Our Groundwater, Our Responsibility

Wells and Groundwater Conservation Workshops in the Islands Trust Area

Why Are We Here?

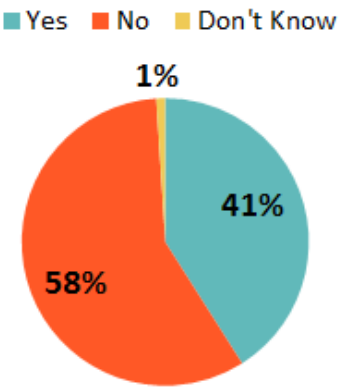
Water is an on-going concern in the Islands Trust Area

Islands Trust Council Strategic Plan 2014-2018

Commitment to protecting water quality and quantity

Water conservation advocacy and education

2016 State-of-the-Islands Poll:
"I sometimes worry about my household running out of fresh water"



Acknowledgement

http://www.rdn.bc.ca/

Please Register Your Domestic Well

Registering your domestic wells creates a record in the Ministry of Environment Wells Database. This database is a very important source of information on wells, aquifers and groundwater and is used by the public, industry, government and academia for research and resource management purposes.

Well registration is not compulsory, but provides you with many benefits, such as protecting your rights for domestic use of groundwater and storing useful information on your well.

To check if your well is already registered, please search the Wells Database:
https://a100.gov.bc.ca/pub/wells/public/indexreports.jsp
or call Front Counter BC: 1-877-855-3222

To register your well, please complete and submit this form as instructed:
http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/water-wells/well_registration_form.pdf

Note that well registration and groundwater licensing are not the same thing (see pages 55 & 56).

Today we'll be covering

1. Understanding groundwater
2. Understanding your well
3. Well protection
4. Drought management
5. Groundwater Licensing
6. Water testing
7. Water treatment

Why is this Information Important?

You are your own water manager. Looking after your well/aquifer helps ensure:

- Reliable, safe and clean water
- Longer well life; lower costs
- Maintain property value
- Environmental Stewardship

Aquifers & Groundwater

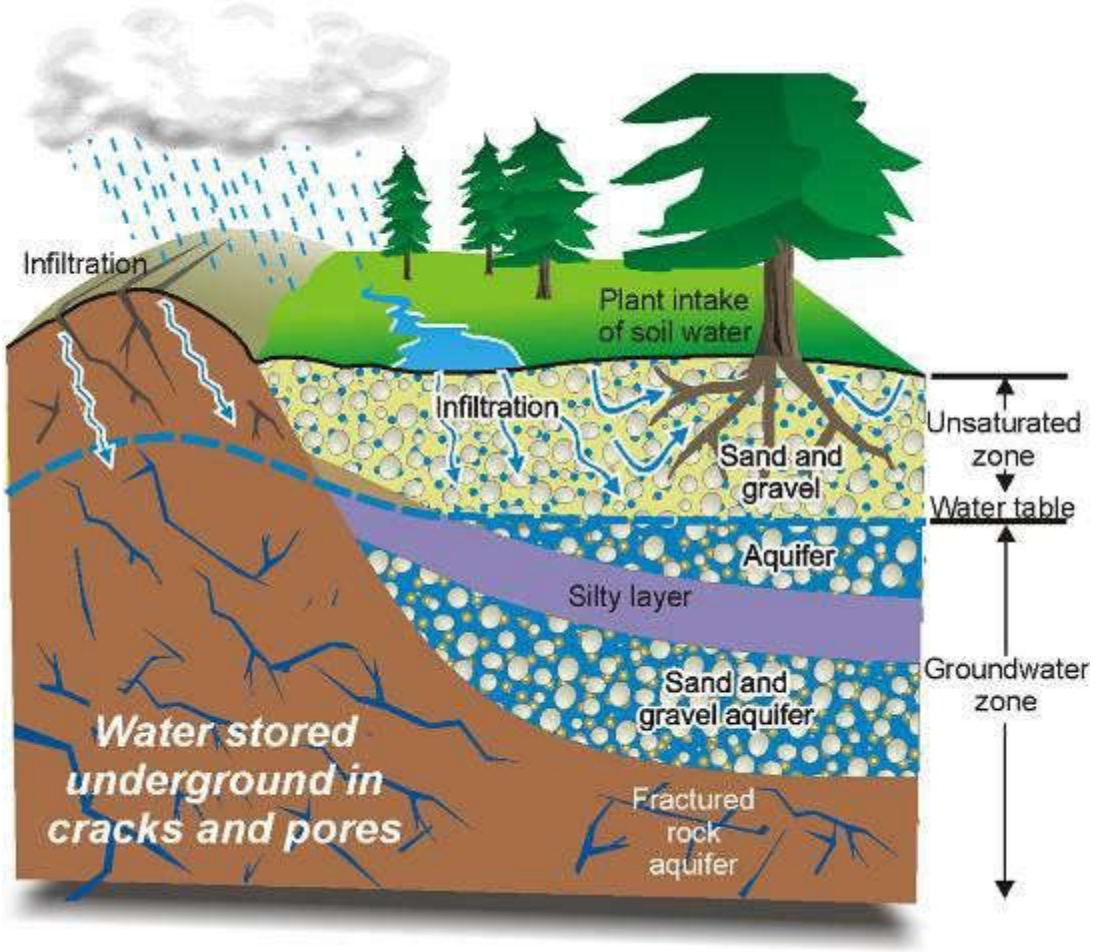
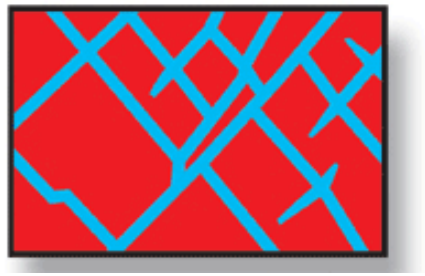
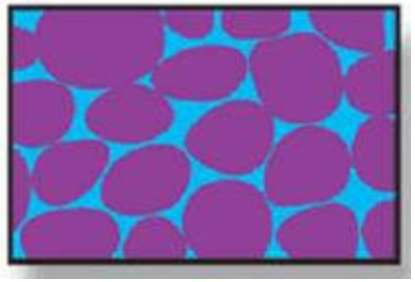


Photo credit: Natural Resources Canada



Water in rock fractures



Water between grains of sand

Coastal Aquifers

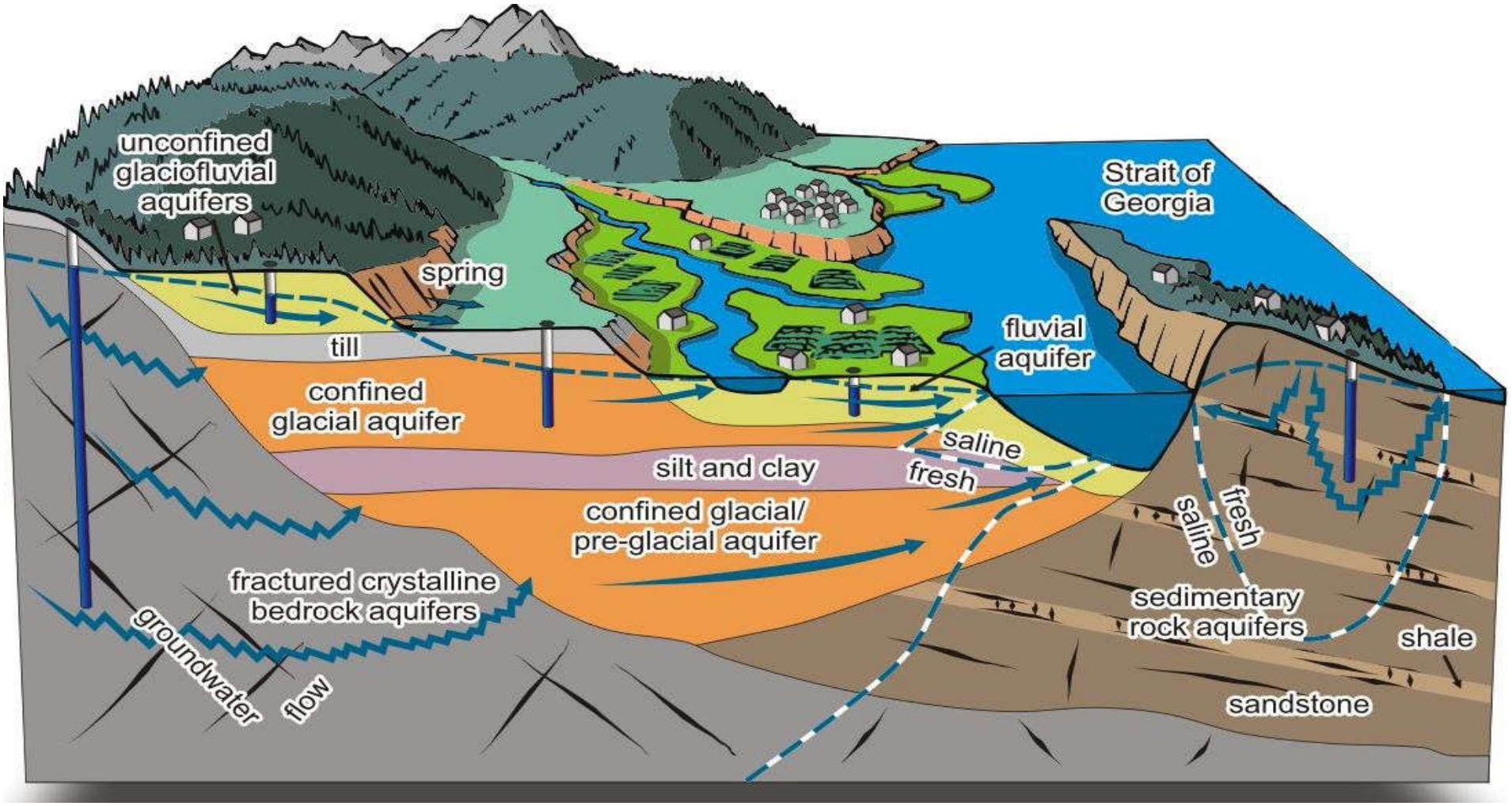
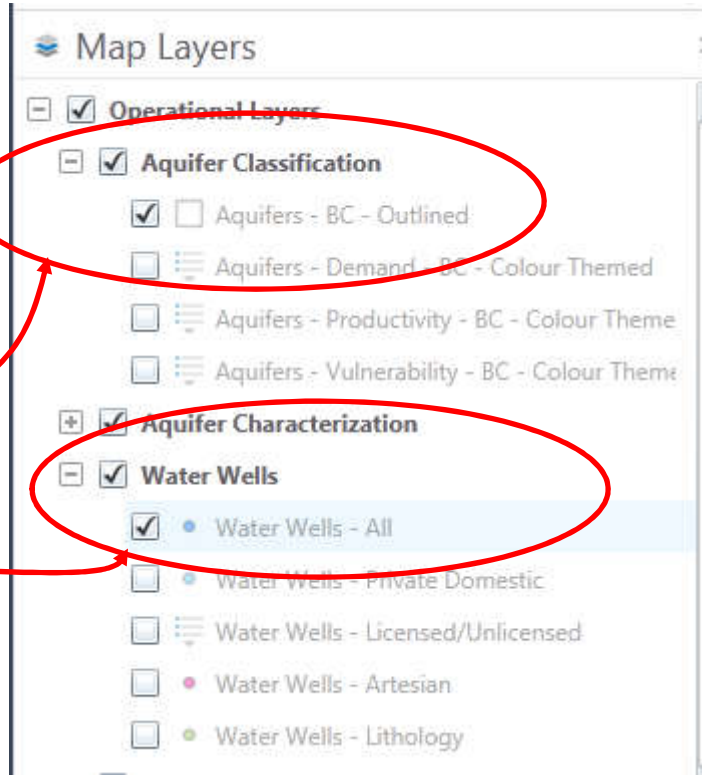


Photo credit: Natural Resources Canada

Wells and Aquifers on Your Island

To find a map of your island showing registered wells and classified aquifers:

Step 1: go to http://maps.gov.bc.ca/ess/sv/wrbc/
Step 2: Under "Map Layers" click on the "+" next to Water Wells and select the box next to "Water Wells All".
Then click on the "+" next to Aquifer Classification and select box next to "Aquifers – BC – Outlined".
Step 3: zoom into your area of interest on the map.
Step 4: add other layers in the same way to see other information of interest.

