1929.

NEW ZEALAND.

DEPARTMENT OF LANDS AND SURVEY.

SWAMP DRAINAGE.

REPORT FOR THE YEAR ENDED 31ST MARCH, 1929, TOGETHER WITH STATEMENT OF ACCOUNTS.

Presented to both Houses of the General Assembly pursuant to Section 13 of the Swamp Drainage Act, 1915.

SIR,— Department of Lands and Survey, Wellington, 1st July, 1929.

In pursuance of section 13 of the Swamp Drainage Act, 1915, I have the honour to forward the report of the Chief Drainage Engineer covering operations on lands proclaimed under the Swamp Drainage Act and amendments. Illustrative plans are also attached.

I have, &c.,

J. B. THOMPSON,

The Hon. G. W. Forbes, Minister of Lands. Under-Secretary for Lands.

REPORT BY CHIEF DRAINAGE ENGINEER.

SIR,—

I have the honour to submit my annual report on the areas proclaimed under the Swamp Drainage Act, 1915, and amendments.

KAITAIA DRAINAGE AREA (61,430 ACRES), MANGONUI COUNTY.

During the year the Swamp Drainage Amendment Act was passed, the principal provisions being as follows: (1) The area was to be reclassified, and the ratepayers given the right of appeal against such classification; (2) the striking of rates in the drainage district was suspended until after the 31st March, 1929.

In accordance with the provisions of this amending Act two classifiers were appointed, and they have practically completed the classification of all lands within the drainage district.

The principal works carried out during the year have been the maintenance of drains, installing of flood-gates, and enlargement of the Whangatane spillway and stop-banks.

Rainfall, &c.—Rainfall and river-gauge readings have been recorded daily at Kaitaia, and schedule and graph are attached giving particulars of data obtained. On the 14th May, 1928, 3·20 in. of rain was recorded in a period of eight hours in the Kaitaia Township, but the rainfall in the hill country was at least twice this figure. As a result flood-waters reached the highest level yet recorded up-stream from Kaitaia, and all low-lying areas were inundated. A large part of the country that was flooded remained under water for a few hours only, but the Tangonge basin and surrounding area, also some low-lying land about Awanui, was inundated for several days.

The following table gives details of rainfall for the past eleven years :—

Year.	Rainfall for Year.	Wettest Month and Rainfall.		Driest Month and Rainfall.	
	Inches.		Inches.		Inches.
1918–19 ..	47·30	Oct., 1918	9·06	Aug., 1918 ..	1·39
1919–20 ..	31·71	July, 1919	7·37	Dec., 1919 ..	0·62
1920–21 ..	53·11	May and Aug., 1920 (each) ..	8·02	Mar., 1921 ..	1·13
1921–22 ..	49·42	Mar., 1922	5·84	Jan., 1922 ..	2·24
1922–23 ..	44·81	Oct., 1922	7·46	Jan., 1923 ..	2·02
1923–24 ..	49·23	Oct., 1923	7·92	Dec., 1923 ..	1·38
1924–25 ..	48·89	May, 1924	10·34	Mar., 1925 ..	0·51
1925–26 ..	57·90	May, 1925	10·43	Feb., 1926 ..	0·88
1926–27 ..	64·91	Oct., 1926	9·62	Dec., 1926 ..	1·51
1927–28 ..	55·97	July, 1927	11·35	Jan., 1928 ..	0·22
1928–29 ..	58·21	June, 1928	9·13	Feb., 1929 ..	0·28

Awanui River.—No work was done on this channel except the removal of some snags which impeded navigation below Awanui, and the hauling-out of overhanging puriri-trees and young willows near Kaitaia. A large quantity of sand has been deposited in the lower reaches of this stream during the past twelve months, and the navigation of the channel with vessels of any great draught will become increasingly difficult from this cause.

Whangatane Spillway.—Dredger No. 27, Marion steam drag-line, was engaged throughout the year in enlarging this channel on the western side to the extended section required to carry eventual discharge, and dredger No. 18, a Monighan oil-driven drag-line, was engaged for six months in similar work on the eastern side. A distance of 2 miles 10 chains was covered by No. 27 dredge, excavating approximately 149,958 cublic yards of spoil, mostly stiff clay. No. 18 dredge widened for a distance of 76·08 chains, excavating 57,260 cubic yards of spoil, of which approximately half was light peaty soil and the balance stiff clay. Much of the work was carried out in country below or about high-tide level, where the spoil was required for construction of stop-banks. Owing to the presence of water the spoil could not be shaped by machines as excavated, and hand shaping had to be carried out after the spoil had dried sufficiently to stand to the required height at a reasonable batter. Internal drains leading to flood-gates under the banks have also been constructed by hand, and a certain amount of hand-work is entailed at bridge-sites, especially as these structures could not be completed in advance of dredging owing to delays in arrival of timber-supplies from Australia.

Certain alterations were made to No. 27 dredge, giving greater range and adaptability to the different kinds of work required. This entails operating in soft as well as hard country, cuttings up to 20 ft. in depth, and the handling of heavy timber. This machine is now eminently suitable for the job in hand. Two ten-hour shifts were worked with the aid of electric light supplied by a steam-driven generating plant. Coal has been delivered on the line of work throughout, and as water is gravitated direct into the boiler through pipe-line laid to the Kaitaia River it is hoped that little time will be lost in operation in the ensuing year.

Dredger No. 18 was erected and placed in commission this year, and during six months consistent operation has proved a thoroughly efficient machine for the work required. A new one-yard bucket capable of dealing with stiff clay has been fitted, which, with the provision of " pads " for soft country, is the only alteration found necessary to suit local conditions.

Drains.—The principal work in connection with drains has been maintenance, which entails heavy expenditure owing to the rapid and almost continuous growth of many varieties of water-weeds in this locality. Certain drains of flat grade have been cleaned, in spring as well as late autumn, proving of undoubted benefit to the low-lying country served by these outlets. During the late autumn 37 miles of drain was cleaned out, and 5 miles 35 chains was cleaned again in October. Deepening and improvement of drains was carried out on 3 miles 68 chains, and 78 chains of new drain constructed, mostly in connection with additional flood-gate outlets to the Awanui River.

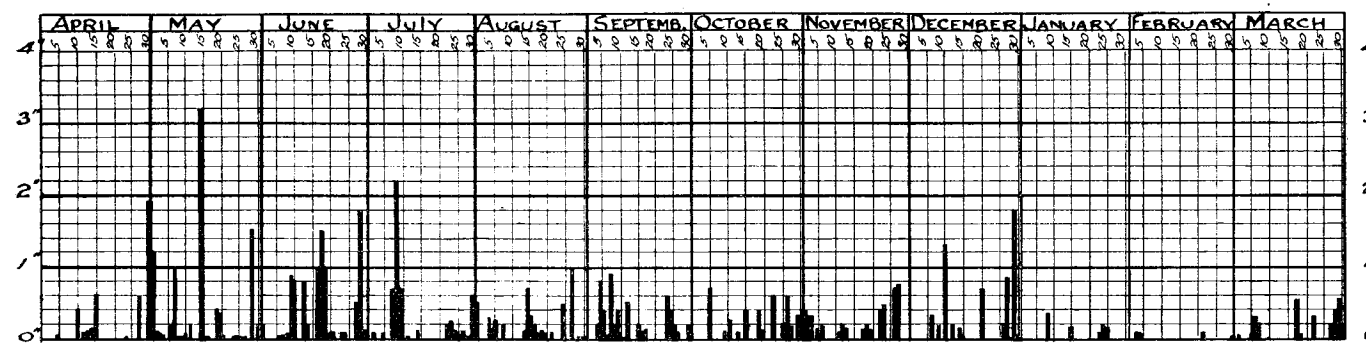
Stop-banks.—The maintenance of 10 miles of stop-bank and drain with eighteen flood-gate outlets was carried out, and 60 chains of new bank was erected on the west bank of the Awanui River, thus continuing the stop-bank system to a point higher up-stream.

Six flood-gates, ranging from 18 in. to 3 ft. diameter, were placed in position to give additional outlets to the Awanui River. Five gates were installed to discharge through spoil-bank into the Whangatane spillway, and one culvert was lengthened for this purpose. Three gates were refitted with iron flaps.

The shaping of stop-banks thrown up by drag-line excavators was carried on by hand as spoil dried out, and 80 chains of bank completed. About 30 chains of bank constructed of light peaty soil was planted in Kikuyu grass in order to bind and strengthen the embankment.

Bridges.—Five sill bridges were erected over outlet drains to serve severances, and the Kareponia Road bridge was raised 3 ft., lengthened 54 ft., and approaches reconstructed to conform to enlargement of the Whangatane spillway. A temporary bridge was erected at this point to carry traffic pending completion of the permanent structure.

