

1922.
NEW ZEALAND.

PUBLIC WORKS STATEMENT

BY THE HON. J. G. COATES, MINISTER OF PUBLIC WORKS.

MR. SPEAKER,—

The various reports and accounts appended to this Statement will show that the total expenditure on railway, hydro-electric, road, bridge, and irrigation construction works during the past financial year has passed all previous records in the history of the Dominion.

Expenditure of money need not necessarily have a proportionate result in completed works. If the cost of construction, materials, and labour, be high—as it was during the past financial year—it follows that special effort must be made to increase the actual result from such outlay. A heavy expenditure has been incurred in the purchase of up-to-date labour-saving machinery, and this means my Department has been able, despite the relatively high cost of materials and labour, to produce the maximum result possible in the existing circumstances.

The Public Works Statement of last year indicated a policy of concentration on particular works, rather than the diffusion of money and energy on many works. Concentration on works of particular importance means the application of all the financial, mechanical, and human resources of a construction Department to the completion of these works so that they may soon become revenue-producing and self-supporting. Diffusion of these resources over a greater number of works inevitably means a lessened reproductive result, and, since interest and sinking fund on unproductive works must be found by the taxpayer, an increased capital cost of such works.

That I was unable to carry into full effect the policy of concentration previously outlined is attributable solely to the effect in this country of the world-wide financial depression, and consequent unemployment. When unemployment became general throughout the Dominion it naturally became a matter of Government policy to assist as far as possible the alleviation of distress. Whatever steps may have been taken in past crises of a similar nature, the Government had no doubt that the true economic remedy was to provide employment in various localities on works of such a nature as would assist in the normal and profitable development of the country. It was accordingly decided to carry on with certain railway-construction works of secondary importance, which in other circumstances would have been closed down for the time being. While, therefore, I regret to have to state that circumstances necessitated a temporary modification of the policy of concentration and maximum achievement, honourable members may rest assured that every pound devoted by the Government to the relief of unemployment has been expended on road and irrigation works of primary importance, and on railway-works of not less than secondary importance.

It is of primary importance to the country as a whole that there should be no considerable measure of unemployment. Fortunately, there are already indications of a return to more normal conditions, and as quickly as circumstances permit concentration on works of first importance will be continued. Such a policy is undoubtedly in the best interest not only of those works selected for completion but those which will be temporarily deferred, for I have no doubt it will mean that they also will be completed at an earlier date, and at less cost, than would otherwise be the case.

It may be of interest to honourable members for me to mention a few railway-works which have had special attention and which will continue to be pushed forward to completion or to a payable point.

On the North Auckland line the Golden Stairs Tunnel has within the last few days been pierced through on the bottom heading. The heavy work referred to in my last Statement, between the railheads running north from Auckland and south from Whangarei, is now so far advanced that rails should be laid over the whole length, with the exception of a mile, by the end of the year; and shortly thereafter the through connection of 130 miles of line will be made between Auckland and Whangarei. Owing, however, to the extremely unstable nature of the country in this locality, it will probably be many months before the formation can be brought to a condition of stability to enable the line to be worked by the Railways Department.

On the East Coast Main Trunk line—Tauranga eastwards—good progress has been made; while as to the westwards section, between Tauranga and Katikati, the Department is pushing ahead with the preparation of plans for work to enable the isolated section of over forty miles from Tauranga eastwards to be connected up with the general Working Railways system. I purpose inviting tenders for the construction of this twenty-two-mile section and to have the work completed, and through communication established, with the least possible delay.

Unfortunately, the history of big constructional contracts in New Zealand has not been a satisfactory one, and in future, before letting a contract, the Government will have to be thoroughly satisfied that to do so will be in the best interests of the country.

Many large works are in hand, and great progress is being made, but the completed results will come into next year's Statement. Work has been continued on a small scale on the Waipu Branch Railway; nothing has been done on the Waikokowai or Waipa gravel-pit access lines. The Waihi line eastwards to Tauranga has not been suspended as intended, but, on the contrary, the large number of unemployed in the Auckland District has led to an increased number of men being placed on this section of railway. The Gisborne-Wairoa line has also been continued as a relief work, and a considerable amount of work has been done on the Napier-Eskdale Section and beyond. The Tutira Section of the Napier-Wairoa line is one which I should like to have taken in hand vigorously and completed to a point where a branch off the main road would enable a large area of profitable country to be served, but I regret that the ways and means available, after providing for liabilities of work already planned, have not permitted it.

Two works of considerable importance which last year I indicated would be concentrated upon with a view to early completion were the Midland Railway and the Waikokopu line. Unfortunately, essential material for both of these works was lost in the wreck of the "Wiltshire" some months ago, and the delay in obtaining duplicate supplies has to some extent affected the time of completion. Every effort is being made, however, to minimize this unavoidable delay.

The good results that were anticipated from the use of modern mechanical construction plant have been fully realized, and are dealt with later. The most significant feature is a reduction in earthwork costs of 30 per cent. The large expenditure necessary for this plant has already been mentioned. In addition, I might here state, in order to provide for unemployment, the number of men on construction-works generally has been very largely increased, with the natural result that this year's expenditure exceeds last year's by over three millions. It may be as well to explain, however, that some of this expenditure will not be recurring. I refer particularly to the item "Additions to open lines," where an expenditure of £1,856,380 has occurred. This, however,

represents principally a large purchase of rolling-stock to make up the shortage created during the war period.

The Public Works Statement is primarily a report to Parliament of the operations of the past year, and a forecast of policy intentions of the ensuing year. It may, however, be of interest to honourable members if I take the opportunity of outlining, briefly, the achievement of the Department during the past ten years.

During the period 1912-1922, £18,178,422 has been expended in public works. This amount does not include expenditure on additions to open lines, telegraph extension, immigration, workers' dwellings, or school buildings. For this sum we have had 235 miles 18 chains of railway completed and handed over to the Working Railways Department, while between forty and fifty miles have been brought to the stage of being used for public traffic under the direction of the Public Works Department, although not yet handed over. In addition, there is a very large mileage of formation over which there is not yet traffic.

Practically the whole of the hydro-electric work of the Department has been done since April, 1912. This includes the ultimate development of 16,000 horse-power at Coleridge, where very shortly there will be an actual development of 12,000 horse-power. The headworks for the whole 16,000 have been completed, and the reticulation for the disposal of the whole practically completed. In addition, the Government has purchased the Horahora power-station of 8,000 horse-power, constructed transmission-lines permitting the sale of the whole output, and has in hand the extension of both power-house and headworks. The preliminary development of 1,000 horse-power at Lake Waikaremoana has been constructed and will shortly be in commission. The development of 24,000 horse-power to supply Wellington and surrounding districts from Mangahao is in hand. These works have been vigorously prosecuted during the last two years. The constructional works necessary at Mangahao are very considerable, consisting of over two miles and a half of tunnel, three large concrete dams, three-quarters of a mile of pressure pipe-line—part double and part quadruple—together with the necessary power-house, &c. The whole of this work is well advanced. A considerable amount of the material necessary for the hundreds of miles of transmission-lines is in hand, and erection has commenced. Complete surveys for the duplication of Lake Coleridge, and for development at Hawea-Wanaka, Teviot, Gowan, Aratiatia, Arapuni, and Hutt Rivers have been carried out. The detail plans in connection with Arapuni are well advanced, and an arrangement has already been made for the sale of a large portion of the power when available. Local-body proposals have been investigated, and approved or disapproved as circumstances required.

An immense amount of roadwork has been carried out. Over 5,100 miles of road have been formed, and over 2,500 miles metalled. On these roads—not including small bridges and culverts—a length of 111,881 ft., or over twenty-one miles, of bridges have been erected. Some of the bridges are of very considerable magnitude: three are between 950 ft. and 1,000 ft. long, two are 1,200 ft., while twenty-four are over 300 ft.

Irrigation works involving over one hundred miles of water-races, some of very large capacity, have been constructed. A number of concrete dams were built. One of these is over 100 ft. high and holds 1,800,000,000 cubic feet of water, enabling the irrigation of 20,000 acres of land to be effected. Other schemes, providing for the irrigation of many thousands of acres, have been investigated, and for some the survey is completed.

During the whole of the war period, and since, the erection of public buildings has been deferred to as great an extent as possible, but nevertheless 283 Government buildings of various classes have been erected, including 131 post-offices.

Irrigation provision, like hydro-electricity supply, is a matter upon which educational effort is necessary, even to the extent, in the general public interest, of undertakings which, for the time being, do not completely pay their way. Irrigation works are of a peculiar nature. They are very similar to development roads in that they enable settlement to take place and production to be effected, which would be impossible without the water-supply which they provide. It is, of course, desirable that in addition to paying their way they should also provide interest and sinking fund, but in this respect the call for repayment of interest should not be so strong as in the case of hydro-electric undertakings. If electric power is

required and is not produced by hydraulic agency it can be produced in some other way, and the industry for which the power is required can still go on; but in the case of irrigation works, if the water is not supplied, nothing can take its place, and land which might carry from three to five sheep to the acre must remain tussocky waste, carrying less than one-tenth part of the stock; and crops which can be grown most luxuriantly with water cannot be raised at all without it. For every acre irrigated the State as a whole gains in many ways. Although the total number of sheep in the dry counties surrounding the irrigated area decreased between 1914 and 1922 the numbers carried by the irrigated area actually doubled, the increase being progressive and keeping pace with the increasing sale of water. The increase in irrigation receipts ever since irrigation water was first made available has been sustained, and this year I am glad to say that there has been a substantial surplus of receipts over working-expenses and maintenance costs. But more has yet to be earned—and it can be earned—to recoup the State for its expenditure.

EXPENDITURE.

The total net expenditure under all votes and accounts appearing on the public-works estimates for the financial year ended 31st March, 1922, was £6,922,039.

Of this sum £5,286,687 was expended out of the Public Works Fund, and the balance, £1,635,352, out of accounts which have their own ways and means and are quite separate from the Public Works Fund.

A brief summary of this expenditure, as well as the total expenditure since the inception of the public-works policy to the 31st March last, is shown below in tabular form :—

Class of Work.	Expenditure.	
	Expenditure for Year ended 31st March, 1922.	Total Expenditure to 31st March, 1922.
	£	£
Railways—		
New construction	1,276,820	28,466,020
Additions to open lines	1,856,380	12,269,621
Roads	564,159	13,111,960
Public buildings	344,739	8,635,603
Immigration	247,528	2,507,271
Purchase of Native lands	...	2,061,739
Lighthouses, harbour-works, and harbour-defences	18,774	1,175,553
Tourist and health resorts... ..	17,996	304,181
Telegraph extension	590,981	5,000,427
Development of mining	2,130	885,805
Defence-works (general)	15,586	1,086,052
Departmental	128,002	1,817,407
Electric-power supply and development	600	...
Irrigation and water-supply	82,713	332,892
Payment to Midland Railway bondholders	...	150,000
Lands-improvement	17,478	157,846
Minor works and services	...	312,607
Plant, material, and stores	106,432	435,638
Timber-supply and sawmills for Public Works Department	16,369	16,369
Cost and discount, raising loans, &c.	174,280	1,427,538
	5,460,967	80,154,529
Wellington-Hutt Railway and Road Improvement { Railway	...	228,374
Account { Road ...	...	101,658
Railways Improvement Account	...	641,275
Railways Improvement Authorization Act 1914 Account	141,860*	814,379
Loans to Local Bodies Account—Roads to open up Crown lands	...	697,408
Opening up Crown Lands for Settlement Account—Roads to open up Crown lands	...	206,626
Land for Settlements Account—Roads to open up Crown lands	51,471	403,113
National Endowment Account—Roads to open up endowment lands	...	53,401
Aid to Water-power Works and Electric Supply Account	834,060	1,638,007
Waihou and Ohinemuri Rivers Improvement Account... ..	54,379	243,453
Education Loans Account... ..	563,201	777,772
Totals	7,105,938	85,959,995

* Includes proportionate cost of loan raised under this account.

WAYS AND MEANS.

On the 1st April, 1921, the available ways and means for public-works purposes were	£	£
.....	....	489,489
Additional funds were received as follows :—		
Under Finance Act, 1920, section 15 (public works)	560,000	
Under Finance Act, 1921, section 10	2,673,111	
Aid to Public Works and Land Settlement Act, 1921	2,155,290	
Other receipts—		
(a.) Recoveries on account of expenditure of previous years	11,616	
(b.) Special receipts in connection with the Ellesmere and Forsyth Reclamation and Akaroa Railway Trust Account	1,583	
	—	5,401,600
Thus making available for expenditure a gross total of	£5,891,089	

The actual net expenditure on all works and services chargeable on the Public Works Fund for the year was—	£	£
(a.) Under appropriations	5,286,687	
(b.) Under section 6, subsection (1), of the Ellesmere Land Drainage Act, 1905	439	
(c.) For charges and expenses of raising loans	174,281	
	—	
Making a total of	£5,461,407	

This left a credit balance in the Ways and Means Account at the 31st March, 1922, of	£	£
.....	....	429,682
Legislative authority exists for providing further funds as follows :—		
In terms of Aid to Public Works and Land Settlement Act, 1921	2,844,710	
It is proposed to make further provision this session for an additional	4,000,000	
Transfer from accumulated surpluses (part of £1,250,000)	1,000,000	
	—	7,844,710
Making available for the current year a total of	£8,274,392	

The estimated expenditure on public works for the current year (exclusive of accounts which have their own ways and means) is £4,967,223, which will leave a credit balance of £3,307,169 to be carried forward to next year (1923–24).

Exclusive of the before-mentioned funds, statutory authority at present exists for raising the following moneys for public undertakings which are not chargeable against the Public Works Fund, but which have their own statutory ways and means, viz. :—

	£	£
(a.) Aid to Water-power Works Act, 1910	....	31,000
(b.) Finance Act, 1919 (addition for Waihou and Ohinemuri Rivers Improvement Account)	....	34,000
(c.) Electric-power Works Loan, 1919	4,229,990	
(d.) Finance Act, 1920, section 15 (electric-power works)	2,750,000	
	—	6,979,990
		£7,044,990

RAILWAY-CONSTRUCTION.

Only one section of completed railway (Clyde to Cromwell, 12 miles 34 chains in length) was handed over to the New Zealand Railways Department during the year, although other sections were in a sufficiently advanced state to permit of a goods and passenger service being maintained by my Department.

The Mount-Matata Section, 40 miles in length, has been completed for several years, but owing to its isolation has not been taken over by the New Zealand Railways Department. A regular service under Working Railways conditions, however, is in operation.

The net expenditure on construction, maintenance, and supervision for the financial year was £3,265,440, as follows:—

Construction, improvement, and maintenance of new lines	£ 1,276,820
Additions to open new lines (rolling-stock, locomotives, &c.)	1,856,380
Railways Improvement Authorization Act 1914 Account	.. 132,240

Total		£3,265,440
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The following is a brief description of the work carried out during the year on the principal lines:—

KAIHU RAILWAY EXTENSION.

Formation, except a small portion of road approaches at Aranga and Donnelly's, is complete. Platelaying on the main line and at Aranga and Donnelly's station-yards has been finished. The final lifts of ballast have been completed except at the two station-yards. It is anticipated that this section will be handed over this year.

The concrete piers and abutments of the bridge at Donnelly's station-yard have been finished, and the steel girders erected. The bridges at 21 miles 24 chains and 22 miles 65 chains will be completed shortly. Passenger platforms and loading-banks have been constructed, cottage-sites cleared, and approaches made.

Tenders will shortly be invited for the erection of station buildings and cottages, the Department supplying the timber from its mill at Whatoro.

This section will be ready to transfer to the New Zealand Railways on completion of the bridges at 21 miles 24 chains and 22 miles 65 chains.

WHANGAREI BRANCH.

Oakleigh Section.—The deviation at 7 miles 15 chains has been completed and the rails on either side connected. Ballasting has been finished and efficiently maintained. A temporary connection from the main line to the Portland Cement Company's quarry line has been used to enable cement-supplies being loaded direct into the Department's wagons.

Tauraroa Section.—Work has been confined chiefly to removal of slips and maintenance. One large embankment at 9 miles 75 chains gave considerable trouble through subsidence, which necessitated drainage drives to reach the seat of trouble. The output of the Tauraroa crushing plant was over 21,000 yards.

To provide increased quantities of ballast for the Main Trunk connection an auxiliary crusher has been installed, and fresh tenders have been invited for the further supply of stone for crushing purposes.

Waiotira Section.—I referred in my last Statement to the treacherous nature of the country traversed by this line, and two deviations have been made to avoid dangerous ground. These deviations have proved satisfactory. A drainage drive was constructed in the bank at 17 miles 10 chains, which has prevented further subsidences.

Throughout the whole section large drains are being made in the cuttings, pipes laid in them and covered with boulders to facilitate drainage and prevent upheaval of the line. The toes of slopes that slip will be protected with stone walls. It is confidently expected the line will become stabilized by the end of the approaching summer.

Platelaying on the deviations above referred to completes the linking-in of the main line from Portland to Waiotira.

The Tie tamping-machine has been used on this line with marked success. The ballast is tamped quickly, tightly, and evenly, thereby producing an even running-track, and minimizing the cost of maintenance—which has hitherto involved heavy and constant expenditure when hand-packed. A contract has been let for the girder spans of bridges from Portland to Waiotira.

The goods traffic has been exceptionally heavy from Portland (cement and coal) and from Oakleigh, where a wharf gang had to be constantly employed discharging and loading cargo.

Most of the traffic was in connection with the Main Trunk Railway, but the goods and produce of trades-people and settlers were carried. A passenger service has now been inaugurated, and is increasing to an extent necessitating additional carriages. It is anticipated that this class of traffic will still further develop during the coming summer.

WAIPU BRANCH.

Ruakaka and Waipu Sections.—The principal work on the former section consisted of formation over the mud-flats, about a mile of which is now complete. One steam-shovel was engaged continuously excavating from a borrow-pit. No work was done on the Waipu Section.

NORTH AUCKLAND MAIN TRUNK.

Huarau Northwards.

Paparewa Section.—Second and third lifts of ballast have been placed on the main line throughout, which completes this section, with the exception of plate-laying, ballasting, and buildings in Paparoa station-yard, clearing up northern approach cutting to Huarau Tunnel, and general cleaning-up.

Mareretu Section.—Workmen were concentrated on this section during the year, and considerable progress was made. Fifty horses were transferred from the Whangarei end for plough and scoop work, with excellent results.

Enlarging and lining Golden Stairs Tunnel (south end) was commenced last July, the position now being that $12\frac{1}{2}$ chains of lining are completed.

Work was delayed during the months of October and November by a strike of workmen for higher rates of pay. During this suspension of work the "Chicago" compressor plant was extensively overhauled and repaired. Both plant and men are now working satisfactorily, and during the last three months $4\frac{3}{4}$ chains of lining has been completed.

At the north end a commencement was made in October with the bottom heading. Lining, however, was delayed till January of this year as a result of difficulty in procuring experienced men.

A subsidence in the first length caused further delay. Working-conditions at both ends of this tunnel are good. The men appear to be contented, and at the present rate of progress the remaining $11\frac{1}{2}$ chains of lining should be finished by the end of November. Only 5 chains now separate the bottom heading faces.

During the year a second and third lift of ballast was laid over the whole length from Paparoa station-yard to Golden Stairs. The Mareretu Section is well in hand and should be ready for service about February next.

Waikiekie Section.—Suitable labour was concentrated on the erection of Mangawai River Bridge. Considerable difficulty was experienced with pile-driving on account of the soft ground, which necessitated pile cradling and splicing: this portion of the construction, however, is practically finished.

Temporary staging and other preliminary work has been done in connection with Kikowhiti Bridge erection, and pile-driving is being commenced. This bridge should be completed in three months.

Between 102 miles 48 chains and 103 miles 9 chains a deviation had to be made, as practically the whole locality was slipping, so much so that large cuttings were completely filled. The Waiotira station-yard was completed with two steam-shovels, which excavated 30,000 cubic yards to make up the required filling.

The Mareretu Tunnel was completed last April, $13\frac{1}{2}$ chains having been lined during the year and one portal built. Owing to the treacherous nature of the

ground, heavy, closely-placed timbering was necessary for the entire length, and the complete section was encased in concrete. It was only by vigorously pushing on the excavation, followed closely by the concrete lining, that construction was at all practicable.

About three miles of temporary line has been removed and replaced with permanent rails, and a commencement made with laying the sidings in Waiotira station-yard. It is anticipated that the permanent rails will reach Kikowhiti Bridge by the end of the year; and by March, 1923, rail connection should be established between Whangarei and Auckland.

Ballasting (first and second lifts) is proceeding at a rapid pace.

Both passenger and goods traffic has been heavy over the length north of Mareretu Tunnel, and it will increase in volume as the permanent rails are extended southward, especially when through connection has been established with Auckland.

Kirikopuni Section.—Operations have been confined to the northern end of this section. A temporary tram-line has been laid from the Wairoa River to Omana Tunnel. The northern approach to this tunnel has been opened, but owing to the treacherous nature of the country it was impossible to commence driving in the usual way, and three lengths of reinforced-concrete section-lining had to be built at the entrance.

It is proposed to construct a jig-line over the tunnel hill for the transport of material for driving operations at the southern end.

Kaikohe Northwards, Okaihau Section.—Slips on this line have caused trouble, but I am pleased to say that the measures taken to cope with these have proved effective. Rails are being laid in Okaihau station-yard.

Goods traffic has been commenced, and within a few weeks it is intended to commence a passenger service, which will be a great benefit, particularly to Hokianga residents. Mails will also be carried between Kaikohe and Okaihau. A concrete water-reservoir has been commenced at Okaihau, and it is hoped to have yards erected before November next, to facilitate the transport of sheep and cattle from Hokianga to the freezing-works at Moerewa.

WAIUKU BRANCH.

Both sections of this line have been finally completed and transferred to the New Zealand Railways Department for regular traffic purposes.

HUNTLY-AWAROA.

Steady progress has been made with this line. Formation, bridge and culvert construction, drain-cutting, and access-road formation are in hand from 7 miles 20 chains to 9 miles.

The earthworks on this line are heavy. The nature of the material to be excavated renders it economically necessary to employ large plant, and three steam-shovels have been installed. Considering the difficulties to be overcome good progress has been made.

It is proposed to let a contract for the Summit cutting to the owners of the coal-mines at the terminus of the line. The advantage of this is that material from the cutting will be used for the special mine sidings.

WAIKOKOWAI BRANCH.

A contract has been let for the land-plan survey of this railway, and this should be completed shortly.

EAST COAST MAIN TRUNK RAILWAY.

Waihi-Taneatua (including Mount Branch).

Athenree Section.—Formation is practically complete. Several cuttings and banks having been completed. Athenree station-yard has been widened, and filling around abutment "A" of Mangatoetoe Bridge is in hand. Seven bridges are in various stages of construction. Adams Street subway is well advanced, and subway at 8 miles 62 chains has been completed.

Katikati Section.—Formation, culvert-building, line clearing and fencing have proceeded steadily along several miles of this section. Permanent survey has been completed to the Wairoa River, and plans are in course of preparation.

Tauranga Westwards.—Work on this section was practically suspended last February. One overbridge was completed. Another similar structure, including the approach and the road to Tauranga Railway-station, are in hand.

Matapeihi Section.—Satisfactory progress has been made with the Tauranga Harbour Bridge. The completed work during the year consisted of concreting and reinforcing 106 lineal feet of cylinders, 155 ft. of cylinder-sinking, while six piers were sealed and are in readiness for filling in. Cylinder L has been filled in, and core-rods placed in position. The Matapeihi embankment was completed, and a loading-platform erected for delivery of stone for the Tauranga waterfront works.

Mount-Matata Section.—Several banks have sunk, but have been efficiently maintained throughout the year. The passenger and goods railway service has been continued.

Rangitaiki Section.—Cuttings have been widened, over a mile of drains cut, and the approach road to the Rangitaiki Station put in hand. Three steam-shovels were in operation at different times at Awakaponga, the spoil being deposited in the several banks along the line. Many culverts have been built, and one bridge completed.

Awakeri Section.—Little work has been undertaken on this line, except 15 chains of drain-cutting and about 2 miles of fencing.

Taneatua Section.—106 chains of formation have been completed during the year, culverts erected, and necessary drains cut. A "Marion" steam-shovel commenced work in May last, and an "Osgood" is in course of erection. A departmental telephone-line 5 miles long was erected, and a small amount of platelaying done. The rail-head is now 52 miles from Tauranga.

Mount Workshop.—A large quantity of material for use in the erection of the Tauranga Bridge has been prepared, consisting of cylinder core-rods, reinforcing for piers, transoms (straight and curved), extension stringers, sway and diagonal bracing, cutting and drilling top chord and wind-brace gussets and cover and stiffening plates. The fabrication of structural steel for numerous bridges throughout the Dominion as well as the structural steel for boiler and engine roof-trusses for Otira power-houses have been completed.

GISBORNE-NAPIER RAILWAY.

Eskdale Section.—The river gap at 0 miles 32 chains still remains to be filled; in the meantime a temporary bridge has been provided to allow platelaying to proceed. The Harbour Board has completed the filling on the main line at 0 miles 55 chains, but still has the completion of the port line to attend to. Both this and the gap at 0 miles 32 chains are dependent upon the completion of the river-channel by the Harbour Board.

Platelaying was commenced and completed almost to the Westshore station-yard, and it is anticipated that the rails will reach Petane in October. Two more platelayers' cottages of concrete blocks have been erected, and the Stationmaster's house in similar material is almost complete. Platform and loading-banks have been finished at Eskdale station-yard.

Tutira Section.—Fair progress has been made in various cuttings, especially where the "Thew" steam-shovel has operated. Formation is now practically complete to 14 miles 47 chains. Concrete piles for the bridges at 11 miles 41 chains and 13 miles 35 chains have been made, and abutment D at the former has been completed.

Ngatapa Section.—A passenger and goods service has been operated during the year.

The Ngatapa station-yard and formation (where necessary) have been raised above flood-level.

The formation at Repongaere station-yard was brought up to correct level. Bridges have been maintained, culverts lengthened, and the third lift of ballast spread from 9 miles 40 chains to Ngatapa Station. The Waipaoa ballast-pit line has been taken up and shipped to Wairoa.

Waikura Section.—The cutting at 11 miles 65 chains gave much trouble by slipping. The slips, however, have been removed and used for raising Ngatapa station-yard above flood-level.

Several cuttings have been completed, and formation is now roughly complete to 13 miles.

Rails are laid to 11 miles 55 chains, the first lift of ballast to 11 miles 50 chains, the second lift to 10 miles 60 chains, and the third to 10 miles 45 chains.

A "Marion" steam-shovel has been worked between 11 miles 65 chains and 11 miles 75 chains throughout the year.

WAIROA-WAIKOKOPU.

Nuhaka Section.—The formation over the whole section is sufficiently completed to admit of rails being laid throughout. Three miles of rails have been laid at the Wairoa end, and a further 50 chains of wharf-siding to the Wairoa River. Platelaying-material was unloaded at Waikokopu Harbour and carted to Nuhaka, where permanent rails were laid from 17 miles 47 chains back to 13 miles 62 chains.

A line to ballast-pit near the 15-mile peg has been laid. From this pit practically all the ballast for this line will have to be obtained.

A Stationmaster's and three platelayers' cottages have been erected at Wairoa, and two platelayers' cottages at Nuhaka.

Waikokopu Section.—The heavy formation from Nuhaka to Waikokopu has been steadily pushed forward despite the very unfavourable weather experienced. It is anticipated the formation will be sufficiently advanced to admit of rails being laid right through by January next. A large number of men are employed, and some of the cuttings are being worked with double shifts to expedite completion.

Three steam-shovels are now in operation on this line.

STRATFORD.—MAIN TRUNK.