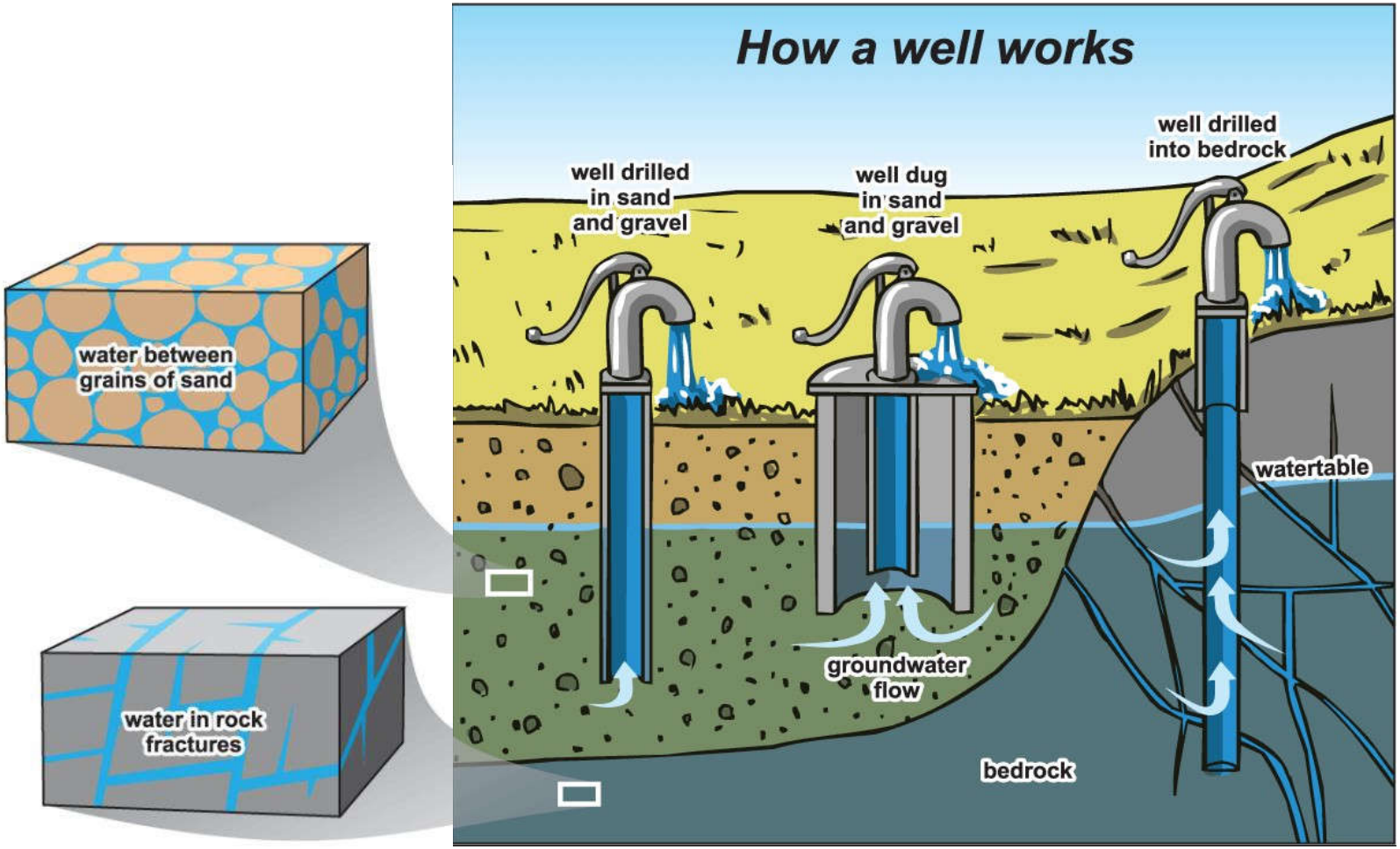


Additional Information

Access reports on local groundwater studies by searching the "Eco Cat" at:
http://a100.gov.bc.ca/pub/acat

Access water levels and chemistry data from the Provincial Observation Well Network data at (not on all islands):
http://www.env.gov.bc.ca/wsd/data_searches/obswell/map/

How a Well Works



What kind of well do I have?

There are 3 common well types.

DugWells

DrilledWells

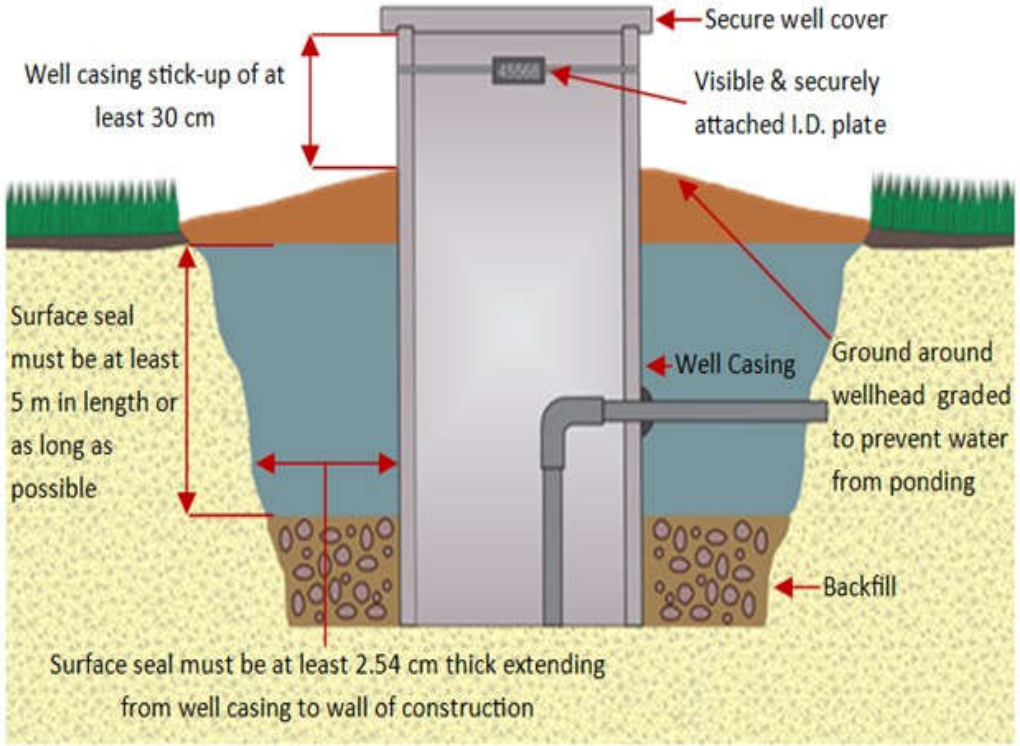
DrilledWells in Pits

Photo credit: BC FLNRO, Island Health

Well Types: Dug

Large diameter/ shallow

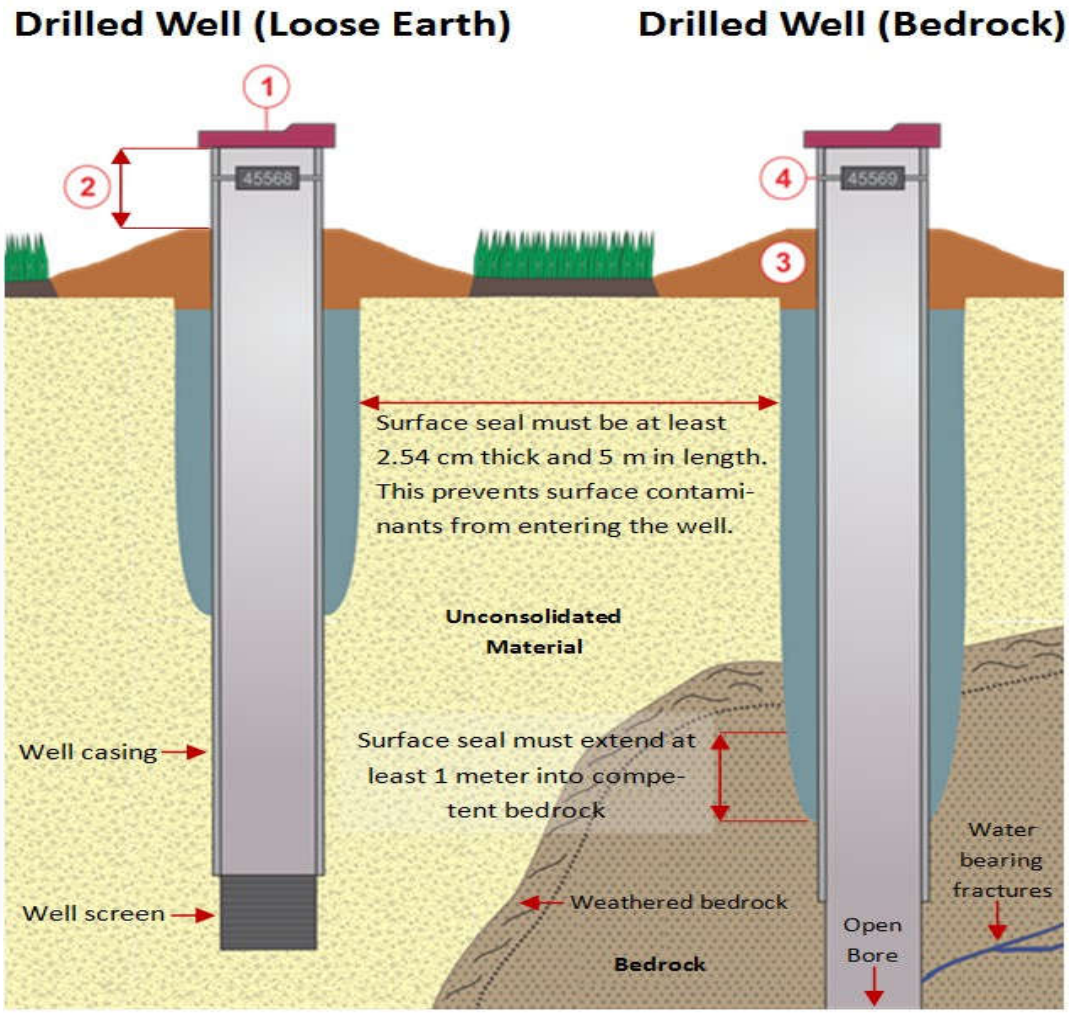
Photo credit: BC FLNRO, Ontario Ministry of Agriculture, Food and Rural Affairs/ Agriculture (OMAFRA)



Well Types: Drilled

Small diameter/ deep

Photo credit: Island Health, OMAFRA



Well Types: Drilled Wells in Pits

An excavation lined with wood, stone or metal cribbing.

