Hydrosphere

WHAT IS THE BIG DEAL ABOUT WATER ANYWAY?

The Structure of Hydrosphere

HYDROSPHERE: "THE WATER CIRCLE": ALL THE WATER LOCATED ON THE EARTH.

Why should we care about water?

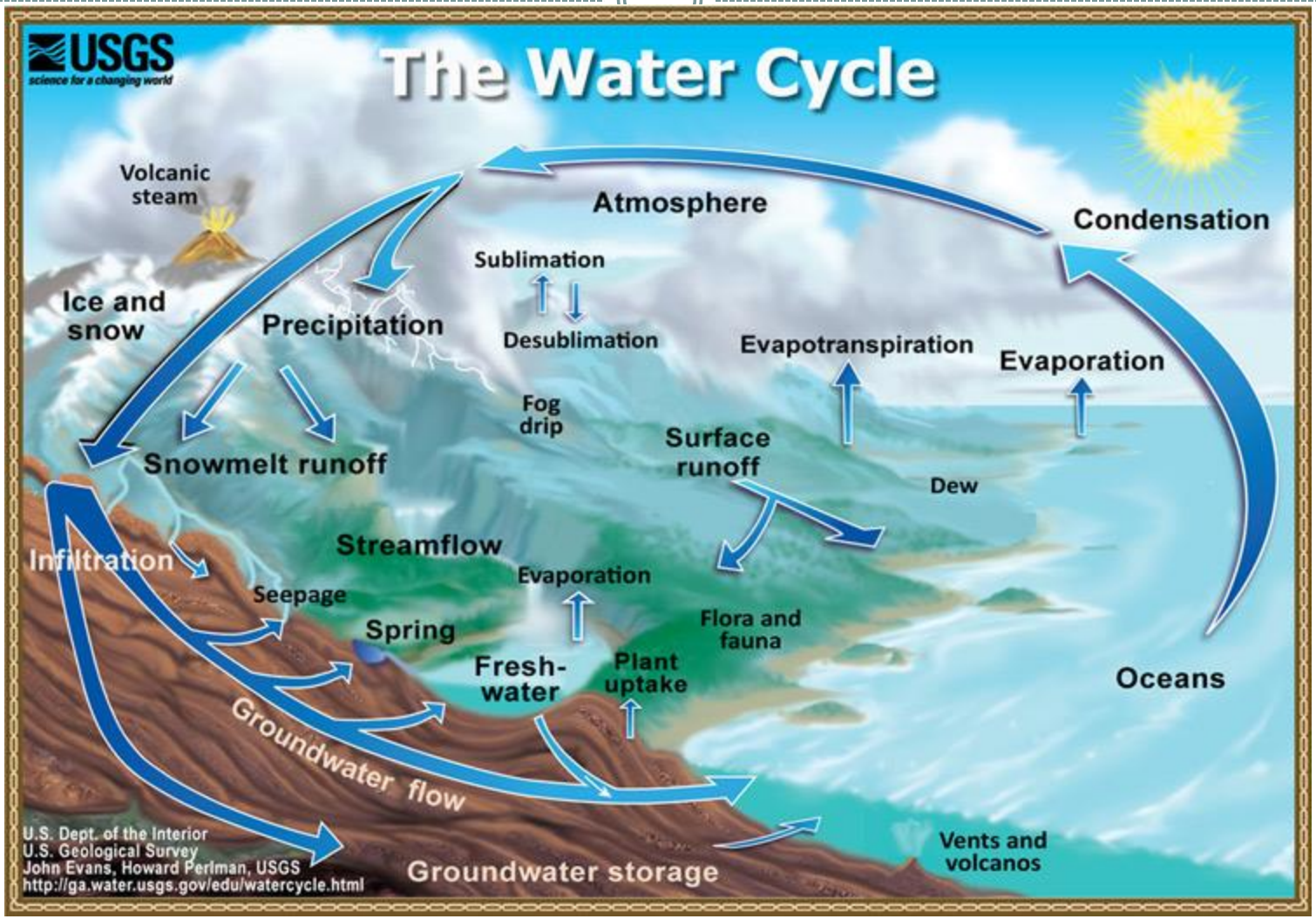
- We need water to live; so do animals and plants. No living being on Earth can survive without water.

Why should we care?

- Water is rarely found on Earth as "pure".

- Water is recycled, so that means that all the water we have on earth is the water we started with.