Buildings, &c.—Two small buildings were erected, one for accommodation of dredge crew of No. 18, and one for storing tools and stores for dredger No. 27. All wooden buildings and surplus plant were painted.



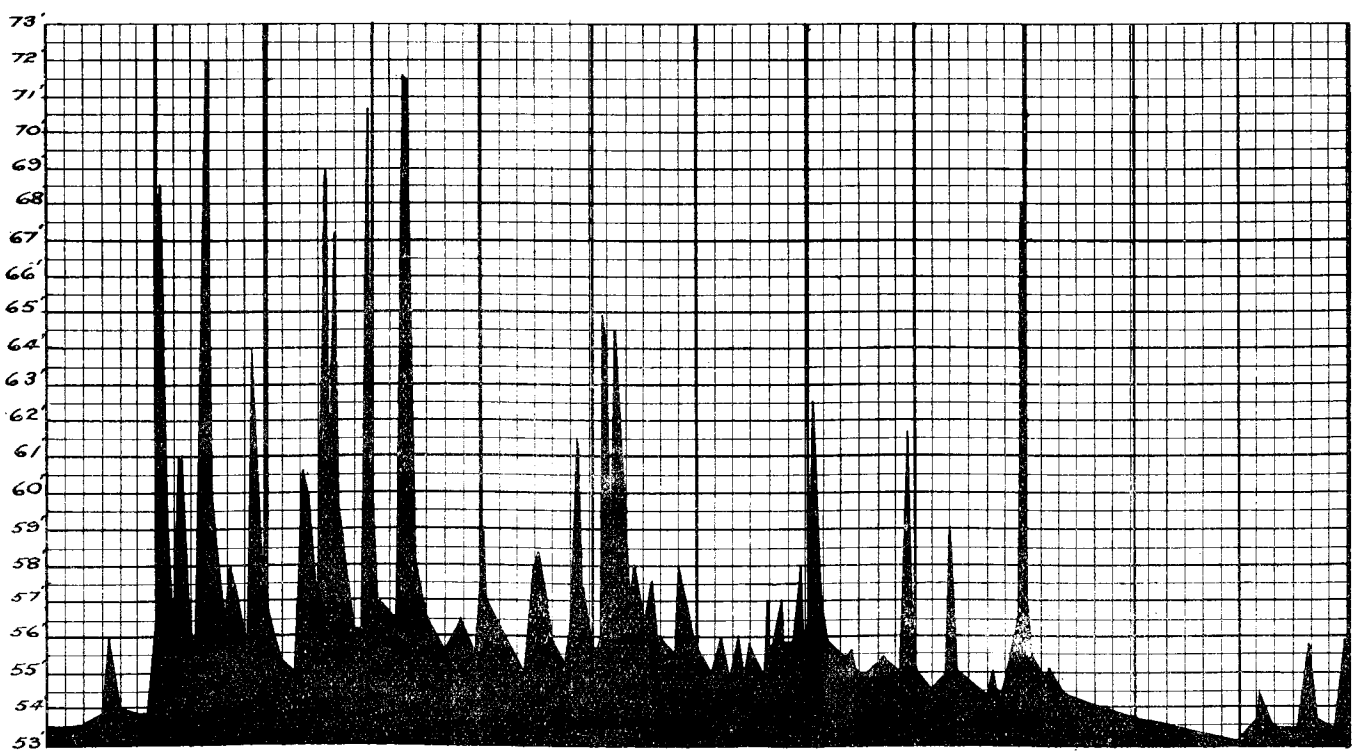
— RAINFALL —

RAINFALL & RIVER GAUGE RECORD

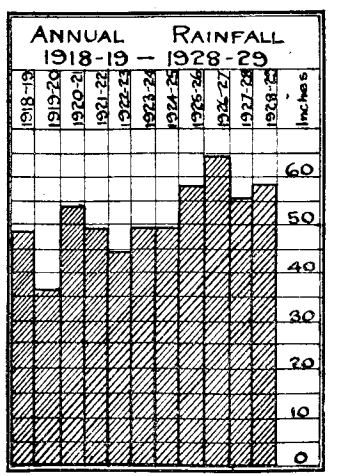
WAIKURUKI BRIDGE (FOSTERS)

— KAITAIA RIVER —

APRIL 1ST 1928 – MARCH 31ST 1929



— RIVER GAUGE —



Summary of Work done.—Hereunder is a summary of the principal work carried out during the year: Drains cleared, 42 miles 35 chains; drains widened and deepened, 3 miles 68 chains; new drains constructed, 78 chains. Dredge cuts—90 ft. completed width, 47 chains; 60 ft. completed width, 29·08 chains; 40 ft. completed width, 1 mile 14·27 chains. New stop-banks formed, 60 chains; repairs to stop-banks, 4 miles. Levels taken, 8 miles. Flood-gates built, 11. Pile bridge erected (temporary), 70 ft., 1; pile bridge lengthened from 72 ft. to 126 ft., 1; Sill bridges erected—18 ft., 2; 14 ft., 3. Buildings erected, 2 (1 quarters for men, 1 storehouse for tools, &c.). Fascines used, 80 bundles. Spoil excavated by land-excavators, 207,218 cubic yards.

Proposals for ensuing Year.—The principal work in hand for the ensuing year is the widening of the Whangatane Spillway, raising and lengthening of existing bridges, and installation of flood-gates to carry local run-off under the spoil-banks and prevent back flow of flood-waters on to the country adjoining the spillway. It is anticipated that the western side of the cut will be completed within twelve months, and work on the eastern side carried to such a point that the spillway may be used to a limited extent, and shortly afterwards to its full capacity.

Works Expenditure, and General.—The sum of £25,661 1s. 11d. was expended during the year, of which day labour absorbed £8,493 2s. 3d. Some fifteen piecework contracts were let, entailing an expenditure of £1,622 19s. 1d.

Hikurangi Drainage Area (50,000 Acres), Whangarei County.

Rainfall.—The year has been notable for the number of heavy rainfalls, but owing to frequent winds the hill country and roads were not so sodden as usual in winter. The total rainfall for the year at the Ruatangata headquarters was 50·65 in., whilst at Puhipuhi—where the heaviest rainfalls occur—the total recorded was 79·83 in. The heaviest daily fall at the Ruatangata headquarters was 2·84 in., on the 7th July, 1928, whilst at Puhipuhi the heaviest was 5·04 in., on 29th April, 1928. The greatest rainfall at Ruatangata for any one storm was that from the 7th to the 9th July, 1928, inclusive, when 3·99 in. was recorded, whilst at Puhipuhi 8·53 in. fell from the 29th April to the 1st May, 1928, inclusive. A graph showing rainfall and run-off data for the year is attached.

Floods.—The highest flood of the year occurred at the beginning of the winter, at the end of April, when the ground was still dry after the summer months. On the 2nd May the maximum flood heights were reached—viz., 33·7 ft. at the Jordan Bridge, 32·5 ft. at Lewis's Bridge, 25·1 ft. at Purua Bridge, 18·5 ft. above G–H Diversion, and 3·7 ft. at lower lagoon. Several more heavy floods occurred during the winter. Although the floods were high during the year, the effect of the still uncompleted works down-stream from the swamp show in the rapidity with which the flood-waters got away compared with former years before the commencement of these works. The plan attached shows the maximum flood levels and the low summer level for the past year.

Run-off.—The maximum discharge of the Wairua River at the Ruatangata camp (0 m. 55 ch.) during the flood of the 2nd May mentioned above was in the vicinity of 4,000 cusecs, representing a run-off from the catchment area of 19 cusecs per square mile, or $\frac{3}{4}$ in. run-off for twenty-four hours; but the inflow from the tributary streams at their maximum stages was very much in excess of this discharge. The low summer discharge at 0 m. 55 ch. was 45 cusecs, or a run-off of 0·2 cusecs a square mile, or 0·008 in. run-off for twenty-four hours over the whole area. The Whakapara Stream contributed nearly half of this low discharge.

River-gauges.—Twelve staff gauges have been installed on the river and tributaries, and one Gurley Automatic Stage Recorder has been installed at the gauging-station at 0 m. 55 ch. Two more are being installed, one at the Jordan Bridge and one at Lewis's Bridge on the Wairua River. With the use of these gauges and the current-meter a fair amount of discharge data has been collected, and during the coming winter careful and frequent gaugings will be made on the river and tributaries to determine the relation between inflow to the swamp area and outflow at flood periods

Utilization of the Swamp: Production.—The only two areas to date that are practically protected from flooding are the upper end of the Ngararatunua arm of the swamp and the Mangahahuru Valley. These two areas are now safe from flooding except at the junction with the main swamp, and capable of being brought to a state of full production. The remainder of the swamp is still subject to flooding.