Matiere Section.—Platelaying was commenced in November last, and on the 23rd May of this year the line, 10 miles 23 chains in length, was formally opened for goods and passenger traffic under my Department's control.

One lift of ballast has been laid over the whole length, and a commencement made with the second.

The Ongarue combined bridge was finally completed during the year. It consists of two decks: the upper, which carries the railway, has two central 60 ft. trusses, outflanked by one 45 ft. and one 25 ft. steel-plate girder at each end. The lower or vehicular-traffic deck is carried on the bottom chords of two 60 ft. trusses.

The concrete-work on three of the Ohura River bridges has been completed, and temporary superstructures have been provided to carry the traffic. The fourth Ohura crossing is provided with a temporary structure to carry the traffic. The excavation for foundations of the permanent piers for this bridge has been commenced. The steelwork for these four bridges is being prepared in the Mount Workshops, Tauranga. Two subways have been completed, one to give access for a sawmill tramway, and the other for the Otahu access road.

The principal work remaining to be done comprises completion of ballasting, finishing bridges, Tuhua and Matiere station-yards, and the necessary buildings at these two stations.

Ohura Section.—Formation-work on this length is now being opened up.

Tahora Section.—All earthwork formation and platelaying has been completed. At Tahora Station a water-service has been installed, shelter and goods sheds erected, and station-platform and loading-bank built.

The main Ohura Road, which is used as a service road, has been efficiently maintained. A bi-weekly passenger and goods service has been run between Kohuratahi and Tahora, connecting with New Zealand Railway service at Kohuratahi.

Te Wera Quarry.—A branch line, 1 mile 16 chains in length, connecting with the Stratford—Main Trunk Railway at 22 miles 63 chains, has been constructed.

Stripping has been commenced, and 50,000 yards of rock is ready for excavation. The crusher has been erected, and as soon as the bins, which are in course of erection, are complete, crushing operations will proceed. Suitable accommodation has been erected to meet the needs of all employees.

OPUNAKE BRANCH.

Kapuni Section.—The formation, with the exception of a little widening and easing batters, is fully ready for platelaying. This latter work has been commenced, and 34 chains of rails laid. Platelaying will now proceed uninterruptedly except for the time required for launching girders on Mangatoki and Kapuni bridges. A steam-shovel has been employed stripping ballast-pit at Kaupokonui River, and 18,000 yards of stripping removed. A goods-shed has been erected at Kapuni Station.

Auroa Section.—Work has been confined primarily to fencing (which is complete except for flood-gates), culverting, and earthwork, including excavation of Auroa station-yard, which is nearing completion.

Pihama Section.—About a mile of formation has been finished, the remaining culverting is in hand, and clearing, including logging and stumping, has been finished to 14 miles 60 chains.

A concrete-block platelayer's cottage has been erected in Pihama station-yard at 16 miles 40 chains.

Opunake Section.—This section has only just been commenced, the work done being of the usual preliminary character—viz., erecting camps, clearing, carting shingle, draining, besides a little formation.

Manaia Section.—The only work done on this branch was completion of cutting at 3 miles, the erection of gates at private crossings, and general maintenance.

MIDLAND.

Glenhope-Murchison.

Kawatiri Section.—Tunnel at 62 miles 43 chains. A commencement was made in November with one shift, and 246 ft. of bottom heading has been driven. The material encountered is hard granite, broken with seams of quartz, which has made both drilling and shooting difficult.

The piers for Hope River Bridge have been completed, and the four girders have been erected for field riveting.

The temporary bridge was seriously damaged by flood in March last, but it has been restored to the level of concrete piers and is ready for the launching of girders.

Otira-Bealey.

This section extends from Arthur's Pass Station, the present railway terminus on the Canterbury side of the pass, to Otira Station, the present railway terminus on the Westland side. The section is only 8 miles 54 chains long, but includes the Arthur's Pass or Otira Tunnel, of 5 miles 25 chains in length, and nearly the whole length of the section is on a grade of 1 in 33, the summit of the line being 1,177 ft. above the Otira Station and 2,436 ft. above sea-level.

The lining of the tunnel was completed in October, and the floor has now been cleaned up and the permanent 100 lb. track laid from 51 miles 54 chains to 58 miles 40 chains, with the exception of about 10 chains across the Rolleston Bridge. The dismantling of buildings and plant required in the tunnelling operations has commenced, and portions of the plant transferred for use on other works.

A crushing plant, with two crushers and a steam-navvy, was installed at Arthur's Pass, and with this and the aid of a small crusher at Otira the line has been ballasted and lifted with the first lift from 51 miles 54 chains to 58 miles 12 chains.

Arthur's Pass Station-yard.—The formation was completed, and a start made with the concrete kerbing for the platform and excavation for the subway. A permanent water-supply for railway and village requirements has been located.

Bealey Bridge.—This bridge is immediately at the Canterbury portal of the tunnel. It is a skewed structure, and includes vertical and horizontal curves in the track. The permanent superstructure, comprising about 230 tons of structural steel, has been delivered at site, and six of the girders riveted up ready to be placed on the piers.

Electrical Equipment.—The steam-power station located at Otira has been erected in reinforced concrete, and the associated workshops, electric-locomotive sheds, and coal-bunkers are nearing completion. Overhead electric cranes are being installed in the main engine-room, workshop, and over the coal-bunkers.

The boiler equipment comprises three Babcock and Wilcox marine-type boilers, specially arranged to meet the conditions of load that will exist. A large quantity of the material has arrived and is in course of erection.

Of the engine-room equipment two steam electric generating sets of 100 kilowatts capacity have been erected, with condenser, also the condensers for the main traction turbo-generating sets. A quantity of switch-gear and piping is on the site.

The main turbo-generators will supply electrical energy to the locomotives at 1,500 volts, and the first of the two sets was shipped from England early in June, the second set being then in an advanced state of erection at the makers' works.

The five main-line electric locomotives are in various stages of completion at the Dick-Kerr works of the English Electric Company. The motors and control-gear have undergone satisfactory tests, and the final assembly of the first two locomotives is nearing completion.

Inangahua Junction.—The condition of the Inangahua Junction Traffic-bridge is such that rebuilding is essential. It is proposed, therefore, to make provision enabling the combined road and railway bridge to be put in hand immediately.

In connection with the overhead equipment of the line, the contractors have installed feeder cables throughout the tunnel, involving the erection of 6,000 cast-iron racks, and arrangements for erecting the poles outside the tunnel are in hand. The wiring of the tunnel for electric lighting has been completed. Some 1,500 rail-joints have been bonded.

The shipment of boilers and electrical machinery has been seriously delayed by the widespread lockout in the engineering industry in Great Britain.

Water-supply.—The development of Goat Creek for the supply of condensing water at Otira has been undertaken and pipes ordered. To provide sufficient water for condensing purposes and for operating air-pumps, two storage reservoirs have been provided in the designs, and excavation for these is nearing completion. The pipe-line has been cleared and a road formed to the intake. The intake dam across Goat Creek has been concreted.

Village.—A site for some forty-three cottages has been prepared at Otira, and fourteen are in course of erection.

At Arthur's Pass the sites for eighteen cottages have been cleared, and excavation carried out for sixteen.

It is hoped to have trial runs by the end of the year, and if these prove satisfactory general traffic will be carried.

GREYMOUTH—POINT ELIZABETH.

Platelaying has been completed to 5 miles 69 chains, and about three-quarters of a mile of sidings linked up. First and second lifts of ballast have been placed from 3 miles 46 chains to 5 miles 68 chains. Necessary side drains have been cut and culverts built. A temporary bridge over the Seven-mile Creek has been erected.

Excavation for a 25,000-gallon reservoir is complete. Water-race has been graded and suspension rope swung across Rocky Creek to carry the water-pipes.

OREPUKI—WAIATU.

Orawia Section.—Work has steadily proceeded, and the formation, with the exception of two cuttings which are well advanced, is complete throughout. It is proposed to proceed at once with platelaying and ballasting.

LAWRENCE—ROXBURGH.

Formation is more or less complete over the first 4 miles, except in cuttings which have been left narrow, as the balance of widening can be more expeditiously carried out when the construction-train is available for removal of spoil.

The Beaumont Creek Bridge is in hand, abutments A and E are complete, and pier D finished to hand-holes.

Rails have been laid to this bridge, and will proceed beyond after its completion.

SURVEYS.

Rimutaka Deviation.—Work on the various trial surveys in connection with the Rimutaka deviation is nearing completion. The surveys of the Tauherenikau and Coach Road routes have been completed, and plans and estimates are being prepared. The party is now being moved to complete the survey of the Wainuiomata route, work on which was suspended during the war.

Tuapeka Mouth Branch Railway.—During the year the various trial surveys for the above railway were completed. Three routes were surveyed, as follows: (1) Crichton to Tuapeka Mouth via Hillend; (2) Lovell's Flat to Tuapeka Mouth via Lovell's Creek and Hillend; and (3) Lovell's Flat to Tuapeka Mouth via Stony Creek and Hillend. A fourth route, running from Sterling to Tuapeka Mouth, and known as the Riverbank route, was surveyed some years ago. Plans and estimates for all these routes have been prepared and reports submitted. Plans have also been forwarded to the Agriculture and Railways Departments for investigation and report.

Dunback-Kokonga Railway.—A reconnaissance survey of this suggested railway was made during the year, and approximate estimates prepared.

PLANT.

In the last Statement I said something about the installation of a large quantity of machinery on the works and about the beneficial results obtained. I am pleased to be able to announce that the results of last year's work with the plant have been highly satisfactory, and have more than justified the outlay involved.

The class of machinery most beneficial on our public work is that in connection with the excavation and transport of earthwork, and in this direction our plant has not only speeded up the rate of work, which was to be expected, but it has also considerably reduced the cost, a result not always so easily attained.

The excavating machinery consists chiefly of steam-shovels and drag-line excavators for heavy earthwork, and scoops, hauled by caterpillar tractors, for the lighter work. Thirty-four steam-shovels and drag-lines are now at work, and an indication of their economy is provided in the fact that the average cost of excavation by these shovels during the last year has been 2s. 3d. per cubic yard, whereas the cost by hand would undoubtedly have been 30 per cent. higher.

This rate, of course, includes haulage, which has chiefly been done by small construction locomotives, which attend almost every steam-shovel. The equipment necessary for excavation by a steam-shovel, consisting as it does of a locomotive, a large number of trucks to cope with the increased output, and appliances for tipping trucks and spreading material, is in many cases more expensive than the steam-shovels themselves. Success and economy have also been achieved in transporting material from steam-shovels by means of caterpillar tractors hauling rakes of trailers.

The excavation-costs of drag-line machines have been so satisfactory that I have considered myself justified in purchasing from England this year two machines of a much larger type than any yet used in this country, and I am hoping to have these in operation early next year.

The metalling of roads presents one of our most difficult problems, and one in which there is considerable economy to be obtained by using modern appliances. The actual crushing of the road-metal is the part of the problem most easily solved, and a large number of modern stone-crushing and screening plants installed now for some years have economically settled this point. The haulage of road-metal is, however, a more serious matter, and one whereby a great deal of money can be wasted. The solution so far seems to have been the use of the motor-lorry, and therefore the Department has invested in a considerable number of these for the purpose. This service has resulted in a considerable saving over the old methods of haulage, and has enabled lengths of road to be metalled on which the cost would have been almost prohibitive by any other means, chiefly on account of the distances over which the haulage was necessary.

The Department is now constantly on the lookout for machines that will accelerate and consequently cheapen the rate of work, and, in addition to the above examples, much advance has been made in regard to tunnelling and concreting machinery used. It is now recognized that machinery sets the pace and speeds up construction, especially when concentrated.

It must be remembered that any reduction in the time of the completion of a work by the use of better appliances results in a shorter period in which capital lies idle, and therefore in a reduction of interest and overhead charges. Very often I know it can be shown that machinery has not actually reduced, and has even sometimes increased, the construction-costs of a work, but investigation would show that the saving in interest and overhead charges on idle capital has compensated many times over for the use of the plant.

I am pleased to say that none of the larger works in this country have as yet shown an increase in construction-costs by the use of larger plant, but even had it been so I would consider myself quite justified in its use if I were satisfied I could save eventually by a reduction of interest and overhead charges.

RAILWAYS IMPROVEMENT AUTHORIZATION ACT, 1914.

The expenditure under this Act amounted to £132,241, for grade easements, formation of new line signalling interlocking and safety appliances, new station and station-yards, goods-sheds, and terminal facilities at Auckland, Wellington, and Addington.

ADDITIONS TO OPEN LINES.

The expenditure out of the Public Works Fund under the head "Additions to open lines" amounted to £1,856,380. Of this sum £1,121,132 was expended in the provision of additional rolling-stock, tarpaulins, Westinghouse brakes, workshops machinery, and steam heating. The balance covered expenditure upon improvements to engine-depots, workshops, station facilities, water-services, additional dwelling for the staff, signal, tablet, telegraph and telephone installation, bridge-work, subways, and purchase of land.

PUBLIC BUILDINGS.

GENERAL.

Parliament Buildings, Wellington.—A large amount of work was carried out in this building during the year, and was finally completed in time for the opening of Parliament. The most important portion was the working and setting of the ornamental marble for the interior finish of the main lobbies, together with the marble tiling and the general finishing-work. A particular feature of the finishing-work was the Cabinet-room. This has been panelled in Canadian walnut and birdseye maple, the timber being supplied by the Canadian Government as a gift to the New Zealand Government, the working-up and finishing being carried out in the Department's local workshops.

DEPARTMENTAL BUILDINGS.

Auckland (Stamp Office).—An additional story in brick was erected, and alterations carried out to provide additional accommodation for both the Deeds and Stamp Departments.

Wanganui.—The Wanganui Native Land Court building, which was commenced last year, has been completed. It is of brick with plaster finish inside and out, and comprises Court-room, offices, strong-rooms, and outbuildings.

COURTHOUSES.

New Courthouses were erected at Waipukurau and Pukekohe.

With these exceptions, only essential repairs and maintenance were carried out.

PRISONS.

Prison-building operations were limited to the completion of partially constructed buildings, and the provision of purely essential accommodation. Three cottages for married officers were completed on the Auckland Prison Reserve, and also a shelter-shed for the prisoners in the quarry. At Waikeria Reformatory, quarters for the single officers have been completed and are now in occupation.

Inmates of this institution were employed clearing and bringing into cultivation a block of land on the Tokanui Mental Hospital Reserve. Roadmaking and sawmilling have been pushed on at the Waikune Camp, Erua, and considerable quantities of timber have been supplied for public works during the year. The new Hoffman brick-kiln at Wi Tako Prison, Trentham, has been completed, and bricks in large quantities are now being turned out. The construction of the second cell-range and kitchen block at Paparua has progressed satisfactorily, the kitchen block being now in occupation and the cell-range well advanced. The new kitchen block at the Borstal Institution is now approaching completion, and two additional cottages have been built for married officers.

POLICE-STATIONS.

Expenditure was restricted practically to the completion of works for which contracts had already been entered into, the purchase of a few properties in cases where there were no other means of obtaining accommodation, and essential maintenance. New police-stations were erected at Bull's and Waikari, and a sergeant's residence at Mount Cook (Wellington); the new police-station at Dannevirke and sergeant's residence at Palmerston North were completed; additions and improvements were made at Seddon Police-station; and the police buildings at Karangahake were removed and re-erected at Matamata. Alterations and improvements were made to the properties which had been purchased during the previous year at Green Island, St. Kilda, Port Chalmers, Woodhaugh, and Ravensbourne. Houses for use as police-stations were purchased at Whataupoko, Takapau, North Invercargill, Tuatapere, and Winton.

New police buildings are required at a number of places where the existing buildings, many of which were erected over forty years ago, have become almost unfit for habitation, and also where the Department has at present to rent unsuitable properties at high rentals. Provision for the erection of police-stations at such places is being made on the current year's estimates, with a view to the works being proceeded with as soon as financial circumstances permit.

POST AND TELEGRAPH BUILDINGS.

Plans are in course of preparation for a number of post-office buildings, the erection of which will be proceeded with when finances permit.

During the year departmental buildings were erected, or the erection completed, at Alexandra, Amberley (line foreman's residence), Aria, Chatham Islands (Superintendent's residence), Devonport (automatic telephone-exchange building), Fitzroy, Garston, Henderson, Hororata, Lumsden, Manurewa, Matawai, Nightcaps, Onehunga (automatic telephone exchange), Papanu, Paraparaumu, Ranfurly, Rangiotu, Rockville, Tapawera, Taupiri, Te Kopuru, Waiotemarama, Whakahoro.

Alterations rendered necessary by growth of business were carried out at Chatham Islands (radio-station), Dunedin, Hawera, Morrinsville, and Timaru.

The old post-office building at Port Nelson was removed to Stoke, where it was refitted for use as a post-office.

Small buildings were purchased at Cave, Mayfield, and Mokauti, and adapted for use as post-offices; also at Glen Orua, where the old building had become unsuitable for use as a post-office.

MENTAL HOSPITALS.

Additions in brick to auxiliary No. 2 female ward at the Auckland Mental Hospital, to accommodate eighty patients, were completed.

Minor repair and maintenance works have been carried out at the Avondale Mental Hospital, and a new roof put on part of the Wolff Home.

The Tokanui Mental Hospital male admission block, with pressed bricks and rough-cast walls, was completed, giving accommodation for approximately twenty patients.

At Nelson a new reception block in brick was recently completed.

Extensive additions to provide for kitchen, bakehouse, workshop, store, staff dining-room, billiard-room, and nurses' quarters are being carried out by day labour at Hokitika Mental Hospital, while the usual maintenance-work has been attended to.

Maintenance-work has been carried out at Seacliff, and a new unit has been completed at Waitati. A day-room extension has been erected on the women's side of the main building at Sunnyside. At Hornby the alterations and additions have been completed.

HOSPITALS AND CHARITABLE INSTITUTIONS.

Among the works carried out during the year was the renovation and improvement of military hospitals taken over by the Health Department from the Defence.

A very considerable amount of this renovation-work, however, had to be postponed owing to financial circumstances, but must be proceeded with as soon as funds will permit.

The St. Helens Hospital accommodation recently erected at Auckland, and which is almost internally completed, is of brick and provides for thirty-seven beds, together with all facilities and requirements for carrying out the functions required in a modern maternity hospital.

Similar accommodation is required in Christchurch, and as soon as finances will permit this important work will be taken in hand. In the meantime the present buildings have been put in repair, and additional accommodation has been provided for the nurses.

EDUCATION.

During the past financial year the expenditure on educational buildings was £565,670—£563,201 from the Education Loans Account, and £2,469 from the Public Works Fund, the latter amount being expenditure not provided for by the Education Purposes Loans Act, 1919. This expenditure exceeded by over £100,000 that for the previous year, which was at that time a record. The large expenditure was owing to the fact that during war-time the amount approved for the erection of educational buildings was reduced to a minimum, and after the war closed very substantial grants were approved to overtake the arrears of urgent works, the cost of which had greatly increased. So difficult was it, however, to obtain the necessary labour and materials that there was considerable delay in carrying out the work, and consequently much of the expenditure during the past year had reference to authorities given during previous financial years. In this connection it may be pointed out that, while at the end of the financial year 1920-21 the unexpended commitments were £825,661, at the end of the last financial year the amount was only £366,766. Of the total expenditure for last year £328,228 was for primary schools, £101,199 for technical-school buildings, £81,197 for secondary schools, and £39,071 for University buildings.

Circumstances, however, necessitated a considerable curtailment of sums approved for new buildings, and the total new grants for the year were only £105,424, as against £724,902 for the previous year. Grants were confined to cases of the greatest urgency, and were made as far as possible for actual school accommodation, chiefly in backblock districts. Wherever possible, temporary accommodation in the form of rented buildings is being utilized in lieu of providing permanent buildings.

At the close of the year there were before the Department applications amounting, under all heads, to £600,376, of which £461,403 had reference to public schools.

The urgent necessity of providing funds for the many pressing requirements is fully recognized, and it is hoped, in the not-far-distant future, to revert to the progressive building policy initiated a few years ago.

LIGHTHOUSES.

Owing to the site of the East Cape Lighthouse at East Island having become dangerous, it was decided to transfer the lighthouse to the mainland. Its removal was undertaken during the latter part of the year, and its re-erection on the mainland is nearing completion.

An automatic light was erected on Ninepins Rock early in the year, and first exhibited on the 30th August, and has proved very useful to navigation.

Two new cottages for keepers were erected at Cape Campbell, two at Cape Maria van Diemen, and one at Pouto, Kaipara, the old structures having become uninhabitable.

It is intended to proceed with the erection of automatic lights on Gable End Foreland and Mercury Island as soon as the Department's lighthouse expert is available.

Arrangements are being made for the installation of an oil-engine hoist for hauling goods from the landing to the lighthouse on Stephen Island in place of the present wooden whims, which are out of repair and unsuitable.

HARBOUR-WORKS.

All the buoys and beacons in the harbours under the control of the Department have been regularly overhauled, cleaned, and painted, and, where necessary, new moorings have been put down.

TOURIST AND HEALTH RESORTS.

No new works of magnitude were undertaken, but considerable improvements and additions were effected. At Rotorua wooden water-mains are being replaced by cast-iron ones, and a stand-by plant and extensions to the electrical system are in hand. Other works carried out were the erection of and improvement to residences at Rotorua, provision of "Crescent" gas lighting at the Hermitage, improvement and erection of huts at Tongariro National Park, construction of a further section of the Grave-Talbot track from Wakatipu to Milford, the purchase of Sutherland's accommodation-house at Milford Sound, and the installation of telephonic communication on the Te Anau—Milford Track, whereby travellers are able to communicate direct from Milford to Glade House, Te Anau.

The work of substituting iron for wood water-mains at Rotorua will be continued, as well as improvements at the various resorts. The necessity of the new massage building at Rotorua is recognized, and will be proceeded with when finances permit.

ROAD CONSTRUCTION AND MAINTENANCE.

The sum provided on the estimates for the year ending 31st March, 1922, for road and bridge construction and maintenance was less than for the previous year, but the expenditure has been greater—indeed, the heaviest on record for this class of work.

With a view to increasing the general productivity of the Dominion, the expenditure has been confined principally to those roads that are at present the only means of communication to and throughout settled districts where railway facilities do not exist, and in the development of new districts. These activities have been mainly in the direction of formation of new roads, construction of bridges and culverts, metalling existing roads, and general maintenance.

The works of greatest magnitude have been carried out by my Department, but local bodies have been entrusted with the execution of such undertakings as came within the scope of their capabilities.

It is estimated there are at the present time approximately 50,000 miles of formed roads and bridle-tracks in the Dominion, of which 27,000 miles are metalled. It is further estimated that an additional 20,000 miles require to be formed before the roading of the Dominion can be considered complete, even to an elementary standard.

The desirability, and indeed the necessity, of roads of a sufficiently high standard to carry all classes of traffic become more apparent each year, and it is now generally recognized that this standard can only be attained by proper organization and modern equipment.

The severe tests applied to road-surfaces by swiftly-moving and often heavy motor traffic have induced some local bodies to adopt a more modern and perma-

nent method of surfacing than mere metalling. The result of their experiences, I am informed, has demonstrated that it is more economical to adopt this system than incur the expense of costly repairs incidental to the previously existing systems of construction and maintenance.

Much information has been collected by my Department regarding modern methods of main-highway construction, and other matters relating to the roading problem generally, all of which will be available for immediate use when the Highways Bill has been placed on the statute-book of the Dominion.

The estimates for roads this year have been prepared as far as possible on a system of factors representing areas, populations, productivity, loans raised by local bodies, mileages of formed roads, amounts required for roads still to be formed and metalled, and values of Crown and Native lands still available for settlement, the last two of which are of the greatest importance when consideration is being given to the claims of the several districts.

The construction and improvement of roads was jointly discussed by the District Engineers and the representatives of the various local bodies, and as far as practicable the allocation of the moneys available was mutually agreed to, and I desire to record my appreciation of the reasonable spirit shown by local bodies in recognizing the monetary limitations existing at the present time.

During the past year the Department has continued, to as great an extent as possible, to avail itself of local-body organization for the expenditure of Government grants and subsidies.

There has been a tremendous demand throughout the country for the putting in hand of road and bridge works, but financial considerations have dictated the necessity of the selection of works of special merit for authorization, rather than a general authorization for all works, and although this has meant deferring many undertakings of considerable local importance the great majority of local bodies have adopted a helpful attitude and have materially assisted the Department through a difficult period.

TELEGRAPH EXTENSION.

During the year 106 miles of new telegraph and inter-urban telephone pole line, carrying 998 miles of wire, were erected. The telephone-exchange plant (subscribers' lines) was also considerably extended by the erection of 555 miles of pole line, carrying 5,271 miles of open aerial wire, and 63 miles of lead-covered cable, containing 15,110 miles of wire. The substantial increase over the figures of the previous year is due to supplies of material which had been under order for a considerable time becoming available.

The telephone exchanges were increased by six during the year, while twenty-six others are in various stages of completion. The number of new subscribers connected with telephone exchanges was 9,259, and this increase necessitated additional switchboard capacity at forty exchanges. There are 6,132 applicants awaiting telephone connections.

During the year considerable progress has been made with automatic-telephone installations, new exchanges having been opened at Oamaru and Kelburn, while the installations at Palmerston North and Khandallah are almost complete. The installation of automatic exchanges is proceeding at several places in the Auckland metropolitan area, and also at Christchurch. At Wellington and Dunedin the installation of the main exchanges is in abeyance owing to the non-completion of the necessary buildings. With the completion of automatic-telephone exchanges at the larger centres the system will be extended to the country exchanges where continuous telephone service is desirable.

The necessary apparatus for a machine-printing telegraph system was received in New Zealand in October last, and an installation between Wellington and Christchurch was opened for traffic on the 5th December, 1921. The system is now being installed for operation between Wellington and Auckland. This will have the effect of releasing telegraph-wires and making them available for a continuous telephone service between the two centres.

CONTINGENT DEFENCE.

The Burnham Industrial School was transferred from the Education Department to the Defence Department and converted into ordnance and mobilization stores for the Southern Command. This change necessitated the erection of suitable buildings for the storage of military equipment. Several wooden hutments have therefore been transferred and are being used as a temporary convenience until a fireproof building is available. For the storage of vehicles buildings are now in course of construction at Trentham.

It is proposed later to erect a magazine to store reserves of ammunition for both the Navy and the Military Forces, also to build at Ngaruawahia, on the area of land recently acquired, an ordnance store to take the military equipment for the Northern Command. Featherston Camp will then be dismantled and the hutments sold.

LANDS, MISCELLANEOUS.

Hauraki Pastoral Areas, &c.—This work consists of the formation, widening, and re-conditioning of roads in the Hauraki pastoral areas, the principal items in hand being the Tapu-Coroglen and Kauaeranga-Tairua Roads, and the Port Charles-Jackson track. Access to a large area of reasonably good country will be afforded by the Tapu-Coroglen Road, and as a result early settlement of discharged soldiers is anticipated along the Tairua Road.

Reclamation of Sand-dunes.—Considerable work has been accomplished during the year, and the results achieved are very encouraging. The importance and value of the work is generally recognized, and can be regarded as a truly reproductive work. Where valuable lands are threatened by the drift the work becomes one of necessity, and the ends to be attained are twofold—firstly, the reclamation of the sand-dune area, and, secondly, the protection from injury and possible destruction of valuable adjoining lands now in a productive state. Work has been carried on during the year south of Kaipara Heads in the vicinity of Woodhill, on the east coast between Marsden Point and the Waipu River, and on the west coast near Te Kopuru, in the Northern Wairoa district. A little preliminary work has been done on the west coast north of Kaitaia, near Waiharara.

LANDS FOR SETTLEMENT ACCOUNT.