Water is recycled using the water cycle



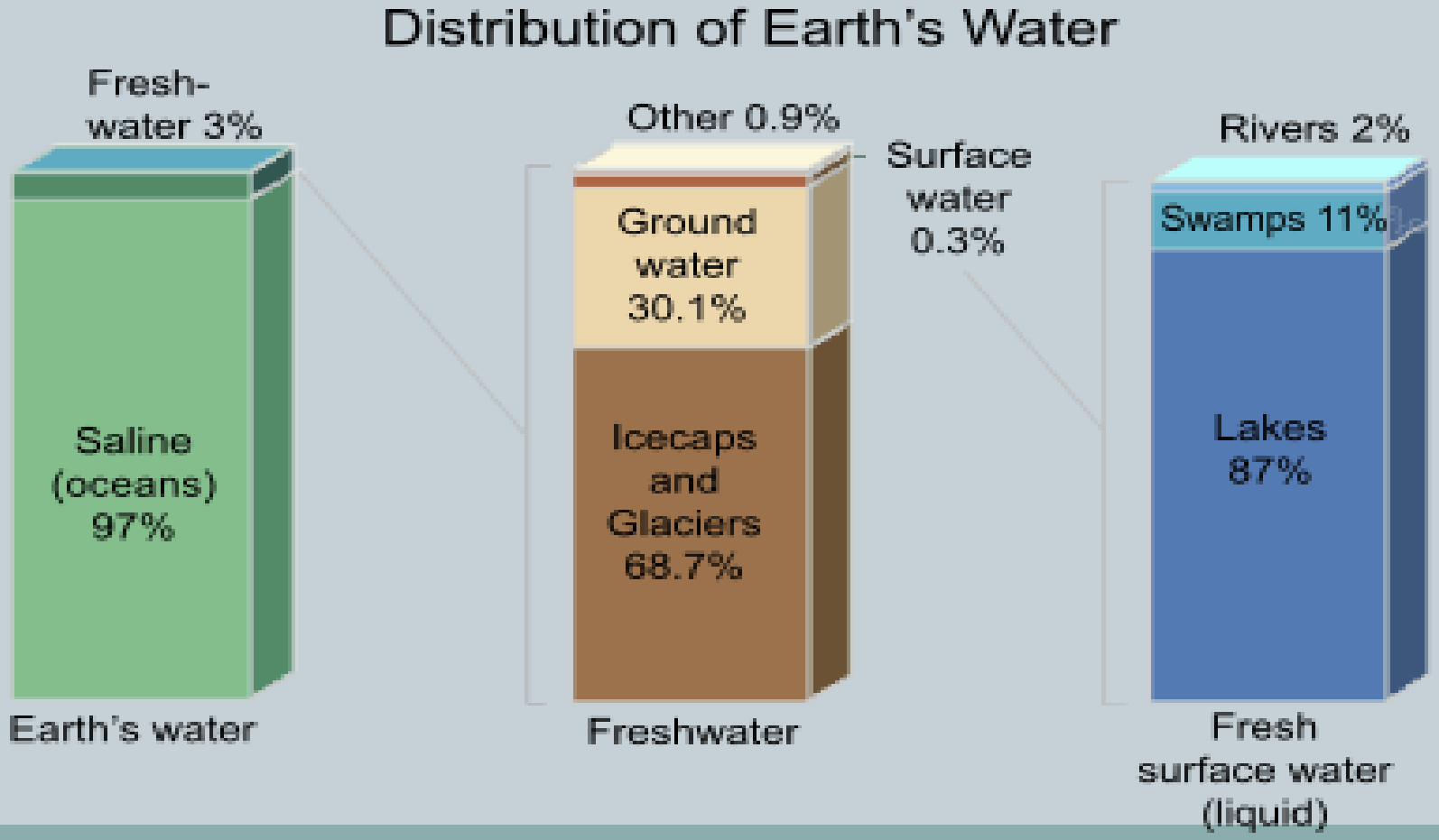
The Structure of Hydrosphere (Review)

- Water is found in the hydrosphere in two locations. Those two are:
- Oceans—96.5% of water found here
- Fresh water—3.5% of water found here

- Water is distributed as fresh water in the following locations.
- Fresh water distribution:
  - Ice: 1.762%
  - Groundwater: 1.7%
  - Surface Fresh Water: 0.014%
  - Atmosphere and soil: 0.002%

So really….

- We only have <u>1.7%</u> that we can use.



Side note:

- Water is the only substance on Earth found in all three states at the same time. Those states are
- Solid = ice
- Liquid = surface water
- Gas = water vapor

Salt water locations: Oceans

- What bodies of water hold the largest amount of water?
  - Oceans—the largest bodies of water on Earth (contain salt water only) Non-potable: not able to be used as drinking water. Potable water (water which we can drink) is found in fresh water sources.
    - Potable water: live up to drinking standards
    - Clean water: only clean enough to wash/cook with, not necessarily drink
    - Contaminated water: water that is toxic.

- What would ocean water be?

What is salt water made of?

- Salt water is made of water and dissolved "salts". It not only has NaCl, but other things too.

- The oceans contribute to the overall climate of the Earth due to water's high specific heat.