Construction Work.—Construction work on the Wairua River and subsidiary channels was pushed on as expeditiously as possible during the year, though floods seriously hindered some portions of the work.

Wairua River Diversions.—The shovel-work at G–H diversion was completed at the end of April, while the top and bottom ends were opened out to full depth and width by drag-line during the summer. The G–H spillway was also completed by drag-line through the summer.

In May, drilling and blasting, followed later by shovel-work, was commenced in the long spillway around the D–B diversion, and up to the end of October 14 chains of rock-excavation was completed. The spoil was tracked down the spillway and across a temporary bridge over the lower end of the D–E diversion to a dump around the edge of the No. 2 lagoon. The amount of rock trucked out was 9,250 cubic yards. At the end of October the machine was equipped as a drag-line and completed the stripping of this spillway, excavating 8,800 cubic yards before being moved to the G–H cut at the end of November.

Nos. 1, 2, and 11 rock bars were drilled and blasted in the summer months, No. 1 bar and part of No. 2 bar being excavated by drag-line. The excavation of these rock bars is the heaviest work that the Bucyrus plant could possibly be put on when rigged as a drag-line. From No. 1 bar 2,000 cubic yards of rock was excavated, and from No. 2 bar 1,600 cubic yards.

Rainfall Record.

— 1928-9 —

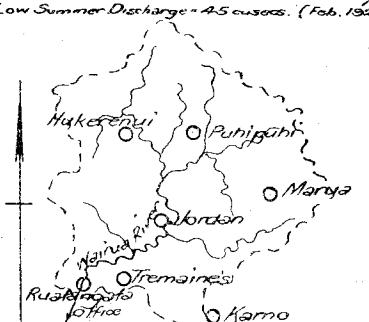
Wairua Catchment Area.

Hikurangi Drainage Works.

Monthly & Annual Totals.

Month \ Place	Rustlangata Office	Tremaines	Rustlangata	Kamo	Maruia School	Puhipuhi	
April	5.21	6.49	8.50	9.00	11.13		
May	7.53	8.19	7.96	10.19	12.82		
June	7.45	10.19	9.24	11.79	14.62		
July	7.92	8.10	4.35	8.32	12.53		
August	2.18	2.30	2.93	2.28	2.69		
September	4.27	5.34	4.61	3.98	7.31		
October	4.41	6.91	5.51	4.98	3.39		
November	2.18	2.13	2.16	2.28	1.85		
December	4.95	6.18	3.45		6.85		
January	0.89	1.00	0.92		1.14		
February	0.19	0.32	0.00	0.00	0.25		
March	3.47	4.54	4.76	5.90	5.25		
Totals	50.65	61.69	53.89		79.83		

Catchment Area at 0m.55ch = 218 sq.m.
Low Summer Discharge = 4.5 cusecs. (Feb. 1929)



Locality Map.
Scale: 10 Miles = 1 inch

No. 6 diversion was practically completed during the period, some 34,110 cubic yards being excavated. There still remains the rock bar at the down-stream end, and some chains of soft mud where the cut is not down to full depth.

No. 7 diversion was commenced through the year. Up to the time that No. 13 Bucyrus had to be moved to Hikurangi to carry on with the Mangawhero Stream improvement work, most of the long toe at the top end and 1½ chains of the cut were completed, entailing the excavation of some 3,500 cubic yards. Work will be recommenced on this diversion during next summer.

In March No. 13 Bucyrus was moved from the site of the No. 6 diversion to the Mangawhero Stream, and was ready to commence excavation in April.

No. 3 Priestman dredge, after leaving the Ngararatunua Canal, worked down the river, and several shallows were removed, and widening done as far as the reach of the machine allowed. Some little distance below Lewis's Bridge the river was very constricted, and widening was carried out there, and will be required at intervals all the way down the river. Approximately 31,250 cublic yards were excavated during the year.

Mangahahuru and Mangawhero Diversions.—Good progress has been made with the Mangahahuru diversion, 137 chains having been completed during the period under review. The cut is 45 ft. wide on top, and 30 ft. wide on bottom, with an average depth of 12 ft. 6 in. The adjoining country is now immune from floods. Before the work commenced every fresh in the stream caused flooding over the main road at McLeod's Flat, but now even the largest floods do not cause it to overflow its banks. A number of small severances were created. The largest severance is to have access by a bridge, as it comprises most of the flat area of the owner's farm. Early in the year the crew of the dredge on this work were placed on a contract basis, which resulted in a great improvement in the output. For the year 114,382 cubic yards were excavated from this diversion, at an average cost of 7·2d. per cubic yard.

Towards the end of November No. 26 dipper dredge commenced the excavation of the branch canal. This is a diversion of the Mangawhero Stream, which flows through Hikurangi Township. This Mangawhero diversion was carried up as far as the stream, a distance of 63 chains, and this point was reached at the end of February. From this point a drag-line will continue the work up through the township. This cut is 32 ft. wide on top, 22 ft. wide on bottom, with an average depth of 10 ft. One large severance has been formed, necessitating access being given by a bridge. The total excavation in the Mangawhero diversion was 42,110 cubic yards, at a cost of 9d. per cubic yard.

Okarika Diversion.—The progress of this work was greatly hindered by frequent flooding of the low land through which No. 12 Bucyrus drag-line was working, but by the end of the period the machine had crossed the Otakairangi Road and reached 0 m. 76 ch., covering a distance of 67 chains during the period. This cut has an average width of 50 ft. on top, 25 ft. on bottom, and an average depth of 10 ft. The country proved to be very "rotten," there being a clay surface underlain by peat. Two bad slips occurred near 0 m. 58 ch. and 0 m. 72 ch. respectively, due to the inability of the country to hold the spoil and to withstand the vibration of the machine when digging. The total quantity of spoil excavated by No. 12 drag-line during the period was 70,425 cubic yards, at the rate of 11·8d. per cubic yard.

A contract for the excavation of 3 miles 48 chains of hand drain up the Okarika Valley was let in December, and work was commenced early in January. To date 1 mile 72 chains have been completed. The lower end of this drain is intended to dry out the country ready for machine excavation. The Okarika Valley, which divides into two main arms, is all peat country, and by continual hand draining the peat will be consolidated.

There is a considerable area of Crown land in the Okarika Valley, some of which will be suitable for farming, and the remainder for either flax-growing or farming.

Otonga Outlet.—The Otonga arm of the swamp has been thoroughly explored during the period, and the main outlet located. The draining of this arm will have to be carried out by hand for some years, as the peat will have to be consolidated before it can hold a machine. The main-drain location runs from the river at the upper end of No. 11 diversion to the main North Road at Otonga. The swamp it drains is mostly peat, in some places of great depth, though in others it is shallow, and adjoining the river the country is solid. The peat is generally very firm, and should make good soil when drained and worked up.

Where the swamp narrows as it runs up to Otonga there is a creek which was full of water, and resembled a lagoon rather than a creek. Recently an underground subsidence took place under this creek, and the water drained the lagoon by running underground, and this contributed in a small measure to the flooding of the Hikurangi Coal Co.'s mine. The mine company sealed the subsidence, and the main drain to be put in by the Department was so located that the water will be diverted away from the site of the subsidence.

A contract was let for the construction of 10·5 chains of hand drain, and this has been completed. A further 2 miles 53 chains of drain will be put in hand shortly.

Ngararatunua Canal.—The cleaning of this canal was commenced in March, and by the end of the period 160 chains had been completed.

Summary.—The following is a schedule of some of the works completed during the past year: Dredge cuts cleaned, 2 miles; drains constructed, 2 miles 30 chains; dredge cuts constructed, 3 miles 36 chains; levels taken, 134 miles 37 chains; traverses run, 64 miles 27 chains; peat soundings, 391; river cross-sections, 559; pile bridge erected, 120 ft., 1; temporary bridge erected, 84 ft., on stone and netting piers, 1; buildings, additional room on office and chaff-shed, 2; spoil excavated by floating and dry-land excavators, 312,377 cubic yards; rock excavated, 10,600 cubic yards; stiff clay and rubble excavated, 231,352 cubic yards; soft clay and peat excavated, 70,425 cubic yards.

Programme of Work for Coming Period.

Wairua River.—Before the flood period arrives No. 14 Bucyrus will return to the long spillway around the D–B diversion to work as a shovel, and it is anticipated the spillway will be completed within six months. When the spillway is completed the large slip at the mouth of D–B diversion will be removed, and the machine will concentrate on the removal of the bars and shallows in the river, working up-stream and lowering the water-level in successive steps. No. 14 will move up-stream gradually in carrying out this work.

The removal of bars and shallows and the bringing of the river to an even width from Lewis's Bridge down-stream will be carried out by the Priestman, which is at present engaged on this work. By this means, and by working up-stream, as mentioned above, it is hoped to have a number of the obstructions removed by the end of the next period.

