater clean and free of contaminants.

How is groundwater contaminated?

Manure
Oil tanks
Cars
Sewers
Trash
Industrial Chemicals
Road Salt

Ocean Salts
Iron or Rust
Factories or Industry
Fertilizers
Pesticides:
insecticides
herbicides
fungicides

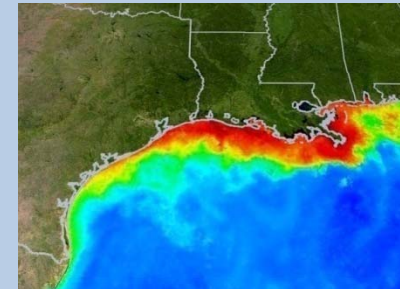


Sources from things on the ground or in air can attach themselves to water and move with the water.

Maine Land Use

What causes groundwater pollution?

- De-icing salt storage piles and loading areas
- Above/Underground chemical or fuel storage tanks
- Fertilizer application
- Graveyards
- Pesticide application and storage
- Land application/storage of sludge & manure
- Construction projects
- Tanneries
- Dioxins from paper mills
- Industrial wastes



Parameters Tested

Nitrates

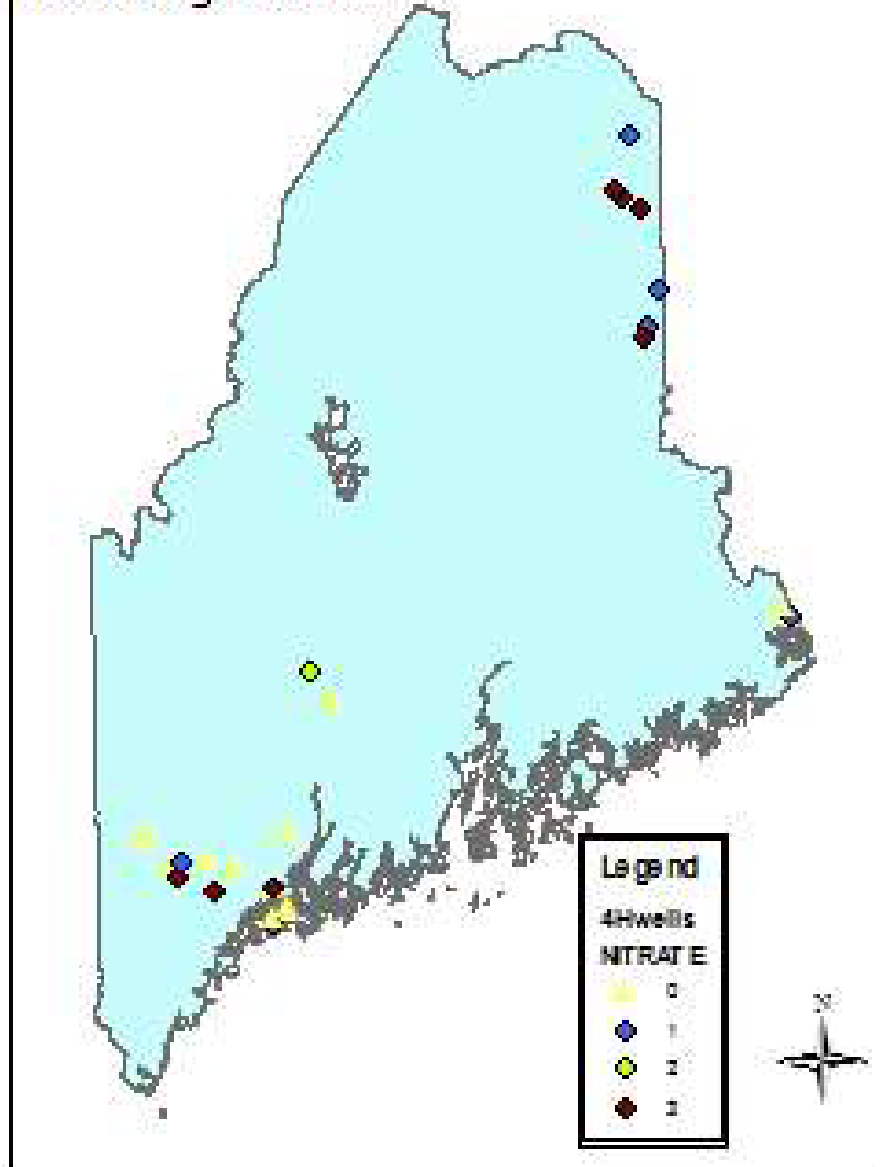
Nitrates are colorless and tasteless compounds that are safe below 10 mg/L of total nitrate

Nitrates come from:

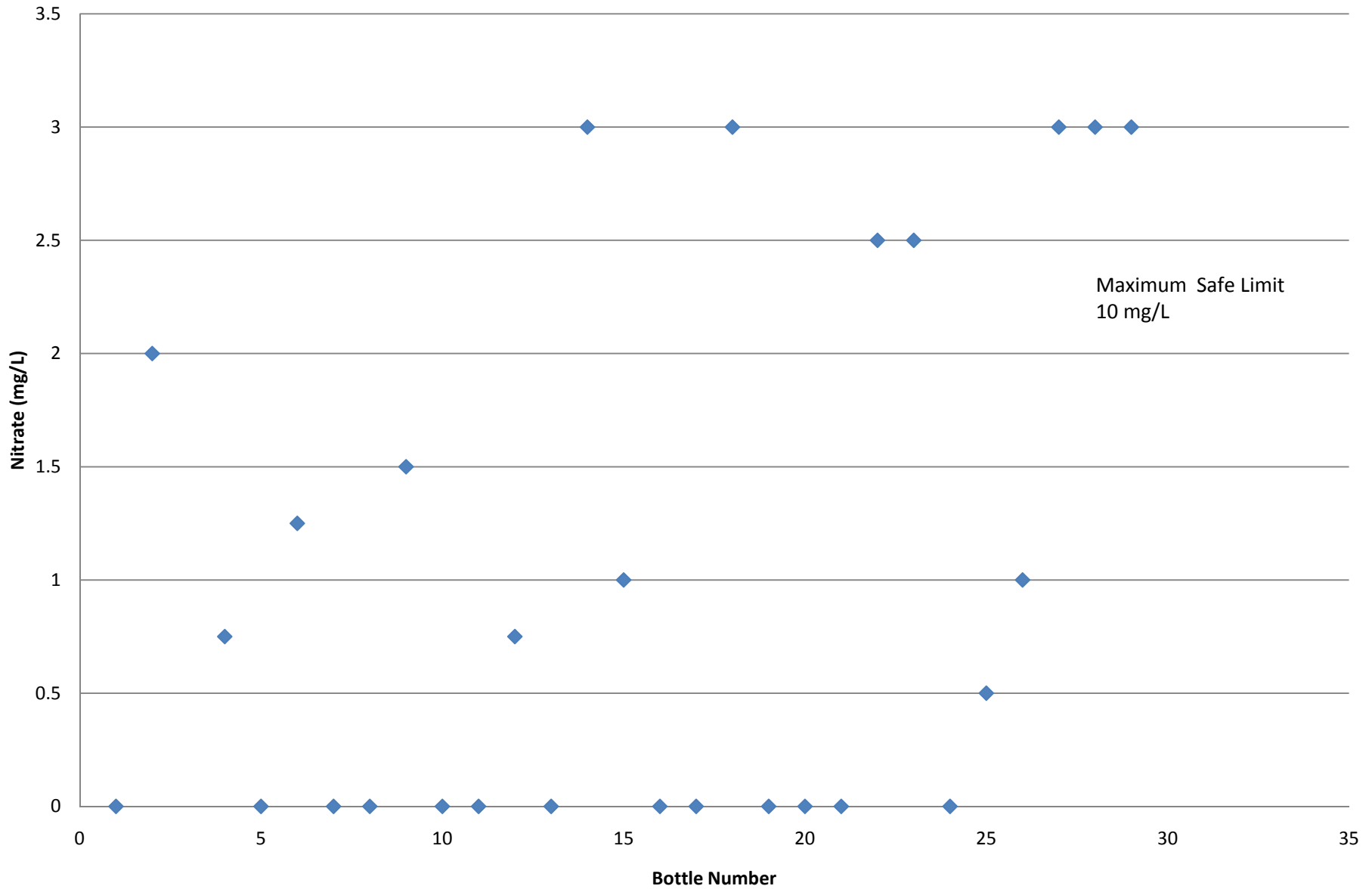
- Fertilizers
 - Farms, lawns, golf courses
- Animal and human waste (feces)
 - septic leakage, farms, household pets