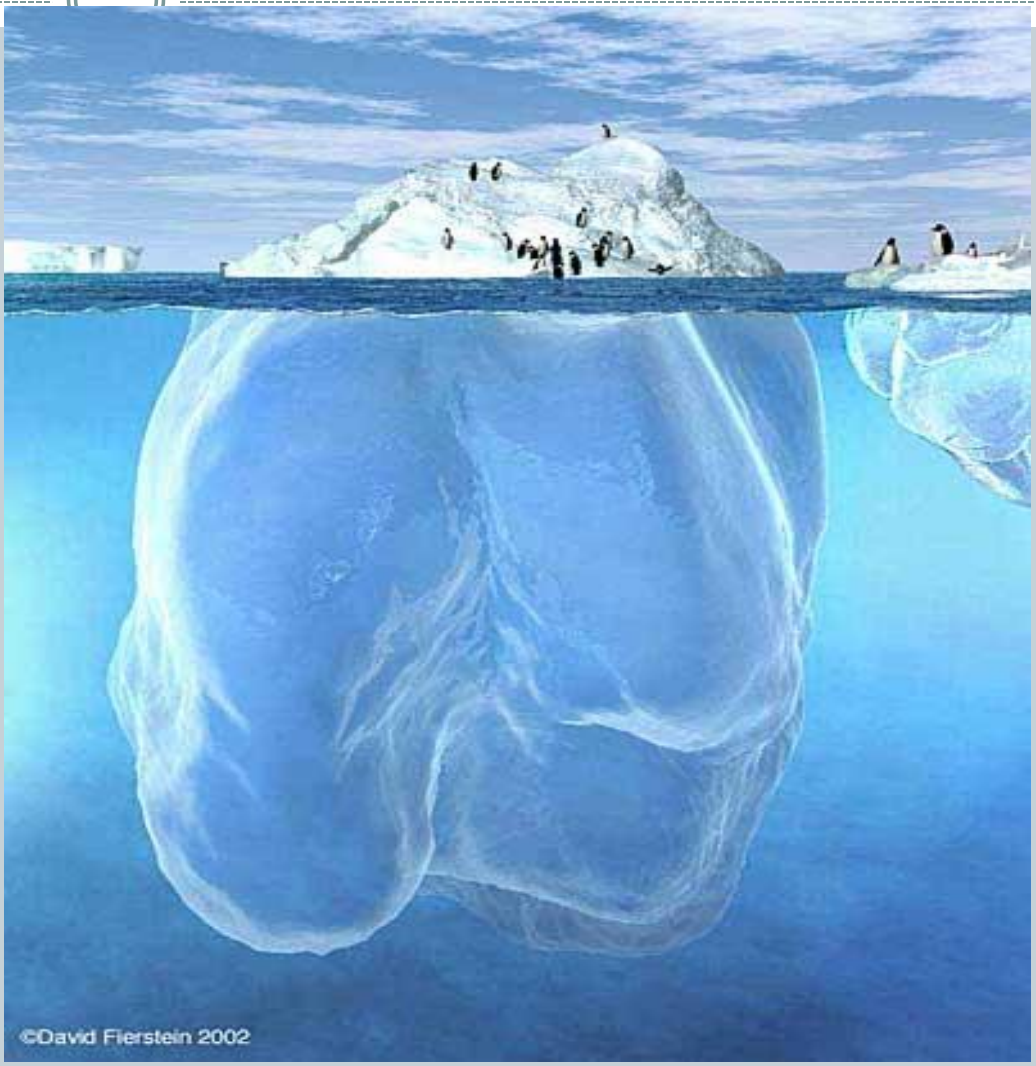
Review: What is Specific Heat? Explain it in the space provided on your notes.

Fresh Water Source-Ice

- Fresh water is water without dissolved "salts" in it.
- Many places on Earth house fresh water; the first is ice. Where would we have ice in our River Basin?
- What features house water as ice?
  - Icebergs: a large piece of freshwater ice floating in open waters
  - Glaciers: any large mass of ice that moves slowly over land
  - Permanent snow areas (areas where snow is there year round) also "house" water as ice

Iceberg

- This picture explains the phrase “the tip of the iceberg”.
- Only a small portion of an iceberg is seen above water.
- Are these in our riverbasin?

