Ministry of Forests, Lands and Natural Resource Operations

Regional District of Nanaimo

Drinking Water Watershed Protection

South Wellington and Cassidy Groundwater Quality Study

Presentation to

South Wellington and Cassidy Residents

October 19th, 2011

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DRINKING WATER WATERSHED PROTECTION

Today we'll be covering.....

- Study Objectives
- Groundwater Characteristics
- Understanding Water Quality
- Study Results
- Well Maintenance & Operation

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Drinking Water Watershed Protection

Study Objectives

To ensure a safe supply of drinking water.

- Assess water quality.
- Investigate the effect of high density septic fields.
- Evaluate wellhead protection.

Site Selection Criteria

- Coverage of study area.
- Density of parcels.
- Water tap available prior to filtration.

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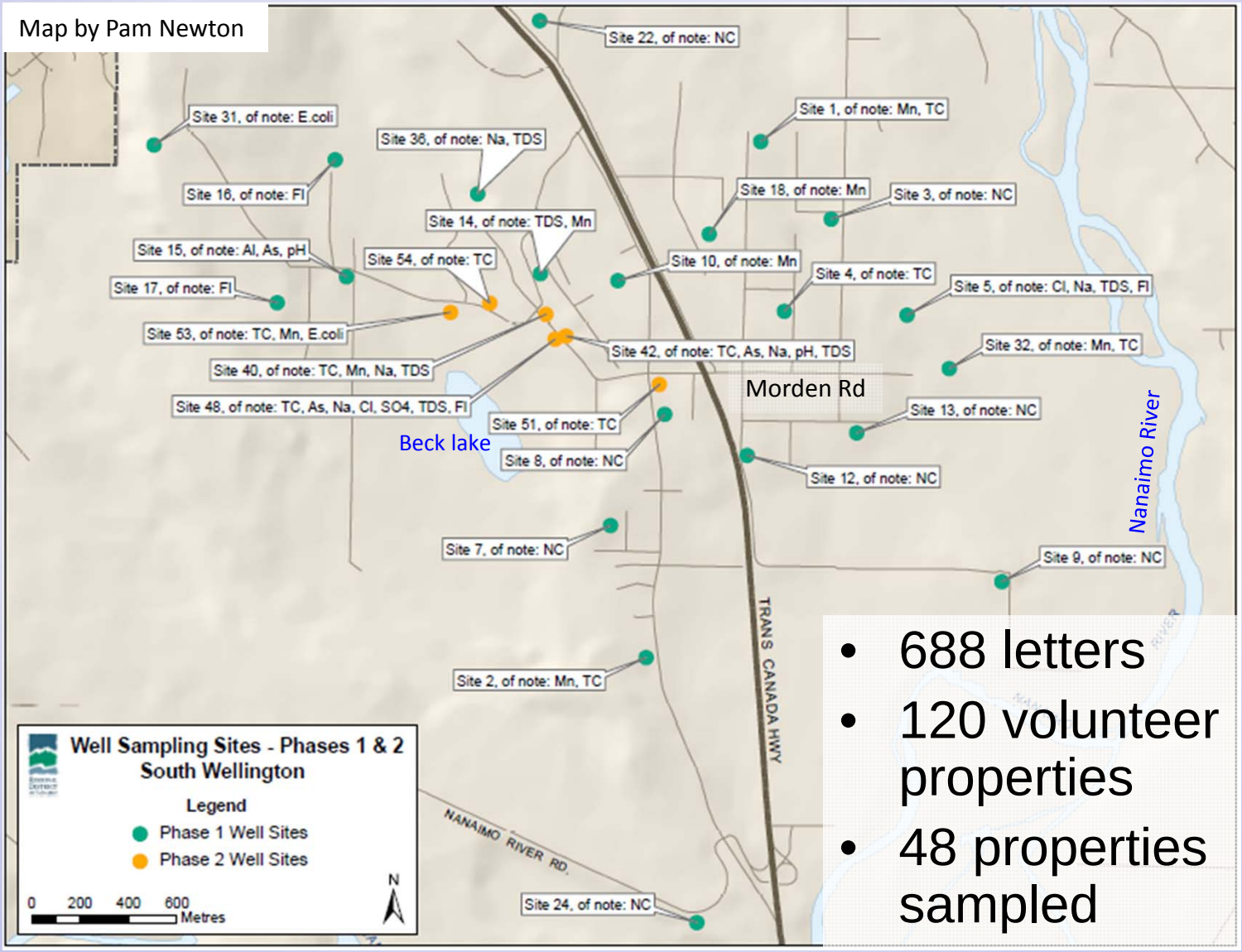
DRINKING WATER WATERSHED PROTECTION

