



Groundwater Basics: Flow and Potential Contamination to Drinking Water Sources from Wells

2012 Clean and Safe
Drinking Water Workshop

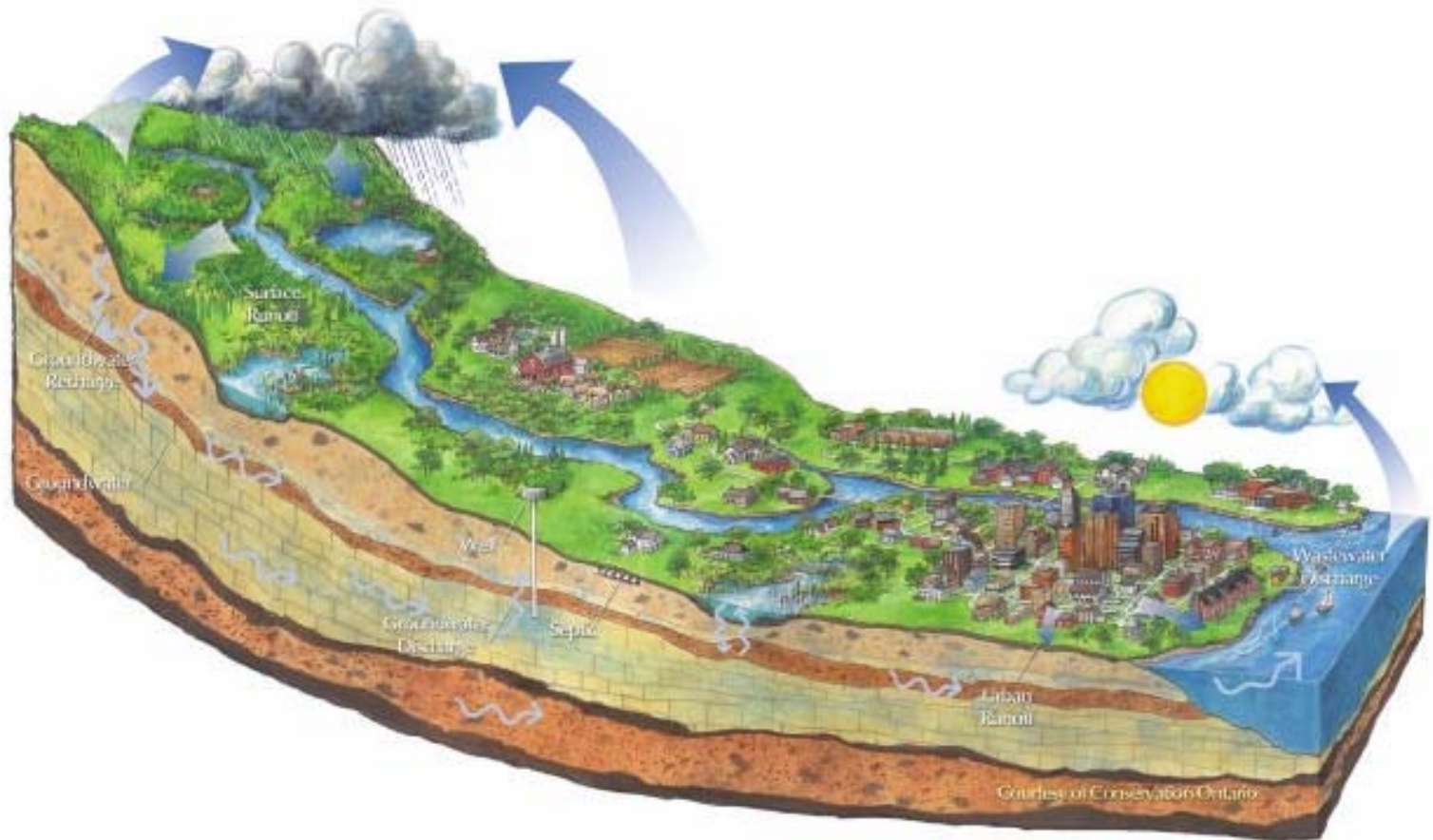
Titia Praamsma

Background

- Who drinks groundwater?
 - 35-40% of municipal supply
 - ~100% of unserviced homeowners/cabins

- Goals for this talk
 - Understand groundwater flow and how groundwater is susceptible to contamination

