PROPOSED KAITUNA RIVER IMPROVEMENTS.

EXPLANATORY NOTES

To Accompany Plans.

The accompanying Plans, Nos. 1 - 4, outline recommendations for the distribution of a total sum of £13,000 on Improvement Works. Plan No.5 shows the general outline of recommendation as to Classification of Lands for Rating Purposes.

Such a programme as delineated in Plans 1 - 4 closely follows the recommendation of Messrs Holmes & Blair Mason, MM.Inst.C.E., in their Report of the 14th March, 1922, and practically covers those Works forming the first stage of their recommendation.

Messrs Holmes & Blair Mason's Estimate for this Stage was £26,400: the proposed expenditure of £13,000, therefore, will be sufficient for carrying out these works only, if

(A), Suitable Machinery is employed, and

(B), Dredge Cuts are made of widths not exceeding those specified in the accompanying drawings, - Plans 1,2 and 3.

(A). I understand that suitable machinery, briefly outlined hereunder, may be available on hire or loan:-

(a). DRAG SCOOPS for Outlet Cut, from Land Drainage Dept., (Rangitaiki). There is involved here a 50 day programme for 6 Drag Scoops. I believe this number may be available from Rangitaiki,- two in working order, the remainder requiring considerable repairs.

(b). DREDGE, American Dipper, 80' x 20' steel hull, 1½ yard, type "D", for all other Cuts, from Land Drainage Dept., (Waihi).

(c). BARGE, 60' x 20', with suitable Winch mounted, for Snagging, Conveying manuka brushwood, stores, etc., from Land Drainage Dept., (Rangitaiki).

(d). CENTRIFUGAL PUMP, 6 in., for Channel Blocks, from Land Drainage Dept. (Rangitaiki).

INJECTOR PUMP, for Channel Block "X", to be purchased.

It is probable that these items will not be required.

(e). TUGS, for towage of Dredge from Waihi Estuary to the Kaituna. I recommend the engagement of the Whakatane Harbour Board's Steam Tug, the "Toiler", and of the P.W.D. Oil Launch. (Tauranga).

Note! All the equipment available from the Rangitaiki may conveniently be picked up by the "Toiler" in passing Matata.

(f). LAUNCH. For shifting the Dredge and the Snagging Barge from site to site, and for towing stake and wattling materials, etc., the casual services of a launch will be necessary.

(g). UTILISATION OF ELECTRIC POWER. It is probable that the working of two shifts on the Dredge will be found desirable, and in such a case Electric Lighting is recommended. It is possible that, on account of the nature of the loads to be expected in dredging through submerged timber, the substitution of Electric Motor for Oil Engine may be found economical. (The Dredge was designed for Steam Power).

In the event of Pumping and Sluicing being necessary to block existing Channels, ("W" and "X", Plan 1), the use of Electric Motive Power would be the most economical if Power is already being used in the vicinity.

(B). The Dredge Cuts proposed, in width and depth, are within the range of the most efficient, and cheapest, operation of the Dredge.

While the proposed Cross Sectional Areas are in no case equal to the existing sectional area of the River at the same point, they are nevertheless sufficiently large to carry all the water it would be safe to discharge suddenly into the Estuary, in its present shoaled and silted condition, without danger of exceeding its storing and regulating capacity, and of causing serious overflow along the low reaches.

IT IS ADVISABLE to leave to GRADUAL EROSION such enlargeme

to full channel area as the River demands, thus giving the Estuary time to accommodate itself to the new conditions imposed upon it.

In view of the greatly increased velocity of flow in the Cuts due to shortening, it is certain that the necessary erosion will occur.

IT IS DESIRABLE that Cuts A,B,C & D should be put through, even at the expense of decreasing the width to be dredged, for the establishment of these Cuts constitutes a definite stage in ANY Scheme of COMPLETE River Protection.

NOTES ON WORKS IN DETAIL. (See Plan 1).

OUTLET CUT. (Plan 2). - To be carried out by Arawa labour on Contract, using Drag Scoops supplied by the Board.
Unit Cost, 6d. per cub. yd.