Map by Pam Newton



- 688 letters
- 120 volunteer properties
- 48 properties sampled

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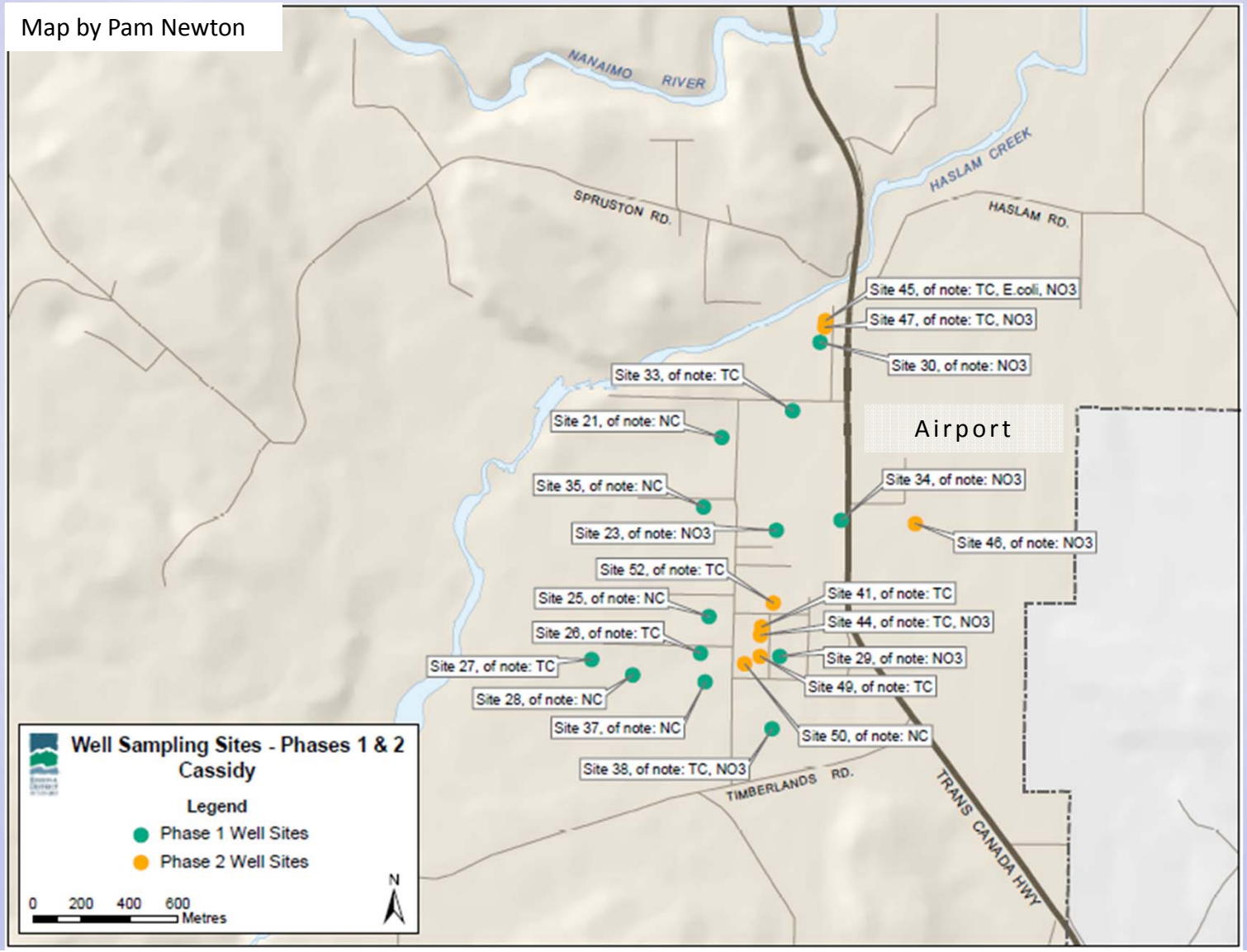
Map by Pam Newton



Sampling Procedure

- Disinfect tap with bleach.
- Run water until temperature, conductivity and pH stable.
- Inspect wellhead.
- Fill sample bottles to send to the labs.

