

REPORT

OF

Sir J, Wolfe Barry & Partners

TO THE

Dartmouth Harbour Commissioners

ON

Dredging Dartmouth Harbour,

28th AUGUST, 1912.

*Dartmouth House,
2, Queen Anne's Gate,
Westminster, S.W.
28th August, 1912*

To the Dartmouth Harbour Commissioners.

Gentlemen,

DREDGING DARTMOUTH HARBOUR.

1. In accordance with your instructions we have inspected Dartmouth Harbour and our Assistant, Mr. W. B. Cole, has made a careful survey of that part between the Ferry and the Floating Bridge, the improvement of which is now under consideration.

2. Cross sections of the harbour were taken at intervals of 200ft., and from these the dotted contour lines shown on the accompanying Plan No. 1554 have been plotted. These lines represent low water of ordinary spring tides (which is 8ft. below Ordnance Datum or 8ft. 9ins. below the summit of the half-tide rock at Warfleet Point) and depths of every fathom from one to five fathoms respectively beneath low water line. According to the Admiralty records the depth at low water of ordinary neap tides is 4ft. 3ins. more than at low water of ordinary springs, while at high water of ordinary neaps and springs the depths are 10ft. 6ins. and 14ft. 2ins, respectively more than at low water of ordinary springs.

3. On comparing the contours with those shown on the latest Admiralty Chart No. 2253, surveyed in 1900, we find that the only change of any consequence during the past twelve years has been a shoaling to the extent of one to three feet along the two and three fathom contours on the Kingswear side, commencing about 50 yards to the southward of Buoy No. 6, and extending thence up the Harbour for a distance of 350 yards. The other contours between these points and all the contours elsewhere remain very much the same as in 1900.

4. We have also compared the new soundings with those shown on the Admiralty Chart of 1853. This chart is on a smaller scale and has fewer soundings than the later chart, so that it is difficult to make an exact comparison ; but so far as we are able to judge, the Harbour is now rather deeper in the middle and shallower both on the Kingswear and Dartmouth sides than it was in 1853.

5. We understand that no dredging of the Harbour, other than that executed by the Great Western Railway Company in the neighbourhood of their Jetties, has been executed since about 1885. It appears, therefore, that the natural scour is sufficient to prevent the accumulation of silt except at the sides of the Harbour where the currents are slack and where the run of the tide is obstructed.

6. As an instance of silting due to obstruction, the area on the up-stream side of the Great Western Railway Company's

Kingswear Jetty, which has to be dredged every five or six years, may be mentioned. We have been furnished by the courtesy of Mr. Grierson, Chief Engineer of that Company, with a plan showing the accumulation of silt at this spot between the years 1904 and 1909, the average depth of which amounted to two feet in the five years, the depth varying from half-a-foot in line with the front of the jetty to a maximum of five-and-a-half feet close against the Quay.

7. In addition to the soundings we have had a series of current observations carried out both on the flood and ebb at neap tides on 25th July and at spring tides on 1st August. Floats were placed in the water near the Ferry on the flood tides and near the Floating Bridge on the ebb tides. The floats in mid-channel were carried along the middle of the Harbour as shown by the full lines on the Plan. The floats on the Dartmouth side continued on that side, while those on the Kingswear side were carried towards the concave bend of the Harbour to the Eastward of the coal hulks where the tide is comparatively slack.

8. The following were the average velocities of the mid-channel floats:—

Neap flood tide...	...	...	...	0.95 mile per hour.
„ ebb „ ...	...	...	...	1.00 „ „ „
Spring flood tide	....	...	...	1.06 „ „ „
ebb „	...	...	...	1.34 „ „ „

The velocities of the floats on the Dartmouth side were a little less than in mid-channel, while the velocities on the Kingswear side fell off considerably towards the shore. No doubt this circumstance is the reason for the deposit of silt on the Kingswear side which is indicated by the soundings referred to above.