Nitrates can cause cancer, and blood problems in infants

Nitrate mg/L 4H Maine

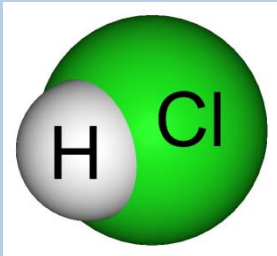


Nitrate (mg/L) 4H Maine Spring 2010

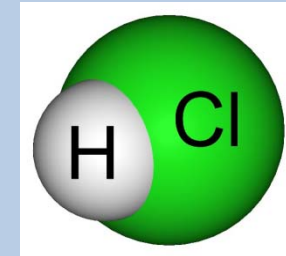


Nitrate (mg/L)
4H Maine
Spring 2010

- Mean: 1.02678571
- Median: 0.625
- Mode: 0.00
- Standard Deviation: 1.20442718
- Range: 0.00-3.00



pH



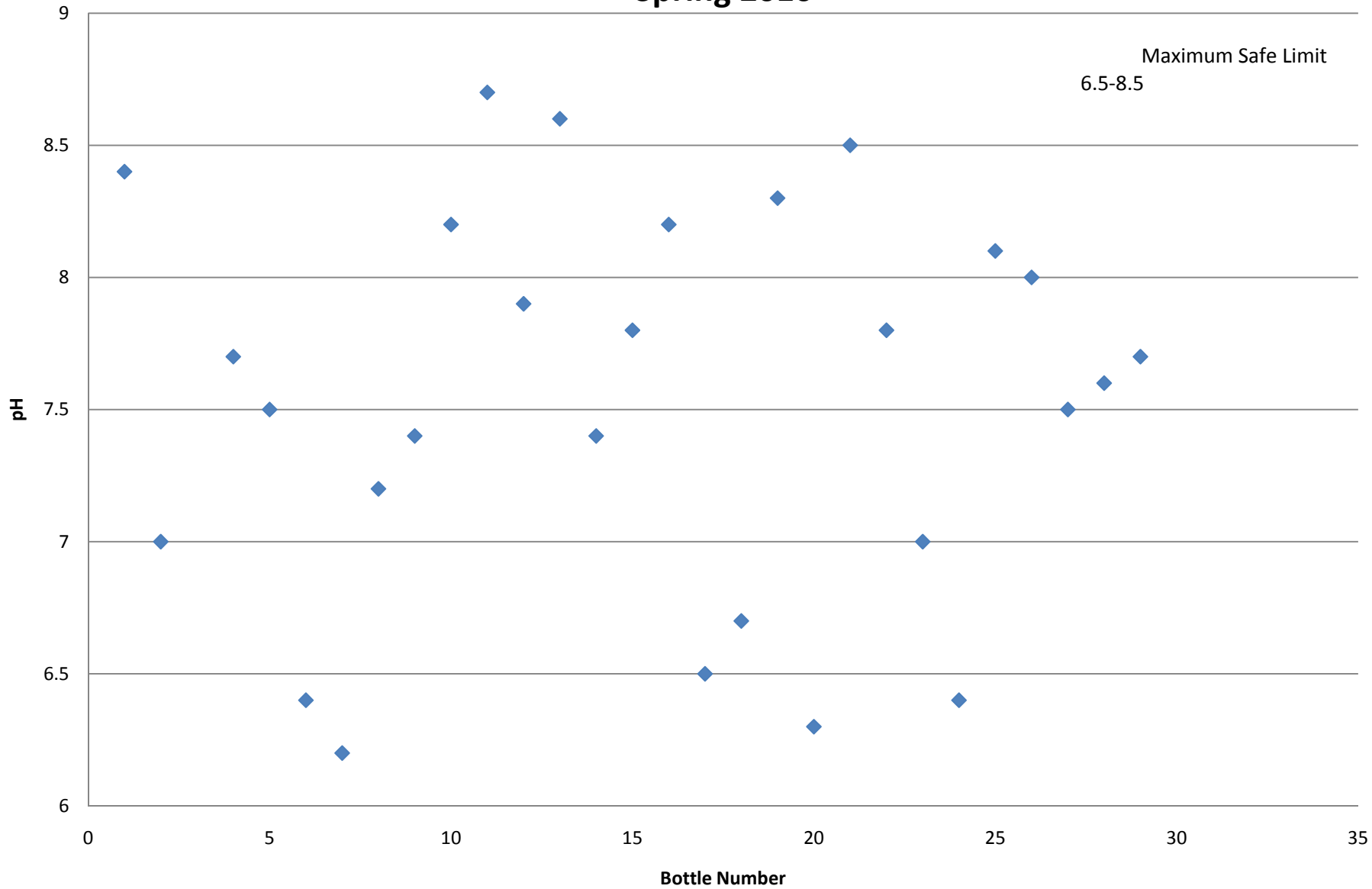
- pH is the acidity or alkalinity of water
- On a scale of 0 to 14, acid being 0 and alkaline being 14, the maximum safe pH range in water is 6.5 to 8.5.

