Niagara River Current Lab

Name _____

Date _____

Period _____

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Flow = how much water passes a line across the river each second. It is measured in cubic meters per second (m^3/s).

☐ 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 Using Math · CCC Scale, Proportion, and Quantity

Pick each station. Copy its **width**, **average depth** and **average speed**. Use a calculator for the other two columns.

Example: width 200 m, depth 5 m, speed 2 m/s. Area = 200 × 5 = 1,000 m^2. Flow = 1,000 × 2 = 2,000 m^3/s.

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

Station	Width (m)	Average depth (m)	Area = width × depth (m^2)	Average speed (m/s)	Flow = area × speed (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: ☐ Peace Bridge ☐ Pool below the falls ☐ Whirlpool Rapids at _____ m/s.

Slowest station: ☐ Peace Bridge ☐ Pool below the falls ☐ Whirlpool Rapids at _____ m/s.

3. Area of the fastest station: _____ m^2. Area of the slowest station: _____ m^2.

Where the area is small, the water is ☐ fast ☐ slow. Where the area is big, the water is ☐ fast ☐ slow.

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

4. Add the two sides of Grand Island: Station 2 _____ + Station 3 _____ = _____ m^3/s.

That is ☐ about the same as the Peace Bridge ☐ much less than the Peace Bridge, so by **conservation of matter**, going around the island ☐ loses no water ☐ loses a lot of water.

5. The same water passes Station 4 and then Station 5. Station 4's area is _____ m^2 and Station 5's area is _____ m^2.

To get the same water through a much smaller gap, the water has to ☐ speed up ☐ slow down ☐ stop.

6. Flow at Stations 1 and 6: about _____ m^3/s. Flow at Stations 4 and 5: about _____ m^3/s.

Missing in the middle: _____ – _____ = _____ m^3/s. I predict it went ☐ into the ground ☐ into the air ☐ somewhere people sent it.

Part 2. Share the water (Tab 2)

SEP 4 Analyzing Data · CCC Energy and Matter

Press **Daytime**. Copy from **Where the water goes**. Find Station 5 in **The stations at this setting**. Then press **Overnight**.

Example: 2,900 through the plants. 2,900 ÷ 5,800 × 100 = 50%.

7. Fill in the table.

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. Stations 1 and 6 stay the same day and night. Stations 4 and 5 change.

The water leaves the river ☐ above the falls ☐ below Lewiston and comes back ☐ above the falls ☐ just before Lewiston.

So Stations 4 and 5 are ☐ between the two places ☐ outside the two places, and they get less water when the plants take more.

9. Rapids depth, daytime _____ m – overnight _____ m = _____ m shallower at night.

This could matter to (tick any):
☐ fish ☐ people fishing from the rocks ☐ tour boats ☐ birds that feed in the river

10. Move the slider yourself.

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. Check the lab's daytime power: _____ m^3/s through the plants × 0.8 = _____ MW.

Inside the plants the water falls about 90 m. Its ☐ potential energy (position) ☐ heat energy turns into **kinetic energy** (motion), and the turbines turn that into ☐ electrical energy ☐ chemical energy.

Part 3. Ride the river (Tab 3)

SEP 2 Using Models · CCC Systems and System Models

Pick **Daytime**. Press **Release 10 floats**, watch, then press **Skip to the end**. Then do **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. The floats' percent is ☐ close to ☐ far from the percent of water through the plants in Q7, because floats are **tracers** that go ☐ where the water goes ☐ wherever they want.

It is not exact because ☐ 10 floats is a small sample ☐ the lab is broken.

14. Daytime. Copy the **Checkpoint times**. Then subtract to fill in each stretch. Speed = km ÷ hours. **Upper river** = Peace Bridge to Rainbow Bridge. **Gorge** = Rainbow Bridge to Lewiston. **Lower river** = Lewiston to Lake Ontario.

Example: a float is at 2.0 km at hour 1.0 and at 12.0 km at hour 3.0. That is 10.0 km in 2.0 hours. 10.0 ÷ 2.0 = 5 km/h.

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 has the fastest station (Station 5). It also has Station 4, which is the ☐ slowest ☐ second fastest station. The float spends a long time in that deep pool, so its **average speed** for the whole gorge is ☐ only a little higher than the rest ☐ ten times higher than the rest.

Wrap it up

SEP 7 Argument from Evidence · CCC Cause and Effect

16. How much water would you send over the falls? Tick one:
☐ 1,450 m^3/s (the least) ☐ 1,850 (overnight) ☐ 2,832 (daytime) ☐ 5,800 (all of it)

With my choice, the plants make _____ MW, enough for _____ homes.

One good thing about my choice: _____

One cost of my choice: _____

NYSSLS: building toward HS-ESS3-1 and HS-ESS3-2 (DCI ESS3.A Natural Resources). Every number comes from a computer model of the river built from NOAA depth charts and river gauges.