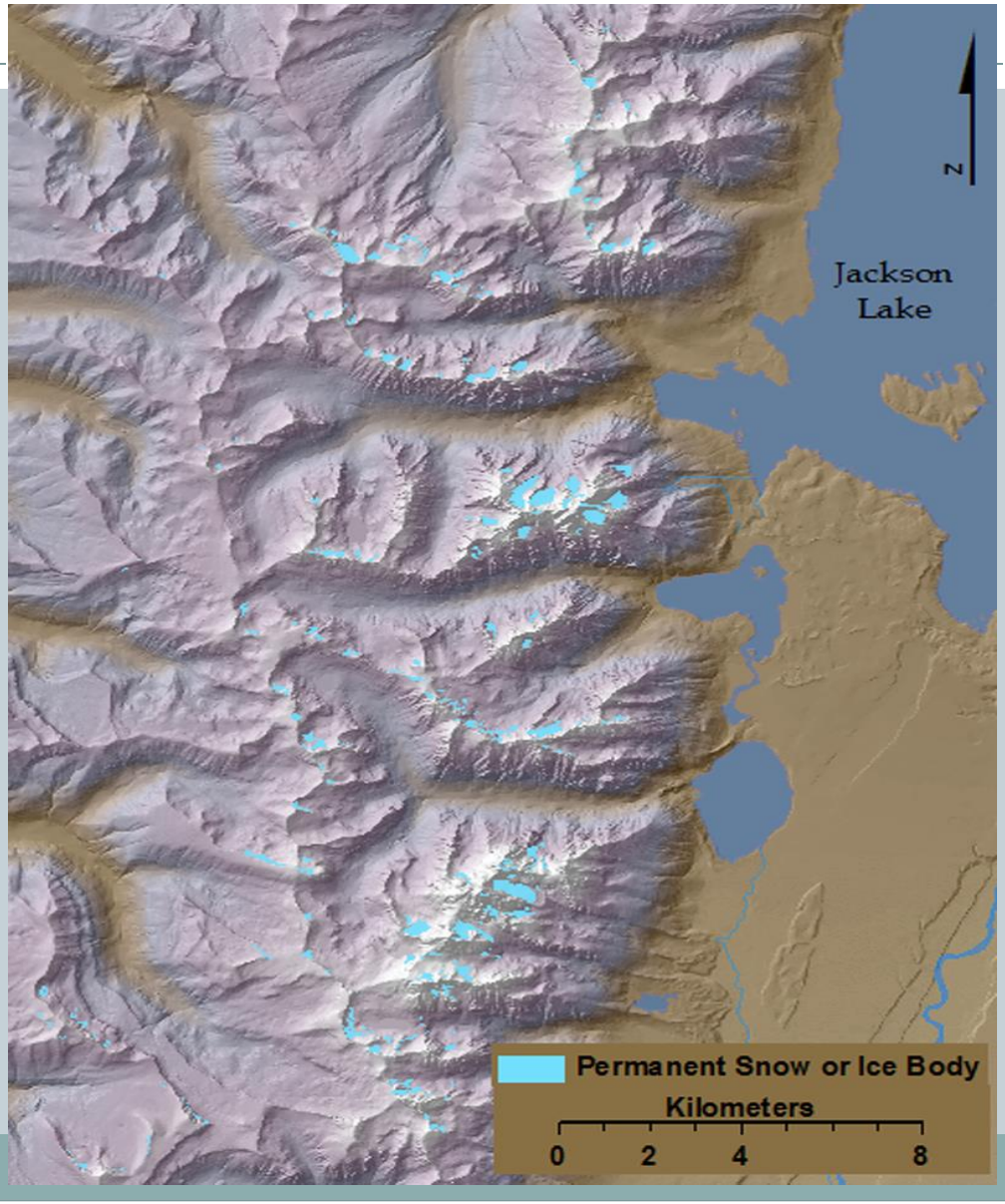


Glaciers: (frozen rivers)

- Are these in our river basin?

Permanent Snow Area

- Another example of water being housed as frozen ice.
- Are these in our river basin?



Fresh Water Locations—Surface Water

- Fresh water is located as surface water , too. Surface water is water that is located on the surface of the land. Examples would be rivers, lakes and streams.
- Where we get our water from in NC. What about our river basin?
- Rivers get their water from surrounding river basins. What is a river basin?
  - River Basin: the term used to describe an area that drains into a large river. A river basin is made of many water sheds.
  - Watershed: the term used to describe an area that drains into a smaller river or stream

Surface Water Locations—Rivers, Streams, and Lakes

- What is a river?
  - A large channel along which water is continually flowing down a slope—made of many streams that come together
- What is a stream?
  - A small channel along which water is continually flowing down a slope—made of small gullies
- What is a lake?
  - A body of water of considerable size contained on a body of land

