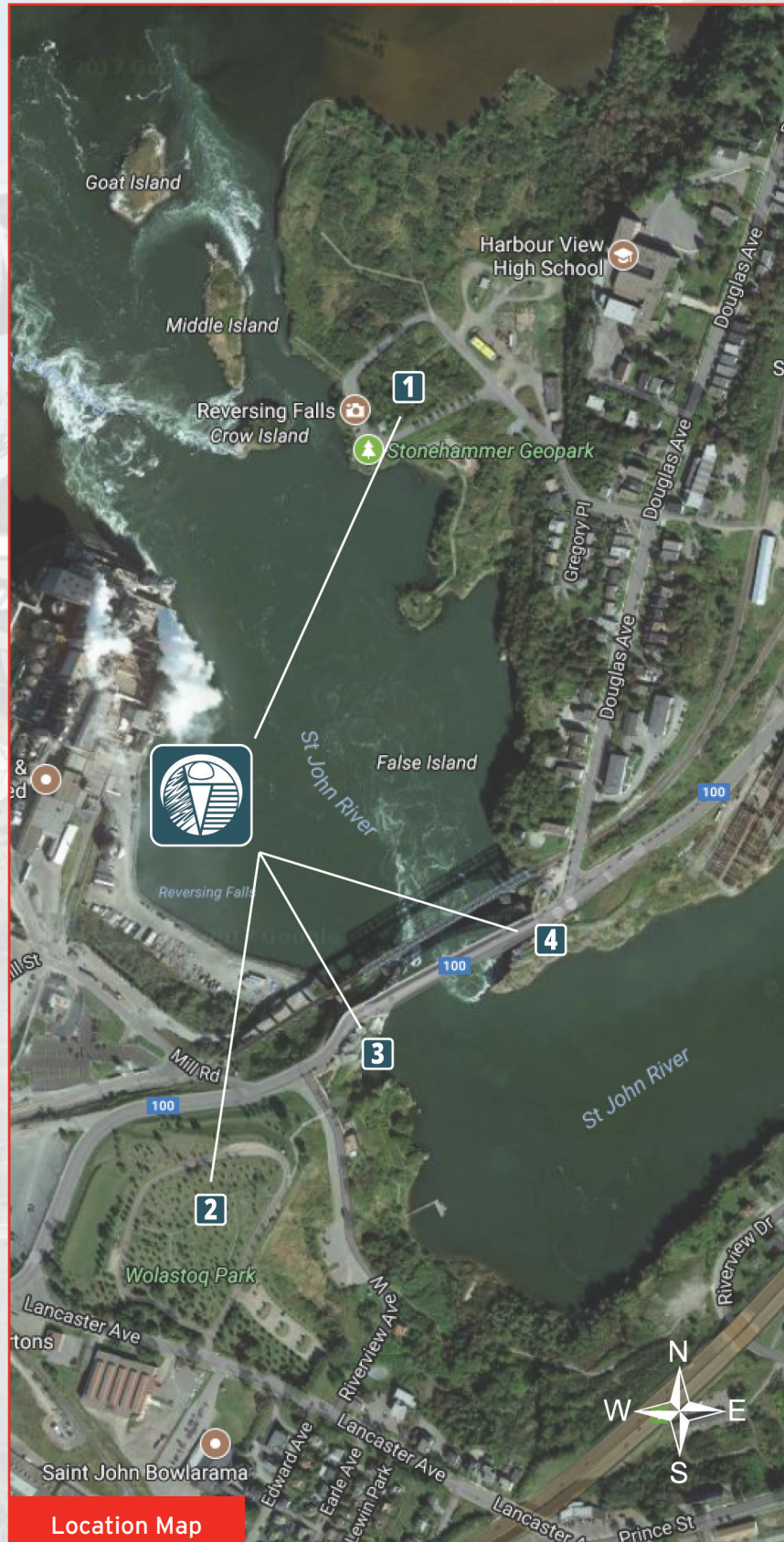


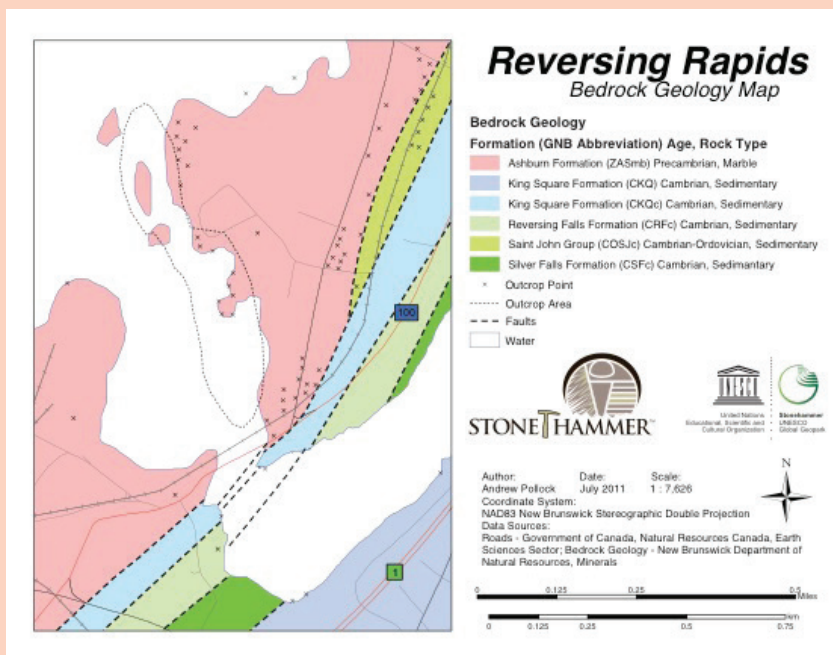
Reversing Falls Rapids

Teacher's Sheet



Teacher's Notes

SUGGESTED STOPS	POINTS TO NOTE
Access:	<p>Reversing Falls site visit includes four locations:</p> <p>Fallsview Park (1) can be accessed via Douglas Avenue. At this location you can see the rapids up close, view up into Marble Cove and the pond beside the pulp mill which was historically used for log driving. You may be able to spot seals and cormorants and there is seasonal access to washrooms. Note the Saint John Zipline must be booked in advance and fees apply.</p>
1	<p>On the hill to the West of Reversing Falls is Wolastoq Park (2) accessible from Lancaster Avenue seasonally. From this location a wide view of the landscape and water course can be seen. This location hosts flags of the provinces and wooden sculptures with information on historical figures.</p> <p>The Saint John Skywalk and Information Centre (3) provides information on the history and geology of the site. Parking is available immediately southwest of the Reversing Falls Bridge. There is a short steep walking path from the parking area which leads to a boat dock and viewing platform closer to the water's edge. Note there is a fee for accessing the Skywalk.</p> <p>Using the passage under Reversing Falls Bridge or walking from (3), available from Douglas Avenue, you can cross under the bridge to reach the Harbour Passage Reversing Falls Lookout (4). There is limited parking near the train bridge off Douglas Ave, none available on the lookout side of the bridge.</p> <p>During the short under passage you will see the foundation of the old Suspension Bridge built in the 1850s. Panels at the lookout provide information on the terrane contact which is clear to see from this location, a view of the whirlpools and possible sightings of seals, eagles and cormorants. From here Harbour Passage connects to uptown Saint John and includes interactive science and marine life outdoor exhibits, murals relating to Fort LaTour and Wolastoqiyik history, public art, and interpretive panels about many aspects of the Port and the City of Saint John.</p> <p>Amenities: Check if seasonal washrooms, parking, gates, and other facilities are open at the time you plan to visit.