What influences the pH in your well water:

- Natural geological conditions (bedrock types/soil types/vegetation)
- Acid rain
- Lime applications in gardening

- Moderate levels pose no major health threats.
- However, low pH can cause pipe corrosion

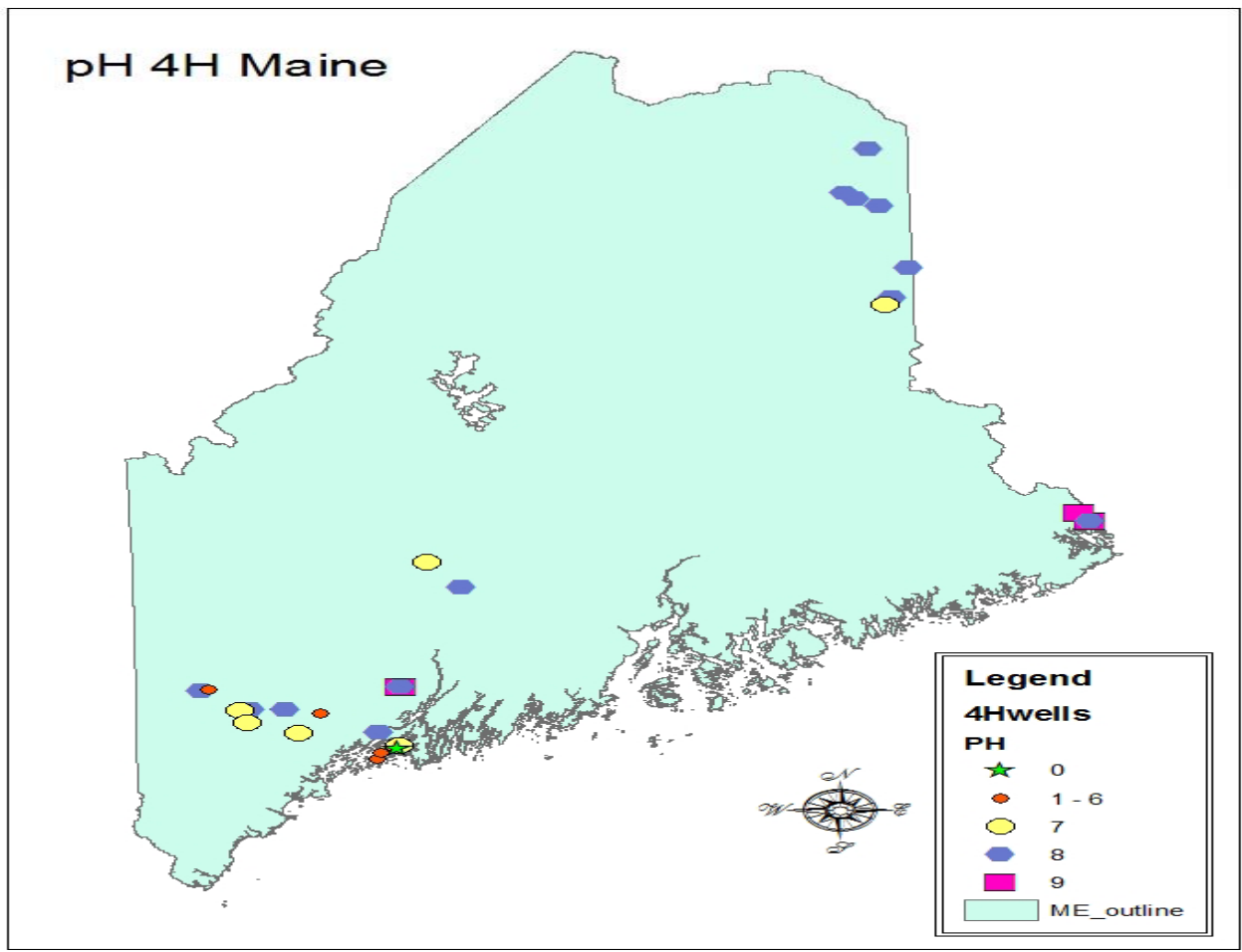
pH 4H Maine Spring 2010



pH
4H Maine
Spring 2010

- Mean: 7.53571429
- Median: 7.65
- Mode: 7.0
- Standard Deviation: 0.74247548
- Range: 6.2-8.7

pH 4H Maine



Chloride



Chloride can naturally occur from the following:

- Road Salt Storage and Application
- Industrial Wastes
- Sewage
- Fertilizers
- Water Softeners

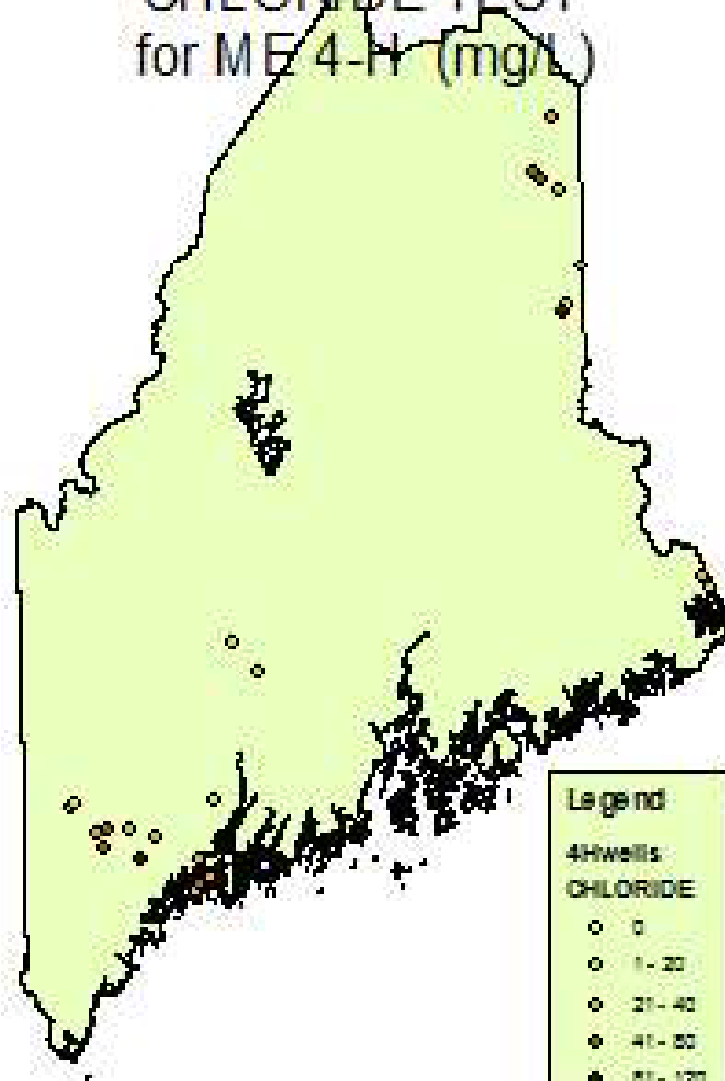
WARNING: High levels of sodium and chloride may interfere with taste and can affect household plumbing.

Sodium Chloride



- Sodium Chloride is the compound known as “salt” consisting of sodium and chloride.
- In well water, sodium chloride could occur from road run-off or it could leach from bedrock.
- Excessive sodium can contribute to high blood pressure and heart disease. Also, high sodium can damage some house plants.