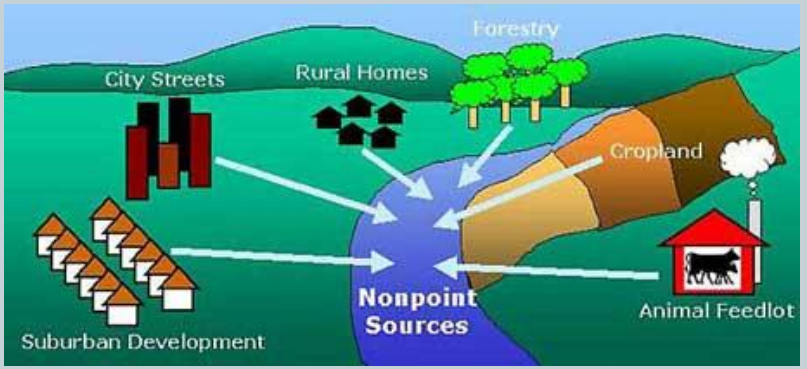
Water gets dirty by Human Land use too…

Point Source Pollution

- Pollution that comes from one specific source

Non-Point Source Pollution -

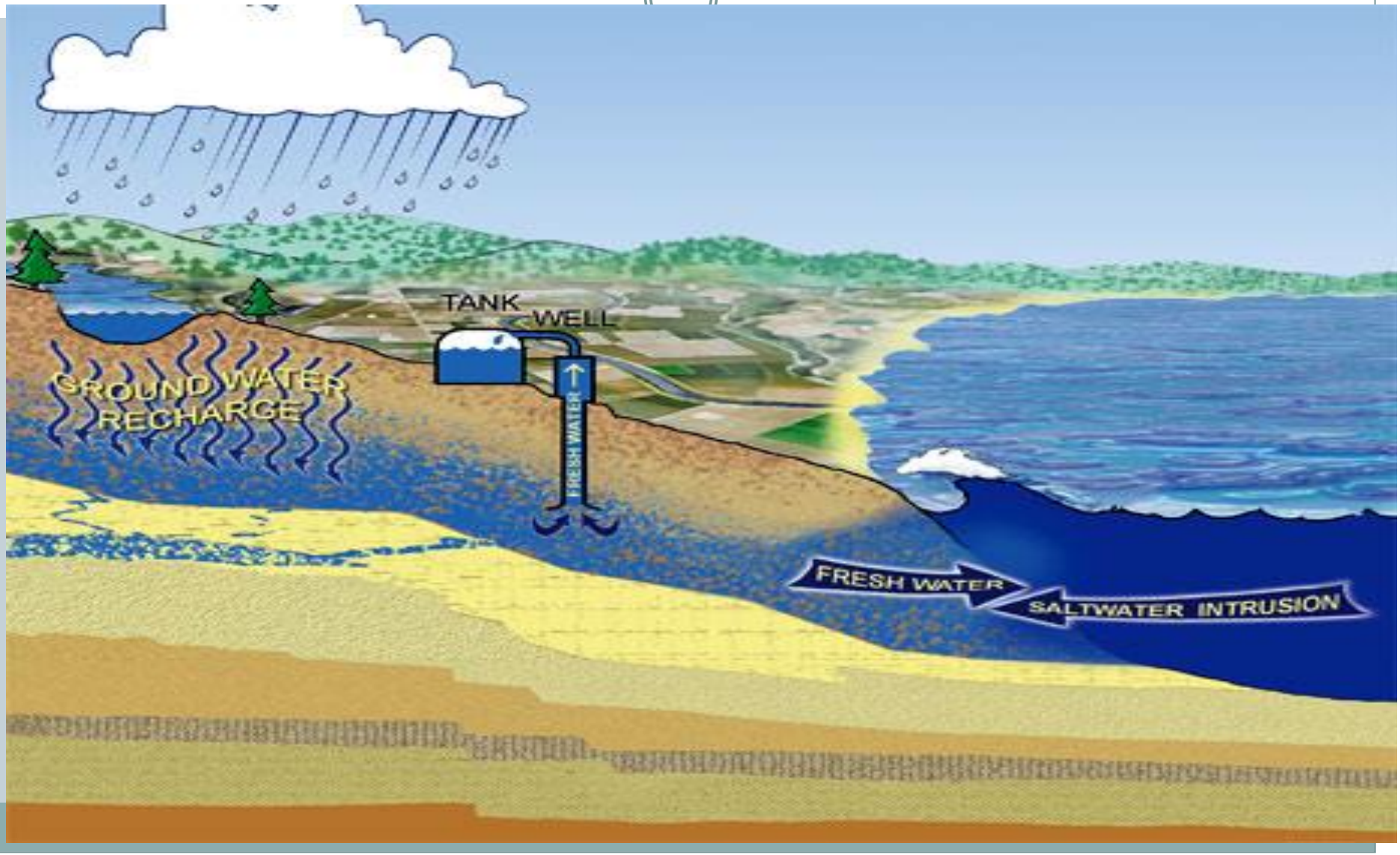
- Pollution that does not have a specific source (a bigger concern)