The opening-up of the various blocks of land set apart for selection under the provisions of section 63 of the Land Laws Amendment Act, 1913, was pushed on vigorously during the year. The principal works consisted of road-bridges, drains, and other works necessary to give access to land already selected.

DEVELOPMENT OF MINING.

The vote of last year under this head was slightly overexpended on the purchase of drill equipment, and even now with the extra supply it is anticipated that during the current year all the Department's drills will be in use, owing to the ever-increasing popularity of this form of assistance to the mining industry.

IRRIGATION AND WATER-SUPPLY.

IDA VALLEY SCHEME.

German Hill Race has been enlarged for a distance of $7\frac{1}{4}$ miles. Flumes at Moa, Maori, and Dovedale Creeks are under construction, and four road-deviations have been constructed to avoid several culverts. During the season water was supplied to eighteen irrigators.

MANUHERIKIA SCHEME.

During the year the concrete lining of the intake tunnel, the inlet and intake gates, a concrete gravel-trap, as well as the outlet end of the tunnel, have been completed.

The concrete lining of the main race in the Manuherikia Gorge was completed, all excavation finished, and four large flumes erected.

A double line of pipes at Chatto Creek has been placed in position, and is in working-order.

Ten distributing-races have been completed.

ARDGOUR SETTLEMENT SCHEME.

The permanent line and all siphons have been surveyed and plans prepared. Construction is proceeding satisfactorily, the first 6 miles being fully excavated. From 6 to 11 miles the excavation is practically complete, except for a few short gaps.

EARNSCLEUGH SCHEME.

With the exception of a few culverts this scheme has been completed sufficiently to supply occupied land, but will require extension when other lands are brought into occupation.

GENERAL SURVEYS.

Upper Manuherikia Scheme.—A detailed survey of the wall for the upper dam site at Lauder has been made, and 60 miles of race have been levelled and pegged. Rough surveys have been made of the Falls and the Dunstan Creek dam sites, and trial race-lines have been run with a view to irrigating the northerly end of Ida Valley, as well as the Manuherikia Valley, in all about 100,000 acres. Tarras, Roaring Meg, and Bendigo schemes are being investigated.

GENERAL

This may be an appropriate place to give a few particulars of the effects of irrigation on the land as obtained from actual figures supplied by the farmers on Government irrigated land, and some on land irrigated by private schemes. One man grew 400 tons of lucerne on 80 acres of irrigated ground, and with 350 tons of this fodder he wintered 5,000 sheep, 75 cattle, and 20 horses. With the aid of the pasture on irrigated land he was able to sell 4,900 fat sheep from a property which had never previously been able to turn out a single fat sheep. Another settler brought in a private scheme costing £20 per acre, and was then able, on 100 acres of land which previously was drifting sand of no value, to winter 3,300 sheep as well as horses and cattle; and in addition, in the month of February, he held 2,000 sheep and fattened 300 wethers. Figures of this description must carry conviction to the most sceptical.

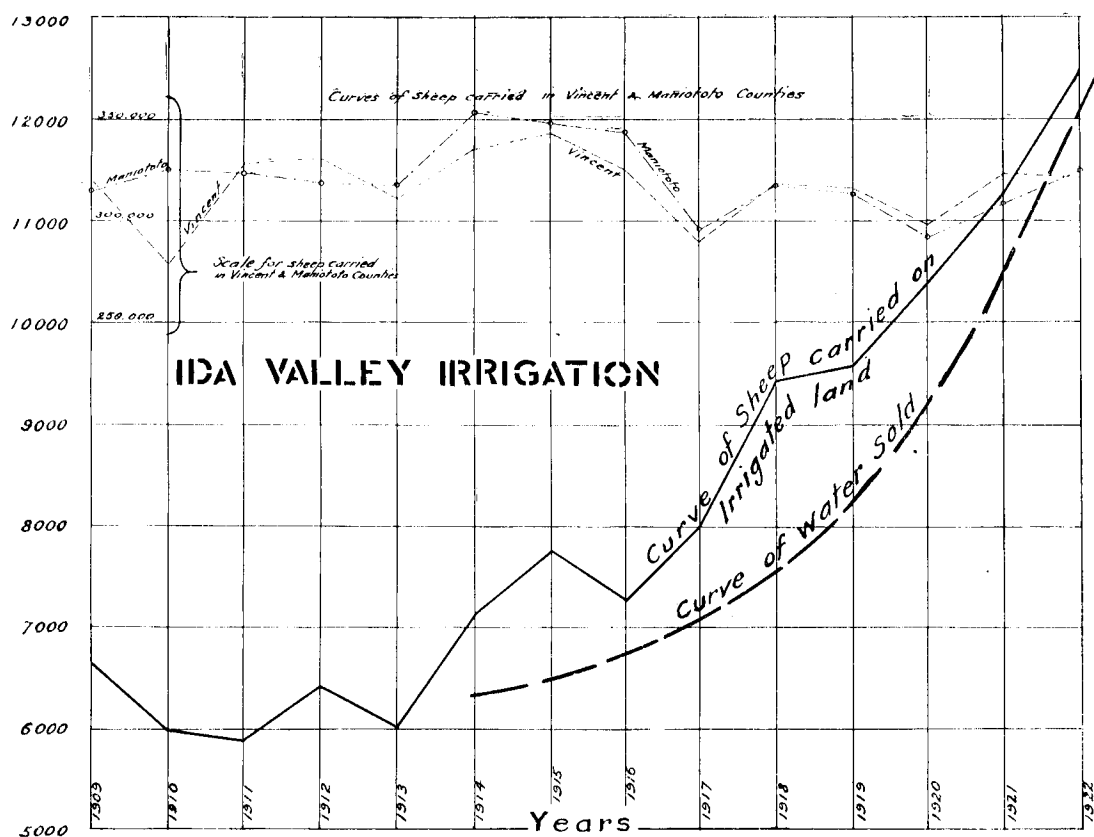
Another man, before irrigation, on a little over 300 acres, grazed 100 sheep and fattened 80. He now grazes 600 sheep and fattens 400, and estimates that his land has increased in value five-fold. Another, before irrigation, sold 250 fat sheep and 13 bales of wool per annum. He now sells 1,200 fat sheep and 35 bales of wool; and, further, he estimates that the wool off irrigated land is 2 lbs. or 3 lbs. per sheep heavier and fetches 3d. to 4d. per lb. more as compared with adjoining unirrigated land. Another man who previously sold no fat sheep and four bales of wool, now sells 980 fat sheep and fifteen bales of wool. The increase in the carrying capacity of the land actually irrigated is estimated as increasing from between one-sixteenth and one-quarter of a sheep per acre up to figures ranging between 2 and 10 sheep to the acre.

As a means of arriving at the increased production investigations were made as to the number of sheep and other produce sent away from the stations which serve the principal irrigated areas, and it is found that the average weight of goods between 1908 and 1914 was 1,885 tons, and since that period 4,395 tons; the average of the last year was 5,170 tons.

The sheep exported in the six years prior to 1914 averaged 40,345, since that date 52,500, and last year 60,034. Only about 11 per cent. of the land which might be irrigated is now irrigated, and yet the increase as shown by last year's output as compared with the pre-irrigation average shows: cattle, 35 per cent., sheep, 49 per cent., grain, chaff, and wool, 108 per cent.

The average enhancement in land-values per acre estimated by a number of owners is £6 7s. 6d., after making due allowance for the cost of the water-supply. This amount is much less than the enhancement estimated by Government officers, but naturally the owners would be cautious in estimating the values, particularly as there was no question at the time of their selling. Taking, however, the farmers' values of enhancement, and capitalizing the water-rents receivable, we find that in the case of the Ida Valley scheme we have an asset worth £226,325 from an expenditure of £160,000. If extremely conservative values adduced by the Department's officers from actual crop and flock returns be taken, the national asset is really £281,146 from the expenditure of £160,000. If all the schemes now under construction, or already constructed, be pooled, and the same basis of argument be used on the farmers' estimate we will have a Dominion asset of £498,310 from an expenditure of £370,000, or, on the Department's figures, £619,846 from the same expenditure. All the above values are adduced from sheep-farming operations almost entirely, but the real future of a considerable amount of the irrigated land lies in the development of dairying, and when the change is brought about—and it can be only brought about by irrigation and subdivision—then the results will be such as could only be believed by persons who have actually seen the country both before and after irrigation.

Attached is a diagram showing the relation between the sale of water and the increase in the numbers of sheep carried by a group of irrigated farms in Ida Valley.



WAIHOU AND OHINEMURI RIVERS IMPROVEMENT ACCOUNT.

Upper Waihou (Mangaiti-Tirohia Section).—Both banks have been cleared of willows to Tirohia Bridge, a total length of $4\frac{3}{4}$ miles. The formation of the preliminary left-bank stop-bank is in hand from 3 miles 42 chains to 5 miles.

Tirohia-Ngararahi.—The stop-bank on left side has been completed, partly to preliminary and partly to final levels, over its whole length of $4\frac{3}{4}$ miles.

On the right bank final level has been reached (with the exception of one small gap at Mill Road) for a distance of approximately 2 miles. The suction dredge pumped 127,000 cubic yards of sand into this bank since the 12th August last.

Ngahina – Waimarie Bend.—Except for temporary drainage gaps, preliminary levels have been reached with the stop-banks on either side of the river. Cut-off drains on the right bank have been completed, and those on the left bank are in hand.

Waimarie Bend – Wharepoa.—About $1\frac{3}{4}$ miles of stop-bank on each side of the river has reached preliminary levels. Flood-gates have been erected, and a mile of willows ring-barked.

Ngahina Bridge Extension.—The stop-bank on the left bank of this river was commenced last May.

HYDRO-ELECTRIC POWER.

Of the hydro-electric programme of the Government two schemes are now in operation—Lake Coleridge (12,000 h.p.) and Horahora (8,400 h.p.). These have both shown satisfactory results for the year, both having paid operating-expenses, interest, and depreciation, and shown a margin towards reduction of the accumulated deficiency.

LAKE COLERIDGE SUPPLY.

The financial result of the year's operation is as follows:—

	£
Capital outlay	671,608
Working-expenses	25,911
Interest	20,981
Depreciation	8,424
Total annual cost	<u>£55,316</u>

The revenue for the year amounted to £56,814, showing a net profit of £1,498. This amount was paid off the accumulated deficiency for the previous years of operation, which now stands at a net debit of £29,175.

Although the scheme is thus showing a profit on the accounts, no sinking fund is yet provided. In accordance with the State Supply of Electricity Act, 1917, under which these accounts are kept, a sinking fund of 1 per cent. must be set up as soon as there are available profits out of which to pay it. Had this sinking fund been paid last year it would have converted the profit of £1,498 into a loss of £4,458, and had it been paid from the inception of the undertaking it would have increased the accumulated deficiency on the net revenue account by £29,855. Thus, although the results are satisfactory, they are not such as to justify any reconsideration of the standard scale of charges until the sinking fund is provided for. But the savings effected by consumers are very much greater than the revenue received by the Department. To supply the same output as was supplied from Addington substation (33,947,100 units) by means of a modern highly efficient steam station would have taken 45,500 tons of coal—nearly 150 tons per day. But the actual fuel saved as compared with the consumption of the hundreds of small engines used throughout the district before the advent of electric power is three to five times this amount.

The operation of the plant was carried out satisfactorily during the year. Trouble with two of the turbine-cases caused some difficulty, and rendered it necessary to fall back on the steam reserve maintained by the Christchurch Tramway Board for a few weeks, but with the hearty co-operation of the consumers all the essential services were maintained in spite of the shortage of power.

Insulator troubles are still frequent, but show an improvement as compared with the previous year, as the original insulators purchased in 1912 are replaced by a more modern type, and considerable credit is due to the staff for maintaining the service under the circumstances with such immunity from breakdown. The replacement of the insulators and of the aluminium wire by copper wire will be completed during the current year, and should ensure much greater freedom from interruptions.

The main work during the year was the extension of the plant capacity from 8,000 h.p. to 12,000 h.p. by the addition of a new 4,000 h.p. unit with necessary switch-gear and pipe-line. This was completed and put into service at the end of the financial year, and its influence on the financial returns will not be realized until next year. A further 4,000 h.p. unit is in hand, which will bring the plant up to the full capacity of the existing tunnel and power-house building. This will enable the output to be increased to 16,000 h.p., and will render available a limited supply of 1,000 h.p. reserved for Ashburton, Timaru, and South Canterbury. The transmission-line for this purpose is well in hand. Supply was given during the year to Banks Peninsula and Springs-Ellesmere Electric-power Boards. In order to obtain the necessary additional supply of water for these and future extensions the Harper River is being diverted into the lake, and the permanent works for this purpose have now been completed.

In order to provide for further extensions up to the full requirements of the district—viz., 36,000 h.p.—the survey has been carried out for a second tunnel, 11 ft. in diameter, and plans are in hand for the extension of the power-house by the addition of two 10,000 h.p. units, with further provision for a third unit of the same capacity when required.

WAIKATO ELECTRIC-POWER SUPPLY.

The Horahora power plant has now completed its second year of service since it was taken over from the Waihi Gold-mining Company, and the financial results are as follows :—

Capital outlay	..	..	..	..	£	353,807
Working-expenses	..	..	..	..		7,986
Interest ..	..	..	..	..		13,187
Depreciation	..	..	..	..		4,512
Total costs	..	..	..	..		<u>£25,685</u>

The revenue for the year was £28,207, showing a net profit of £2,522, as compared with a loss for the previous year of £6,282. This result is largely due to the increased revenue received from the mines and dairy factories. In addition supply has been given to Hamilton Borough and to four Electric-power Boards—viz., Thames Valley, Cambridge, Central, and Te Awamutu. For this purpose the transmission-lines have been extended by sixty-seven miles. The maximum load at power-house during the year was 5,800 kw. out of the plant capacity of 6,300 kw., but this has since been reduced owing to a temporary reduction in the mining load. But, again, as in the case of Lake Coleridge, no sinking fund has been provided, and this, had it been paid, would have converted this profit into a loss of £59.

The operation of the power-house and transmission-lines during the year has been carried on satisfactorily.

In order to provide for the normal increase in the demand, contracts have been placed for two additional generating-units of 2,000 kw. each, which will bring the full power-house capacity up to 10,300 kw., or 14,000 h.p., which it is anticipated will be fully loaded up before the Arapuni works are completed. The headworks and power-house extensions to accommodate these additional units are now in hand.

MANGAHAO ELECTRIC-POWER SUPPLY.

In addition to the two plants in actual operation, work is in hand at Mangahao, Arapuni, and Waikaremoana.

At Mangahao substantial progress has been made with the excavation and lining of the two main tunnels, the by-pass tunnel for the Mangahao dam, the excavation for the Mangahao and Arapeti dams, the foundations for the power-house, and with the transmission-lines to Wellington. For the supply of the necessary materials thirty-five contracts, amounting in all to £277,000, have been placed.

The installations when completed will have a capacity of 24,000 h.p., which is the full capacity of the available supply of water. The distribution of the power will be entrusted to Wellington City and seven Electric-power Boards which have been constituted for the purpose. Each of these Power Boards is making good progress. The power will, of course, be supplied to the districts which are first ready to take supply, and, obviously, power cannot be held idle for any district unless it is paid for. But on the basis of all being ready to take up their quota on the completion of the headworks and distribution-lines the following allocation has been made :—

			Horse-power.
Wellington City and district	..	..	12,000
Hutt Valley Electric-power Board	..	..	2,000
Horowhenua Electric-power Board	..	..	1,200
Manawatu Electric-power Board	..	..	3,300
Rangitikei Electric-power Board	..	..	1,800
Wairarapa Electric-power Board	..	..	2,000
Tararua Electric-power Board	..	..	1,000
Dannevirke Electric-power Board	..	..	1,300

Negotiations are now in hand for the contract for the supply to Wellington City, but the Power Boards have not yet entered into negotiations for their supply contracts. The above allocations amount to about one in ten of the population—approximately the same proportion as the output of the Lake Coleridge and Waipori plants bears to the population of the districts supplied. It is therefore anticipated that Mangahao will be fully loaded to the same extent, as those plants now are within a very few years of the inception of supply, and that it will then become necessary to supplement the supply by joining up with Waikaremoana.

ARAPUNI ELECTRIC-POWER SUPPLY.

The Arapuni scheme stands on a different footing to the others that have previously been put in hand in New Zealand in that it cannot be developed to advantage in stages to meet the load as it grows. Owing to the large dam and heavy headworks, this scheme cannot pay until the output reaches about 36,000 h.p., and the only district which could offer a sufficient demand to ensure this load being reached in the early future is Auckland City. But the City Council had recently arranged to consolidate and increase its steam plant to 26,000 h.p., and it was necessary, therefore, to know definitely before putting the Arapuni works in hand whether the city intended to take power from Arapuni when available or to continue to operate its steam plant. A contract was therefore negotiated providing for the supply to the city from the Arapuni works, and this contract has been completed by the Auckland Electric-power Board, which in the meanwhile was formed to take over the whole electric-supply system from the City Council. This contract anticipates that the Board will take a supply of at least 15,000 kw. (20,000 h.p.) in 1928, when it is anticipated that the Arapuni works will be ready to supply, the Board building up its load to this or such greater demand as may be available in the meanwhile by means of its steam plant. In the meanwhile the surveys and preliminary works at Arapuni have been put in hand.

WAIKAREMOANA ELECTRIC-POWER SUPPLY.

This power-station will be required in the early future, mainly to supplement the demand for power from Mangahao Power-station, and the proposal is to then provide an installation of 40,000 h.p. In the meanwhile the exciter units of the large plant consisting of two 500 h.p. water-wheels coupled to 350 kw. alternators and direct-current generators are being installed in a temporary power-house, and will be utilized at once for supply to the Wairoa Electric-power Board up to a capacity of 750 h.p., the balance of 250 h.p. being reserved for the construction of the main works.

In order to reduce the overhead expenses an arrangement has been entered into to lease the plant to the Power Board, who will operate and manage it by means of its own staff, thus keeping the operating-cost at a minimum.

In addition to the installation of this 1,000 h.p. plant which has been completed, surveys for the main scheme have been pushed on, including a survey for a sawmill tram-line and investigation of the foundations of the main power-house. The necessary permanent-road improvement and new-construction roads and bridges have also been carried on during the year, accounting for the greater portion of the capital outlay hitherto incurred. Whilst these will not be required for the construction of the new works for some time, they will be immediately useful in serving to improve the access for the settlers of the district.

ELECTRIC-POWER BOARDS.

Whilst the responsibility of generating and transmitting the electric power in bulk rests on the Government, it is intended that the whole of the reticulation shall be undertaken by the Electric-power Boards, and the Power Boards Act and its amendments gives these Boards full powers and responsibilities in this direction. The legislation is so far optional on the part of the ratepayers of any district—that is to say, a Power Board can only be formed on receipt of a petition from the ratepayers. Hitherto twenty-three such Boards have been constituted, covering about one-third of the Dominion. Petitions are in course of preparation for ten more districts, which will increase the proportion of the Dominion included in electric-power districts to one-half. In order to ensure the most efficient subdivision of the whole Dominion a suggested scheme of forty-one electric-power districts was drawn up in the last annual Statement. Of the twenty-three Boards now constituted, nineteen of them correspond closely to the scheme there laid down. The other four are for small areas, and were constituted to deal with an urgent demand in a special district; and as the demand extends and the power becomes available to meet the demand over a comprehensive area, these districts must be extended or merged with adjacent districts in order to ensure the most efficient results. In order to meet this position special legislation is being introduced this year providing for the merger of adjacent electric-power districts. Several petitions are in course of preparation for the formation of further large districts in accordance with the general scheme laid down, but it is a serious question as to whether the procedure should not be mandatory instead of permissive—that is to say, whether the whole country should not be incorporated in electric-power districts, either in rateable inner areas or, if there is no immediate prospect of supply being given in that district, in non-rateable outer areas. This would enable the question of electric supply, which is now a necessity to the industrial development of the Dominion, to be considered in a comprehensive manner for the whole Dominion.

Of the twenty-three districts already constituted four are now taking power from the Government power-station at Horahora, four have entered into contracts to take supply from other Government schemes, eight propose also to do so, and seven of the districts are outside the area within which a supply of power is available from the Government stations. Three of these—Southland, Opunake, and Teviot—have arranged to install their own power-stations, and the other four have not yet decided upon their source of supply. Whilst the main object of the Electric-power Boards is to undertake the distribution of the power supplied in bulk by the Government, the Boards must, of course, set up their own generating-station or make other arrangements to obtain power in districts in which a Government supply is not yet available.

The suggestion has been made that some of the Boards are not spending their funds to the best advantage, and thus increasing the cost of power to the consumers. In two or three cases the Boards in their desire to give a general supply over the whole of their inner area have constructed or arranged to construct lines which will not be remunerative for some years. The responsibility of licensees to supply in their district has not been clearly defined in the past. New regulations are

being issued which render this responsibility quite definite but at the same time protect the interests of the licensee or Board by giving them the power to require from prospective consumers a guarantee for a period of five years of an annual revenue from any line at a rate not less than 20 per cent. of the capital cost of such line. The Power Board would, of course, lay out its original reticulation of the districts, which will obviously be remunerative, and would then extend it piece by piece under this guarantee to the more remote and sparsely settled portion of its area, thus ensuring an ultimate supply to all who require it, and at the same time ensuring a sufficient revenue to the Board to render the scheme self-supporting as it develops. As long as the Boards generally administer their affairs economically it is desired to leave the question of their internal policy in their own hands as representatives of the ratepayers concerned. But if it is found that work is being done that will involve undue cost of power to consumers, thus restricting the development of the output of the main Government station, it may be necessary to take power by legislation to enable the Department to review the Board's estimates at the beginning of each financial year. If, on the other hand, it is found that a Power Board fails to adopt a sufficiently progressive policy to ensure the disposal of the proportion of the output of the Government power-stations developed for that particular district, it may also become necessary for the Government to protect itself in this direction in making the contract for the supply of power to the Board.

On the whole the Electric-power Board legislation has so far proved successful in putting into the hands of the ratepayers themselves the responsibility of undertaking the distribution of the power and in giving them a local interest in ensuring the financial success of the undertaking.

LOCAL ELECTRIC-SUPPLY SYSTEMS.

In addition to the Government and Power Boards systems, the Department is responsible under the Public Works Amendment Act, 1911, for the licensing and supervision of all the electric-supply systems of the Dominion. The industry as a whole now involves a capital outlay of £5,224,629, and after paying working-expenses and capital charges at an average rate of 5·85 per cent. it yielded a net profit of £82,688, or 1·6 per cent. additional on the capital outlay. Full details are included in the tables herewith.

FUTURE DEVELOPMENTS.

With regard to future developments, a programme was set out in my last annual Statement covering a total expenditure of £12,902,000 spread over a period of ten years, providing 260,000 h.p. and reaching a maximum rate of expenditure of £2,023,000 in 1925. The financial position has rendered it necessary to revise this programme in order to keep the annual expenditure per year, in the meanwhile, down to about £1,000,000. To do this it has been necessary to postpone for a couple of years the commencement of the main works at Lake Waikaremoana, and to hold over a number of the smaller developments in the South Island until the Power Boards are constituted to deal with the reticulation. At the same time the transmission-lines from the schemes to be proceeded with will be pushed on, in order to make the supply as general as possible within the capacity of the headworks at each site. With this object the mains from Lake Coleridge will be extended into Otago and North Canterbury, and from Mangahao to Wanganui and Napier, in addition to the lines already under construction. The revised programme herewith provides for a slightly less total expenditure (£11,355,000) spread over a longer period, and keeps for the first few years within the limit of £1,000,000 per annum.

SCHEME OF HYDRO-ELECTRIC-POWER DEVELOPMENT.

Schemes to be developed.—Coleridge (36,000 h.p.), Mangahao (24,000 h.p.), Horahora (14,000 h.p.), Arapuni (48,000 h.p.), Waikaremoana (36,000 h.p.): total, 158,000 h.p.
Extensions and additional Schemes.—Arapuni (24,000 h.p.), Otago (25,000 h.p.), Westland (10,000 h.p.), Marlborough, Nelson, and Buller (10,000 h.p.): additional total, 69,000 h.p.

Schemes.	Expended to 31st March, 1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.	Later Expenditure.	Total.
Surveys, &c.	£	£	£	£	£	£	£	£	£	£
Lake Coleridge—	10,000	5,000	4,000	4,000	4,000	4,000	4,000	4,000	..	39,000
Headworks—	..	..	..	..	..	..	..	..	..	..
Transmission ..	328,000	100,000	150,000	150,000	..	..	..	..	..	878,000
Horahora—	344,000	115,000	65,000	60,000	..	..	..	..	..	584,000
Headworks ..	..	..	..	..	..	..	..	..	..	..
Transmission ..	181,000	50,000	50,000	..	..	..	..	..	..	281,000
Mangahao—	173,000	80,000	100,000	..	..	..	..	..	..	353,000
Headworks ..	..	..	..	..	..	..	..	..	..	..
Transmission ..	284,000	350,000	190,000	80,000	..	..	..	..	..	904,000
Arapuni—	40,000	70,000	120,000	100,000	100,000	100,000	100,000	..	..	630,000
Headworks ..	..	..	..	..	..	..	..	..	..	..
Transmission ..	13,000	20,000	200,000	200,000	200,000	200,000	100,000	..	240,000	1,223,000
Waikaremoana—	50,000	110,000	..	50,000	200,000	200,000	200,000	100,000	200,000	960,000
Headworks ..	..	..	..	..	..	..	..	..	..	..
Transmission ..	63,000	100,000	20,000	150,000	150,000	200,000	200,000	50,000	100,000	1,033,000
Otago—	..	..	..	50,000	50,000	100,000	100,000	200,000	800,000	1,300,000
Headworks ..	..	..	..	..	80,000	100,000	100,000	100,000	320,000	700,000
Transmission ..	..	..	100,000	100,000	120,000	100,000	100,000	100,000	330,000	950,000
Westland—	..	..	..	..	..	..	..	..	..	..
Headworks ..	..	..	..	..	..	20,000	100,000	100,000	100,000	320,000
Transmission ..	..	..	..	..	..	..	..	200,000	200,000	400,000
Marlborough, Nelson, and Buller—	..	..	..	..	..	..	..	..	..	..
Headworks ..	..	..	..	..	..	20,000	100,000	100,000	180,000	400,000
Transmission ..	..	..	..	..	..	..	..	100,000	300,000	400,000
Totals ..	1,486,000	1,000,000	999,000	944,000	954,000	1,044,000	1,104,000	1,054,000	2,770,000	11,355,000

ELECTRIC-POWER ORGANIZATIONS.

The work involved in the development of the electric-power resources of the Dominion is outgrowing the present organization as a branch of the Public Works Department, and a Special Board or Commissioner will be necessary in the early future to deal with the commercial, financial, and electrical and engineering problems involved. Owing to the financial stringency the appointment of this special Board has been postponed as long as possible, but will be necessary in the early future, and a careful note is being kept of the development of the corresponding organizations in Great Britain, Canada, and Victoria, where the work is undertaken by Electricity Commissioners; in Tasmania, where a separate Hydro-electric Department has been set up; and in New South Wales, where the organization is carried out by a branch of the Public Works Department; and the local proposals will be based on those which are proving most efficient elsewhere.

STAFF.

The work of the whole of the Staff during the past year is worthy of the very highest commendation, and I desire to take this opportunity of expressing to all those officers my thanks for their untiring energy and hearty co-operation in carrying out successfully the many and varied functions of the Department.

It is with sincere regret that I have to record the loss by accident of a promising young Assistant Engineer, Mr. R. W. Miller, who unfortunately lost his life through being gassed while endeavouring to rescue some of his men similarly affected in one of the tunnels being constructed in connection with the Mangahao hydro-electric scheme.

CONCLUSION.

