1883.

NEW ZEALAND.

SURVEY OF WAIKOUAITI BAY

(REPORT ON THE).

Presented to both Houses of the General Assembly by Command of His Excellency.

Mr. W. H. Scott, C.E. to Mr. W. N. Blair, M.I.C.E., Engineer-in-Charge, Middle Island, Dunedin.

Sir,— Oamaru, 9th April, 1883.

I have the honour to forward herewith my survey plan of Waikouaiti Bay, and, in accordance with the Marine Engineer's memorandum, No. 502–34, dated the 28th November, 1882, to report as follows :—

Description of Bay.—The greatest length of the bay, measured between high-water marks, is 2 miles 26 chains; and the greatest breadth, from high-water mark on the beach to a line drawn from the outside of the north head to the outside of the south head, is 1 mile 10 chains. It is bounded on the north-east by a high hill, known as Matanic Head, or Cornish Head; on the north-west by a sandy beach, beyond which are sand-hills, and, at the back of these, at a distance of about a mile from the high-water mark, towards the north end of the beach, is situated the Town of Waikouaiti. On the south-west it is bounded by a rugged peninsula, which is about 200 feet high at the highest point. This peninsula is terminated by a rock about 30 feet high, known as the Shag Rock. The entrance of the bay, opening on the Pacific Ocean, forms its south-east boundary. The Waikouaiti River falls into the bay at its south-west corner. A reef of rocks runs out from each head, as shown on the plan. With the exception of these reefs, and a small reef at the mouth of the river, the whole of the bay has a bottom of firm sand, affording very good anchorage-ground.

Area.—The area of a harbour that could be made by constructing a breakwater from each head would be about 1,175 acres to low-water line, or about 700 acres outside of the five-fathom line. From all I can learn, the bay does not appear to be anywhere silting up.

River.—The river has silted up somewhat of late years, since navigation has ceased. This appears to be due chiefly to sand from the sea-beach and sand-hills being blown into the river.

Tides.—The rise and fall of ordinary spring-tides may be taken at 6 feet 6 inches, neaps at 4 feet 6 inches, and extraordinary springs at 8 feet. The direction of the wind has a great influence on the tides, westerly winds causing high and easterly winds low tides.

Currents.—The ocean-current runs from south to north, and enters and leaves the bay in the directions indicated by arrows on the plan. The velocity of the current within the limits of the survey is very small, varying from almost nothing to about 11 chains per hour. This does not refer to the tidal current in the river, which, at times, is very strong. In order to ascertain the direction and velocity of the current a small cask was loaded with a bar of iron on one side, then filled with water just sufficient to sink it. It was then suspended by a line 3 feet long, secured to a fishing-float, and this allowed to drift. The area exposed to the wind and ripple of the sea bore a very small ratio to the area of the cask under water, so there would be very little error due to the wind. Indeed, the line by which the cask was suspended appeared always to be quite slack and perpendicular, showing that the cask did not require much to support it, and that the float was not dragging it. On the other hand, the boat, which, in order to determine the position of the float, was brought alongside of it every five minutes, was carried to a considerable distance between each observation, although there was but little wind and the sea was comparatively calm.

Prevailing Winds.—Northerly and easterly winds prevail from November to May, and southerly to westerly winds from June to October. During fine north-easterly weather in the summer the breeze is usually from the land (northerly) in the early morning, and, as the day advances, it gradually works round to the north-east, from which direction it blows a strong breeze from about 9.30 a.m. till near sunset.

Line of Swell.—The swell usually comes in from the east or south-east. The heaviest seas are from these directions, but very heavy seas are not of frequent occurrence. The southern end of the

bay is sheltered from southerly winds, but these cause the sea to break on the north head, and no landing can be effected at the north end of the bay during a southerly wind. During north and north-easterly winds the north end of the bay is well sheltered and the water calm; and at the south end, unless it blows very hard, a small boat can usually enter the river with safety, except, perhaps, towards the end of the ebb tide, when the sea breaks on the bar.

