Newfoundland Labrador

Identifying Problems and Solutions for Groundwater Wells

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Acknowledgements

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Water Well Problems

- Water Quality
- Water Quantity/Adequate Supply
- Well Location Concerns
- Pressure Problems
- Mechanical Issues
- Biofouling
- How ***Not*** to Construct a Well

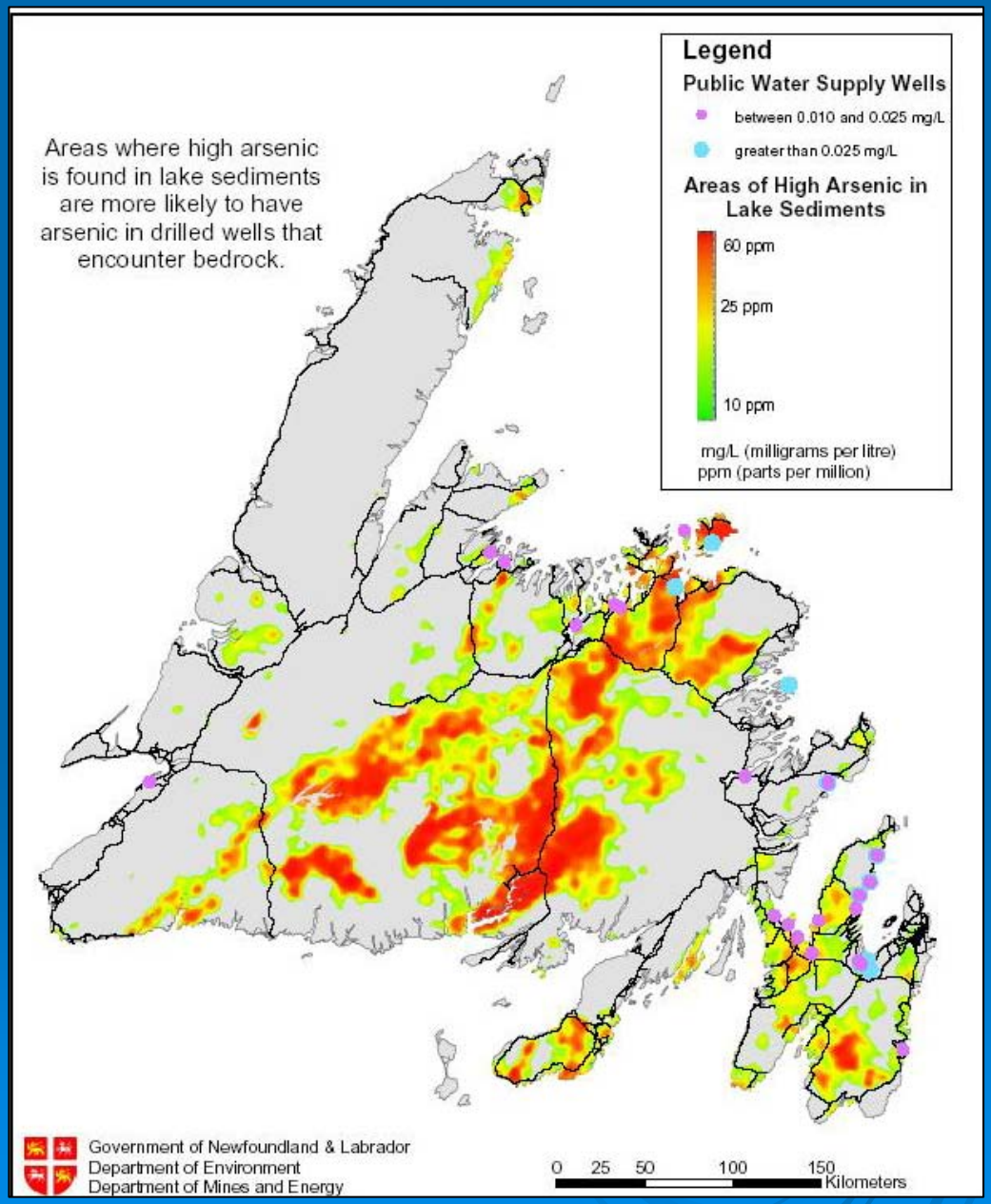
Water Quality

- Metals and Minerals
- Aesthetics (color, odour, taste)
- Pesticides, Fertilizers & Gasoline