In conclusion, I feel confident that the judgment of the country will be that substantial results have been achieved. The money at my disposal has been expended in accordance with my ideas of what is in the best interests of New Zealand as a whole. Under the direction of a thoroughly qualified staff, and with a due regard to the necessity of obtaining, in increased production due to better communications, an adequate return for the expenditure.

PUBLIC WORKS STATEMENT, 1922.

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TABLE NO. 1.
SUMMARY SHOWING THE TOTAL EXPENDITURE ON PUBLIC WORKS AND OTHER SERVICES OUT OF PUBLIC WORKS FUND TO 31ST MARCH, 1922, AND THE LIABILITIES ON THAT DATE.

Number of Table containing Details.	Works.	Total Net Expenditure to 31st March, 1921.	Expenditure during Twelve Months ended 31st March, 1922.	Recoveries on Account of Services of Previous Years.	Total Net Expenditure to 31st March, 1922.	Liabilities on 31st March, 1922.	Total Net Expenditure and Liabilities.	Works.
3	Railways*..	£ 37,603,192	£ 3,133,200	£ 751	£ 40,735,641	£ 456,402	£ 41,192,043	Railways.
..	Roads ..	12,547,998	564,159	197	13,111,960	211,209	13,323,169	Roads.
..	Development of mining ..	833,726	2,130	51	835,805	..	835,805	Development of mining.
..	Telegraphs ..	4,409,446	590,981	..	5,000,427	385,109	5,385,536	Telegraphs.
..	Public buildings ..	8,300,794	344,739	9,930	8,635,603	56,944	8,692,547	Public buildings.
..	Lighthouses, harbour-works, and harbour-defences ..	1,156,779	18,774	..	1,175,553	550	1,176,103	Lighthouses, harbour-works, and harbour-defences.
..	Departmental ..	1,689,930	128,002	525	1,817,407	562	1,817,969	Departmental.
18 of 1878	Electric-power supply and development ..	Cr. 600	600	..	..	..	..	Electric-power supply and development.
11 of 1877	Coal-exploration and mine-development ..	10,835	..	..	10,835	..	10,835	Coal-exploration and mine-development.
..	Aiding works on Thames goldfields ..	50,000	..	..	50,000	..	50,000	Aiding works on Thames goldfields.
..	Immigration ..	2,259,743	247,528	..	2,507,271	..	2,507,271	Immigration.
..	Purchase of Native lands ..	2,061,791	..	52	2,061,739	..	2,061,739	Purchase of Native lands.
..	Defence ..	1,070,466	15,586	..	1,086,052	..	1,086,052	Defence.
..	Charges and expenses of raising loans ..	1,253,258	174,280	..	1,427,538	..	1,427,538	Charges and expenses of raising loans.
..	Interest and sinking fund ..	218,500	..	..	218,500	..	218,500	Interest and sinking fund.
..	Rates on Native lands ..	68,672	..	..	68,672	..	68,672	Rates on Native lands.
..	Thermal springs ..	14,600	..	..	14,600	..	14,600	Thermal springs.
..	Tourist and health resorts ..	286,295	17,996	110	304,181	78	304,259	Tourist and health resorts.
..	Lands improvement ..	140,368	17,478	..	157,846	1,926	159,772	Lands improvement.
..	Payment to Midland Railway bond-holders ..	150,000	..	..	150,000	..	150,000	Payment to Midland Railway bond-holders.
..	Irrigation and water-supply† ..	250,179	82,713	..	332,892	4,591	337,483	Irrigation and water-supply.
..	Plant, material, and stores ..	329,206	106,432	..	435,638	24,498	460,136	Plant, material, and stores.
..	Timber-supply and sawmills for Public Works Department ..	..	16,369	..	16,369	1,734	18,103	..
	Totals ..	74,705,178	5,460,967	11,616	80,154,529	1,143,603	81,298,132	Totals.

* Exclusive of expenditure on Hutt Railway and Road Improvement and Railways Improvement Accounts.
† Includes £115,000 previously expended under Irrigation and Water-supply Account 1911-12 to 1915-16 and part 1917-18, now included in Public Works Fund.

TABLE NO. 2.
GENERAL SUMMARY.

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND, 1900-1901 to 1921-22.

N.B.—The figures in italics, prefixed by “Cr.,” are either recoveries on account of services of previous years or receipts-in-aid applied in reduction of expenditure. Expenditure from 1892-93 to 1896-97, inclusive, includes expenditure under Native Lands Purchase Account; and from 1894-95 to 1896-97, inclusive, expenditure under Lands Improvement Account.

Description of Services.	Total Net Expenditure to 31st March, 1900.	Expenditure.										
		1900-1.	1901-2.	1902-3.	1903-4.	1904-5.	1905-6.	1906-7.	1907-8.	1908-9.	1909-10.	1910-11.
Immigration	£ 2,147,505	£ 214	£ 139	£ 142	£ Cr. 7	£ 6,481	£ 8,753	£ 14,353	£ 9,132	£ 15,075	£ 17,003	£ 9,441
Public Works, Departmental	446,384	12,932	17,771	13,949	16,088	12,814	13,517	16,710	18,219	24,512	41,176	42,733
Development of Water-power	..	..	..	..	..	468	2,901	4,664	315	..	..	1,021
Irrigation and Water-supply	..	..	..	..	..	..	..	..	..	..	..	1,562
Railways	16,450,303	717,723	1,333,940	759,752	828,704	779,891	1,021,265	1,227,880	1,093,535	1,116,183	1,128,400	1,104,071
Payment to Midland Railway Bondholders	..	..	..	..	150,000	..	..	..	..	..	..	Cr. 652
Roads :—												
Miscellaneous Roads and Bridges	4,492,090	267,374	354,687	230,349	316,248	202,850	306,065	308,500	285,248	422,174	297,932	229,537
Roads on Goldfields.. .. .	Cr. 247 439,462	48,417	47,573	51,690	45,594	26,112	45,139	38,970	38,494	47,375	40,830	25,626
Development of Thermal Springs and Natural Scenery	16,023	..	..	..	..	..	..	..	..	..	..	..
Lands Improvement Account*	300,930	..	..	..	..	..	..	..	..	..	..	..
Total, Roads	5,248,158	315,791	402,260	282,039	361,842	228,962	351,204	347,470	323,742	469,549	338,762	255,163
Development of Mining	670,446	15,907	15,326	24,213	16,278	6,258	18,533	11,064	8,633	32,859	18,597	10,845
Purchase of Native Lands	1,444,302	28,688	18,261	15,782	5,352	6,281	13,777	9,135	2,190	2,099	30,567	2,976
Native Lands Purchase Account	491,980	..	..	..	..	..	..	..	..	..	..	Cr. 2,286
Total, Land Purchases	1,936,282	28,688	18,261	15,782	5,352	6,281	13,777	9,135	2,190	2,099	30,567	690
Telegraph Extension-	856,057	50,101	31,729	68,578	47,228	79,298	77,186	114,068	155,491	163,032	123,423	111,867

* Subsequent expenditure under separate class “Lands Improvement,” see next page.

[Continued on page 4.]

TABLE NO. 2—continued.
GENERAL SUMMARY—continued.
 Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND, 1900–1901 to 1921–22—continued.

Description of Services.	Total Net Expenditure to 31st March, 1900.	Expenditure.										
		1900-1.	1901-2.	1902-3.	1903-4.	1904-5.	1905-6.	1906-7.	1907-8.	1908-9.	1909-10.	1910-11.
Public Buildings :—												
General (including Miscellaneous)	£ 238,239	£ 5,594	£ 12,513	£ 9,031	£ 10,964	£ 9,021	£ 2,231	£ 14,216	£ 16,260	£ 39,635	£ 41,964	£ 44,044
Parliamentary	51,987	3,039	4,424	1,503	602	697	71	1,047	4,119	5,172	3,157	237
Judicial	380,497	29,630	28,728	33,224	25,978	13,083	15,899	35,192	28,938	37,211	31,606	22,295
Post and Telegraph	196,371	20,954	40,361	74,686	53,918	16,008	38,419	43,918	43,724	62,262	68,574	117,815
Customs	7,027	875	2,066	6,630	8,719	13,018	7,903	414	47	2,507	233	..
Quarantine Stations	3,834	2,607	424	..	..	..	..	..	..	..	..	..
Mental Hospitals	439,980	18,872	16,743	10,167	15,812	15,949	16,235	8,049	7,987	15,296	19,839	12,707
Public Health	..	..	..	..	6,315	4,265	7,926	1,765	7,497	4,402	319	..
Hospitals and Charitable Institutions	49,343	5,141	1,200	3,540	4,291	1,204	4,786	10,259	15,576	11,153	7,259	1,484
School Buildings	1,015,680	33,681	38,606	57,790	87,089	42,721	69,223	109,459	100,197	102,340	98,103	124,926
Agricultural	5,238	971	535	883	2,504	1,362	2,618	2,707	1,690	5,543	6,103	1,160
Workers' Dwellings	..	..	..	..	..	..	..	..	..	..	..	..
Total, Public Buildings	2,388,286	121,364	145,600	197,454	216,192	117,328	165,311	227,026	226,035	285,521	277,157	324,668
Lighthouses, Harbour-works, and Harbour-defences :—												
Lighthouses..	144,361	1,017	2,060	6,082	6,206	2,167	962	..	1,417	7,481	6,762	1,470
Harbour-works	318,194	1,540	3,421	1,373	1,773	1,308	2,684	2,963	2,867	4,439	4,548	4,092
Harbour-defences	496,541	3,960	6,678	6,126	2,885	2,515	1,300	1,541	2,579	7,297	5,372	2,865
Total, Lighthouses, &c.	959,096	6,517	12,159	13,581	10,864	5,990	4,946	4,504	6,863	19,217	16,682	8,427
Rates on Native Lands	63,553	673	571	471	666	631	548	695	837	27	..	..
Contingent Defence	512,310	37,650	146,875	37,005	38,723	46,588	35,569	14,874	18,574	10,766	4,977	6,071
Tourist and Health Resorts	..	..	11,260	10,949	15,643	17,508	15,888	42,271	45,048	24,286	14,507	5,912
Lands Improvement*	..	..	1,741	2,349	2,019	2,248	1,052	5,605	9,561	19,542	6,910	11,125
Charges and Expenses of raising Loans	1,056,311	1,460	5,620	88,180	87,249	10,764	236	Cr. 5,175	Cr. 8,487	575	17,715	66,367
Interest and Sinking Funds	218,500	..	..	..	..	..	..	..	..	..	..	..
Coal-exploration and Mine-development	10,835	..	..	..	..	..	..	..	..	..	..	..
Thermal Springs	14,600	..	..	..	..	..	..	..	..	..	..	..
Total Ways and Means Credits	347	..	516	..	7	..	..	5,175	8,487	..	..	..
Grand Total—Net Expenditure	32,978,626	1,309,020	2,142,736	1,514,444	1,796,841	1,321,510	1,730,686	2,035,144	1,909,688	2,183,245	2,022,876	1,891,918
									Cr. 12,000	Cr. 66,392		

* For previous expenditure see Roads Class.

[Continued on page 5.]

TABLE NO. 2—continued.
GENERAL SUMMARY—continued.
 Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND, 1900–1901 to 1921–22—continued.

Description of Services.	Expenditure.										Total Net Expenditure to 31st March, 1922.
	1911–12.	1912–13.	1913–14.	1914–15.	1915–16.	1916–17.	1917–18.	1918–19.	1919–20.	1920–21.	1921–22.
Immigration	£ 11,681	£ 14,694	£ 33,914	£ 33,219	£ 10,010 <i>Cr. 10</i>	£ 6,533	£ 3,856	£ 115,419 <i>Cr. 12,018</i>	£ 62,561 <i>Cr. 62,561</i>	£ 7,806 <i>Cr. 7,806</i>	£ 247,528
Public Works, Departmental	49,864	57,426	66,650	100,719	111,489	131,701	127,962 <i>Cr. 2,662</i>	115,419 <i>Cr. 4,119</i>	121,677	143,280 <i>Cr. 6,281</i>	1,817,407
Development of Water-power	9,082	..	..	..	..	..	<i>Cr. 18,451</i>	9,254	..	<i>Cr. 600</i>	600
Irrigation and Water-supply*	2,794	14,689	33,602	32,090	29,874	20,794	11,650	13,665	34,115	55,344	82,713
Railways	1,125,905 <i>Cr. 6,987</i>	1,148,832 <i>Cr. 29,528</i>	1,104,897 <i>Cr. 5,485</i>	2,146,753† <i>Cr. 6,022</i>	1,065,171 <i>Cr. 4,633</i>	620,947 <i>Cr. 4,345</i>	495,771 <i>Cr. 110</i>	387,923 <i>Cr. 4,924</i>	748,649 <i>Cr. 105,196</i>	1,365,466 <i>Cr. 388</i>	3,133,200 <i>Cr. 751</i>
Payment to Midland Railway Bondholders	..	..	..	..	..	..	..	..	..	..	150,000
Roads:—											
Miscellaneous Roads and Bridges	383,511	337,584	353,836 <i>Cr. 515</i>	484,365	400,062	203,746	128,730 <i>Cr. 600</i>	221,887 <i>Cr. 997</i>	376,097 <i>Cr. 603</i>	527,854 <i>Cr. 81</i>	552,895 <i>Cr. 197</i>
Roads on Goldfields	41,067	36,761	24,143	30,065	24,432	17,099	6,912	4,186	12,465	11,050	11,264
Development of Thermal Springs and Natural Scenery	..	..	..	..	..	..	..	..	..	..	..
Lands Improvement Account	..	..	..	..	..	..	..	..	..	..	..
Total, Roads	424,578	374,345	377,464	514,430	424,494	220,845	135,042	225,076	387,959	538,823	563,962
Development of Mining	21,244 <i>Cr. 30</i>	10,644 <i>Cr. 1,015</i>	4,889	2,384 <i>Cr. 255</i>	6,602	4,592	27 <i>Cr. 6,545</i>	518 <i>Cr. 1,000</i>	1,173 <i>Cr. 7,008</i>	2,153 <i>Cr. 1,606</i>	2,130 <i>Cr. 51</i>
Purchase of Native Lands	<i>Cr. 2,466</i>	<i>Cr. 917</i>	<i>Cr. 857</i>	<i>Cr. 1,060</i>	<i>Cr. 972</i>	<i>Cr. 868</i>	<i>Cr. 57</i>	..	<i>Cr. 57</i>	<i>Cr. 57</i>	<i>Cr. 52</i>
Native Lands Purchase Account	..	..	..	..	..	..	..	..	..	..	..
Total, Land Purchases	<i>Cr. 2,467</i>	<i>Cr. 917</i>	<i>Cr. 857</i>	<i>Cr. 1,060</i>	<i>Cr. 972</i>	<i>Cr. 868</i>	<i>Cr. 57</i>	..	<i>Cr. 57</i>	<i>Cr. 57</i>	<i>Cr. 52</i>
Telegraph Extension	147,692	251,375	392,648	288,395	249,554	203,311	213,955	198,611	249,379	336,468	590,981

* Previously included under Lands Improvement.

† Includes £1,000,000 expended 1908–9 and 1909–10 under Wellington–Manawatu Railway Purchase Account.

[Continued on page 6.]

TABLE No. 2—continued.

GENERAL SUMMARY—continued.

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND, 1900-1901 to 1921-22—continued.

Description of Services.	Expenditure.										Total Net Expenditure to 31st March, 1922.
	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.	1916-17.	1917-18.	1918-19.	1919-20.	1920-21.	1921-22.
Public Buildings :—											
General (including Miscellaneous)	£ 34,721	£ 44,719	£ 43,199	£ 52,239	£ 22,050	£ 12,648	£ 11,646 <i>Cr. 15,067</i>	£ 43,168	£ 64,207	£ 39,504	£ 87,057
Parliamentary	2,004	18,806	23,612	31,478	17,133	22,586	37,233	..	..	1,400	4,358
(Courthouses	..	..	..	..	4,902	299	21	..	868	30,038	41,740
Judicial Prisons	..	..	..	..	17,786	15,685	13,195	16,299	20,981	<i>Cr. 800</i>	..
Police-stations	44,133	45,431	28,445	38,808	..	..	..	6,157	24,944	36,843	22,544
Post and Telegraph..	130,815	122,999	78,815	60,838	25,484	21,147	18,814	26,072	66,543	93,364	112,906
Customs	..	..	..	..	35,258	22,744	33,525	..	..	<i>Cr. 560</i>	<i>Cr. 675</i>
Quarantine Stations	..	..	..	..	..	..	..	..	35,490	15,529	4,581
Mental Hospitals	8,809	46,181	26,001	53,996	54,898	44,602	26,502	14,640	18,277	27,368	41,838
Public Health	..	376	..	..	..	..	..	..	..	..	..
Hospitals and Charitable Institutions	12,745	8,750	1,435	998	1,426	7,570	4,080	2,332	8,484	4,099	26,131
School Buildings	90,535	105,000	121,954	122,940	97,972	70,387	63,082	115,656	195,500	244,722	2,469
Agricultural	3,684	6,475	4,398	2,428	2,972	3,046	5,685	4,229	7,227	9,345	<i>Cr. 9,255</i>
Workers' Dwellings..	22,644	46,455	41,741	68,275	55,893	35,437	15,505	7,293	26,674	..	1,115
Total, Public Buildings	350,090	445,192	369,600	431,966	335,759	256,131	214,221	235,846	469,195	500,851	334,809
Lighthouses, Harbour-works, and Harbour-defences :—											
Lighthouses	5,428	9,031	5,174	3,887	1,415	449	561	1,663	253	758	16,350
Harbour-works	6,004	7,415	3,346	12,563	9,355	2,280	2,359	3,729	3,245	4,080	2,424
Harbour-defences	1,144	339	<i>Cr. 1,462</i>	681	2,903	1,038	56	..	..	..	..
Total, Lighthouses, &c.	12,576	16,785	7,297	17,131	13,673	3,767	2,976	5,392	3,498	4,838	18,774
Rates on Native Lands	..	..	..	..	..	..	..	..	..	..	68,672
Contingent Defence	10,437	23,790	30,186	15,221	37,619	9,742	6,714	8,809	10,187	8,701	15,586
Tourist and Health Resorts	13,361	12,906	14,989	8,232	5,167	1,094	931	1,620	6,194	19,041	17,996
Lands Improvement*	20,394	22,550	16,996	13,810	5,936	<i>Cr. 2,731</i>	1,838	<i>Cr. 4,268</i>	2,964	2,064	<i>Cr. 110</i>
Charges and Expenses of raising Loans	67,470	72,950	105,449	35,495	5,037	35	1	..	..	184	17,478
Interest and Sinking Funds	<i>Cr. 66,954</i>	<i>Cr. 71,681</i>	<i>Cr. 96,741</i>	<i>Cr. 34,865</i>	<i>Cr. 5,030</i>	..	..	..	..	..	174,280
Coal-exploration and Mine-development	..	..	..	..	..	..	..	..	..	..	1,427,538
Thermal Springs	..	..	..	..	..	..	..	..	..	..	218,500
Plant, Material, and Stores	..	..	..	..	..	..	..	..	..	..	10,835
Timber-supply and Sawmills for Public Works Department	..	..	..	..	74,418	9,778	6,811	20,638	47,682	169,910	14,600
Total Ways and Means Credits	10,530	103,524	105,792	43,400	11,760	5,713	43,492	11,993	112,864	19,627	..
Grand Total—Net Expenditure	2,190,731	2,362,654	2,455,066	2,597,109	2,363,658	1,502,588	1,237,422	1,207,482	2,020,714	3,121,131	5,449,351
* Includes expenditure on Irrigation and Water-supply—1905-6, £22; 1906-7, £750; 1907-8, £1,554; 1908-9, £1,966.											

TABLE NO. 3.

EXPENDITURE ON RAILWAYS TO 31ST MARCH, 1922.

Lines of Railway.	Total Expenditure by General Government to 31st March, 1921.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1921-22.					Expenditure under Special Acts during Year 1921-22.*	Amounts previously charged to "Surveys of New Lines," now charged to Individual Lines.	Total Expenditure by General Government to 31st March, 1922.	Valuation of Works constructed by Provinces and Midland Railway Company.
			New Works.		Works on Open Lines.						
			Construction and Surveys.	Permanent-way.	Total New Works.						
						£	£				
Kaihu Valley	£ 145,035	£ ..	£ 14,492	£ 2,239	£ 16,731	£ 106	£ ..	£ 161,872	£ ..		
Opua Wharf to Whangarei and Onerahi	525,771	..	..	..	..	2,754	134	528,659	..		
Otaria to Ngapuhi	125,771	..	..	..	..	..	..	125,771	..		
Whangarei (Kioreroa) to Waiohira	317,891	..	29,233	..	29,233	..	..	347,124	..		
Waipou Branch	16,444	..	3,961	..	3,961	..	..	20,405	..		
North Auckland Main Trunk—											
Ngapuhi Northwards	192,102	..	18,711	4,173	22,884	..	..	214,986	..		
Helensville Northwards	1,176,894	8	186,922	21,617	208,539	..	..	1,385,425	..		
North Auckland Main Trunk to Dargaville	474	..	..	..	..	..	..	474	..		
Helensville to Te Awamutu	2,488,986	..	..	..	..	96,182	67,000	2,652,168	..		
Waikuku Branch (Paerata to Waikuku)	164,330	..	34,119	3,058	37,177	1,638	..	201,507	..		
Huntly to Awaroa	122,019	..	25,294	..	25,294	..	..	148,951	..		
Waikokowai Branch	2,852	..	850	..	850	..	..	3,702	..		
Waipa Gravel Access Branch	117	..	Cr. 3	..	Cr. 3	..	..	114	..		
Frankton to Thames	365,435	..	..	..	..	342	5,770	371,547	..		
Cambridge Branch (Ruakura Junction to Cambridge)	51,978	..	..	..	..	46	..	52,024	..		
Morrinsville to Rotorua	376,579	..	..	..	..	2,039	..	378,618	..		
Marton to Te Awamutu	2,783,583	..	..	..	..	73,920	2,156	2,859,659	..		
Raeitihi Branch	84,479	..	667	..	667	2,286	..	87,432	..		
Paeroa to Waihi and Tauranga	251,718	..	33,591	..	33,591	..	..	285,309	..		
Tauranga to Taneatua, including Te Maunga to Maunganui Branch	629,096	..	157,190	4,958	162,148	..	..	791,244	..		
Gisborne to Motu	623,880	..	224	..	224	71	..	624,175	..		
Gisborne to Ormond Tramway	4,975	..	..	..	..	..	..	4,975	..		
Napier to Gisborne—											
Gisborne Southwards	220,604	..	16,452	69	16,521	..	..	237,125	..		
Waioa Northwards	15,756	..	3,485	..	3,485	..	..	19,241	..		
Napier Northwards	126,595	..	38,462	1,793	40,255	..	..	166,850	..		
Waikopu Branch	56,715	..	104,161	3,080	107,241	..	..	163,956	..		
Wellington to Napier—											
Napier to Woodville and Palmerston North	940,402	..	..	..	..	4,465	2,700	947,567	..		
Wellington to Woodville, including Te Aro Extension	1,705,942	150	..	..	..	32,926	31,961	1,770,679	..		
Featherston to Martinborough	399	..	..	..	..	..	..	399	..		
Wellington to Waitara—											
Wellington to Longburn	1,028,294	..	..	..	..	11,053	2,264	1,041,611	..		
Foxton to Waitara and Moturoa	1,580,610	593	..	..	..	4,318	6,880	1,591,215	..		
Mount Egmont Branch	72,070	..	Cr. 6	..	Cr. 6	..	..	72,064	..		
Moturoa to Opunake	759	..	..	..	..	..	..	759	..		
Opunake Branch (Te Roti to Opunake)	84,192	..	21,334	1,056	22,390	..	..	106,582	..		
Mania Branch (Kapuni to Mania)	11,384	..	2,677	..	2,677	..	..	14,061	..		
Rangitikei River Quarry Line	206	..	..	..	..	..	..	206	..		

* Railways Improvement Authorization Act 1914 Account.

TABLE NO. 3—continued.
EXPENDITURE ON RAILWAYS TO 31ST MARCH, 1922—continued.

Lines of Railway.	Total Expenditure by General Government to 31st March, 1921.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1921-22.					Expenditure under Special Acts during Year 1921-22.*	Amounts previously charged to "Surveys of New Lines," now charged to Individual Lines.	Total Expenditure by General Government to 31st March, 1922.	Valuation of Works constructed by Provinces and Midland Railway Company.
			New Works.		Works on Open Lines.						
			Construction and Surveys.	Permanent-way.	Total New Works.	£	£				
Stratford to Okahukura (East End)	£ 283,324	..	£ 36,958	£ 26,901	£ 63,859	£ ..	£ ..	£ ..	£ 347,183	..	£ ..
Stratford to Okahukura (West End)	754,648	..	8,933	535	9,468	..	..	..	764,116	..	..
Nelson to Greymouth—											
Nelson to Inangahua	370,584	..	16,068	..	16,068	3,267	17	..	386,669	78,307	..
Stillwater to Inangahua	209,906	..	103	..	103	..	..	..	213,276	279,685	..
Ngahere to Blackball	147,532	..	..	..	..	950	16	..	147,532	..	..
Westport to Ngakawan	188,354	..	..	..	..	..	..	..	189,320	..	..
Westport to Inangahua	152,623	..	Cr. 14	..	Cr. 14	..	..	..	152,609	..	..
Greymouth to Rewanui	255,076	..	..	..	..	..	..	..	255,076	..	..
Point Elizabeth Branch	20,249	..	20,505	7,301	27,806	..	..	..	48,055	..	..
Greymouth to Ross and Mikonui	339,250	..	..	..	..	2,666	..	..	341,916	..	..
Picton to Waipara—											
Picton Southwards	657,129	..	Cr. 55	..	Cr. 55	1,252	..	..	657,074	..	..
Waipara Northwards	374,162	..	..	..	..	..	..	..	375,414	..	..
Christchurch to Greymouth—											
Rolleston to Bealey	816,671	..	367	..	367	17,481	..	..	834,519	61,579	..
Whitecliffs Branch	25,021	..	..	..	..	..	..	..	25,021	..	..
Greymouth to Bealey	1,211,796	..	130,530	63,411	193,941	46,786	..	..	1,452,523	263,889	..
Hurunui to Waitaki—											
Main Line (Waiau to Waitaki)	2,011,230	..	94	..	94	21,688	19,848	..	2,052,860	316,135	..
Oxford Branch (Rangiora to Oxford West)	52,840	..	..	..	..	112	..	..	52,952	..	..
Eyreton Branch (Kaiaipoi to Bennett's)	44,277	..	..	..	..	..	..	..	44,277	..	..
Lyttelton Branch..	80,908	..	..	..	..	..	..	..	80,908	340,500	..
Southbridge Branch (Hornby to Southbridge)	91,377	..	..	..	..	..	..	..	91,377	..	..
Little River Branch (Lincoln to Little River)	108,761	..	..	..	..	424	..	..	109,185	..	..
Rakaia to Methven	74,671	..	..	..	..	5	..	..	74,676	..	..
Ashburton to Springfield	61,742	..	..	..	..	24	..	..	61,766	..	..
Orari to Geraldine	321	..	..	..	..	..	..	..	321	..	..
Fairlie Branch (Washdyke Junction to Fairlie)	67,115	..	..	..	..	809	..	..	67,924	75,124	..
Waimate Branch ..	81,341	..	Cr. 482	..	Cr. 482	..	..	..	80,859	..	..
Canterbury Interior Main Line—											
Oxford to Malvern	54,248	..	..	..	..	..	..	..	54,248	..	..
Whitecliffs to Rakaia	542	..	..	..	..	..	..	..	542	..	..
Temuka to Rangitata	5,152	..	..	..	..	..	..	..	5,152	..	..
Waitaki to Bluff—											
Main Line, including Port Chalmers Branch	3,326,056	..	..	..	..	9,407	3,114	..	3,338,577	82,259	..
Dunroon Branch (Pukeuri to Kurow)	97,311	..	..	..	..	..	..	..	97,311	37,500	..
Ngapara Branch (Waiareka Junction to Ngapara)	26,090	..	..	..	..	..	..	..	26,090	58,009	..

