

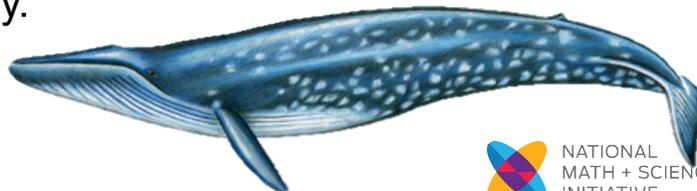
WATER AND WATER POLLUTION



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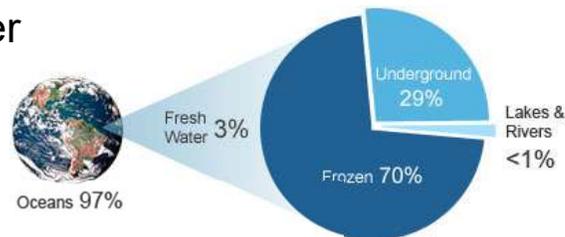
Properties of Water

1. High specific heat allows for constant temperatures.
2. Buoyant nature minimizes energy spent by organisms struggle with gravity.
3. Aquatic organisms easily obtain dissolved nutrients.
4. Mitigates world's climates by redistributing energy.



Available Water

1. 97% of Earth's water is saltwater or marine
2. 2.3% of freshwater is locked up in ice caps and glaciers
3. 0.7% is easily accessible
 - a. Groundwater
 - b. Streams
 - c. Lakes



Freshwater



Groundwater

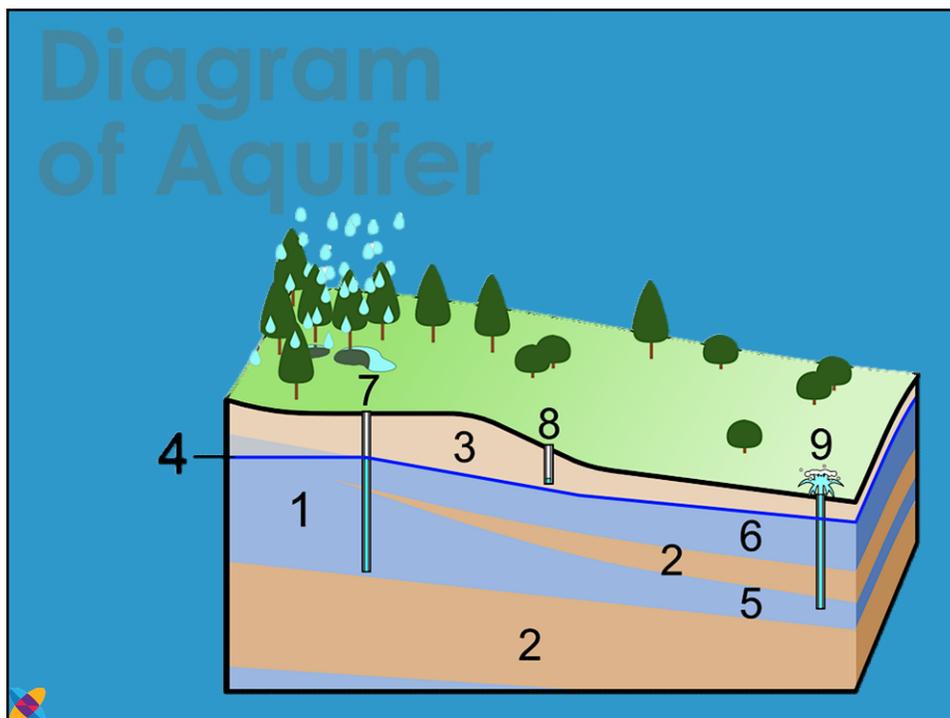
Water found below the surface

- As precipitation infiltrates and **percolates** through voids in soil and rock
 - Pores, fractures, crevices, etc.
- **Zone of saturation** is at a depth where ground is filled with water
- Top of this zone is **water table**
 - Falls in dry weather
 - Rises in wet weather



Aquifers

- Porous, water-saturated layers of sand, gravel or bedrock through which groundwater flows
- Area of land that supplies water to aquifer is called the **recharge area**
- Natural recharge is when water percolates downward, but sometimes **lateral recharge** occurs



Aquifer Subsidence

=

that sinking feeling!

