

Groundwater Quality Changes Over Time – The Importance of Regular Source Water Quality Testing.

Water Resources Management Division, Groundwater Section

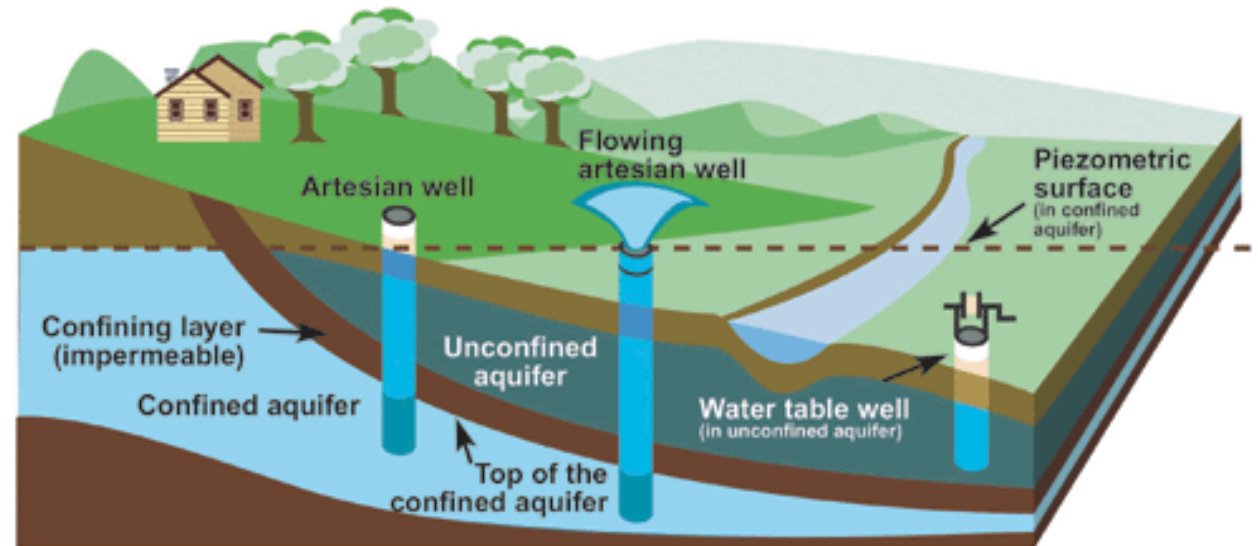
Outline

- What is Groundwater?
- Basics of Groundwater
- Groundwater in Newfoundland and Labrador
- Groundwater Quality Changes in Newfoundland and Labrador
- Public Groundwater Supplies
- Conclusions

What is Groundwater?

- Water found underground in the cracks and spaces in soil, sand and rock.
- It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.

Aquifers and wells



Credit: Government of Canada

What is Groundwater?

Main types of porosity:

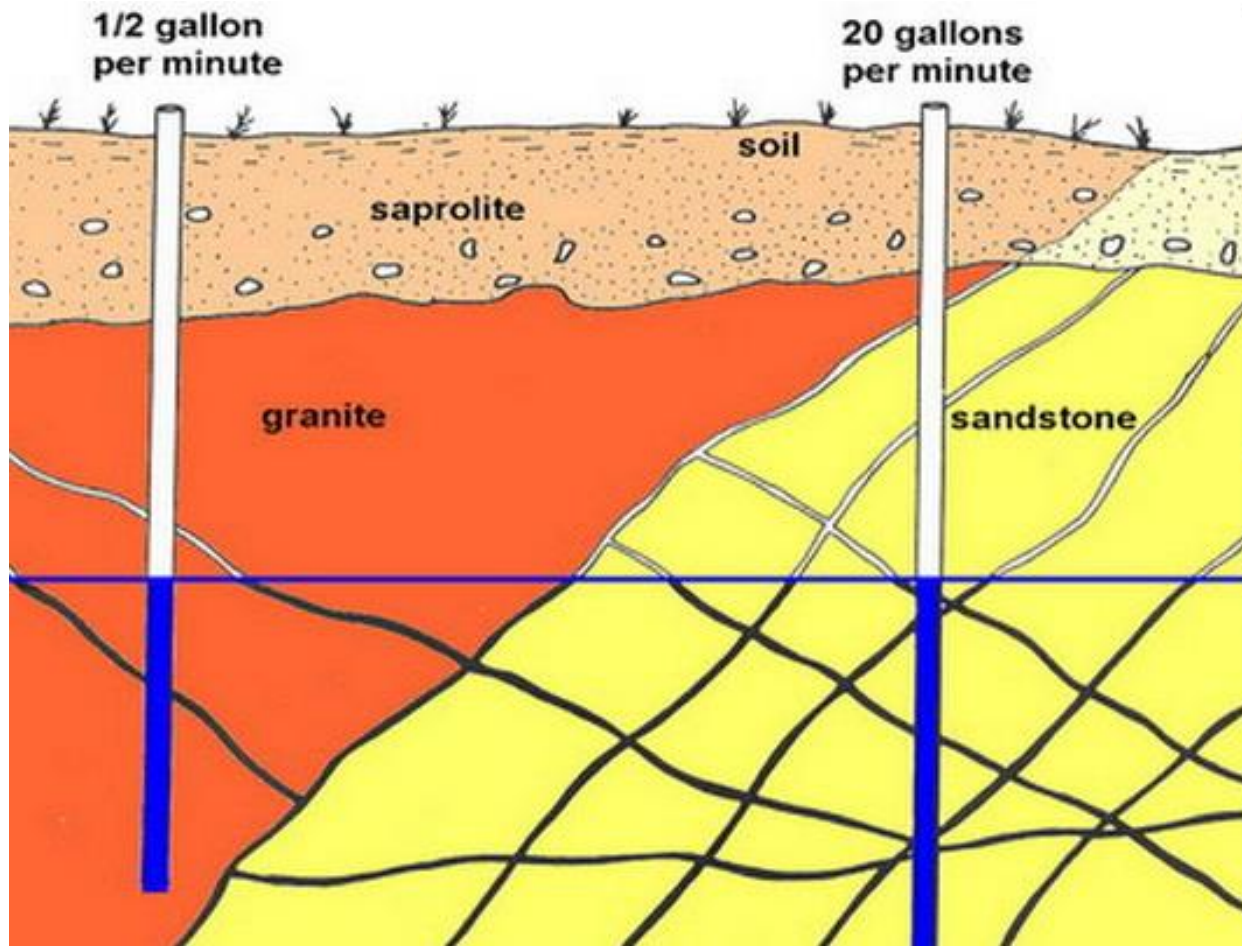
Primary: Porosity of the rock or sediment that formed at the time of deposition

Secondary: Develops after the deposition of rock or sediment, for example fractures