Building Materials.

Stone.—The north head and part of the south head are composed of yellow limestone rock, and a considerable portion of the south head is igneous rock. Specimens of these rocks have been left at your office. Although the limestone rock is not very hard it seems to improve by exposure, either in air or entirely under water, and I consider it would be suitable for the construction of a mole or breakwater if used as "pierres perdues," up to the level at which the work would begin to be exposed to the direct action of the waves. Blocks of any required size could be easily procured. The igneous rock at the south head is of a hard quality, but I doubt if large blocks of it could be obtained. It might, however, be used with advantage in the construction of béton blocks for the upper portion of a breakwater.

Gravel.—There is a moderate amount of gravel in the bed of the Waikouaiti, at a distance of about two miles from the south head.

Shingle.—An unlimited supply of shingle, suitable for concrete blocks, is obtainable from the Shag Valley, near Palmerston, a distance of about ten miles from the north head. The railway runs over the shingle-beds, and a short branch line might be constructed from Waikouaiti Railway-station to the work, which would afford an easy means of transport.

I have, &c.,
W. H. Scott.

By Authority: George Didsbury, Government Printer, Wellington.—1883.

The COLONIAL MARINE ENGINEER to the Hon. the MINISTER having charge of the MARINE DEPARTMENT.

SIR— Marine Department, Wellington, 14th May, 1883.

In accordance with your instructions, I have examined the plan of Waikouaiti Bay as prepared by Mr. W. H. Scott, C.E., after a careful marine survey executed by himself, and have read his report accompanying the plan; the object of the survey being to ascertain approximately the cost of a breakwater or breakwaters projecting from the North or South Head, or both, for the protection of the bay.

I have prepared an estimate for one rubble breakwater 40 chains long, this being the minimum length required, in my opinion, to effect the desired result. The estimate will apply either to the North or South Head, as the soundings are very similar.

ESTIMATE.

Forty chains of breakwater composed of rubble, the exposed surfaces to be covered with heavier blocks, the whole reaching up to high-water spring-tide level	£338,000
Staging, locomotive engines, trucks, cranes, and other tools, supervision, &c.	40,000
	£378,000

Another estimate for a breakwater with a smaller rubble base, topped with large concrete blocks, amounts to £488,000.

Neither of the above estimates includes roadway along the top of breakwater, nor protection of end of breakwater, nor lighthouse, &c.

I have, &c.,
JOHN BLACKETT,
Marine Engineer.

By Authority: GEORGE DIDSBURY, Government Printer, Wellington.—1883.

