

Understanding water quality

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Defining water quality



- “Water quality” is a term used to express the suitability of water to sustain various uses or processes
- Dependent on
 - Type of use
 - Source of water

Surface and Subsurface Water

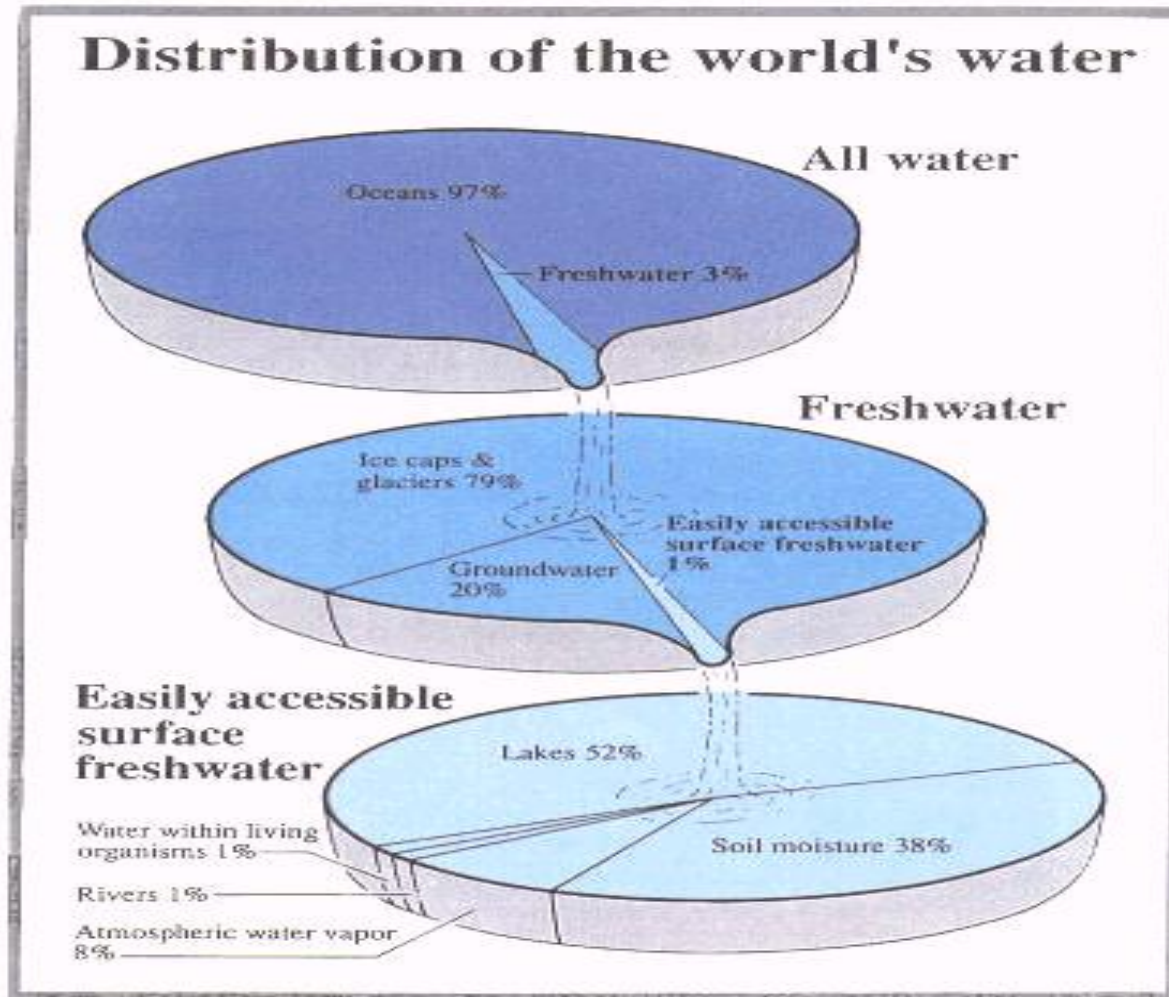


Table 2.3 Common water uses



Water uses	Consuming	Contaminating
Domestic use	Yes	Yes
Livestock watering	Yes	Yes
Irrigation	Yes	Yes
Aquaculture	Yes	Yes
Commercial fisheries	Yes	Yes
Forestry and logging	No ¹	Yes
Food processing	Yes	Yes
Textile Industry	Yes	Yes
Pulp and paper Industry	Yes	Yes
Mining	Yes	Yes
Water transportation	No	Yes
Hydroelectric power generation	No	No ²
Nuclear power generation	Yes	Yes
Recreation	No	Yes