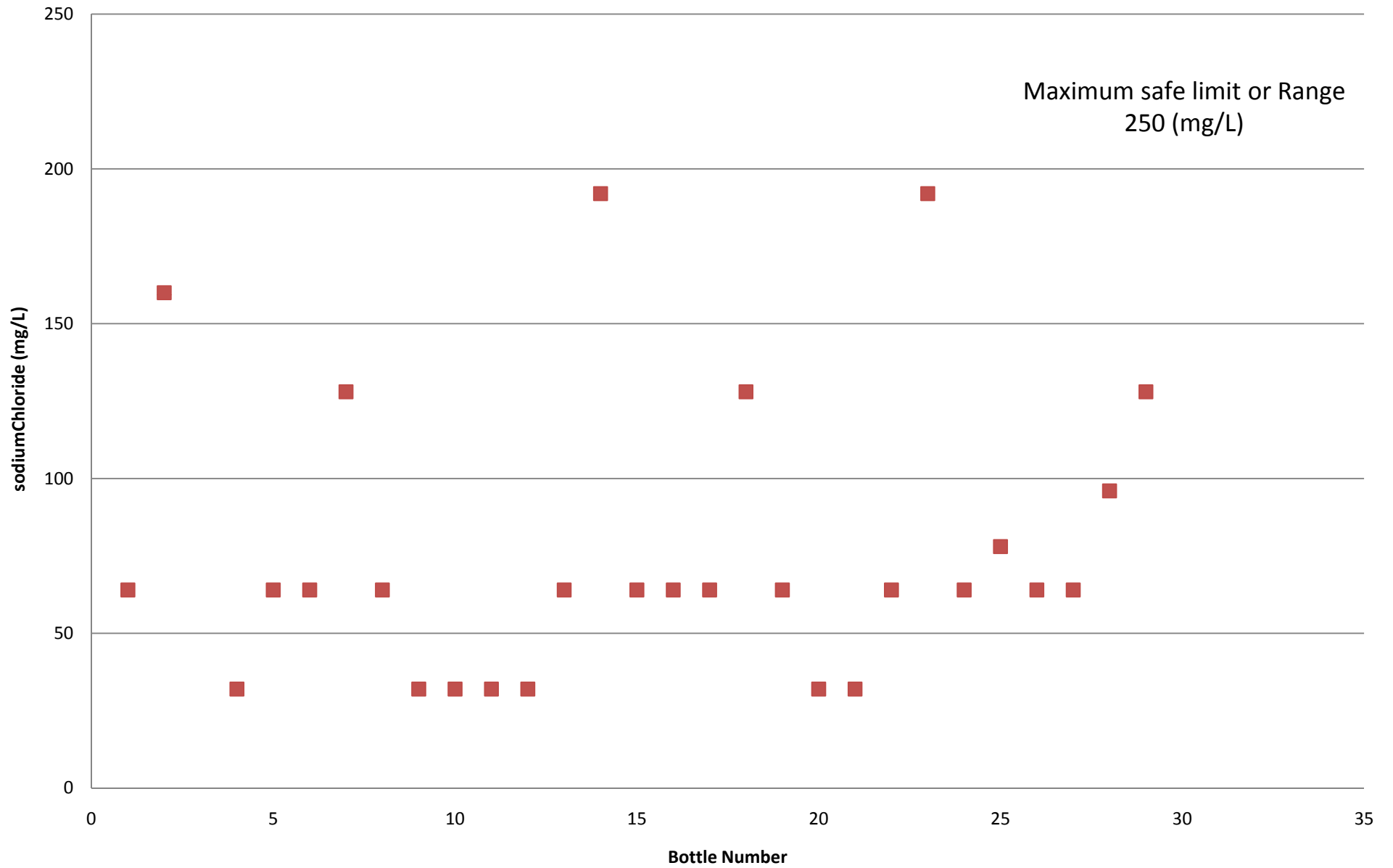
CHLORIDE TEST for ME 4-H (mg/L)



Sodium Chloride (mg/L)

Maine 4-H

Spring 2010



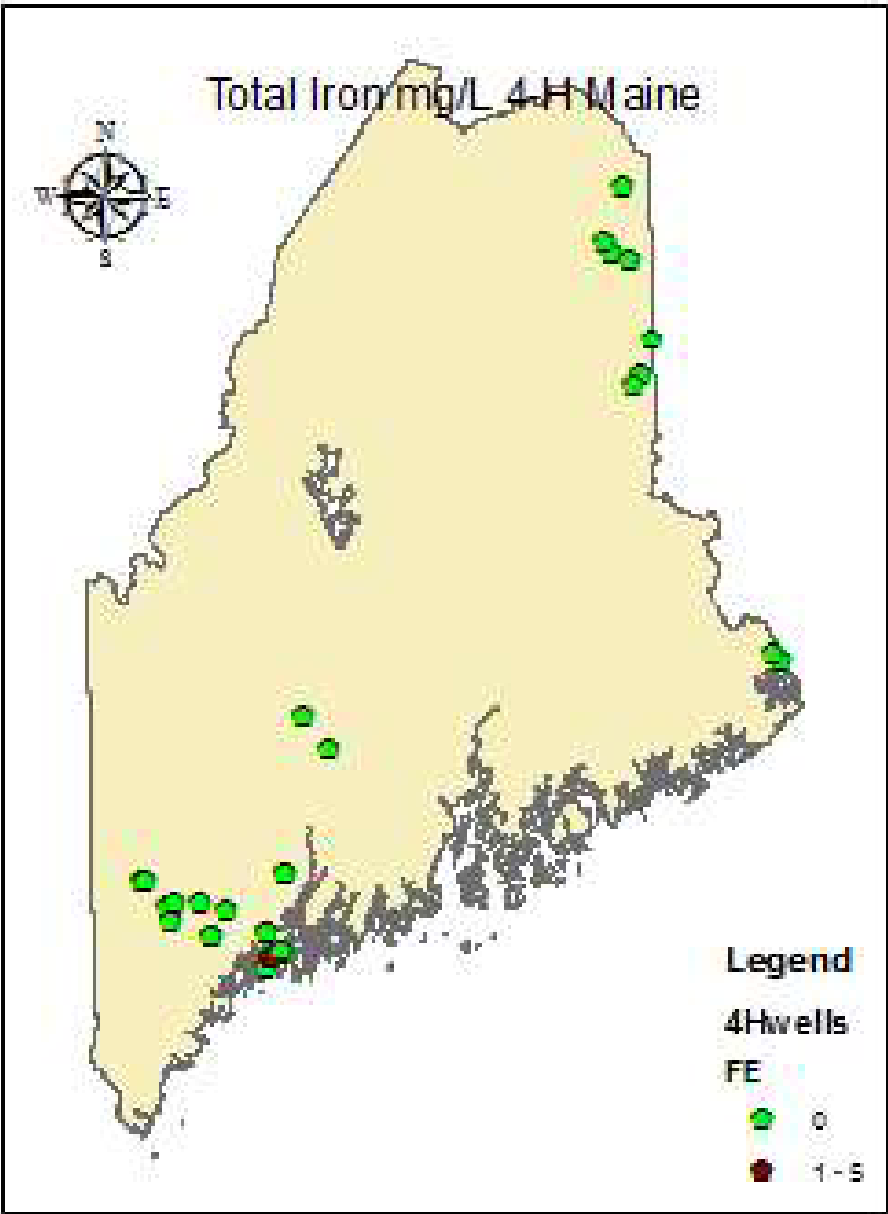
Statistics for Sodium Chloride Maine 4H Spring 2010

- Mean : 77.0714286
- Median : 64.0
- Mode : 64.0
- Standard Deviation : 46.298491
- Range : 32.0 to 192.0