Area of Subsidence

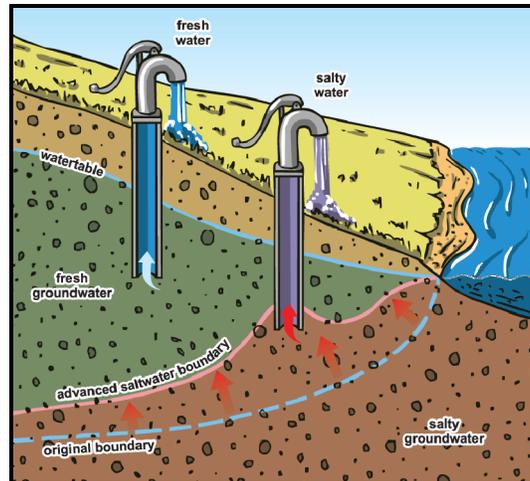
Groundwater Depletion Going, going, gone...

95% of water removed from Ogallala Aquifer is for irrigation and the removal rate is **six times** greater than the refreshing rate.

USGS

Saltwater Intrusion

The movement of saltwater into freshwater aquifers, which can lead to contamination of drinking water sources.



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Streams and Lakes

Lake facts:

- Largest surface area – Superior (US and Canada)
- Deepest and largest volume – Baikal (Russia)

River facts:

- Longest – Nile (many)
- Largest – Amazon (many)



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Streams and Lakes

Reservoirs and man-made lakes are created by dams. These dams not only provide a means for water storage, but can also be used to produce electricity through **hydroelectric** means. Hydroelectric energy production limits greenhouse gas emissions.



Streams and Lakes

Problems associated with dams:

1. dams can destroy habitat reducing biodiversity
2. downstream reduced water quality
3. blocked fish migration
4. dams trap sediments
5. increased water-borne illnesses in reservoir
6. dams greatly disrupt the flow of rivers.



Dam Construction



1800-2009

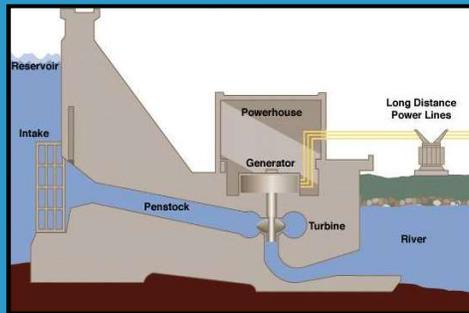


Three Gorges Dam



- World's largest hydroelectric dam, Three Gorges, Yangtze River
- 1.2 - 1.9 million people displaced

James Bay



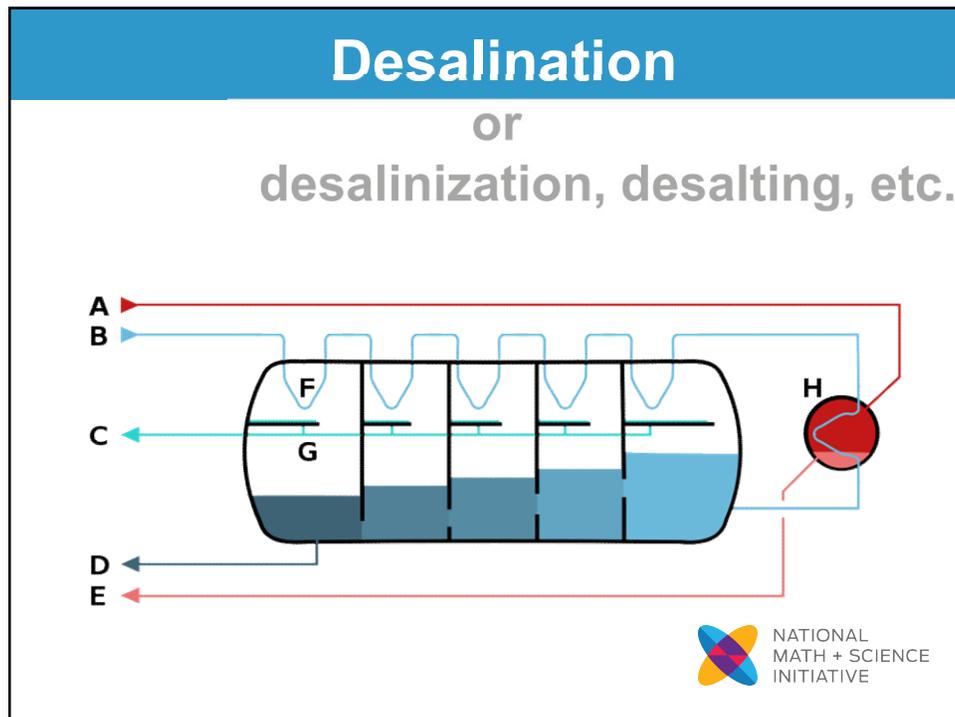
Problems project created:

1. the release of organic mercury into the water of the reservoirs from decaying trees
2. interference with fish populations
3. disruption of animal populations
4. severe alteration of a traditional way of life of the local native people

+ H₂O

Increasing Water Supplies

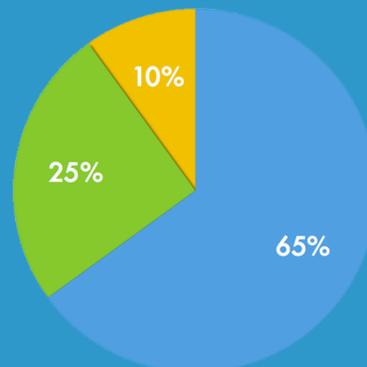
- Build dams and reservoirs to store runoff
- Bring in surface water from another area
- Withdraw groundwater
- Convert salt water to fresh water (desalination)
- **Improve the efficiency of water use**



1. 65% of all water withdrawn for human use on an annual basis is used in **agriculture**
2. 25% is used in **industry**
3. 10% used **domestically** (household, drinking water, sanitation)

H₂O

Global Use





H₂O
National Use

- 41% - Energy production
- 38% - Irrigation
- 11% - Industry
- 10% - Public

Too Little Water...

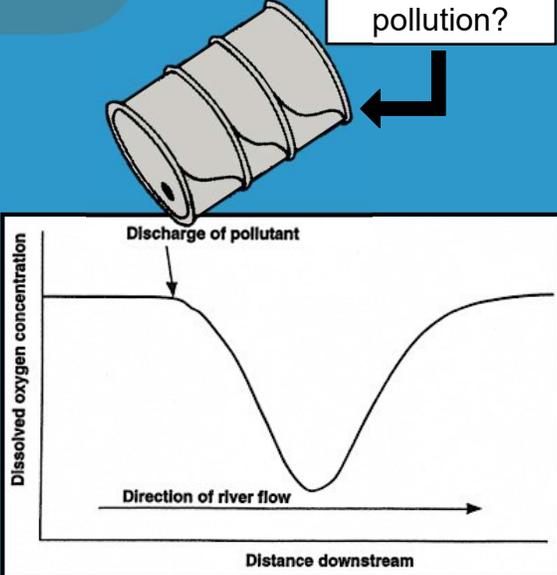
Dry climate and poor conservation practices lead to:

1. **Drought** - a period in which precipitation is much lower and evaporation is much higher
2. **Desiccation** - drying of soil because of such activities as deforestation and overgrazing
3. **Water stress** - low per capita availability of water caused by overpopulation

BOD

Biological Oxygen Demand is a measure of the oxygen used by microorganisms to decompose this waste.

Is this point source or non-point source pollution?



Water Quality Tests

Macroinvertebrates



Coliform Bacteria



Chemical Tests

Organisms that are large (macro) enough to be seen with the naked eye and lack a backbone (invertebrate).

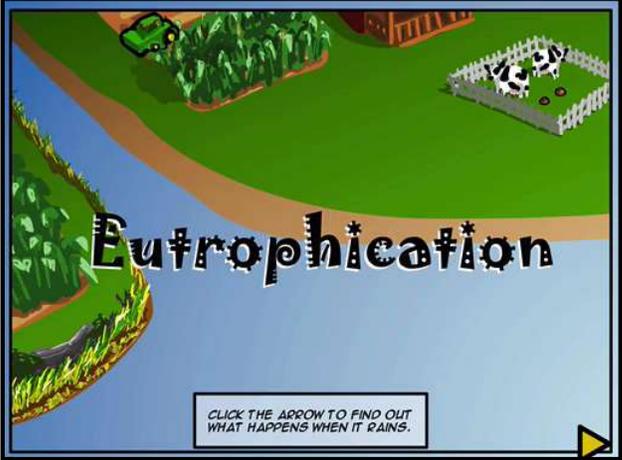
WHO recommends 0 colonies for drinking. **EPA** recommends max of 200 colonies for swimming (100 mL-sample).