Metals and Minerals

- Arsenic
- Manganese
- Nitrates
- Sodium Chloride (salt)
- Iron
- Hydrogen sulfide
- Hardness

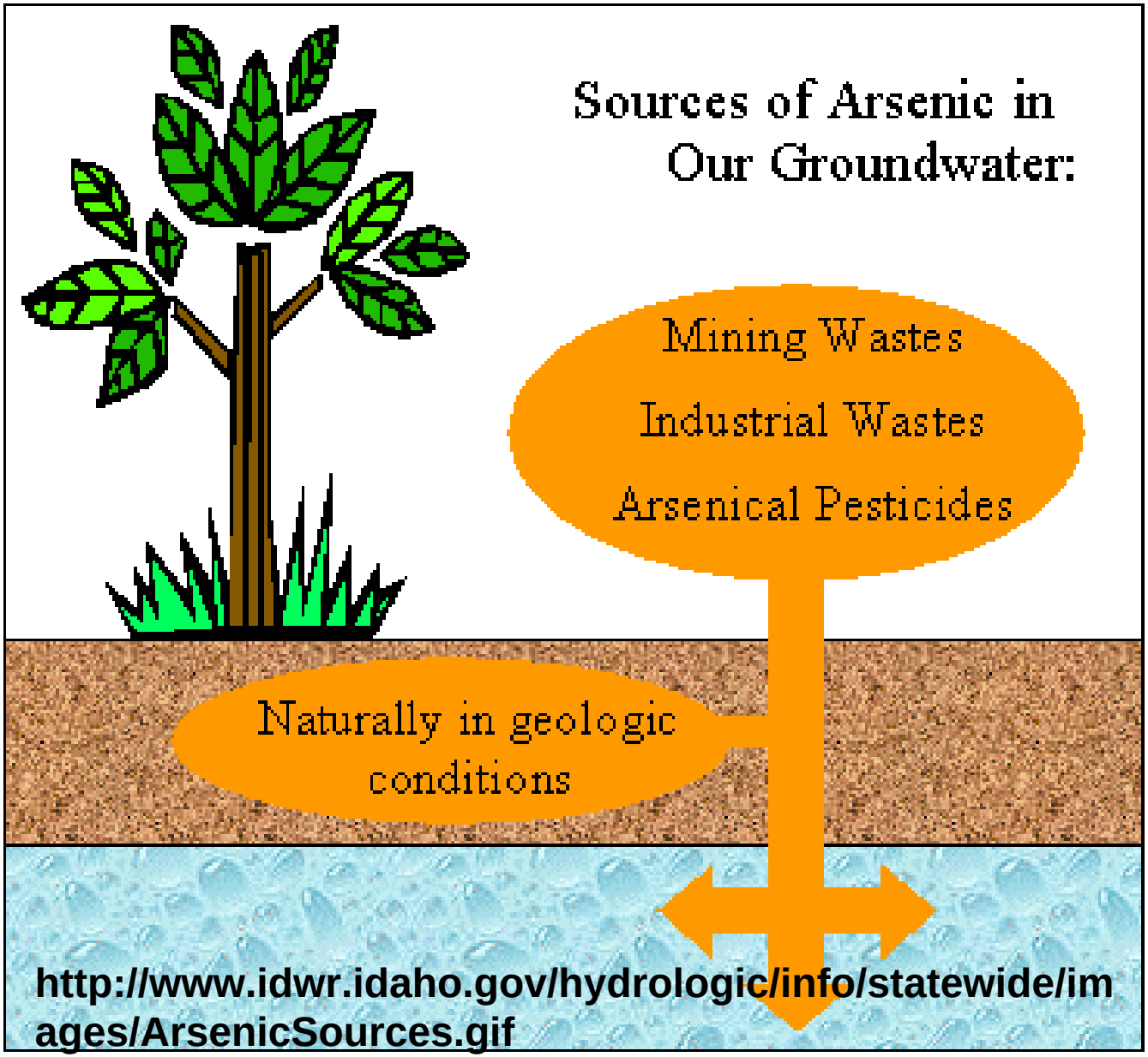
Arsenic



Areas of Potential Arsenic Concentration in Well Water

Arsenic

Causes	Solutions
Geology of area Mining & Industrial wastes Pesticides **Detected **only** by testing the water*	Installation of treatment system: 1. Filters 2. Reverse osmosis