After No. 13 Bucyrus has completed the Mangawhero Stream improvements it will return to No. 9 diversion of the river and commence excavation at that point. The site is now being cleared and stocked with coal.

When No. 12 Bucyrus has excavated the Okarika diversion as far as possible before the coming of winter, it will be shifted to No. 10 diversion of the river in order to commence excavating there.

Okarika Diversion.—No. 12 Bucyrus is to excavate some distance farther, and before the advent of winter will proceed to No. 10 diversion of the river. The hand-drain contract will be completed in April or May. This drain will be deepened and possibly enlarged next summer, as the peat will have subsided considerably by then.

Mangahahuru Diversion.—This will be completed during the coming period. There is a considerable amount of scrub at the lower end of the location, and a contract has been let for the clearing of same.

Mangawhero Diversion.—This work will be completed up through the township by No. 13 Bucyrus within about four months, and should absolutely eliminate all danger of flooding there.

Otonga Outlet.—The main outlet drain will be proceeded with, and contracts will shortly be let for its completion by hand-work. Next summer the portion of the outlet through the peat country can be deepened as required.

Waiotu Stream.—Detailed surveys of the Waiotu Stream from Hukerenui down to the junction with the Whakapara Stream will shortly be made, as this will be a suitable work for No. 26 dredge after it has completed the Mangahahuru diversion.

Excavating Machinery.

No. 12 Bucyrus.—This machine, equipped as a drag-line with a 41 ft. jib and a 1 cub. yd. bucket, has been working on the Okarika diversion except when laid up on account of floods. This machine is in good running-order, though the boiler will require retubing at an early date.

No. 13 Bucyrus.—This machine has been engaged on drag-line work all the period, using a 50 ft. boom and a $\frac{3}{4}$ cub. yd. bucket. The boiler was completely retubed, and the machine is now in good running-order. Most of the year was spent on No. 6 diversion.

No. 14 Bucyrus.—Until October this machine was working as a shovel in the long spillway round D–B cut, but since then it has been equipped as a drag-line with 50 ft. jib and a 1 cub. yd. bucket excavating clay and blasted rock from the bars in the river. The machine has been kept in good order.

No. 3 Priestman.—Early in the period, whilst proceeding down the river from the Ngararatunua Canal, the pontoon struck and was holed by a hidden snag, and she sank in fairly deep water. In July arrangements were made with the Auckland Harbour Board for the loan of their diver, who was engaged on the salvage operations for some three weeks, and on the 6th August the dredge was refloated. Since then she has been proceeding down-stream, removing bars, shallows, &c.

No. 26 Dipper Dredge.—This dredge has been engaged on the Mangahahuru and Mangawhero diversions, and has excavated 156,492 cubic yards for the period. At the middle of March the Diesel engine was removed, and the engine from No. 25 dredge, which has been overhauled, was installed. Some difficulty was experienced in putting the substituted engine in running-order, otherwise the plant has been kept in good order.

Drilling and Compressor Plant.—One compressor was transferred to the Rangitaiki works during the period. The remaining six compressors and the drilling plant have been in fairly constant use in the spillway, rock bars, and at the shops.

Locomotives and Rolling-stock.—These were in use for the first half of the period until No. 14 was converted to a drag-line for the removal of rock bars, &c. Another locomotive will shortly be transferred from Hauraki Plains, as the haul will be long when shovel-work is recommenced, and a third locomotive will speed up the output. The plant is all in good order.

Motor Truck and Cars.—There are at present on the works one Thorneycroft 2-ton lorry, one Ford 30 cwt. lorry, two Ford touring-cars. The Thorneycroft lorry will shortly be transferred to Hauraki Plains. The Overland car was sold to a local settler.

Workshops.—These have been kept busy all through the period. A large variety and amount of repair work has been done here, and many machine parts have been made in the shops. On account of the heavy nature of the work on which the machines are engaged the repair work is heavy, and buckets continually require repairs. Drill-steel sharpening is a large item in the work, and a considerable amount of bridge ironwork was made during the latter part of the period.

It is anticipated that with the completion of the long spillway next summer the workshops and most of the camp will be shifted up to the swamp near Apotu, where a site has already been selected.

Other Works.

Bridges.—A settler's access bridge over No. 6 diversion of the river, 120 ft. long, was completed recently by contract. A temporary tramway bridge, 84 ft. long, over the mouth of the D–B diversion, was constructed early in the period, to provide access from the spillway to the dump. Materials are on the ground ready for the commencement of construction of two settlers' access bridges—viz., one, 40 ft. long, over the Mangawhero diversion, and one, 48 ft., over the Mangahahuru diversion—and also a road-bridge, 58 ft. long, over the Okarika diversion.

Surveys.—The new engineering survey of the Wairua River, which was commenced at the end of the previous period, was completed in October. Complete and accurate engineering data for the river is now available. On the completion of the river survey two parties were in the field, one investigating the Otonga arm of the swamp and the other on the Riponui arm of the swamp. Both of these areas were thoroughly investigated, and the main outlet channels located. Plan work for all these surveys is almost completed. During the coming year an engineering survey will be made of the Ngararatunua arm of the swamp, the Waiotu Stream and adjoining swamp area, and the Whakapara Stream.

Compensation Claims.

Quite a number of claims for compensation for loss of land, &c., have been received during the year, and a fair number can be expected to come in during the coming year.

Works Expenditure.

The expenditure recorded for the year totalled £24,272 19s. 10d., of which £12,654 10s. 10d. was paid in wages.

WAIHI DRAINAGE AREA (20,000 ACRES), TAURANGA COUNTY.

It was pointed out in my last report that rates covering both capital and maintenance expenditure had been struck for the 1927–28 rating-year. However, an amendment of the Swamp Drainage Act was passed in 1928 suspending the collection of drainage rates on this area until after the 31st March, 1929. This amendment also provided for a reclassification, giving ratepayers the right of appeal against such classification. The two classifiers were appointed, and they completed their classification of all lands towards the end of the period under review.

The work carried our during the year consisted almost entirely of maintenance and improvement of existing works.

Towards the end of the period a Monighan drag-line was transferred from the Rangitaiki drainage-works in order to carry out the widening and deepening of the Kaikokopu Stream as scheduled, from the East Coast railway-line to the end of the previous dredging, and also minor dredging at the mouth of the Mangatoetoe Stream. This work will be pushed on as quickly as possible, and when completed will afford much-needed relief to an area previously waterlogged in wet seasons. Whilst the dredge is in the locality the opportunity will be taken to remove the accumulation of pumice in a length of the Wharere Canal. It will probably be found necessary to carry the dredging of the Kaikokopu to the north of the main road for some distance in order to remove the pumice brought down by the dredging above mentioned.

Dredges.—The only dredge employed was Monighan No. 17, and the distance dredged by this plant in the short time worked was 11 chains, a total of 12,100 cubic yards of spoil being removed. The American steel dipper dredge hired to the Kaituna Drainage Board was returned by the Board to The Mount Wharf, Tauranga, where it was dismantled and stored.

Maintenance.—This work, which includes the patrolling of stop-banks and flood-gates as well as the general maintenance of hand drains, is now supervised by a working foreman. This man also has the care of the departmental property still remaining on the works. During the year 37 miles 14 chains of drains were cleaned, and 2 miles 26 chains of drains deepened.

Flax Leases.—Milling has been carried on continuously through the season by the company leasing the bulk of the Crown land on the area. The subsidence of much of this country following drainage is making desirable the construction of an increased number of subsidiary drains to prevent the water-stagnation which is fatal to successful flax-growing. Where the areas are provided with sufficient drainage the flax is making a very healthy growth, but the growth is disappointing in places where it is apparent the land lacks internal drainage.

A certain amount of clearing and drainage has been carried out in the small flax leases west of the Wharere Canal, but probably the unstability of the hemp-market is a factor influencing the development of this country for flax-growing purposes.

Fires.—The damage from fires is ever present on a flax area, and only the vigilance of lessees has prevented serious consequences following several outbreaks during the year. As pointed out on previous occasions, it would seem that the necessary legislative authority should be granted empowering the constitution of fire districts on flax-bearing lands.

Buildings.—These consist of a store-shed and workshop, two cottages, and foreman's quarters. The three first named of these are leased to the flax-milling company operating on the area.

Levels.—During the year levels were run over all the drains and canals in the area for record purposes. A total of 68½ miles of levels and 30 chains of traverse were run during the year.

Future Works.—Kaikokopu, Mangatoetoe, and Wharere dredging, and the maintenance and minor improvement of existing works.

Works Expenditure.—The total expenditure for the year was £3,395 9s. 1d.

POUKAWA DRAINAGE AREA (13,567 ACRES), HAWKE'S BAY COUNTY.