Places wellhead below ground to protect from freezing.

Photo credit: Ministry of Environment (MoE)

Well Types: Drilled Wells in Pits

Pits can become infested and are commonly flooded.
(Risks: debris, bacteria, pesticides, fertilizers, disease)

Pits are a health hazard to enter.
(Risks: low oxygen, high levels of carbon dioxide, other gases)

Photo credit: MoE

See MoE brochure "Upgrading Wells in Pits"

Well Types

Shallow dug wells may be higher risk than drilled wells

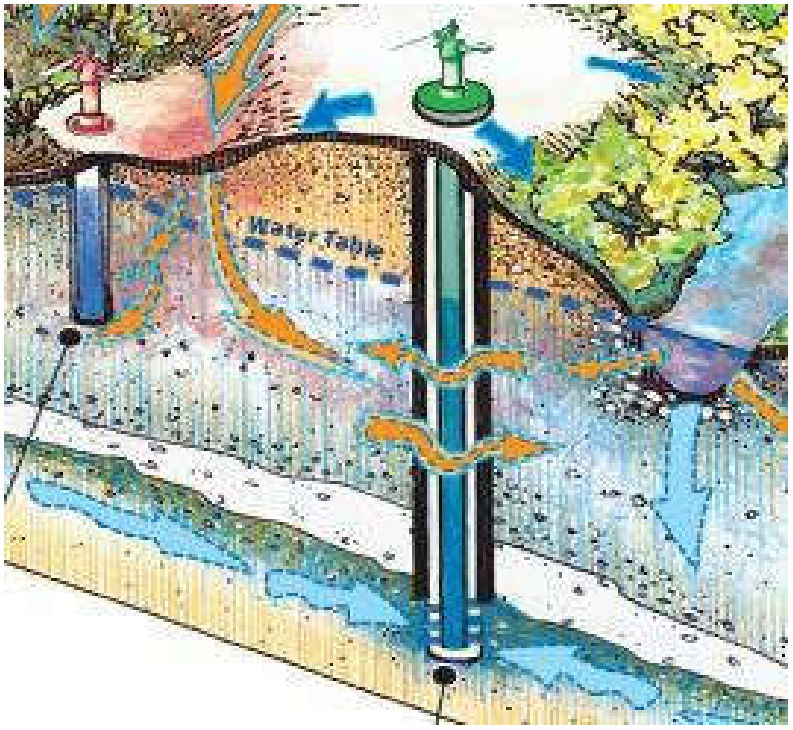


Photo credit: BC Ground Water Association

<u>The safest water source</u>:
Generally, a **drilled well** into a confined aquifer at a minimum depth of **15 metres** (49 feet)

Components of a Well

1. Borehole
   - Conduit to aquifer
2. Casing/Cribbing
   - Keep borehole open
   - Houses pumping equipment
3. Surface Seal
   - Prevents contamination from surface
   - Prevents mixing of aquifers
4. Well Intake
   - Allows groundwater into the well
   - Slotted liner/casing or screen

Photo credit: Alberta Working Well Program

Components of a Well

5. Pitless Adaptor
   - Water-tight connection to distribution system

6. Pump
   - Properly matched to recommended pumping rate

7. Well Cap
   - Protects well from direct contamination

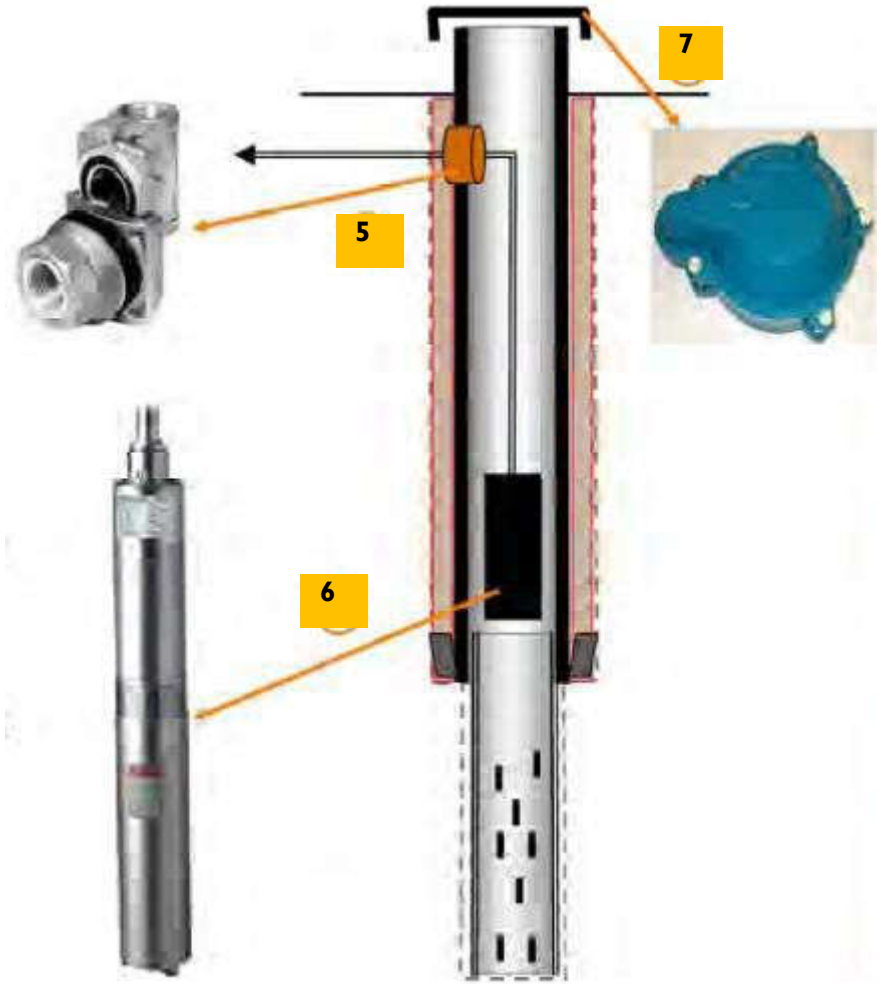
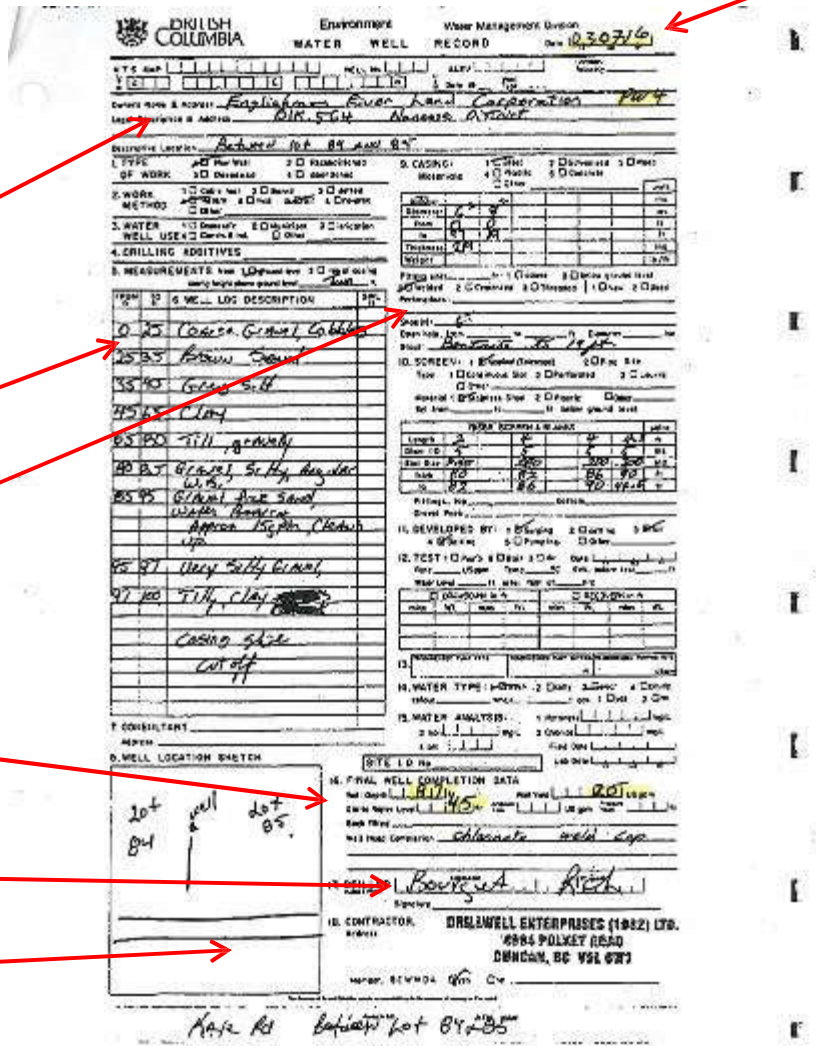


Photo credit: AlbertaWorkingWell Program

Well Records

Understanding your well record:

- Address and Owners
- Geology
- Construction
- Depth, Water Level, Yield
- Driller
- Location
- Date of construction



Well Protection

Factors influencing **water quality** & **quantity**:

1. Groundwater Laws
2. Aquifer properties
3. Location
4. Construction & set-up
5. Maintenance
6. Operation
7. Proper closure

Groundwater Laws in BC

Water Sustainability Act, Groundwater Protection Regulation	Protects groundwater supplies by requiring all wells to be properly constructed, maintained, and closed at end of service (BC FLNRO)
Environmental Management Act	Prohibits disposal of waste without a permit (MoE)
Drinking Water Protection Act	Protects water supplies by prohibiting contamination of a water source (Island Health)
Public Health Act	Protects water supplies by requiring well setbacks of 30m from potential source of contaminants