Main type in NL

Basics of Groundwater

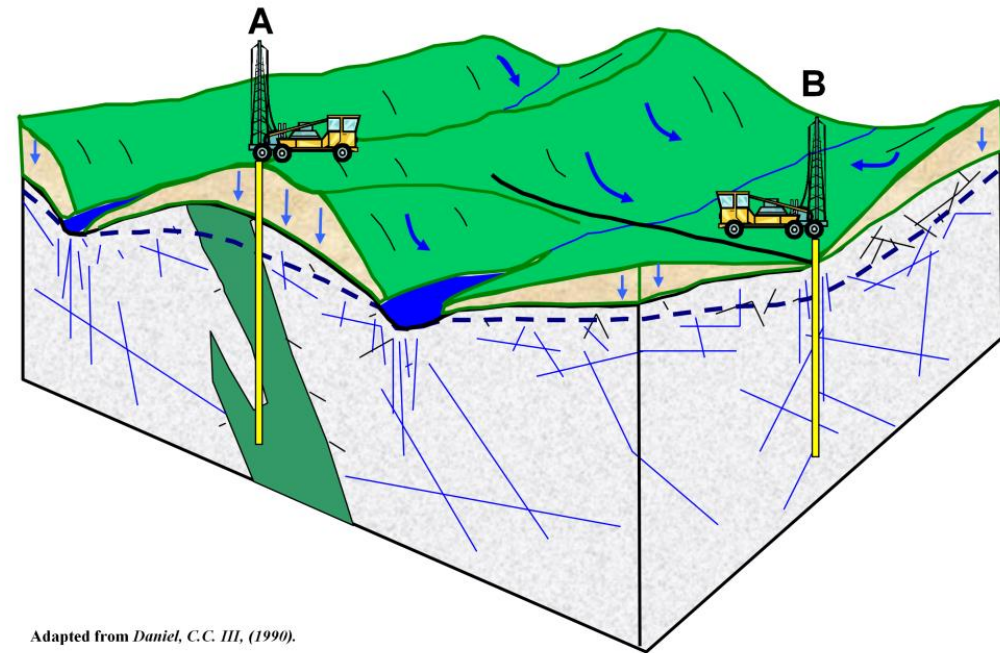


Fractures can be highly variable due to different bedrock geology

Basics of Groundwater

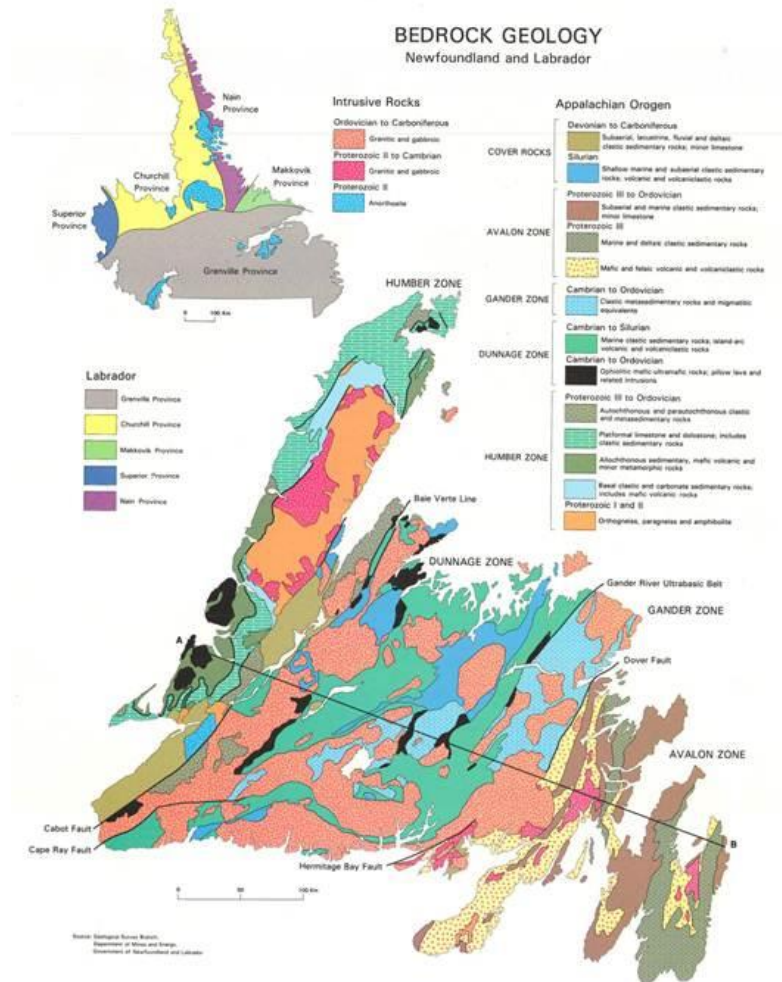
Why are some wells drilled dry?

Dry Well
(no fractures intercepted)



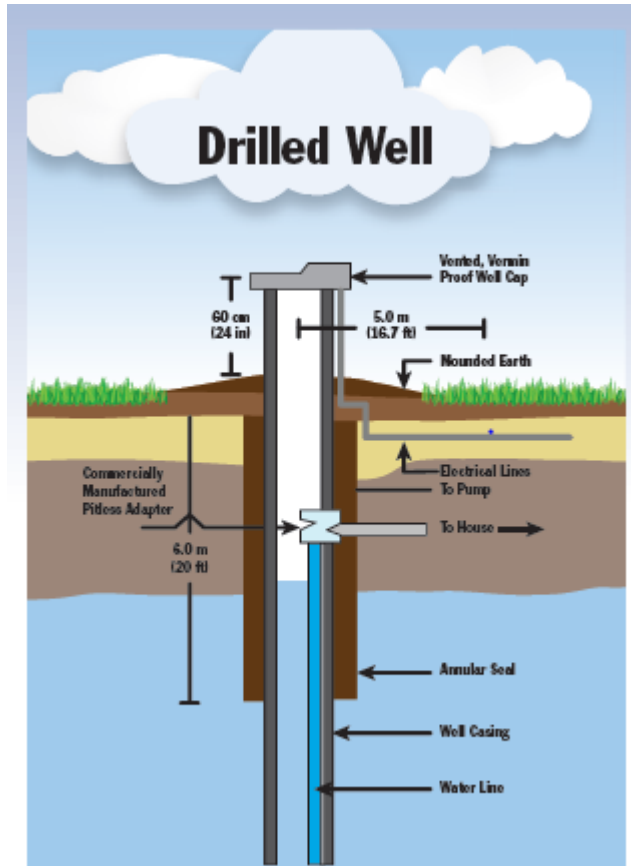
Adapted from Daniel, C.C. III, (1990).