Sources of Arsenic in Our Groundwater:
Mining Wastes
Industrial Wastes
Arsenical Pesticides
Naturally in geologic conditions
http://www.idwr.idaho.gov/hydrologic/info/statewide/images/ArsenicSources.gif

Manganese

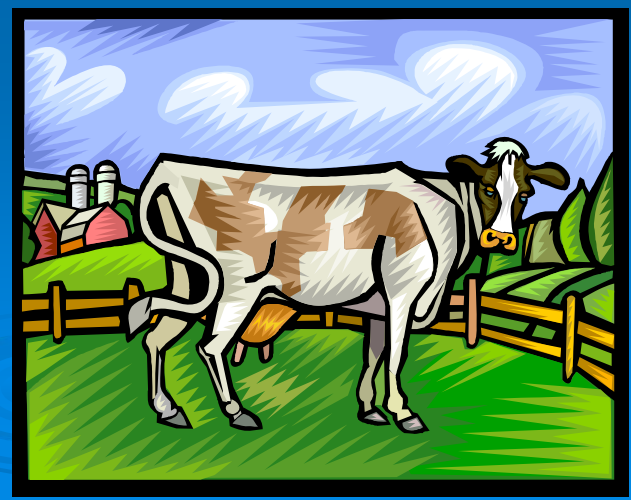
- Found often with iron
- Metallic taste in beverages
- Black stains on fixtures and laundry
- Like iron, can lead to microbial growth in distribution systems.
- May form deposits within pipes, with black particles breaking off, giving water an unpleasant appearance and taste.

Manganese

Causes	Solutions
Naturally occurring in minerals and rocks May also leak into water from industrial effluent, acid-mine drainage, sewage, and landfill leachate	Treatment systems: 1. Filtering 2. Chlorine 3. Ozone

Nitrates

- Requires a water test
- Harmful to human health
- Contamination sources
  - Septic Systems
  - Manure
  - Fertilizers



Nitrates

Causes	Solutions
Too close to contamination source Casing not properly sealed or watertight Contaminated aquifer	Treatment processes: 1. Reverse osmosis 2. Distillation 3. Ion exchange

Sodium Chloride (Salt)

- **Salty taste**

Causes	Solutions
Naturally from rocks and soil Road salt Salt water intrusion	Filtering by reverse osmosis

Iron

- Upon exposure to air, iron in water precipitates and staining will occur
- Reddish brown stains on fixtures, dishes, laundry
- Reddish color in water sample after standing 24 hours

Iron

Causes	Solutions
Mineral deposits. Soil & sediments.	Water softener filter Aeration Potassium permanganate ion exchange

Hydrogen Sulfide

- Foul taste and “rotten egg” odour
- Scale & black stains on pipe
- Unlikely a human would consume enough to be harmful due to unpleasant taste and odor.

Hydrogen Sulfide

Causes	Solutions
Decaying vegetation & oil deposits beneath the earth's surface.	Can be treated with a filter & water softener
Sulphate reducing bacteria.	Shock chlorination

Hardness

- Naturally occurring Ca & Mg
- Not a health hazard
- But causes buildup and scaling of
  - Appliances
  - Plumbing fixtures
  - Pipes
- Excess soap use, soap scum

Hardness

Causes	Solutions
Calcium and Magnesium minerals dissolved in water from minerals in the area	1. Water Softeners. 2. Soluble phosphate additives.

Calcium Carbonate

- Hard water caused by Calcium ions

Calcium Carbonate

CO_2 + Water

$Ca(HCO_3)_2$

Calcium Bicarbonate

$Ca(HCO_3)_2$ + HEAT = + $CO_2(g)$

Calcium Carbonate ($CaCO_3$) precipitate in water, CO_2 given off into air

Calcium Carbonate

Causes	Solutions
Calcium carbonate from rocks dissolving in water, then heated in water systems	Water softeners

Aesthetics

- Color
  - sediment, tannins, lignins, minerals
- Odour
  - Hydrogen sulfide, decaying organic material
- Taste
  - Sodium chloride (salt), manganese, iron

Color

- **Cloudy, discolored, or gritty water**

Causes	Solutions
Organic materials (tannins & lignins) Sediment in water (surface water in well) Pump intake too close to bottom of well Poor aquifer with sand, silt or clay Surface water washing into well	Activated carbon filtration

Odour or Taste

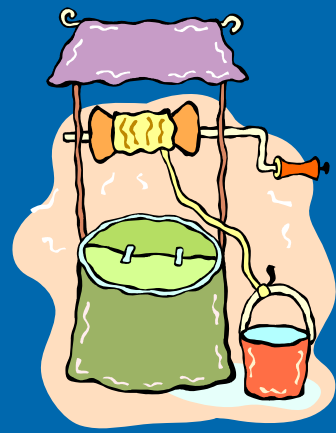
Causes	Solutions
High concentration of minerals, organics or bacteria	Test water for quality and bacteria.
Debris or decaying material in well	Check and have well cleaned and disinfected.
	Activated carbon filter system.