1. Aquifer Properties

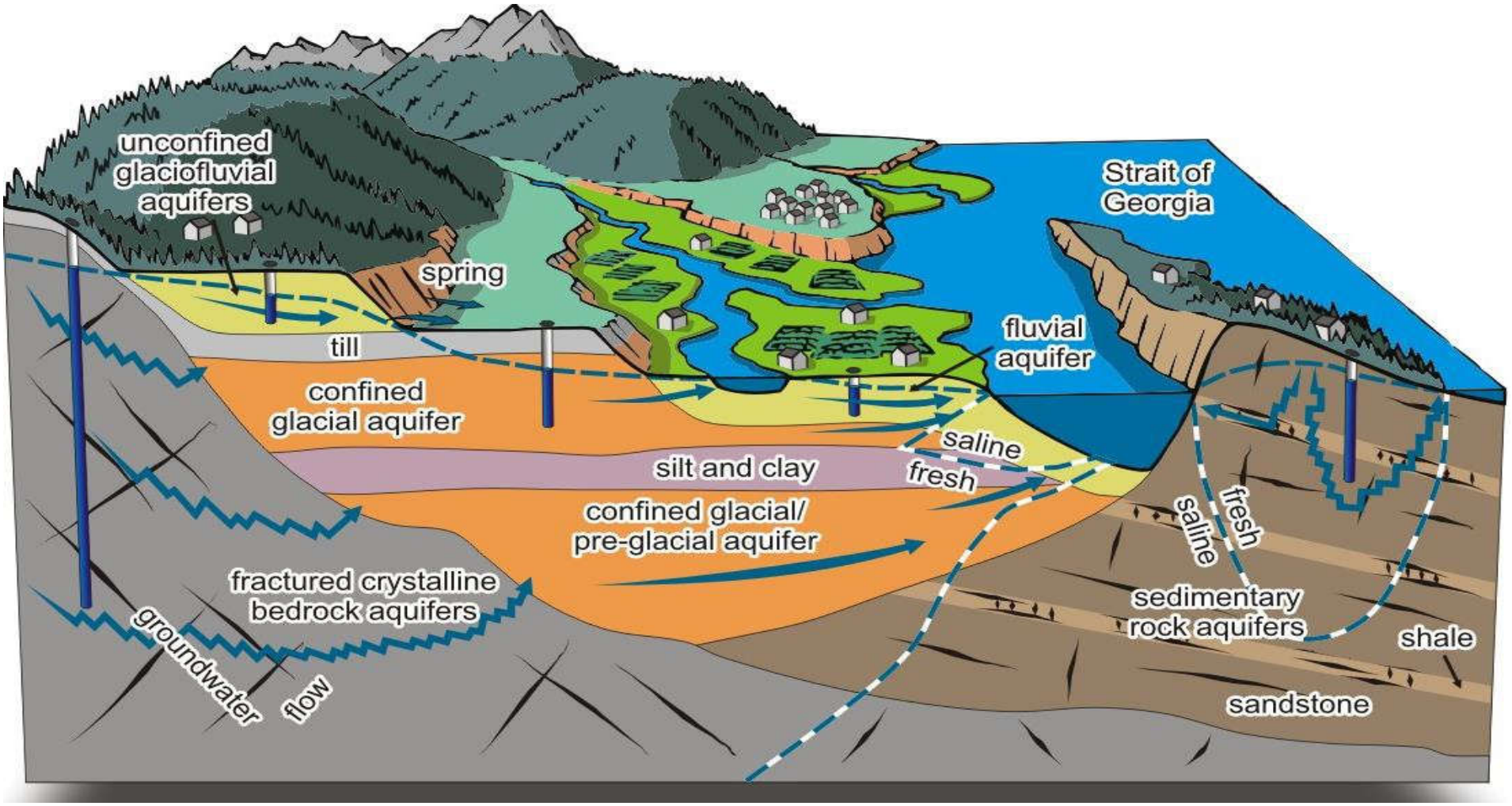
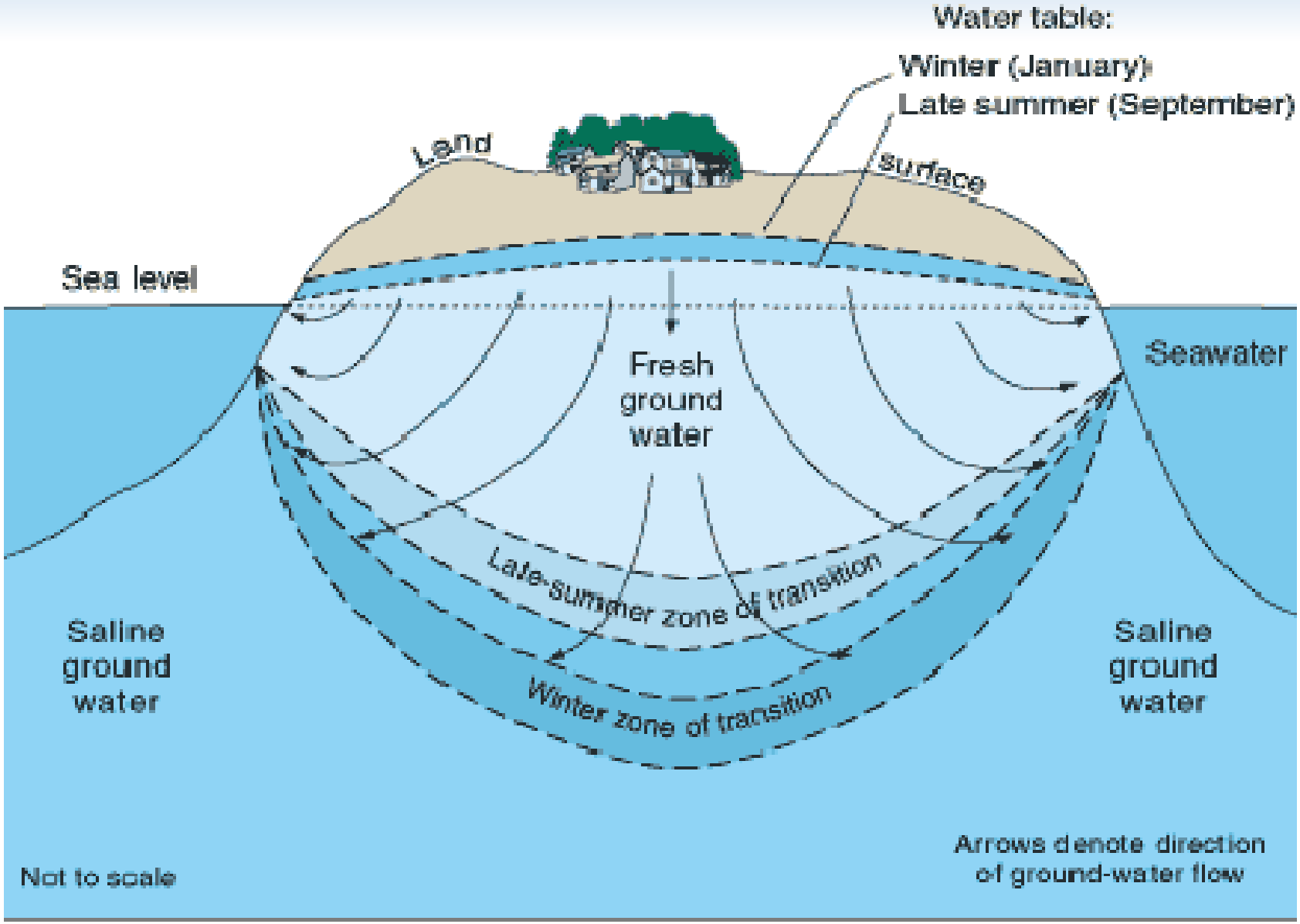


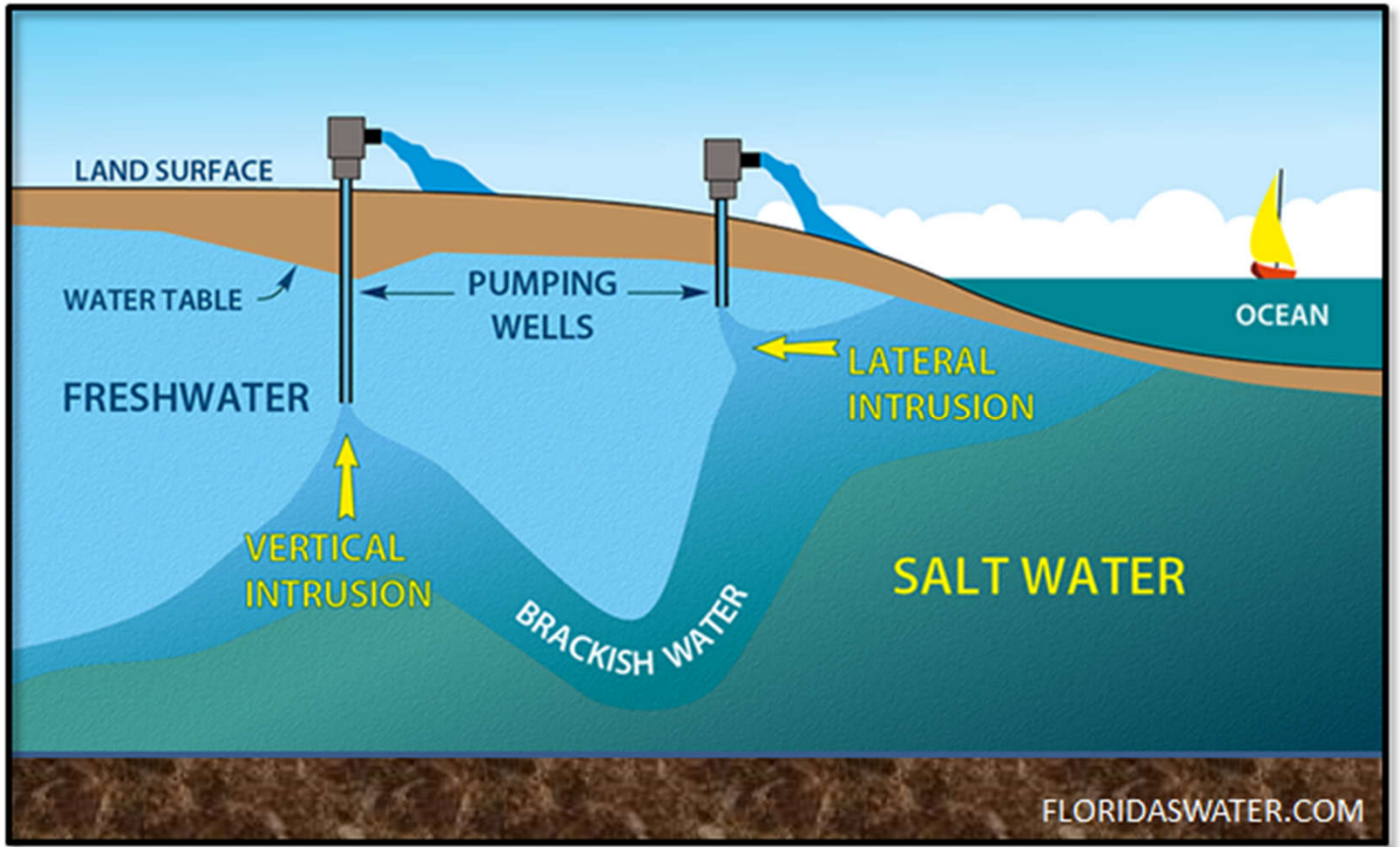
Photo credit: Natural Resources Canada

1. Coastal Aquifers & Saltwater Intrusion



1. Coastal Aquifers & Saltwater Intrusion

Well operation can cause saltwater to be introduced to a well/aquifer.