</p> <p>Equipment: tide table, lunar phase chart, NBM website to visit Virtual Exhibition; cornstarch (half a box per experiment), waxed paper, gravel and sand and a container such as a small cake pan and water; Reversing Rapids Bedrock Geology Map from the Stonehammer website (Learn tab, downloads section), optional: cookie subduction experiment materials (see Brundage Point materials)</p> <p>There are many tide tables online, including Fisheries and Oceans Canada and the Fundy Tide Watch at the Discover Saint John website http://www.discoverstjohn.com/fundy-tides/</p> <p>Geological Age: Precambrian to Ordovician (1,000 to 480 million years old)</p>



Continental Collide Locations 3 and 4; Task E, F

From either side of the Reversing Falls Bridge you can see pieces of two ancient continents, Avalonia and Ganderia, and the fault line that separates them. The spot where these two ancient continents meet is exposed between the railway bridge and the road bridge.

The rocks show evidence of a terrane contact where Ganderia and Avalonia became attached to ancient North America. Locally these two terranes are called Brookville (a piece of Ganderia) and Caledonia (a piece of Avalonia). Ganderia and Avalonia originated in the southern hemisphere but they are 300-500 million years apart in age. Starting in the Precambrian, around 600 million years ago, these two fragments of crust were sliced off a continental mass called Gondwana centered near the South Pole. Avalonia may have travelled even further, starting its journey as a small solo microcontinent. As the Rheic Ocean basin opened behind them and the Iapetus Ocean closed in front, they drifted northward to collide with Laurentia (ancient North America). The opening and closing of Oceans in this way is called the Wilson Cycle. A line of weakness separates the two terranes. During later movements of the crust the Caledonia Fault developed along their boundary. The fault crosses the river near the bridges. It was formed over 300 million years ago and is no longer active.

The Rocks

The marble (metamorphosed limestone), sandstone and shale found at Reversing Falls Rapids formed as shallow ocean sediments on the margins of ancient continents. Over millions of years the landmasses moved, a process sometimes known as continental drift, and parts broke away from ancient Africa and South America and then collided with ancient North America. The light grey metasedimentary rocks below the railway bridge at Reversing Falls Rapids are Precambrian age marble 750 million to a billion years old, a fragment of continental crust once attached to a landmass we now know as South America. These rocks contain the oldest fossils in the province, the remains of cyanobacteria which formed into structures called stromatolites.

