

High water of neap tides has been adopted as the level of the top both of the north training bank and the outer portion of the north breakwater for the purpose of utilizing the scouring forces both of the tidal and fresh waters to the greatest possible extent compatible with the avoidance of gorging during times of excessive floods. The half-tide training bank, laid down on Drawing No. 1, for future construction near Cobden Gorge and the mouth of the Coal Creek, should all be formed at the same relative level—viz., half-tide at this section of the river.

Estimate of Cost of Works now Recommended.

	£	s.	d.
1. Training mound and south breakwater, 3,000 feet in length, formed of rubble stone, and protected at the seaward termination by concrete blocks built <i>in situ</i> , including staging for the outer portion of the breakwater, and railway to connect with the existing system at the western termination of the southern training bank already executed; also a viaduct of open timber piling across the entrance to the lagoon	105,120	0	0
2. North breakwater, 1,280 feet in length, formed of rubble stone, including provision of staging for the outer portion of the work, and a temporary railway from Cobden Gorge Quarry, over which the materials for the breakwater would be conveyed	40,530	0	0
3. North training-bank of rubble stone, 1,670 feet in length	8,060	0	0
4. Dredging shingle-bank on the north side of channel, from opposite the lagoon's entrance to abreast of Johnstone Street, and depositing the surplus materials at the back of the south training bank over the area crossed by red lines on the plans	8,330	0	0
Gross estimated cost of works recommended for construction	£162,040	0	0

The foregoing amounts include a fair allowance for plant, contingencies, and supervision, and are based upon the local rates of materials and labour furnished with the other data from the colony. Item No. 4 provides for the working charges only of a dredger, and not for interest on the first cost of the machine. In considering the gross estimated outlay it should be borne in mind that the expenditure would be distributed over a period of from five to six years. Items 1, 2, and 3 assume that a sufficient quantity of large stone to insure the stability of the rubble mounds can be obtained at the quarries named. Before, however, proceeding with the works, or even prior to letting contracts for their execution, a sufficient extent of quarry-ground should be opened out to give accurate and definite information as to the relative yield of large and small material. In considering this question it must be borne in mind that the system of depositing from a stage, recommended for the outer or more exposed portions of the north and south breakwaters, will render practicable the construction of the moles when it might have been impossible to carry them forward as simple end-tips; and this will readily be understood when it is considered that the staging admits of depositing the materials, layer on layer, with flat slopes at the ends and along the sea-faces, the rubble being thereby dropped over a much greater range of area than by a system of tipping as an embankment from the end, and widening and feeding at the sides; hence, the slopes of the works, where deposited from a stage, would from the first be better adapted to withstand the action of the sea, provided the materials contain a fair admixture of heavy blocks. Again, the saving in settlement due to depositing from a stage as compared with tipping over end is very important in works of the class contemplated. For the less exposed inner lengths of the north and south breakwaters the conditions are in favour of the ordinary embankments system of depositing the materials.

Upon the completion of these works, and after the improved scour continuously acting over the same track has come fairly into operation, it may be expected that the navigable depth in the centre of the entrance and channel will be 10 feet at low water, or 18 feet at high water of spring tides, which will be sufficient for the navigation of vessels drawing up to 12 feet, allowing 6 feet for "scend" or undulation—a safe deduction except on the occurrence of heavy storms, but ordinarily a margin of 3 or 4 feet will suffice. Such a depth in the entrance, when permanently obtained, will, I imagine, be found adequate to the present and prospective requirements of the port for some years to come. At neap tides the depth would be 3 feet less than named above.

Future Extensions.

Having described the works I have to recommend for present execution, the principles by which I have been guided in designing them, and their estimated cost, it now remains for me to indicate the extensions which may be necessary hereafter when the trade of the port shall have been developed to such a degree as to call for still further improvements.

Works in River near Cobden Gorge.—It appears to me that, after the execution of the works hereinbefore described and recommended, those next in importance in the way of internal improvements will be the alteration of the line of the easternmost portion of Mawhera Quay for a length of 900 feet, and, concurrently therewith, the formation of the half-tide training bank on the north side of the channel westward of the mouth of the Coal Creek to a point about 650 feet below the outer end of the existing rubble stone groyne at Cobden Gorge, as shown by red dotted lines on Drawing No. 1. The half-tide training banks on the north side of the river eastward of the Coal Creek should be carried out at the same time upon the lines indicated by thick red dots on the drawing.

When the works last described shall have been executed, the area eastward of the Mawhera Quay, within the red-dotted line, described as "assumed future low water," will doubtless be filled up by the accretion of river deposits to such an extent that, with the addition of quarry waste or spoil from the hill at the back, it could, at a comparatively small outlay, be made available as standage ground for railway coal wagons, &c., &c. An important benefit to be derived from these works would be the maintenance of deep water in front of Mawhera Quay, where a shingle-bank has been accumulating