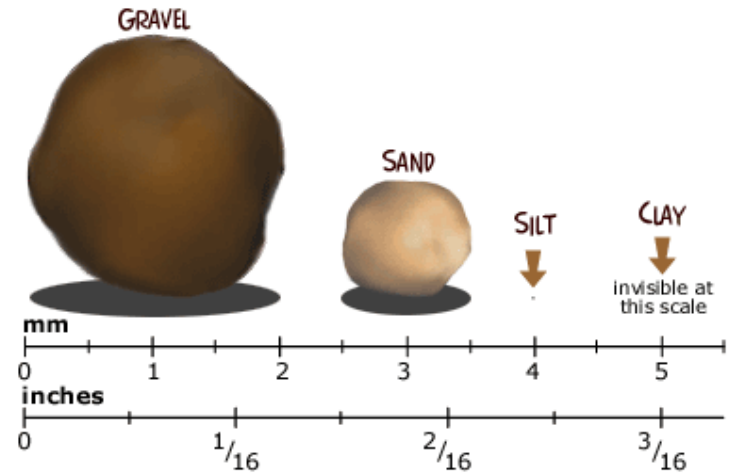
Water Cycle



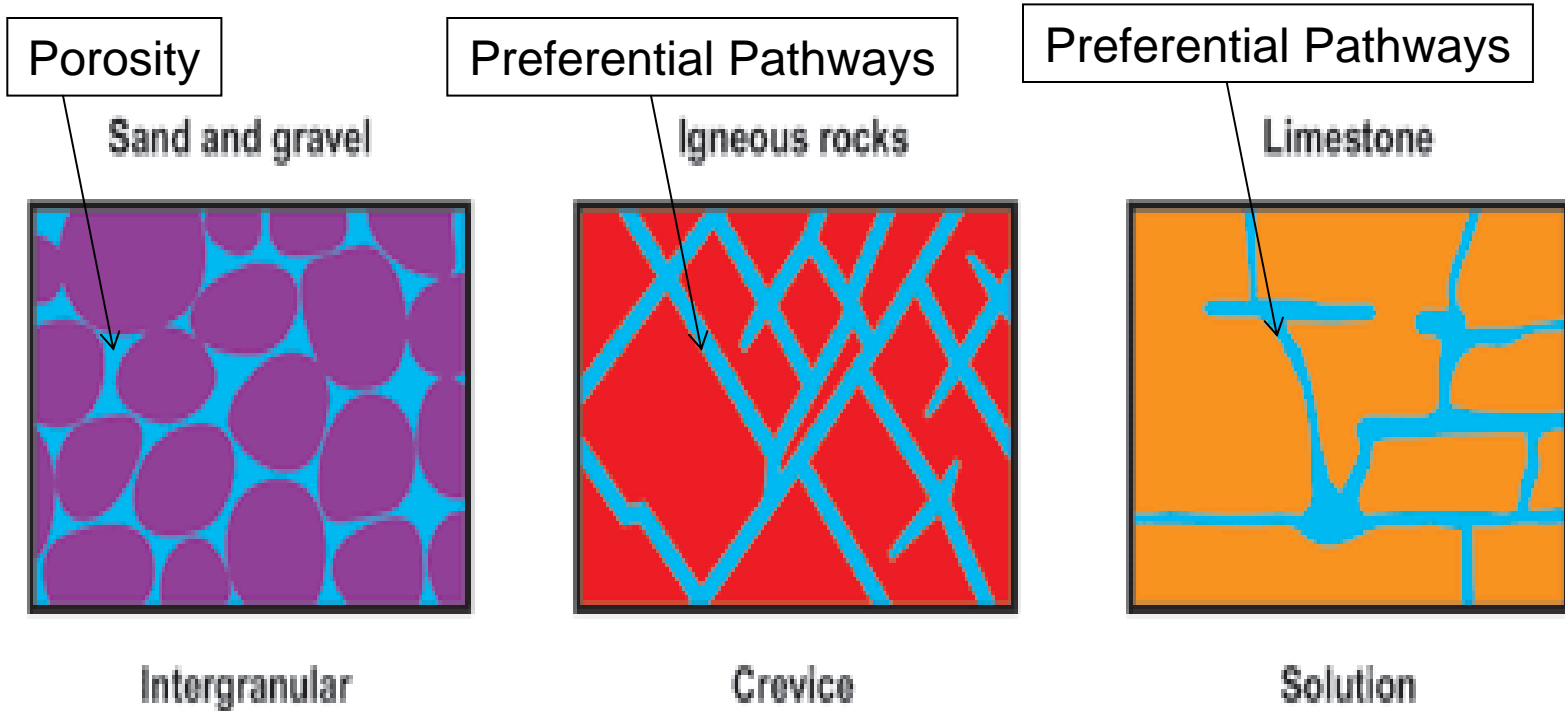
Courtesy of Conservation Ontario

How does water infiltrate?

- Gravity!
- But what is stopping infiltration?
 - Porosity
- Preferred pathways

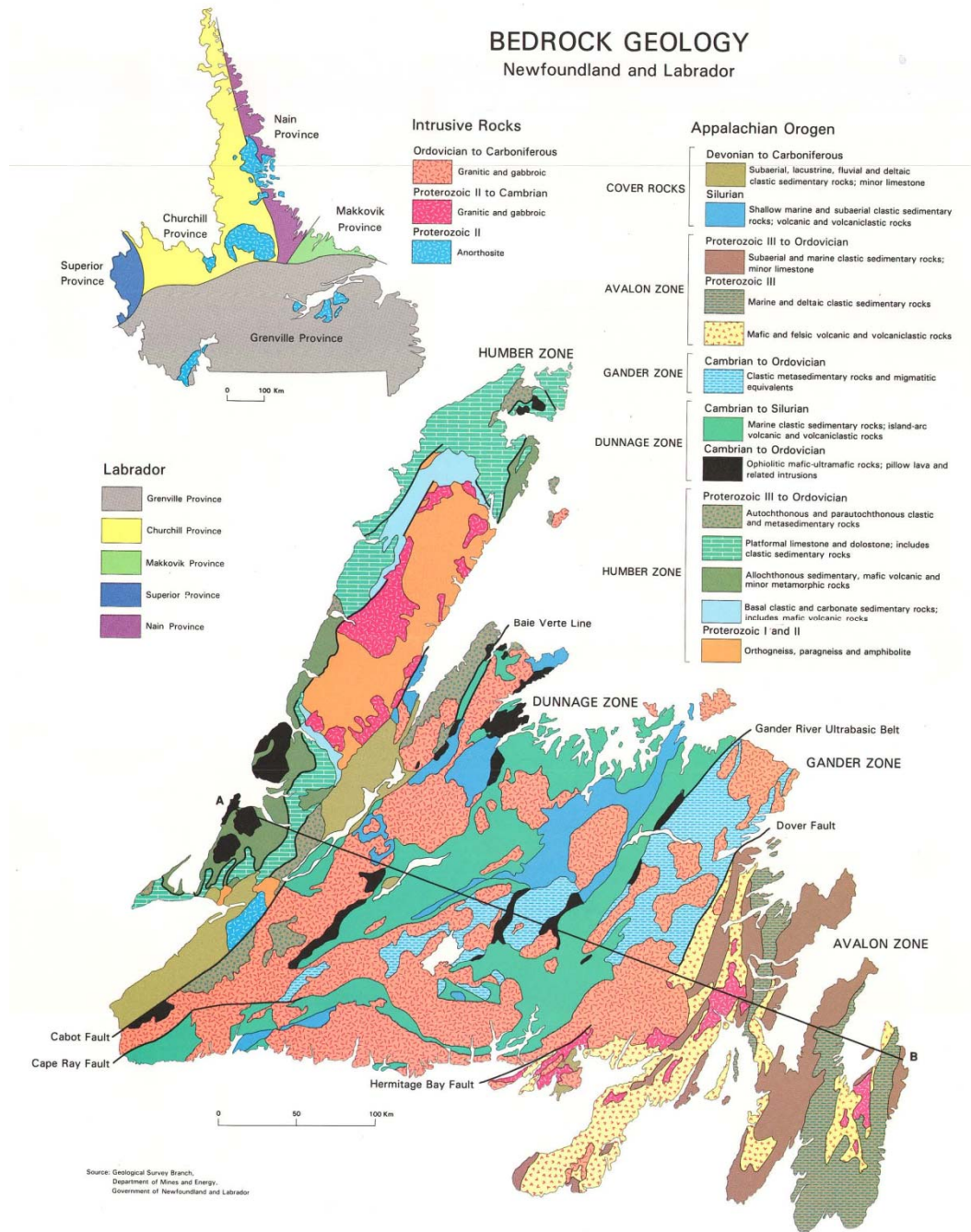


How does water infiltrate?