1. Coastal Aquifers & Saltwater Intrusion

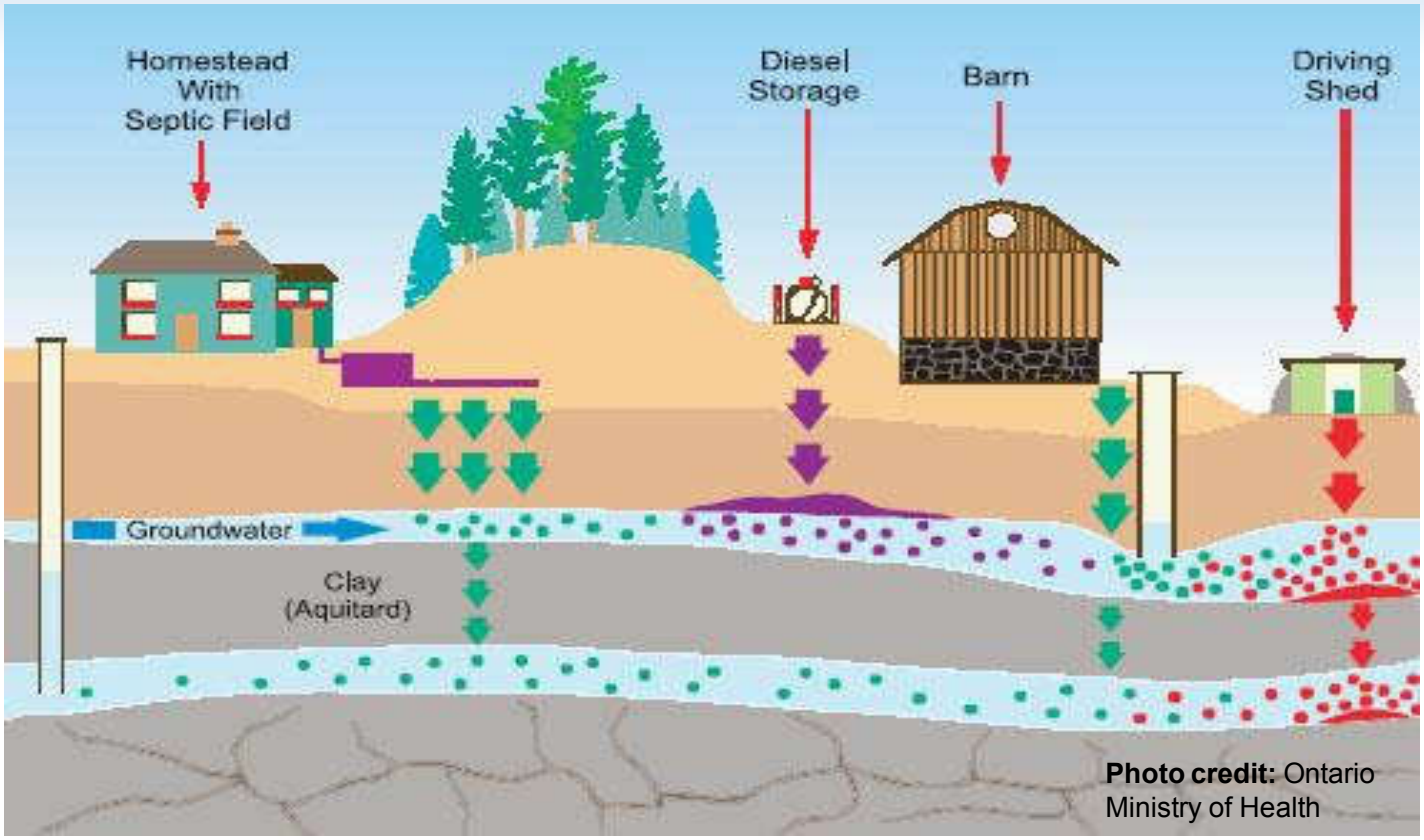
Risk factors for saltwater intrusion include:

- Proximity to coast (500 m)
- Well depth (>200 ft)
- Pumping rate &/or well density
- Peninsulas and low-lying regions

Test your well water for signs:

- Electrical Conductivity (>1000 us/cm)
- Total Dissolved Solids (>700 mg/L)
- Chloride Concentration (> 150 mg/L)

2. Ideal Well Location



- High elevation
- Secure, dry area
- Avoid wells in pits
- 30m / 100' away from potential contaminant sources
- Not in basement or surrounded by concrete

2. Possible Contaminant Sources

30 metres or 100 feet from potential contaminant sources including:

Pesticides	Septic Fields
Vehicles	Storage Tanks
Fertilizer	Contaminated Runoff
Fuel	Waste
Animals	Etc.

3. Construction & Set-up

Standards for well construction protect the health of your family and the aquifer.

- All drilled wells, and dug wells more than 15m deep, must be constructed by a provincially registered well driller

- All pumps must be installed by a provincially registered pump installer

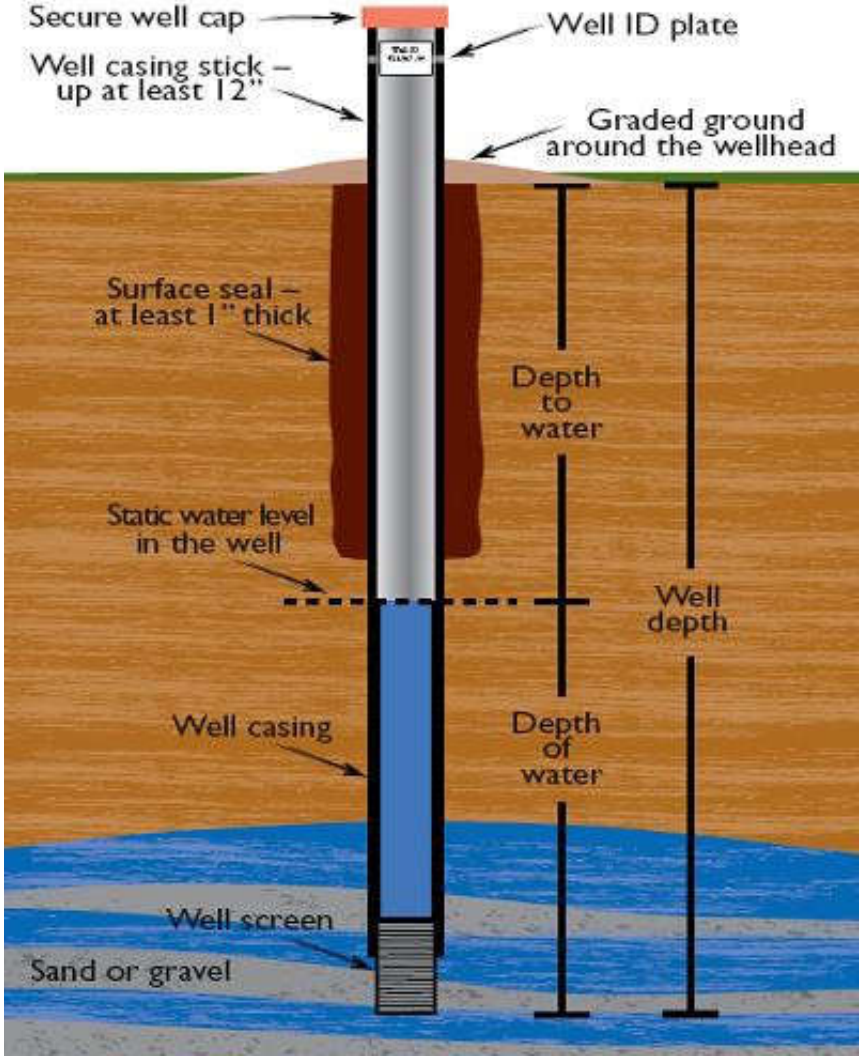


Photo credit: BC FLNRO

3. Construction & Set-up: ID Plates

All new wells must have identification plates

Available from the well driller

Photo credit: BC FLNRO

3. Construction & Set-up: Well Caps

Wells must have a water-tight, vermin-proof cap

Photo credit: BC FLNRO

3. Construction & Set-up: Well Caps

Different types of well caps…

- Dug well
- Drilled wells

3. Construction & Set-up: Surface Seal

A surface seal prevents contaminants from entering a well along the outside of the casing

An improper surface seal allows contaminants into the well

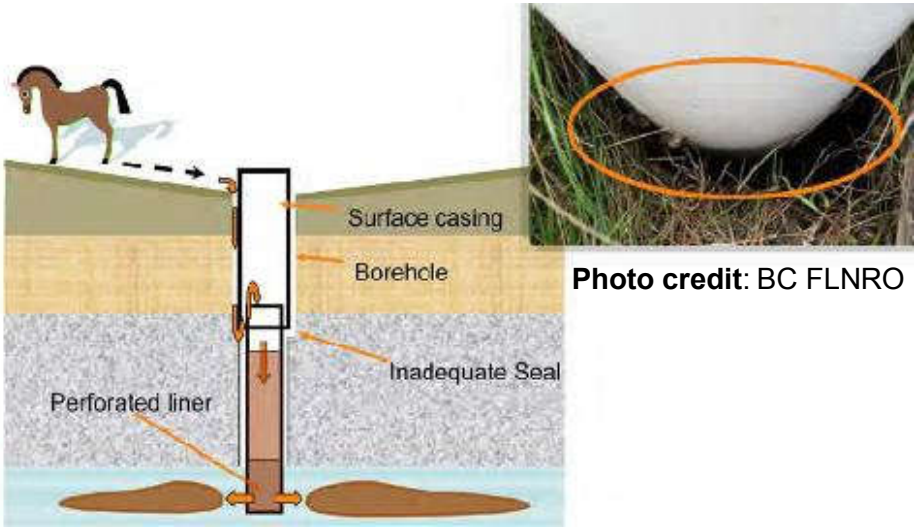


Photo credit: BC FLNRO

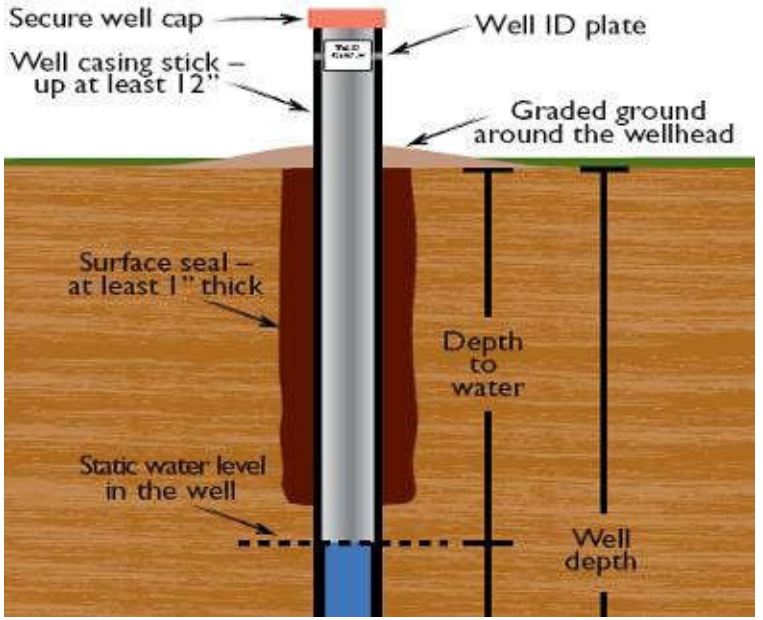


Photo credit: Alberta Working Well Program

3. Construction & Set-up: Surface Seal

Well Protection

Photo credit: MoE

Photo credit: Alberta Working Well Program

3. Construction & Set-up: Pumphouse

Keep the pumphouse clean and free of stored chemicals.

Ideally, don't construct concrete a floor around the wellhead.

Lock it up!