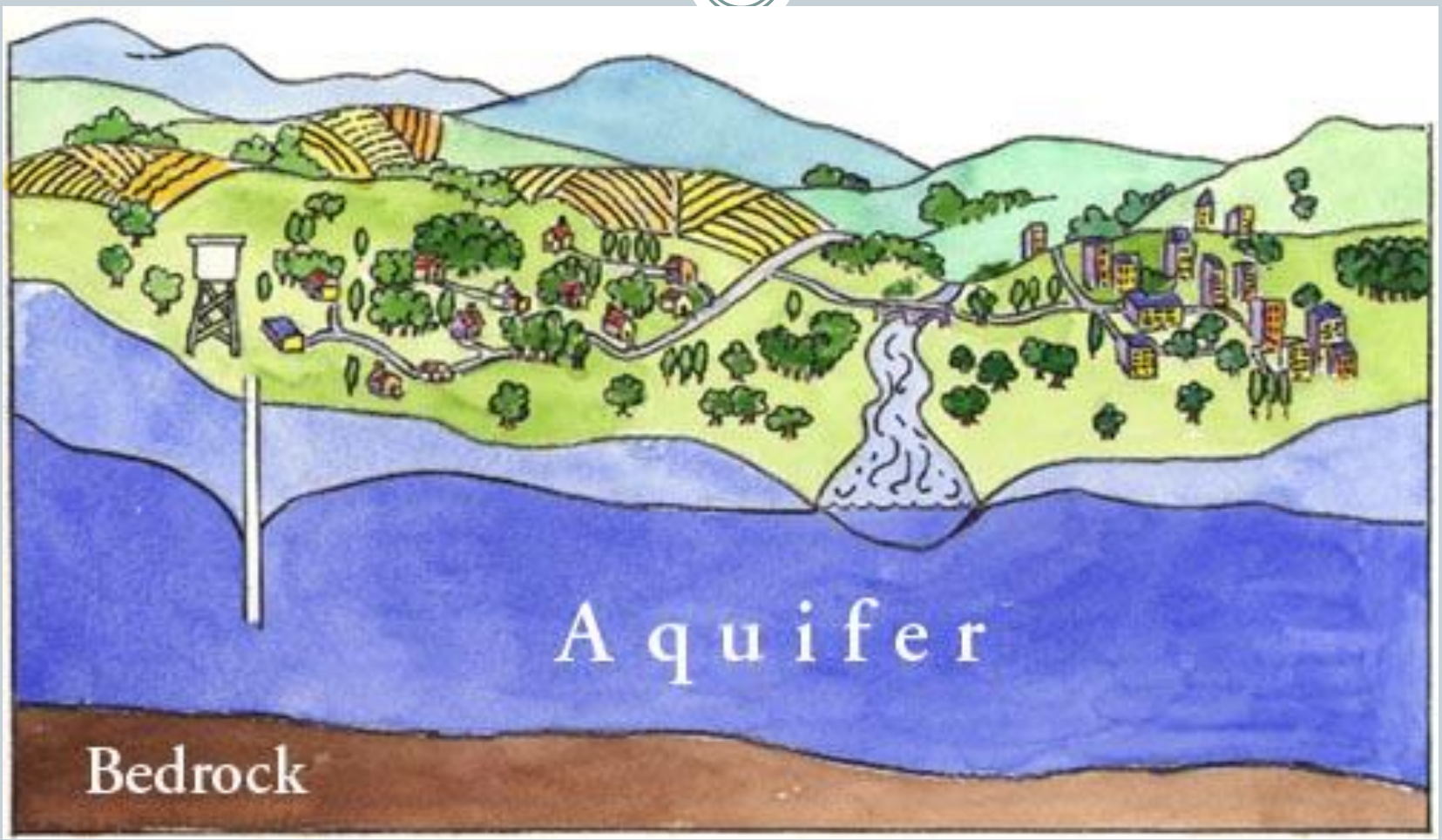
Surface Water Locations--Groundwater

- Thankfully, the ground can filter water.
- Water can also be found in the ground. This is commonly known as groundwater.
- What is groundwater?
  - The water found in cracks and pores in sand, gravel and rocks below the earth's surface
  - This is usually stored in a "water table", which houses water.
  - Water is also stored in aquifers
- What is an aquifer?
  - A porous rock layer underground that is a reservoir for water

Groundwater



Aquifer



Permeability

Non-Permeable:

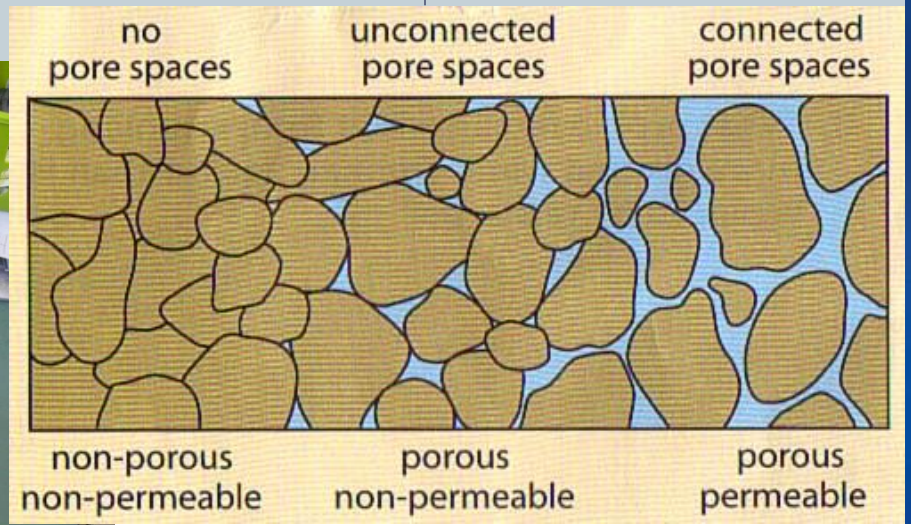
- A substance that does not allow water to flow through.

Marble, Granite

Permeable:

- Substance that allows water to flow through

Clay



Gravel and Sand

Other Surface Waters

- What is a wetland?
  - An area where the water table is at, near or above the land surface long enough during the year to support adapted plant growth
- What are the types of wetlands?
  - Swamps, bogs, and marshes
    - Swamp: a wetland dominated by trees
    - Bogs: a wetland dominated by peat moss
    - Marshes: a wetland dominated by grasses

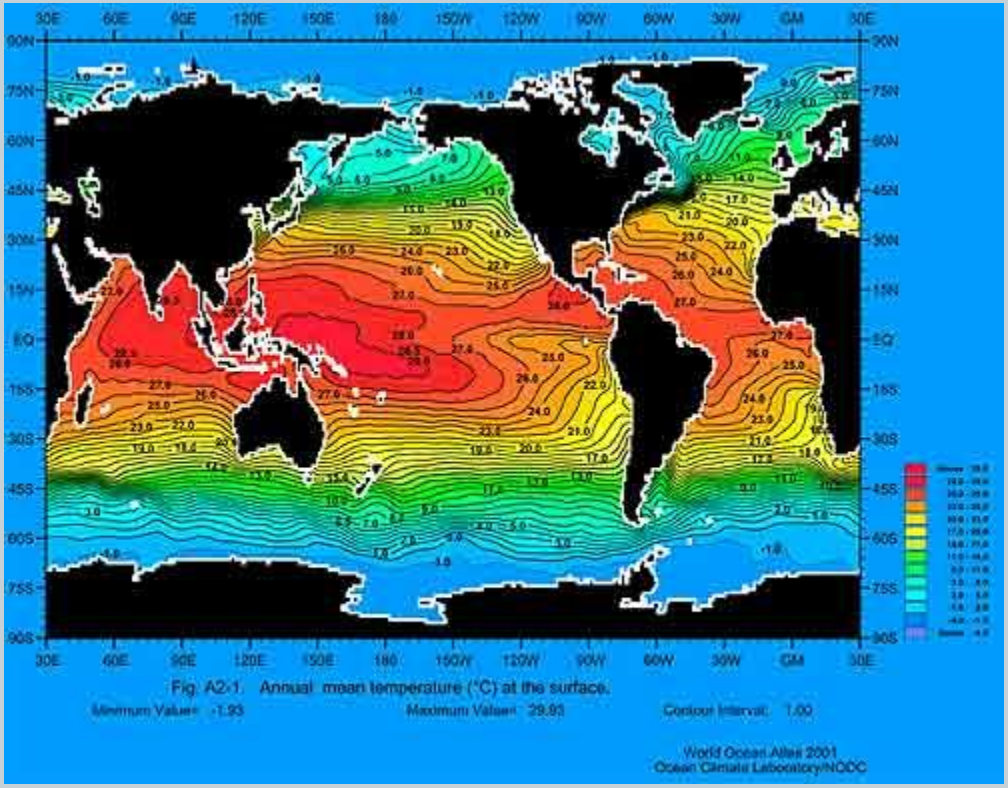
The Oceans

- Five major oceans
  - Pacific Ocean
  - Atlantic Ocean
  - Arctic Ocean
  - Indian Ocean
  - Southern Ocean (as of 2000)