Towards the end of the year it was decided to proceed with the alternative drainage scheme of developing the area as a flax-growing proposition. Briefly, the scheme is to lower the summer level of Lake Poukawa by some 6 ft. by constructing a main channel, and leave the subsidiary drainage to the settlers interested.

The dredge pontoon constructed in 1916 was naturally in a very bad state of repair, and the first work put in hand was the reconditioning of this pontoon. After this work had been carried out the Priestman dredge machinery and chutes were railed from Auckland and re-erected. At the end of the period under review the dredge commenced operations, and it is anticipated good progress will be made henceforth.

Other minor works comprised building coal-punt, 18 ft. by 7 ft. 6 in., and repairs to road and two bridges through private property to ensure safe cartage of heavy machinery.

The buildings, comprising cookhouse, office, and tool-shed, have been placed in good order.

The expenditure recorded for the year totalled £785 1s. 5d.

I have, &c.,
R. G. MACMORRAN,
Chief Drainage Engineer.

The Under-Secretary for Lands, Wellington.

SWAMP LAND DRAINAGE ACCOUNT.

Receipts and Payments Account for the Year ended 31st March, 1929.

Receipts.	£	s.	d.	£	s.	d.
Balance as at 1st April, 1928	19,262	18	0			
Debentures issued under Swamp Land Drainage Act, 1915, and Appropriation Act, 1918, section 46	35,000	0	0			
Temporary transfers from other accounts (Public Revenues Act, 1926, section 40)	15,000	0	0			
Rents from the letting of national-endowment lands in the Waihi drainage area	2,245	13	8			
Special rate for interest and sinking fund: Swamp Land Drainage Act, 1915, section 5—						
Kaitaia drainage area	69	13	6			
Waihi drainage area	1	0	11			
	70	14	5			
General rate for administration and maintenance: Swamp Land Drainage Amendment Act, 1926 (5)—						
Kaitaia drainage area	18	6	11			
Waihi drainage area	0	17	7			
	19	4	6			
Rents	119	17	4			
Plant-hire	55	0	0			
Royalty	1	17	8			
Interest on mortgage	10	10	0			
Repayment in reduction of mortgage	50	0	0			
Interest on investments	338	17	11			
Interest on temporary transfers charged during year 1927–28	1,145	11	9			
Miscellaneous	918	16	2			
	£74,239	1	5			

Payments.	£	s.	d.	£	s.	d.
Kaitaia Drainage District—						
Drainage-works, &c.	11,456	12	5			
Management and engineering expenses	958	14	5			
				12,415	6	10
Waihi Drainage District—						
Drainage-works, &c.	2,060	4	10			
Management and engineering expenses	98	4	6			
				2,158	9	4
Hikurangi Drainage District—						
Drainage-works, &c.	15,695	15	6			
Management and engineering expenses	1,424	13	11			
				17,120	9	5
Poukawa Drainage District—						
Drainage-works, &c.	504	0	7			
Management and engineering expenses	42	17	9			
				546	18	4
Fuel and stores				11,209	2	8
Interest on debentures recouped to Consolidated Fund				1,660	0	0
Loose tools				12	15	0
Management charges on Consolidated Stock	7	12	2			
Stamp duty on transfers, Consolidated Stock	14	9	4			
				22	1	6
Plant and machinery, &c.				4,807	13	1
Refund of special rates for interest and sinking fund—						
Kaitaia drainage area	337	14	0			
Waihi drainage area	4	10	11			
				342	4	11
Refund of general rates for administration and maintenance—						
Kaitaia drainage area	109	13	1			
Waihi drainage area	161	19	7			
				271	12	8
Temporary transfers from other accounts repaid				15,000	0	0
Balance at the end of the year—Cash in the Public Account				8,672	7	8
				£74,239	1	5

SWAMP LAND DRAINAGE ACCOUNT—*continued.*

BALANCE-SHEET AS AT 31ST MARCH, 1929.

Liabilities.	£	s.	d.	£	s.	d.
Debentures issued under Swamp Land Drainage Act, 1915				571,000	0	0
Temporary advances from other accounts (section 40, Public Revenues Act, 1926)				10,000	0	0
Consolidated Fund—For loans redeemed under Public Debt Repayment Act, 1925				5,000	0	0
Public Works Fund—Land Improvements vote				4,563	19	7
Consolidated Fund—Interest on debentures paid but not recouped from Swamp Land Drainage Account				49,790	2	8
Consolidated Fund—Accumulated interest on amount expended out of Public Works Fund				2,743	10	2
Sundry creditors						
Interest on debentures accrued but not due	8,913	14	0			
Interest on temporary transfers	1,413	10	7			
Departmental	352	10	6			
Miscellaneous	5,770	8	4			
				16,450	3	5
Rent accrued but not due				298	0	0
Suspense Account				5,557	11	6
				£665,403	7	4

Assets.	£	s.	d.	£	s.	d.
Kaitaia Drainage District—						
Allocated cost of works on which rates are levied—						
Rural subdivision	110,000	0	0			
Town district	15,000	0	0			
				125,000	0	0
Excess cost of works not recoverable	62,696	7	3			
Interest Account—Proportion chargeable to district	69,417	14	5			
				132,114	1	8
Waihi Drainage District—						
Allocated cost of works on which rates are levied				75,000	0	0
Excess cost of works not recoverable	5,500	10	4			
Interest Account—Proportion chargeable to district	27,778	19	9			
				33,279	10	1
Ponkawa Drainage District—						
Drainage-works	5,121	1	10			
Interest Account—Proportion chargeable to district	2,115	11	11			
				7,236	13	9
Hikurangi Drainage District—						
Drainage-works	162,784	18	6			
Interest Account—Proportion chargeable to district	41,833	9	2			
				204,618	7	8
Mangawai Drainage District—						
Drainage-works	1,877	15	9			
Interest Account—Proportion chargeable to district	616	8	4			
				2,494	4	1
Harihari Drainage District—						
Drainage-works	4,354	15	1			
Interest Account—Proportion chargeable to district	1,141	6	11			
				5,496	2	0
Buildings				2,611	4	6
Wharves				85	1	9
Plant and machinery				48,650	6	9
Loose tools				762	3	4
Live-stock				28	4	5
Fuel, &c.				2,854	5	11
Stores on hand				6,848	1	5
Sundry debtors—	£	s.	d.			
Advance on mortgage	160	0	0			
Interest on mortgage	2	1	5			
Hut rents	16	9	3			
Dredge-hire	940	10	0			
Rent under section 4 (5), Swamp Drainage Amendment Act, 1926	268	17	1			
Departmental	700	15	3			
Miscellaneous	51	17	6			
				2,140	10	6
Kaitaia Drainage District—Maintenance costs on completed works (in suspense)				4,068	18	2
Waihi Drainage District—						
Maintenance costs on completed works (in suspense)				2,373	0	1
Balance carried forward on general revenue—Central subdivision				1,070	3	7
Cash in Public Account				8,672	7	8
				£665,403	7	4

J. B. THOMPSON, Under-Secretary for Lands.
J. H. O'DONNELL, Controller of Accounts.

I hereby certify that the Statement of Receipts and Payments and Balance-sheet have been duly examined and compared with the relative books and documents submitted for audit and correctly state the position as disclosed thereby.—G. F. C. CAMPBELL, Controller and Auditor-General.

Approximate Cost of Paper.—Preparation, not given; printing (700 copies, including graphs, illustrations, and maps), £85.

By Authority: W. A. G. SKINNER, Government Printer, Wellington.—1929.

Price 2s. 6d.]

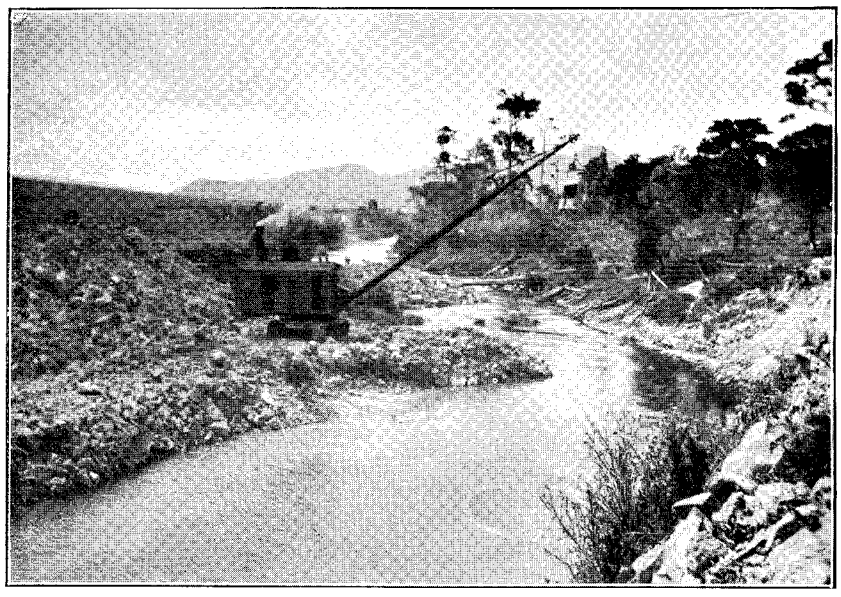
SWAMP LAND RECLAMATION ACCOUNT—continued.