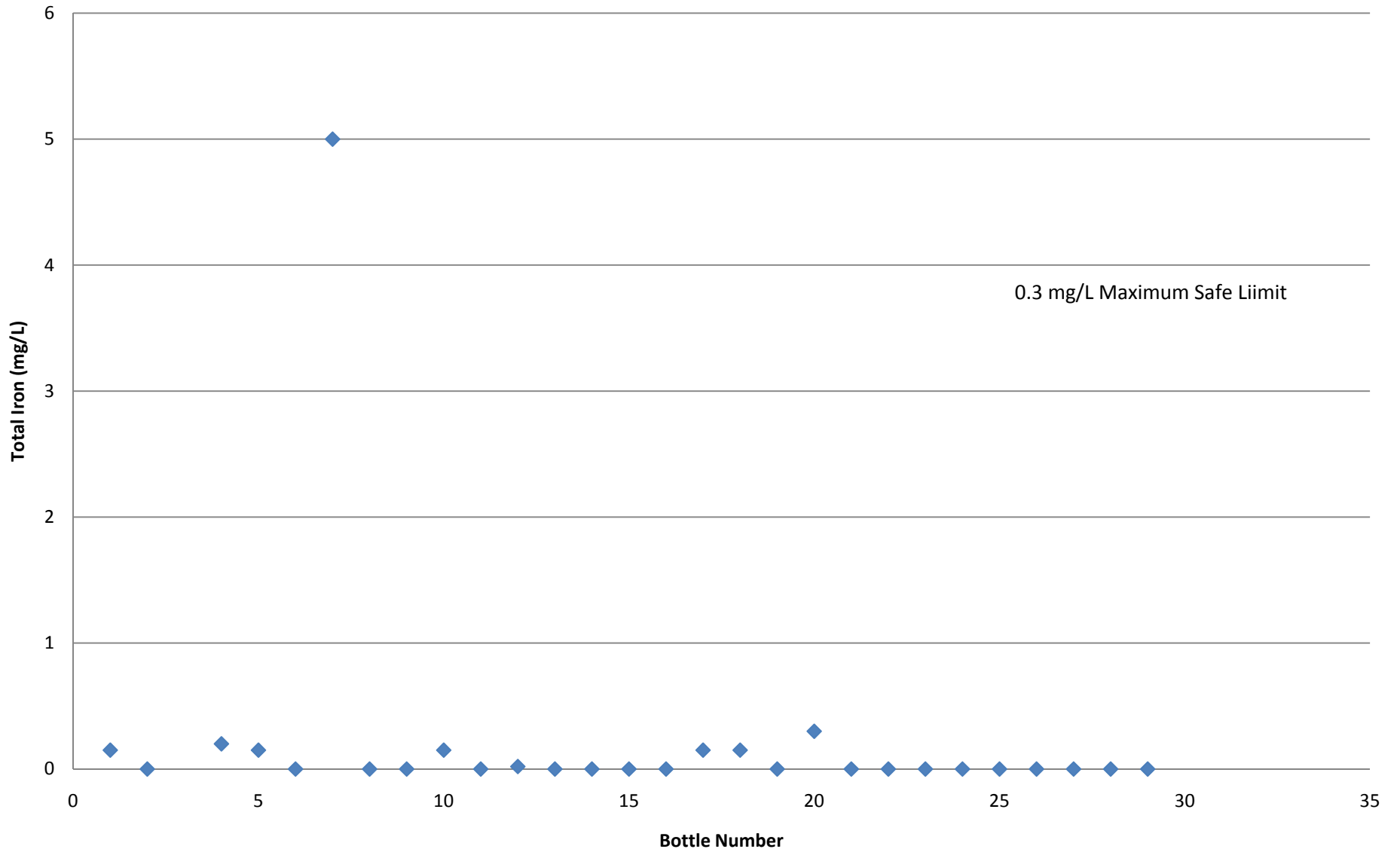


Iron

- Iron is a metal or metallic element.
- Iron naturally occurs in rock and soil and is released by rainwater into surface waters or travels to groundwaters through infiltration.
- Iron is not generally hazardous in drinking water, but it tastes funny and makes the water reddish.
- Water high in iron can stain tubs and dishware



Total Iron (mg/L)
Maine 4-H
Spring 2010



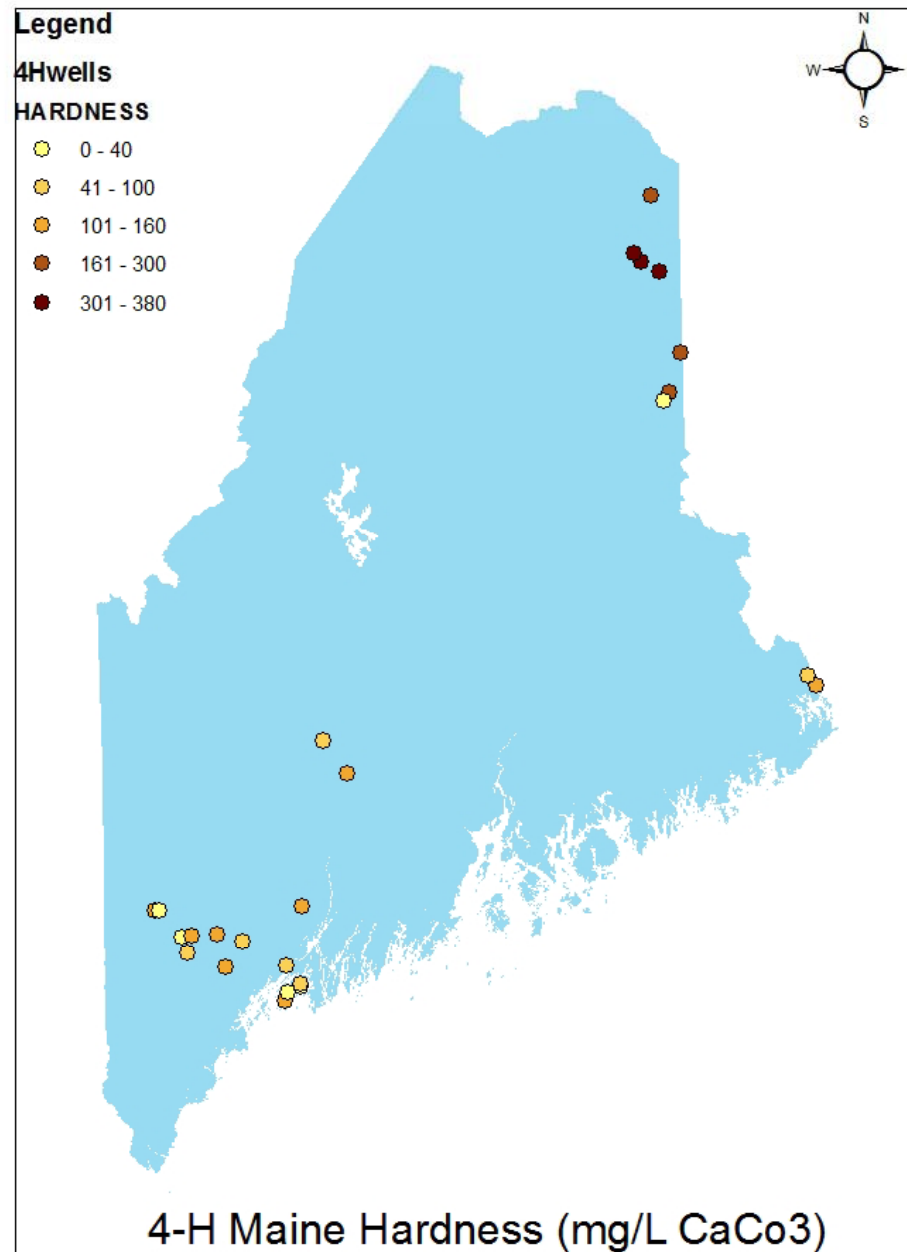
Total Iron (mg/L)
Maine 4-H
Spring 2010

- Mean 0.22392857
- Median 0.00
- Mode 0.00
- Standard Deviation 0.93963878
- Range 0.00-5.00