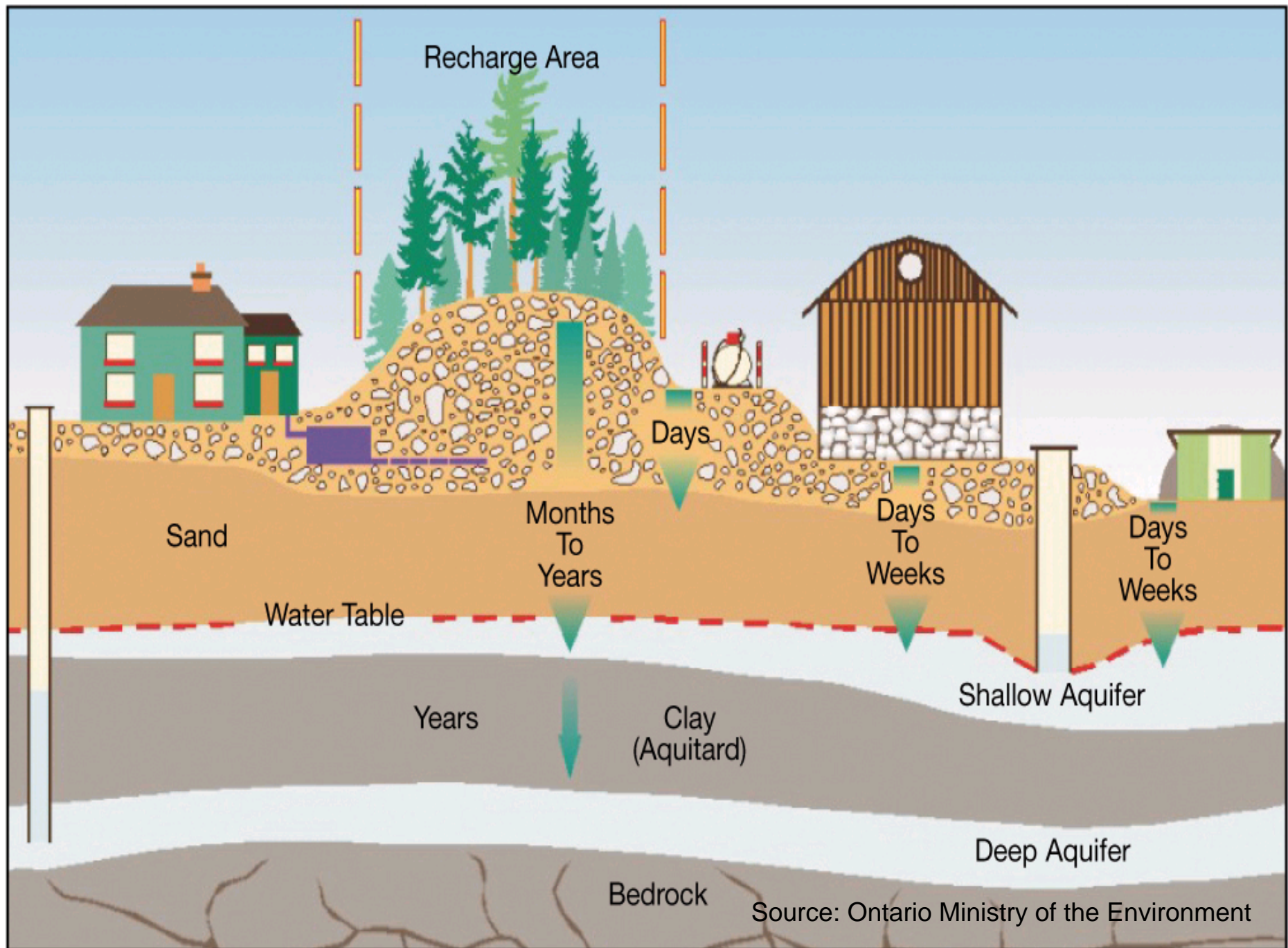


BEDROCK GEOLOGY

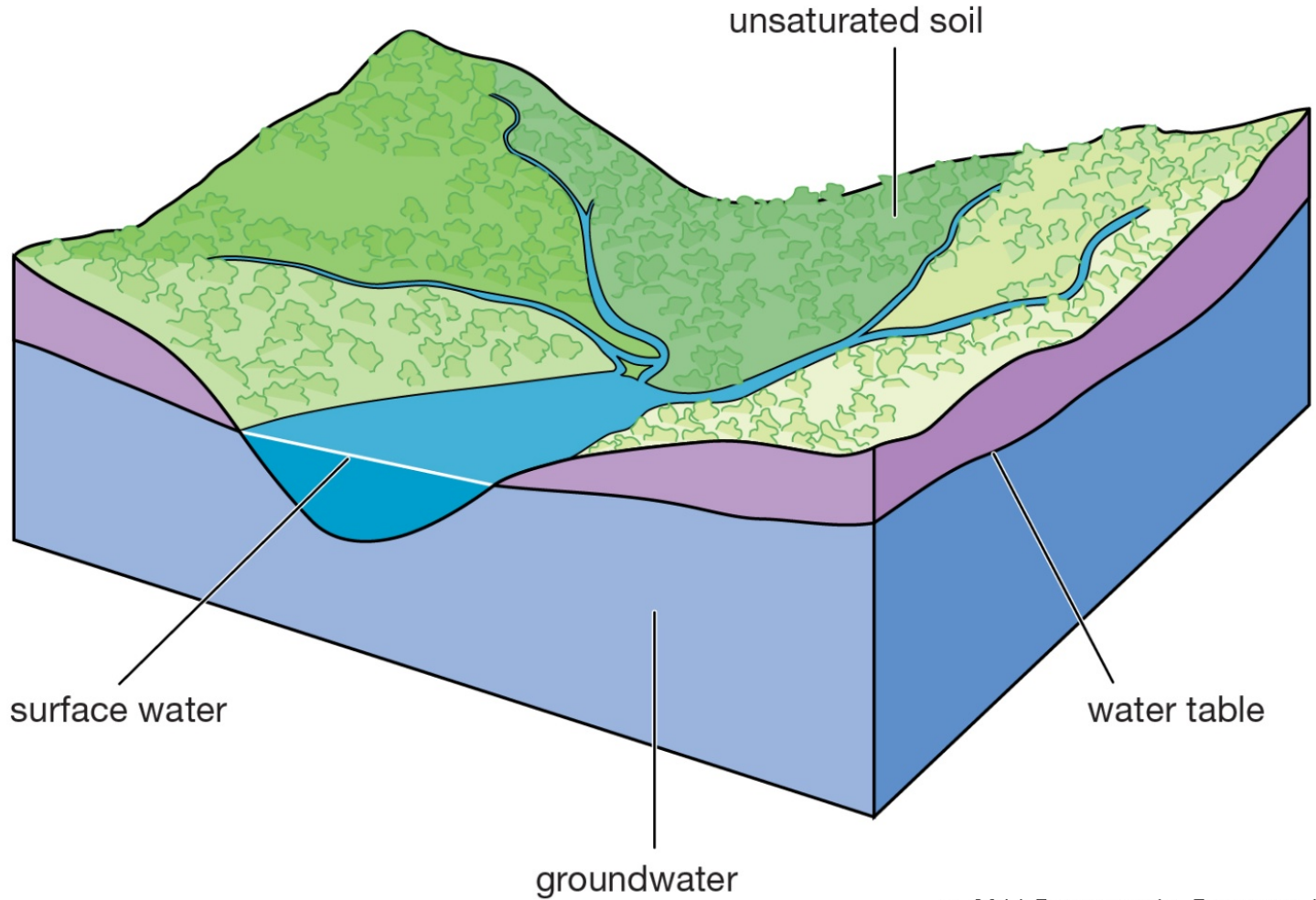
Newfoundland and Labrador



Source: Geological Survey Branch,
Department of Mines and Energy,
Government of Newfoundland and Labrador



Water Table



Recharge Area
(High Rate)

Infiltration

Discharge
Area

Recharge Area
(Moderate Rate)