BALANCE-SHEET AS AT 31st MARCH, 1929.

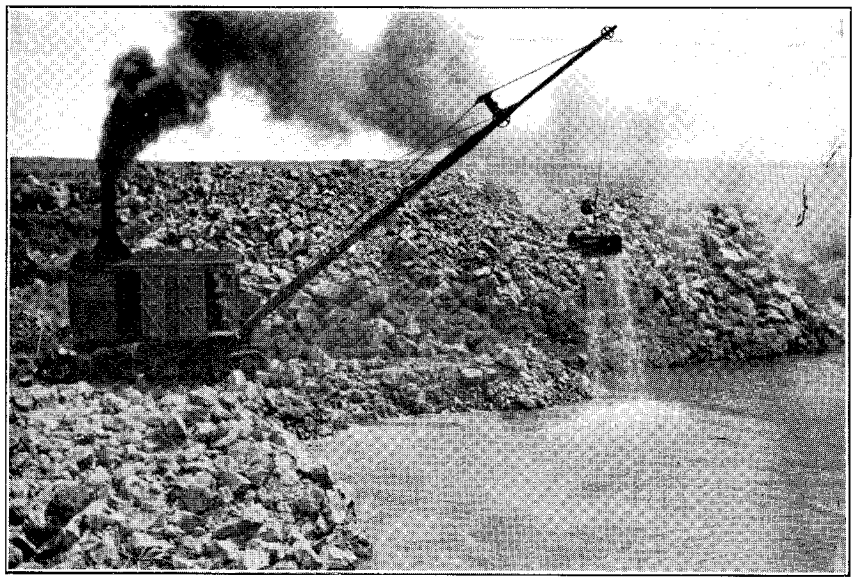
£ s. d.	£ s. d.
Balance brought forward—	Balance brought forward—
Drainage-works .. 10,000 0 0	Drainage-works .. 10,000 0 0
Interest Account .. 5,000 0 0	Interest Account .. 5,000 0 0
Drainage-works .. 4,205 19 7	Drainage-works .. 4,205 19 7
Interest Account .. 2,700 2 8	Interest Account .. 2,700 2 8
Drainage-works .. 2,758 10 2	Drainage-works .. 2,758 10 2
Interest Account .. 3,912 14 0	Interest Account .. 3,912 14 0
Drainage-works .. 1,213 10 7	Drainage-works .. 1,213 10 7
Interest Account .. 205 10 0	Interest Account .. 205 10 0
Drainage-works .. 2,150 3 6	Drainage-works .. 2,150 3 6
Interest Account .. 208 0 0	Interest Account .. 208 0 0
Drainage-works .. 5,557 11 6	Drainage-works .. 5,557 11 6
Interest Account .. 2,104 4 1	Interest Account .. 2,104 4 1
Drainage-works .. 1,417 15 1	Drainage-works .. 1,417 15 1
Interest Account .. 2,110 10 0	Interest Account .. 2,110 10 0
Drainage-works .. 4,106 12 2	Drainage-works .. 4,106 12 2
Interest Account .. 2,378 0 1	Interest Account .. 2,378 0 1
Drainage-works .. 1,079 3 7	Drainage-works .. 1,079 3 7
Interest Account .. 675 7 8	Interest Account .. 675 7 8
£100,103 7 8	£100,103 7 8

J. B. THOMPSON, Under-Secretary for Lands.
J. H. O'BRYAN, Controller of Accounts.

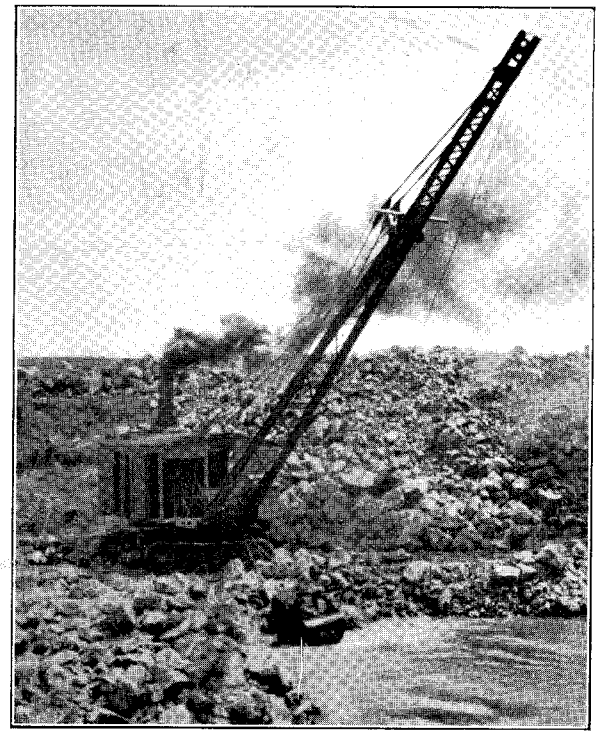
I have compared the foregoing Balance-sheet with the Ledgers and Drainage-sheet books, and have duly examined and compared with the vouchers submitted for audit, and correctly state the position as shown thereby.—E. S. [illegible], Controller and Auditor-General.



No. 14 Bucyrus opening out Upper End of G–H Diversion. Nos. 1 and 2 Rock-bars in background.

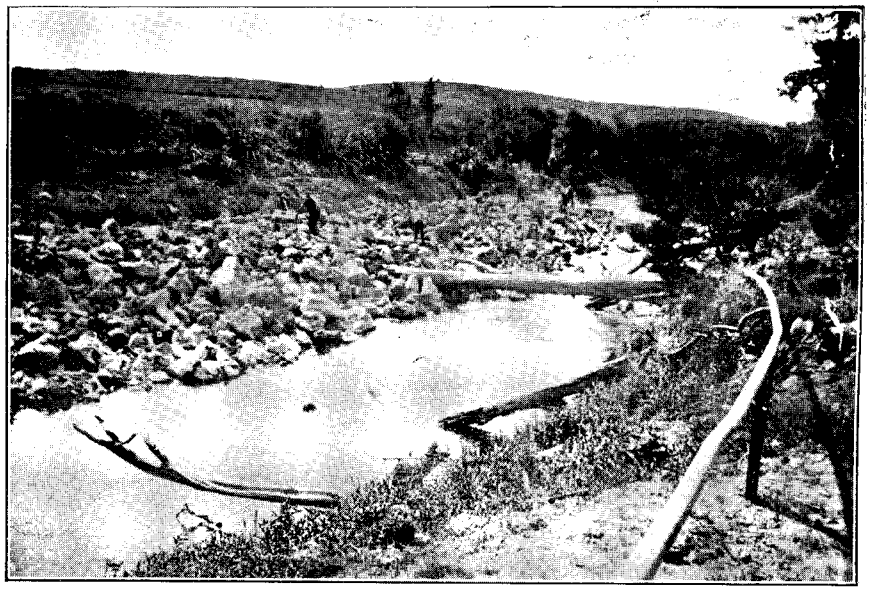


No. 14 Bucyrus excavating No. 1 Rock-bar, equipped with 50 ft. Jib and 1 c.y. Drag-line Bucket.

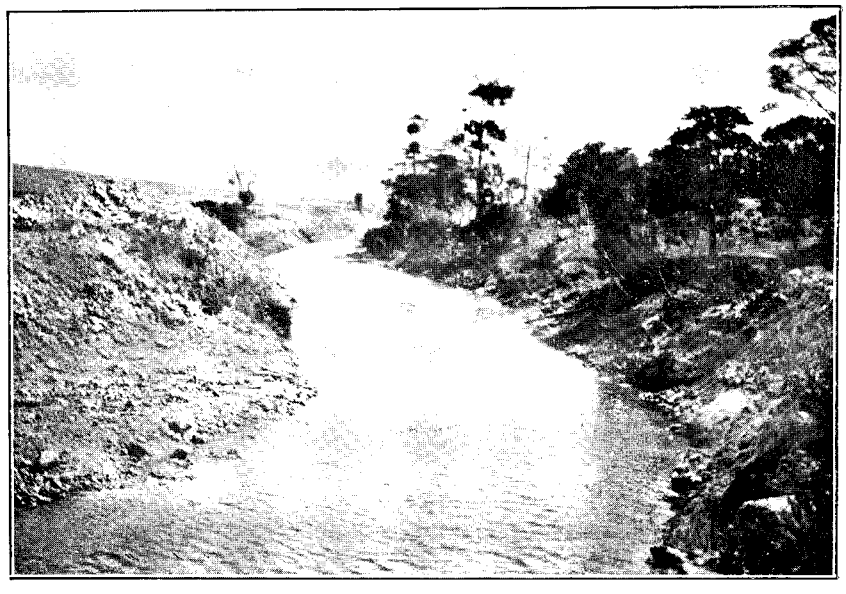


No. 14 Bucyrus excavating No. 1 Rock-bar.