The layered grey and purple rocks below the lookout and to the south are sandstone and shale rocks, Cambrian age sedimentary 541 to 485 million years old and were once part of Avalonia, a fragment of continental crust once attached to modern day Africa. These rocks have been studied extensively to develop a time frame for Cambrian rocks worldwide. They contain fossil remains of trilobites, brachiopods, trace fossils and more: part of the 'Cambrian Explosion' of life.

Industry: Mining, lumbering and fishing

Location 1, 2, or 3; Task G

The marble here contains veins of graphite, a mineral used as an industrial lubricant along with other purposes. The first mine which sought to exploit this valuable mineral opened close to the water's edge here at Reversing Falls Rapids in 1853 and operated until 1874. In 1882 a second shaft opened about 500 metres from the shore and operated until 1887 and a third was opened 60 metres northeast.

New Brunswick has a longstanding history of lumbering. The pulp mill today continues on a century-long tradition of wood processing activity in the area. Historically logs were floated down the Saint John River to Marble Cove in the annual log drive and historic photos show the log booms holding in 'The Pond', the calm area of water beside the pulp mill, out of the river current. The lumbering industry of New Brunswick is commemorated with National Historic Site significance in nearby Riverview Park.

Today it is common to see small fishing boats at the mouth of the Saint John River and docked along Harbour Passage. The presence of seals at high tide and cormorants diving for fish indicate that Reversing Falls Rapids is an abundant food source, although dangerous to access. Historically salmon was fished in the Saint John Harbour. The treacherous water at the gorge was avoided using portage.

Water Movement: all locations; task A, B

The Reversing Falls Rapids phenomenon is created by the collision of the Bay of Fundy's monstrous tides and the mighty Saint John River. The Bay of Fundy tides are the highest in the world due to the basin shape of the Bay and commonly rise 8.5 metres here and up to 16 metres further inland, completing a high-tide/low-tide cycle about every 12.5 hours.

When the Bay of Fundy's tides are low the full flow of the Saint John River thunders through a narrow gorge. An underwater ledge about 11 metres below the surface causes the water in the river to tumble downward into a 53 – 61 meter deep pool, causing a series of rapids and whirlpools. At this point tidal waters are 4.4 metres lower than the river level. As the Bay's tides begin to rise, the water level at the bottom of Reversing Falls Rapids increases, slowing the course of the river and finally stop the river's flow completely. This short period of complete calm is called slack tide and lasts for about 20 minutes. Only during this time are boats able to navigate the Reversing Falls Rapids. Shortly after this slack tide the Bay's tides become higher than the river level. As the Bay's tides continue to rise, their powerful force gradually reverses the flow of the river and the rapids begin to form again, reaching their peak at high tide. At this point the tidal waters are actually 4.4m higher than the river. The effect of this reversal is felt upstream as far as Fredericton which is more than 70 kilometers inland. After high tide the Bay's tides begin to fall and the up-stream flow of the river gradually lowers until the tides fall to the level of the river – resulting in another slack tide and then lower again to return to 'normal' river flow.

Glaciation Location 2 or 3; Task D

Why are the Reversing Falls Rapids here? About 20,000 years ago the last glacial period reached its climax. Glaciers covered all of the Maritimes and as these continental glaciers retreated they changed the landscape. Before this last glaciation the Saint John River flowed through South Bay, near Dominion Park, and out to the sea at the Irving Nature Park. As the last glaciers melted, moraines, material built up at the bottom of a glaciers' path, dammed that outlet. The river found a new path, flowing over the rock ridges of the relatively resistant marble of the Green Head Group at Reversing Falls Rapids to create this gorge.

Thousands of years ago waterfalls existed here but as sea levels rose, increasing the bottom water levels and the upper riverbed eroded the waterfalls drowned. A profile of the riverbed shows that a series of three waterfalls must have existed here starting near the islands at Fallsview Park and ending near the bridges. Just past the islands the river bottom drops to around 25 metres below low water level and then drops two more times to more than 40 metres below low water level just past the road bridge. The phenomenon of the Reversing Falls Rapids is in fact, only about 3,000 years old.

Koluscap Location 2 or 3; Task C

The first people arrived here at the end of the last ice age almost 13,000 years ago. They witnessed the end of the ice age and development of the rivers and forests. Their stories, like the legend of Koluscap and Giant Beaver, describe the changing landscape. The legend relates well to the changing landscape and ice age history of southern New Brunswick as interpreted by geologists. Giant beaver (*Castoroides ohioensis*) were part of the Interglacial (more than 75,000 years ago) and Late-glacial (15,000 to 10,000 years ago) fauna of North America. Their fossils are known from Alaska to Florida. The most easterly Canadian record from Passamaquoddy Bay is an interglacial fossil in the New Brunswick Museum. No doubt the first people in North America encountered the giant beaver.

TEACHER TIP:

The volcanic landscape of the Kingston Peninsula upriver is a result of the continental collision that happened at Reversing Falls Rapids. If your class is not visiting Brundage Point, you can do the cookie subduction experiment with relation to the plate tectonics story at this site.