the constant current at sea, which runs across the ends of the breakwaters with a velocity varying from one-half to about five miles an hour according to the weather and the direction of the waves also, if the breakwaters are ever lengthened, the new channel will be more in the centre of the breakwater ends than the original line would be.

The line of training-wall and channel shown on the plan herewith is very nearly in the same direction as intended by Sir J Coode, but shifted towards the west it therefore avoids a considerable portion of the dredging. The west wall is, however, in rather deeper water than on the original line, but this is unavoidable if the present fairway is to be kept open while the new channel is being cut.

Your Engineer has furnished me with the result of the dredging done in the river during the last fifteen months, from which it appears that there has been no silting-up of the deep parts which were dredged in front of the staiths. The part dredged along the merchandise wharf has silted to the extent of 5,500 tons, and the appearance of the sections taken across this space shows that this silting is caused by the rapid currents on the west side of the river, which here cross over and fall into the deepened part, leaving the sand they carry on the west slopes of the dredged trench. "Since this trench was dredged along the merchandise wharf and staiths, the river has set more directly towards the east side, and there is a perceptible fall in the surface of the water at the upper end of the berthages, where it drops from the original bed into the dredged basin"

The dredging done in the fairway from opposite the lagoon for 800ft. towards the signal-station was taken out 150ft. wide, and also, for some distance further down, at 50ft. wide. This has nearly all silted up to its original condition. I have had a complete set of contour-lines marked on the plan over the whole of the lower part of the river Contour-lines omitted from lithograph, lest on so small a scale they should prove confusing. And from this it is seen that the above-mentioned dredging, done in the fairway, lies along the eastern side of a deep natural channel. Now, the natural channel has maintained its depth of 24ft., but the dredged channel taken out on one side of it, and on the shallow ground, has silted up, showing that a new channel cannot be maintained while the old, deep, natural channel exists, and it is only by the assistance of the west training-wall that the proposed new channel can be maintained at a proper navigable depth.

With the object of gaining some idea of the state of the currents, and of their action on the bottom, Mr Wilson has had the velocities taken in various parts of the river at half-ebb tide when the river was low. These observations indicate that the velocity of the surface-current diminishes from 140ft. a minute at the bridge to 100ft. at the end of the staiths. The bottom velocities are extremely irregular, but they diminish with increasing depth of water and, in the deep dredged parts near the staiths, there is still water near the bottom. But a very slight fresh increases the current greatly, during one such the velocity of a float 7ft. deep was 350ft. per minute from bridge to Rintoul Street, 355ft. from Rintoul to Brougham Streets, 365ft. from Brougham to Lyndhurst, 190ft. from Lyndhurst to end of staiths, end of staiths to upper end of old half-tide wall, surface-velocity 297, bottom-velocity 207, upper end of wall to lower end of same (in line of fairway), surface-velocity 252, bottom-velocity 207ft. lower end of training-bank to below signal-station, surface-velocity 258, bottom-velocity 183ft.

Also, on the night of the 10th June, with a small flood, the velocity of the current at the staiths, 10ft. below the surface, was 546ft. a minute—a velocity which could not fail to scour any deposits in the deep water at the berthages.

These observations are only useful to show that the only scouring action occurs during floods, at the same time, it is only during floods that sand is carried by the currents.

From section across the river taken in 1888, before any dredging was done, the natural depth along the staiths was 16ft. to 19ft. below low-water spring-tides. In 1889 the berthages were dredged to 18ft., and, in place of subsequently silting, the dredged depths increased. In 1891 the berths at wharf and staiths were widened at 18ft. below low-water spring-tides, with the result that at present no silting has occurred, and in some places the depth is 23ft. The small amount of silting mentioned above is fine granite sand. So far no shingle has made its appearance as a deposit in the port. It is possible that in course of time the shingle will creep down from the higher parts of the river, but, until it arrives, one cannot tell whether it will form a deposit in the deep water at the wharves. When the design is completed by the construction of the training-walls there will be a considerable increase in the velocity of the currents along the wharf and staiths, and, seeing that there is little evidence of re-silting at present, I think one may confidently anticipate that the depths required for navigation will be maintained by the natural scour.

Height of Walls.—The training-walls are shown according to the height defined by Sir John Coode—that is, half-tide level, or 4ft. 9in. below high-water spring-tides.

Depth under a High Flood.—High water is practically level from the sea to the Buller Bridge, but, during the flood of the 2nd August, 1890, your Engineer has shown that the surface of the river was inclined over 4ft. from the signal-station to the Buller Bridge. Such a flood would stand 6ft. over the top of the training-walls at the lagoon bridge, and 10ft. over them at the Buller Bridge. Smaller floods have intermediate inclinations over this extreme, and in this feature there is a means of diverting more of a flood towards the wharves, if experience shows that it is desirable, for, by raising the walls at the upper end, this can be done, but no attempt of the kind should be made until the phenomena of a high flood have been studied.

Roads to Walls.—On the plan is shown the position of three lines of rails over which stone can be brought from the Cape Foulwind railway to the walls.

Ends not to join Shore.—Wherever it can be avoided the ends of the training-walls should not be joined solid to the shore, as in that case the enclosed space is sure to become silted up, which is not desirable, as all tidal waterway within the port is valuable.

Floating-basin.—On the plan accompanying this report it was necessary to determine the position of the proposed floating-basin, as this would influence the line of the training-wall on the