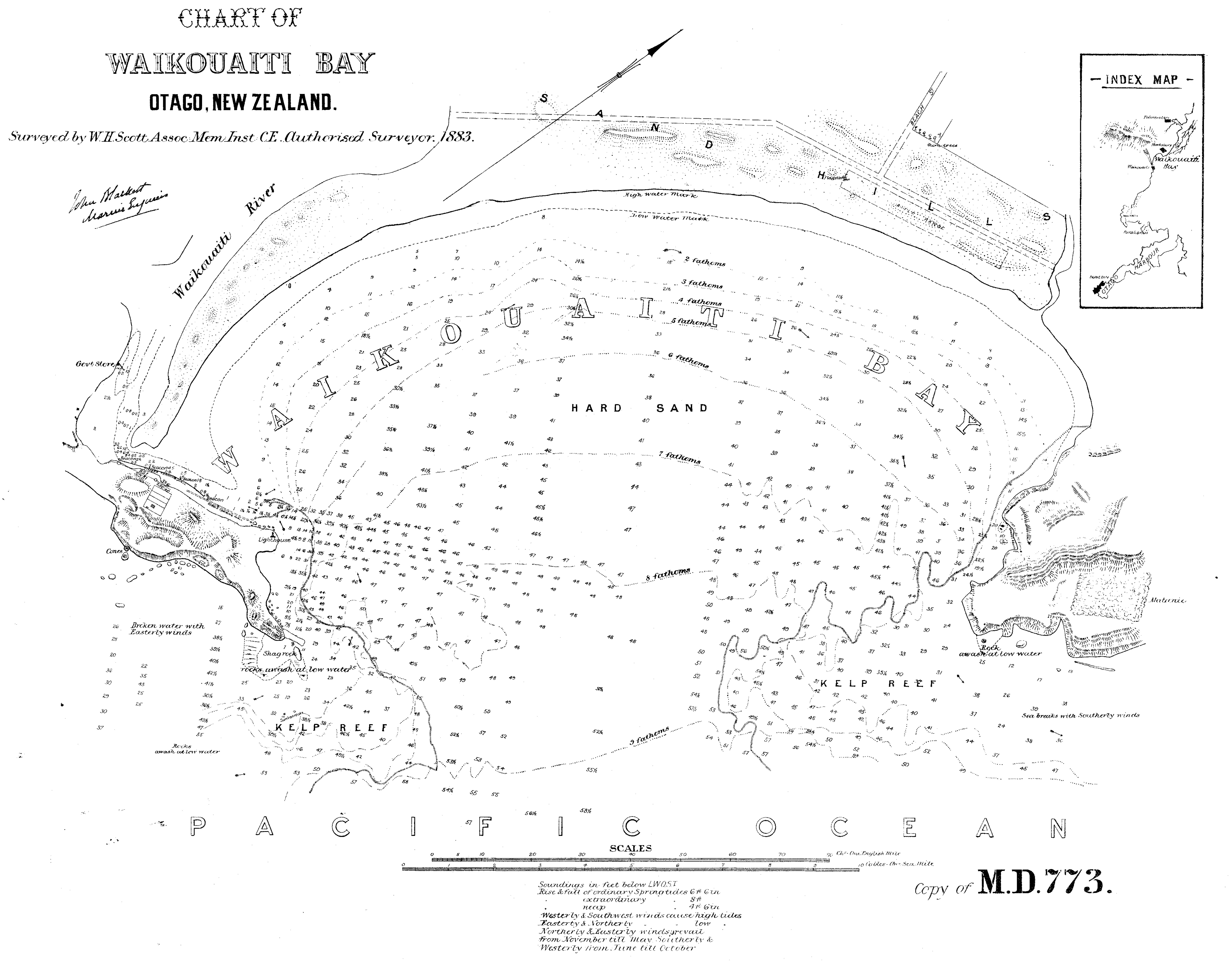

CHART OF
WAIKOUAITI BAY
OTAGO, NEW ZEALAND.
Surveyed by W.H. Scott Assoc. Mem. Inst. C.E. Authorised Surveyor. 1883.
INDEX MAP
Waikouaiti Bay
OTAGO HARBOUR
Waikouaiti River
SANDHILLS
High water Mark
Low Water Mark
2 fathoms
3 fathoms
4 fathoms
5 fathoms
6 fathoms
7 fathoms
8 fathoms
9 fathoms
WAIKOUAITI BAY
HARD SAND
Govt Store
Beacon
Lighthouse
Cones
Broken water with Easterly winds
Shag rock
rocks awash at low water
KELP REEF
Rocks awash at low water
Rock awash at low water
KELP REEF
Sea breaks with Southerly winds
Matanaka
PACIFIC OCEAN
SCALES
Chs. One English Mile
Cables. One Sea Mile
Soundings in feet below L.W.O.S.T.
Rise & fall of ordinary Spring tides 6 ft 6 in
" extraordinary " 8 ft
" neap " 4 ft 6 in
Westerly & Southwest winds cause high tides
Easterly & Northerly " " low "
Northerly & Easterly winds prevail from November till May, Southerly & Westerly from June till October
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