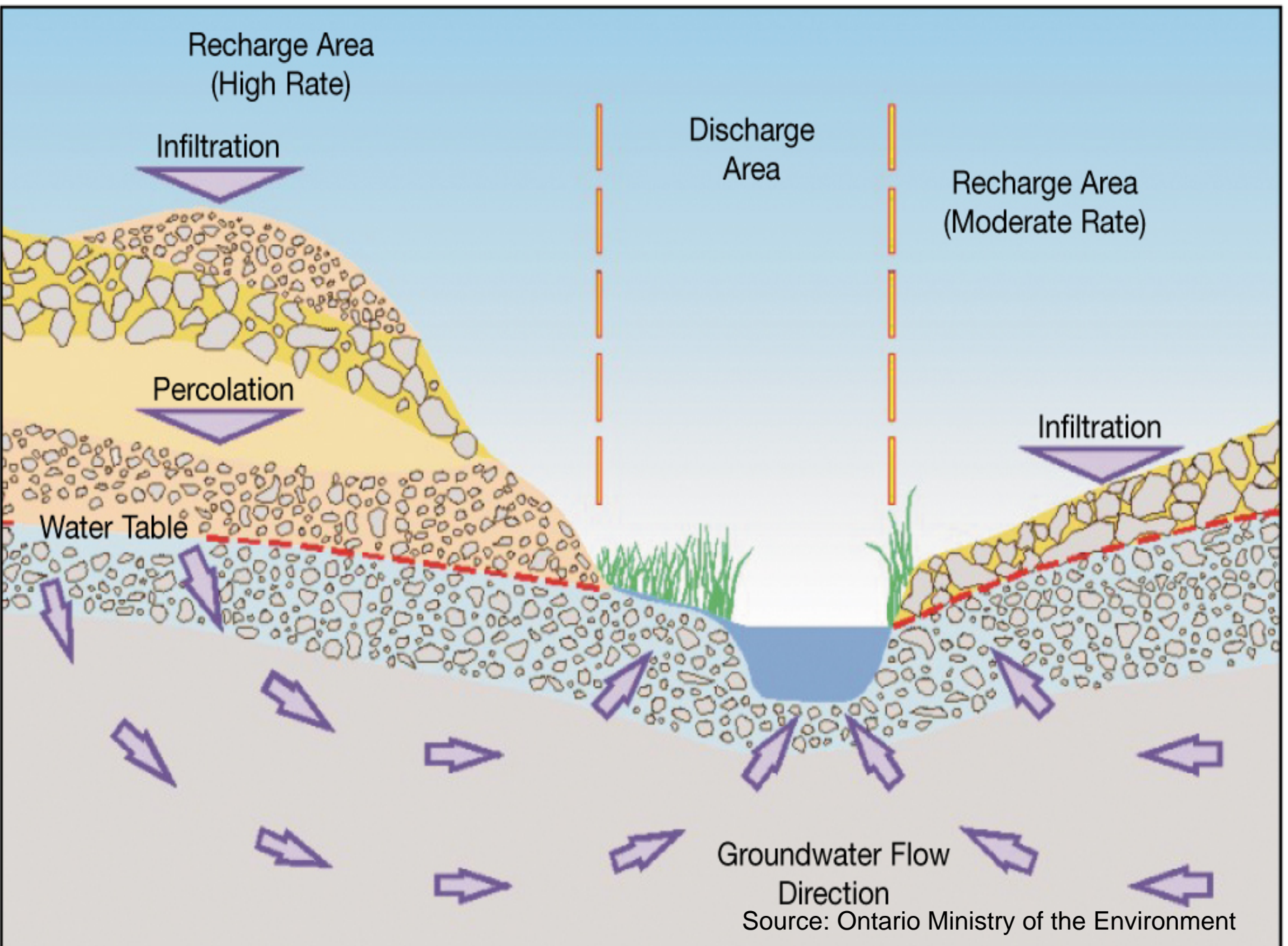
Percolation

Infiltration

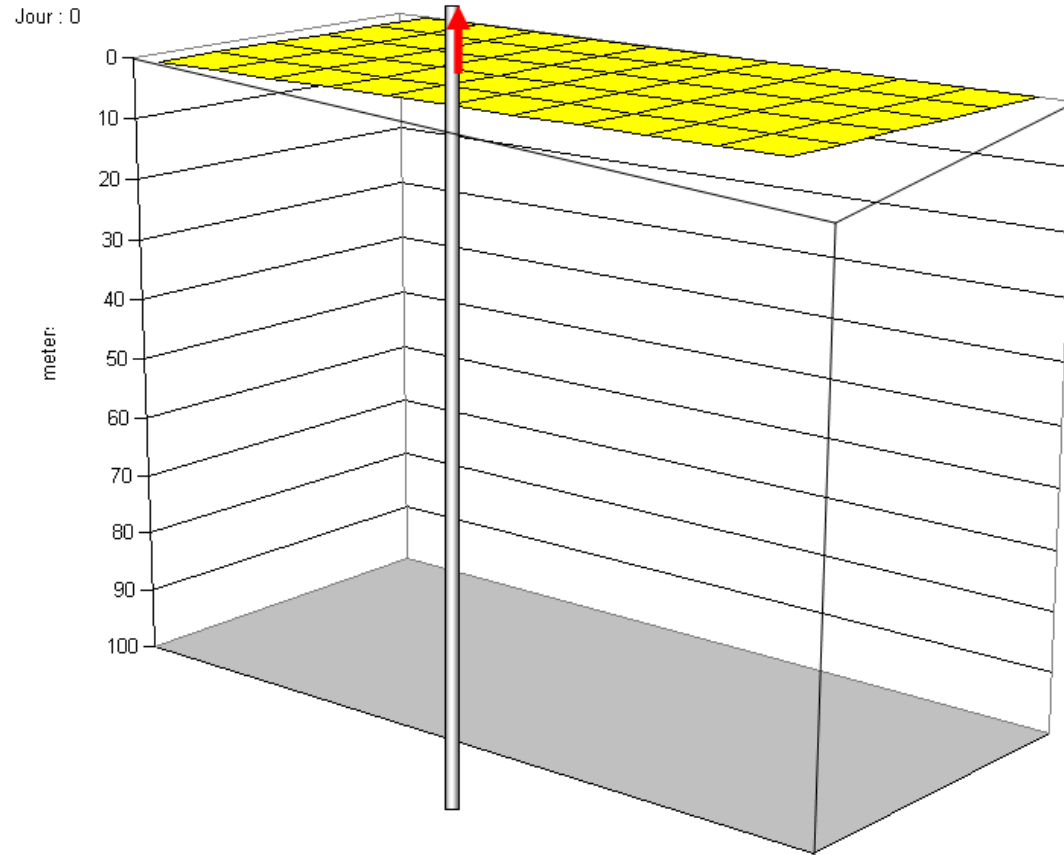
Water Table

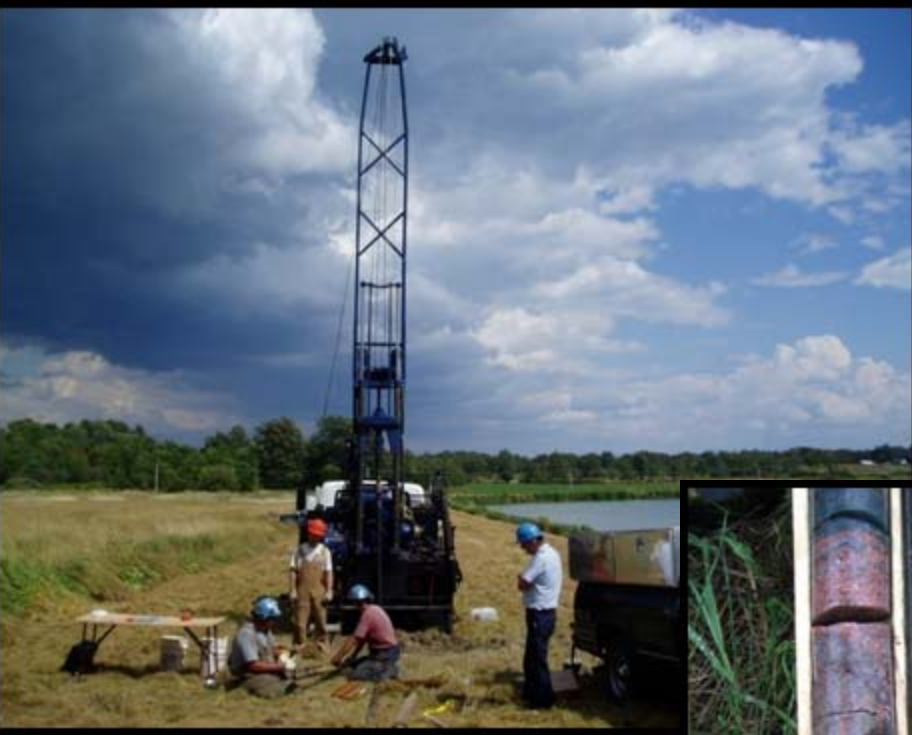