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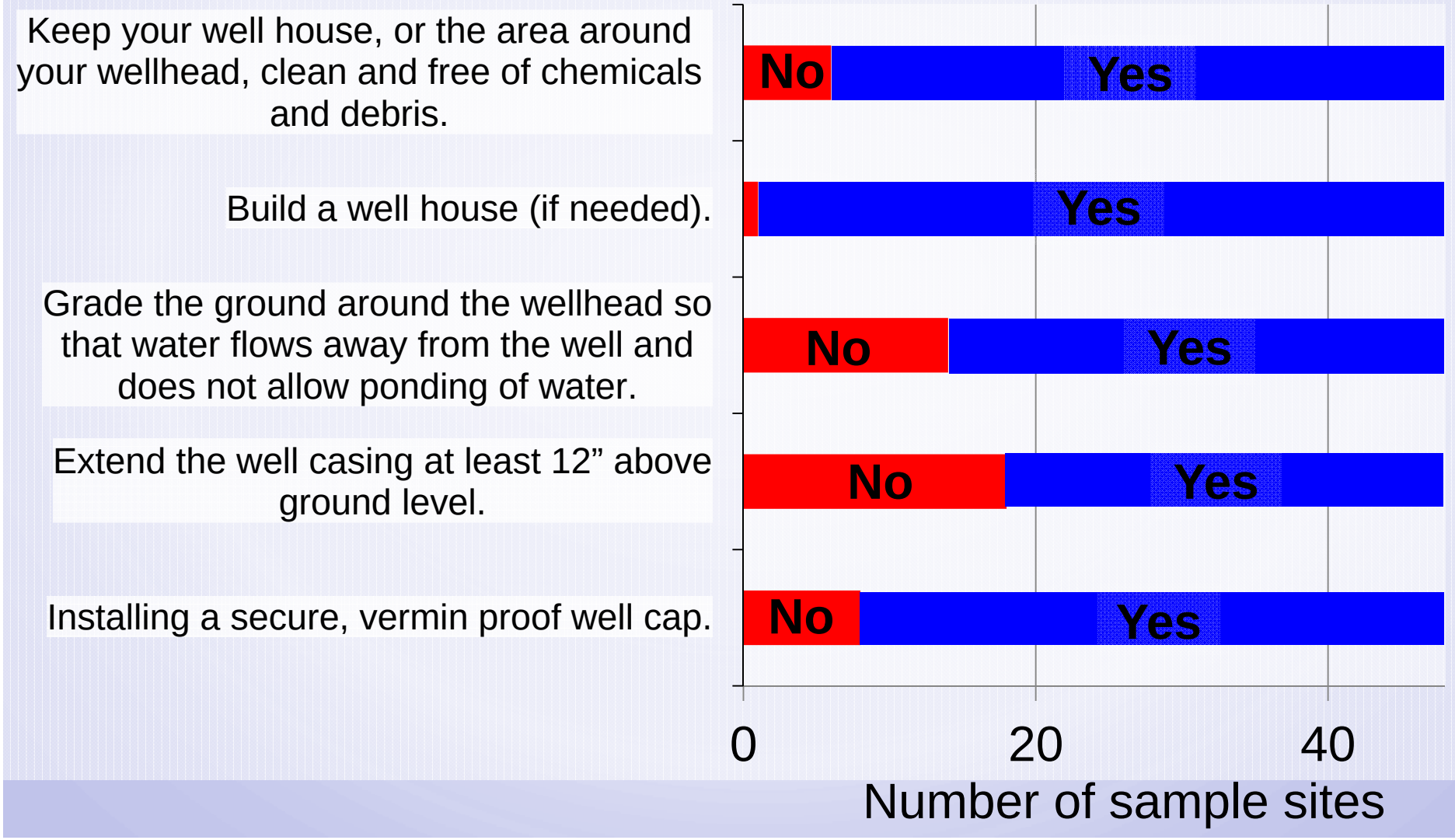
Wellhead Protection



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Good examples of wellhead protection

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DRINKING WATER WATERSHED PROTECTION

Test Parameters:

Misc. Inorganics
Fluoride (F)
Alkalinity (Total as CaCO3)
Alkalinity (PP as CaCO3)
Bicarbonate (HCO3)
Carbonate (CO3)
Dissolved Hardness (CaCO3)
Bromide (Br)

Calculated Parameters
Nitrate (N)

Anions
Dissolved Sulphate (SO4)
Dissolved Chloride (Cl)

Nutrients
Ammonia (N)
Total Kjeldahl Nitrogen
Total Organic Nitrogen (N)
Nitrate plus Nitrite (N)
Nitrite (N)
Total Nitrogen (N)

Physical Properties
Conductivity
pH
Total Dissolved Solids
Turbidity

Bacteria
Total coliform
Escherichia coliform

Dissolved Metals
Dissolved Aluminum (Al)
Dissolved Antimony (Sb)
Dissolved Arsenic (As)
Dissolved Barium (Ba)
Dissolved Beryllium (Be)
Dissolved Bismuth (Bi)
Dissolved Boron (B)
Dissolved Cadmium (Cd)
Dissolved Chromium (Cr)
Dissolved Cobalt (Co)
Dissolved Copper (Cu)
Dissolved Iron (Fe)
Dissolved Lead (Pb)
Dissolved Lithium (Li)
Dissolved Manganese (Mn)
Dissolved Molybdenum (Mo)
Dissolved Nickel (Ni)
Dissolved Selenium (Se)
Dissolved Silicon (Si)
Dissolved Silver (Ag)
Dissolved Strontium (Sr)
Dissolved Thallium (Tl)
Dissolved Tin (Sn)
Dissolved Titanium (Ti)
Dissolved Uranium (U)
Dissolved Vanadium (V)
Dissolved Zinc (Zn)
Dissolved Zirconium (Zr)
Dissolved Calcium (Ca)
Dissolved Magnesium (Mg)
Dissolved Potassium (K)
Dissolved Sodium (Na)
Dissolved Sulphur (S)