Hardness



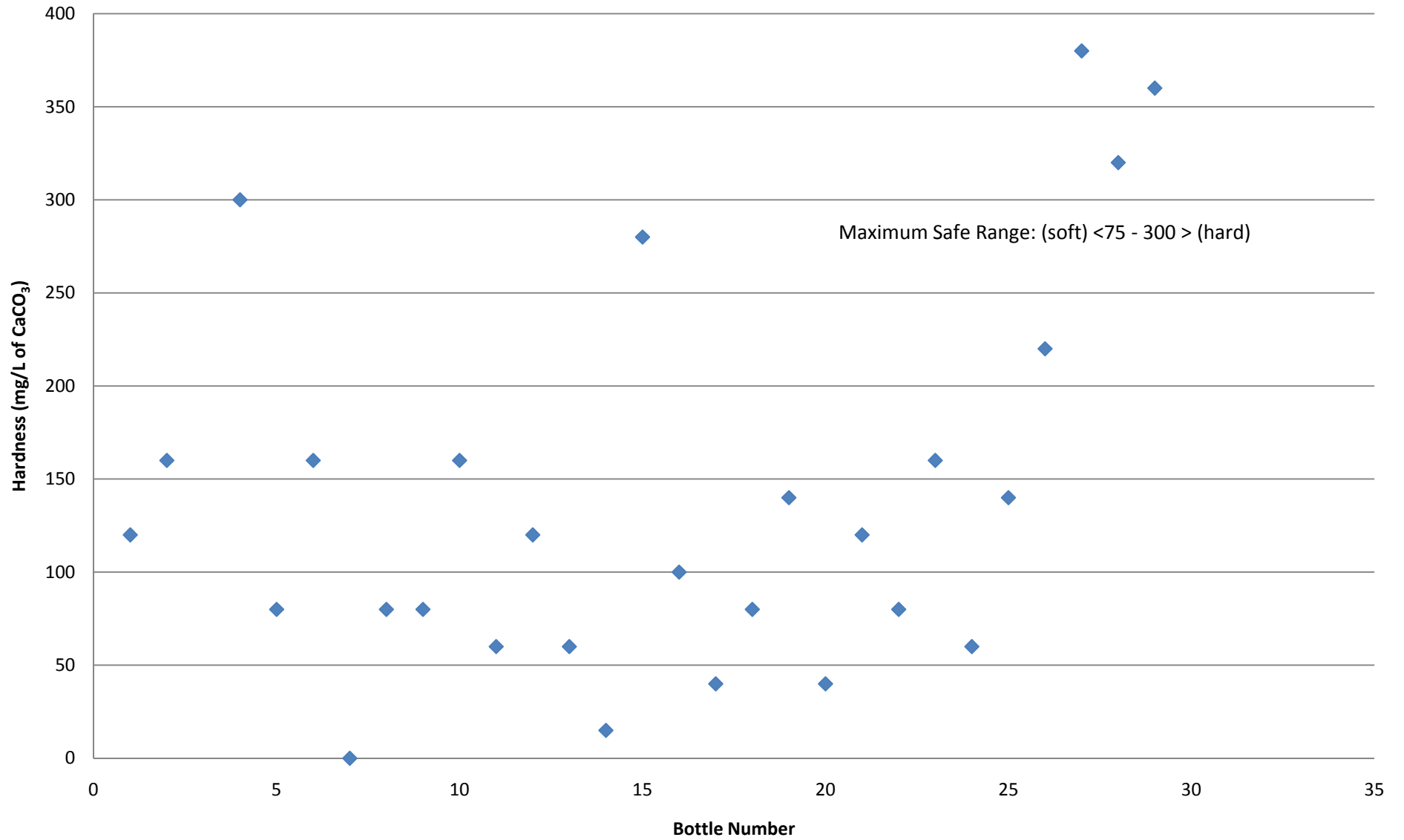
- Hard water is water that has a high mineral content
- It usually comes from the dissolution of bedrock
- Common minerals are:
 1. Calcium (Ca^{2+})
 2. Magnesium (Mg^{2+})
- Our test measured Calcium Carbonate: CaCO_3
- Hard water is not necessarily bad for people, but it is bad for pipes!



Hardness (mg/L CaCO₃)

Maine 4-H

Spring 2010



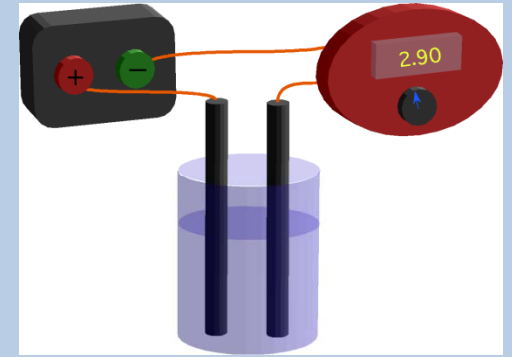
Hardness (mg/L CaCO₃)

Maine 4-H

Spring 2010

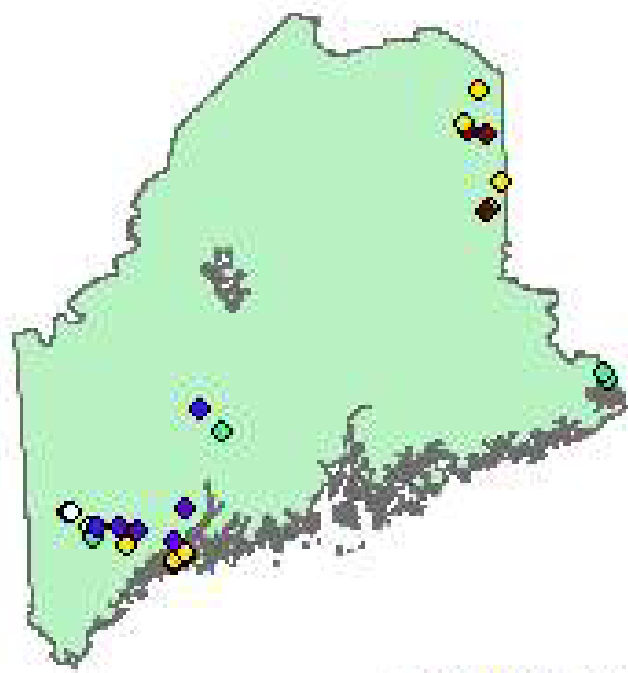
- Mean: 145.0
- Median: 120.0
- Mode: 80.0
- Standard deviation: 101.251781
- Range: 15.0 – 380.0

Conductivity



- Electrical conductivity (EC) estimates the amount of total dissolved salts (TDS), or the total amount of dissolved ions in the water.
- Pure water is not a good conductor of electricity.