Groundwater Flow
Direction

Source: Ontario Ministry of the Environment

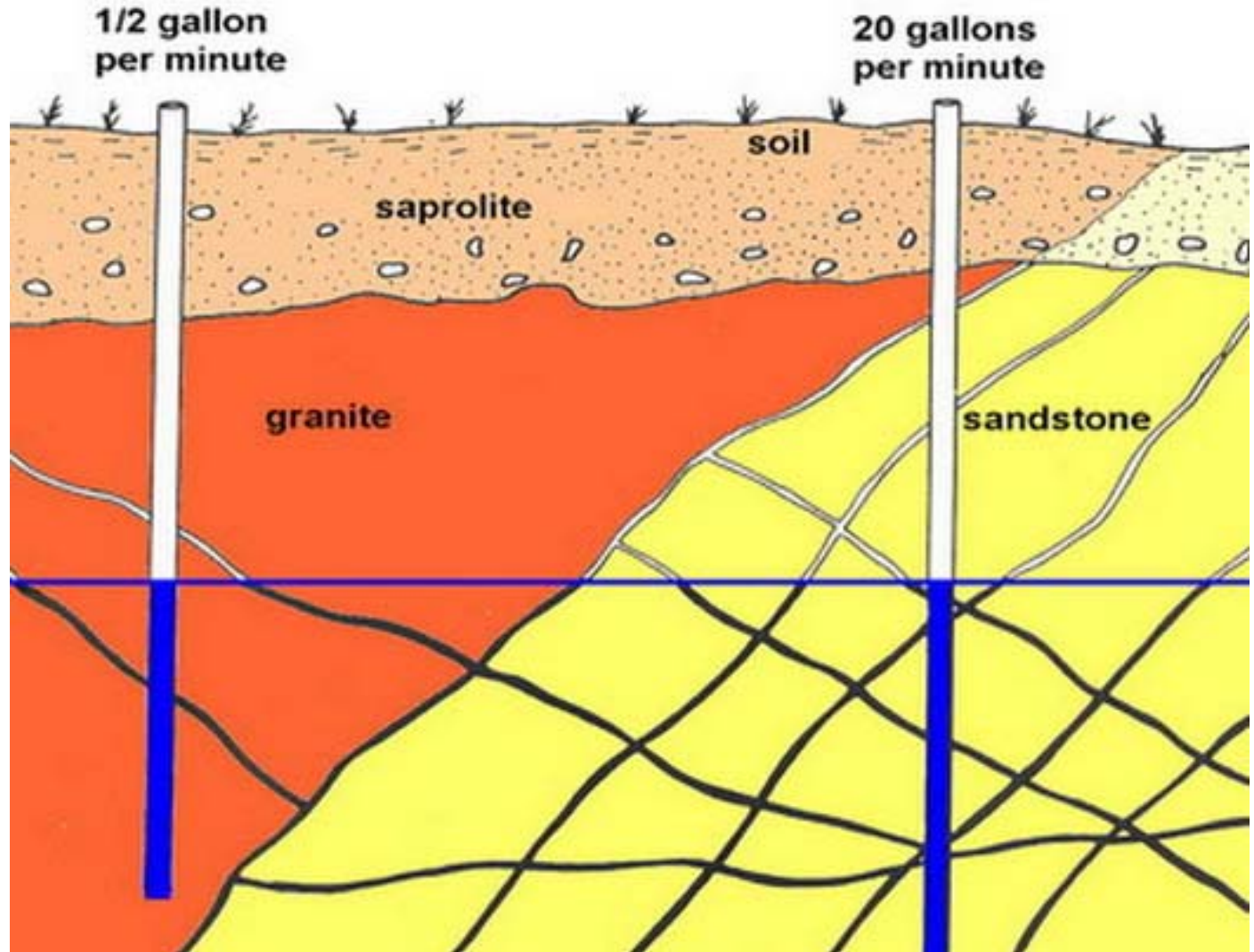


Pumping a Well