9. We should scarcely expect that such small velocities as those we have recorded would be sufficient to keep the channel clear, and probably the fact that the silt does not accumulate in the middle of the Harbour is due to the action of the ebb tides when the land floods are coming down the river. At such times we are informed that the velocity of the ebb tide is greatly increased, but we have had no opportunity of practically testing this.

10. Judging from the general directions of the tidal currents and from the comparison of the recent soundings with the earlier ones, we should anticipate that a channel dredged to a moderate width along the middle of the Harbour would be maintained by the natural scour, but that, if the channel is wide, silt would probably be deposited at the sides, particularly on the Kingswear side.

11. On referring to the late Mr. Cuthbert A. Brereton's report to the Harbour Commissioners dated 19th January, 1894, we find it stated that a channel dredged along the centre of the Harbour with a depth of 26ft. at low water of ordinary spring tides and a bottom width of 250ft. would not be silted up ; but in a later report dated 7th February, 1894, when a project for deepening the Harbour for a much greater width was under consideration, Mr. Brereton was unable to say without further tidal observations whether the extended area when dredged would be kept open by scour alone.

12. From the observations recently made we are certainly of opinion that the extended area suggested in 1894, which had a width of about 900ft. near the Ferry, diminishing to about 600ft. near the Floating Bridge, would require periodical dredging to keep it clear.

13. We are unable to determine exactly the limit of the width which would be maintained without dredging, but probably any channel with a bottom width of more than about 300ft. would be liable to some accumulation of silt at the sides. Such a width, however, would scarcely meet the requirements of the case, as there ought to be room for large vessels to turn in the deep water without fouling the coal hulks or the vessels coaling alongside.

14. We think, therefore, that any comprehensive scheme of improvement should provide for a deep water channel between the Ferry and the Floating Bridge having a bottom width of not less than 600ft, and we recommend that the channel should be dredged along the area shown on the accompanying plan by the red tint which is set out with the view of deriving the best advantage from the natural scour of the tides.

15. On the completion of the dredging the coal hulks and moorings for other large vessels could be shifted towards the Eastern side of the channel, thus leaving the Western side clear for vessels passing up and down or manoeuvring in the Harbour.

16. The Western side of the channel as shown would be at least 300ft. away from the Embankment Wall in front of the New Ground so that the dredging could cause no injury to the foundations, which show signs of settlement in places.

17. With regard to the depth of the new channel, we believe that the draught of vessels at present frequenting the Port seldom exceeds 25ft., although occasionally vessels drawing as much as 27ft. have been accommodated at the coal hulks. With a view to attracting larger vessels we think that a depth of not less than 28ft. at low water of spring tides should be provided if funds will permit. This depth would accommodate vessels drawing that amount of water even at spring tides, and upwards of 28ft. at other times. It is true that they could not come alongside or leave the hulks at dead low water of spring tides ; but, so long as they could lie alongside without grounding, they would suffer no injury, and they would have enough water under the bottom to enable them to navigate within an hour or so of dead low water.

18. The present depths at low water of spring tides alongside the coal hulks vary from 17ft. to 22ft. alongside the " Juno," 22ft. to 24ft. alongside the " Prince Arthur," and 24ft. to 25ft. alongside the " Stratford" and " Sabrina " ; so that a deepening even to the extent of 26ft. would be a considerable improvement on the present state of affairs. At the same time it is obvious that the greater the depth, the better the prospect of developing the trade of the Port, and we have therefore prepared estimates for dredging the 600ft. channel to depths varying from 26ft. to 30ft., so that the Commissioners may see to what extent their resources will permit them to go.

19. In estimating the quantities of the dredging we have assumed that the side slopes of the channel will stand at 3 to 1 on the Dartmouth side of the Harbour except abreast Coombe Mud where the ground is softer, and we have consequently adopted a slope of 4 to 1 for this part of the dredging. On the Kingswear side the mud appears to be softer still, so we have taken the slopes on this side at 5 to 1 throughout.

20. We understand that the dredging contract of 1885 was executed at a price of. 1/3 per cubic yard and from enquiries we have made we believe that a new contract could probably be arranged at a similar price, or possibly rather less if the quantity be large. In the following estimates we have therefore adopted the price of 1/3 for the dredging of the 26ft channel, the price falling to 1/2 in the case of the 30ft. channel.