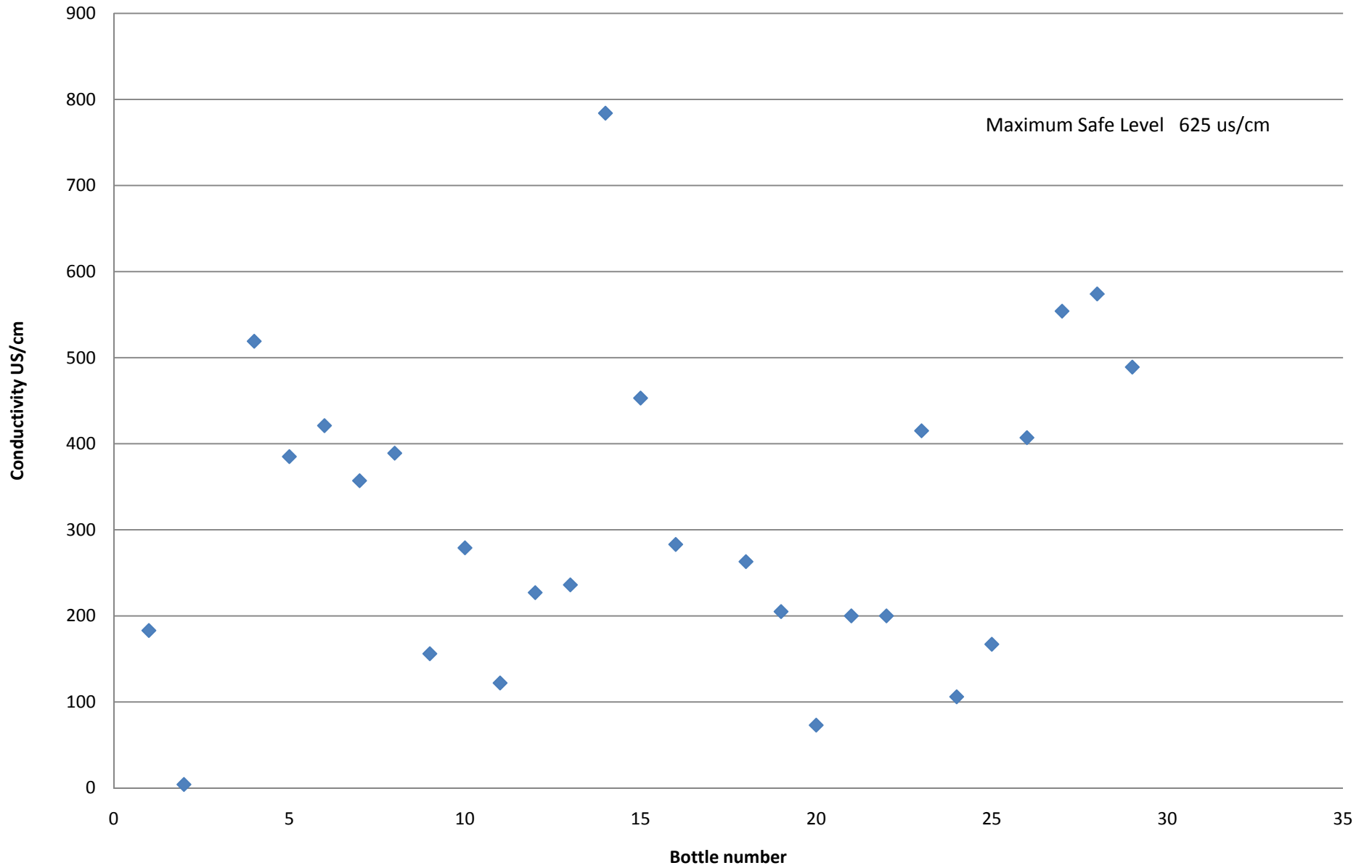
4-H Maine Conductivity uS/cm



Legend Conductivity

- | | | |
|---------|---|-----------|
| 4Hwells | ◆ | 306 - 353 |
| CONDUCT | ◆ | 254 - 319 |
| | ○ | 0 - 13 |
| | ◆ | 14 - 205 |
| | ◆ | 520 - 754 |

Conductivity (uS/cm)
ME 4-H
Spring 2010



Conductivity (uS/cm)

ME 4-H

Spring 2010

Average:	313.002963
Median:	16.00
Mode:	200.00
Standard Deviation:	16.00
Range:	4.08 -748.00

What to test for in your well!

- Volatile Organic Compounds (VOCs): VOCs are industrial and fuel-related chemicals that may cause bad health effects at certain levels.
- Total Coliforms: Coliform bacteria are microbes found in the digestive systems of warm-blooded animals, in soil, on plants, and in surface water.
- Arsenic: cancer causing element that can come from degrading granitic bedrock
- Radon: a natural radioactive element that can come from degrading granitic bedrock

Volatile Organic Compounds (VOCs)

Volatile Organic Compounds, or VOCs, are created as the result of various industrial processes

Some specific VOCs and their related health effects:

- Tetrachloroethylene- used in drycleaning and is a suspected cause of cancer
- Trichloroethylene- used in cleaning metal parts and is linked to birth defects as well as cancer
- Toluene- an organic compound that is harmless to adults but is known to cause birth defects

Total Coliforms

Coliforms are a group of bacteria that are found in the digestive tracts of animals and humans.

The presence of coliforms in groundwater indicates contamination

Defects in well that may lead to coliform contamination of drinking water:

- a missing well cap
- contaminate seepage through well casing
- well flooding

The most well-known coliform is E.coli, which can cause serious illnesses in some cases



Arsenic

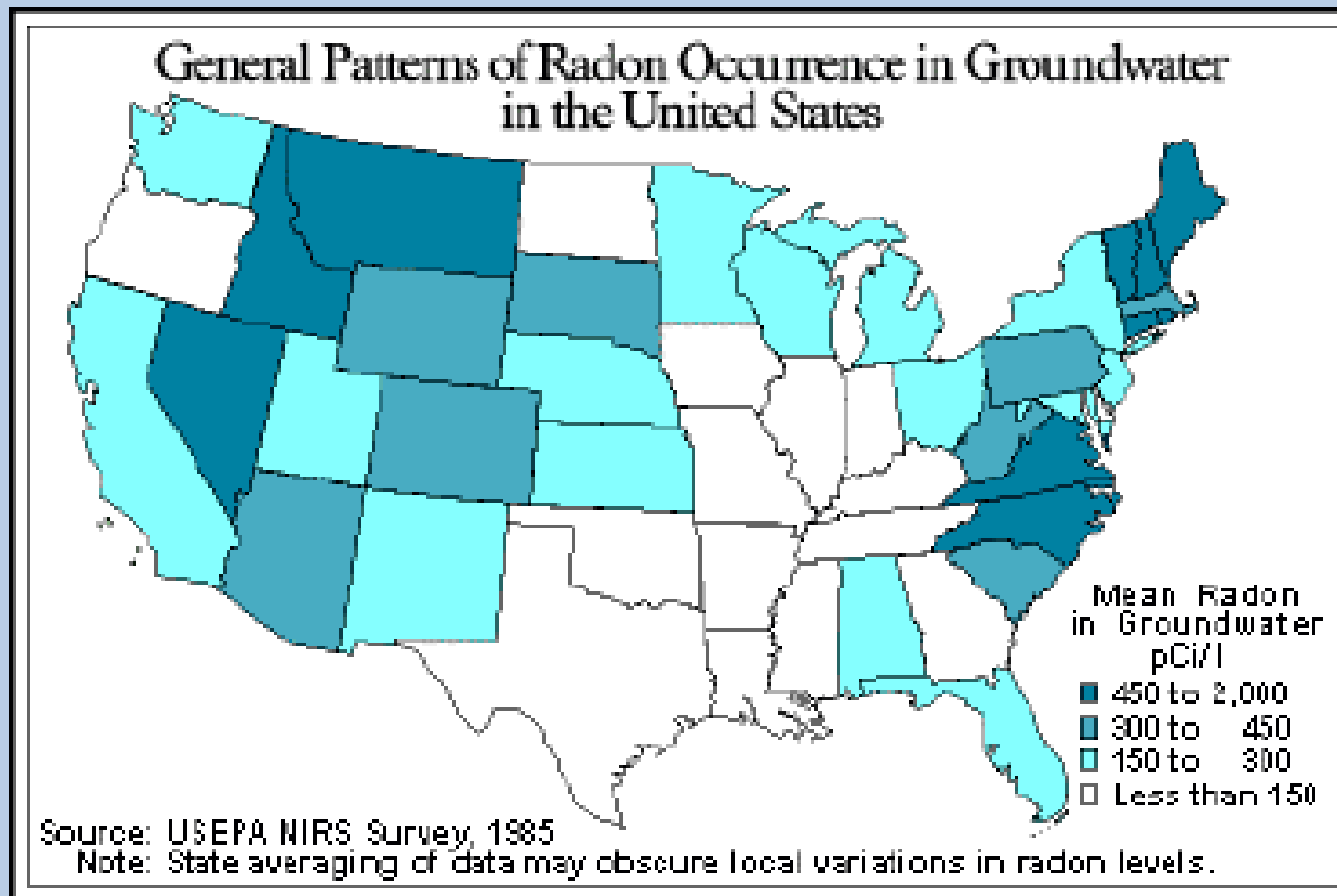
- Arsenic is a metalloid, meaning that it is neither a metallic or non-metallic element.
- It occurs naturally in soils and rock, especially granite, and can enter groundwater when these rocks erode, a process often sped up by human activity. Another common cause of contamination is leachate from solid waste landfills, or from pesticides. (mostly stopped after the 1960's)
- The acceptable level in drinking water is anything under 0.01 mg/L.
- It is not readily absorbed through the skin, so hand-washing, bathing, etc. in contaminated water is not a health risk, but drinking or eating food prepared in contaminated water is.
- Effects of long-term exposure include higher risk of various kinds of cancer and cardiovascular disease, though studies indicate that small amounts of arsenic may actually be beneficial.