Basics of Groundwater



Geology in Newfoundland is very complex

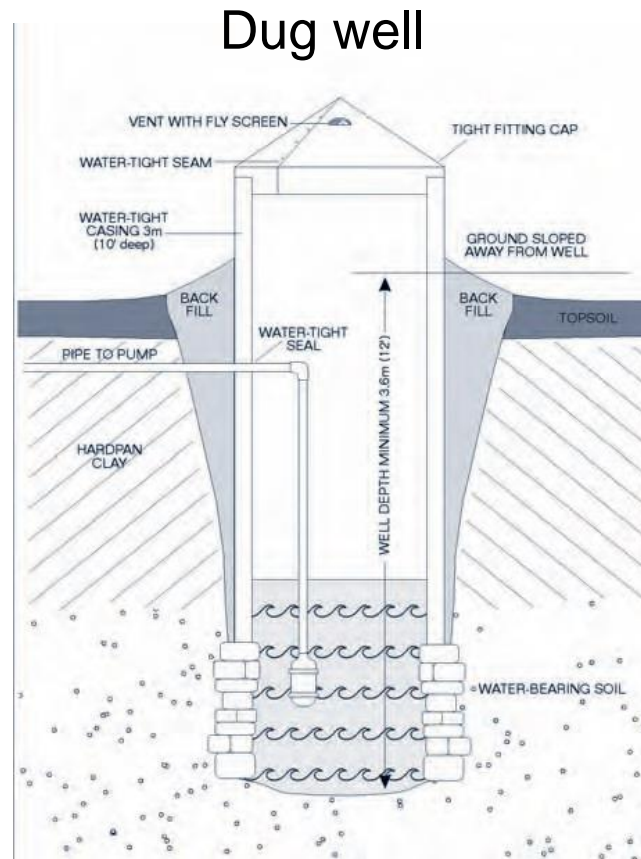
Basics of Groundwater



- Usually 6 inch diameter
- Deeper
- Less susceptible to contamination from surface water
- More likely to have metal contaminants like arsenic (water interacts with bedrock)

Basics of Groundwater

- Larger diameter
- Shallow
- Susceptible to contamination from surface water
- Less likely to have metal contaminants, like arsenic, less interaction with the bedrock



Groundwater in Newfoundland and Labrador

- Source of drinking water to nearly 30% of the population
- Preferred water supply in rural areas – sometimes the ONLY water supply in rural areas
- Used in most community and cottage areas
- 264 public wells in the province servicing 94 communities
- More than 24,000 drilled wells and at least that many dug wells in the province

Groundwater Quality Changes

- Many people think that groundwater quality remains the same over time, however, that is not always the case
- Surface spills of contaminants like fuel can infiltrate the soil and contaminate groundwater.
- Groundwater can also be contaminated by underground sources, such as leaking fuel storage tanks or malfunctioning septic systems.
- Saltwater intrusion – can be caused by over pumping or climate change (rising sea levels)
- Geologic sources

Groundwater Quality Changes in Newfoundland and Labrador

Geologic Sources

- As groundwater flows, it reacts with the minerals, rocks, and sediments that make up the aquifer and soil. Chemical components are released into the groundwater from these geologic sources.
- Differences in geology, recharge rates, groundwater residence times, and geochemical conditions contribute to differences in chemical concentrations within aquifers
- In general, the more water that flows through the system, the lower the concentrations of metals, such as arsenic, from geologic sources are likely to be

Other factors (geochemical conditions) – basically changes to water characteristics which may allow or stop minerals from being dissolved

- Redox conditions (oxidizing or reducing)
- pH
- Temperature
- Changes in chemistry

Groundwater Quality Changes in Newfoundland and Labrador

So what does all that mean?