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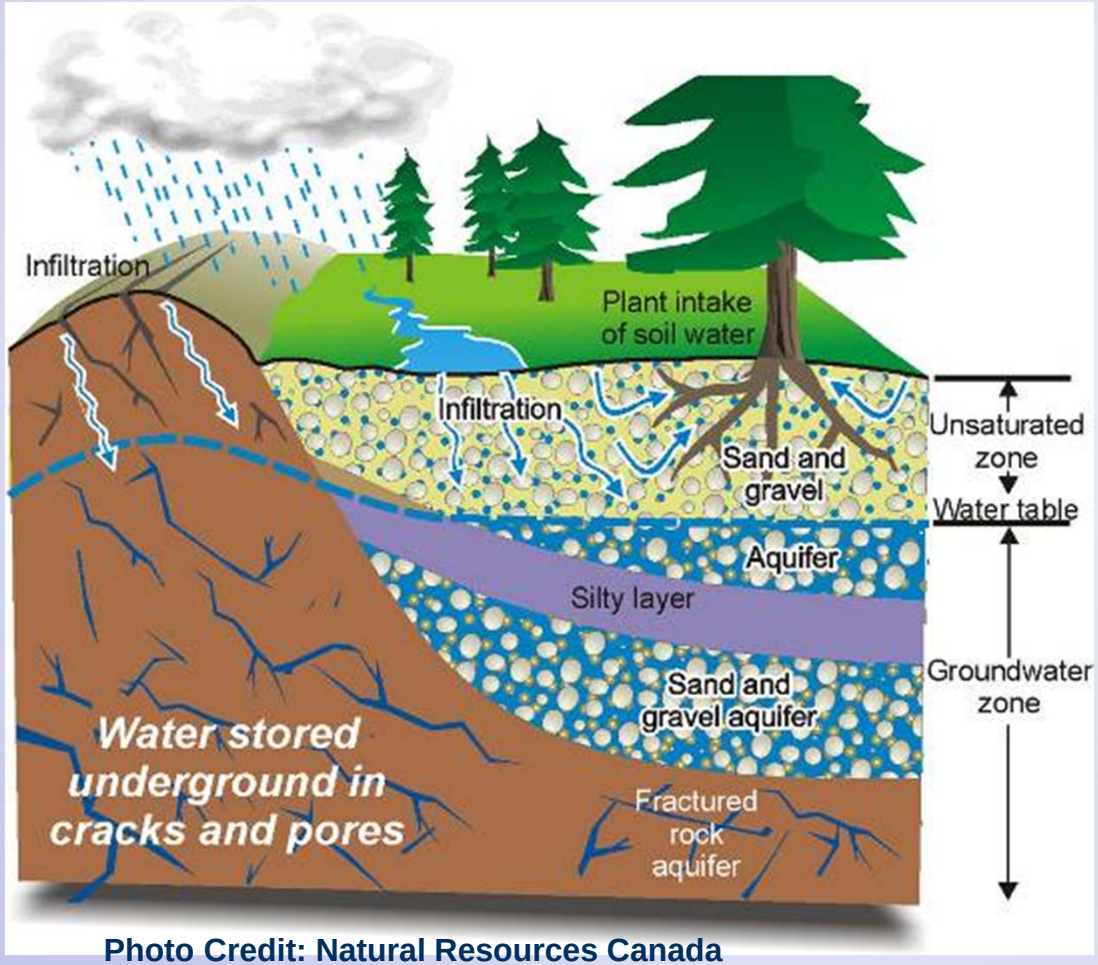
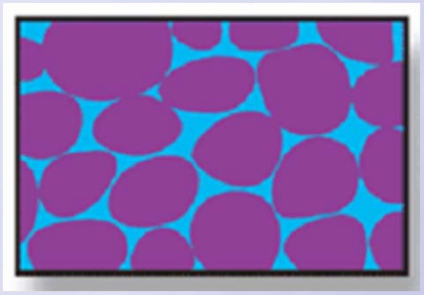