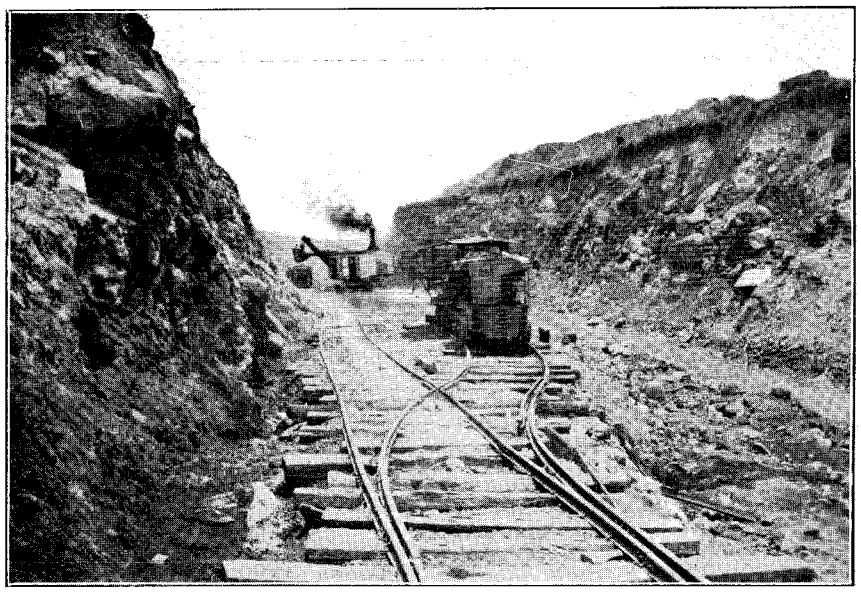
Drag-line Bucket in Rock, No. 1 Bar.



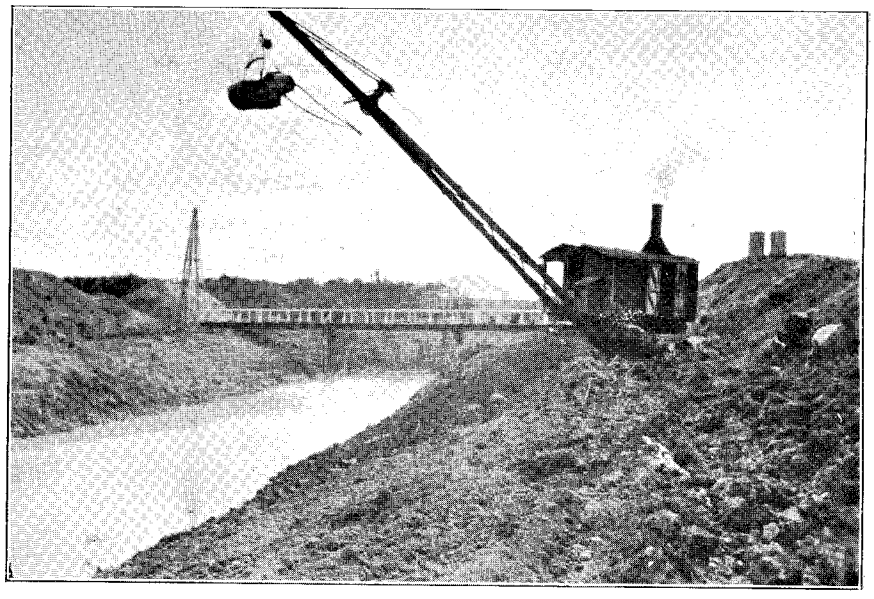
No. 1 Rock-bar after Drilling and Blasting.



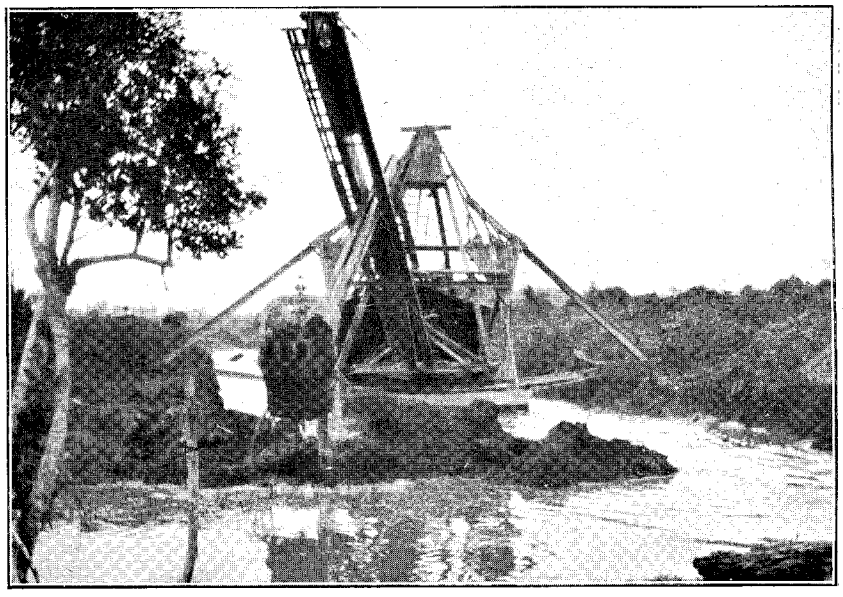
River after opening-out of Upper End of G–H Cut and removal of No. 1 Rock-bar.



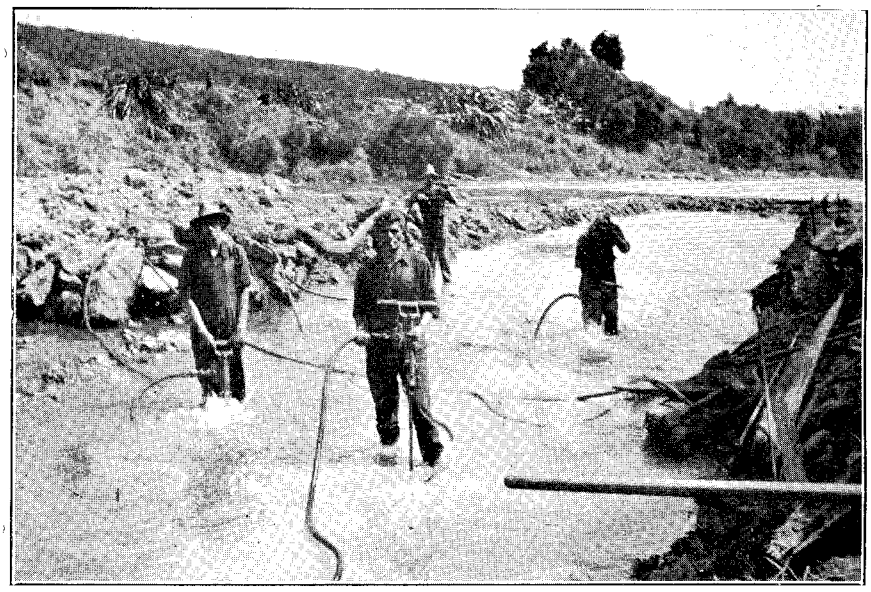
No. 14 Bucyrus 1 c.y. Steam-shovel excavating G–H Diversion.



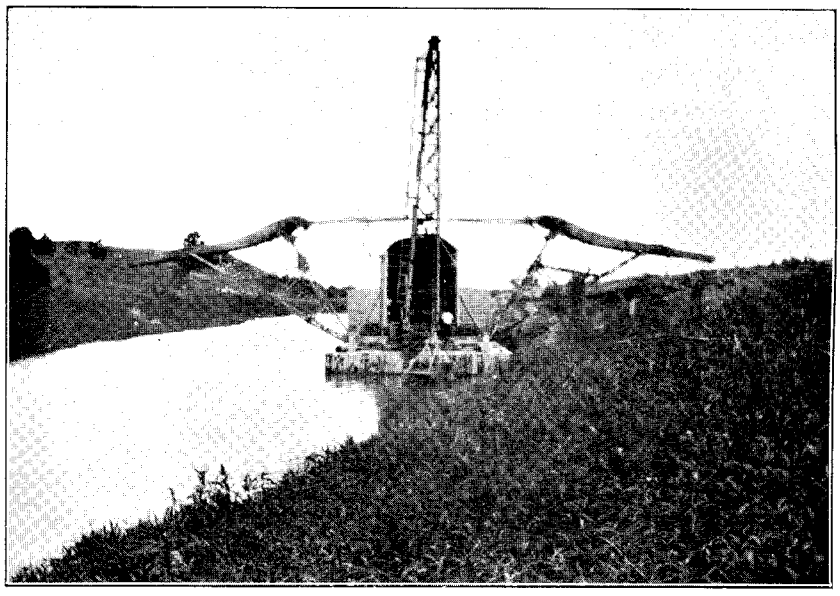
No. 6 Diversion and Settlers' Access Bridge, with No. 13 Bucyrus Drag-line on Bank (110 ft. top width).