Radon In Maine Groundwater

- Second highest cause of lung cancer, after cigarette smoking.
- Produced by the decay of naturally occurring element radium-226, most oftenly found in soils and rocks, especially granite.

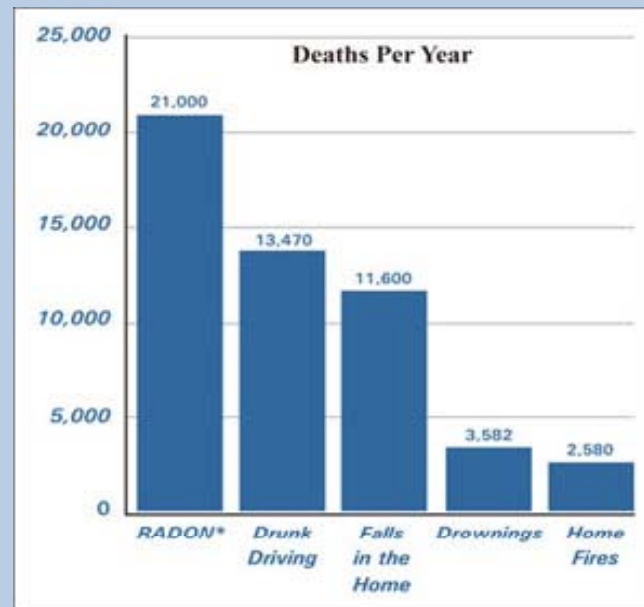
Radon, Pt. 2



Radon occurs more often in states with higher granite levels.

Radon, Pt. 3

- Not all drinking water contains radon. If your drinking water comes from a surface water source, such as a river, lake, or reservoir, most radon that might be in the water will be released into the air before reaching your water supplier or home. Radon is only a concern if your drinking water comes from underground, such as a well that pumps water from an aquifer, though not all water from underground sources contains radon. (EPA.gov)



EPA estimates that radon is responsible for more deaths each year than drunk driving.



Fluoride



- Occurs naturally in deposits in soil and bedrock. Through the process of erosion, these deposits can leach into the groundwater.
- Hydrofluorosilicic acid, a by-product of the phosphate fertilizer industry, is added to many town water supplies. It can also leach into groundwater as discharge from these and aluminum factories.
- The EPA's maximum contaminant level is 4.0 mg/L. A secondary level of 2.0 mg/L is recommended. It isn't considered dangerous, but can cause mottling (dental fluorosis) of still-developing teeth in young children. Towns are required to inform citizens if their water exceeds this level.
- Bone disease can occur as a result of high levels of fluoride. Its ability to cause cancer and other serious illnesses is disputed.



Lead



- Lead is a naturally occurring heavy metal. It is also considered a 'poor metal' (referring to its low melting/boiling points), as are aluminum and tin.
- There is no safe level for lead in drinking water; even very small quantities can adversely affect your health. In children it can cause anemia, delays in mental and physical development, and deficits in attention span and learning ability. In adults it can cause anemia, cardiovascular and kidney disease, among other things.
- Lead can get into your water either through erosion of natural deposits, or from corrosion of lead pipes or pipes with lead soldering. If you live in an old house, it's possible that degrading lead-based house paint (banned since the 1970's) could leach into your well also.

Where to test your well?

Where can you get professional tests done?

- **Central Office:**
221 State St., Augusta, Maine 04333
- **Telephone:**
207-287-2727
- **Fax:**
207-287-6832
- **Mailing Address:**
Statehouse Station #12
Augusta, Maine 04333-0012
- **Web Site:**
<http://www.maine.gov/dhhs/etl/homepage.htm>



Remediation



What is remediation?

- The correction of something bad or defective
- Maine DEP prevents, abates, and controls pollutions of the air, land, and water.
 - <http://www.maine.gov/dep/rwm/Central>
- Maine Region (Augusta):
 - 207-287-7800
- Eastern Maine Region (Bangor):
 - 207-941-4570
- Southern Maine Region (Portland):
 - 207-822-6300
- Northern Maine Region (Presque Isle):
 - 207-764-0477

Additional Information/Guidelines

When should you have your well water tested?

Test water every year for: total coliform bacteria, nitrates, total dissolved solids and pH levels, *especially* if you have a new well, or have replaced or repaired pipes, pumps or the well casing.

Do you expect to have a new baby in the household?

- Test for nitrate in the early months of a pregnancy, before bringing an infant home, and again during the first six months of the baby's life.

Do you have taste, odor and staining issues?

- Test for sulfate, chloride, iron, manganese, hardness and corrosion, and every three years. If you suspect other contaminants, test for these also.

Have you had a chemical or fuel spill or leak near your water supply?

- Test your well for chemical contaminants, such as volatile organic compounds.



http://www.epa.gov/ogwdw000/faq/pdfs/fs_homewatertesting.pdf<http://www.epa.gov/ogwdw000/faq>



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Emily Ross

Caroline Ross

Gemma Blanchette

Lucian Sulloway

Ella Sulloway

Ella Ting Forbes

Reed Bridge-Koenigsberg

Frederic

Rosemary Harkenrider-Crossman

Christopher Reid

Lindsey Wallace

Jesse Wallace

Dan Smith

Jade Consalvi

Jodie Harris

Tierra Newell

Jessica Bennett

Logan Craig

Klairissa Kern

Haley Smith

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