Photo Credit: Natural Resources Canada

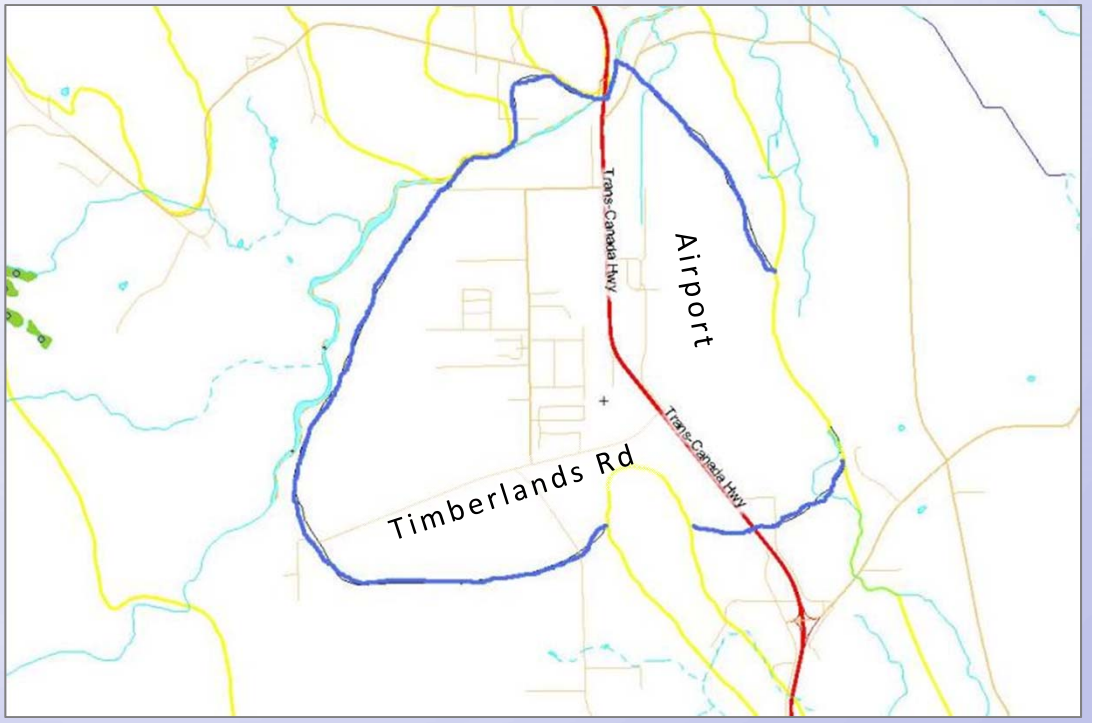
Water in rock fractures



Water between grains of sand

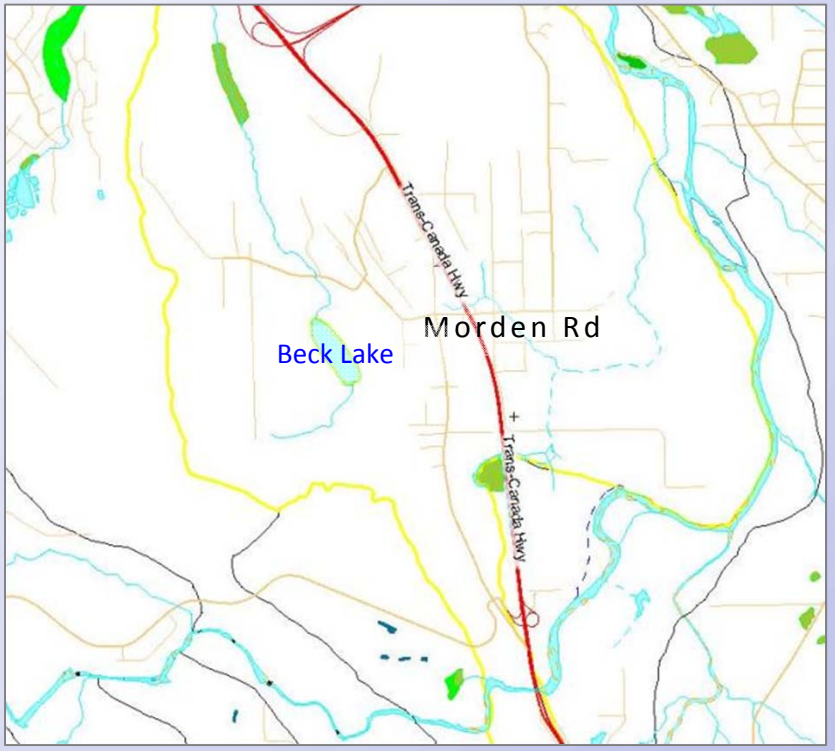
Lower & Upper Cassidy Aquifer Properties

- Sand and gravel, lower aquifer has a clay confining layer but thickness varies
- Recharged by precipitation and surface water
- Lower aquifer flow direction is northeast
- Upper aquifer flow direction is north and south of the airport and east



South Wellington Aquifer Properties

- Fractured bedrock, sandstone and shale
- Recharged by precipitation and surface water
- Partially confined
- Coal noted in some well logs