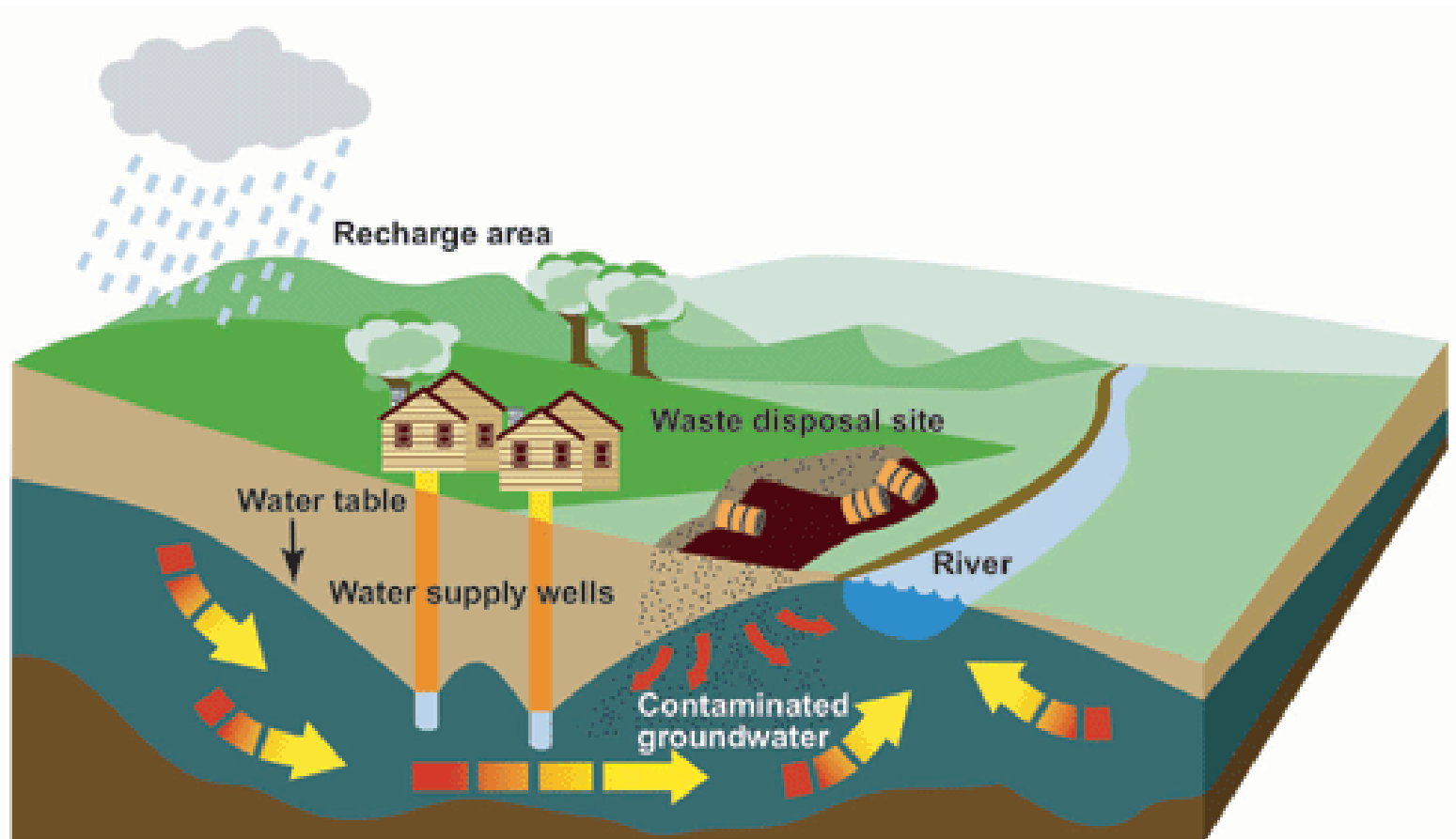




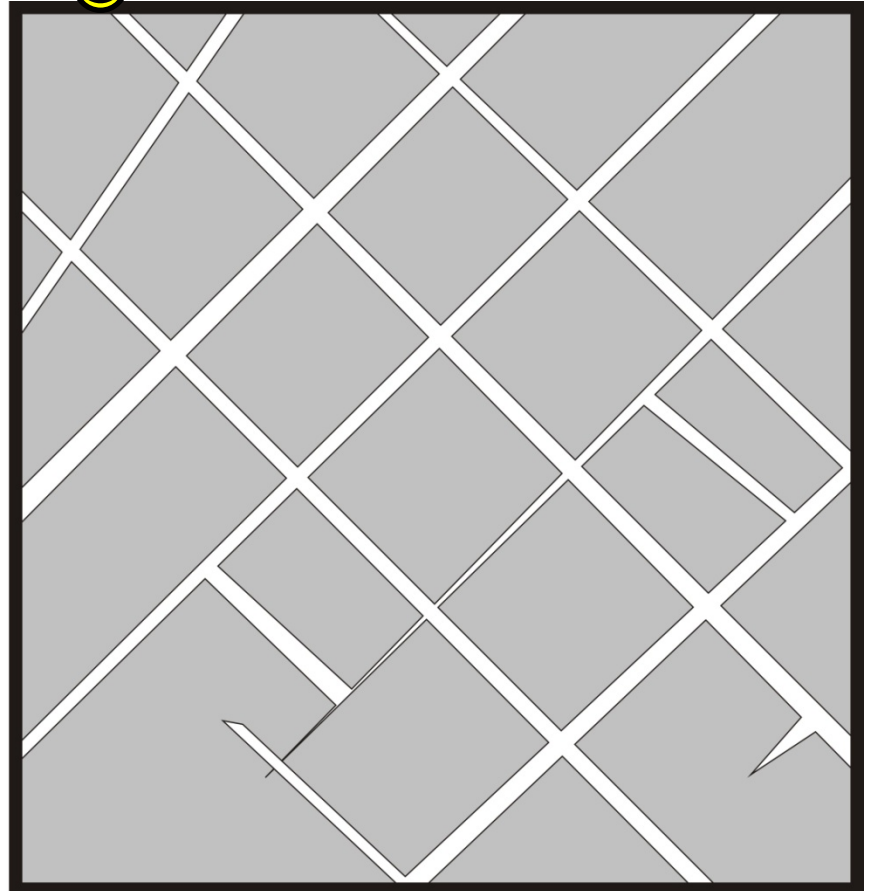
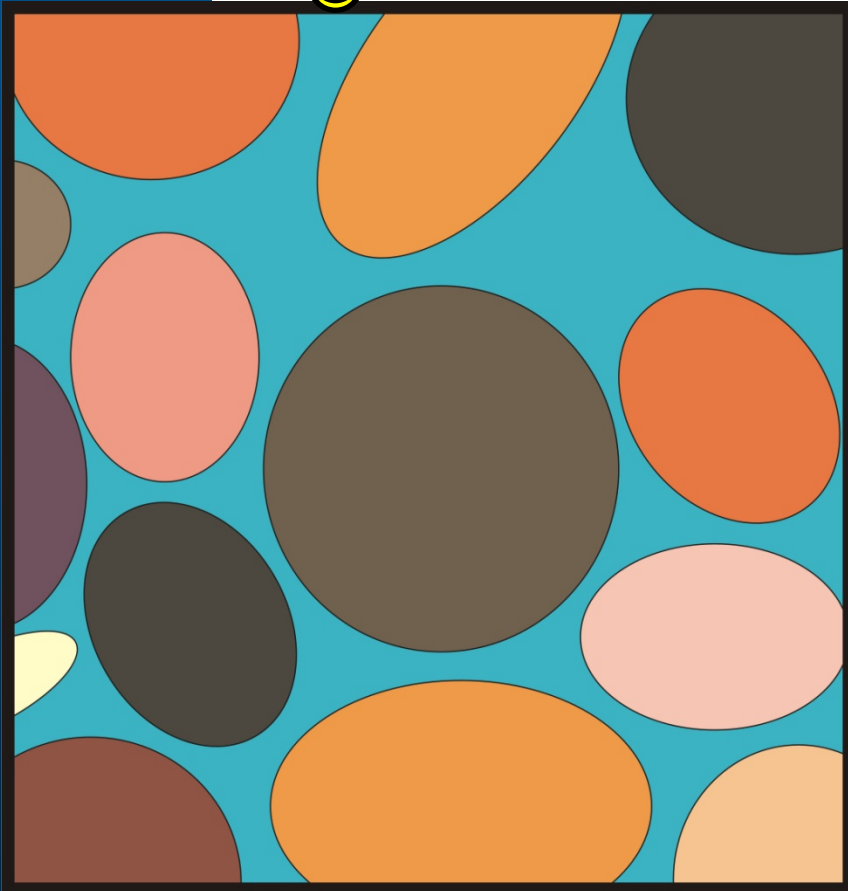
Pumping Rates