3. Construction & Set-up: Artesian Flow Control

Artesian flow must be stopped or brought under control

Responsible parties:

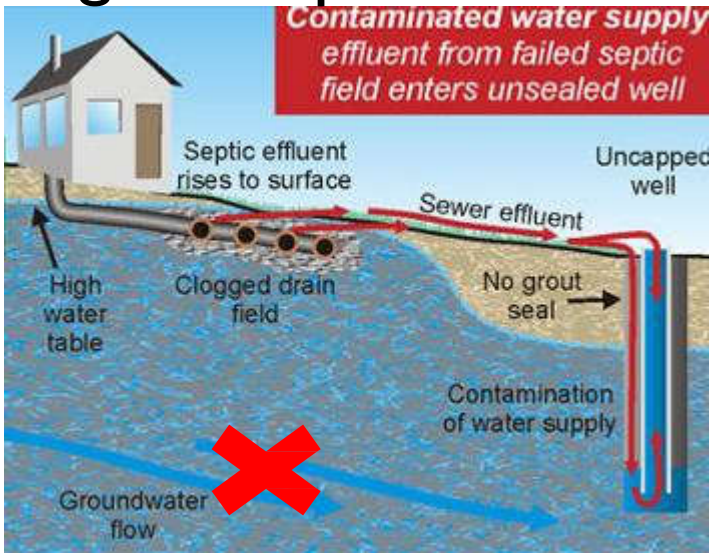
- Driller at time of construction
- Well owner or land owner for existing well

"Under control" means:

- Clear of sediment
- Entirely conveyed through casing (if applicable)
- Can be turned off indefinitely
- Does not pose a threat to property, public safety or the environment

4. Well Protection: Good Maintenance

- Inspect the wellhead regularly
- Properly maintain septic system
- Test water quality regularly
- Keep wellhead and pump house in good repair and free of contaminants
- Disinfect the well and water system if:
  - Work is done on the well
  - Water testing indicates bacterial contamination
  - After a flood if surface water entered well



Prevent Foreign Matter from Entering a Well

- Refuse
- Carcasses
- Human/animal waste
- Pesticides/fertilizers
- Construction debris
- Chemicals (paint, fuels, etc.)
- Flood waters and debris

Owner Maintenance Requirements

Store contaminants >3m away and prevent from traveling within 3m of wellhead

Maintain 0.3m stick up and protect from damage

Keep ground sloped so water does not pond and is conveyed away from wellhead

Maintain access to wellhead for inspections

Keep area clear of obstructions and vegetation

Replace ID plate if lost or damaged

Maintain surface seal and fill any visible annular space with sealant

5. Well Operation

1. Controlling pumping in well
   - Adjust pump depth setting
   - Pumping on timer (well "sipping")
   - Pump to storage tank not directly to pressure tank
   - Install a shut-off valve

1. Increasing water storage
   - ie. pump in wet season, install rainwater collection system, buy water

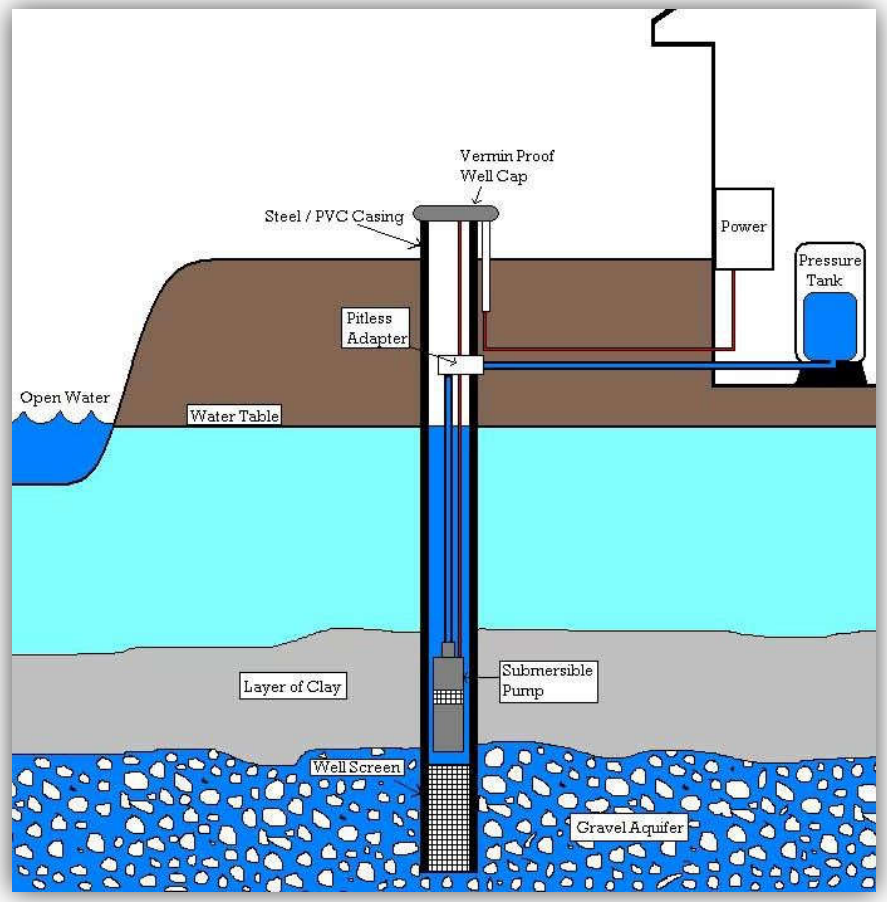


Photo credit: buildingadvisor.com

5. Well Operation

3. Monitoring
   - Groundwater levels
   - Meter water use
   - Electrical conductivity
   - Water quality testing (include chloride)

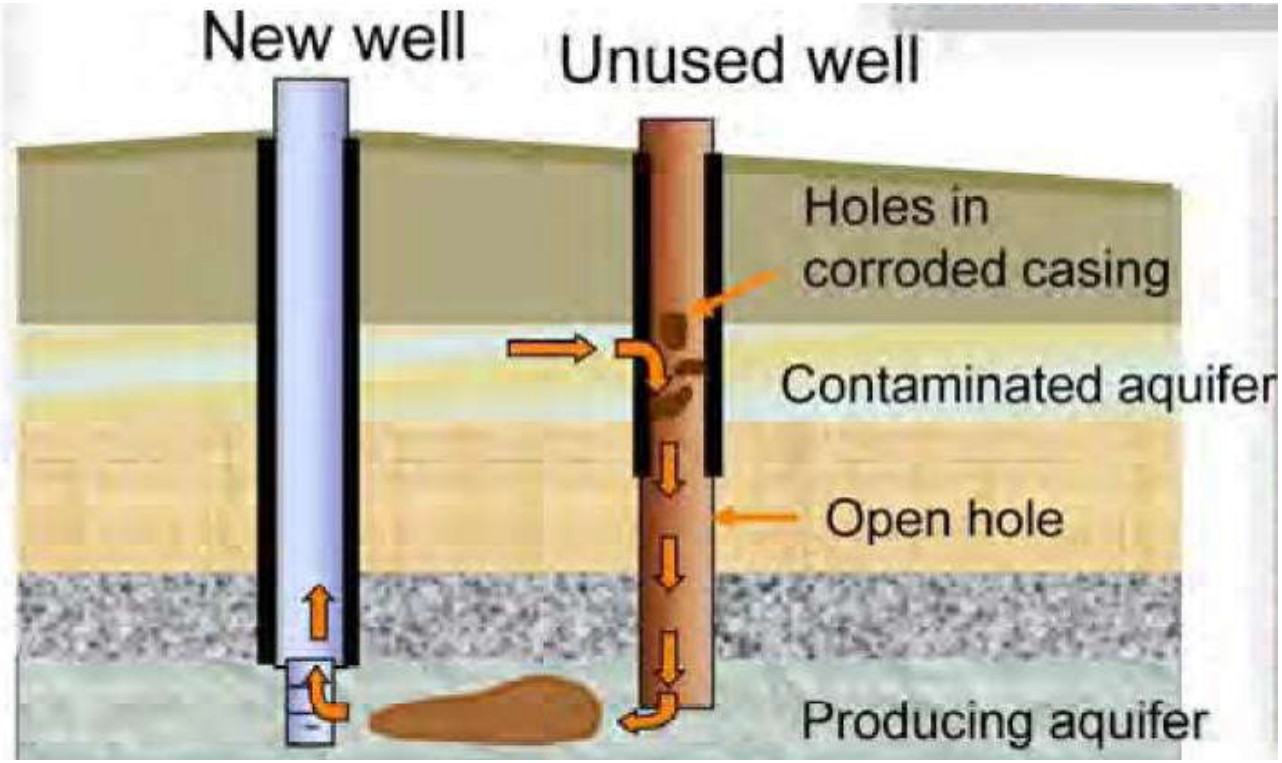
4. Early detection & elimination of leaks
   - Use shut-off valve on hose

Photo credit: bmeters.com

Photo credit: heroninstruments.com

6. Decommission Abandoned Wells

Improperly closed wells create a direct pathway for groundwater contamination



6. Decommissioning

Photo credit: BC MoE

Anyone can decommission a drilled well < 5 m or dug well <15 m Deep. Must follow GWPR standards.

All other wells require a qualified well driller or pump installer.

Wellhead Protection… Starts with Inspection

Photo Credit: BC FLNRO

What's wrong with this photo?

Wellhead Protection

Photo Credit: BC FLNRO

What's wrong with these photos?

Wellhead Protection

Photo Credit: BC FLNRO

What's wrong with these photos?

Wellhead Protection

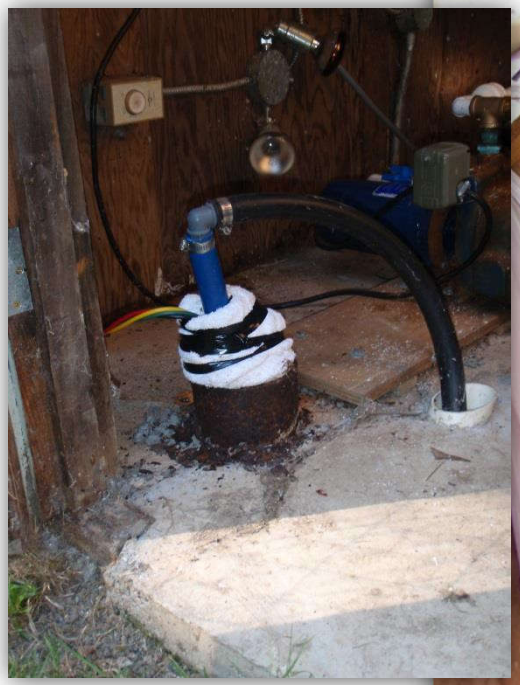


Photo Credit: BC FLNRO

What's wrong with these photos?