- pH
- Dissolved oxygen
- Nitrate
- Heavy metals

Eutrophication

“enrichment of lakes and rivers”

Cultural Eutrophication:
process of human activities accelerating the input of nutrients





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Classes of Water Pollution

<p><i>Disease Causing Agents</i> (pathogens)</p>	<p>bacteria, viruses, protozoa, and parasitic worms from domestic sewage from human and animal wastes</p>
<p><i>Oxygen Demanding Wastes</i></p>	<p>organic wastes that can be decomposed by aerobic bacteria which depletes oxygen</p>

Classes of Water Pollution

Water-Soluble Inorganic Materials

water-soluble nitrates and phosphates, can cause excessive growth of producers that die and deplete the oxygen content

Organic Chemicals

threatens human, animal and aquatic plant life, i.e., oil, gas, plastic, pesticides, detergents, ext.



Classes of Water Pollution

Sediments or Suspended Matter (largest class)

Suspended solids that make water cloudy reducing photosynthesis which disrupts food webs and clogs water ways

Thermal Pollution

rise in temp due to heat absorbed in water to cool power plants; increases disease

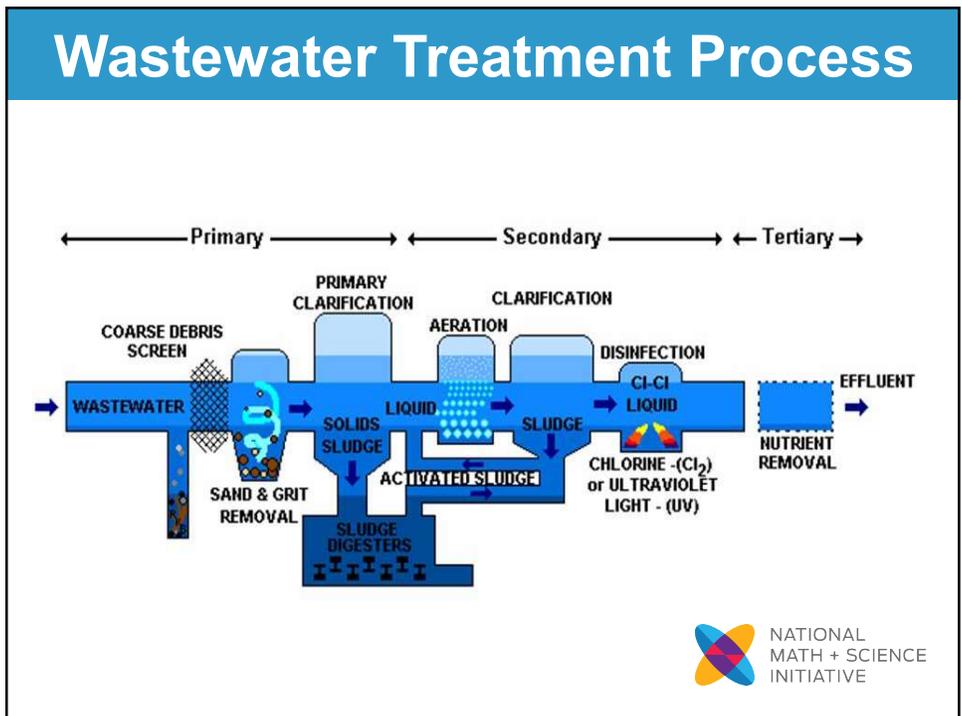


Classes of Water Pollution

Genetic Pollution

deliberate or accidental addition of nonnative species; disrupts aquatic systems and crowd out natives; reduces biodiversity:

The image features a map of the United States with numerous red dots scattered across the landmass, representing the locations of genetic pollution. To the right of the map, there are several images of clams, likely representing a species that has been introduced or spread through genetic pollution.



Clean Water Policies

Clean Water Act established the basic structure for regulating discharges of pollutants into the waters of the United States. It gave EPA the authority to implement pollution control programs such as setting wastewater standards for industry.

Safe Drinking Water Act of 1974 established to protect the quality of drinking water in the U.S. This law focuses on all waters actually or potentially designed for drinking use, whether from above ground or underground sources.

**Preservation
of
Clean water**

