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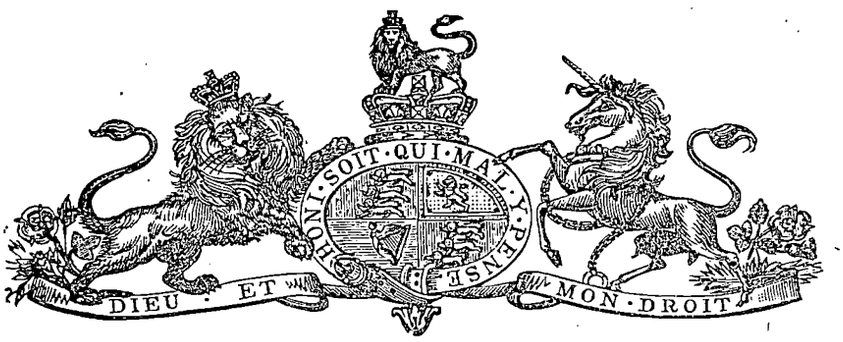
PARLIAMENT OF TASMANIA.

THE RIVER LEVEN:

REPORT BY C. NAPIER BELL, M. INST. C.E.

Presented to both Houses of Parliament by His Excellency's Command.



REPORT ON THE RIVER LEVEN.

By C. Napier Bell, *M. Inst. C.E.*

Greymouth, 25th June, 1890.

Sir,

On the 15th and 16th April I made an examination of the mouth of the Leven, and of the upper tidal part for four miles above the town. I also inspected the channel rock and the beach to the east and west of the river mouth.

Since my last visit in 1882 your engineer, Mr. Townshend, had made a more detailed survey than I had to work with at first. This survey shows the outline of a patch of basaltic rock which extends across the river, and from its appearance I suspected that the river bed was rock in this part; I therefore requested your Board to have borings or probings made all over the bottom, which has been done, but the information sent me on this subject is still very deficient, and consequently I have not been able to determine whether the proposed dredging will require rock to be taken out, nor the quantity, if any. I have, however, assumed that there will be some rock to be removed, although there may be more, of which the plans sent me give no definite information, as the borings were not taken across the river in the form of cross sections.

The new plan also shows a considerable increase in the width of the bar, and less water on it than I found in 1882.

In my previous report I discussed the question of deepening the bar to 4 feet below L.W., but I understand that now it is desired to obtain 6·6 feet, or about 16 feet at H.W. I have accordingly made the accompanying plans to answer this requirement, which involves a considerable increase of cost over my original estimate.

All things being the same, to maintain an increase of depth it is necessary to contract the width between the breakwater so as to obtain increased scouring power, but the width cannot be reduced without due regard to the safety of navigation, which becomes dangerous to vessels in rough weather, when the entrance is narrow. By contracting the entrance there is also the danger of throttling the tide if the river channel be not deepened to correspond with the diminished width. In soft material the increased current will usually excavate the channel to a sufficient depth, but in the case of the River Leven there is a bar of rock, and below it a patch of heavy boulders, on which the increased current would have no effect. The plan which I have now the honour to submit to your Board shows the entrance of the river contracted by the east and west breakwater, the bases of which are widely splayed with the object of reducing the height of waves rolling in between the walls, and of enclosing as much tidal water as possible; but the currents down the river are directed by a long training wall, as shown.

I am in doubt whether the tidal currents alone would be sufficient to scour out the bar to the required depth of 16 feet at H.W. or 6·6 at L.W.S.T., but if a channel were dredged to that depth the currents will most likely maintain it.

I have shown the dredging that is necessary to get the above depth as far as the wharves, above which the water is much deeper owing to the soft silt of the bottom. It will be observed that the dredged channel is 200 feet wide near the bar, and only 120 feet in the river; it is to be understood that this is a very narrow channel, which would be widened with advantage were funds available. The depth on the bar will depend on the volume of water which enters the tidal estuary

of the river and ebbs out on the falling tide. The larger the waterway the greater the quantity of tidal water will enter the upper parts of the river. It is, therefore, important that the hard bar of basalt should be excavated from the low-water mark to the base of the training wall, and all boulders and shingle similarly removed to the level of L.W.S.T. if possible. This can be done in constructing the training wall, which should be built of this material as far as it will go. With the same object of facilitating the tidal flow, the jetty called Cox's Jetty should be removed, as well as the mound of boulders below the baths. In future it would be advisable that the Marine Board should not permit any private persons to erect structures below H.W.M. without its assent.

As mentioned above, the breakwaters as laid down will cause the bar to be materially deepened, but as it is impossible to define the exact depth they will cause, the bar must be made the required depth by dredging, when the walls will most likely maintain the depth, but if they do not their effect may be assisted by dredging from time to time. This is a small river to get such deep water by its own scouring action, but it is quite possible that the beach sands being excluded by the walls, the material brought down by the river may be fine and light and quite within the scouring power to maintain the desired depth. The breakwaters are shown to be built as rubble mounds to the level of one foot above H.W.S.T., and constructed from a staging: I have shown it as built from a staging because I suspect that stone of large size is not obtainable, and if the stone be small it will be found to be almost impracticable to maintain a roadway on the top of the mound. If, however, stone of large size can be got to cover the slopes it is always preferable to build the rubble mound without staging, the line of rails conveying the stone trucks being laid on the top of the wall, which in this case must be raised to such a height above H.W. as will ensure the safety of the traffic and the rails; seven feet above H.W.S.T. would probably be high enough.