Estimated Cost of Well Upgrades

FIX	APPROX. COST
Well Cap	$55 - $175 (usually more for a dug well)
Well Casing Stick-Up Extension*	$300 -$600
Surface Seal *	$1000 - $2000
Well Closure *	$800 - $2000
New Well *	$7,000 - $20,000

*** Work MUST completed by a registered qualified person.**

When to call a professional

Well owners can:

- Install a cap or cover and flow meter
- Measure water depth and sample
- Deactivate a well
- Disinfect a well
- Close a drilled well < 5m or dug well < 15m
- Construct a dug well < 15 m

For all other work, a registered qualified well driller or pump installer is required. Registries are available online

Water Quantity

The amount of water a well can produce is influenced by:

- Geology
- Aquifer type
- Precipitation / recharge
- Depth
- Pumping rate

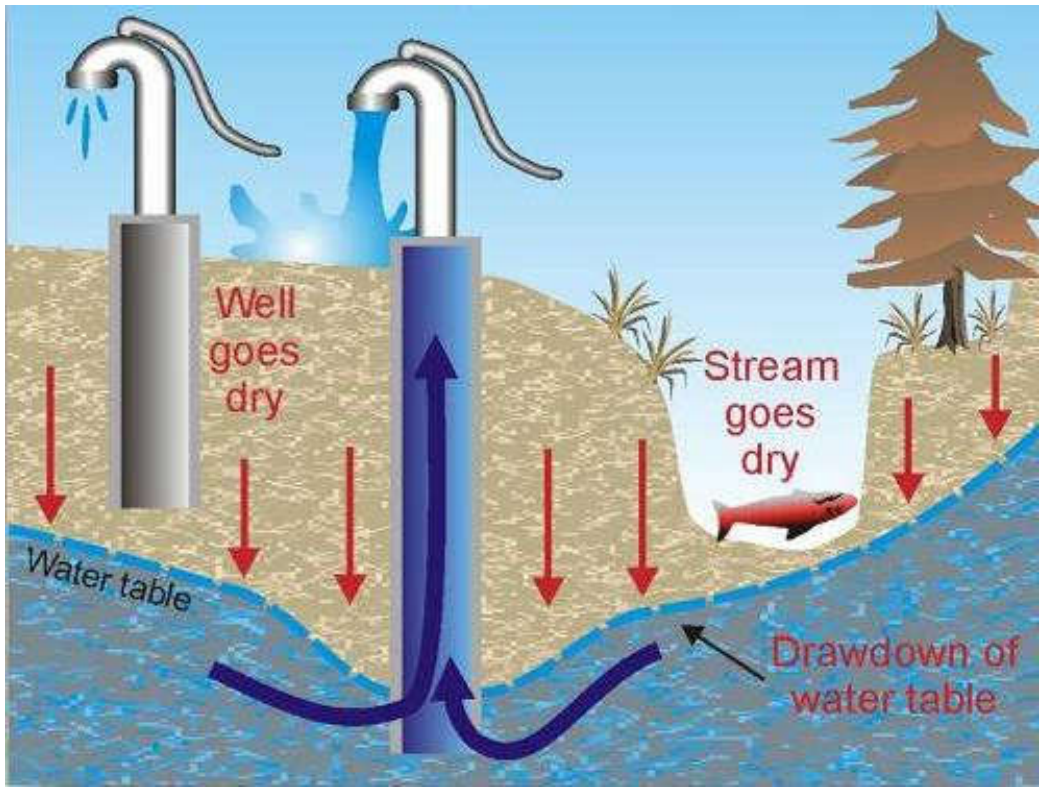


Photo credit: Natural Resources Canada

Groundwater & surface water are connected:

Over pumping of the groundwater can impact stream base flow

Water Quantity: Common Problems

- Low well yields
- Interference between adjacent well users
- Seasonal water shortages
- Aquifer overuse or depletion

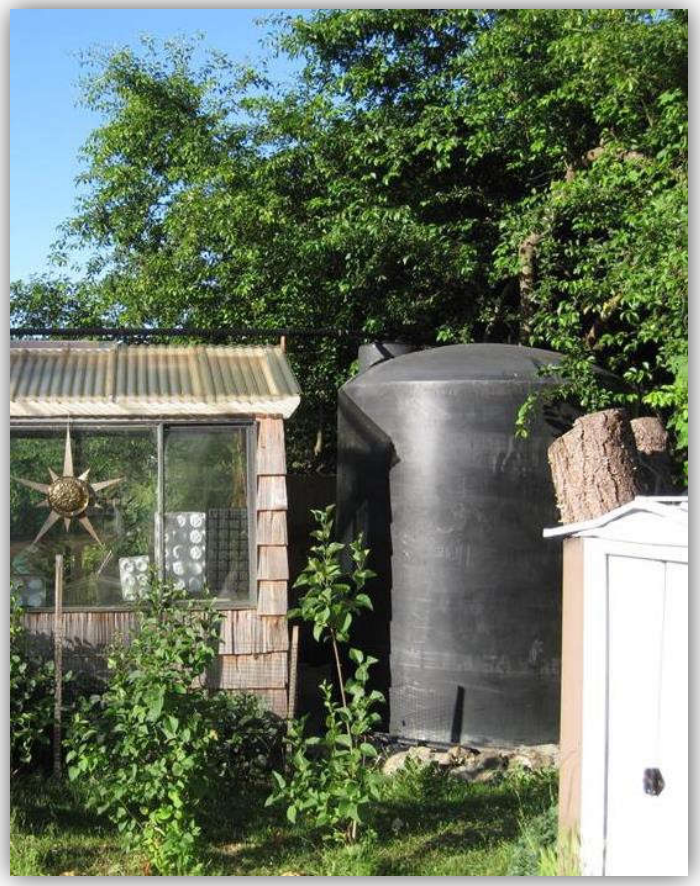
Photo credit: Natural Resources Canada

Water Quantity: Minimise Risk

- If you are at risk of running out of water → put contingency plans in place before water shortages occur!
  - identify alternate water sources

- Never use your well to store hauled water → buy or rent cisterns / tanks
  - stored water may need treatment

Follow water conservation practices consistent with local restrictions



Climate Change & Drought Management

What can we expect?

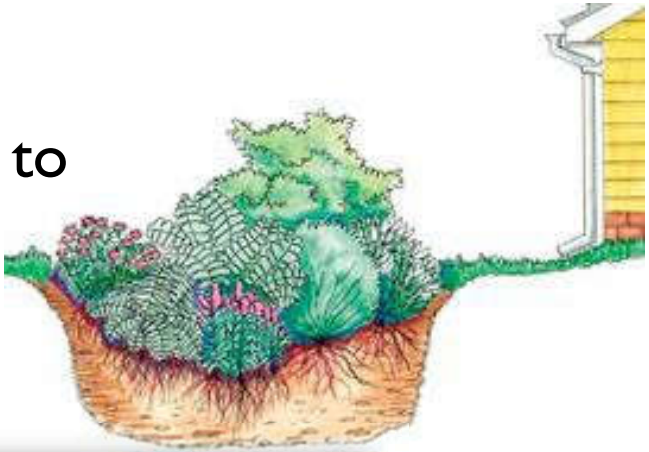
- Increased winter precipitation (+5%)*
- Decreased summer precipitation (-18%)*
- Warmer temperatures (+1.6 C°)*
- More extreme events – droughts/floods

- **Likely drier summers & increased water demands**
- **Shallow wells and marginal aquifers hit first**

*Source: Pacific Climate Impacts Consortium. Values for 2050 are compared to 1961-1990 baseline. We are already experiencing changes.

Climate Change & Drought Management: Minimise Risk

- Conservation & Curtailment
  ie. Increase efficiency & cut back on use
- Increase storage capacity on property to fill during wetter times
- Diversify water sources
  ie. add rainwater collection
- Change landscaping
  ie. xeriscaping, rain gardens, etc.
- Monitor water levels



Groundwater Licensing

- All groundwater used for non-domestic purposes requires licensing
  - E.g., more than one domestic home, livestock watering, small commercial, irrigation over 1000 m^2

- Exiting groundwater users have until March 1, 2019 to apply for a license. Application fee is waived if applied before Dec 31, 2017.

- All new (post Feb 28, 2016) non-domestic groundwater users must apply prior to diverting and using the water.

- License holders pay an annual water rental based on the purpose and amount to be diverted.

Groundwater Licensing

A license is:

- Attached to the land, but will require a "transfer of ownership" (a simple process) if the land is subdivided or sold;
- A right to divert groundwater from an aquifer for use on the property;
- Not attributed to a well. The well is the works. A license is a right to use works;
- For a specific use only e.g., irrigation, drinking water system, livestock watering;
- For a pre-determined volume; and,
- Sometimes for a specific timeframe e.g., winter only.

- During scarcity, right to water will be dictated by FITFIR, based on date of first use.

- Potential Buyers
  - Do they know the licensing requirements?
  - Do they plan to use a domestic well to supply other water needs?

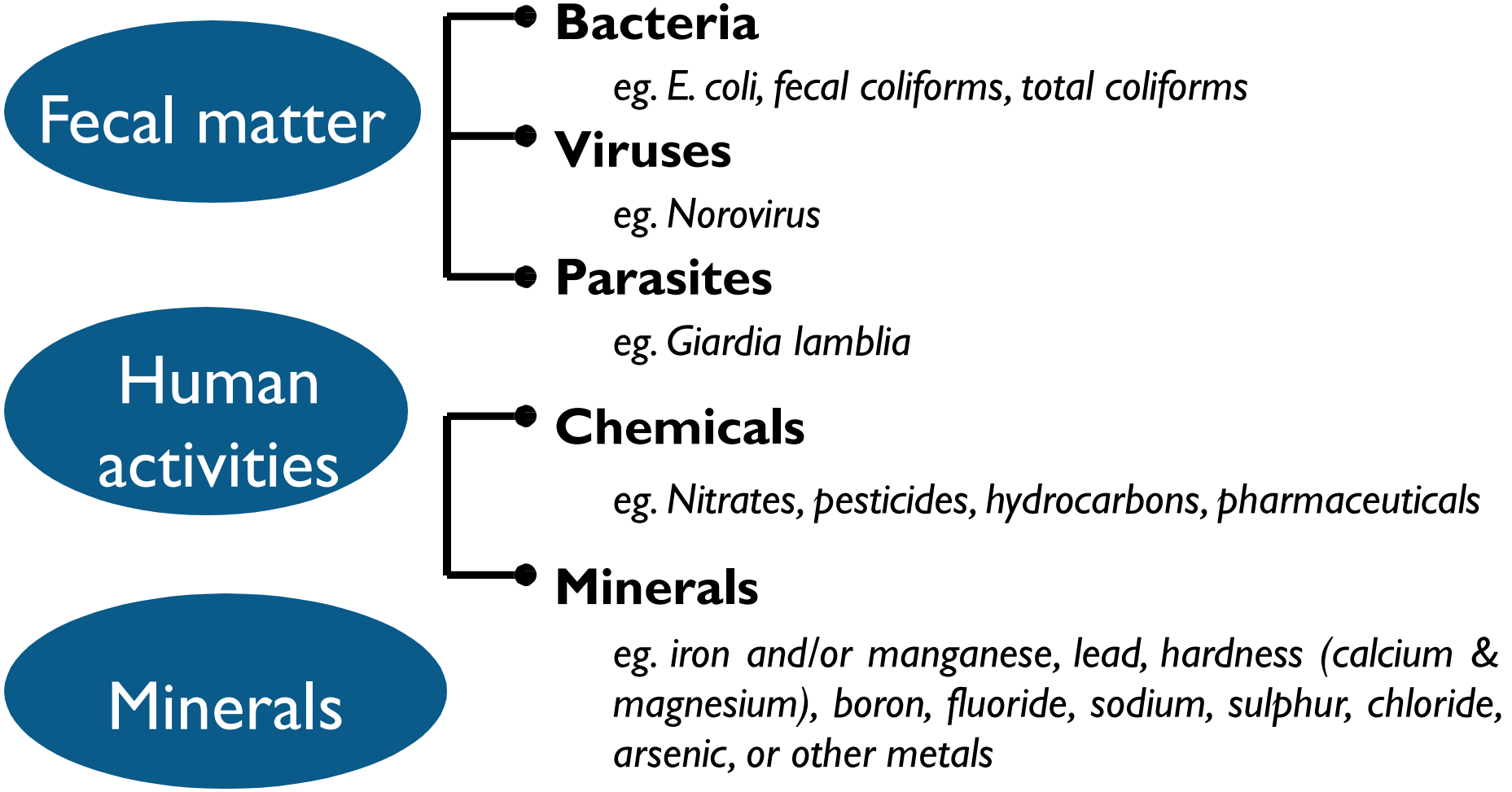
Contact Front Counter BC for licensing questions: 1-877-855-3222