* Railways Improvement Authorization Act 1914 Account.

TABLE NO. 3—continued.
EXPENDITURE ON RAILWAYS TO 31st MARCH, 1922—continued.

Lines of Railway.	Total Expenditure by General Government to 31st March, 1921.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1921-22.					Expenditure under Special Acts during Year 1921-22.*	Amounts previously charged to "Surveys of New Lines," now charged to Individual Lines.	Total Expenditure by General Government to 31st March, 1922.	Valuation of Works constructed by Provinces and Midland Railway Company.
			New Works.		Works on Open Lines.	Total New Works.					
			Construction and Surveys.	Permanent-way.		£	£				
Waitaki to Bluff—continued.	£	£	£	£	£	£	£	£	£	£	£
Livingstone Branch (Windsor to Tokarahi) ..	82,785	..	..	..	..	..	..	..	..	82,785	..
Waitema Branch (Palmerston to Dunback) ..	33,191	..	..	..	..	..	..	..	..	33,191	..
Fernhill Railway ..	1,415	..	..	..	..	..	..	..	..	1,415	..
Brighton Road Branch ..	6,474	..	..	..	..	..	..	..	..	6,474	..
Outram Branch (Mosgiel to Outram) ..	11,951	..	..	..	..	..	..	..	..	11,951	12,829
Lawrence Branch ..	307,218	..	..	..	..	..	..	..	..	341,083	29,691
Baldutha to Tusepeka Mouth ..	1,950	..	..	..	..	..	..	..	..	2,489	..
Catlin's River Branch (Baldutha to Tahakopa) ..	462,726	..	..	..	..	..	..	..	..	462,726	..
Heriotburn Branch (Waipahi to Edievale) ..	124,088	..	..	..	..	..	..	..	..	124,088	..
Waikaka Branch (McNab to Waikaka) ..	68,423	..	..	..	..	..	..	..	..	68,423	..
Gore to Lumsden ..	112,047	..	..	..	..	..	..	..	..	112,054	..
Edendale to Glenham ..	53,328	..	..	..	..	..	..	..	..	53,328	..
Riversdale to Switzers ..	82,304	..	..	..	..	..	..	..	..	82,304	..
Seaward Bush to Catlin's (Appleby to Tokanui) ..	184,985	..	..	..	..	..	..	..	..	185,144	..
Otago Central (Wingatui to Cromwell) ..	1,429,740	..	..	..	..	..	..	..	..	1,433,902	..
Invercargill to Kingston—											
Main Line ..	359,851	..	..	..	..	..	..	..	..	360,383	91,937
Mararoa Branch (Lumsden to Mossburn) ..	27,217	..	..	..	..	..	..	..	..	27,217	..
Winton to Heddon Bush ..	231	..	..	..	..	..	..	..	..	140	..
Makarewa to Orepuki and Waiau ..	261,472	..	..	..	..	..	..	..	..	272,370	37,097
Thornbury to Wairoa ..	85,943	..	..	..	..	..	..	..	..	86,125	23,200
Forest Hill (Winton to Hedgehope) ..	23,337	..	..	..	..	..	..	..	..	23,337	..
Expenses of Railway Commissions and other Expenditure not chargeable to Individual Lines	10,337	..	..	..	..	..	..	..	..	10,337	..
Surveys of New Lines—											
North Island ..	35,927	..	..	..	..	..	..	..	..	38,443	..
Middle Island ..	5,752	..	..	..	..	..	..	..	..	5,763	..
Rolling-stock ..	7,046,624	..	..	..	..	..	..	..	..	8,565,107	..
Suspense Account, being proportion of cost of raising loan of £1,000,000 at 6 per cent. for Railways Authorization Improvement Act 1914 Account	..	..	..	..	..	..	..	..	..	67,319	..
Stock of Permanent-way Materials, 31st March, 1921 ..	£81,400	..	..	..	..	..	..	..	..	..	..
Stock of Permanent-way increased by ..	39,185,360	..	..	..	..	..	..	..	..	..	..
Stock of Permanent-way Materials, 31st March, 1922 ..	179,906	..	..	..	..	..	..	..	..	..	..
.. ..	..	..	..	..	..	..	..	..	..	261,306	..
Total ..	39,365,266	751	955,719	141,195	1,096,914	1,856,380	209,179	..	..	42,526,988	1,787,741†

* Railways Improvement Authorization Act 1914 Account.
Amendment Act. 1903

† Includes value for £150,000 paid to debenture-holders under the Midland Railway Petitions Settlement Act

TABLE No. 4.
EXPENDITURE OUT OF SEPARATE ACCOUNTS ON WORKS UNDER THE CONTROL OF THE PUBLIC WORKS DEPARTMENT.

Year.	Loans to Local Bodies Account. Roads to open up Crown Lands.	Opening up Crown Lands for Settlement Account. Roads to open up Crown Lands.	Land for Settlements Account. Opening up Crown Lands for Settlement Account. Roads to open up Crown Lands.	National Endowment Account. Roads to open up National endowment Lands.	Land for Settlements Account. Roads to open up Land for Settlements.	Waihou and Ohinemuri Rivers Improvement Account. Waihou and Ohinemuri Rivers Improvement.
	£	£	£	£	£	£
1890-91	25,000					
1891-92	64,000					
1892-93	800					
	89,800*					
1891-92	8,000†					
1892-93	29,833†					
1893-94	30,000†					
1894-95	6,114†					
1894-95	42,971‡					
1895-96	30,057‡					
1896-97	31,017					
1897-98	18,770					
1898-99	16,972					
1899-1900	31,363					
1900-1	37,890					
1901-2	31,979					
1902-3	18,578					
1903-4	25,753					
1904-5	28,895					
1905-6	38,801					
1906-7	47,371					
1907-8	38,524					
1908-9	54,713					
1909-10	40,507	..	..	4,975	..	
	607,608§					
1910-11	..	45,691	..	5,619	..	..
1911-12	..	49,739	..	6,554	..	3,769
1912-13	..	47,951	..	2,689	..	9,555
1913-14	..	63,245	..	4,282	..	9,632
1914-15	..	..	92,975	9,151	..	10,004
1915-16	..	..	47,974	13,344	..	9,225
1916-17	..	..	24,730	6,787	..	10,407
1917-18	..	..	..	..	43,996	12,025
1918-19	..	..	..	..	51,355	27,402
1919-20	..	..	..	..	61,692	34,806
1920-21	..	..	..	..	28,920	62,249
1921-22	..	..	..	..	51,471	54,379
	697,408	206,626	165,679	53,401	237,434	243,453

* Payment to the Public Works Fund under section 31 of the Government Loans to Local Bodies Act, 1886, in reduction of expenditure under Class "Roads."
† Paid into the Public Works Fund, reducing the expenditure under Class "Roads."
‡ Paid into the Lands Improvement Account (now included in Public Works Fund under Class "Roads"), reducing the expenditure on roads.
§ Expenditure under the Government Loans to Local Bodies Act Amendment Act, 1891.

TABLE No. 5.
EXPENDITURE ON PUBLIC BUILDINGS OUT OF PUBLIC WORKS FUND TO THE 31ST MARCH, 1922, AND THE LIABILITIES ON THAT DATE.

	Total Expenditure to 31st March, 1921.	Expenditure for Year ended 31st March, 1922.	Total Expenditure to 31st March, 1922.	Liabilities on Authorities, Contracts, &c., 31st March, 1922.	Total Expenditure and Liabilities.
	£	£	£	£	£
Judicial*	1,093,161	68,642	1,161,803	2,727	1,164,530
Postal and telegraph	1,462,421	112,231	1,574,652	17,098	1,591,750
Customs	49,441	..	49,441	..	49,441
Offices for public Departments	570,228	17,977	588,205	3,822	592,027
Mental hospitals	918,893	41,838	960,731	1,982	962,713
Alexandra Depot, Wellington†	8,084	..	8,084	..	8,084
School buildings	3,107,545	Cr. 6,786	3,100,759	..	3,100,759
Hospitals‡	200,020	26,131	226,151	1,264	227,415
Quarantine-stations	57,883	4,581	62,464	17	62,481
Parliament Buildings (old buildings)	76,553	..	76,553	..	76,553
Parliament Buildings (new buildings)	219,354	57,685	277,039	29,850	306,889
Parliament Buildings (alterations to streets, surrounding grounds, and purchase of land)	14,187	..	14,187	..	14,187
Government House, Wellington (land and new building)	61,686	10,702	72,388	61	72,449
Agricultural	80,769	1,115	81,884	82	81,966
Workers' dwellings	319,916	..	319,916	..	319,916
Miscellaneous	60,653	693	61,346	40	61,386
Totals	8,300,794	334,809§	8,635,603	56,943	8,692,546

* Includes Courthouses, prisons, and police-stations.
† Includes £32,754 previously shown under "Public Health."
‡ Recoveries in reduction of
§ Expenditure re Defence requirements only. Other expenditure included in "Judicial" class.

TABLE NO. 6.

DEVELOPMENT OF WATER-POWER.

STATEMENT OF ACCOUNTS AT THE 31st MARCH, 1922.

GENERAL BALANCE-SHEET AT 31st MARCH, 1922, COMPARED WITH POSITION AT 31st MARCH, 1921.

1920-21.			1921-22.			1920-21.			1921-22.		
Liabilities.			Assets.								
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Aid to Water-power Works and Electric Supply Accounts—			Lake Coleridge scheme—			Assets as per separate balance-sheet			Profit and Loss Account—Accumulated loss to date		
405,000	0	0	..	..	..	567,704	2	8	814,050	14	1
64,000	0	0	..	..	..	30,673	18	4	29,175	9	5
56,500	0	0	..	..	..	598,378	1	0	843,226	3	6
1,331,010	0	0	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..
212,500	0	0	..	..	..	..	..	..	..	..	..
Waihi Gold-mining Company (Limited)—Purchase of Horahora works—Deed of security at 5 per cent. interest			Waikato River schemes—Horahora			Assets as per separate balance-sheet			Profit and Loss Account—Accumulated loss to date		
..	..	..	..	..	..	294,848	8	7	404,933	6	10
..	..	..	..	..	..	8,404	3	3	5,882	15	9
..	..	..	..	..	..	303,252	11	10	410,816	2	7
Consolidated Fund—Interest accrued on loans to 31st March, 1922			Arapuni—Headworks and surveys			11,276	0	10	13,848	13	9
19,155	3	5	..	..	..	..	..	..	500	0	0
1,417	2	3	..	..	..	..	..	..	46,353	0	0
44,750	17	9	..	..	..	11,276	0	10	2,706	13	8
7,590	7	4	..	..	..	..	..	..	63,408	7	5
5,653	4	9	..	..	..	..	..	..	8,527	11	2
3,673	14	5	..	..	..	..	..	..	52,676	0	0
Lake Coleridge scheme—Depreciation reserve			Mangahao River scheme—Land and easements			5,680	10	4	39,487	10	8
..	..	..	..	..	..	21,213	11	10	5,098	16	7
..	..	..	..	..	..	3,902	13	2	12,611	6	1
..	..	..	..	..	..	6,919	2	2	2,859	15	4
..	..	..	..	..	..	3,815	17	0	78,301	16	4
..	..	..	..	..	..	51,092	8	8	28,151	17	0
..	..	..	..	..	..	10,003	9	7	23,004	4	4
..	..	..	..	..	..	12,437	8	3	56,955	14	9
..	..	..	..	..	..	19,636	10	7	16,929	1	3
6	17	0	..	..	..	..	..	..	324,603	13	6
Interest on securities held by Investment Fund			Sundry debtors			143,109	13	1	1,544	15	1
..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	32,079	12	3
..	..	..	..	..	..	..	..	..	12,525	5	0
..	..	..	..	..	..	..	..	..	9,544	12	3
..	..	..	..	..	..	2,906	17	4	5,327	10	0
..	..	..	..	..	..	..	..	..	1,573	19	6
..	..	..	..	..	..	..	..	..	1,515	5	3
..	..	..	..	..	..	..	..	..	62,566	4	3
2,151,257	6	11	..	..	..	1,058,923	4	1	1,706,165	6	4
Carried forward			Carried forward			Carried forward			Carried forward		

GENERAL BALANCE-SHEET AT 31ST MARCH, 1922, COMPARED WITH POSITION AT 31ST MARCH, 1921—continued.

1920-21.		Liabilities.		1921-22.		1920-21.		Assets.		1921-22.	
£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.
2,215,257	6 11	Brought forward	..	4,089,936	1 10	1,058,923	4 1	Brought forward	..	1,706,165	6 4
								Other schemes, surveys, &c.—	..		
								North Island—	..		
						376	13 11	Aratiatia (Waikato River)	..	376	13 11
						413	9 6	Huka Falls (Waikato River)	..	423	9 6
						2,778	17 3	Hutt River (including dam site)	..	2,754	17 3
						38	9 0	Makuri River	..	38	9 0
						1,216	19 7	Rokiti-Kaituna	..	1,355	4 4
						879	16 8	Tauherikau River	..	879	16 8
						236	6 8	Wairua River	..	236	6 8
						5,940	12 7		..		6,064 17 4
						803	1 9	South Island—	..	803	1 9
						5	0 0	Clarence River	..	5	0 0
						129	15 9	Lake Kanieri	..	749	8 2
						96	1 0	Nelson-Marlborough	..	96	1 0
						519	12 7	Timaru-Oamaru	..	519	12 7
						17	7 0	Opihi River	..	17	7 0
						543	0 5	Toaroha River	..	543	0 5
						11	19 0	Teviot River	..	11	19 0
						475	5 8	Upper Taieri River	..	475	5 8
						2,601	3 2	Lake Hawea	..		3,220 15 7
						4,259	15 4		..		4,404 9 11
								General expenditure not chargeable to any individual scheme	..		
								Balance in Electric Supply Account at the end of the year—	..		
						40,495	8 9	Cash in Public Account	..	4,788	11 1
						1,517	0 0	In hands of Government officers in New Zealand	..	1,309	17 6
						36,760	3 0	In hands of Government officers in London	..	60,558	10 6
						78,772	11 9		..		66,656 19 1
						1,000,760	0 0	Investment Account (funds invested until actually required for use)	..		2,104,460 0 0
								Interest accrued on investments to 31st March, 1922	..		3,890,972 8 3
								Suspense Accounts—	..		28,905 17 2
								Treasury charges for raising loans	..		3,919,878 5 5
								Interest not allocated to any scheme	..		170,057 16 5
2,151,257	6 11			£4,089,936	1 10	2,151,257	6 11				£4,089,936 1 10

I hereby certify that the general balance-sheet has been duly examined and compared with the relative books and documents submitted for audit and correctly states the position as disclosed thereby.

G. F. C. CAMPBELL.

P. S. WALDIE,
Accountant, Public Works Department.

TABLE NO. 6—continued.
LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY.
PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1922, COMPARED WITH YEAR ENDED 31ST MARCH, 1921.
Gross Revenue Account.

1920-21.	1921-22.	1920-21.	1921-22.	1920-21.	1921-22.
£ s. d. 2,366 8 7 1,562 1 5 118 9 7 764 0 9 .. 67 11 0 41 9 4 26 12 8 649 18 7 133 0 2 272 19 3 6,002 11 4	To Generating expenses, headworks, and power-house— Salaries Wages Supplies Transport of stores, &c. .. Maintenance and repairs— Maintenance, Harper diversion .. Headworks Pipe-lines Power-house building Power-house machinery Roads and fences Staff residences, &c. Transmission-line— Salaries Transport, including upkeep of horses, traps, cars, and cycles Repairs to power-lines Repairs to roads Substation, Addington— Salaries Wages Supplies Maintenance and repairs— Buildings and yards Machinery Distribution— Salaries Wages Transport, including upkeep of motor lorry and car Maintenance of feeder cables, transmission stations, and tools Maintenance of secondary distribution Maintenance of and testing meters Earth-testing Carried forward	£ s. d. 2,971 13 3 1,016 16 11 195 10 9 651 11 0 1,002 10 2 49 1 10 .. 49 0 0 987 7 10 256 13 4 120 11 4 518 6 4 593 0 10 1,897 11 3 146 10 0 1,124 9 7 679 0 9 145 12 11 185 11 5 147 11 8 208 18 10 1 2 4 143 7 1 1,686 19 8 772 14 4 244 1 5 289 3 2 ..	£ s. d. 47,874 0 10 1,767 8 5 49,641 9 3 18 5 2 630 0 10 157 10 0 63 7 0 850 17 10 341 10 0 160 0 0 30 0 0 31 8 6 22 16 1 276 18 9 51,373 5 7 16,084 18 0	By Sale of energy— Wholesale Retail Discounts forfeited Rents— Land and buildings Electric lines " plant Fees for testing and repairing electrical appliances Stand-by provision: Fees from wholesale consumers Supervision charges on works not connected with Lake Coleridge, carried out by staff Royalty on shingle sold Interest from local bodies in respect of reticulations sold on deferred payment Earnings motor-vehicles Carried forward	£ s. d. 52,866 7 0 1,869 15 11 813 17 10 169 14 0 20 14 4 .. 746 3 1 160 0 0 156 19 4 56,813 15 3

TABLE NO 6—continued.
LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY—continued
PROFIT AND LOSS APPROPRIATION ACCOUNT.

1920-21.	—	1921-22.	1920-21.	—	1921-22.
£ s. d. 34,120 14 7	To Balance from previous year's statement	£ s. d. 30,673 18 4	£ s. d. 3,446 16 3 30,673 18 4	By Balance from Net Revenue Account Balance to balance-sheet—Accumulated loss	£ s. d. 1,498 8 11 29,175 9 5
£34,120 14 7		£30,673 18 4	£34,120 14 7		£30,673 18 4

DEPRECIATION RESERVE ACCOUNT.

£ s. d.	To Amounts written off motor vehicles and tools	£ s. d.	£ s. d.	By Balance from previous year's statement Interest at 4 per cent. per annum Amount set aside as per Profit and Loss Account	£ s. d.
44,750 17 9	Balance to balance-sheet	427 9 6 54,536 19 0	35,389 4 2 1,415 11 2 7,946 2 5		44,750 17 9 1,790 0 9 8,423 10 0
£44,750 17 9		£54,964 8 6	£44,750 17 9		£54,964 8 6

NOTE.—The State Supply of Electrical Energy Act provides for the establishment of a sinking fund of 1 per cent. per annum when profits are available for the purpose, and for the payment of arrears of sinking-fund contributions out of any future profits. The arrears of sinking fund (at 4 per cent. interest) since commencement of operations in 1915 total £29,855.

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY—continued.

BALANCE-SHEET AT 31ST MARCH, 1922—continued.

1920-21.			1921-22.			1920-21.			Assets.			1921-22.		
£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
598,378	1	0	Brought forward ..	..	..	336,310	9	5	Brought forward ..	..	..	472,997	11	3
									Primary distribution—					
						6,882	12	7	Supply cables—Christchurch City			6,829	9	4
						4,834	0	6	Christchurch Tramways			4,834	0	6
						6,913	8	7	Lyttelton			7,013	3	9
						16,354	5	7	Northern			16,513	15	8
						7,729	4	6	Southern			10,786	5	1
						1,406	8	4	Motukarara			3,515	12	4
						622	9	9	Lightning-arresters			622	9	9
						310	14	5	Tools and equipment			300	4	5
						1,516	12	8	Alterations to public telegraph-lines			1,516	12	8
						46,569	16	11				51,931	13	6
									Secondary distribution—					
						19,052	0	9	Supply cables and reticulation			22,024	17	3
						8,817	17	4	Local substations			20,395	4	11
						27,869	18	1				42,420	2	2
						16,147	16	5	Service transformers and meters			16,744	12	4
						8,452	10	4	Motor cars, lorries, and cycles, &c.			8,171	12	0
						93	15	10	Test-room equipment			101	10	7
						8,852	3	3	Loose plant, tools, and equipment			10,796	7	7
						1,729	3	9	Public telephones to the lake			1,729	3	9
						173	19	1	Telephones to Christchurch City Council and			173	19	1
						236	16	7	Tramway Board and local officers			247	3	2
						19,423	8	4	Christchurch office—Furniture and fittings			23,969	18	8
						16,772	8	11	Engineering, office, and general expenses on			20,378	10	7
						978	11	11	preliminary surveys and during construction..			..		
						16,346	8	1	Salaries of Engineers and others on preliminary			..		
									surveys and during construction			..		
									Survey and investigation, Timaru line route			..		
									Interest during construction			21,945	14	4
						499,957	6	11				671,607	19	0
						56,184	5	9	Stocks of material, &c., on hand at date			128,674	19	8
						152	12	1	Telephone subscriptions and fire insurance paid			162	18	10
									in advance			..		
						9,016	8	10	Sundry debtors—			11,839	13	3
						2,393	9	1	For current and rent			1,765	3	4
						11,409	17	11	For work carried out, &c..			..		
						567,704	2	8				13,604	16	7
						30,673	18	4	Balance from Profit and Loss Appropriation			814,050	14	1
									Account			29,175	9	5
						£598,378	1	0				£843,226	3	6
						£843,226	3	6						

The balance-sheet has been duly audited with the various supporting books, vouchers, and documents, and found to correspond therewith.

G. F. G. CAMPBELL, Controller and Auditor-General.

TABLE NO. 6—continued.

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA SCHEME.

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1922, COMPARED WITH YEAR ENDED 31ST MARCH, 1921.
Gross Revenue Account.

1920-21.	—	1921-22.	1920-21.	1921-22.
£ s. d.		£ s. d.	£ s. d.	£ s. d.
2,363 5 2	To Generating expenses, headworks, and power-house—	2,546 2 11	14,719 8 5	27,105 2 7
433 8 2	Salaries ..	139 19 2	..	271 16 7
281 11 4	Wages ..	326 19 8	..	26,833 6 0
93 1 8	Supplies ..	70 14 6	..	
	Transport ..		..	
	Maintenance and repairs—		..	
259 9 10	Headworks and buildings	288 7 4	..	83 16 10
301 7 10	Power-house machinery	282 18 2	..	216 6 0
111 7 10	Staff village ..	79 14 10	85 10 1	348 7 0
3,843 11 10		3,734 16 7	85 10 1	648 9 10
748 16 10	Transmission-line, Horahora to Waihi—	691 1 8	..	725 8 3
36 16 10	Wages ..	45 16 0	..	..
35 10 11	Supplies ..	38 13 0	..	
136 4 2	Repairs, &c. ..	135 4 7	..	
957 8 9	Transport ..		910 15 3	
..	Transmission-line, Horahora to Frankton—	97 8 7		
..	Wages ..	3 1 0		
..	Supplies ..	3 6 10		
..	Repairs ..	22 2 10		
..	Transport ..		125 19 3	
..	Transmission-line, Mystery Creek to Te Awamutu—	..	8 2 9	
	Wages ..	..		
	Substations—			
	Waikino Substation—			
491 16 8	Operating wages (half) ..	561 5 0		
154 5 4	Repairs to building, machinery, &c. ..	178 17 6		
..	Hamilton Substation ..	61 11 8		
..	Grand Junction Substation ..	297 10 4		
..	Various substations ..	12 0 10		
646 2 0			1,111 5 4	
5,447 2 7	Carried forward ..	..	5,890 19 2	..
			14,804 18 6	28,207 4 1
			Carried forward ..	..

TABLE NO. 6—continued.
 WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA SCHEME—continued.
 PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1922, COMPARED WITH YEAR ENDED 31ST MARCH, 1921—continued.
Gross Revenue Account—continued.

1920-21.	—	1921-22.	1920-21.	1921-22.
£ s. d. 5,447 2 7 142 17 2	Brought forward	£ s. d. 5,890 19 2 ..	£ s. d. 14,804 18 6	Brought forward
503 5 3	Hire of plant	769 13 2		
60 12 4	Management and general—			
87 16 11	Management, salaries, and wages ..	180 2 2		
35 10 1	Accident insurance, sick and holiday pay	191 14 10		
41 8 10	Travelling-expenses and motor-cars ..	59 7 2		
27 6 0	Postages, telegrams, and telephone ..	24 16 11		
34 15 5	Fire insurance	7 7 0		
60 7 0	Legal expenses	48 11 9		
..	Printing, stationery, and advertising ..	97 19 3		
10 18 2	Office rent, cleaning, and lighting ..	17 5 1		
862 0 0	Experimental testing	9 5 8		
..	Miscellaneous expenses	1,406 3 0		
..	Purchase of current	8 15 6		
..	Testing, oil-drying, repairs, &c., for consumers	680 10 7		
6,451 19 9	.. ..	7,986 8 3		
8,352 18 9	Balance to Net Revenue Account ..	20,220 15 10		
£14,804 18 6		£28,207 4 1	£14,804 18 6	

Net Revenue Account.

£ s. d. 10,675 0 0 3,959 14 0	To Interest on purchase-money for plant purchased from Waihi Gold-mining Company, and on advances from Treasury .. Depreciation on completed works (2 per cent.) Special depreciation provision to cover cost of replacing temporary work Balance to Profit and Loss Appropriation Account ..	£ s. d. 13,187 5 0 4,262 3 4 250 0 0 2,521 7 6 £20,220 15 10	£ s. d. 8,352 18 9 6,281 15 3 £14,634 14 0	By Balance from Gross Revenue Account Balance to Profit and Loss Appropriation Account	£ s. d. 20,220 15 10 £20,220 15 10
---	--	---	---	---	--

TABLE NO. 6—continued.

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA SCHEME—continued.

PROFIT AND LOSS APPROPRIATION ACCOUNT.

1920-21.		—		1921-22.		1920-21.		1921-22.	
£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.
2,122	8 0	To Balance from previous year	..	..	..	By Balance from Net Revenue Account	..	2,521	7 6
6,281	15 3	Balance from Net Revenue Account	..	..	..	Balance to Balance-sheet—Accumulated loss to date	..	5,882	15 9
£8,404	3 3			£8,404	3 3			£8,404	3 3

DEPRECIATION RESERVE ACCOUNT.

£ s. d.		£ s. d.		£ s. d.		£ s. d.	
To Amount written off for value of motor-cycle accidentally destroyed		180 0 0		By Balance at 31st March, 1921		5,653 4 9	
Balance to balance-sheet		10,210 10 7		Interest for year		225 2 6	
				Amount set aside as per Net Revenue Account		4,512 3 4	
		£10,390 10 7				£10,390 10 7	

BALANCE-SHEET AT 31ST MARCH, 1922.

[illegible]

TABLE No. 6—continued.

WAIKATO ELECTRIC-POWER SUPPLY.—HORAHORA SCHEME—continued.

BALANCE-SHEET AT 31st MARCH, 1922—continued.

