

striking against the curved root of Tainui Street wall, and forcing the water too suddenly across the river to the bend in the wharf at Boundary Street. This can be done, and a more direct and uniform current produced, by extending the Coal Creek training-wall as shown on the plan which accompanies this report, and I recommend this extension to be done, as I believe it will secure a more uniform depth across the river just where it is most wanted, and probably obviate the necessity for much dredging. This extension will also hasten the scouring-away of the shingle-bank below the bridge, which is continually wasting away, and the more it is removed the better will be the direction of the current.

*Middle Training-wall.*—I do not think there is any necessity at present to extend the middle training-wall, although, if the wharf should ever be extended to the lagoon, the extension of the middle training-wall might improve the channel, and make the depth more uniform. At present, from Chapman Street to the lagoon-mouth, the right side is very shallow.

*Effect of Floods and Shingle.*—The floods and heavy shingle moved down the river by them are no doubt the cause of the very irregular depths which are found in the navigable part of the river. This irregularity is clearly shown on the contour-lines of the depths which I have laid down on the plan herewith. I do not think the training-walls can always regulate the depth, and that from time to time shoals will be found after floods in unexpected positions. If left alone for some time such shoals gradually disperse, and the average depth is restored but, as navigation cannot wait on natural causes, it is more than likely that dredging must be resorted to, and to what extent this will be required it is not possible, without long experience, to foresee. The heavy shingle which composes the river-bottom can only be removed during floods, but, in the lower part of the river the bottom is softer, and the bar is composed of gravel and sand. When the river is low the currents are feeble, and it is important to secure all the scouring-power that can be got. The scouring-currents are derived partly from the river-water, and partly from the tide which flows in and out of the river, and into a number of small lagoons.

*Channel to Karoro Lagoon.*—I consider it to be of sufficient importance, with the view of securing a greater quantity of tidal water, to incur the expense of dredging the channel referred to in Sir John Coode's report, to the Karoro Lagoon, and I recommend the Board to undertake this work at its earliest convenience. The channel should be 100ft. wide at bottom, and should be 3ft. 6in below low-water spring-tides. This will enable the lagoons to fill up to the level of the tide in the river itself, and will secure a material addition to the scouring-force of the river. The cost would be about £4,180.

*Dredging.*—A large quantity of dredging has been done to secure the existing depth of water along the wharves. Dredging commenced under the Public Works Department, and, from 1879 to 1882, 295,548 tons were dredged along the wharves from Wereta Street downwards, at a cost of £14,311, the average per ton being 11½d. From 1885 the Harbour Board has done a considerable quantity of dredging at various times until this year, amounting to 92,771 tons, at a cost of £5,117, the cost per ton varying from 1s. to 1s. 6d. and 1s. 8½d. per ton. The total quantity of dredging that has been done to improve the berthage and give room for swinging is 388,319 tons, costing £19,428. The average cost is 1s. per ton.

*Necessity for it.*—The necessity for so much dredging has arisen largely from the deepening of the bar by the construction of the works, which has allowed vessels of deeper draught to seek the port. The berthages have now a depth of about 12ft. at the upper wharf, and 15ft., 18ft., and 21ft. at its lower parts, below low-water spring-tides, and for a width of about 75ft. from the wharf.

*Permanence of Dredging.*—I have not been able to entirely satisfy myself as to whether the depths gained by dredging are silted up to any extent after floods. The evidence, so far as it goes, appears to show that the depths are maintained by natural scour. I believe the dredging has had a useful effect, and, with occasional exceptions from floods causing partial deposits, I think the good results will be fairly maintained. Where dredging has been done, quantities of snags and heavy limestone rocks, slipped out from the pitching underneath the wharf, have been raised.

*Nature of Bottom.*—The dredgings show that coarse shingle, with boulders up to 1cwt., cover the surface, and below that the shingle is finer and contains more sand. These snags and heavy stones have no doubt taken centuries to creep down the river, and when once removed it will perhaps take centuries to replace them by floods. The removal of snags, limestone rocks, and heavy shingle by dredging would therefore leave the bottom covered with finer shingle and sand, which is much more under the influence of the ordinary scouring-power of the river. The only dredging which is contemplated is that necessary to give good berthage for ships along the wharf, and to secure turning-room at the lower wharf, and to maintain the depth so gained.

*Dredger.*—The dredger employed is a very effective machine for its size. It is capable of raising from 100 to 125 tons an hour. The difficulty of disposing of the shingle, which has to be lifted up to the wharf and carried away in trucks, limits the output, and increases the cost. At present about 260 tons per day is raised, at a cost of 1s. 6d. per ton, or 2s. 3d. per cubic yard, but the greater part of the previous dredging cost about 1s. 1d. per ton.

*Stones slipping into Fairway.*—In dredging alongside the old part of the wharf some trouble will occur from the very steep slope of the stone pitching which covers the bank under the wharf, and which, as the bottom is deepened by dredging, keeps slipping into the fairway. The wharf cannot keep the stones up, as the piles are 12ft. apart, and it may be found necessary, if deeper water is wanted at this part of the wharf, to drive piles 1ft. apart all along it, and secure their heads by walings to the present piles. If this is not done, and deep dredging is carried on along the old wharf, the whole of the pitching may slip down, and let down the street at the back of the woodwork.

*Velocity of Currents.*—I took a few observations on the velocity of the current in the river, with the object of ascertaining the variations in speed at different parts, variations which the floods will also be subject to when they occur. The following list shows the velocities on two different days, the river being very low and the sea smooth;—