21. In fixing these prices we have assumed that no rock will be encountered, which we believe is a reasonable supposition, as nothing but mud, gravel and sand have been met with in taking the soundings, and only these same materials are indicated on the Admiralty Chart. We have also assumed that the dredged materials would have to be deposited at sea three miles beyond the headlands.

22. If the materials could all be pumped ashore the dredging could no doubt be executed at a cheaper rate than if carried to sea; but, so far as we are aware, there are no suitable low-lying sites which could be utilized for this purpose. Even if the North Embankment were to be continued across Coombe Mud, the space at the back, if filled up to Embankment level, would only contain about 80,000 cubic yards of dredgings and this would only represent about one-seventh of the total quantity to be dredged for the 28ft. channel which we have recommended.

23. It would not be advisable to deposit part of the materials on shore and the remainder at sea, because the plant required for the one operation would be unsuitable for the other, and the expense would be greatly increased if two separate types of plant were to be employed.

24. In addition to the cost of the dredging, provision would have to be made for removing and replacing the buoys, moorings, coal hulks, etc., within the area to be dredged, the cost of which we estimate approximately at £700.

25. In all probability, also, it would be necessary to remove and make good the ends of the two sewers which we believe are carried across Coombe Mud and have their outlets beyond low water line. The cost of this work may be estimated roughly at about £200

26. Besides the foregoing items provision should be made in the estimates to cover the cost of any contingencies which may arise, as well as the cost of supervision and other incidental expenses. We think that an addition of 2d. per cubic yard on the price for the dredging would be a fair allowance to cover the cost of all these items, including the above mentioned sums of £700 and £200. The inclusive prices, therefore, will vary from 1/5 per cubic yard for the 26ft. channel to 1/4 per cubic yard for the 30ft. channel.

27. The following tabular statement gives the inclusive estimated cost of dredging the area tinted red on the accompanying Plan to depths varying from 26ft. to 30ft. at low water of ordinary spring tides.

l.w.s.	l.w.n.	b.w.n.	h.w.s.	Quantity of Dredging cub. yds.	Inclusive price per cub. yd.	Inclusive cost of Dredging £
26' 0"	30' 3"	36' 6"	40' 2"	405,000	1/5	28,688
27' 0"	31' 3"	37' 6"	41' 2"	476,000	1/4 ³ / ₄	33,220
28' 0"	32' 3"	38' 6"	42' 2"	550,000	1/4 ¹ / ₂	37,813
29' 0"	33' 3"	39' 6"	43' 2"	628,000	1/4 ¹ / ₄	42,521
30' 0"	34' 3"	40' 6"	44' 2"	710,000	1/4	47,333

28. With regard to the maintenance of the dredged area, we have already said that some silting at the sides must be anticipated, but to what extent we cannot give any reliable estimate. Judging from the rate of accumulation behind the Kingswear Jetty and making allowance for the comparatively slack water which facilitates the deposit of silt at this spot, we should think that, as a rough approximation, a deposit of about 9,000 cubic yards a year within the dredged area might be reckoned upon. The depth of the channel would no doubt affect the quantity of silt, because there would be rather more as the depth increases; but we do not think that the difference in the quantity would vary to any great extent within the limits of the depths under consideration.

29. The price for removing the silt would probably be more than for the large quantities of dredging provided for in the above estimates; but if dredged once every five or six years, we think it could be done for about 1/6 per cubic yard, at which rate the cost of maintaining the dredged area would amount on the average to about £675 a year. Probably the cost of maintenance could be met from the Commissioners' ordinary revenue, but we have mentioned the subject in case it may be necessary to provide any additional capital fund for the purpose.

We are, Gentlemen,

Yours faithfully,

For SIR JOHN WOLFE BARRY & PARTNERS,

(Signed) E. CRUTTWELL.

H. WILLIAMS, PRINTER, DARTMOUTH.

NB The Plan referred to in the report has not been located. (2009)