Pesticides, Fertilizers, Gasoline

Water Quantity/Inadequate Supply

- Screen blockage
  - Sand, silt, bacteria
- Decline in aquifer water levels
- Natural seasonal lowering of water table
- Competition with other well usages from same aquifer (Well Interference)
- Increase in water demand by well owner

Increasing Supply of Low Yielding Wells



- Deepen existing well
- Drill new well

- Hydrofracturing
  - Useful in areas of fractured bedrock
  - Stimulate existing well to increase yield

Hydrofracturing

Injecting water into the well bore at high pressures, increases fracture width and propagates fractures deeper into the bedrock so more water is available.

Hydrofracturing

Well Location Concerns

- Plan out area around proposed well

- Follow recommended set-back distances from possible sources of contamination:

Drilled wells:

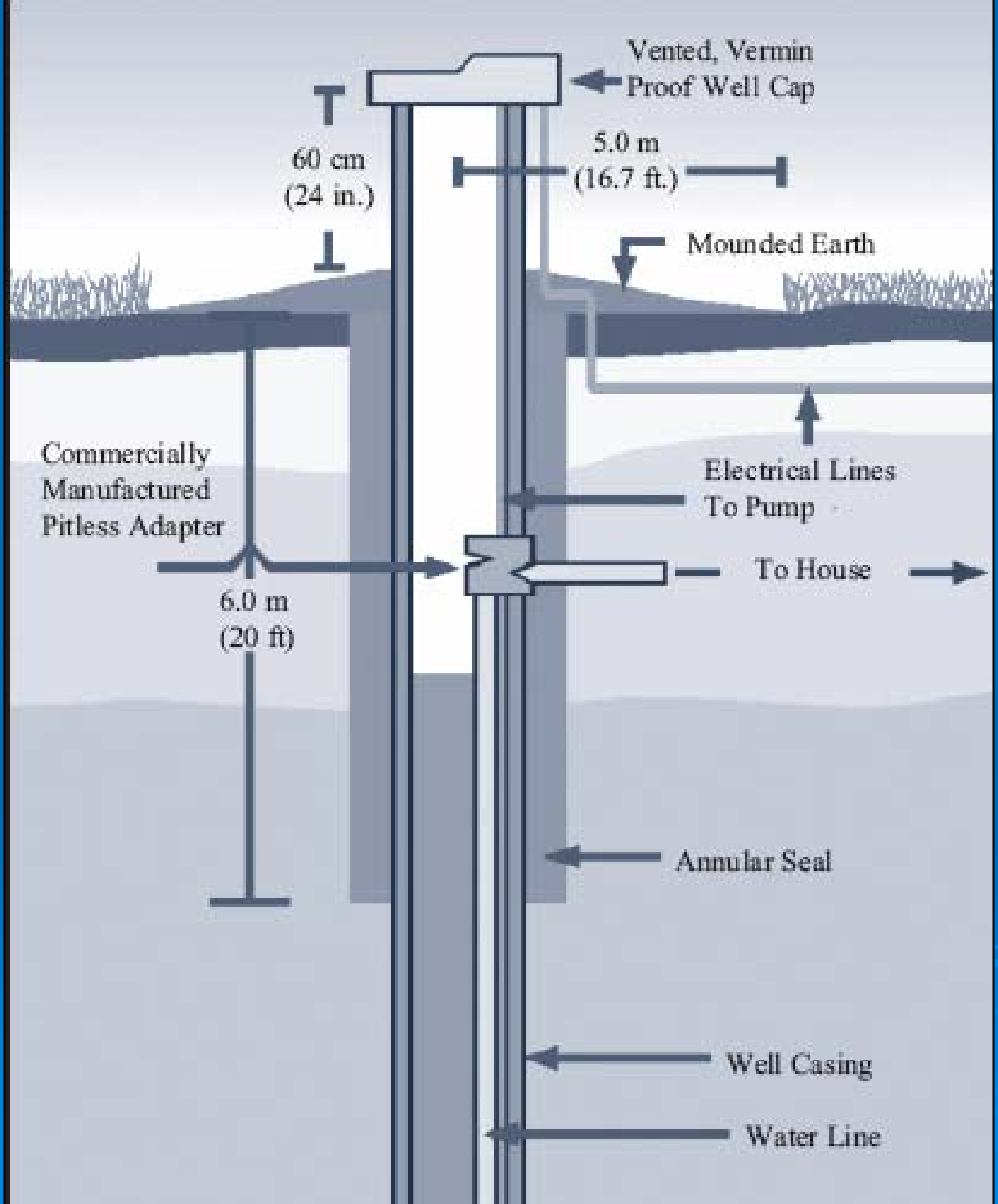
- 15 m from septic tank systems
- 30 m from cesspools of sewage
- 1 m from pumphouse floor drains
- 2 m from buildings
- 75 m from manure spreadings on agriculture fields