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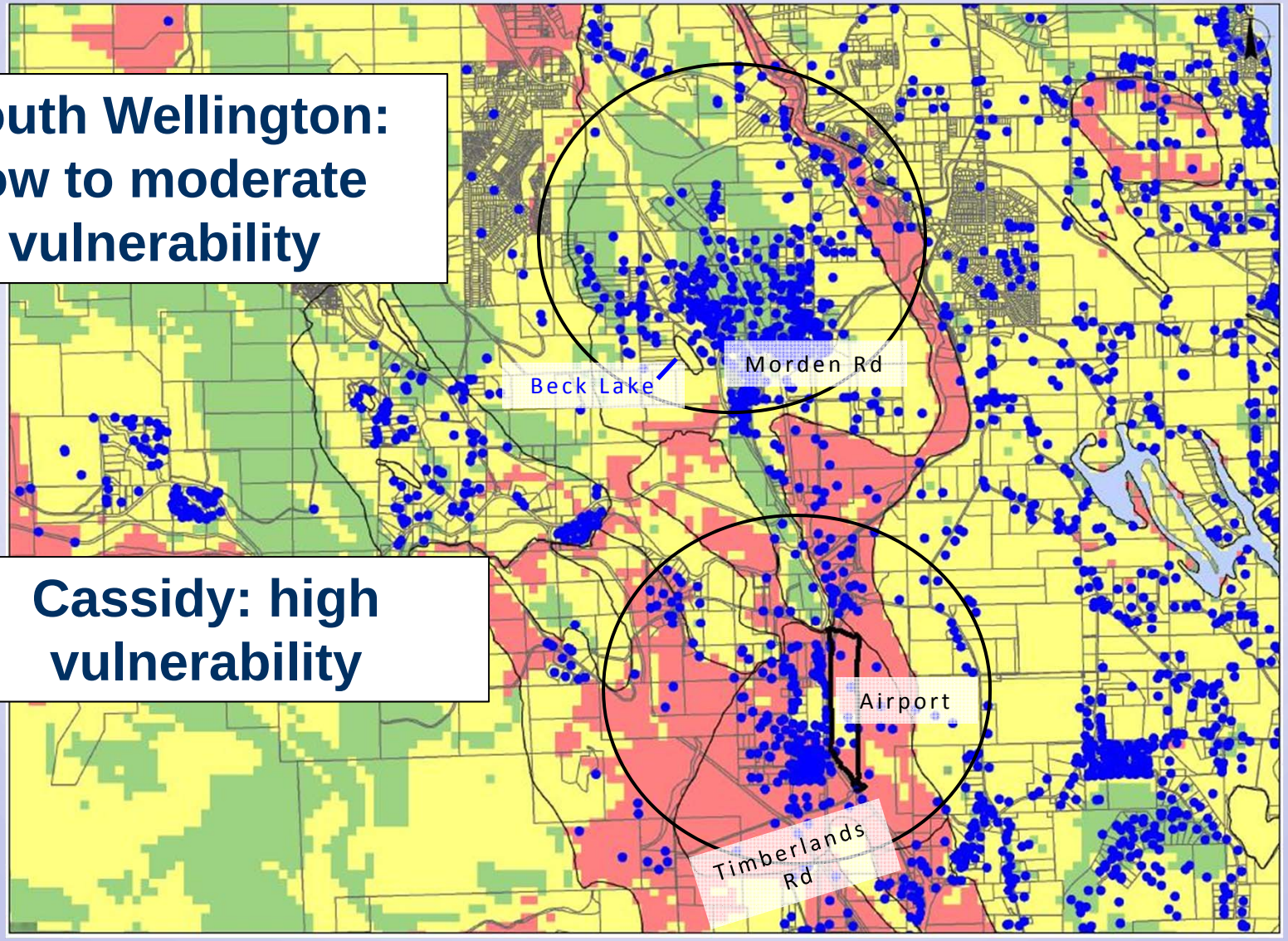
DRINKING WATER WATERSHED PROTECTION

