Name: _____

APES Lab: Study of Flowing Water & Water Diversions

Great Lakes Water Use and Diversions
The waters of the Great Lakes are, for the most part, a nonrenewable resource. They are composed of numerous aquifers (groundwater) that have filled with water over the centuries, waters that flow in the tributaries of the Great Lakes, and waters that fill the lakes themselves. Although the total volume in the lakes is vast, on average less than 1 percent of the waters of the Great Lakes is renewed annually by precipitation, surface water runoff, and inflow from groundwater sources.

A diversion is any transfer of water across watershed boundaries through a man-made pipeline or canal. Diversions may transfer water in or out of the Great Lakes basin, or between the watersheds of different lakes or rivers within the basin. While the impacts of existing diversions on lake levels are minor, they alter the natural flow of the Great Lakes and water returned from diversions may be of a different quality than when it was withdrawn.

Current Great Lakes Diversions

The Chicago diversion from Lake Michigan into the Mississippi River system is the only major diversion out of the Great Lakes Basin.

The Long Lac and Ogoki diversions into Lake Superior from the Albany River system in northern Ontario are the only major diversions into the Basin. The Long Lac and Ogoki diversions represent 6 percent of the supply to Lake Superior. (At present, more water is diverted into the Great Lakes Basin through the Long Lac and Ogoki diversions than is diverted out of the Basin at Chicago and by several small diversions in the United States.)

The Welland and Erie Canals divert water between subbasins of the Great Lakes and are considered intrabasin diversions. Aside from these major diversions, there are also a few small diversions:

- Forestport, New York diverts waters of the Black River into the Erie Canal and the Hudson River watershed

- Portage Canal diverts Wisconsin River waters (Mississippi Basin) into the Great Lakes Basin.

- London, Ontario, and Detroit take water from Lake Huron for municipal purposes. London and Detroit discharge their effluent to Lake St. Clair and the Detroit River, respectively

- The Raisin River Conservation Authority in New York takes water from the international section of the St. Lawrence River to maintain summer flows in the Raisin River

- The communities of Pleasant Prairie, Wisconsin, and Akron, Ohio, which lie outside the Great Lakes Basin take water from the Great Lakes on the condition that they return an equivalent volume of water over time to the Basin

- Haldimand, Ontario takes water from Lake Ontario

Diversions of water from the Great Lakes are currently negligible. However, an increasing number of droughts and climate change from global warming may result in more arid conditions in southern, central, and western US. Moreover, the US population is expected to swell by 50 percent – an additional 150 million people – in the next few decades, thus exacerbating water needs. As fresh water supplies are dwindling in the American West and South, and US states surrounding the Great Lakes experienced increasing pressure to divert water to dry parts of the country.

Water diversions from the Great Lakes on a large scale could have serious consequences. Proposals to divert water from the Great Lakes hydrologic system have proven very controversial. As these lakes are a shared international resource, many governments and organizations are concerned with managing and protecting the integrity of the Great Lakes waters and ecosystem. For these groups, the bulk export of Great Lakes basin water became an increasing concern in a water-scarce world. In order to protect the Great Lakes from commercial interests hooking up pipelines and sending tankers to deplete the Lakes, the Great Lakes Compact was developed.

Great Lakes Compact

The Great Lakes – St. Lawrence River Basin Water Resources Compact (the Compact) bans large-scale diversions from the Great Lakes and establishes a consensus-based process for managing the region's waters. It also is a catalyst for state and regional water conservation measures. Additionally, it sets uniform standards for monitoring new water withdrawal proposals within the basin.

This formal, interstate compact has the force of a federal law, with standing in federal court. It was signed by all eight Great Lakes state Governors in December 2005. It then began a journey that included being passed by each of the eight state legislatures, ratified by the United States Congress, and finally signed into law by the President on October 3, 2008.

The Compact is an agreement among the eight Great Lakes states to prevent diversions and withdrawals that would harm the ecosystem created by the waters of the Great Lakes. It is rooted in history and a long tradition of managing the lakes cooperatively. Importantly, the Compact treats groundwater and surface water as one system subject to the same standard, and also includes the following statements about the Waters of the Great Lakes:

- They are valuable public resources held in trust by the States;
- They are interconnected and part of a single hydrologic system;
- They can concurrently serve multiple uses; and
- Future diversions and consumptive uses have the potential to significantly impact the environment, economy, and welfare of the region.

The Compact, rooted in conservation, also includes some exceptions for vital economic and agricultural activities carried out across the basin. This allows domestic commerce and international trade activities to go on. None of the exceptions invalidate the primary motivation of the Compact to conserve the waters of the Great Lakes. The Product exception, for example, allows water to leave the region if it is used to make something. This means that water used in the process of manufacturing goods, or to make items such as baby food or cherry jelly, and shipped out of the basin is not

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Objectives addressed:
26. The Availability of Water
27. Human Alteration of Water Availability

Make sure you can define the following terms.

1. Surface Water
2. Runoff
3. Watershed
4. Delta
5. Estuary
6. Tributary
7. Sediment
8. Wetlands
9. Dams
10. Floodplain

Procedure: In this activity, the effects of diverting water away from a flowing river will be investigated in order to determine the problems associated with building dams and interrupting the natural flow of water.

For each representation:

1. Use a gutter to represent a river and the area where water is able to flow. Establish a height/incline at which the gutter will always start. Curb height (3-4 inches) should work well.

2. Use clay to alter the flow of the water. Firmly press the clay against the gutter to ensure it does not move when the water is flowing.

3. For each representation of a river, place 200 mL of sand at the top of the gutter.

4. For each representation pour 500 mL of water over the sand.

<u>Materials</u>: Make sure you have all the materials you need before you go outside and when you come back to the classroom.

___Sand bucket ___2 L Water bottle ___Clay

___2 Beakers (600 & 200) ___Gutter

<u>River #1</u>

In this representation you will have no diversions to the water.

a. Sketch the pattern of sediment in relation to the river.

b. What do you notice about the pattern of sediment that forms as the water exits the gutter?

c. What do you notice about the sediment?

d. What is the area at the end of the gutter called?

River #2

In this representation use the clay to cause the water to meander as it flows to the mouth of the river. Use various sized pieces of clay to represent changes in the flow of the river.

a. Sketch the pattern of sediment in relation to the river.

b. How as the pattern at the end of the gutter changed from the first investigation?

c. What impact could this have on the environment?

River #3

In this representation use the clay to represent a dammed river. The clay must block the entire gutter to make a dam. Place a pencil hole somewhere in the dam to allow water to flow through.

a. Sketch the pattern of sediment in relation to the river.

b. What do you notice happens to the sediment?

c. What would you expect to happen to the sediment if there was a constant supply of water flowing down the gutter?

d. How does the dam affect the pattern at the mouth of the gutter?

River #4

Use the gutter with the holes in it and repeat the scenario represented in the second investigation. The holes represent additional manmade diversions in the river. These diversions are used for irrigation of new farmland.

a. Sketch the pattern of sediment in relation to the river.

b. Compare the results from River #2 and River #4. Describe the similarities and differences.