** Two important factors when studying oceans are **temperature** and **salinity**

Ocean Temperature

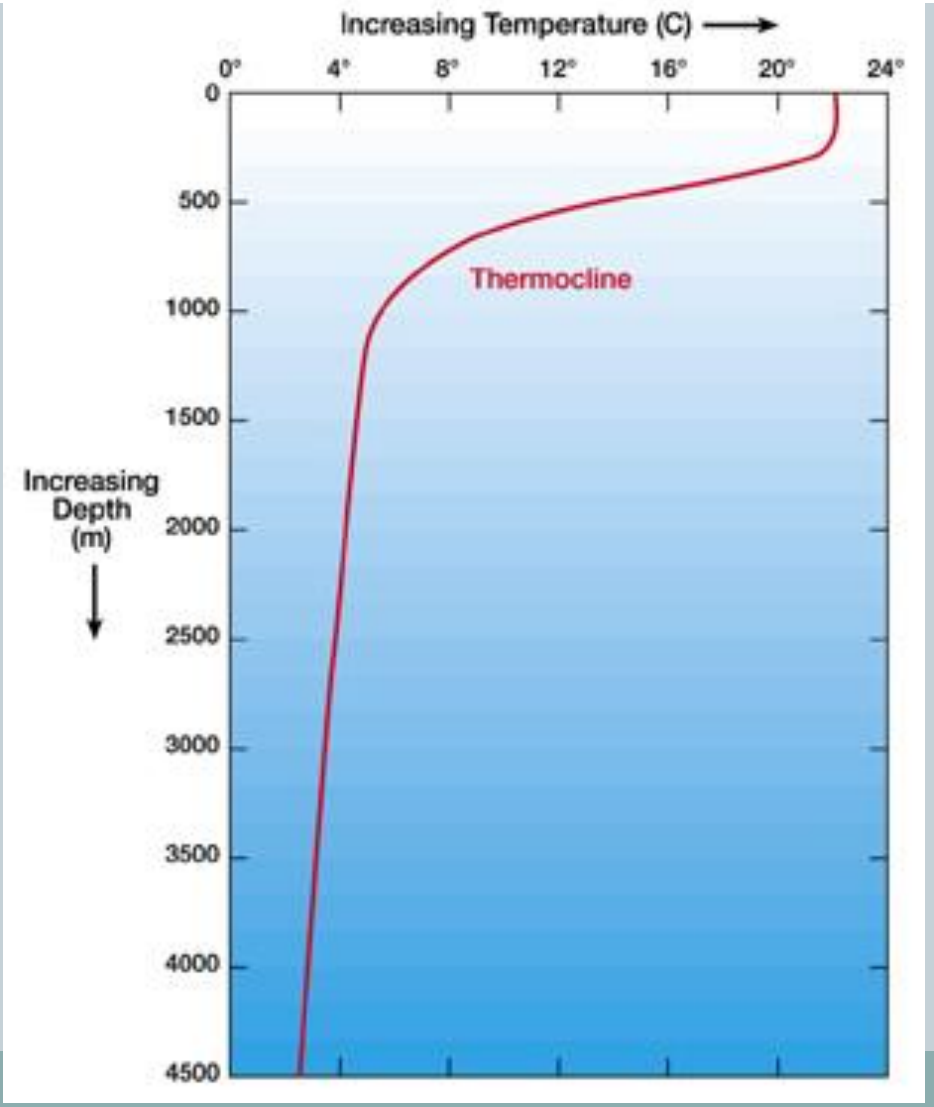
- Ocean temperature varies with depth, season and latitude



Depth

- Sunlight warms the top layer of ocean water which is called the **mixed layer**
- Below 200m temperature drops quickly; this zone of rapid temperature change is called the **thermocline**
- Beneath the thermocline at about 1000m, water temperatures are uniformly cold at about 4°C

Ocean Temperature and Depth



ST
EST

Season

- Oceans warm slightly in summer and cool slightly in winter.
- The changes in temperature are less pronounced than on the land because water loses or gains heat much more slowly than land.

Latitude

- Ocean waters are 25°C to 28°C at the equator and only 12°C to 17°C in the temperate zones.
- They are colder still at extreme northern and southern latitudes (<10°C).

