Niagara River Current Lab

Name _____

Date _____

Period _____

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The Niagara River carries Lake Erie's water to Lake Ontario. Measure it, find out where half of it goes, and ride it.

☐ I can use width, depth and speed to explain why a river runs fast in some places and slow in others.

☐ I can use flow numbers to weigh the costs and benefits of sending river water through power plants.

Part 1. Measure the river (Tab 1)

SEP 5 · CCC Scale, Proportion, and Quantity

Pick each station. Copy its **width**, **average depth** and **average speed**. Then work out: **area = width × depth** and **flow = area × speed**. Flow is how many cubic meters of water pass the line each second (m^3/s).

1. Fill in the table. Round area and flow to the nearest whole number.

Station	Width (m)	Average depth (m)	Area (m^2)	Average speed (m/s)	Flow (m^3/s)
1. Peace Bridge					
2. Chippawa Channel					
3. Tonawanda Channel					
4. Pool below the falls					
5. Whirlpool Rapids					
6. Lewiston					

2. Fastest station: _____ at _____ m/s. Slowest station: _____ at _____ m/s.

3. Compare the **area** of the fastest and slowest stations. What is the pattern between area and speed?

READ FIRST. In the lab, find the blue **Learn It** box and read it. Then answer 4 to 6.

4. Stations 2 and 3 are the two sides of Grand Island. Add their flows: _____ + _____ = _____ m^3/s. Compare this with the Peace Bridge. Use **conservation of matter** to explain what happens to the water that goes around the island.

5. The same water passes Station 4 and then Station 5, only 3 km apart. Use **flow = area × speed** and the areas in your table to explain how it can crawl at one and race at the other.

6. Flow at Stations 1 and 6 is about _____ m^3/s. Flow at Stations 4 and 5 is about _____ m^3/s. How much water is missing in the middle? _____ m^3/s. Predict where it went.

Part 2. Share the water (Tab 2)

SEP 4, 5 · CCC Energy and Matter

Press **Daytime**. Read **Where the water goes**, then find Station 5 in **The stations at this setting**. Do the same for **Overnight**.

7. Fill in the table. Percent through the plants = plants ÷ 5,800 × 100.

Setting	Over the falls (m^3/s)	Through the plants (m^3/s)	Percent through the plants	Electric power (MW)	Rapids depth (m)	Rapids speed (m/s)
Daytime						
Overnight						

READ FIRST. In the lab, find the blue **Learn It** box and read it. Then answer 8 to 11.

8. Look at the bar graph. The flow at Stations 1 and 6 is the same day and night, but Stations 4 and 5 change. Explain why. Use where the water leaves the river and where it comes back.

9. Overnight, the water at the Whirlpool Rapids gets _____ m shallower. Name one person or living thing in the gorge that this change could affect, and how.

10. Move the slider yourself and fill in the table.

Slider setting	Over the falls (m^3/s)	Electric power (MW)	Homes	Rapids speed (m/s)
All the way right (nothing to the plants)				
All the way left (the most the plants can take)				

11. Each 1 m^3/s through the turbines makes about 0.8 MW. Check the lab's daytime number: _____ m^3/s × 0.8 = _____ MW. The water falls about 90 m inside the plants. Use **potential energy**, **kinetic energy** and **electrical energy** to tell what happens to the water's energy, from the top of the river to the power lines.

Part 3. Ride the river (Tab 3)

SEP 2, 4 · CCC Systems and System Models

Pick **Daytime** and press **Release 10 floats**. Watch for a while, then press **Skip to the end**. Do the same for **Overnight**.

12. Count where the 10 floats ended.

Setting	Reached Lake Ontario	New York power intake	Ontario power intake	Percent that went into an intake
Daytime				
Overnight				

READ FIRST. In the lab, find the blue **Learn It** box and read it. Then answer 13 to 15.

13. Compare the last column with the percent through the plants in Q7. The floats are **tracers**: use that to explain why the two should be close. Then use **sample** size to explain why they are not exactly the same.

14. Daytime. Copy the **Checkpoint times** for the first float to reach Lake Ontario. Then subtract to get the km and hours for each stretch. Speed = km ÷ hours. **Upper river** = Peace Bridge to Rainbow Bridge. **Gorge** = Rainbow Bridge to Lewiston. **Lower river** = Lewiston to Lake Ontario.

Checkpoint	Hours	Distance (km)
Peace Bridge		
Rainbow Bridge		
Lewiston		
Lake Ontario		

Stretch	km	Hours	Speed (km/h)
Upper river			
Gorge			
Lower river			

15. The gorge holds the fastest station in Part 1, but the float's **average speed** through the whole gorge is not much higher than the rest of the river. Use Station 4 to explain why.

Wrap it up

SEP 7 · CCC Cause and Effect

16. Some people say all the water should go over the falls, because it is a natural wonder. Others say more should go to the power plants, because the electricity is made without burning fuel. Choose how much water you would send over the falls: _____ m^3/s. Argue for your choice with at least two numbers from Part 2, and name one cost of your choice.

NYSSLS: building toward HS-ESS3-1 and HS-ESS3-2 (DCI ESS3.A Natural Resources). Tags: SEP = Science and Engineering Practice, CCC = Crosscutting Concept. Every number comes from a computer model of the river built from NOAA depth charts and river gauges. 1 m^3/s is about 35 cubic feet per second.