FORD'S CUT. (Plan 3). - Unit Cost: This Dredge has been working for the past 2 years on similar work in the Waihi Swamp Area at a total cost per cub. yd. varying between 6.23d and 8.68d, according to the nature of the ground worked in.
There is more submerged timber in FORD'S CUT than has been encountered in the Waihi Swamp, but it lies within 7 feet of the surface, and generally in firm spudding ground.
This Dredge should readily excavate FORD'S CUT for 9¼d per cub. yd., provided that -
THE HIRE CHARGE, (ADDITIONAL TO WORKING EXPENSES & MAINTENANCE), FOR THE USE OF THE DREDGE IS NOT MORE THAN 10% HIGHER THAN THE TOTAL OVERHEAD CHARGES CHARGED AGAINST THE DREDGE BY THE DEPARTMENT OWNING IT.

A Block of 40 feet is left between the two parallel Cuts principally to assist and cheapen the work of the second Cut by providing spudding ground on both sides of the Dredge when working on it.

The Hydraulic conditions of these Cuts, though at a slight disadvantage in the matter of Cross-sectional Area, are im-

proved as to Mean Depth and Gradient, and will accommodate the River's normal flow.

The removal of the isolated strip may safely be left to gradual erosive action. The presence of timber will assist erosiom; but it may be necessary at some future date to remove such timber if it is found that it forms obstructions to navigation.

It may be objected that material eroded from Cuts A,B,C,D and FORD'S will form deposits in the Estuary. I am of opinion that the Estuary will clear itself of this material which is generally of a light, peaty nature, especially as the Scouring Process is a gradual one, quickest when the velocity is highest, - and when the eroded particles are held longest in suspension.

NAVIGATIONAL CUTS. The necessary use of "Spuds" on arms of limited range for holding and levelling, renders this type of Dredge generally unsuitable for deepening wide channels. It will, however, be effective for use in cutting through sandbars which are covered not more than 4 feet at low water. (Tidal Range, 4 feet).

The object will be gained by breaking through the hard crust of the sand bar, even if the excavated material is dumped only 55 feet, the maximum for this Dredge, from the centre of the Cut.

Unit Cost, 6½d per cub. yd.

PROMOTING SANDSPIT GROWTH. This very necessary work will be carried out as insurance against a repetition of the Tumu breakout, and against the disastrous projection of sand across the present spit into the River Channel by wave action during storm.

The hundreds of thousands of tons deposited through this agency during the last 20 years have been distributed over the Channel and Estuary, rendering navigation difficult or impossible, and greatly interfering with the storing and regulating action of the natural reservoir.

This growth will be promoted by erecting manuka brushwood hurdling, 3 feet high, in 100 feet lengths, placed quincunx, and by raising them from time to time as necessary to keep pace with the growth of the dune.

When the required width, (about 10 chains), and height, (not less than 10 feet), have been attained, the spit thus formed will be fixed by the planting of marram grass and lupins. Roots of the one, and seed of the other, may be obtained locally.

BLOCKING PRESENT CHANNEL AT TUMU. This work may not require to be undertaken. It would be put in hand only as a safe+guard against a new breach by the River at the Tumu.

The probability of this occurrence will decrease with the lapse of time after the completion of Ford's Cut, and with the growth of the Sandspit.

If, as the work proceeds, it is found necessary to place these blocks, the one at "W" may be sluiced down from the 30' Sandhills there. The other at "X" may be formed by utilising an Injector Pump in conjunction with the Sluicing at "W".

Whether these Blocks are constructed or not, it will be necessary to arrest, or decrease the flow at "W" and "X" in order to assist the work of promoting the Spit Growth. This will be attained by attaching manuka brush to post and wire fencing erected across the stream at the positions "W" and "X".

IMPEDING THE FLOW AT PRESENT OUTLET, and at the same time Deflecting the main current t owards the OUTLET CUT, may be necessary for a few days after the new outfall is through and until it establishes itself.

It may be done by erecting one or two lines of post and wire fencing, with manuka brushwood interlaced, carried as far towards the Eastern Bank of the present outfall as the depth of water will permit.