Dug wells:

- 15 m from septic tanks
- 30 m from septic fields
- 30 m from all other potential contaminants
- 75 m from manure spreadings on agriculture fields

Well Aware, 2005.

Drilled Well



Credit:Well Aware; BMP: Water Wells

Location

Improper Location of Farm and Private Well Showing Farm Runoff

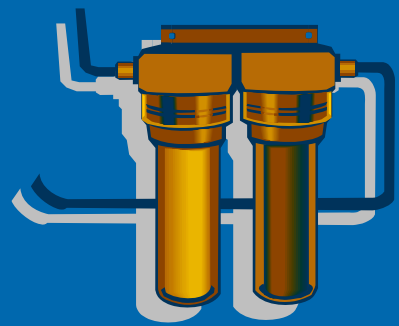
Pressure Problems

- **Problem:** Reduced or no water pressure

Causes	Solutions
Well has run dry	
Pump pressure switch needs adjusting	Install constant pressure valve between pump and pressure tank
Faulty or hole in pump	
‘Water logged’ pressure tank	Add additional pressure tank
Scaling in pipes	

Mechanical Issues

- Pressure tank
- Pump
- Pipe breakage or blockages



- Wires chafe off from pump
  - Torque arrestor

Iron Bacteria Biofouling

Causes	Solutions
Natural iron-bearing waters	Agitate water
Bacteria introduced during drilling or repairs	Shock chlorination

Biofouling

The effects of biofouling on a pump and other well equipment

Photos courtesy of Conboy & Smith, 2005: Well Wise: A Comprehensive Consumer's Guide for Private Water Wells

How ***not*** to construct a well

Maintaining Your Well

Test for:

Bacteria – 2 times/year

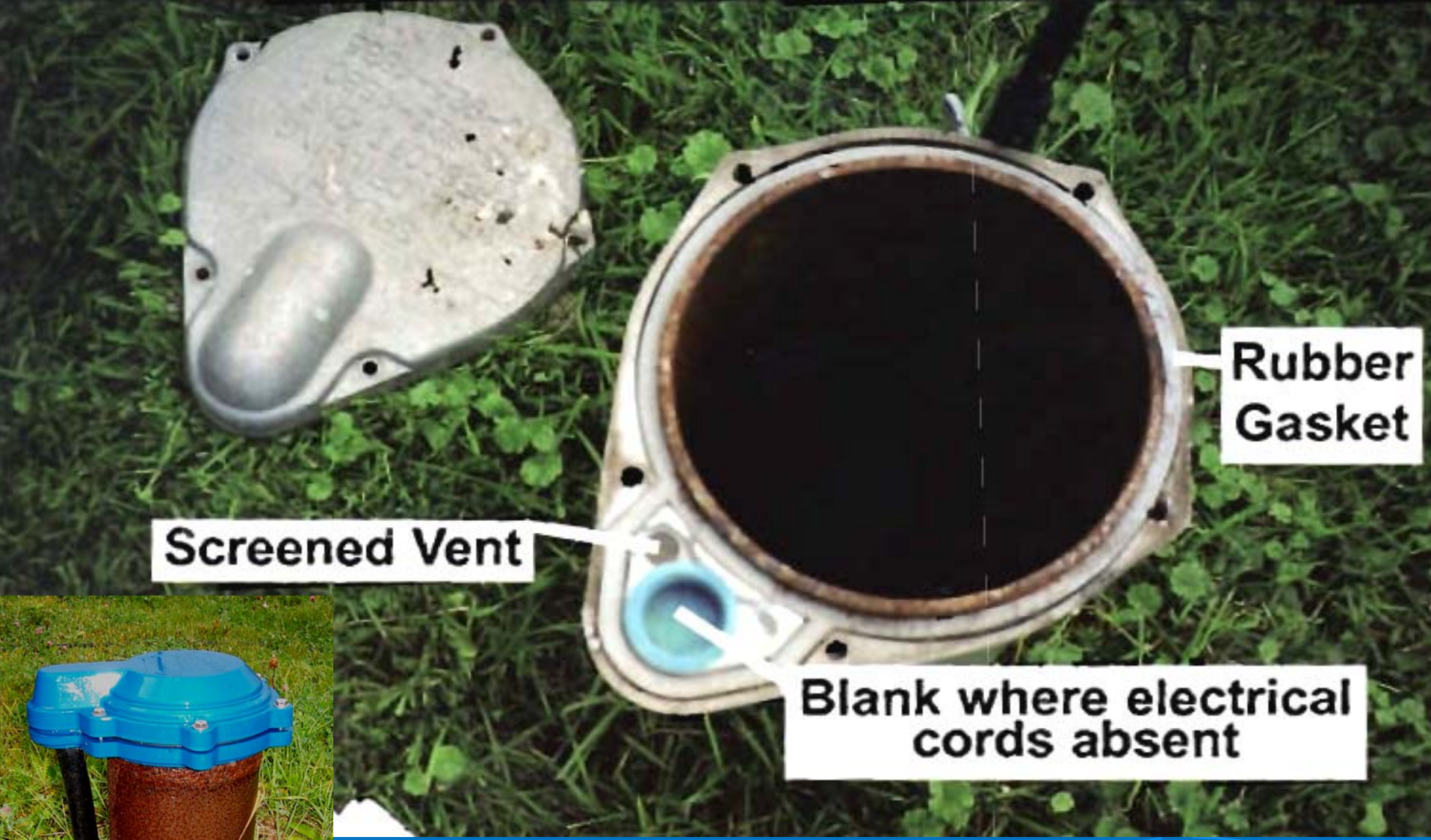
Metals and Minerals – at least once

… Or anytime you conduct maintenance or suspect a problem with the well system

Proper Coverings

Dug Well

Drilled Well



Vermin-proof well cap for drilled well

Photo courtesy of Conboy & Smith, 2005: Well Wise: A Comprehensive Consumer's Guide for Private Water Wells

Sealing of Wells

- Reasons to seal a well:
  - Well is contaminated or water unsuitable
  - Well is no longer used
  - Well could contaminant water in aquifer
  - Dug well or pit presents a danger

The Telegram, July 22, 2000

PUBLIC SAFETY

City man takes plunge down well

GARY HEBBARD/THE TELEGRAM

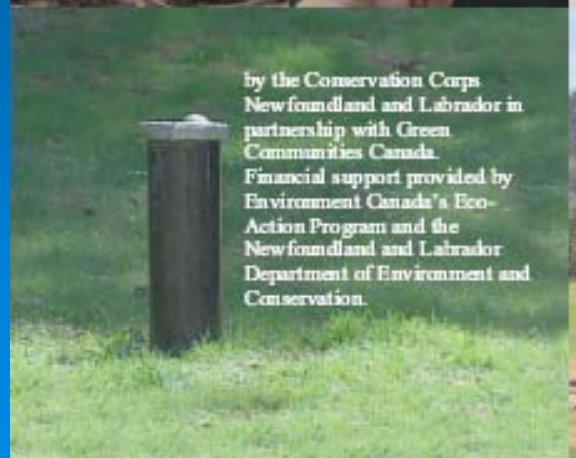
David Heffernan was lucky to escape with relatively minor injuries when he fell down this four-metre-deep well on his Goulds property.

Sealing / Decommissioning a well

Photos courtesy of Conboy & Smith, 2005: Well Wise: A Comprehensive Consumer's Guide for Private Water Wells

Well Aware

A guide to caring for your well and protecting your family's health.



by the Conservation Corps Newfoundland and Labrador in partnership with Green Communities Canada. Financial support provided by Environment Canada's Eco-Action Program and the Newfoundland and Labrador Department of Environment and Conservation.

Thank you!