the observations were taken at half-ebb, or three hours after high water The bottom-velocity in line of fairway at the upper end of old training-wall was 207ft. per minute at lower end of old training-wall, 207ft. per minute, at signal-station, 183ft. per minute, 26 chains from end of west breakwater, 198ft. per minute and at end of east breakwater, 210ft. per minute. On the 23rd June the river was low, and, without any flood-water, a ground-float showed the velocity at end of east breakwater to be 150ft. per minute. The above shows a good current to prevent accumulations of deposits, but it is rapidly diminished seaward. The above velocities are due to the emptying of the tidal area and the river-water, the tidal water being three and a half times as much as the discharge of the river

Tidal Area and Discharge.—The tidal area at low-water mark is 505 acres, and that between low water and high water 381 acres tidal area, 887 acres. The discharge of tidal water from a spring-tide is about 550,000 cubic feet per minute, to which is to be added the discharge of the river when it is low, which amounts to 157,000 cubic feet per minute. The total discharge is 708,000 cubic feet. A small flood of 4ft. high discharges 2,250,000 cubic feet, and a high flood like that of 2nd August, 1890, discharges about 11,000,000 cubic feet per minute, which would give a velocity between the ends of breakwaters of about 900ft. a minute, sufficient to produce a powerful scour a long way out to sea.

Depth at end of Wall.—When Sir John Coode made his design he anticipated placing the end of the west breakwater in 20ft. at low water, but in 1887, eight years afterwards, and long before the breakwater had reached this intended point, the depth had shoaled to 10ft. The west wall would have to be 840ft. longer to reach the 20ft. at present, but as the deposits of 1887 are deepened by the advance of the breakwater, as is shown by the sections herewith, probably at half that distance a depth of 20ft. would be attained. With the extension of the breakwaters seaward the line of low water, if it continues to advance, will do so at a diminishing rate, and the shoal-water in front of them will be steeper the farther seaward they are carried. For this reason I believe that the farther out the walls are carried the greater will be the permanent depth. As the inevitable shoaling in front of the breakwater gets steeper and steeper the farther they are carried out, so the deep water of the original bottom becomes closer to the ends of the walls, and the powerful scour of floods is more able to maintain a deep channel.

Injurious Effect of one Wall longer than the Other.—The east wall is at present 400ft. behind the end of the west wall, and, as the prevailing waves and currents are towards the east, the effective width is to be measured between the ends in a slanting direction to the flow of the river The effect of the outflow is therefore weakened by the water spreading like a fan as soon as it escapes from the end of the east wall. To concentrate and properly direct the outflow towards the nearest deep water the east wall should be carried out at least as far as the west one, and I believe that a still better effect would be secured by carrying the east wall a good distance beyond the west one. The river-current would in that case be kept up to its work in the desired direction by the pressure of the sea-current and the waves, which is most frequently exerted in an easterly direction. Although the east wall, being much longer than the west, would secure the best results in preserving a deep channel straight out to deep water in the sea, yet it might be dangerous for navigation having the longest breakwater on the lee side, and I should hesitate to recommend the work being carried out in this form, unless the Board were prepared, in case it were found to be bad for navigation, to extend the west wall also, so as to have the two ends opposite.

The Sulina Danube.—The experience gained at the Sulina mouth of the Danube supports my opinion that the east breakwater should be at least as long as the west one, especially as the condition of the shore and prevailing winds and currents at the Sulina are singularly like the state of things at Westport. At the Sulina the breakwaters were at first built with the one to leeward of the prevailing winds and sea-currents 670ft. shorter than the windward one, with the idea of sheltering vessels passing in and out. The effect of this was found to be that a shoal formed on the lee side of the shorter breakwater, which extended 200ft. inside the opening. The wall was then extended 457ft., but, this being found insufficient to cure the evil, it was extended 204ft. more, so that the ends were opposite. I quote from the report "So that now the full current is maintained to the end of the piers, any sediment deposited by the river beyond the ends of the piers is directly exposed to the combined action of the heavy seas produced by N to N.E gales and the littoral current from the north, and is swept away southward."

Evidence of Progressive Shoaling.—Having carefully considered all the circumstances of the case with somewhat deficient data, I come to the conclusion that there is not sufficient evidence to prove that the water on the bar has been steadily shoaling, and if that is the reason for extending the breakwaters it is not so conclusive as to give grounds for recommending the extension. On the other hand, the conditions of the depths of water round about the breakwater ends are totally different to those which existed when the works were designed, and the changed conditions are not the result of the construction of the breakwaters.

Suggestions.—I would therefore suggest that, as the preservation of the navigable depth is the first necessity which the Board should have in view means should be secured to undertake the extension of the breakwaters whenever further evidence is available to prove conclusively that the bar is permanently shoaling. But if the Board is desirous of obtaining a greater depth than was contemplated by Sir John Coode the breakwaters should be extended at once. In this case the west breakwater should be extended 600ft. at high-water level only, and the east breakwater 1,000ft. at half-tide level, and the walls should be converged to a width at their ends at mean-tide level of 600ft.

Ends to be Opposite.—This extension would place the ends of the breakwaters in about 14ft. of water with deep water outside close by, and the ends would be opposite each other so as to produce the best scouring effect. Whether this extension is carried out or not, I would recommend that the east breakwater be at once extended on the line of the extension proposed above, so that the end be opposite the end of the west breakwater.