1920-21.	Liabilities.	1921-22.	1920-21.	Assets.	1921-22.
£ s. d. 303,252 11 10	Brought forward	£ s. d. 410,816 2 7	£ s. d. 202,777 11 6	Brought forward	£ s. d. 263,904 5 9
			535 16 1	Distribution-lines	715 16 0
			17,724 9 0	Main substations—	
			83 19 2	Waikino	18,557 17 11
			131 6 4	Hamilton	4,124 3 10
			..	Te Awamutu	2,279 6 0
			17,939 14 6	Te Aroha	5,884 19 10
			..	Distribution substations	30,846 7 7
			..	Land at Ruakura	6,077 19 2
			1,532 12 4	Stores buildings and fittings and railway-siding, Ruakura	3,600 12 4
			2,368 14 7	Staff residences, Ruakura	6,315 15 2
			2,815 8 8	Loose tools and equipment	2,611 17 6
			363 0 0	Motor lorries, cars, and cycles	3,705 11 8
			3,174 0 6	Office furniture, Hamilton	4,106 2 6
			2,372 2 8	Engineering, office, and general expenses on surveys and on construction	427 6 10
			15,619 13 8	Salaries of officers on surveys and on construction	5,744 19 9
			249,498 14 6	Interest during construction	6,434 12 10
			44,023 17	General stocks of material on hand	19,316 8 0
			4,023 17 2	Stocks of spares, &c.	353,807 15 1
			1,276 8 7	Debtors—	
			49 8 4	For electricity and sales of material	45,098 5 8
			1,325 16 11	For insurance premiums, &c., paid in advance	300 9 0
			294,848 8 7	Balance from Profit and Loss Appropriation Account—Accumulated loss to 31st March, 1922	45,398 14 8
£303,252 11 10	£410,816 2 7	£303,252 11 10	£303,252 11 10		5,726 17 1
					404,933 6 10
					5,882 15 9
					£410,816 2 7

The balance-sheet has been duly audited with the various supporting books, vouchers, and documents, and found to correspond therewith.

G. F. C. CAMPBELL, Controller and Auditor-General.

TABLE NO. 7.
IRRIGATION AND WATER-SUPPLY.
SCHEDULE OF SCHEMES COMPLETED OR UNDER CONSTRUCTION.

Scheme.	Source of Supply.	River Discharge (Minimum).	Main Canal Discharge (Maximum).		Rainfall Average for Five Years.	Rainfall, 1921.	Area commanded (Gross).	Area irrigated at Present.	Works authorized.		Works completed.		Expenditure to 31st March, 1922.	Estimate to complete.	Remarks.
			As per Design.	During 1921-22.					Main Canals.	Distributaries.	Main Canals.	Distributaries.			
Steward Settlement	Waitaki River	Cusecs. ..	Cusecs. 110	Cusecs. ..	Inches. 22.51	Inches. 16.92	Acres. 18,000	M. ch. 14 60	M. ch. 50 31	M. ch. 14 60	M. ch. 50 31	£ 12,115	£ ..	Completed. Completed scheme. Mostly on west side of river. 1½ cusecs to east side for stock-race.	
Otekaie	Otekaie River	9	15	..	21.84 (Duntroon)	17.94	800	14 37	3 47	14 37	3 47	3,631	..		
Ida Valley	Poolburn, Manorburn, and Moa Creek. (Storage Manorburn Dam)	..	109	68	15.39 (Moa Cr.)	14.58	28,600	56 0	54 0	52 0	14 0	135,086	32,847	Further work consists of German Hill race extension and various distributaries. Further conservation required to provide complete irrigation, which is not included in estimate.	
Galloway	Manorburn Dam	..	15	14	16.82 (Clyde)	15.67	1,300	7 30	4 0	7 30	4 0	13,494	396	Completed. Further expenditure for details to adapt races to land as settled.	
Manuherikia - Alexandra-Clyde No. 1	Manuherikia River	77	100	..	15.42 (Clyde and Ophir)	14.22	11,000	21 58	41 0	21 58	33 55	164,847	15,308	Expected to be completed within year.	
Ardgour	Lindis River	50	20	..	21.75 (Luggate)	22.33	2,000	13 0	2 0	10 0	Nil.	11,877	14,851	Under construction.	
Fraser River, Earnsclough	Fraser River and storage dam	8	20	20	16.82 (Clyde)	15.67	4,000 (Main), and 1,580 (Temp.)	4 30	12 10	4 30	12 10	2,834*	614 (Temp.)	Main scheme for dam. Temporary scheme for Sandy Point water-rights under construction.	
Ohrig Terrace	Manorburn Dam	..	..	..	14.02 (Ophir)	12.77	1,600 (Temp.)	300	..	..	..	..	..	..	Included in Ida Valley scheme.

* Includes £1,500 paid for Sandy Point mining rights.

TABLE NO. 7 -continued.
SCHEDULES OF SCHEMES UNDER INVESTIGATION.

Scheme.	Source of Supply.	River Discharge (Minimum).	Main Canals Discharge (Maximum), as per Design.	Rainfall (Average for Five Years).	Rainfall, 1921.	Area commanded (Gross).	Length of Main Canals.	Length of Distributaries.	Expenditure to 31st March, 1922.	Estimate to complete.	Remarks.
Last Chance Water-race	Shingle Creek, Gorge Creek, and Chasm Creek	Cusecs. 9	15	Inches. No records	Inches. No records	Acres. 4,300	Miles. 30	Miles. ..	£ 1,139	£ 7,000	Water available for 1,800 acres only.
Maniototo ..	Taieri River and storage dam	25	500	20-10 (Eweburn)	18-34	100,000	60	..	66	..	Modified scheme for complete irrigation of 5,000 acres is possible without storage, or for reasonable partial irrigation of 15,000 acres.
Cromwell Flat and Low-burn	Roaring Meg Stream (gravity), Kawarau River (pumping)	29 3,000	40	21-75 (Luggate)	22-33	15,000	10	30	..	39,700	Roaring Meg Stream: This will irrigate 3,750 acres, and may be reduced in cost by charging £11,350 to possible hydro-electric - power development. Kawarau River: A private company is developing this portion of scheme. These schemes include the whole of irrigable lands in Manuherikia Valley, White Sow Valley, and part Maniototo Plains about Raifurly. For complete irrigation depends entirely on storage dams, but a useful partial irrigation supply might be installed without dams for majority of area. Dams to follow later. Survey proceeding.
Upper Manuherikia schemes	Manuherikia and Dunstan Rivers, two storage dams in Manuherikia River, and one in Dunstan River	77	Several, not fixed	17-59 (Clyde, Ophir, and Blackstone Hill)	17-21	90,000	..	..	325	..	To irrigate Arrow Flats, Miller's Flat, Speargrass Flat, and Frankton. Survey proceeding.
Arrow River scheme ..	Arrow River ..	100	..	32-18 (Queenstown)	28-65	6,536	17	24	..	93,598	
Hawea Flat scheme ..	Timaru Creek..	20 (About)	30	24-96 (Maungawera)	23-03	3,000	10 M. ch. 13 16	M. ch. 15 60	..	..	
Tarras scheme ..	Lindis River ..	50	63	21-75 (Luggate)	22-33	7,000	Miles. 7	..	..	77,500	
Bendigo Flat scheme ..	Lindis River and storage dam	50	30	21-75 (Luggate)	22-33	3,000	22	Miles. 18	..	..	
Teviot River scheme ..	Teviot River and Lake Onslow dam	40	80	21-97 (Roxburgh)	22-08	16,400	..	..	7	..	Involves enlarging Lake Onslow dam.

TABLE No. 8.
IRRIGATION AND WATER-SUPPLY.
IDA VALLEY, GALLOWAY FLAT, AND OLRIG TERRACE SCHEME.
PROFIT AND LOSS ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 1922.

<i>Gross Revenue Account.</i>					
To Management—			By Sales of water—		
Ida Valley section—	£	s. d.	Ida Valley section	£	s. d.
Salaries	57	7 4	Galloway Flat section	1,905	3 4
Wages, horse allow- ances, and other costs of maintenance ..	995	0 3	Olrig Terrace section	82	12 11
		1,052		43	17 0
Galloway Flat section—		7 7			
Salaries	6	7 1			
Wages, horse allow- ances, and other costs of maintenance ..	116	12 2			
		122			
Olrig Terrace section—		19 3			
Salaries	8	18 1			
Wages, horse allow- ances, and other costs of maintenance ..	100	19 4			
		109			
Office rent		10			
Gross profit in working		736			
		9 0			
		£2,031			£2,031
		13 3			13 3

<i>Net Revenue Account.</i>					
To Interest on capital outlay—			By Gross profit on working as per Gross		
4 per cent. per annum on £137,426	£	s. d.	Revenue Account	£	s. d.
12s. 2d. (half charged against revenue)	2,748	10 7	Net loss for year	3,386	6 11
Amount required as contribution to National Sinking Fund, 1 per cent. on capital outlay	1,374	5 4			
	£4,122	15 11			£4,122
					15 11

GENERAL BALANCE-SHEET AT 31ST MARCH, 1922.

<i>Liabilities.</i>			<i>Assets.</i>		
Public Works Fund—	£	s. d.	Dams, weirs, water-races, &c.—	£	s. d.
Capital expenditure to 31st March, 1922	148,579	2 7	Ida Valley section—		
Consolidated Fund—			Proportion Manorburn dam and headraces	46,829	0 0
Maintenance expenditure for year ended 31st March, 1922	1,295	4 3	Main water-races ..	79,503	17 3
Interest for year ended 31st March, 1922	5,497	1 3	Distribution water- races	1,000	0 0
		6,792			127,332
Arrears of sinking-fund con- tribution	1,374	5 4	Galloway Flat section—		17 3
Sundry creditors—			Proportion Manorburn dam	5,829	0 0
Ida Valley section	1,354	13 11	Dip Creek diverting- weir	1,095	0 0
Galloway Flat section		1 0 10	Main water-races ..	6,509	15 8
					13,433
			Olrig Terrace section—		15 8
			Proportion Manorburn dam and water- races	6,970	6 0
			Main water-races ..	315	8 4
					7,285
					4 4
					148,052
			Staff accommodation	1,140	7 3
			Telephone system	400	0 0
			Stocks of material on hand	250	0 0
			Interest during construction	2,748	10 8
			Sundry debtors (sale of water)—		
			1920-21 and pre- vious years	92	10 1
			1921-22	2,031	13 3
					2,124
					3 4
			Profit and Loss Account—Net loss	3,386	6 11
					£158,101
					8 2

Public Works Department,
Wellington, 2nd October, 1922.

P. S. WALDIE,
Accountant.

APPENDICES TO THE PUBLIC WORKS STATEMENT, 1922.

APPENDIX A.

AUDITED STATEMENT OF EXPENDITURE ON PUBLIC WORKS
OUT OF THE PUBLIC WORKS FUND FOR THE YEAR 1921-22.*Prepared in compliance with Section 8 of the Public Works Act, 1908.*

SIR,—

Public Works Department, Wellington, 12th July, 1922.

In compliance with the 8th section of the Public Works Act, 1908, I enclose a statement of the expenditure during the preceding financial year on all works and services chargeable to the Public Works Fund.

I have, &c.,

J. G. COATES,

Minister of Public Works.

The Controller and Auditor-General, Wellington.

STATEMENT OF NET EXPENDITURE ON ALL WORKS AND SERVICES CHARGEABLE TO THE PUBLIC
WORKS FUND (GENERAL PURPOSES ACCOUNT) FOR THE YEAR 1921-22.

Vote.	Summary.	Appropriation.	Expenditure.	Credits.	Net Expenditure.
	PUBLIC WORKS FUND (GENERAL PURPOSES ACCOUNT).	£	£ s. d.	£ s. d.	£ s. d.
43	Public Works, Departmental	165,082	184,225 5 6	55,941 16 3	128,283 9 3
44, 45	Railways	3,250,000	3,220,686 4 7	87,486 10 9	3,133,199 13 10
46-54	Public Buildings	389,960	357,363 9 7	12,624 4 5	344,739 5 2
55	Timber-supply and Sawmills for Public Works Department	42,000	16,372 7 11	3 4 0	16,369 3 11
56, 57	Lighthouses, Harbour-works, and Harbour-defences	21,575	18,916 6 3	142 2 8	18,774 3 7
58	Tourist and Health Resorts	25,925	20,770 0 11	2,773 18 9	17,996 2 2
59	Immigration	225,000	324,647 4 10	77,137 13 11	247,509 10 11
60-61	Roads, Bridges, and other Public Works ..	618,473	594,370 8 1	30,211 4 9	564,159 3 4
62	Development of Mining	2,000	2,129 18 7	..	2,129 18 7
63	Telegraph Extension	500,000	681,076 6 8	101,177 2 4	579,899 4 4
64	Contingent Defence	17,500	16,166 5 6	580 5 2	15,586 0 4
65, 66	Lands Improvement	25,033	17,549 11 2	87 3 9	17,462 7 5
67	Irrigation and Water-supply	85,000	87,704 6 7	4,991 9 4	82,712 17 3
68	Plant, Material, and Stores	175,000	230,705 16 8	124,273 19 5	106,431 17 3
..	Unauthorized	..	11,634 4 0	200 1 6	11,434 2 6
	Total, Public Works Fund	5,542,548	5,784,317 16 10	497,630 17 0	5,286,686 19 10

P. S. WALDIE,
Accountant.F. W. FURKERT,
Engineer-in-Chief and Under-Secretary.

Examined and found correct.

G. F. C. CAMPBELL,
Controller and Auditor-General.

APPENDIX A—continued.

	Name of Vote.	Appropriation.	Expenditure.	Credits.	Net Expenditure.
		£	£ s. d.	£ s. d.	£ s. d.
PUBLIC WORKS FUND.					
43	Public Works, Departmental	165,082	184,225 5 6	55,941 16 3	128,283 9 3
Railways—					
44	Railway-construction	1,150,000	1,363,682 11 11	86,862 14 10	1,276,819 17 1
45	Additions to Open Lines	2,100,000	1,857,003 12 8	623 15 11	1,856,379 16 9
Public Buildings—					
46	General	90,700	92,691 2 2	5,633 16 5	87,057 5 9
47	Courthouses	6,750	5,357 18 4	1,000 0 0	4,357 18 4
48	Prisons	45,000	42,953 12 11	1,213 7 10	41,740 5 1
49	Police-stations	30,000	22,562 14 7	18 10 11	22,544 3 8
50	Postal and Telegraph	128,510	114,959 6 9	2,053 2 0	112,906 4 9
51	Agricultural	4,000	2,809 19 4	1,695 4 3	1,114 15 1
52	Mental Hospitals	40,000	41,874 7 5	36 15 2	41,837 12 3
53	Hospitals and Charitable Institutions	41,200	31,282 0 10	569 11 2	30,712 9 8
54	School Buildings	3,800	2,872 7 3	403 16 8	2,468 10 7
55	Timber-supply and Sawmills for Public Works Department	42,000	16,372 7 11	3 4 0	16,369 3 11
Lighthouses, Harbour-works, and Harbour-defences—					
56	Lighthouses	17,500	16,492 14 3	142 2 8	16,350 11 7
57	Harbour-works	4,075	2,423 12 0	..	2,423 12 0
58	Tourist and Health Resorts	25,925	20,770 0 11	2,773 18 9	17,996 2 2
59	Immigration	225,000	324,647 4 10	77,137 13 11	247,509 10 11
Construction and Maintenance of Roads, Bridges, and other Public Works—					
60	Roads, &c.	603,048	583,078 11 8	30,183 14 9	552,894 16 11
61	Road and other Works on Goldfields and Mineral Lands	15,425	11,291 16 5	27 10 0	11,264 6 5
62	Development of Mining	2,000	2,129 18 7	..	2,129 18 7
63	Telegraph Extension	500,000	681,076 6 8	101,177 2 4	579,899 4 4
64	Contingent Defence	17,500	16,166 5 6	580 5 2	15,586 0 4
Lands Improvement—					
65	Improved-farm Settlements	30	..	16 0 0	Cr. 16 0 0
66	Lands, Miscellaneous	25,003	17,549 11 2	71 3 9	17,478 7 5
67	Irrigation and Water-supply	85,000	87,704 6 7	4,991 9 4	82,712 17 3
68	Plant, Material, and Stores	175,000	230,705 16 8	124,273 19 5	106,431 17 3
	Unauthorized—Services not provided for	..	11,634 4 0	200 1 6	11,434 2 6
	Total, Public Works Fund	5,542,548	5,784,317 16 10	497,630 17 0	5,286,686 19 10

APPENDIX B.

ANNUAL REPORT ON PUBLIC WORKS BY THE ENGINEER-IN-CHIEF.

The ENGINEER-IN-CHIEF to the Hon. MINISTER OF PUBLIC WORKS.

SIR,—

I have the honour to submit the following report upon the various works under my control completed and in progress throughout the Dominion during the period from the 1st June, 1921, to the 31st July, 1922.

RAILWAYS.

ABSTRACT.

The following table shows the expenditure on Government railways in New Zealand up to the 31st March, 1922 :—

Name of Railway.	Total Length of Railway or Section.	Open for Traffic.	Expenditure to 31st March, 1922.
	M. ch.	M. ch.	£
Kaihu Valley	24 30	19 58	161,872
Otiria-Hokianga	45 25	16 25	125,771
Opua Wharf—Onerahi	58 6	58 6	528,659
Kioreroa-Waiotira	19 79	5 23	367,529
North Auckland Main Trunk Railway (from Helensville)	84 24	54 27	1,600,885
Helensville—Te Awamutu, with Branches	163 48	150 39	3,006,328
Frankton Junction—Thames, with Branches	127 35	87 20	708,880
Thames Valley—Rotorua	69 33	69 33	378,618
Tauranga—Opotiki, with Branches	145 32	..	791,244
Gisborne—Opotiki	93 44	49 32	624,175
Napier—Gisborne	231 44	..	587,172
Wellington—Napier and Palmerston North (including Te Aro Extension and Greytown and Martinborough Branches)	249 44	233 12	2,718,645
Wellington—Waitara, with Branches	350 11	285 59	2,826,498
Stratford—Okahukura	112 47	42 26	1,111,299
North Island Main Trunk (Marton—Te Awamutu), including Raetihi Branch and Waipa Gravel-access Branch	225 79	218 39	2,947,205
Picton—Waipara (South Island Main Trunk Railway)—			
Picton southwards	92 38	56 6	657,074
Waipara northwards	90 45	44 14	375,414
Nelson—Greymouth	177 51	125 57	599,945
Stillwater—Arthur's Pass	51 41	42 27	1,452,523
Rolleston—Arthur's Pass (including Whitecliffs Branch)	92 59	84 45	859,540
Westport—Ngakawau	19 56	19 56	189,320
Westport—Ngakawau Extension to Mokihinui*	7 12	7 12	..
Mokihinui Colliery Line†	3 69	3 69	..
Westport—Inangahua	26 0	5 74	152,609
Ngahere—Blackball	3 40	3 40	147,532
Greymouth—Rewanui and Branches	11 34	8 70	303,131
Greymouth—Waitaha	50 32	38 68	341,916
Hurunui—Waitaki, with Branches	459 34	413 70	2,717,105
Canterbury Interior Main Line—Oxford—Temuka	83 0	11 44	59,942
Waitaki—Bluff, with Branches	600 21	546 12	5,029,433
Otago Central	182 51	147 27	1,433,902
Invercargill—Kingston, with Mararoa Branch	117 4	97 44	387,740
Forest Hill Railway—Winton—Hedgehope‡	12 40	12 40	23,337
Western Railways	94 8	70 31	358,495
Preliminary surveys	..	..	44,206
Miscellaneous	..	..	10,337
Stock of permanent-way on hand	..	..	261,306
Rolling-stock	..	..	8,565,107
Suspense Account, being proportion of cost of raising loan of £1,000,000 at 6 per cent. for Railways Improvement Authorization Act 1914 Account	..	..	67,319
Total	4,177 16	3,030 5	£42,522,013
PROVINCIAL GOVERNMENT LINES, ETC.			
Canterbury (lengths included above)	..	..	731,759
Otago and Southland	..	..	372,522
Gisborne to Ormond Tramway	..	..	4,975
Midland Railway, valuation of works constructed by company .. .. .	..	..	||683,460
Grand total	4,177 16	3,030 5	44,314,729

* The funds for this extension—namely, £35,501 2s. 11d.—were provided by the Westport Harbour Board.

† The funds for purchase of this line, £15,745, were provided by the Westport Harbour Board.

‡ The expenditure on this line as a tramway was made by the Lands Department.

§ Includes expenditure on railways under Hutt Road and Railway Improvement, Railway Improvement Authorization Act and Railway Improvement Authorization Act 1914 Accounts.

|| Includes value for £150,000 paid to debenture-holders under the Midland Railway Petitions Settlement Act Amendment Act, 1903.

KAIHU VALLEY RAILWAY EXTENSION.

(19 m. 17 ch. to 23 m. 71 ch.; length, 4 miles 54 chains.)

All the formation work on this line has been completed; all culverts are also completed, and the fencing is practically finished. Platelaying was completed both on main lines and in station-yards during the year. Ballasting is practically completed; only a small amount has yet to be spread at the Aranga and Donnelly's Crossing station-yards.

A good deal of delay occurred in procuring materials for the bridges on the line. One bridge at Donnelly's Crossing Station is completed. The piers of the other two bridges at 21 m. 24 ch. and 22 m. 65 ch. are completed, and the steel girders are now being placed in position.

Platforms and loading-banks at the stations are finished, but no buildings have yet been erected. All timber for these buildings has been cut at the Department's new mill at Whatoro, and has been delivered on to the sites. It is intended to immediately call tenders for the erection of the buildings.

The carriage of goods, which service was started in September, 1920, to Aranga Station, was extended to Donnelly's Crossing in October, 1921. During last summer large quantities of logs and other materials were hauled over the line.

This line should be completed, with the exception of the station buildings, by the end of September.

NORTH AUCKLAND MAIN TRUNK RAILWAY.

Ngapuhi Northwards.

Okaihau Section (16 m. 25 ch. to 24 m. 45 ch.; length, 8 miles 20 chains).—Formation on this length was finished last year, but large slips in the cutting at 19 m. 68 ch. and in Okaihau station-yard have still to be removed. A steam-shovel is now engaged in removing the one in Okaihau yard, after which it will shift the slip at 19 m. 68 ch. The high bank at 19 m. 55 ch. gave further trouble, and 8,400 cubic yards of stone were placed in the bank to drain it. This has been very satisfactory, and the bank now appears to be stable. A small bank at 20 m. 17 ch. has also given trouble. The culvert under the bank was broken by a slip on the bank and had to be removed, and a new culvert has been put in. On account of the unstable nature of the material in the bank, which was derived from an adjacent cutting, most of it will have to be removed and a new bank made from scoria rock.

No further platelaying has been done during the year. The rails extend to the beginning of Okaihau station-yard, and the yard is now being laid. The large stone-crushing plant for ballast and road-metal is now in good working-order, and is turning out stone at a very satisfactory cost. From this quarry the line has received the first lift of ballast from 16 m. 25 ch. to 24 m. 14 ch., and the Okaihau yard is now being ballasted as the main line and sidings are laid. At Okaihau station-yard a concrete block platelayer's cottage is being erected, and a water-supply is being installed. Material is also on the site for the erection of a cattle-yard.

Goods traffic has been run on this line since the beginning of March last.

During the greater portion of the year very few men were employed on this section, but additional men were put on at the end of March, and better progress is now being made.

North Auckland Main Trunk Railway.

Paparewa Section (90 m. 30 ch. to 92 m. 13 ch.; length, 1 mile 63 chains).—During the year the second and third lifts of ballast were put on throughout the main line on the section. No platelaying or ballasting has yet been done in Paparoa station-yard, owing to the uncertainty as to which station would be adopted as the subterminal on this railway. The erection of the fencing and construction of the culverts were completed throughout the year. A good deal of cleaning-up work yet remains to be done, although much was done during the year.

Mareretu Section (92 m. 13 ch. to 96 m. 20 ch.; length, 4 miles 7 chains).—About 3½ miles of fencing was done on this section during the year. Five concrete and five earthenware-pipe culverts, and a large number of pipe-culvert ends, were constructed. The formation is practically completed as far as Golden Stairs Tunnel, but slips occurred in most of the cuttings. These have been cleared sufficiently to allow traffic to get through. A bank at 93 m. 14 ch. has subsided badly, and a temporary line has been made round it. In order to transport plant and materials to the northern side of Golden Stairs Tunnel for the earthwork and tunnel at that end, a service tramway, 1½ miles long, has been laid to the top of the tunnel. A cable incline is used to lower the wagons on the other side of the tunnel. The formation beyond the tunnel has been done to 94 m. 71 ch., and is well in hand from here to the end of the section. Two steam-shovels have been employed on this length. A good many of the cuttings turned out to be very heavy pug, which could only be excavated economically by steam-shovels. The formation of the station-yard at Mareretu is on particularly bad ground, and had to be abandoned until steam-shovels became available. A considerable number of plough and scoop teams have been employed, but, owing to wet weather and the heavy nature of the earth, have not worked so economically as the steam-shovels. The Golden Stairs Tunnel, which is the chief work on this line, is progressing very satisfactorily. There is now 18½ chains of tunnel completely excavated and lined with concrete, of which 12½ chains is done at the south end and 6 chains at the north end. Both ends of the tunnel are now fully manned, and the tunnel should be completed before the end of the year. At both ends the country has been in good and hard sandstone, and only light timbering has been necessary. This justified the extensive deviation made in 1920. The permanent telephone-line has been erected throughout this section. About half a mile of platelaying was done, bringing the permanent-way up to the Golden Stairs Tunnel. Ballasting on the second and third lifts was done from Paparoa Station to Golden Stairs Tunnel. No ballasting has yet been done beyond the tunnel.

Waikiekie Section (96 m. 20 ch. to 107 m. 25 ch.; actual length, 10 miles).—Formation-work between 96 m. 20 ch. and 100 m. 40 ch. is well in hand, and from 100 m. 40 ch. to the end of the section is practically complete, except for the removal of a large number of slips. The difficulty of railway-building in this country may be understood from the fact that there is only one cutting in the whole section that has not slipped. There is nothing better than the steam-shovels for removing the slips, and three of the seven shovels working on this section are engaged on slip-removal. The largest work on this section now is the cutting at 96 m. 37 ch., where a steam-shovel is engaged, and on which another is to be placed in order to complete the cutting by January next. The whole of the other formation work should be finished simultaneously with this cutting. Between 102 m. 48 ch. and 103 m. 9 ch. a deviation of the line had to be made, as practically the whole country was slipping, large cuttings after excavation having been completely filled in again.

The formation of the Taipuha station-yard is in hand, but is being delayed by severe slips. The formation of the Waikiekie and Waiotira station-yards is practically completed, the latter station requiring a filling of over 30,000 cubic yards to make it up. The filling and the approaches to an overbridge across the station have been done by two steam-shovels. The employment of a large number of steam-shovels has been of inestimable value in the heavy formation work along this section, and very poor progress would have been made without them.

Fencing is well on towards completion on the section.

The Mareretu Tunnel was completed last Easter. Owing to slides and heavy ground the piercing of this tunnel was an exceedingly difficult operation. Very heavy timbering, closely placed, had to be used right through, and concrete lining varying from 18 in. to 2 ft. thick had to be used with an invert section. It was only by vigorous pushing-on of the work and close following-up with the concrete lining that the country could be held. All the material for the south end of the tunnel had to be hauled up by a cable tramway over the top of the tunnel. At the tunnel, huts, cookhouse, bath houses, septic tanks, and a large recreation-hall were built.

The understructure of the Managawai River Bridge is practically completed. Considerable difficulty was experienced in obtaining a foundation on account of the soft ground, which necessitated cradling and lengthening the piles by splicing. The Kikowhiti Stream Bridge is now well under way, all the staging and preliminary work having been completed. An overbridge at the north end of Waiotira station-yard has been finished, and work is in hand on the erection of the overbridge at the south end of the yard. Ironbark and other hardwood timbers have been received to do all the remaining bridges on the section.

Platelaying has been completed from Waiotira Junction station-yard (107 m. 9 ch.) southwards to 102 m. 12 ch. The temporary line south of 102 m. 12 ch. is now being lifted and replaced with the permanent rails. The sidings are now being laid in Waiotira and Waikiekie station-yards. The first lift of ballast has been placed from Waiotira station-yard to 102 m. 12 ch., and the second lift to 106 m. 12 ch. From 102 m. 12 ch. to 100 m. a small lift of ballast was placed under the temporary track laid between these points. A few culverts were completed, but most of them were left until the rails were laid and materials therefore more cheaply obtained. Work is now proceeding on these culverts that were left. During the year sixty-eight single huts and eighteen married men's quarters were erected for the workmen.