The smaller the stones covering and protecting the slopes from the dash of the waves the flatter will the slopes become and the greater the quantity of stone will be required in the construction. If stones can only be got of very small size it is questionable whether the mounds can be made at all in this form unless they be covered with concrete blocks, which would greatly increase the cost of the work. Special care must be taken to lay heavy rock on the finished ends of the mounds, as the work is most severely tried at the ends. Rock of from 1 to 5 tons placed on the slopes would no doubt enable the mound to be carried on as a "high tip." I examined a deposit of quartzite and slate about half a mile west of the river mouth; the rock is good, and with care probably some large rock can be quarried out of it, but it strikes me that there is not enough for even the west wall, and your Board will be under the necessity of seeking for and proving a suitable quarry for the east wall. Of course the person who conducts the construction should have the discretion to know where heavy rock is not required, which will be according to the exposure to the waves: but, for instance, that part of east breakwater lying on the boulders and shingle should not require very large stones, and the training wall within the shelter of the breakwater can be made of small stuff.

During construction, if the work should be stopped for a time for want of funds, the unfinished ends must be strongly protected.

To handle the large rock required for this kind of work requires costly plant of cranes, trucks, rails, locomotives, &c., and if both walls are to be carried out together, the amount of plant required will be nearly doubled: Not knowing where the quarry is to be found, I can only give an approximate estimate of the plant to be used for the west wall, supposing the quarry I saw to be suitable. For this there would be required half a mile of rails, one locomotive engine of small size, one ten-ton and one five-ton steam crane, running on wheels of 3ft. 6in. gauge, and, if staging is used, the stone trucks will be all "side-tip," say 12 side-tip trucks to carry 10 tons each, but if the work is carried on as a "high-tip," eight end-tip trucks to carry 5 tons and four side-tip trucks to carry 10 tons will be required; also the necessary quarry tools, chains, slings, stone-boxes, drills, &c., and buildings. Approximately these items would cost £4500, so that the sum of £5000 which is at present at the disposal of the Board would just cover the preliminary expenditure. If the work were carried slowly on, so as one breakwater should not be started until the other were completed, with the exception of some more rails, the above plant might be sufficient for the entire work. When the west breakwater was completed, the water on the bar would deepen alongside of it by the current from the river hugging the stone-work, and thus some advantage will be at once obtained for the expenditure.

The dredging should be done by either a Priestman or Ladder dredge, preferably by the latter, attended by one or two hopper-barges to convey the material to sea; but if it is too costly or not possible to procure steam-hopper barges, the dredgings might be landed and conveyed away at a cost of about 10*d.* to 1*s.* per cubic yard for landing and spreading only. In calculating the quantity of dredging, I find the information supplied by the plan to be rather deficient, so that having assumed that there is a certain quantity of rock to be excavated, I may be out, either in excess or under. I have shown a turning basin to be dredged opposite the wharves, also a length of additional wharf to be erected, and the space between it and the shore to be filled up, and the slopes pitched with stone.

On this occasion I examined the "Channel Rock" more carefully. This rock lies at no great distance off the entrance of the river. This is a dangerous rock for steamers, and it is much too extensive to be removed; however, between it and the western beach is wide and clear of rocks, and I have adjusted the breakwaters to avoid the channel rock as much as possible.

I have the honor to be,
Sir,
Your obedient servant,
C. NAPIER BELL, *M. Inst. C.E.*

To the Master Warden of the Leven Marine Board.

LEVEN HARBOUR IMPROVEMENTS.

ESTIMATE.

NOTE.—The estimate is approximate, as the cost of stone for each Breakwater is uncertain, and the information given me does not enable me to define exactly the quantity of rock to be excavated in the Channels.

Approximate Quantities.

Quantity.	Description.	Unit.	Rate.	Amount.
			£ s. d.	£ s. d.
110,200	Sand, Dredging Channel	cub. yds.	0 0 11	5050 6 0
10,400	Rock, " "	"	0 12 0	6240 0 0
	Training Wall, 28½ chains—			
5400	Filling	"	0 3 6	945 0 0
	Note.—Spoil from basalt rock and shingle and boulder excavations to be put in wall, no data to give respective quantities.			
42,400	East Breakwater, stone, uncertain, say ...	"	0 5 0	10,600 0 0
42,800	West " " " " ...	"	0 4 0	8560 0 0
	Proportion of heavy stone included in price.			
1254	Staging on East Breakwater	lin. ft.	3 5 0	8198 10 0
1268	" West "	"	3 5 0	
208	Wharf extension, Piled work.....	"	6 10 0	1352 0 0
7200	Filling behind Wharf	cub. yds.	0 1 3	450 0 0
	Taken as 180 ft. × 72 ft. × 15 ft. average depth.			
495	12 in. Pitching, end return, slope 1½ to 1—data insufficient	sq. yds.	0 4 0	99 0 0
	Plant, as set forth in report	...	...	4500 0 0
	Contingencies, at 8 per cent.....	...	...	3679 4 0
	Total Approximate Cost			£49,674 0 0

C. NAPIER BELL.

10 *July*, 1890.

WILLIAM THOMAS STRUTT,
GOVERNMENT PRINTER, TASMANIA.

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