South Wellington: low to moderate vulnerability

Cassidy: high vulnerability



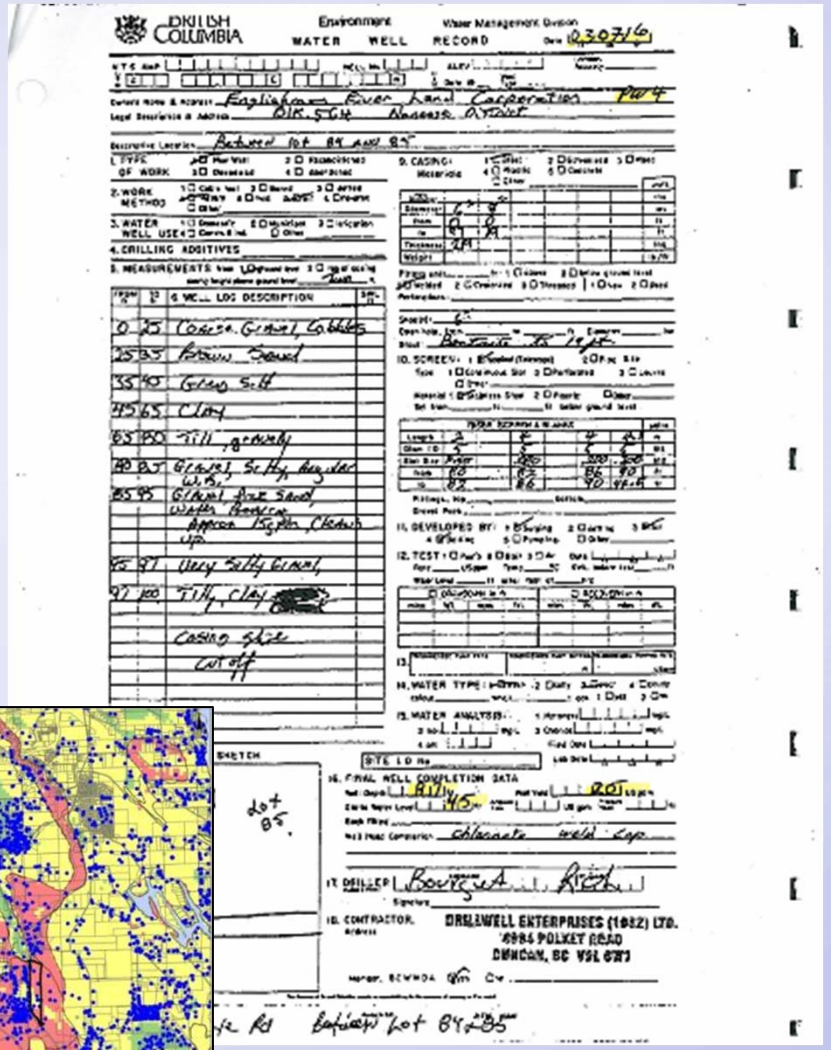
Well Records

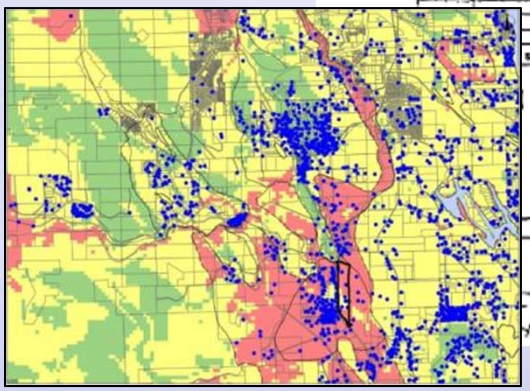
Contain:

- location, geology, construction details, depth, water level, yield

Why?

- Property sale
- MOE database
- Water protection





Common **Water Quality** Concerns

Water quality parameter	Example
Naturally present minerals and elements	Elevated iron and/or manganese, hardness (calcium & magnesium), boron, fluoride, arsenic or other metals
Bacterial contaminants & indicators (natural or human source)	Total coliforms, fecal coliforms, *E. coli*
Natural contaminants related to well use or location of aquifer	High TDS, sodium and chloride associated with salt water intrusion in coastal aquifers
Contaminants from human activities	Nitrates (farm practices, sewage disposal) hydrocarbons, pesticides

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What is an unacceptable water quality result?

Health Canada Guidelines for Drinking Water Quality

- Set the standards for drinking water quality

Health Based Guidelines (MAC)

Aesthetic Objectives (AO): Impacts taste, odour, colour but does not affect health

Water may taste and look fine, but contain harmful substances.