ST
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Ocean Salinity

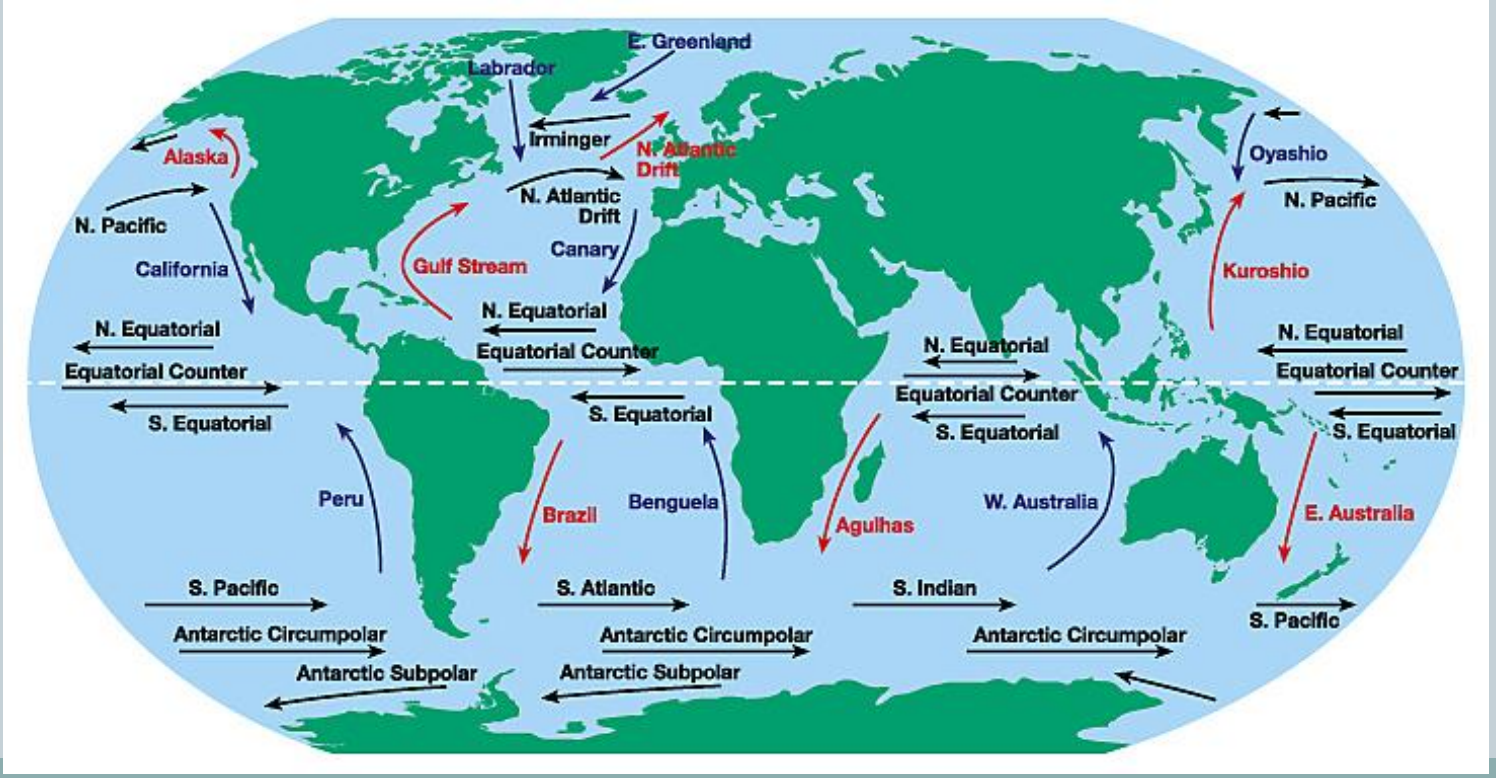
- Salts dissolved from the lithosphere create a salty ocean. These salts dissolve as rivers flow over the ground and empty into the ocean.
- **Salinity** is a measure of the amount of salt dissolved in a liquid.
- Ocean salinity is about 3.4 to 3.7%

Ocean Circulation

- Water in the ocean is in constant motion.
- An **ocean current** is the movement of seawater in a certain direction.
- **Ocean circulation** is the combined effect of all currents that move in oceans.

Surface Currents

- Wind driven ocean currents
- Push the top 400m of water



Subsurface Currents

- Occur at depths of more than 800m
- Due to variations in density between layers of water
- Cold water is more dense and tends to sink
- High salinity water is also more dense and sinks below less saline water

Thermohaline Circulation

- The combined effect of surface and subsurface currents is termed **thermohaline circulation**
- Results in water being moved all around the globe
- Accounts for major transfers of heat
- Dramatically affects global weather patterns

Pollution and Degradation of Water Resources

- **Chemical pollution**→ metals, mercury, PCB's, mine drainage
- **Thermal pollution**→ heat discharge from factories can decrease oxygen content and lead to fish kills
- **Oil spills**→ 6 million tonnes per year
- **Plastics**→ north Pacific Gyre an ocean "garbage dump"

Fish Kill

EST
SE

Oil Spills

EST
SE

North Pacific Trash Gyre

EST
SE

Eutrophication

- Farming activities add excess fertilizers to rivers and lakes (mostly phosphorus and nitrogen).
- These excess fertilizers can stimulate algae growth.
- Excess algae growth can then lead to algae blooms, toxins being produced, reduced oxygen levels, fish kills and green scum forming on lakes.
- This whole process is called **eutrophication.**

Eutrophication experiment conducted by the University of Manitoba.

Can you guess to which side of the lake fertilizer was added?

EST
ES


Fertilized with
Carbon & Nitrogen
No Blue-green
Algal Bloom
Blue-green
Algal Bloom
Fertilized with
Carbon, Nitrogen
& Phosphorus