¹Water availability may be altered due to changes caused in run-off regimes

²Thermal characteristics of the water body may be altered



Drinking Water Sources

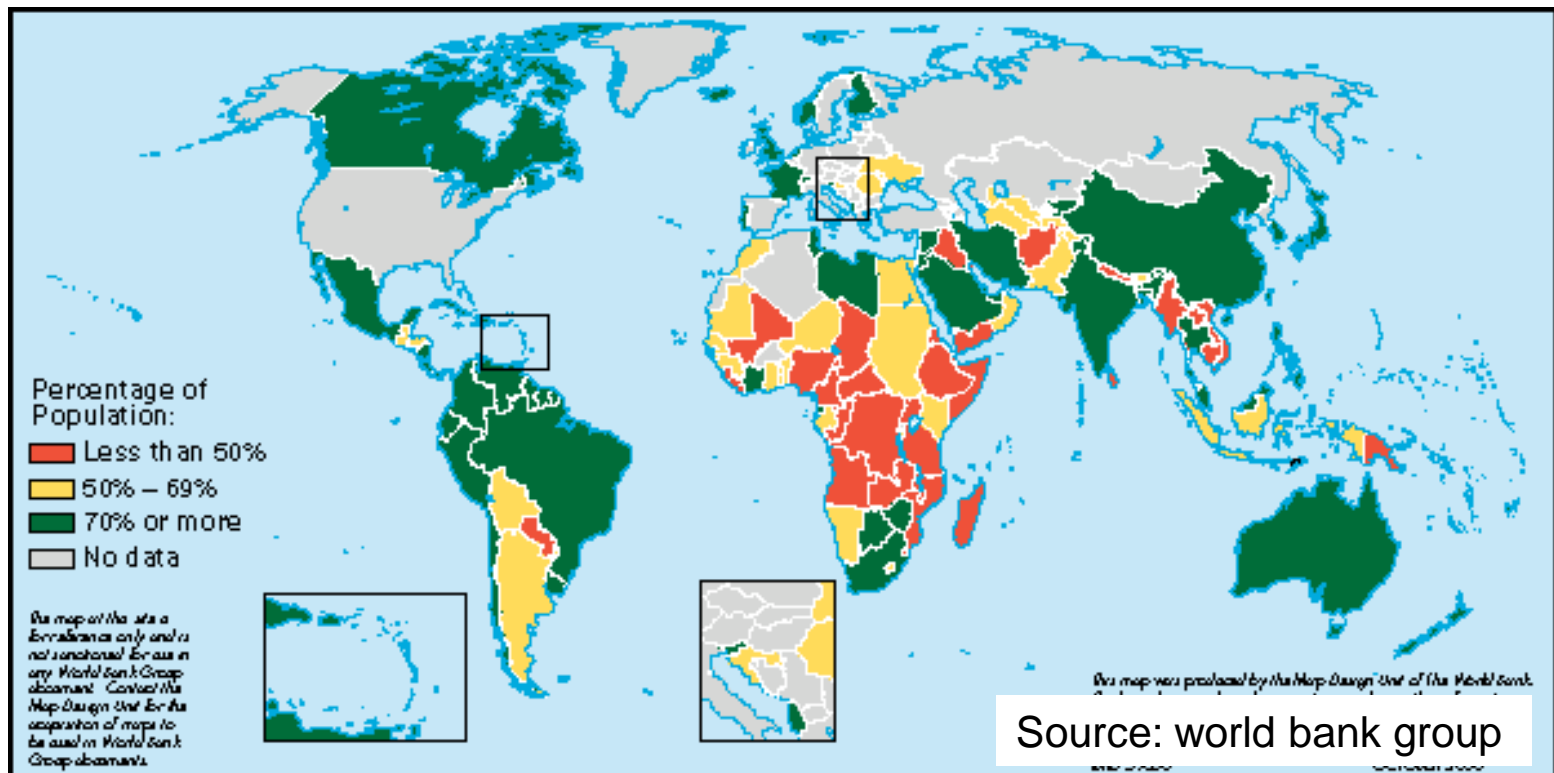
- Groundwater is stored in large aquifers beneath the soil surface
- Groundwater has been the preferred source for drinking water, because the quality tends to be better than surface water
- Advancements in the water treatment process have increased the use of surface water as a drinking water source





Access to Safe Water

- Estimates suggest that nearly 1.5 billion people lack safe drinking water and that at least 5 million deaths per year can be attributed to waterborne diseases (U of M).