Contaminant Transport



Porous Media vs. Fractured Rock



Types of Contaminants

- Agriculture
 - Pathogenic bacteria
 - Nitrates
 - Pesticides



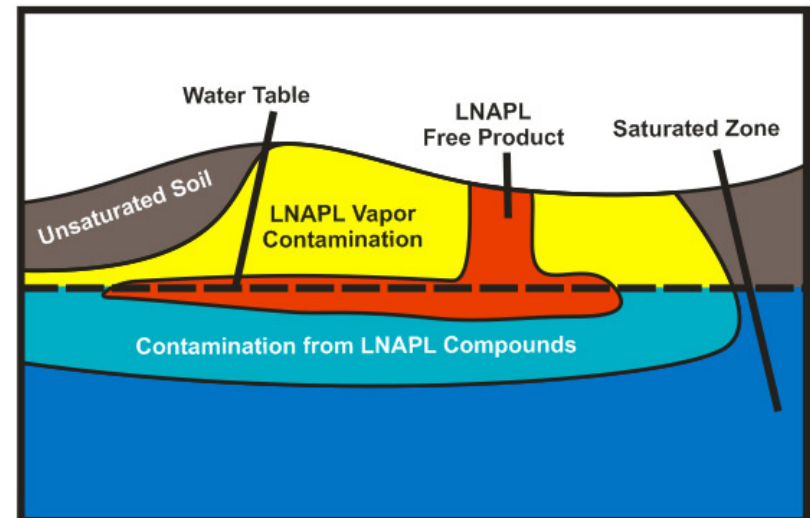
Types of Contaminants

- Septic tanks
 - Pathogenic bacteria
 - Nitrates
 - Pharmaceuticals



Types of Contaminants

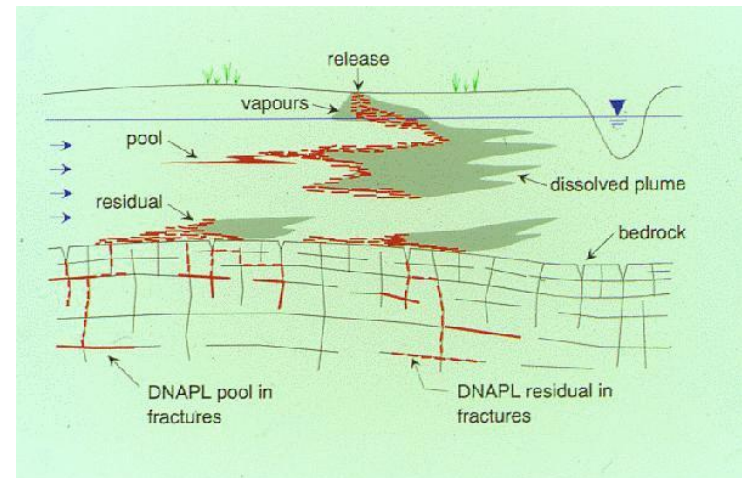
- LNAPLs
 - Oil and gas
 - Less dense than water



Source: amiandini.com

Types of Contaminants

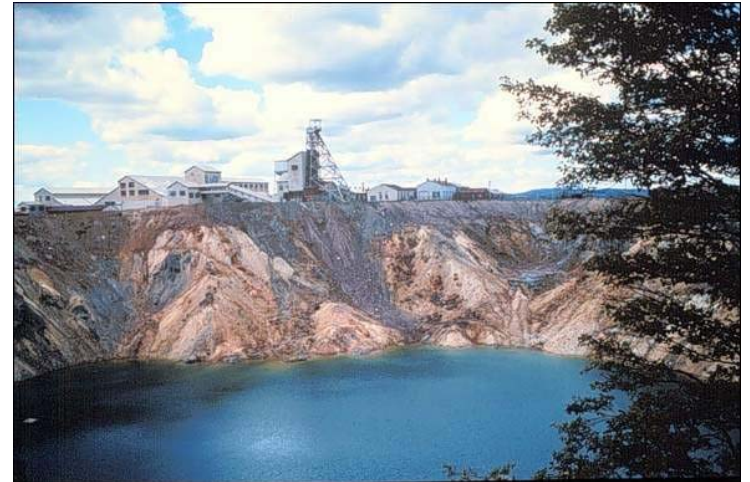
- DNAPLs
 - Solvents
 - Denser than water
 - Very persistent in nature



