

the Welland River, which would be caused by placing the Canadian end of the proposed weir below the mouth of the Welland, and thus make the lock unnecessary. If so, provision for this should be made in any treaty.

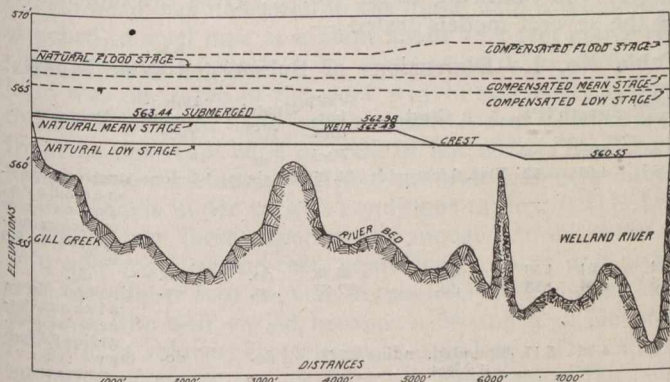


Fig. 2.—Natural and Compensated Stages at Site of Submerged Weir.

The commission believes that the very great advantages to navigation interests will justify and amply repay the necessary expenditure, and recommends that a treaty be entered into between Great Britain and the United States providing for the construction of the weir.

The report has appended to it the findings of Messrs. W. J. Stewart, engineer for the Canadian section, and E. E. Haskell, engineer for the American section, and the following is extracted therefrom:

Niagara River is the outlet of Lake Erie and discharges into Lake Ontario; it is divided into two reaches by the Falls, the "upper" and the "lower." The upper reach is navigable from Lake Erie to Chippewa, Ontario, and to Niagara Falls, N.Y., and is the reach with which we are at present concerned. Strawberry and Grand Islands divide a part of this reach into two channels, known as Tonawanda and Chippewa. The distance from Lake Erie to the head of Strawberry Island is approximately 4 miles and the fall in this distance at mean stage is 5.8 feet. The distance from the head of Strawberry Island to the end of navigation by the Tonawanda Channel is 16½ miles, and between the same points by the Chippewa Channel is 12¾ miles. The fall in these reaches at mean stage is 4.8 feet.

The natural conditions in this upper reach of river are therefore such as to indicate that by placing a submerged weir of proper size at the end of navigation, or below Navy and Connors Islands, it might be possible to create sufficient backwater to restore to Lake Erie a part at least, of what it has lost in stage by diversions, and at the same time greatly improve the navigation of the reach of river under consideration.

It was this project that was in mind when the last report was submitted. Naturally, the question arises: Can the water be raised sufficiently at the location indicated to actually restore to Lake Erie a quantity worth while and at the same time keep within control all flood waters, particularly those that come from heavy southwest windstorms on Lake Erie?

To answer this question it was necessary to have more data than existed at the time of our previous report. A careful topographic survey was required of all lands likely to be affected and a type of weir best suited for the location and conditions had to be determined.

Surveys were started early in 1910 and prosecuted as diligently as the affairs of the commission would permit.

The results from these did not become available, however, until about the beginning of the present year. A detailed topographic survey was made of the shores of the Niagara from Lake Erie to within a mile of the Falls; the islands within this reach; and of the Welland River from its mouth to its source, a distance of about 40 miles.

In order to determine the best type of weir, it was deemed necessary to study various types under as nearly as possible true river conditions. These studies were made at the hydraulic laboratory of the college of civil engineering of Cornell University. They covered experiments on seven different types, ranging in height from 3.7 to 6.02 ft. and having in general a 3 to 1 upstream slope and a 1 to 1 downstream, five having a flat crest and the remainder a rounded crest. In two of the flat-top types, the upstream, and in all the downstream corners were rounded on a radius of 9.5 ft. On two of the flat-top and all of the round-top types, the downstream nappe was an ogee curve.

These experiments furnished what was being sought, namely, a type of submerged weir that would be very efficient at high stages and much less so at low stages.

Fortified with these new data, a study was made of the probable effect of submerged weirs placed at right angles to the general direction of the river in the following localities: Willow Island, Port Day, Grass Island, and Gill Island, as well as one on a line between Gill Creek and Hog Island, at the mouth of Welland River. Only the last of these met the conditions desired, and it is not thought necessary to give the results of the studies of the rejected locations because the end to be attained is clearly set forth in the consideration of the site finally chosen.

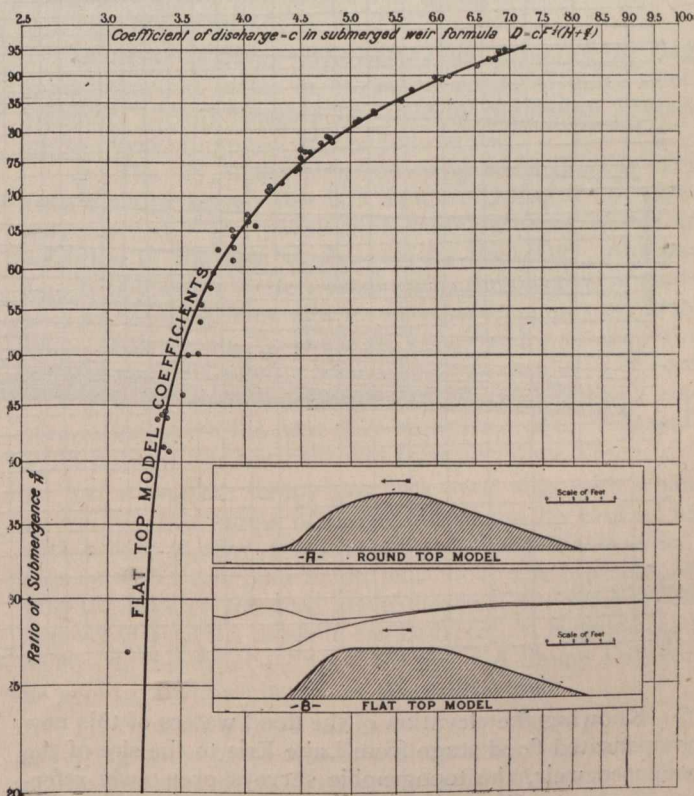


Fig. 3.—Experimental Coefficients and Cross-Sections of Weir Models.

As shown in the previous report, the stage of water in several of the Great Lakes will be materially lowered by artificial diversions of water therefrom. This loss of level on Lake Michigan-Huron, if 10,000 c.f.s. be taken