The construction of cable tramways over the tunnels on this section has greatly facilitated the handling of materials, and expedited the formation work and ballasting. A considerable saving was also made in cartage costs by these and other temporary tramways at grade level. A number of small construction locomotives were purchased and used to haul materials over these temporary tracks, as well as to handle earth excavated by the steam-shovels. Passenger and goods traffic has been run between Waikiekie and Waiotira Stations for the last few months.

Kirikopuni Section (107 m. 25 ch. to 121 m. 40 ch.; length, 14 miles 15 chains).—A temporary tram-line was completed from the Wairoa River to the Omana Tunnel. A lift of ballast was put on this track to enable heavy traffic to be carried safely. A limestone quarry was opened up and a crushing plant installed in order to obtain this ballast. A small construction locomotive is used to run ballast and other material and attend a steam-shovel. The northern approach cutting to the tunnel, which consisted of a heavy sticky pug, was taken out by a steam-shovel. This shovel is now engaged in taking out the cuttings between the Wairoa River and the tunnel. A start was made on the tunnel, but owing to the treacherous nature of the ground it was impossible to commence driving in the usual way, and it was therefore decided to build three lengths of special reinforced-concrete section of lining. One of these lengths has been constructed. A large quantity of timber and slabs have been delivered for the tunnel excavation. Forty-six single huts and eight married men's quarters, together with a cookhouse and bath houses, have been erected for the men in the tunnel and vicinity. An adequate water-supply has also been installed, as well as a septic tank and other sanitary appliances. All timber was procured from the Department's sawmill at Whatoro.

It is proposed to divert this line to cross the Wairoa River at Omana instead of at Kirikopuni, and a start is about to be made on the survey of this deviation.

WHANGAREI BRANCH RAILWAY.

Oakeleigh Section (5 m. 27 ch. to 7 m. 60 ch.; length, 2 miles 33 chains).—A deviation was made at 7 m. 15 ch. to avoid a very bad slip in a cutting at this point. The banks at 7 m. 7 ch. and at 7 m. 23 ch. have both slipped badly, and necessitate constant repairs to keep the line open for traffic. A steam-shovel was engaged for seven months removing a slip at 6 m. 18 ch. The steam-shovel is now on other work, but later on will be needed again to remove slips in this cutting. The fencing of the railway reserve has been finished. The rails have been laid throughout the section, and ballasting is practically completed. Goods traffic is now being handled over this section.

Tauraroa Section (7 m. 60 ch. to 14 m. 67 ch. ; length, 7 miles 7 chains).—Work on this section has been confined chiefly to the removal of slips and the usual maintenance of the track. A high bank at 9 m. 75 ch., near Mangapai, has given a lot of trouble through subsidence, and several drives are now being put in to thoroughly drain the foundations. The large stone-crushing plant at Tauraroa has been running continuously, and has crushed 22,000 cubic yards. The capacity of the plant has been increased so as to provide for the large amount of ballast required on the North Auckland Main Trunk Railway. Tenders have been invited for the quarrying and crushing of the ballast.

Waiotira Section (14 m. 67 ch. to 19 m. 79 ch. and junction with North Auckland Main Trunk Railway at 107 m. 22 ch. ; length, 5 miles 12 chains).—A great many slips have been removed by steam-shovels during the year. Two deviations of the line were made to avoid as far as possible particularly bad places, and have saved a good deal of work. A drainage drive was put in the bank at 17 m. 10 ch. ; and has prevented further sliding of the bank. Large stone drains are being put in, and pipes laid in nearly all the cuttings throughout this section to drain the formation. A few further slips at 16 m. 30 ch. will have to be dealt with later when a steam-shovel is available. The line from 18 m. 27 ch. to 18 m. 60 ch. has been raised so that it will be above the level of the exceptional flood which occurred after the line was first formed.

All the culverts on this railway are now finished. The breaks in the permanent-way were laid, thus completing the rail-laying on the branch railway. The third lift of ballast was placed between 18 m. 40 ch. and 19 m. 67 ch., and only a short length of the whole section requires a final lift. A mechanical tamping plant, driven by compressed air, was used, and has given most satisfactory results. The fencing has been completed. Goods traffic has been run over the whole line throughout the year, and has been fairly heavy between Oakleigh and Waiotira. A wharf gang is continuously employed at the former place discharging and loading from steamers and scows.

WAIPU BRANCH RAILWAY.

Ruakaka Section (0 m. to 9 m. 20 ch. ; length, 9 miles 20 chains).—The only work that has been carried out on this railway during the year has been the banks across the mud-flats between 0 m. 15 ch. and 0 m. 76 ch. These banks, which are now completed, were made with material excavated from a borrow-pit by a steam-shovel. The material was good, and has been taken out at a very economical rate by the shovel.

WAIUKU BRANCH RAILWAY.

Glenbrook Section (5 m. to 8 m. ; length, 3 miles).—The third lift of ballasting was put on along this section during the year, and all other work completed.

Waiuku Section (8 m. to 12 m. 15 ch. ; length, 4 miles 15 chains).—The second lift of ballast was placed between 10 m. and 12 m. 15 ch. The final lift and the ballasting of the station-yards was done. Overbridges and the station buildings were all completed during the year.

This railway was handed over to the Railway Department on the 10th May last.

HUNTLY-AWAROA RAILWAY.

(7 m. 20 ch. to 10 m. ; length, 2 miles 60 chains.)

Heavy formation work has been in progress during the year on this railway. Three steam-shovels are engaged on this work, and, considering the difficult nature of the material to be excavated, have done good work. The big bank at 7 m. 25 ch. is practically completed, as well as the cutting at 7 m. 40 ch. from which the bank material is obtained. Formation has been completed from 7 m. 42 ch. to 8 m. 6 ch. An amount of 33,000 cubic yards has been taken out by one steam-shovel. The very large summit cutting, consisting of sticky pug overlying hard rock, is being excavated by a steam-shovel at each end. This cutting, the material from which is being used to make up the Glenafton Station, is the largest work on the railway, and is nearly half-completed. The selected position and character of the material to be shifted makes this a very difficult cutting. A road deviation from 8 m. 35 ch. to 8 m. 7 ch. was done, and an overbridge at 8 m. 45 ch. is in hand. A large concrete drain to carry water from a swamp and creek above the station-yard has been put in from 8 m. 27 ch. to 8 m. 37 ch.

EAST COAST MAIN TRUNK RAILWAY.

Waihi Eastwards—Athenree Section (0 m. to 8 m. 68 ch. ; length, 8 miles 68 chains).—The earth-work has been completed on this section except where material is required for bridge approaches, in which case the cuttings from which earth is available have been left until the bridges are completed. The widening of the Athenree station-yard is now in progress. Road deviations at 8 m. 13 ch. and 8 m. 62 ch. have been practically completed. Five culverts were put in, and an 8 in. arch culvert at 8 m. 5 ch. is in hand. Fencing was done on both sides from 4 m. 58 ch. to 6 m. 55 ch. The telephone-line was erected from Waihi to Athenree. The stone-crushing plant was removed from 8 m. 20 ch., and re-erected at 7 m. 25 ch. The concrete piers for the Mangatoetoe Bridge at 0 m. 3 ch. are completed. Most of the steel girders are on the site. The concrete piers for Adams Street Bridge and for the five bridges over the Waiau Creek are now all in hand. The overbridge at 8 m. 13 ch. was completed and open for traffic. The abutments for the subway at 8 m. 62 ch. were completed. Arrangements have been made for the steel superstructures for all bridges on this section.

Katikati Section (8 m. 68 ch. to 17 m. ; length, 8 miles 12 chains).—The formation on this section has been finished from 8 m. 71 ch. to 10 m. 29 ch. The formation is well in hand from 10 m. 29 ch. to 12 m., and has been started from 12 m. to 14 m. in various places. A culvert was built at 13 m. 17 ch., and two others have been started. Fencing was done on both sides for a distance of 2 miles. The permanent-line survey was completed to the Wairoa River at 35 m. 15 ch.

Tauranga Westwards – Tauranga Section (35 m. to 41 m. 5 ch.; length, 6 miles 5 chains).—The formation is now done from 35 m. 26 ch. to 39 m. 55 ch., with the exception of four gaps totalling about 28 chains in length. Stone-pitching the embankment was done from 35 m. 65 ch. to 36 m. An overbridge at 38 m. 35 ch. was completed, and the bridge approaches and road to overbridge at 40 m. 22 ch. are in hand. The stationmaster's house and four platelayers' cottages were erected at Tauranga station-yard.

Tauranga Eastwards – Matapeahi Section (41 m. 5 ch. to 45 m. 0 ch.; length, 3 miles 75 chains).—The approach bank on the east side of the Tauranga Harbour Bridge was completed during the year. Progress on the Tauranga Bridge has not been very rapid, owing to the bad formations encountered, but the cylinder piers are now nearing completion, and a start will be made almost immediately with the erection of the steel girders. During the year 106 ft. of concrete cylinder was made, and 155 ft. sunk into position. Considerable difficulty and delay was experienced in sinking cylinders in pier P owing to the presence of timber. In six of the piers the cylinders are now sealed and ready to receive the concrete core filling, and in one pier the cylinders are filled. The manufacture of the steel girders for this bridge is being done at the Department's Workshops at the Mount. One span has been completed and erected at the shops, and the majority of the steel for the other spans has been fabricated.

Mount Branch (0 m. to 4 m. 7 ch.; length, 4 miles 7 chains).—In the Mount station-yard extensive alterations and additions have been made to the sidings to accommodate extra traffic in connection with the workshops, and to provide for general increase of traffic on the line as it is extended. Workshops were enlarged during the year, and are now carrying out a large amount of steel-manufacturing for the Department's works all over the Dominion. In addition to the fabrication of the Tauranga Bridge, steel girders are being made for bridges on three other railways. Repairs were made to all locomotives and to rolling-stock as required. Sixty new M hopper-wagons were built, as well as a large number of earth-wagons. During the year 146 double huts and 173 single huts for workmen were built.

Te Puke Section (45 m. to 54 m.; length, 9 miles).—The banks have been raised where subsidences have occurred, and the line generally maintained in good order for the running of traffic. At the Te Puke ballast-quarry about 10,000 cubic yards of rock were crushed and delivered on to the construction works, or sold for road-metal to the local bodies. In addition to the crushed metal, 16,000 cubic yards of inferior stone spalls were taken from the quarry, and used for protection work along the railway.

Paengaroa Section (54 m. to 59 m. 67 ch.; length, 5 miles 67 chains).—In addition to the ordinary maintenance of the railway, a 2 ft. arch culvert was put in at 56 m. 25 ch., and a private crossing made at 59 m. 67 ch.

Pongakawa Section (59 m. 67 ch. to 64 m.; length, 4 miles 13 chains).—An overbridge was erected at 61 m. 50 ch. Except for this, work was confined to the usual maintenance of the railway.

Otamarakau Section (64 m. to 71 m. 5 ch.; length, 7 miles 5 chains).—A considerable amount of work has been done during the year on this section in raising and widening banks. At Otamarakau Bluff 11,000 cubic yards of spoil were excavated by hand-work, and 16,000 cubic yards by steam-shovel, and utilized for the making-up of the banks, 12,000 cubic yards being used on this section and 15,000 cubic yards on the Matata Section. The work was considerably hampered by the necessity for keeping traffic open during the running of the spoil on to the line. Another steam-shovel was employed excavating from a borrow-pit for the making-up of the Otamarakau station-bank. The spoil excavated by the shovel was transported by a caterpillar tractor and bottom-dump wagons. In four months' time 23,000 cubic yards were excavated and transported an average distance of 24 chains, at a cost of less than 1s. per cubic yard. A 3 ft. Armco culvert was put in at 64 m. 56 ch. A number of concrete posts were made at Otamarakau, as well as a few concrete piles.

Matata Section (71 m. 5 ch. to 79 m. 16 ch.; length, 8 miles 11 chains).—A quantity of 15,000 cubic yards was obtained from Otamarakau Bluff to raise and widen the banks on this section. An 8 ft. arched concrete culvert is now in hand at 77 m. 40 ch. Reinforced-concrete bridges are being erected at 75 m. 54 ch. and 76 m. 16 ch.

Rangataiki Section (79 m. 16 ch. to 87 m. 71 ch.; length, 8 miles 55 chains).—Cuttings from 79 m. 55 ch. to 80 m. 5 ch. have been widened; 85 chains of side drains were cut. A steam-shovel has been constantly employed at Awakaponga excavating material for the construction of the banks between 83 m. and 88 m. During the year 78,500 cubic yards were taken out, at a very low cost, considering the distance the material had to be transferred. One concrete culvert was completed and two others are in hand. A reinforced-concrete bridge was completed at 79 m. 24 ch. One and a half miles of fencing was done, and additional sidings were put in at Awakaponga Station.

Awakeri Section (87 m. 71 ch. to 91 m. 40 ch.; length, 3 miles 49 chains).—Very little work was done on this section except to keep it open for traffic. Two and a quarter miles of fencing was done, and a little widening of the banks.

Taneatua Section (91 m. 40 ch. to 100 m.; length, 8 miles 40 chains).—One and a quarter miles of formation was done, practically completing the earthwork to as far as 96 m. 67 ch. A steam-shovel has been employed on portion of this distance. The cutting at 97 m. 10 ch., which is being taken out with another steam-shovel, is now well on towards completion. A third steam-shovel is now being installed at 97 m. 25 ch. for the purpose of excavating the large summit cutting. From here on to 98 m. earthworks are now well in hand. Forty chains of side drains have been cut; ten concrete culverts and two earthenware-pipe culverts were constructed. One mile of fencing was done, and permanent-way was laid for a distance of 12 chains, making the railhead now at 93 m. 35 ch.

GISBORNE-NAPIER (NORTH END).

Ngatapa Section (0 m. to 10 m. 29 ch. ; length, 10 miles 29 chains).—The formation in Repongaire station-yard was widened. Between 9 m. 40 ch. and 9 m. 65 ch. the formation was raised, and the raising of the Ngatapa station-yard to its new level was completed. The third lift of ballast was completed from 9 m. 40 ch. to Ngatapa station-yard (10 m. 29 ch.), and some ballasting was done in the station-yard. The line has been maintained and a regular goods and passenger traffic service run.

Waikura Section (10 m. 29 ch. onwards).—The formation was raised from 10 m. 40 ch. to 11 m. 23 ch. The cutting at 11 m. 63 ch. has given a good deal of trouble with slips, which were removed by steam-shovel and utilized to raise Ngatapa station-yard, and banks at other places. Cuttings at 12 m. 34 ch. and 12 m. 50 ch. were finished during the year. The formation is now practically finished to 13 m., and very little has been done beyond this. The first lift of ballast was completed to 11 m. 50 ch., the second to 10 m. 60 ch., and the third lift to 10 m. 45 ch.

WAIKOKOPU BRANCH RAILWAY.

Nuhaka Section (0 m. to 17 m. 12 ch. ; actual length, 18 miles 65 chains).—The large cutting at 0 m. 40 ch. was practically completed by steam-shovel and hand labour during the year, over 60,000 cubic yards being taken from the cutting. The slopes of this cutting are now being flattened, and the material is being used to raise and widen the bank from 1 m. 50 ch. to 3 m. This raising and widening process is necessary where the bank has been built with material from the peat swamp between 1 m. 50 ch. and 4 m. Fencing is well on towards completion on this section. The under-structure of the bridges at 1 m. 2 ch. and 1 m. 23 ch. was completed, and temporary stringers erected. Pile-driving is in hand on the bridges at 3 m. 76 ch. and 13 m. 62 ch. Hardwood for most of the bridges is now on the sites. The rails have been laid from 0 m. 5 ch. to 1 m. 20 ch., an actual distance of 3 miles, and a further 50 chains were laid to the wharf on the Wairoa River. Platelaying-materials were also unloaded at Waikokopu Harbour and carted back to Nuhaka, and the permanent-way has been laid from 17 m. 21 ch. back to 13 m. 62 ch. A branch line 50 chains long to a ballast-pit opposite 15 m. has been laid. The stripping of the ballast-pit at 15 m. is now being done. About 20,000 cubic yards of stripping has been removed. It is proposed to erect a drag-line excavator here to dig out the ballast and load it on to the trains. It is proposed to work another ballast-pit at Wairoa, and the prospecting-work has been done at this pit.

At Wairoa station-yard a Stationmaster's house and three platelayers' cottages, and at Nuhaka Station two platelayers' cottages, were completed.

Waikokopu Section (17 m. 12 ch. to 23 m. 5 ch. ; length, 5 miles 73 chains).—Formation has been practically completed up to 22 m. There are still two cuttings to be completed at 21 m. 19 ch. and 21 m. 60 ch., but these should be done in a month or two. Formation is also well in hand from 22 m. to the end of the section, the only large remaining earthworks being a bank of 20,000 yards at 22 m. 30 ch. and two cuttings in the Waikokopu station-yard. Two steam-shovels were employed on the formation of this section. Most of the fencing is completed or in hand. Pile-driving for the Nuhaka River Bridge at 17 m. 50 ch. is well on towards completion. Several concrete culverts were completed, and the construction of a large 12 ft. arched culvert at 22 m. 30 ch. is now well advanced. Hardwood timber for the bridges on this section is now arriving, and contracts have been let for all the steel girders for the superstructures. The rails have been laid from 17 m. 12 ch. to 17 m. 47 ch. A large number of rails and sleepers have been landed at Waikokopu Harbour, and some of them have been carted back to 19 m. 60 ch. to lay the line between 17 m. 47 ch. and 19 m. 60 ch.

GISBORNE-NAPIER (SOUTH END).

Eskdale Section (0 m. to 10 m. 51 ch. ; length, 10 miles 51 chains).—The formation on this section is done, with the exception of a small gap in the bank at 0 m. 32 ch., over which a temporary bridge has been built. The Harbour Board filled in the gap at 0 m. 55 ch., and their contract, with the exception of this and some dredging of the river-channel, is completed. Both sides of the railway have been fenced to 3 m. Rail-laying has been done to 2 m. 49 ch., and has received a bottom lift of ballast. The ballast has also been placed on the formation from the railhead to 5 m. 50 ch. The telephone-line has been completed along the section. Two platelayers' cottages were erected during the year in concrete blocks at Eskdale Station, and a Stationmaster's house is now in course of erection.

Tutira Section (10 m. 51 ch. onwards).—The formation of this section is practically completed to 14 m. 47 ch. A good deal of the excavation was done with a steam-shovel, which is now working in a long cutting at 14 m. 47 ch. Several cuttings have been opened out between this and 16 m. The formation of the service road was completed from 17 m. to 19 m. 40 ch. A concrete culvert at 15 m. 6 ch. was completed ; a water-drive at 15 m. 44 ch. was finished, and one at 15 m. 21 ch. is in hand. Reinforced-concrete piles for bridges at 11 m. 41 ch. and 13 m. 35 ch. have been completed.

STRATFORD—MAIN TRUNK RAILWAY.

(East End.)

Matiere Section (0 m. to 10 m. 23 ch. ; length, 10 miles 23 chains).—Formation has been trimmed and platelaying has been completed to the Matiere Township at 9 m. 49 ch. A temporary station has been provided here, and two locomotives are constantly employed in ballasting and running a goods and passenger service. A considerable quantity of slips had to be removed, and five temporary bridges were erected, in order to enable the platelaying to proceed. The combined road and railway bridge over the Ongarue River at 0 m. 7 ch. was completed in November last. In this bridge the railway is carried on the upper level, while lower road-traffic deck is carried on the bottom chords of the two

60 ft. trusses. Subways have been erected at 4 m. 20 ch. and 6 m. 79 ch. The concrete-work for the Ohura River Bridge at 7 m. 67 ch. has been completed, and work is in hand on the other bridges on which there are at present temporary superstructures. The steelwork for these bridges is being manufactured at the Department's Tauranga workshops. All tunnels have been completed, and the principal work still remaining on this section is the completion of ballasting, finishing of bridges and station-yard at Tuhua, together with the erection of the necessary station buildings at Tuhua and Matiere.

Ohura Section (10 m. 23 ch. to 19 m. 70 ch. ; length, 9 miles 47 chains).—This section was closed down during the previous period, but during the current year the work was again put in hand, primarily as a relief work ; but as this was only towards the end of the period there is very little to report.

(*West End.*)

Tahora Section (42 m. 26 ch. to 47 m. 40 ch. ; length, 5 miles 14 chains).—Formation-work and platelaying on this section have been completed, but no ballasting has been carried out during the period, as material which had previously been obtained from Mount Egmont quarry was not available. Culverts, drains, fencing, &c., have been completed, as well as the stone-pitching at No. 1 and No. 3 bridges. The shelter-shed, latrines, goods-shed, water-vat and stand have been erected at Tahora, and the station-platform and loading-bank, together with goods and wicket entrance to goods-shed and station, are completed. A small reservoir of 4,000-gallons capacity was completed, and 1,800 ft. of pipe laid to connect with the station supply.

Raekohua Section (47 m. 40 ch. to 50 m. 60 ch. ; length, 3 miles 20 chains).—Work was closed down on this section, and nothing has been done during the past year.

Te Wera Quarry.—The formation of the branch line, $1\frac{1}{4}$ miles long, has been completed, together with 8 chains of siding to the bins and $15\frac{1}{2}$ chains of incline between the bins and the quarry : 1 mile 16 chains of rails have been laid, together with sidings and inclines. The branch line has been connected with the main line at 22 m. 63 ch., and all fencing and crossings, except the incline and the quarry, are completed. 26,000 cubic yards of stripping have been cleared from the quarry, and 50,000 cubic yards of rock are ready for working. Concrete foundations at the crusher-site have been laid, and the necessary engines, crushers, hopper, and tippie erected and assembled. The erection of the bins is in hand. A number of huts have been erected to accommodate the quarry staff, and a cookhouse capable of boarding twenty-five men has been established. A ballast-engine has been transferred to this line, and it is anticipated that we shall now be able to proceed vigorously with the ballasting on the Tahora Section, as well as supply a considerable amount of stone throughout the Taranaki District, for which there is at present a fair demand.

OPUNAKE BRANCH RAILWAY.

Kapuni Section (0 m. 0 ch. to 7 m. 0 ch. ; length, 7 miles).—Formation on this section is now ready for platelaying, although a certain amount of widening and the taking-down of some batters still remains to be done. This work, however, will be carried out by the works train after the platelaying has been completed. The excavation carried out on this section during the period consisted of regrading formation from 1 m. 20 ch. to 1 m. 38 ch. in order to fit in with the road overbridge at 1 m. 22-40 ch. A great deal of water had to be contended with here, making the work difficult. Cutting and filling between 4 m. 60 ch. and 4 m. 66 ch. was completed, and the Kapuni station-yard at 6 m. 56 ch. has been levelled, and is ready for platelaying. Work at the Waingongoro Bridge at 0 m. 25 ch. has been completed, including the underpinning of one of the piers which developed weakness after an earthquake. The erection of piers for the Kapuni Stream Bridge at 4 m. 67 ch. has been completed, while the foundations for the Skeet Road overbridge at 0 m. 42 ch. have been laid. An overbridge across the Skeet Road at 1 m. 22-40 ch. was built during the period. A start has been made with platelaying, and 34 chains of rails have been laid, together with a temporary siding for handling permanent-way material. The ballast-pit at Kaupokonui River has been stripped, and approach cutting, together with a river-diversion and piers for temporary bridge over the Kaupokonui River, has been completed, so that as soon as rails have been laid to this point a start can be made with the ballasting. A goods-shed has been erected at the Kapuni station-yard at 6 m. 56 ch.

Auroa Section (7 m. to 12 m. ; length, 5 miles).—Formation-work has been carried out vigorously on this section. The work has been treated as a relief work, and a large number of unemployed have been absorbed. The majority of the earthwork has now been completed ; eight culverts have been built, together with side drains, and, generally speaking, the section is well in hand.

Pihama Section (12 m. 0 ch. to 16 m. 40 ch. ; length, 4 miles 40 chains).—The work carried out on this section comprises clearing, fencing, culvert-construction, earthwork, and the erection of concrete-block platelayer's cottage at 16 m. 40 ch. in Pihama station-yard. Twenty concrete culverts and pipe culverts have been constructed ; fencing on the right-hand side has been completed from 12 m. to 13 m. 24 ch. ; 2 miles 60 chains of logging, stumping, and clearing have been completed ; and a number of cuttings are in hand.

Opunake Section (16 m. 40 ch. to 23 m. 0 ch. ; length, 6 miles 40 chains).—Work has just been commenced on this section, and, in common with the previous sections, it is being utilized as relief works. The principal work done here comprises the erection of camps, carting of shingle for culverts, drainage, and a small amount of formation.

Manaia Branch (0 m. to 5 m. 49 ch. ; length, 5 miles 49 chains).—Very little work has been done in this section during the year, what has been done being confined to the completion of the cutting from 2 m. 70 ch. to 3 m. 0 ch., and the construction of a private crossing at 2 m. 68 ch. During the period further accommodation has been provided for the workmen by the erection of twenty-one single and two double huts. These huts were transferred from Tahora and erected on this work.

SOUTH ISLAND MAIN TRUNK RAILWAY.

Kekerangu Section (56 m. 6 ch. to 63 m. 6 ch. ; length, 7 miles).—No work has been done on this section during the year.

MIDLAND RAILWAY.

Nelson-Westland (North End).

Kawatiri Section (59 m. 17 ch. to 63 m. 8 ch. ; length, 3 miles 71 chains).—The principal work on this section has been the driving of the tunnel at 62 m. 43·85 ch., and the erection of the Hope River Bridge. A compressor plant was provided, but was not fully employed at the tunnel owing to the shortage of men. During the latter portion of the year, however, better progress has been made, and 246 ft. of bottom heading was driven, the face now being at 62 m. 42·91 ch. The material in this tunnel is a very hard granite, broken with seams of quartz, and has so far been difficult to excavate. A number of tunnel blocks have been made, and shingle for the concrete aggregate has been carted from the Buller River for use in lining the tunnel. The piers for the Hope River Bridge have been completed ; the steel girders for both Hope bridges have arrived, have been carted to their respective sites, and are now ready for field riveting. A temporary bridge was constructed over the Hope River in order to deal with the spoil from the tunnel.

Arthur's Pass Tunnel.

The lining of the tunnel was completed in October, 1921. The 100 lb. track is now laid from 51 m. 54 ch. to 58 m. 40 ch., with the exception of about 10 chains across the Rolleston Bridge. The plate-laying in Arthur's Pass station-yard is well advanced, and should be completed in two months' time, with the exception of the portion to be done by the Railways Department. A crushing plant with two crushers and steam-shovel was installed at Arthur's Pass, and with this and the aid of the small crusher at Otira the line has been ballasted and lifted with the first lift from 51 m. 54 ch. to 58 m. 12 ch. The formation is completed, and a start has been made with the concrete kerbing for platform and excavation for subway at Arthur's Pass station-yard. The girders for Bealey Bridge have arrived, and six of these have been riveted up.

The erection of the reinforced power-house at Otira was commenced in October, and should be completed in two months' time. Material for three Babcock-Wilcox boilers has arrived on the site, and these are now being erected. The bush has been cleared off the pipe-line from intake at Goat Creek to the power-house, a distance of 45 chains. A road has been formed to the intake, and a small dam erected across Goat Creek. The excavation for a 50 ft. circular reservoir, 90 ft. above the power-house, and a 126 ft. by 60 ft. reservoir, 20 ft. above the power-house, are well in hand, and will be completed in one month's time.