http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/guide/index-eng.php

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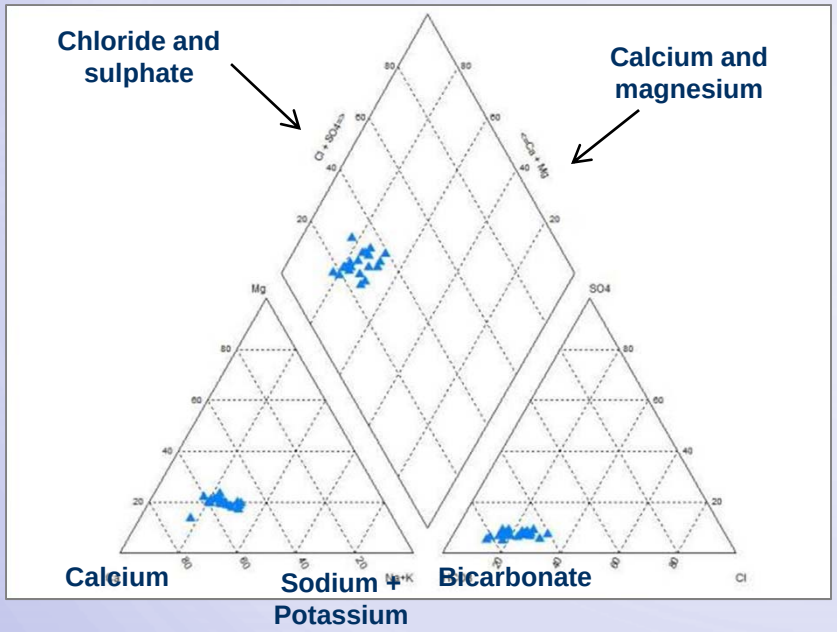
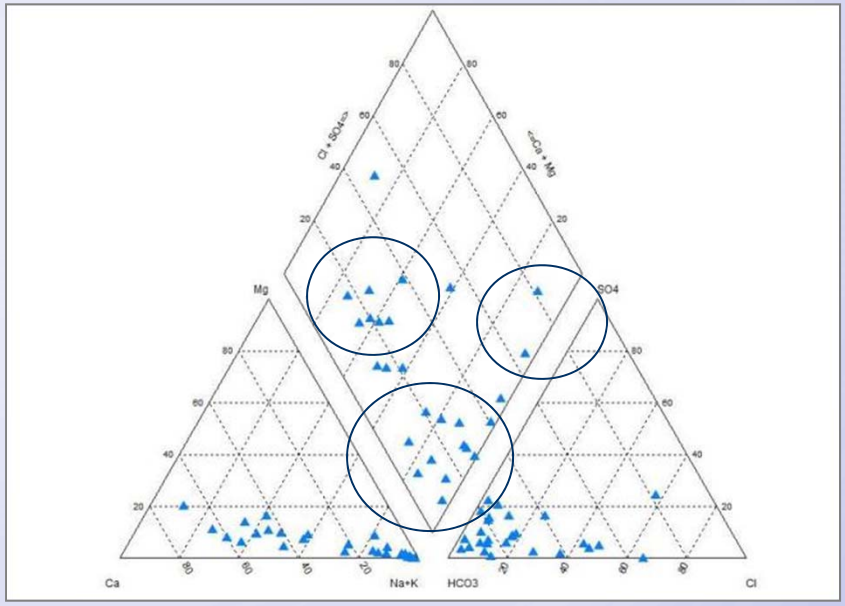
Drinking Water Watershed Protection

Cassidy



South Wellington



Very different water characteristics!

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Cassidy Water Quality Results

- 100% of samples met the measured "health based" Health Canada guidelines

- 9 sites had nitrates greater than 1 mg/L (43%)
  - Nitrates indicate human impacts
  - Can become a health concern (10 mg/L MAC)
  - Sources can include animal manure, fertilizer, and septic systems

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South Wellington Water Quality Results

- 93% of samples met the measured Health Canada "health based" guidelines for chemical parameters

Health Concerns

Arsenic MAC: 10 ug/L

– four sites of interest: 3.2, 1.3, 5.6, 2.1 ug/L

Fluoride MAC: 1.5 mg/L

– four sites of interest: 2.05, 1.93, 1.08, 1.03 mg/L

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South Wellington Water Quality Results

- 59% of samples met the measured Health Canada "aesthetic" guidelines for chemical parame

Aesthetic Concerns

- Chloride, sulphate, manganese, iron, sodium, total dissolved solids, aluminum
- Can cause staining of laundry, unpleasant taste, odours, colours, build-up in pipes
- Most are naturally occurring

Bacteria Water Quality Results

Cassidy

- 13 sites had total coliforms (48%)
  - Total coliforms indicate surface water infiltration
- 1 site had *E. coli*
  - Health concern, indicates fecal contamination

South Wellington

- 10 sites had total coliforms (37%)
  - Total coliforms indicate surface water infiltration
- 2 sites had *E. coli*
  - Health concern, indicates fecal contamination

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Bacteria Results – What next?

Bacteria results suggest need for well assessment and protection measures.

Poor well maintenance and construction can increase the risk of bacteria and other harmful organisms getting into a well water supply.

What can you do?

- Source Protection and well upgrades - does your well meet current standards?
- Shock Chlorination
- Continuous disinfection & treatment
- Re-sample

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Drinking Water Watershed Protection

Unacceptable Chemical Water Quality Result

What you can do:

1. Improve wellhead protection
2. Well upgrades
3. Continuous treatment
4. Re-sample

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DRINKING WATER WATERSHED PROTECTION

What is good well operation?

- Keep good records of construction, water levels, water testing, chlorination, and repairs
- Regularly:
  - Test your water
  - Inspect your wellhead
- Well Chlorination
- Keep your wellhead and pump house in good repair and free of contaminants

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Bacteria

- 2-3 times per year, best in rainy season
- After any major plumbing work

~$45

Other Parameters

- Generally, twice in first year, and every 3-5 years after
- Best in the dry season

~$155

Summary

100% (Cassidy) and 93% (South Wellington) of samples met health based chemical guidelines.

South Wellington samples had a number of naturally occurring aesthetic concerns.

48% of samples had total coliforms, *E. coli*, or both.

Proper well maintenance and construction, and regular water testing is important.

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Thank You!

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Ministry of Environment, Water Stewardship
http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/index.htm

British Columbia Ground Water Association:
http://www.bcgwa.org/index.htm