a class of vessels that cannot make use of the Welland Canal even after its last enlargement. In order to meet this strong competition the Government of the Dominion of Canada was called upon still further to deepen the canal so as to allow the passage of the largest existing lake vessels without lightering; and in 1886 contracts were concluded for deepening it to 14 feet.

The Niagara river flows from Lake Erie to Lake Ontario in a northerly direction. Its width between Buffalo and Fort Erie (the site of the international iron-trussed rail­way bridge; see sketch map of Niagara river in vol. xvii. p. 472) is 1900 feet and its greatest depth 48. At this point the normal current is 51/2 miles an hour,—the ex­treme variation in the level of the river when uninflu­enced by the wind being only 2 feet. During south-west gales, however, the water occasionally rises as much as 4 feet in a few hours, and at such times the current attains a maximum velocity of 12 miles an hour. Two miles below the bridge the river is divided into two arms by Grand Island, at the foot of which they reunite and spread over a width of 2 or 3 miles. The river then becomes studded with islands, until about 16 miles from Lake Erie, after a total fall of 20 feet, it narrows again and begins to descend with great velocity. This is the com­mencement of the rapids, which continue for about a mile with a total descent of 52 feet. The rapids terminate in the great cataract of Niagara, the fall of which on the American side is 164 feet and on the Canadian side 150 feet. The falls are divided by Goat Island, which rises 40 feet above the water and extends to the very verge of the precipice, where the total width of the river, including the island, is 4750 feet. The Horse-Shoe Fall on the Canadian shore is 2000 feet long, and the depth of water on the crest of the fall is about 20 feet. The American fall is only one-half that length, and discharges less than one-fourth the volume of the Horse-Shoe Fall. United, they discharge nearly 400,000 cubic feet per second or 41,000,000 tons per hour. The upper layer of the escarp­ment down which this enormous mass of water leaps con­sists of hard limestone about 90 feet thick, beneath which lie soft shales of equal thickness, which are continually being undermined by the action of the spray, driven violently by gusts of wind against the base of the preci­pice. In consequence of this action and that of the frost, portions of the incumbent rock overhang 40 feet, and often, when unsupported, tumble down, so that the falls do not remain absolutely stationary in the same spot. Sir C. Lyell in 1842 came to the conclusion that the cataract was receding at an average rate of 1 foot annually, “ in which case it would have required 35,000 years for the retreat of the falls from the escarpment at Queens­town to their present site.” From the foot of the falls to Queenstown, a distance of about 7 miles, the river descends 104 feet through a gorge from 200 to 300 feet deep and from 600 to 1200 feet wide. Midway in this deep defile the turbulent waters strike against the cliff on the Canadian side with great violence, and, being thus deflected from west to north, give rise to the dangerous eddy called the “Whirlpool.” The escarpments end abruptly at Queens­town, where the waters suddenly expand to a great width, and finally, 7 miles farther on, tranquilly flow into Lake Ontario.

About one-third of a mile below the cataract a carriage- road suspension bridge (built in 1869 by Mr Samuel Keefer) spans the river with a single opening of 1190 feet, at a height of 190 feet above the water; and 2 miles lower down Roebling’s celebrated railway and road suspension bridge (completed in 1855) crosses the river at a height of 245 feet above the water with a single span of 800 feet. In November 1883 a double-track railway three-span iron and steel cantilever bridge, situated about 100 yards above Roebling’s bridge, was completed for the

New York Central and Michigan Central Railways. The total length of the bridge is 910 feet and that of the centre span 470 feet. The height from the water to the level of the rails is 239 feet.

Lake Ontario is the easternmost and smallest of the great lakes of the St Lawrence system. Its basin drains 29,760 square miles, including the lake surface of 6700 square miles. Tho length of the lake is 190 miles, its greatest width 52 miles, its mean depth 412 feet, and its elevation above the sea 234 feet. It never freezes except near the shore. Its chief tributaries are the Trent on the north shore and the Genesee and the Oswego on the south shore, and its chief ports, Toronto, the capital of Ontario, 32 miles north of Port Dalhousie, at the foot of the Welland Canal; Oswego, at the south-east angle of the lake; and Kingston, at its north-east extremity, 52 miles north of Oswego.

Trent river navigation is a term applied to a series of reaches which do not, however, form a connected system of navigation, and which in their present condition are efficient only for local use. The series is composed of a chain of lakes and rivers extending from Trenton, at the mouth of the Trent on the Bay of Quinté, north shore of Lake Ontario, to Lake Huron. The new works (which will have locks 134 feet by 33 feet with a depth of 5 feet on sill) will give communication between Lakefield, 94 miles from Peterboro, and Balsam Lake, the headwaters of the system, opening up a total of about 150 miles of direct and lateral navigation.

The port of Oswego has been in direct communication with the Hudson river since 1822, by means of a canal of small capacity as far as Syracuse, and thence by the Erie Canal to Troy and Albany. It is now proposed by the United States Government to enlarge this route under the name of the Oneida Ship Canal, so that vessels arriving from the Welland Canal with cargoes of 50,000 bushels of wheat may be able to tranship them at Oswego into steam barges holding 25,000 bushels, or into barges to be towed with a capacity of 28,000 bushels. The length of the proposed route by the Oneida Lake and Durhamville is 200 miles, with a lockage of 609 feet; and its estimated cost, including 20 ascending and 47 descending locks (each 170 by 28 by 84 feet), is $25,213,857. The Government of the Dominion of Canada has also under consideration the follow­ing projects to connect the St Lawrence with Lake Huron: — (1) the Ottawa and Georgian Bay Canal, from Montreal, by the ottawa and Lake Nipissing, to French river ; (2) the Toronto and Georgian Bay Canal, by way of Lake Simcoe ; (3) the Hur-ontario Canal, from Hamilton to Lake Huron, near Port Franks.

Kingston, being the port of transhipment for Montreal of three-fourths of the grain that arrives from the upper lakes, is a place of some commercial importance. Formerly lake vessels were sent from Chicago to Montreal through the St Lawrence canals without breaking bulk. But it was afterwards found cheaper to transfer grain at Kingston, and to send it down the St Lawrence in barges, the cost of such transfer being only half a cent per bushel. Kings­ton is also at the south terminus of the Rideau Canal, which connects it with the city of Ottawa.

This canal, 126 miles long, has 33 locks ascending 292 feet and 14 descending 165, and admits vessels 130 by 30 feet drawing 44 feet of water. It was constructed in 1826-32 by the British Government at a cost of about $4,000,000, chiefly with a view to the defence of the province, but since the opening of the St Lawrence canals it has become of comparatively little importance as a means of transport,—the distance from Montreal to Kingston being 68 miles longer by the Rideau and ottawa Canals than by the St Lawrence.

Almost immediately after leaving Kingston that part of the St Lawrence commences which is called the Lake of a Thousand Islands. In reality they number 1692, and extend for 40 miles below Lake Ontario. At this point the Laurentian rocks break through the Silurian, and reach across the St Lawrence, in this belt of islands, to unite with the Laurentian Adirondack region in the State of New York. Near Prescott, a town on the Canadian side about 60 miles below Kingston, begins the chain of the St Lawrence canals proper, which were constructed to overcome a total rise of 2061/2 feet,—the number of locks being 27 and the total length of the six canals 431/2 miles.

The canals are called, in the order of their descent, the “Galops,” “Rapid Plat,” and “Farran’s Point,” with an aggregate length of