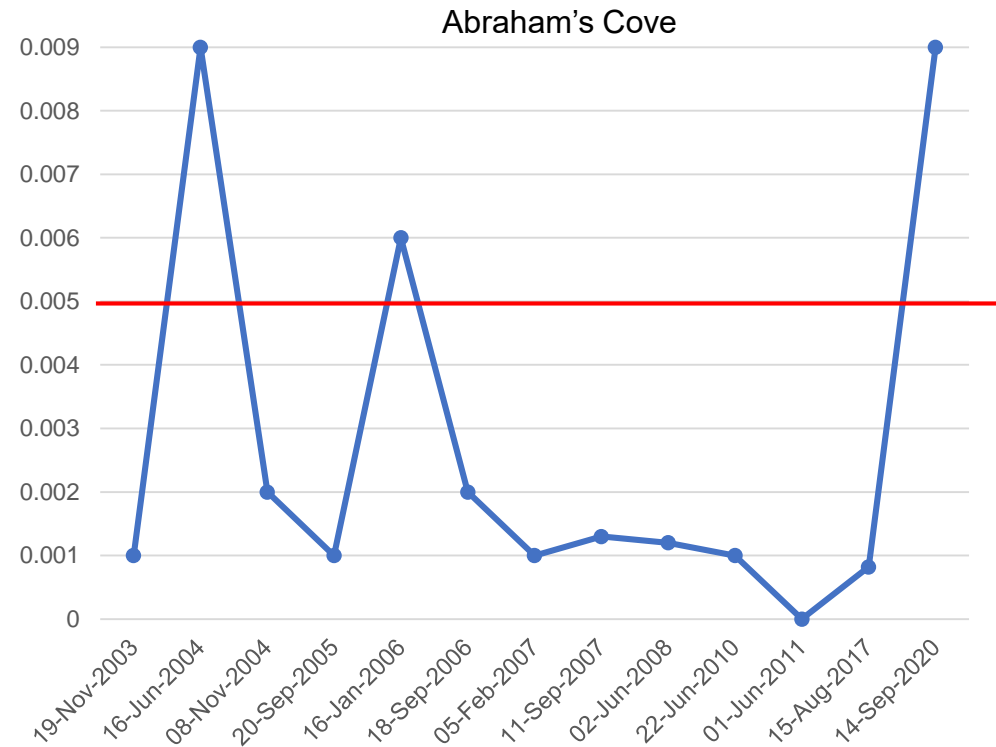
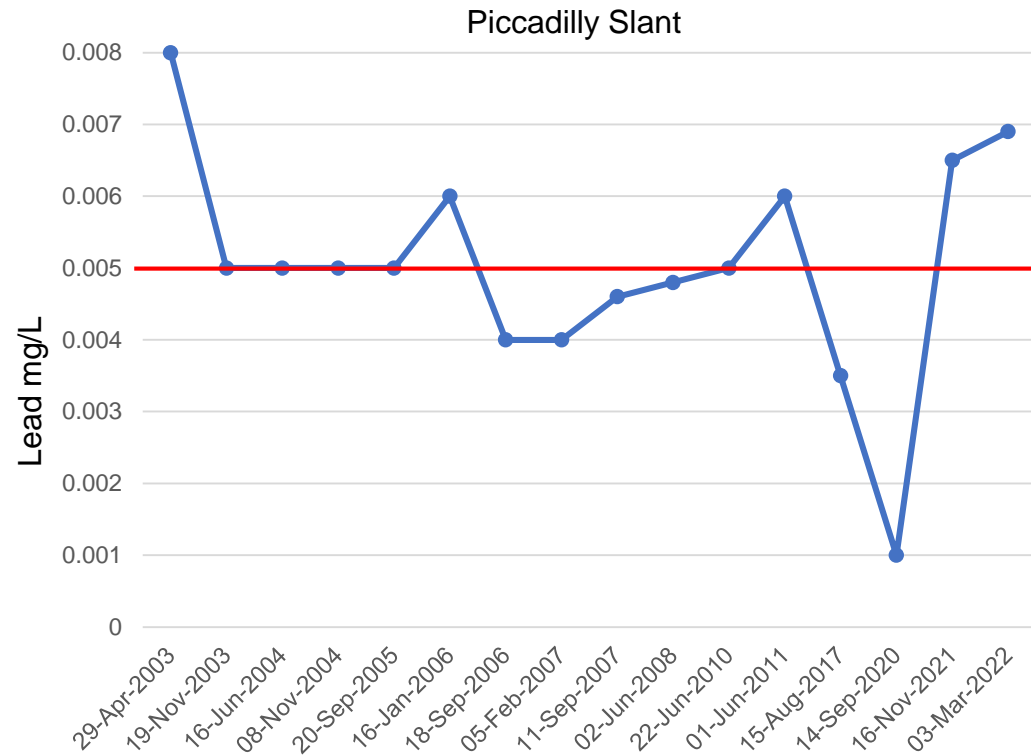
- Changes in precipitation – i.e. dry spring/summer/fall/winter can lead to changes in the aquifer and water quality
- Over pumping – can start pulling water from farther away or from different fractures, which may have different water chemistry
- Saltwater intrusion – salt changes the groundwater chemistry which can lead to the water dissolving new minerals and releasing new metals into the groundwater
- Other contamination from surface or underground. Oil spills, fuel tanks, septic, pressure treated wood, fertilizers, pesticides etc.