DREDGE CUTS of Category II. Unit Cost, 8.84d per cub. yd. Good Spudding Ground and considerably less timber may be expected in these Cuts.

It will be noted from Plan 1 that Messrs Holmes & Blair Mason's alignment as shown in broken lines at 2,3,4,5,6 & 7 differs somewhat from that proposed by the Cuts A,B, C & D. It will be seen that the Proposed Cut B will not affect the water rights enjoyed by the Paroa Flaxmill.

It is not proposed to excavate Cut E (or its alternative, Cuts E^{A1}, E^{A2}, E^{A3}) until the River below, and the Estuary, have had time to accommodate themselves to the new conditions induced by the carrying out of all works up to this point. A too early commencement of Cut E, or its alternative, would result in such a greatly increased discharge into the River below as would seriously raise the water level in the lower reaches.

While Cut E, as compared with its alternative E^{A1-2-3}, would give better results in shortening the river course and lowering Low Water Level, Serious interference with the water rights enjoyed by Broad's Flaxmill would ensue from its adoption, and a considerable amount would probably/ be claimed in compensation therefor, as well as in Severance of Property.

The ALTERNATIVE, ON THE OTHER HAND, would carry no such compensation claims, though a little of the maximum benefits possible would be sacrificed, viz. some 8 inches of Lowering, and 63 Chains of Shortening.

In view of the probable adoption of the Alternative, I have placed Cut D to suit this Stream Alignment.

SNAGGING. As much as possible will be done by Winch, Differential Pulley, etc., mounted either on shore or on barge; and by the use of explosives to cut off below low water line. It may be found practicable and economical to use the Steel Dredge on such work.

SHIFTING OF DREDGE from the Waihi Estuary to the Kaituna will prove a matter of no great risk or expense, provided the Boom and Dipper (weight 11 tons), and the Bank Spuds and Spud Arms are dismantled and transhipped to the auxiliary Barge.

Towing to the site of re-assembly, (Plan 1), will best be done by the Steam Tug, assisted by the P.W.D.Oil Launch.

IMPORTANT.

1. While I have no reason to doubt the accuracy of the data collected for previous reports, I have to point out that Plans 1,4 and 5 have been compiled in large part from such data, and that the benefits to be derived from, and the results due to, the Proposed Improvements depend upon their accuracy.

2. It will be seen from Plan 1, Summary of Allocations, that more than two-thirds of the Total Expenditure will result from Dredging. In estimating the Costs of these Cuts I have assumed that the use of this Dredge may be obtained at a Hire Charge not greatly in excess of the Interest and Depreciation Charges paid by the Department owning it.
Hire Charge, appreciably much greater, will SERIOUSLY INTERFERE with the completion of the desired programme.

CLASSIFICATION SCHEME OUTLINED. (See Plan 5).

In view of the recognised disparity in the Unimproved Valuations of the various low-lying Kaituna Lands, I would recommend the RATING ON ACREAGE BASIS, as being the most direct, simple of application and equitable - equitable in that, judging from the position and formation of the lands to be rated, it might be assumed that the physical and chemical properties of the soil are appreciably similar, and that, with excess water removed, would respond equally to agricultural effort.

It would follow then, that

(I). the More Expeditious Removal of Flood Waters, by improving and sheltering the Outfall, (Works of Category I), and

(II), the Removal of Subterranean Waters, by increasing the Gradient of Subterranean Flow, and thus lowering the Water Table, (Works of Category II), will both result in acquisition of Direct Benefits.

These two Benefits, each resulting from a set of works independent and distinct, have DIFFERENT BOUNDARIES of incidence, and I recommend that each benefit be dealt with separately, -

Benefit I, from an expenditure on Works I, of £7,400.

Benefit II, from an expenditure on Works II, of £5,600.

In M Classifying for Benefit I, the principal considerations taken into account are Frequency and Duration of Flooded Conditions in the several zones, Contour Levels and the Gradient on Flood Waters.
The most important factors of Contour and Gradient are detrimentally influenced and modified by the presence of artificial obstructions to free flow of flood waters, such as the Main Road and the Trunk Railway.