Pollutants of Concern

Municipal Sector:

- Nutrients
- Pathogens
- Pesticides
- Pharmaceuticals

Industrial Sector:

- Nuclear
- Thermal
- Heavy metals
- Nutrients

Agricultural Sector:

- Nutrients
- Pathogens
- Pesticides



Source: LCBP



Source: BBC News



Source: EOEarth



Table 2.2 Important processes affecting water quality

Process type	Major process within water body	Water body
Hydrological	Dilution	All water bodies
	Evaporation	Surface waters
	Percolation and leaching	Groundwaters
	Suspension and settling	Surface waters
Physical	Gas exchange with atmosphere	Mostly rivers and lakes
	Volatilisation	Mostly rivers and lakes
	Adsorption/desorption	All water bodies
	Heating and cooling	Mostly rivers and lakes
	Diffusion	
Chemical	Photodegradation	
	Acid base reactions	All water bodies
	Redox reactions	All water bodies
	Dissolution of particles	All water bodies
	Precipitation of minerals	All water bodies
	Ionic exchange ¹	Groundwaters
Biological	Primary production	Surface waters
	Microbial die-off and growth	All water bodies
	Decomposition of organic matter	Mostly rivers and lakes
	Bioaccumulation ²	Mostly rivers and lakes
	Biomagnification ³	Mostly rivers and lakes



Drinking Water Quality Guidelines

- Obtained from WHO
 - http://www.who.int/water_sanitation_health/dwq/gdwq3rev/en/index.html
- Water treatment facilities use this guide as a reference. Some regions have even lower tolerable concentrations of certain pollutants.

Example:

12.94 Nitrate and nitrite

Nitrate and nitrite are naturally occurring ions that are part of the nitrogen cycle. Nitrate is used mainly in inorganic fertilizers, and sodium nitrite is used as a food preservative, especially in cured meats.....

Guideline value for nitrate	50 mg/litre to protect against methaemoglobinaemia in bottle-fed infants
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Drinking Water Quality Guidelines

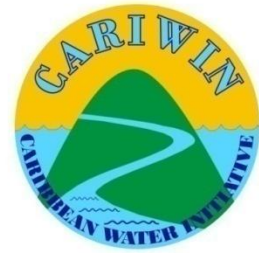


Does this mean that our drinking water is safe?



****What about the rural population who are largely serviced by privately owned wells!!!****

Objectives and guidelines



- In Canada, governments use various measures to protect water quality, among them *guidelines* and *objectives*. The two measures are similar in that both describe how much of a substance we, as a society, will tolerate in water.
- Guidelines and objectives are arrived at and applied differently. Water quality guidelines and objectives not only protect water users and the environment, they also promote sustainable water management strategies.
- Water quality guidelines are scientifically determined and indicate the maximum allowable concentration of substances for a *particular water use* such as livestock watering or swimming. These national guidelines serve as the targets for environmental protection.
- Water quality objectives, on the other hand, specify the concentrations of substances permissible for all intended water uses at a *specific location* on a lake, river, or estuary. The objectives are based on the water quality guidelines for the uses at that location, as well as on public input and socio-economic considerations.



SWP: A Canadian Perspective

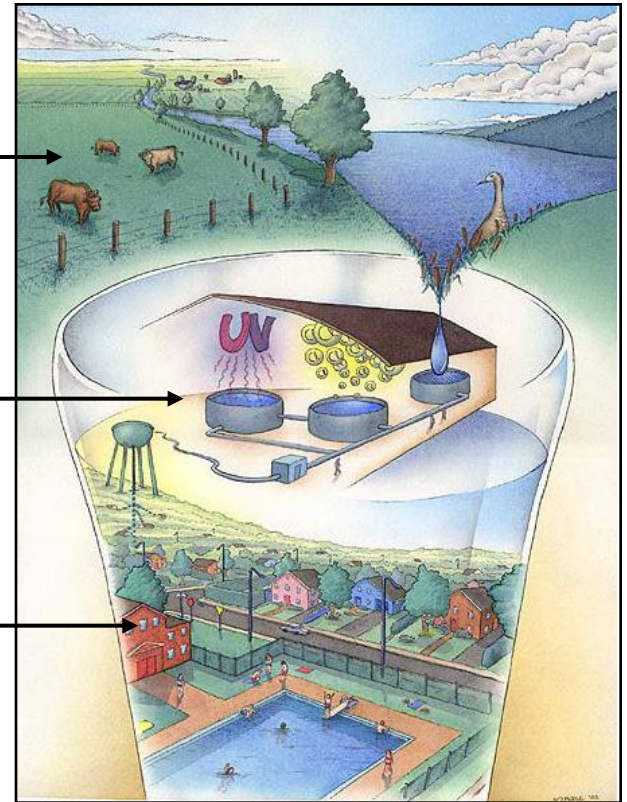
SWP: One part in the multi-barrier approach which is the protection of natural surface and ground water sources for the purpose of securing safe drinking water for the future.

