

along the western bank. I would recommend, however, in view of the heavy expenditure required in fixing and improving the entrance to the river from the sea, that these subsidiary works in connection with the Mahinapua should remain in abeyance, until the more important works at the entrance have been completed. In any case, however, when the necessity arises for improving the navigation on the Mahinapua, the lines and levels I have laid down on the accompanying Drawing No. 2 should be duly observed.

*Conclusion.*

I must not omit, in conclusion, to record my thanks to Mr. Virtue, the Chairman, and to Mr. Craig, a member of the Harbour Board, who accompanied me during my inspection. Captain Turnbull, the Harbourmaster, gave me much useful information as to the changes which have taken place from time to time at the entrance, more especially during the thirteen years which he had acted as Harbourmaster. At the time of my inspection Mr. Blackett, C.E., and Mr. O'Connor, District Engineer, facilitated my inquiry and investigation in every possible way, and to them my thanks are also especially due, and are here tendered.

The Secretary, Marine Department, Wellington.

I have, &c.,

JNO. COODE.

APPENDIX.

By a telegram received since the accompanying drawings have been prepared, I learn that already a facing has been almost completed on this line to the point *B*, and hence the details shown on Figures 7 and 8, Drawing No. 3—representing the mode of construction I should have advised for this facing—cannot now be adopted, although it is desirable that the piling as executed should be stayed, and backed with brushwood and boulders, in the manner indicated on the section, Figure 8. It will be observed that I contemplated filling the space at the back of the piling *A, B*, so as to form a level area adapted for wharfage and other purposes. Whether the nature of the work executed will now admit of this being done I am unable to determine; but this is a point which should receive early attention, seeing that the deepest water in the port may be expected along this portion of the river frontage, although its utilization as berthage would be subject to occasional interruption during heavy onshore gales from the inrun of waves.—J.C.

MILFORD LAGOON (TEMUKA).

SIR,—

5, Westminster Chambers, London, S.W., August, 1879.

Having carefully considered the documents and data received from the colony relative to the proposal to convert Milford Lagoon into an efficient harbour, I have now the honor to submit my report thereon, together with the accompanying illustrative drawing.

*Physical Features.*

Milford Lagoon is situated near the south-west end of the Ninety-mile Beach, on the seaboard of the great Canterbury Plain. It lies about 50 miles north of Cape Wanbrow, and about 10 miles north-north-east from Timaru. The length of the lagoon, in a south-south-west direction, is about two miles and a quarter; its average breadth, between the Opihi and the outfall of the Mill Creek, is about 140 yards at low water and 180 yards at high water. North-east of the Mill Creek the breadth is considerably less, ranging from 20 to 60 yards at low water, and from 30 to 100 yards at high water. Excepting a small area opposite Mill Creek, in and near the line of the outlet channel which existed when the survey was made in October last, the greatest depth was from 3 to 4 feet at low water of ordinary spring tides, as will be seen by reference to the accompanying drawing.

At the time of my inspection—in April of last year—the connection between the lagoon and the sea was entirely cut off by a considerable barrier of shingle, which then extended completely across the line where the channel of communication had previously existed. This barrier had again been cut through at the time of the October survey, as appears by the drawing. The existence or non-existence of such a channel depends, under present conditions, upon the relation between the scouring power of the tidal water, combined with that of the fresh-water discharge of the River Opihi and its tributaries on one hand, and upon the quantity of shingle transported along the coast by the waves of the sea on the other.

The conclusion arrived at during my inspection was to the effect that little or no shingle passed around Cape Wanbrow from the southward, and that the shingle travelling along this south-western portion of the Ninety-mile Beach (where Milford Lagoon is situated) is derived mainly from the materials brought down by the River Waitaki, and partially from the shingle cliffs, averaging about 35 feet high, which fringe the shore northward of Oamaru.

The supply from the two sources named, especially from the Waitaki, is very large indeed, and practically unlimited. Being personally acquainted with numerous coasts and river outlets in several parts of the world, I have never previously seen, nor have I any knowledge of, such vast quantities of shingle being elsewhere transported by the waves as those which travel along this portion of the seaboard of New Zealand. The shingle is drifted or propelled along the coast in a northward direction by the heavy southerly seas, the preponderating force being admitted on all hands to be from that quarter. The waves impinge on the beach at a slightly oblique angle towards the northward, thereby generating an almost constant travel of large quantities of shingle from south to north across the entrance to Milford Lagoon.

The quantity of tidal water flowing into and out from the lagoon at each tide during springs—when communication exists between it and the sea—as calculated from the drawings and data sent from the colony, is under 3,000,000 cubic yards. The fresh-water discharge is of course dependent upon the amount of rainfall over the watershed of the Opihi and its tributary streams: from a tabular statement of the areas of watershed of several of the rivers of New Zealand, kindly furnished by Dr. Hector, I find this area may be taken at about 890 square miles.