It will be noted that a certain area adjoining the Kaituna, - portions of Secs. 1, 2, 10B, etc., in Block VI, have been classified "D" as being so close to H.W.M.S.T., and so saturated in consequence, as to be quite unproductive.

Attention is also drawn to that considerable area on the East of the River Board Area, between the boundaries of the River Board and the Tumu Kaituna Drainage Board.
Although comprising a largish area of Swamp Lands, it is not traversed by any stream subject to flood, and is isolated from the Kaituna Overflow by intervening high country. It has, moreover, its natural drainage outlet at a point well towards the mouth of the Estuary, so that the only benefit derived will be from Benefit I, and that over a small area influenced by the gradient on flood waters from a comparatively small catchment area.

The proposed Classification under Benefit I is shown on Plan 5.

In Classifying for Benefit II, arising through the Lowering of Low Water in the River, practically the only factors to be considered are Contour Levels and Comparative Distance from the Main Drainage Channel (the River).

It is assumed that the position of the Water Table in this class of country bears some definite relation to the General Natural Surface of the Ground.

The presence of obstructions, such as Road and Railway, do not materially affect it.

It is to be noted, however, that downstream from the Eastern End of Cut A, there is no lowering of low water level, and therefore no benefit from the Works of Category II.

The various Classes, and their Extent, are shown on Plan 5.

As to the proportional Rating of the Effective Classes, I would recommend the following ratios for both Categories:-

A:B:C :: 2:1½:1.

The Benefits considered for Rating Purposes are of course onlyt those accruing to Agricultural and Pastoral Activities.

In the matter of Navigation, 2½ miles will be saved between the Outlet and Canaan Landing, - previously 13½ miles, and for the transportation of flax to Mills along the Lower Reaches, the towga distance will be very greatly reduced.

The section of the community to reap the greatest benefit is the population of Maketu. The very real advantages of restored navigation, restored fishing and pipi grounds, and the greatly increased possibilities that proximity to such a waterway will lend to the future plan of a Civic Centre, are incalculable.

APPENDIX I. (See Plan 5).

The completion of the above proposed Programme will mark a definite stage in the Drainage and Flood Control of the Kaituna.

Complete Flood Control cannot, of course, be attained except at an expenditure beyond the unaided resources of the River Board Area for many years to come.

When the time does come, Messrs Holmes & Blair Mason's Proposals, or some modification thereof, will probably be carried out.

It is my duty here to suggest a modification whereby,

1, Flood Waters will discharge into the Ocean MORE DIRECTLY and QUICKLY,(it should particularly benefit Papamoa Estate), and

2, there will be less STOP-BANK LENGTH for construction and maintenance.

There is at present a fall of about 6 feet at extreme Low Water, and 4 feet at Flood, between Broad's Bend and the Ocean - ample to ensure self-cleansing and maintenance of outfall, and to FORCE FLOOD WATERS OUT IN THE TEETH OF HEAVY NORTHERLY WEATHER. Any erosion in the "Proposed Cut" Country would be of little consequence as the land is below the Margin of ordinary Cultivation.

I have indicated the proposal on Plan 5. The essentials are:-

(1). A Direct Cut to Sea from Broad's Bend.

(2). A Fixed Weir designed to spill some 30% of NORMAL RIVER FLOW into this Cut. The balance will remain in its present course, keeping the Channel open for NAVIGATION and for SUBSIDIARY DRAINAGE OUTFALL over the Tumu Kaituna Drainage Area.
It is probable that an efficient design of this weir would ensure that little more than the present normal flow would be discharged along the present channel even in times of High Flood.

(3). A Stopbank, or Levee, along the Eastern Side of the River approximately as shown on Plan 5.

It may not be out of place here, in considering a financial plan to meet such future expenditure, to state that, judging from the experience of the Selwyn and Ashburton County Councils, there may be decided advantages offered by a small Communal Forestry Scheme on lands within the River Board Area.

Te Puke.

December 27th, 1925.

A.M.Inst.C.E., etc.