Groundwater Quality

Water Quality: Common Concerns

- Bacteria
- Naturally present minerals
- Aesthetic concerns
- Human activities and contaminants

Potential Contaminants



Water Quality Testing

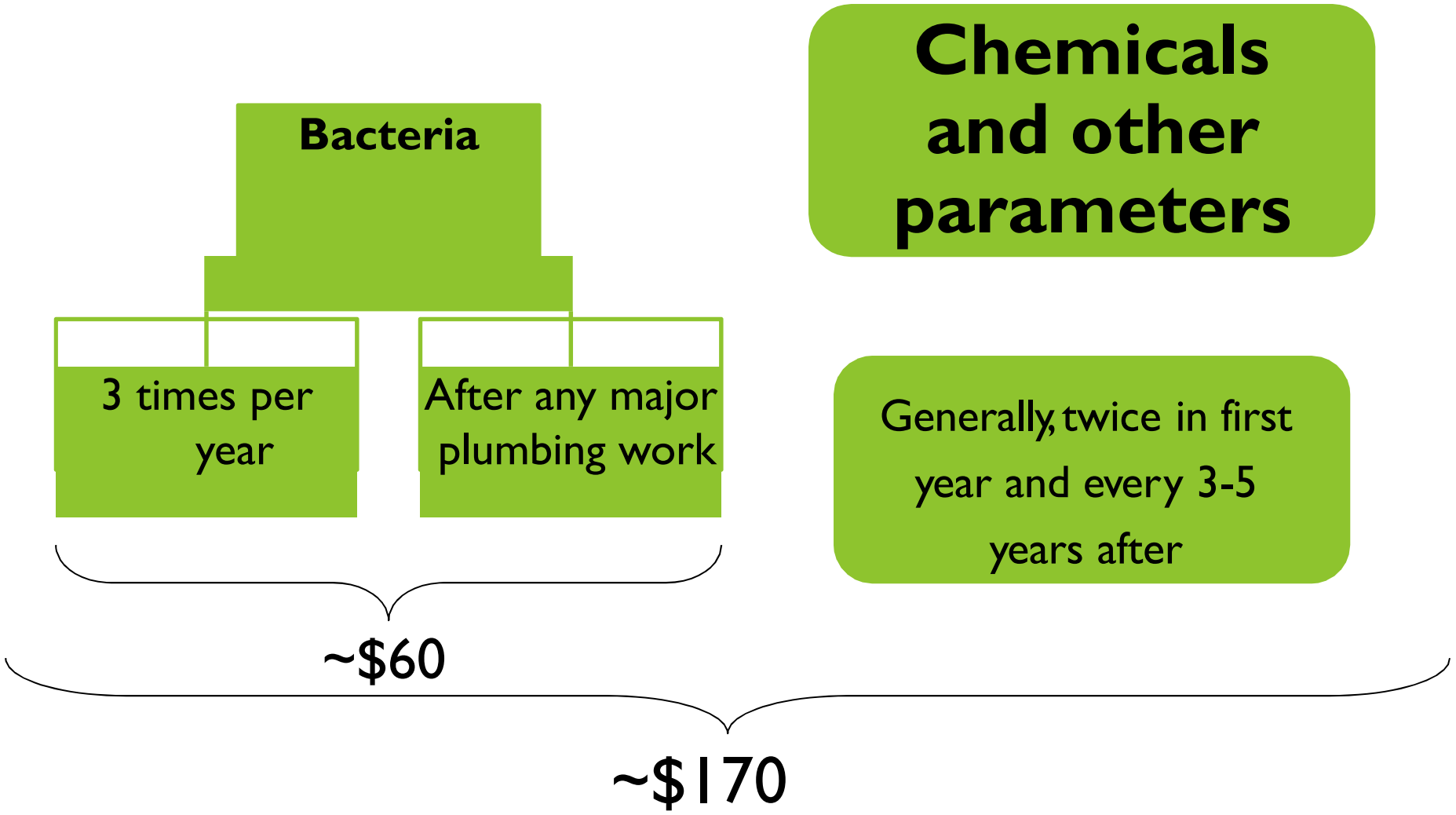
Most well owners drink untreated groundwater

However, wells can contain naturally occurring contaminants, or become contaminated with harmful ***chemicals*** or ***pathogens***

Pick up a water testing kit today!

Water may taste and look fine, but contain harmful substances

When to Test?


Bacteria
3 times per year
After any major plumbing work
~$60
Chemicals and other parameters
Generally, twice in first year and every 3-5 years after
~$170

How to Take a Water Sample

Test Results

MaximumAcceptable Concentration

Aesthetic Objective

HOME SAFETY SCAN (DRINKING WATER)

Maxxam ID							
Sampling Date					2015/09/02 08:00		
COC Number							
	UNITS	MAC	AO	OG	CISTERN	RDL	QC Batch
ANIONS							
Nitrite (N)	mg/L	**1**	-	-	<0.0050	0.0050	8027240
Calculated Parameters							
Total Hardness (CaCO3)	mg/L	-	-	-	26.5	0.50	8024738
Nitrate (N)	mg/L	**10**	-	-	0.085	0.020	8024739
Misc. Inorganics							
Fluoride (F)	mg/L	**1.5**	-	-	0.031	0.010	8028453
Anions							
Dissolved Sulphate (SO4)	mg/L	-	500	-	2.07	0.50	8028633
Dissolved Chloride (Cl)	mg/L	-	250	-	53	0.50	8028631
Nutrients							
Nitrate plus Nitrite (N)	mg/L	-	-	-	0.085	0.020	8027237
Physical Properties							
pH	pH	-	6.5:8.5	-	7.48	N/A	8027075
Physical Properties							
Total Dissolved Solids	mg/L	-	500	-	132	10	8027626
Elements							
Total Sulphur (S)	mg/L	-	-	-	3.4	3.0	8025108
Microbiological Param.							
E. coli	MPN/100mL	**<1**	-	-	<1	1	8026959
Total Coliforms	MPN/100mL	**<1**	-	-	28.8	1	8026959

RDL = Reportable Detection Limit N/A = Not Applicable

Water Quality Tests

Test results will give you CLUES as to the sources of contamination

FOR EXAMPLE …Total Coliform present

Can mean surface water is getting into the well → problem with the well construction

If test results do not meet Drinking Water Guidelines…

Shock Chlorination

- Simple disinfection method
- Used when bacterial contamination of the well has occurred (or is likely to have occurred, such as after pump replacement)
- How to?
  - See MoE brochure "Water Well Disinfection"

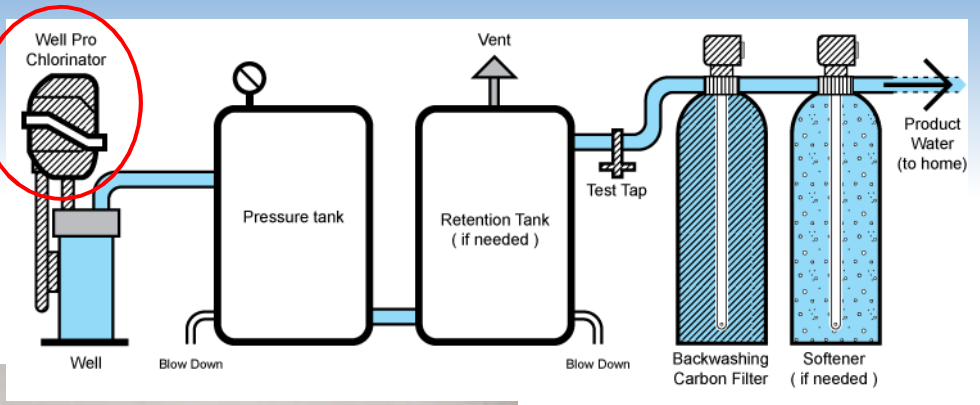
Disinfection

Disinfection for ***pathogens***

- ✓ Chlorinators
- ✓ UV
- ✓ Distillers
- ✓ Ozonators

- ✗ Brita filters
- ✗ Charcoal
- ✗ Ion exchange

Chlorinator



purewaterproducts.com

support.cleanwaterstore.com

Ultraviolet System

vanislewater.com

uvpure.com

Note: iron, manganese, hardness, sediments, turbidity and tannins can interfere with proper UV function. Different types of UV have different tolerances for these parameters. Pretreatment may be required for proper disinfection to occur.

Distiller Unit

distilleddeonizedwater.com

cleardomesolar.com

braintuner.com

ozomax.com

Ozonator

Treatment

Treatments for ***chemical contamination*** and ***physical parameters***

- ✓ Reverse osmosis
- ✓ Activated carbon filters
- ✓ Ion exchange

- ✗ Chlorine shock
- ✗ UV
- ✗ Distillers

Reverse Osmosis Unit

rainfresh.ca

Activated Carbon filtration

rainfresh.ca

Ion Exchange

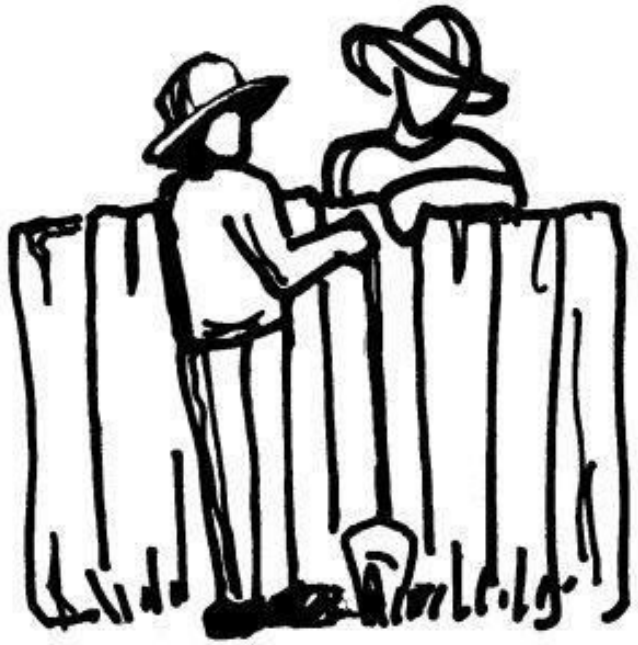
watersystemsz.com

Suspected Problems

On your property: Contact your local health authority or FLNRO

On a neighbours' property:

- Talk to your neighbour
- Provide information
- Discover barriers to solutions
- If the issue can't be resolved, contact FLNRO or local health authority



Resources

Island Health
(Vancouver Island Health Authority)
Information on test results and your well

Nanaimo: 250-755-6215
www.viha.ca

Ministry of Forests, Lands and Natural Resource Operations
(FLNRO)
Information on legislation, regulations, local groundwater resources and your well
Front Counter BC
Phone: 1-877-855-3222
Email: FrontCounterBC@gov.bc.ca

Ministry of Environment (MOE)
Information on legislation, regulations and your well
Email: Groundwater@gov.bc.ca

Islands Trust

island health

Questions?

Please fill out the Feedback Form