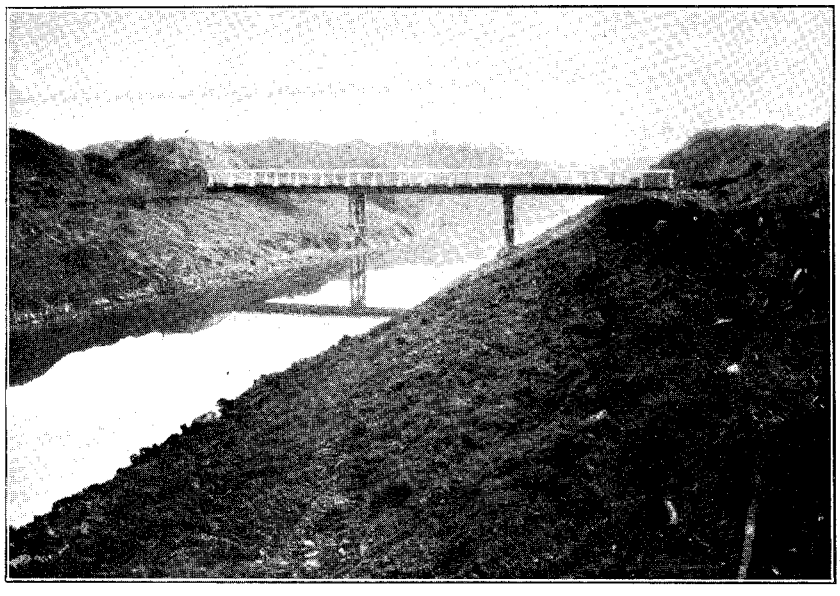
No. 26 American Steel Dipper Dredge (1⅛ c.y.) near 0 m. 48 ch. on Mangahahuru Stream Diversion.



Rock-drilling on No. 2 Bar, Wairua River.



No. 3 Priestman Grab Dredge on River Improvement near Lewis Bridge.



Upper End of No. 6 Diversion of Wairua River, and Settlers' Access Bridge, 120 ft. long.

R. G. MACMORRAN
CHIEF DRAINAGE ENGINEER.

RANGAUNU BAY

REFERENCE.

- *Boundaries of Kaitaia drainage area* -
- *Drains now in operation* - - -
- *Drains under construction* - - - - -
- *Dredged channels* - - - -·-·-
- *Stop-banks* - - - - ▲▲▲▲▲▲▲

Work as standing at end of 1928-9.

PLAN OF KAITAIA DRAINAGE DIST.

SCALE OF CHAINS

OMAIA
Te Waipapakauri
Awarua R.
Puratahi
RANGAUNU
XI
KAREPONIA
Awanui
Awanui River
Whangatane
Spillway
Pt O.L.C. 153
LTP 12517
LTP 11347
RES. Pt O.L.C. 214
Pt O.L.C. 169
L.T.P. 10514
Pt O.L.C. 6
LTP 5148A
LTP 1126
MATARAU
AWANUI
Pt 3
Pt 7
LTP 8655
PUKEPOTO
Pukepoto R.D.
O.L.C. 8
TANGONGE K.O.R.
Lake Tangonge
Wallace St
Tarawhiti
Okerimene
OTEPU
TAWHATI
RANGITIHI
PERUNIA
OHARAE
Victoria
RUAROA
Blk.
PUKEHAHIKOA
KONOTI
Waimamaku
Waimamaku R.
Kaitaia
Pt 65
Pt 66
Pt 67
Pt 68
Pt 69
Pt 178
Pt 179
Pt 180
Pt 181
Pt 182
Pt 183
Pt 184
Pt 185
Pt 186
Pt 187
Pt 188
Pt 189
Pt 190
Pt 191
Pt 192
Pt 193
Pt 194
Pt 195
Pt 196
Pt 197
Pt

REFERENCE.

Proposed work shown thus : ———

Work in hand ,, – – –

Work completed ,, ———

Automatic water-stage recorders installed ,, O

Hikurangi Drainage area ,, ▨

Work as standing at end of 1928-9. – – – – –

HUKERENUI S.D.

OPUAWHANGA S.D.

PURUA S.D.

HIKURANGI DRAINAGE DIST.

OTAKAIRANGI PH

WHENUAROA M.C.

PUHIPUHI STATE FOREST

PUHIPUHI

Waiotu River

Otarikaka Diversion

Waiarua Stream

Makawhero Stream

Mangahahuru Stream

Hikurangi Outlet

Hikurangi Town Drain

Kauri Stream

Wairua River

Wairua No 2 Diversion

Wairua No 4 Diversion

Spillway

Falls

Lagoon

Diversion

K.G.R.

PAPAKURI

KOPUNIAHO

MATARAU

TURANGAMATEA

WHAKAPARA

TAURANGA

MAUNCAREI

TUMUAKIA

NGARARATUNUA

WHAKAPARAKAU

MAKETAWA

PARAKIORE

TE RORO

KAMO TOWN DIST.

Ruatangata Stream

Kamo Stream

Canal

FOREST RES.

SEE ENLARGEMENT

— ENLARGEMENT —

1996 3 29

R. G. MACMORRAN
Chief Drainage Engineer

PLAN OF

HIKURANGI DRAINAGE DIST.

— Scale of Chains —

N.Z. Gazette No 107, Aug. 28th 1919.

R. G. MACMORRAN
CHIEF DRAINAGE ENGINEER.

PLAN OF WAIHI DRAINAGE DIST.

REFERENCE.

- Completed drains
- Existing drains to be dredged
- Existing roads
- Existing stop-banks
- Excluded area
- Amended area

Work as standing at end of 31st March, 1929.

SCALE OF CHAINS

NZ. Gazette N°69 June 22nd 1916 p 1567

Amended Boundaries, vide N.Z. Gazette, No. 10, 24th February, 1927.

MAKETU S. D.

WAIHI SOUTH S. D.

BAY OF PLENTY

I II III IV V VI VII VIII

Maketu
WAIHI ESTUARY
Pt A1
A3
A2
Pukehina Canal & No 1 Drain
Pukehina No 2 Drain
PT A1 PUKEHINA BLOCK
M1
M2
M3
M4 B N°4
M4 B N°3
LN°1B
LN°1C N°2
LN°1C N°3
LN°1C N°1
URUPA
Pt LN°2
D.P. 10387
Pt LN°1D
Pt LN°1B
Pt LN°1C
Pt 12
D.P. 7738
Lot 1
Lot 2 D.P. 9638
15 E.R.
Stream.
Drain
Waeranga Drain
Pongakawa Drain
FLAX LEASE
Northern
WHAREKE ROAD
FLAX LEASES
Central Drain
Pongakawa Eastern Drain
No 2 Drain
Section 23 & 28 Drain
Puhene Drain
TAINUI ROAD
ARAWA ROAD
Wilkins Outlet
Mangaloetoe
Wharere Drain
River
TRUNK
MAIN COAST
EAST COAST
PONGAKAWA RLY. STN.
MANIATUTU RLY. STN.
PAENGAROA RLY. STN.
MANIATUTU VILLAGE
PAENGAROA VILLAGE
PAENGAROA Nth C 1
PAENGAROA Nth C 2
PAENGAROA Nth B
WAEWAETUTUKI BLK
Waewaetutuki No 2
No. 3 Pt 5
Pt 5
Pt 7
Pt 8
Pt 11
Pt 12
Pt 13
Pt 22
Pt 23
Lot 1 D.P. 11991
Lot 2 D.P. 13526
Lot 3 D.P. 11998
Lot 4 P.2724
D.P. 1427
D.P. 7846
D.P. 2801
D.P. 8855
D.P. 9513
D.P. 13467
D.P. 14838
D.P. 7422
D.P. 2787
D.P. 13053
D.P. 15208
D.P. 14207
D.P. 18207
D.P. 13975
Wilson's Dr.
Monds' Drain
Wilkins Stream