Groundwater Quality Changes in Newfoundland and Labrador



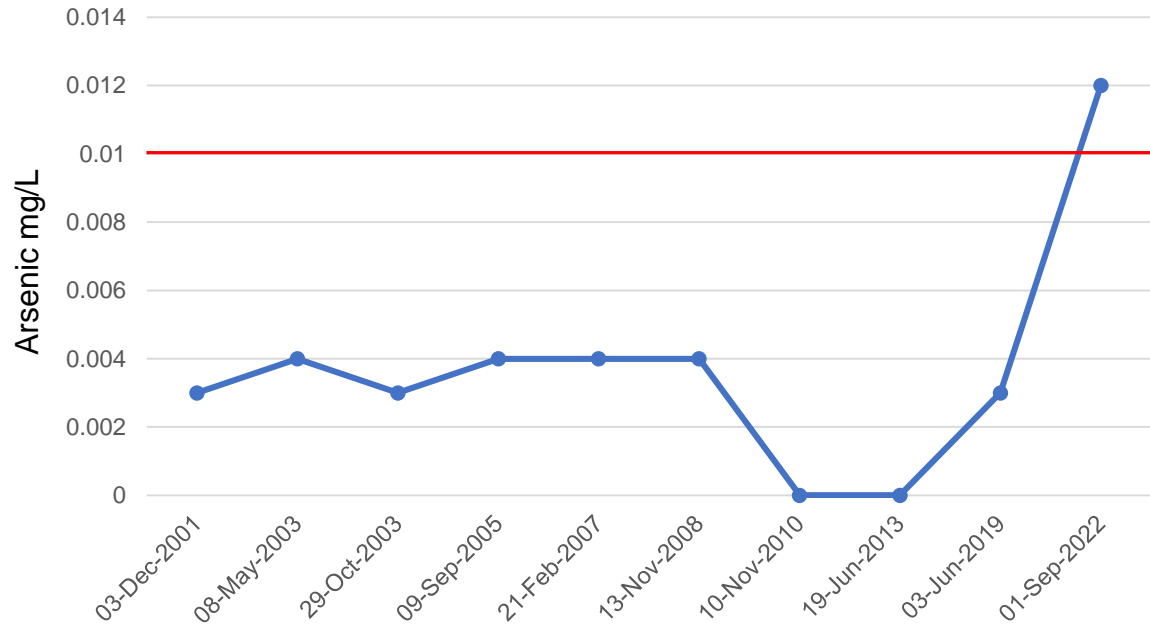
Credit: The National Environmental Education and Training Foundation (NEEF)

