

ON AN IMPORTANT RECLAMATION OF LAND NEAR SACKVILLE,
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(Communicated by R. G. Haliburton)

WHILE engaged as working Railway Engineer during April and May of the present year, I felt professionally interested in the tidal phenomena of the Bay of Fundy, and its connection with the formation of Dyke lands. I was struck with the remarkable work progressing on the Sackville marshes, and was glad to take advantage of a day while waiting for the Steamer *Gaspe*, to drive and walk over (with a good guide) as much of the marsh as possible in my very limited time.

I took notes at the time on points of professional interest, without the least idea of ever sending anything to the N. S. Institute of Natural Science, but I now send them with a few remarks which I think may prove interesting.

The extensive salt marshes near the lower parts of the Sackville and Tantramar Rivers have been for a long time dyked. Higher up the Sackville River and beyond the limits of the original dyked marsh, there used to be very wide expanses of bogs and shallow fresh-water lakes draining into the river. These waste areas originally covered many square miles and were quite worthless. However, they are now year by year being turned into solid land (salt marsh) by a persevering direction of the energies of the high tides of the Bay of Fundy. By "leading" ditches, the salt water charged with its well known mud, is being conducted into the fresh-water area. The fresh-water lakes are being choked with 5 and 6 feet of solid mud. Bogs of at least 3 and 4 feet depth of peaty matter are overflowed by the tide, layer on layer of sediment deposited, and finally the bog is crushed down close and dense by a surface deposit of from 1 to 2 feet of mud, on which hay grows luxuriantly. "High mosses" whose surfaces are above the high tide level are soaked by the salt water which rots them, the moss shrinks together and sinks down, the tides overflow progressively on the edges, and then they also are overlaid by the salt mud, which crushes them down.

To sum up, miles of fresh-water wastes, once desolate, are now covered with hay waist high, growing on a solid bed of tidal mud; much of this has now to be dyked, and all can be overflowed at pleasure. The work has been going on for years—and thousands of acres have been "made." It is going on now and may continue for twenty years more, for as moss after moss is overlaid, and lake after lake filled, the ditches are lengthened and fresh fields entered on. Roughly speaking, from a casual view of the place, there appears yet as much bog and lake to reclaim as has been done already. Works such as this, are of great engineering interest, however quietly carried on or simply effected, all the more so because beyond the surface-simplicity of the means used several questions present themselves, by no means easy to be answered without thinking, and which deserve to be investigated.

The means by which this reclamation is operated, are the widening and straightening of the original channels from the lakes to the rivers,

and the digging of leading ditches to conduct the salt water in during high tide, and what is equally necessary, to drain the fresh-water off during low tide.

The most important of the works is the "floating ditch," this is a cut-off, or shortening of the main outlet channel from the lakes. Begun over twenty years ago, two and a half miles of it were dug by spade to a width of about nine feet. In consequence of the very important effects it produced, it has been gradually enlarged to the dimensions of a canal. It is now said to be 60 feet wide (though I judged it only 50 feet,) and very deep. This ditch was originally dug through a bog of six or seven feet deep. The bog was cut into blocks, with scythe blades cutting vertically, and then floated away—hence its name. I visited it at low tide; the bog matter is now covered with from $1\frac{1}{2}$ to 3 feet of new mud, and is compressed to nearly half its original thickness.

To reclaim a piece of bog, a ditch is dug to conduct the tide water from the main channel through it, shallow side ditches are dug at right angles to this, at intervals of from 20 to 30 feet; the overflow of these at high tides does the work. The lakes are said to be much more quickly filled than the bogs.

To illustrate the rate of progress, I will give the following fact which was related to me by my guide (Mr. Robert Towse, of "Towse's Inn.") In marking out by stakes the place for a leading ditch, by which he proposed to reclaim an area of bog and lake belonging to himself, he was necessitated to use a canoe holding two men, to cross part of the lake. Thirteen months afterwards, he actually drove a yoke of oxen with a load, over the same spot which the canoe passed over.

Underneath the mosses and marshes is invariably to be found a thick bed of mud, which the natives say is old tidal mud. This sub-mud is blueish in color and of fine consistency. The recent tidal deposits is of a brownish color, both are full of glittering specks. I send specimens of both. The sub-mud underlies the whole area, it is found at very variable depths from the surface. The section of the sub-mud as exposed for $2\frac{1}{2}$ miles in the "floating ditch," is undulating like the section of an ordinary flat in a tidal river. If this mud is really of tidal origin, some cause must have arrested the ancient tides and given their sands to the action of the fresh water.

Certain questions arise:—

1st.—How can it be that fresh water lakes of wide expanse, possessing original uninterrupted communication with the Bay, through their outlet creeks, can be flooded with the Bay salt water by the apparently simple means of widening and shortening these channels?

2nd.—Is the elevation of the high water mark of any particular tide, higher at the upper extremity of these artificial channels, than it is in the river, *i. e.* can there be produced by the art of man on a small scale, the same effect by these long leading ditches, which is produced by the Bay tides in the Bay itself. *There* the tidal wave rushing up the continually narrowing Bay, piles the water at the head prodigiously, to the extent of 30 and 40 feet?

3rd.—If the sub-mud is really tidal mud, from what cause has the

tidal overflow of these flats been suspended for such a long period, as to allow of the growth of the overlying bogs?

4th.—Must not the tides of the present time be higher than the ancient ones, seeing that they are depositing mud four or five feet above the level of the sub-mud?

Regarding No. 1. It may be observed, that the straightening of the channels operates powerfully in two ways: first, to drain off the fresh water during the low tides, much quicker than formerly, and thereby the old fresh-water level is greatly lowered; second, it must be remembered, that as the height of the tidal wave lasts only a short time, the shortening of the channel which it follows, enables it to reach a further limit before its rush is spent. Straightening the channel, saves momentum in the tidal flow. Shortening saves time and momentum also. By widening and deepening, a greater quantity of water is passed to and fro, thereby hastening the effects. A fuller and bolder application of these principles on these marshes, may in future times produce much greater effects.

Regarding No. 2. It may be observed, that apparently the only possibility of the water rising higher in the ditches than in the Bay, is the momentum of the tidal stream of water running up the river and the floating ditch—in all six or seven miles in length. The best means to decide this point, that is, whether the water piles at the heads of the ditches, would be to run a chain of levels instrumentally between two test points. In this connection, it is important to remember that there can be but little doubt that the elevation of the “made land” at the head of the ditches, is higher than that of the dyked lands further down the river.

I would suggest that the explanation of No. 4 is, that the Bay of Fundy is silting up, more especially at its head. The enormous quantity of mud in its waters, is supplied by the waste of the high bluffs of soft material along its coast. Their substance is continually being distributed in the Bay; continually being deposited in various parts, more noticeably (as regards the finer components) on the flats at the heads of the inlets.

But as the same quantity of water continues to be caught by its flaring shaped mouth, and the same mechanical causes still pile the water at the head of the Bay, which we have surmised to be silting up, it would follow that the tides would rise gradually to higher limits.