

GREYMOUTH HARBOUR.

SIR,—

5, Westminster Chambers, London, S.W., December, 1879.

I have now the honor to submit my report on the improvement of the entrance and tidal compartment of the Grey River, together with three drawings which I have had prepared for the complete elucidation of the subject, and for the purpose of conveying my views thereon.

Drawing No. 1 is a plan of the river extending from the sea to a point $2\frac{1}{2}$ miles above Cobden Gorge. The works I have to recommend for execution are shown by red colour on this plan; they will be hereinafter more particularly described. The survey which forms the groundwork of this drawing, together with the observations on the range of tides, and the heights of floods, &c., hereinafter adverted to, and used by me in the study of the whole matter, were made under the direction of Mr. O'Connor, C.E., District Engineer.

Drawing No. 2 contains the western portion of Drawing No. 1, and is intended to show the relative extent, position, and direction of the works proposed by Mr. Moriarty, C.E., in 1874, together with the modifications and additions subsequently projected by Mr. Carruthers, C.E., as compared with the works which I have now to recommend for adoption, and shall presently describe.

Drawing No. 3 shows the details of the training banks and breakwater on each side of the river and entrance. These also will be fully described hereinafter.

Physical Features.

Watershed and Rainfall.—The River Grey (or Mawhera) has its sources in the mountainous region which forms the extreme southern and western portion of the Provincial District of Nelson, and, like the other rivers in this part of New Zealand, is subject to violent floods. According to a tabular statement kindly furnished to me by Dr. Hector, the average rainfall of the Grey River and its tributaries is 90 inches per annum, or 25 per cent less than that of Hokitika; but, on the other hand, the area of the watershed of the Grey (1,572 square miles) is rather more than four times greater than that of the Hokitika River.

Floods in the Grey.—In times of exceptional floods the water-surface in the estuary of the Grey is about 14 feet 6 inches higher than under the normal condition at high water at the mouth of the Omotomotu Creek, which point is the head of the tidal compartment. The difference in the levels of the water-surface, as observed at the sea entrance between the same two conditions; normally and in time of flood, is about $4\frac{1}{2}$ feet. The average gradient or fall of the water from the Cobden Gorge to the sea in time of exceptional land floods is at the rate of 72 inches to the mile.

Tides.—The range of tide at ordinary springs may be taken as 8 feet at the sea entrance and 6 feet at Cobden Gorge, the tidal range being about 8 inches at the mouth of the Omotomotu Creek at ordinary springs; although on the occurrence of exceptionally high tides the lift at the Omotomotu has been known to amount to about 12 inches. When the river is in a normal condition—i.e., in the absence of land floods or freshes—the gradient or fall in the water-surface from Cobden Gorge to the sea is 22 inches to the mile at the time of low water of spring tides, and 1 inch to the mile at high water of the same tides. In Erua Moana, or Revell's Lagoon, and in the Karoro Lake, which lie on the southern side of the river channel, and are connected therewith immediately to the westward of the Town of Greymouth, the ranges of tide, as observed by my request, have been ascertained to be as follows, viz.:—

			Springs. Ft. in.		Neaps. Ft. in.
Revell's Lagoon,—					
At entrance north end of Martin's Quay	...		8 3		5 3
South end of lagoon ...	...	...	6 2		3 7
Karoro Lake—					
At bridge, end of Arney Street	...	...	4 3		2 0
At south end of lake ...	...	...	4 3		1 10

Shingle Deposits in Tidal Compartment of River and at Entrance.—Having a watershed of nearly 1,600 square miles, the north-western portion of which attains an elevation of from 4,000 to 6,500 feet above the sea, and, being subject to flooding to such an extent as to raise the water-level nearly 15 feet, it will be readily understood that the River Grey brings down from the higher districts large quantities of shingle, gravel, and other detritus, portions of which are deposited, in the first instance, within the upper reaches of the tidal compartment, to be subsequently carried down towards the entrance. Arriving there, and coming within the influence of the sea waves, they are heaped up in the form of spits or banks, and are ultimately transported to the northward by the preponderating force of the seas coming in from the south on this part of the coast; meanwhile, however, these shingle-spits are subject to considerable changes, often seriously encumbering the outfall channel of the river; they render the navigation frequently difficult and sometimes dangerous. The evil just described is greatly aggravated by the large quantities of sand, shingle, &c., travelling along the coast from the southward.

The freedom of the navigation immediately within the entrance was impeded at the time of my inspection by the existence of a submerged shoal (the rippling over which attracted my special notice just below or seaward of the junction between the currents from the lagoons with those in the main river. Captain Allardyce, the Harbourmaster, mentioned to me that freshes have little or no effect upon this shoal, which is no more than might be expected under the present conditions. Changing its form from time to time, and occasionally projecting somewhat into the main channel, it then becomes a source of danger to vessels entering and leaving the port. I may mention that at the time of my leaving Greymouth in the steam-tug "Dispatch" to join the "Hinemoa," outside the bar, this shoal had encroached upon the line of channel, and the "Dispatch" touched very sensibly upon it.

Heaviest Seas, Gales, &c.—The heaviest seas at the entrance occur with gales ranging between S.W. and W.S.W. Captain Allardyce stated that seas coming directly from the westward are of very rare occurrence; that N.W. winds seldom or ever last more than twenty-four hours, and that these, as