Groundwater Quality Changes in Newfoundland and Labrador

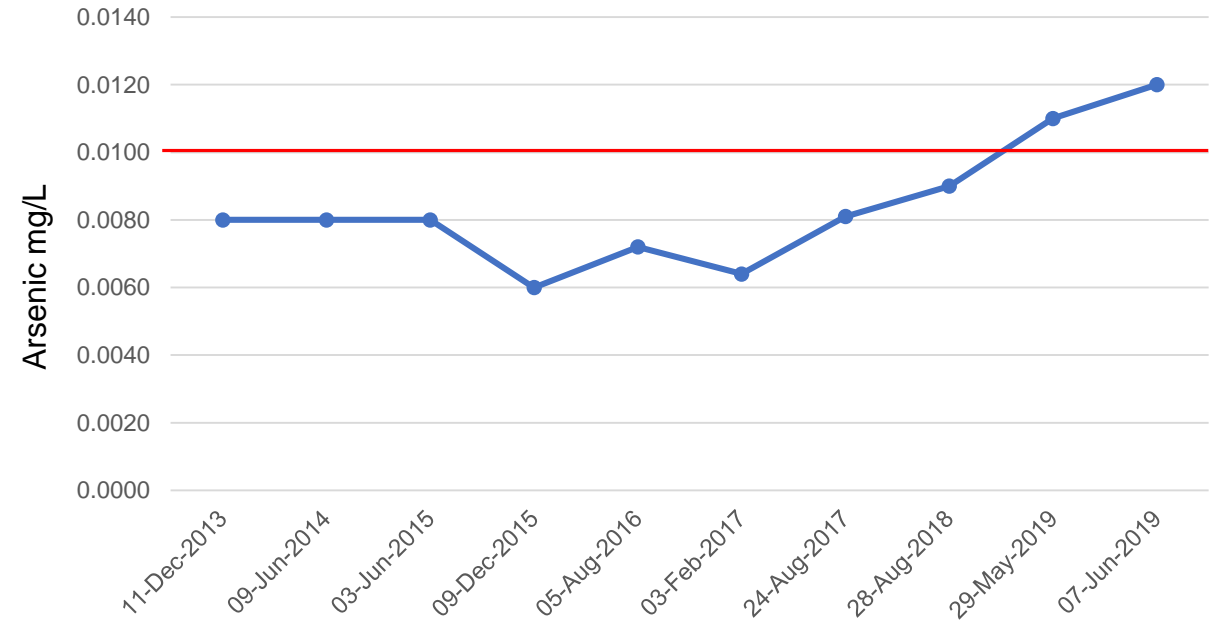


Groundwater Quality Changes in Newfoundland and Labrador

St. Joseph's



New Harbour



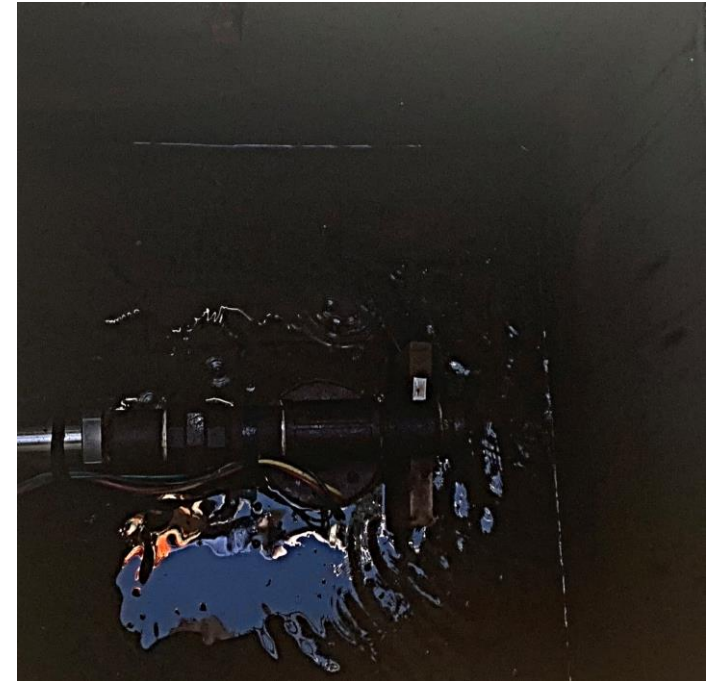
Groundwater Quality Changes in Newfoundland and Labrador

How can you help prevent contamination?

- Properly construct and maintain your wellhead
 - Locate your well away from contamination sources
 - Seal the annular space
 - Slope ground around well casing away
 - Install casing 6 -12 meters into bedrock
 - Install vermin proof well cap
 - Regularly inspect your wellhead

Groundwater Quality Changes in Newfoundland and Labrador

Examples of Poorly Constructed or Unmaintained Wells:



Groundwater Quality Changes in Newfoundland and Labrador

Examples of Poorly Constructed or Unmaintained Wells:



Groundwater Quality Changes in Newfoundland and Labrador

How can you help prevent contamination?