Source: B. Kueper, Queen's University

Types of Contaminants

- Mines
 - metals



Buchans

Source: heritage.nf.ca

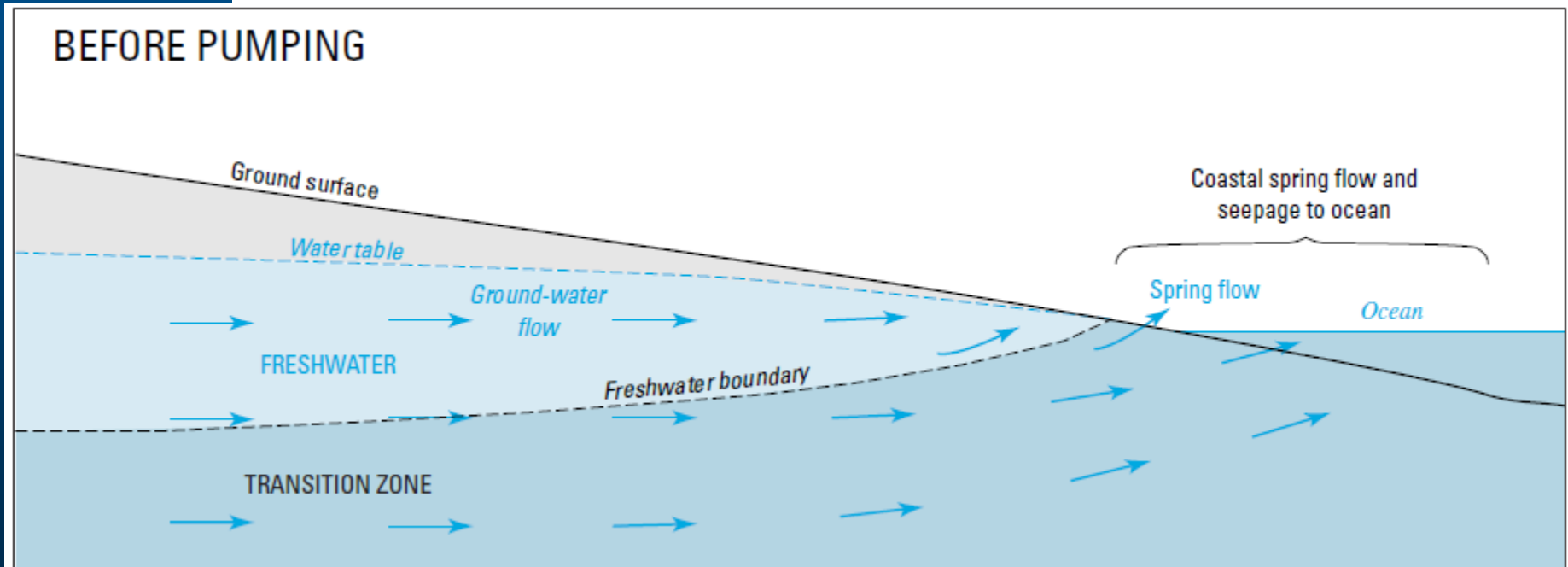
Types of Contaminants

- Landfills
 - Metals, DNAPLs, LNAPLs, etc...



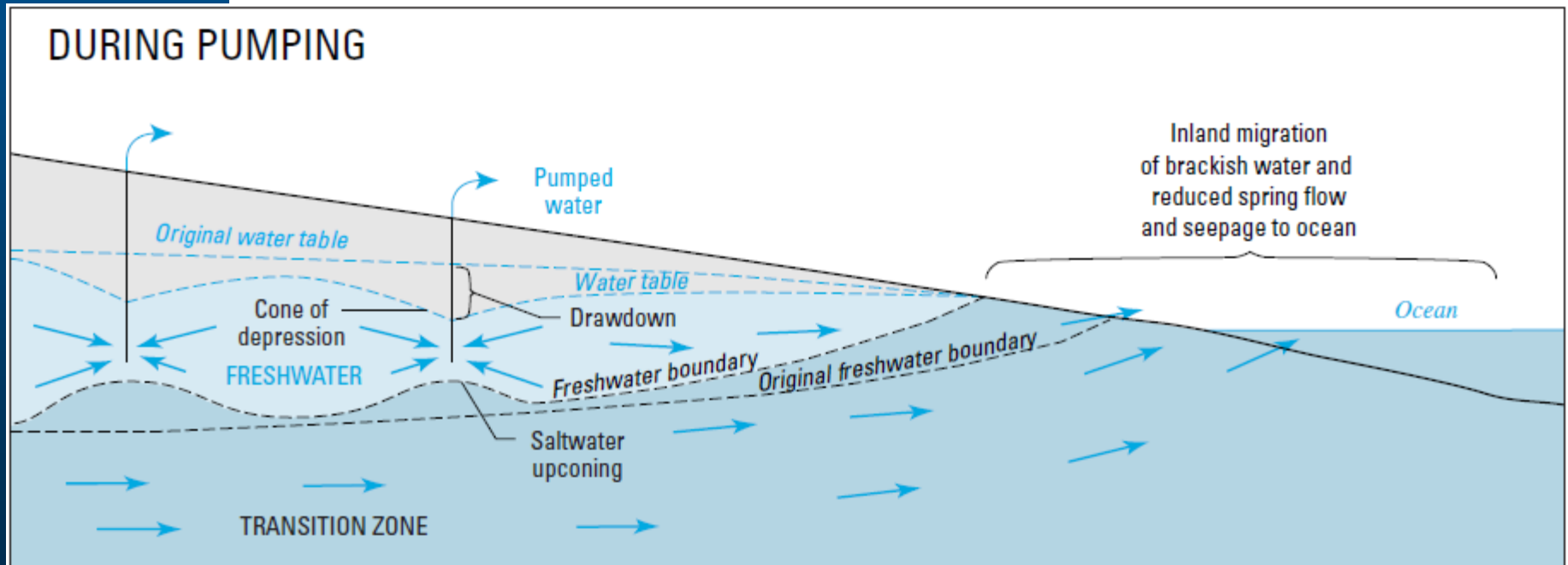
Types of Contaminants

- Salt-Water Intrusion

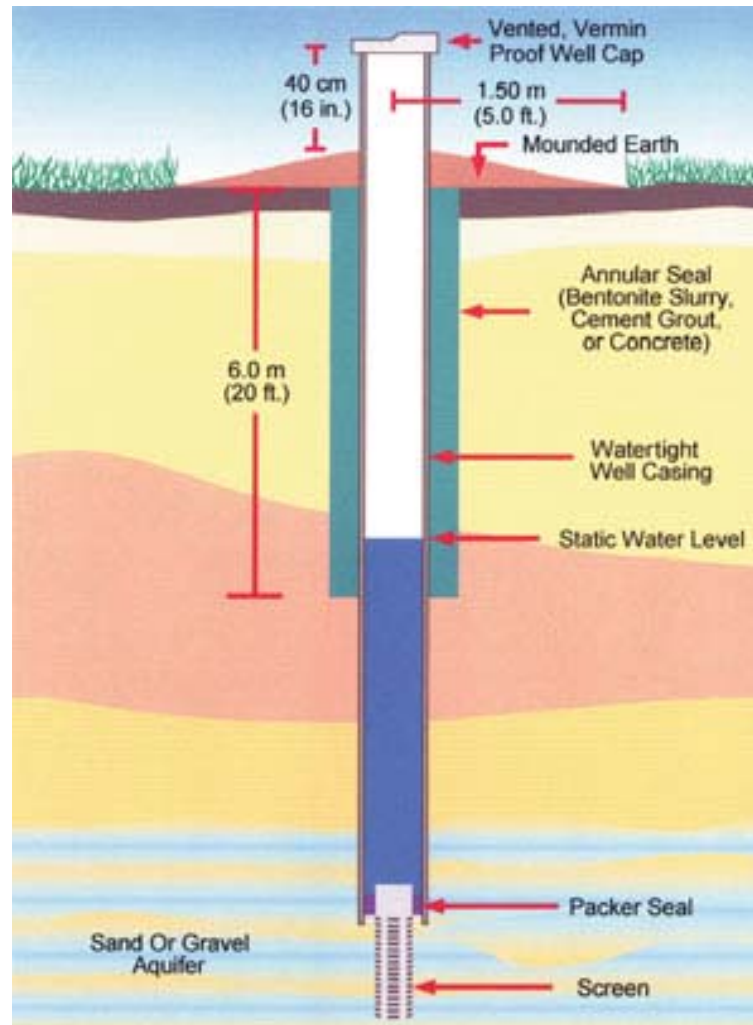


Types of Contaminants

- Salt-Water Intrusion



Well Completion



Source: Ontario Ministry of Health and Long Term Care



Water Resources
Management
Division

Department of
Environment &
Conservation

Thank You

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729-3398