From Source to Tap

SWP

Water Treatment

Water Distribution



Source: Pollution Probe

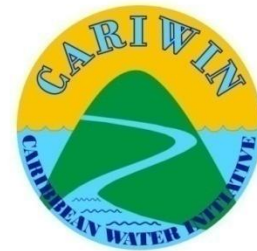


SWP: A Canadian Perspective

SWP occurs at the watershed level

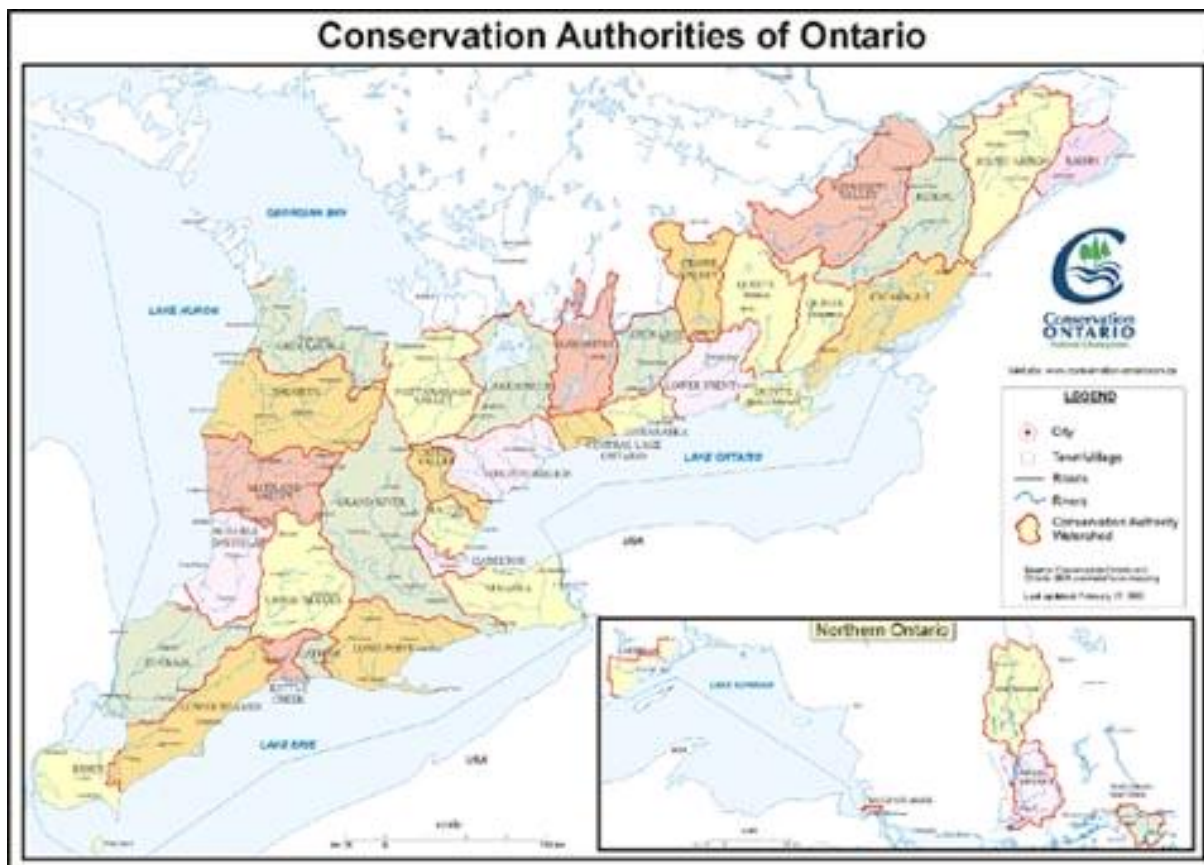


Source: Pollution Probe



SWP: Administration

SWP is administered in conjunction with the federal government, provincial government, *conservation authorities*, interest groups and local municipalities. e.g.: ON, Canada





How to Meet the Goal of SWP?

Answer: Address the issues of pollution within each watershed from each sector

Municipal

- Impose discharge regulations on wastewater treatment facilities
- Impose regulations on septic tank installation and promote the upgrade of dated septic tanks
- Land planning / Zoning

Industrial

- Impose discharge regulations
- Permit to pollute tax programs

Agricultural

- Nutrient management regulations
- Promote BMP's
- Fill in abandoned wells



Source: Iowa State University

Summary: Video