- Avoid over pumping – pump at a lower rate and use additional storage tanks if needed
- Test water chemistry regularly
- Install water level logger to monitor water levels long-term, may need to adjust pumping rate if recharge rates and water levels change

Groundwater Quality Changes in Newfoundland and Labrador

If your groundwater supply is registered as a Public Water Supply:

- WRMD collects tap samples 1-2 times a year (drinking water)
- Source samples every 3 years (directly from the well)

If your groundwater supply is not registered as a Public Water Supply:

- Test the well regularly for water quality (bacteria and chemistry), WRMD recommends annually for bacteria for drilled wells, every 6 months for dug wells and every 2 to 3 years for water chemistry for both types, or if any water changes are observed – like colour or smell

Public Groundwater Supply

To become a Public Groundwater Supply:

- Owned by or supplies water to a municipality or local service district
- Services 14 or more persons per day
- Requires water quality testing (at least two tests) and depending on results treatment may be needed.
- Aquifer testing – Determines safe yield, additional storage may be required
- Approved by ECC and listed on the Government of Newfoundland and Labrador's Public Water Supply List

Public Groundwater Supply

For existing Public Water Supply wells:

- Please install a sample port prior to treatment or filtration, it makes our lives a lot easier and ensures the groundwater sample is a true “source” sample.
 - Chlorination, treatment and filtration can change the water chemistry

Conclusions

Regular source sampling is important to track water quality changes over time

- Test source groundwater quality every 2 to 3 years, especially important if water quality is near Canadian Drinking Water Guideline values or if there is a change (colour, smell, taste etc.)

Water quality can change over time due to a variety of factors

- In particular in NL the effects of climate change may cause saltwater intrusion or changes to recharge which can lead to changes in water chemistry

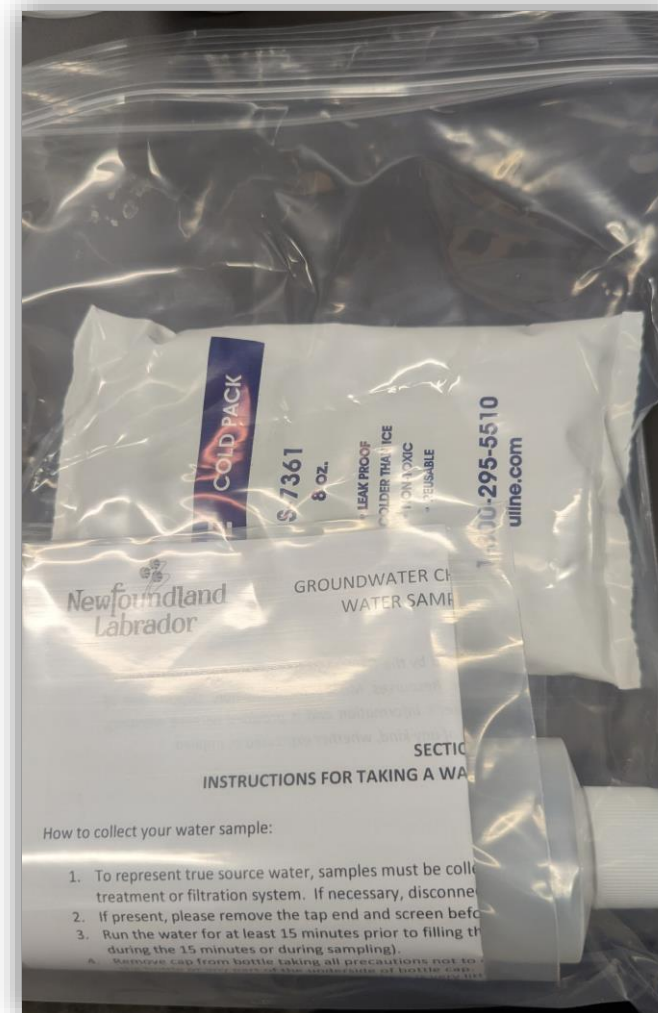
Conclusions

To help prevent contamination:

- Inspect and maintain your wellhead to help prevent contamination from the surface
- Avoid over pumping
- Consider installing water level loggers to observe long term groundwater changes

Groundwater Chemical Test Kits

- Water Resources Management Division, have collaborated with Service NL, Health and Community Services and the Geological Survey Laboratory to distribute chemical test kits and are available for pick up at no cost to well owners from the Government Service Centers
- Tests for major ions and metals including arsenic, manganese, lead and uranium
- A limited number of kits are available at the registration desk if anyone has a private well they would like to test.
- Completed forms and samples need to be returned to your nearest Government Service Center or the Howley Building Lab, Higgins Line, St. John's (cooler in front lobby for sample drop)



Thank you

Questions?

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