The contractors for the electrification have erected 6,000 cable-racks, and completed the erection of the lighting system in the tunnel. At the power-house a 10-ton travelling crane has been erected in the engine-room, and two 100 kw. lighting-sets, one battery booster, and three condensers have been installed. A quantity of switch-room gear and pipes are on the site, but not erected. 1,500 rail-joints have been bonded.

At Arthur's Pass the sites for eighteen cottages have been cleared of bush and excavated for sixteen cottages ; 20 chains of road have been formed and metalled in the village.

At Otira forty cottage-sites have been cleared of bush, fourteen cottages are now in course of erection, and a great deal of material is on the ground.

GREYMOUTH - POINT ELIZABETH RAILWAY.

Extension to Seven-mile (3 m. 45 ch. to 6 m. 10 ch. ; length, 2 miles 45 chains).—The formation on this section has now been completed. The cuttings at 4 m. 12 ch. and 4 m. 45 ch. have been widened. The filling at 4 m. 33 ch. is, however, still subsiding into the swamp, and the above cuttings will require to be further widened to obtain material for this filling. Side drains have been excavated, and several pipe culverts put in. The station-yard formation was almost completed, and a temporary bridge was erected at the Seven-mile Creek. The concrete piers for the permanent bridge have been finished, and the ironbark piles for the abutments have been driven. The girders are on the sites, and as soon as the balance of the material is received the permanent work will be put in hand. The Raleigh Creek Bridge has been finished, and a reservoir to hold 25,000 gallons has been constructed. A water-race has been excavated, and a pipe bridge placed across Rocky Creek, to carry the water-supply to the station-yard. Platelaying has been completed to 5 m. 69 ch. on the main line, and 52 chains of siding have been laid. A ballast line was constructed to the beach, and the first and second lifts of ballast have been put in from 3 m. 46 ch. to 5 m. 68 ch. on the main line, and on 36 chains of sidings in the station-yard. Material is coming to hand for the erection of the station buildings.

LAWRENCE-ROXBURGH RAILWAY.

Beaumont - Miller's Flat Section (34 m. 70 ch. to 49 m. 70 ch. ; length, 15 miles).

The construction of this line has been utilized to provide work for unemployed, and the work has consisted mainly in culverting and formation. Twenty culverts and concrete pipes have been laid, and the formation is more or less complete to 38 m. 60 ch. In places some of the banks have been kept narrow, and will be widened out eventually by means of a construction train. Three gangs are still

employed between 34 m. 70 ch. and 38 m. 60 ch. At 36 m. 41 ch. a slip has been giving a considerable amount of trouble, but otherwise a month or two will see that portion of the formation completed. Work is in hand from 38 m. 60 ch. onward to 43 m. The erection of a bridge over Beaumont Creek at 35 m. 25 ch. is in hand, and abutments A, E, and D are practically complete. The permanent-way has been laid to 35 m. 17 ch., but platelaying has now ceased pending the completion of the bridge at 35 m. 25 ch. The first lift of ballast has been completed to 35 m. 8 ch. Platelayer's cottage, sixteen 24 ft. by 18 ft. hutments for married men, and twenty-three 10 ft. by 8 ft. hutments for single men were erected during the year.

OREPUKI-WAIAU RAILWAY.

Orawia Section (48 m. 23 ch. to 56 m. 47 ch.; length, 8 miles 24 chains).—Work on this section has been carried out under the unemployed-relief system. The formation, with the exception of the heavy bank and cutting between 54 m. 60 ch. and 55 m. 38 ch., and the finishing of the station-yards, is completed. All culverts are complete, and 260 chains of fencing were erected.

SURVEYS OF RAILWAYS UNDER CONSTRUCTION, NEW LINES OF RAILWAY, ETC.

WAIKOKOWAI BRANCH RAILWAY.

A contract has been let for the land-plan survey of this railway from 0 m. to 8 m. 21 ch., and plans should be completed shortly.

EAST COAST MAIN TRUNK RAILWAY.

Waihi Eastwards.—The permanent-line survey has been completed now between Athenree and Tauranga, and the plans are in course of preparation. Deviations were also surveyed from 12 m. 40 ch. to 14 m. 36 ch., and from 14 m. 60 ch. to 16 m. 40 ch.

Tauranga Eastwards.—The permanent-line survey and plans were completed from 97 m. 40 ch. to 100 m. 10 ch. Trial lines were run through the Waimana Gorge from 100 m. 10 ch. to 105 m. 15 ch. From 105 m. 15 ch. to 108 m., near Waimana Township, several trial lines have been surveyed. The trial surveys of the whole section from 100 m. 10 ch. to 109 m. 57 ch. are now under consideration, and a start should soon be made to peg out the permanent line.

GISBORNE-NAPIER (SOUTH END).

Tutira Section.—The permanent-line survey has been completed to 30 m., and the plans are now well on towards completion. Trial-line surveys have been done from 30 m. on to Wairoa, but a good deal more survey work is necessary before the final location of the line can be determined.

WAIKOKOPU BRANCH RAILWAY.

The land-plan survey of this line is practically completed.

RIMUTAKA DEVIATION.

The various routes via the coach-road and the Tauherenikau have been carefully investigated, and detail surveys completed. The preparation of comparative estimates based on these surveys is in hand. The completion of the survey on the Wainui route is now proceeding.

TUAPEKA MOUTH BRANCH RAILWAY.

The surveys of the various proposed routes for this railway have been completed. In addition to the survey of the Riverbank route, which was completed some years ago, three trial lines have been run via Hillend—one from Crichton, one from Lovell's Falt via Lovell's Creek, and a third from Lovell's Flat via Stony Creek. Plans and estimates have been prepared, and the Agriculture and Railways Departments are now making investigations regarding the probable traffic and cost of haulage.

DUNBACK-KOKONGA RAILWAY.

From time to time various proposals have been made in connection with the extension of the Dunback Railway to Central Otago, and preliminary investigations of a proposed route were made during the year. A reconnaissance survey from Dunback to Koponga was carried out, and approximate estimates prepared.

LAWRENCE-ROXBURGH RAILWAY.

A fair amount of survey work has been in hand on this line during the year, several deviations having been tried out, and 9 miles of permanent survey completed. The trial survey is now at 49 m. 70 ch., and the permanent survey at 46 m.

CONSTRUCTION, MAINTENANCE, AND SUPERVISION OF ROADS AND BRIDGES.

The activity in work on roads and bridges which prevailed during the previous year was maintained and even increased during the present year. The works upon which the largest expenditure has already been incurred, or is still likely to be incurred owing to work in hand, are as under :—

WHANGAREI DISTRICT.

Mangamuku to Victoria Valley.—This road has been widened by relief labour to 16 ft. for a length of 8 miles 35 chains.

Awakino Valley to Dargaville.—5 $\frac{3}{4}$ miles have been widened to 18 ft., together with the construction of bridges and culverts.

Donnelly's Crossing to Tutamoe.—3 miles 10 chains of dray-road formed through heavy country.

Wairoa River Bridge, Dargaville.—The contract for the construction of this large bridge was let in December, 1920. The bridge consists of thirty 40 ft., six 20 ft., and one 60 ft. spans, total length being 1,380 ft., with a width of 12 ft., except at passing-places, when the width is 18 ft. The piers are of concrete, and the superstructure of steel and hardwood. All the concrete piles are now made, and all steel joists delivered. The largest span is a draw span to permit the passage of shipping.

Mangakahia River Bridge (Kaikohe to Mangakahia Church Road).—This bridge consists of one 110 ft. Howe truss in hardwood. Most of the materials required for the construction have been delivered at the site.

Awarua River Bridge (Kaikohe to Mangakahia Church Road).—It consists of one 110 ft. Howe truss in hardwood. Most of the materials have been delivered at site, and the construction of the concrete piers is in hand.

AUCKLAND DISTRICT.

Waikumete to West Coast Road.—125 chains of road metalled.

Mangatangi Stream Bridge.—This bridge consists of one 64 ft. Howe truss with two 20 ft. end spans, all in hardwood, on concrete piers and abutments, and has been completed.

Rangiriri Hills Deviation.—Formation of a deviation 5 miles in length is in hand, there being ten parties on co-operative relief work.

Kaueranga Bridge and Approaches (Thames—Te Aroha Road).—This bridge consists of eight 25 ft. and one 5 ft. spans, all in hardwood. Materials being procured.

Stanley Road.—The Piako County Council has laid down 1 mile 27 chains of concrete road 10 ft. wide and 8 in. deep.

Pokeno to Waitakaruru, via Maramarua.—96 chains have been metalled 10 ft. wide and 6 in. deep, thus making 293 chains now completed.

Takuna to Ohinewai (Te Hoe to McKenzie's).—49 chains formed 16 ft. wide, and 118 chains metalled 9 ft. wide and 9 in. deep.

Waipa River Bridge, Ngaruawahia.—The trusses on the three 110 ft. spans have been erected. Other timber-work and the approaches are well in hand.

Moakurua Stream Bridge.—This structure, consisting of one 41 ft. truss and two 25 ft. end spans, all in hardwood, has been completed.

Maungaroa Block.—229 chains of 14 ft. road constructed.

Pamotumotu Block.—649 chains of 14 ft. road constructed.

Wharepuhunga Block.—806 chains of 14 ft. road constructed.

Pukemapou Block.—177 chains of 14 ft. road constructed.

Oparau Block.—182 chains of 14 ft. road constructed.

Te Maari Block.—141 chains of 14 ft. road constructed.

Rangitoto 18b.—257 chains of 14 ft. road constructed.

Tapu-Gumtown.—2 $\frac{1}{2}$ miles of 14 ft. dray-road through heavy country have been formed by relief work.

TAURANGA DISTRICT.

Hairini Bridge and Approaches.—This bridge consists of twenty 20 ft. and one 41 ft. spans, all in concrete, and is being constructed practically on the same site as the present unsafe structure.

Te Puke—Otamarakau (Pukehina to Otamarakau).—71 chains of 17 ft. formation completed.

Whirinaki Stream Bridge, consisting of six 20 ft. spans, completed, together with 20 chains of approaches.

Rotoma Block.—11 miles 44 chains of 12 ft. formation completed, together with 764 lineal feet of culverts and 55 lineal feet of bridges.

Tirohanga Block.—14 miles of 12 ft. formation completed, together with 360 lineal feet of culverts.

Urewera Block.—Work was commenced on the location of the Waimana Valley Road. There are now 20 miles located, 6 miles of 12 ft. formation completed, and a further 4 miles in hand.

GISBORNE DISTRICT.

Opotiki to Matawai.—169 chains of 16 ft. formation and 38 chains of metalling completed, together with 150 lineal feet of culverts.

Waiaua Stream Bridge (Willow-tree Crossing).—This bridge, consisting of three 61 ft., two 25 ft., and one 16 ft. spans and 15 chains approaches, has been completed.

Waioeka River Bridge and Approaches (Tauranga).—Material for this bridge, consisting of one 190 ft. suspension span, 7 ft. 8 in. wide, is to hand. The approaches, 18 chains long, have been completed.

Te Araroa to Hicks Bay.—320½ chains formation, 14 ft. wide, including bridges and culverts, completed.

Rotokautuku Bridge (Waiapu River).—A contract for construction only was let last April. The concrete abutments and piers are under construction. The spans consist of two of 141 ft. 6 in., two of 145 ft., and one of 16 ft. Practically all materials have been delivered.

Waiapu River Bridge, Tikitiki.—On account of damage by floods and the general unsuitability of the site, the construction of this bridge was suspended. This bridge was originally erected by the local County Council. The district will now be served by the Rotokautuku Bridge, some nine miles higher up-stream, where there is a more favourable site.

Gisborne-Wairoa, via Morere.—The re-formation of the section on Wharerata Hill is being carried out by relief labour. A length of 6 miles has already been completed. For the metalling 9,000 cubic yards of spalls have been collected, and contracts for a further 5,000 cubic yards are in hand. It is proposed to overcome the difficulties of the long lead by means of a fleet of lorries.

Pakarae River Bridge, on the Main East Coast Road, has been completed. It consists of one 122 ft., two 43 ft. 6 in., and four 20 ft. spans.

Hangaroa Bridge.—The material for this bridge, consisting of one 100 ft. span in hardwood, on pile piers, has been procured, and is being conveyed to the site.

Frasertown-Waikaremoana Road.—In order to be able to transport materials for the hydro-electric-power station at Waikaremoana, the road from Frasertown at 5 m. to 29 m. has been practically re-formed. The existing metalling has been remetalled for 11 miles, and 3 miles of further remetalling are in progress, while 4 miles of new metalling have been done. The Scamperdown Creek Bridge (three 40 ft. and four 25 ft. spans) and two smaller bridges have been reconstructed with steel joists on hardwood piers.

TAUMARUNUI DISTRICT.

Kumara Road.—3¼ chains metalling completed.

Kaitieke Road.—231 chains re-forming and metalling completed.

Raetihi-Ohuru (Wade's Landing to Te Mata).—47 chains formation in very heavy country completed.

STRATFORD DISTRICT.

Awakino Valley Road (Lower).—On this important road 216 chains of new formation and 40 chains of widening, all to width of 18 ft., have been completed, together with 1,120 lineal feet of culverts. A steam-shovel is being employed in the widening.

Marakopa River Bridge (Karaka).—A new bridge, consisting of 120 lineal feet suspension span, is proposed. Materials being conveyed to site.

Mimi to Mokau Road.—On Mount Messenger and at Tongaporutu 148 chains have been metalled. For transport over the long leads, which extended up to 8 m., motor-lorries were employed. Kawau Bridge, consisting of one 61 ft. and one 20 ft. spans, was reconstructed in hardwood. Rapanui Bridge (one 41 ft. and two 18 ft. spans) and Okura Bridge (one 20 ft. and two 19 ft. spans) are in hand.

Uruti-Tangitu Deviation.—A road-tunnel, 504 ft. in length, is in hand, as well as approaches thereto.

Brewer Road Tunnel.—This tunnel, 533 lineal feet in length, was lined in concrete. The original tunnel was driven in 1908, but the timbering had become dangerous.

Mangare.—A road-tunnel, 594 ft. in length, 20 ft. high, and 12 ft. wide, lined along the arch with timber, has been completed.

Whakaihuwaka.—343 chains of widening have been done.

Patea River Bridge (Stratford).—A reinforced-concrete bridge, with 64 ft. arch span and 97 ft. 6 in. in width, on Broadway, Stratford, was let by contract last March. The foundations are still in hand.

Mangapurua Valley Road.—43 chains of widening along heavy sideling completed.

Mangatiti East Road.—389 chains widening completed by relief labour.

Raetihi-Ohura (Manganui-o-te-ao to Retaruke).—57 chains dray-road, 14 ft. wide, along very heavy sideling completed.

Kauarapaoa Road.—382 chains widening completed by relief labour.

Watershed Road.—206 chains widening completed by relief labour.

NAPIER DISTRICT.

Mohaka River Bridge (Waikare to Mohaka Deviation).—The bridge consists of two 111 ft. 3 in. and two 25 ft. spans. The concrete piers are in hand, but much trouble is being experienced with central piers, which are founded on rock under a considerable depth of gravel, logs, and water.

Waikare to Mohaka.—During the year there have been 3 miles 10 chains of 18 ft. formation, and 4 miles 40 chains of metalling, 12 ft. wide by 9 in. deep, completed. In the Wairoa County, to the north of the Mohaka River, 1 mile 40 chains of 18 ft. formation has been done.

Dartmoor Road.—6 miles dray-road completed.

Matahoura Road Extension.—3½ miles of dray-road formed and handed over to county.

Purahotangahia Access (Waipunga).—6 miles 20 chains dray-road completed and handed over to county.

Mangaonuku River Bridge, consisting of four 38 ft. and two 39 ft. spans, in concrete, has been completed.

Porangahau River Bridge, consisting of three 25 ft., one 15 ft., and two 81 ft. spans, in hardwood, has been completed.

Tukituki River Bridge (Patangata).—This bridge is to consist of twenty-four 52 ft. spans, in concrete. Work was suspended for a time. Since resumption four additional spans have been completed, thus making thirteen spans in all finished to date.

Putere Block Road.—4 miles 20 chains dray-road completed and handed over to county.

WELLINGTON DISTRICT.

Makairo to Coonor.—102 chains of 16 ft. formation, together with 1,001 lineal feet of culverts, completed.

Manawatu Gorge Block Road.—244 chains of 14 ft. formation completed.

Paraheke Road.—153 chains dray-road, together with 582 lineal feet of culverts, completed.

Kaumingi and Rorokoko Bridges, consisting of three 40 ft. and one 35 ft. spans respectively, all in concrete, have been completed.

Taueru Bridge (Masterton to Whakataki Main Road), consisting of one 60 ft. and six 30 ft. spans, all in concrete, is in hand. All the piers have been completed, and construction of superstructure is now in hand.

Waikanae to Upper Hutt.—By relief labour a large amount of improvement has been effected. 375 chains of new formation and widening to 14 ft. in heavy sideling country have been done.

Akatarawa River Bridges.—Materials for three bridges, aggregating 240 lineal feet, are being conveyed to sites.

Horokiwi Valley Road.—By relief labour 185 chains on heavy sideling have been widened to 18 ft. minimum width, with 21 ft. at sharp bends.

Rimutaka Hill Road.—By relief labour 133 chains improved by widening to 15 ft. or 20 ft., all curves being eased to $1\frac{1}{2}$ -chains radius.

NELSON DISTRICT.

Motueka River Bridge, Golden Downs, consisting of one 81 ft. 3 in., one 41 ft., and one 25 ft. spans. All material obtained, and contract let for conveyance and erection.

Buller River Light-traffic Bridge (Murchison).—Material procured and being landed on site for bridge.

Buller River Bridge (Nuggely).—Materials being delivered at site for one suspension span of 156 ft. and two end spans of 22 ft.

Alfred Creek Bridge.—A contract for erection of this bridge, aggregating 123 ft. 8 in. in four nearly equal timber spans, has been let.

Opouri River Bridge (Tunakino Road).—Spans, one 81 ft., two 40 ft., and one 15 ft. : erection practically completed.

Kekerangu River Bridge.—Bridge, consisting of six 30 ft. and two 29 ft. spans, hardwood motor-bridge, and approaches thereto, completed.

GREYMOUTH DISTRICT.

Kaimata to Moana.—By relief labour 322 chains formation and 114 chains metalling have been completed.

Westport to Greymouth, Barrytown to Seven Miles.—A large amount of formation and metalling has been done, extending as far as Twelve-mile Bluff.

Little Wanganui River Bridge (South Westland), consisting of six spans of 61 ft. each with a width of 12 ft., almost completed.

Main South Road (Little Waitaha River Bridge and Approaches), consisting of five 61 ft. 6 in. spans each with a width of 12 ft., completed.

Atupau River Bridge, consisting of seven 25 ft. beam spans, completed, and approaches partly done.

CHRISTCHURCH DISTRICT.

Kaikoura to Parnassus Road.—8 chains of concrete protective wall erected at Kahautara slip, and general improvements over 37 miles of road ; 35 chains deviation to secure 1-in-15 grade completed at Foster's Cutting ; Conway Deviation metalled.

Cooper's Creek Bridge, consisting of seven 25 ft. spans, completed, together with approaches.

Parnassus to Waiau.—230 chains of dray-road formed by relief work.

Sumner to Lyttelton (Sumner to Summit).—51 chains of road, 18 ft. wide, in heavy rock cutting, formed and metalled by relief work.

Ashburton River Bridge, South Branch (Mount Somers - Mesopotamia), consisting of fourteen 25 ft. spans : Material being delivered at site.

DUNEDIN DISTRICT.

Catlin's River Extensions and Catlin's Valley to Table Hill.—80 chains 16 ft. formation and 118 chains metalling completed.

Otanomomo Settlement (raising Stop-bank).—92 chains stop-bank, 8 ft. wide, completed.

Pomahaka River Bridge (Clydevale to Waiwera Road).—Consists of two 121 ft. spans. Contract in hand.

Tahakopa River Bridge and Approaches (Papatowai), consisting of fourteen 25 ft. and one 14 ft. spans, completed ; approaches in hand.

Gentle Annie Stream Bridge (Queenstown to Cromwell Road).—This bridge consists of one 60 ft. and one 40 ft. span, in concrete, and was completed during the year. The work was carried out under adverse labour and other conditions.

Toko Bridge (Milton).—A concrete bridge of four 30 ft. and one 20 ft. spans, nearing completion.

Lalburn No. 1 Block.—638 chains formation practically completed.

In addition to the construction-works as above detailed, maintenance-work has been done over considerable lengths of roads under Government control, the principal items being: Rotorua-Tauranga roads; Rotorua-Taupo-Mohaka; Kohuratahi-Tatu; Clarence-Parnassus Road; Glenhope-Westport; Inangahua-Greymouth-Hokitika-Waiho Road; Waiho to Westland County Boundary Road; Hokitika-Otira-Bealey Road; Mohikinui-Karamea; Pukaki-Mount Cook Road.

IRRIGATION.

IDA VALLEY SCHEME.

During the season water was supplied to eighteen irrigators by means of about 50 miles of races.

The Syndicate race extension has now been completed, but nothing further has been done in connection with the drainage.

The German Hill race has been enlarged from 5 m. 29 ch. to 12 m. 46 ch. Flumes at Moa Creek (0 m. 29 ch.), Maori Creek (7 m. 54 ch.), and Dovedale Creek (9 m. 36 ch.) are in hand. A number of concrete culverts and private crossings, together with 68 chains of road-formation, have been completed.

The German Hill race extension has now been completed from 12 m. 46 ch. to 22 m., but there is still a certain amount of culverting to complete, and this is being gone on with.

GALLOWAY FLAT SCHEME.

Water has been supplied under this scheme during the past season to twenty-three irrigators. The revenue derived is not at present sufficient to cover outgoings, but the scheme is in its infancy, and the position will improve very greatly as the settlers become established.

OLRIG TERRACE SCHEME.

This scheme has not yet been by any means fully developed, and at present only a comparatively small amount of water is being supplied by means of an old existing race. Excellent results should be obtained here with further development.

MANUHERIKIA SCHEME.

During the year the concrete lining of the intake tunnel was completed, as well as the inlet and intake gates, and a concrete gravel-trap at the outlet end of the tunnel. The concrete lining of the race in the Manuherikia Gorge has been finished. A number of concrete culverts and four large iron flumes have been completed, and all excavation is now in a finished condition. The Chatto Creek siphon, consisting of a double line of pipes, 1,800 ft. in length, and varying from 22 in. to 26 in. in diameter, was assembled, and is now in working-order. Distributory races HI, XYZG, CDE, and F have been completed.

ARDGOUR SETTLEMENT SCHEME.

The surveys for the permanent line and siphons have been located, and the necessary plans prepared. Six miles of construction have been completed, and 5 miles are in hand. Fifteen concrete culverts have been installed, and 24 chains of race have been lined with concrete. The concrete intake and stop-gate are in hand.

EARNSCLEUGH IRRIGATION SCHEME.

This scheme has, with the exception of two concrete culverts, been sufficiently completed to supply all the land which has so far been taken up. It will, however, require to be extended somewhat as more land is occupied.

GENERAL SURVEYS.

Upper Manuherikia Scheme.—A detailed survey of the wall for the upper-dam site at Lauder has been made, and 60 miles of race have been levelled and pegged. Rough surveys have been made of the Falls and the Dunstan Creek dam sites, and trial race-lines have been run with a view to irrigating the northerly end of Ida Valley as well as the Manuherikia Valley, in all about 100,000 acres.

Arrow River Scheme.—Preliminary surveys for a pipe-line, $3\frac{1}{2}$ miles long, in the Arrow River gorge, to carry 48 heads and to irrigate about 6,500 acres on the Arrow flats, have been made, and a reconnaissance survey for 45 miles of race-lines and about 2 miles of pipe-lines has been made.

Ida Valley Scheme.—Further investigations were made with a view to diverting water from Hope's Creek to the Manorburn dam, three different proposals being examined.

HYDRO-ELECTRIC WORKS.

ARAPUNI.

A considerable amount of preliminary survey and investigation has been carried out on the site of these works. Preliminary surveys have been made for access roads from Putaruru. Exploration work near Pukeatua has been carried out, and drives put in to test the various outcrops of greywacke, and after a good deal of work suitable sites have been found for a permanent quarry to supply rock for the construction-work at Arapuni and for road-metalling.

Alternative bridge-sites for bridging the gorge and head-race at Arapuni have been selected. Test-pits were sunk in the country on the spillway side, and information is being gathered in order to enable the Department to decide the best site for the power-house.

Alternative plans have been prepared for a gravity arched dam, but the design cannot be finally settled until the talus has been excavated from the site.

Regular gauge-readings were taken throughout the period under review, and further gauges were installed at the power-house site and at various points down-stream, in order to enable the tail-race levels to be investigated. Tests were made of the flow of the Waikato River, and calibrated with the readings on the gauge.

A preliminary location for transmission-line from Arapuni to Te Kuiti was also carried out.

ROTORUA ELECTRIC SUPPLY.

Data were obtained and drawings made for alterations and extensions to the existing power-house and flume. A survey was also made for an alternative hydro-electric-power scheme to supply about 1,000 kilowatts. Exploration surveys were made between Whakarewarewa and Ngongotaha, in order to determine a site for power-house in which the motive power would be a Diesel engine which has been procured. A transmission-line route was also explored from Okere Falls to Rotorua.

HORAHORA.

Ruakura.—A new railway-siding has been laid at Ruakura to give access to the main substation, this, with the work inside the grounds, being done by this Department, whilst the Railway Department carried out the portion on their land. A transformer-house, test-room, and cottages Nos. 1 and 2 have been erected; also new store, 30 ft. by 90 ft., with the necessary internal fittings, and a garage, 26 ft. by 46 ft., all in concrete.

Te Awamutu.—The erection of the substation, 40 ft. by 20 ft., in concrete, is completed.

Waihou.—A transformer-house, 30 ft. by 20 ft., has been erected.

Horahora Headworks.—A considerable amount of work has been carried out at the generating-station, principally in the direction of extending the crib-log and rock weir across the full width of the rapids. In addition to the actual work in the river, a considerable amount of work was involved in the provision and erection of the necessary plant. A tramway had to be constructed, and a bridge, 87 ft. span, erected to bring up the stone to fill the cribs, which were constructed from timber grown a short distance away, floated into position, and then loaded. This crib-log weir, like the original portion constructed by the Waihi Company, is merely of a temporary nature, and under its shelter the permanent concrete weir will be constructed when the river is low, probably during the coming summer season.

Surveys have been made of the existing lay-out. New gauges were installed, and the zeros of all gauges checked.

WAIKAREMOANA HYDRO-ELECTRIC SCHEME.

The surveys of the construction pipe-line have been completed. Trial pits and borings have been sunk on the power-house site and at the main dam, and bearing-values determined. A detailed survey of the Waikare-Taheke River at the site of the proposed dam was also carried out. An engineering survey of the main Waikaremoana Road, and a land-plan survey of both access road reserves, were completed, and the proposed tram-line from the forest reserve to the main power-house laid out. The fencing of the southern boundary, extending from the Waikare-Taheke River to the Kahutangaroa Stream, was completed.

Continuous gaugings of the lake-levels have been kept since May, 1921, and tests were undertaken to endeavour to ascertain the sources of the various subterranean streams flowing from the lake, but with not very great success. A measuring-weir was constructed at the lake-outlet, and a record of the discharge is being kept and compared with the rainfall records.

The excavation for the pipe-line has been completed, and about two-thirds of the pipe-line have been laid and tested.

The site of the power-house has been excavated and cleared, the foundations and all concrete-work have been finished, and, except for a few small matters, the power-house building is complete. A start has been made with the erection of the power-house bridge, the two main piers and south abutment having been constructed. A ropeway was erected at the end of the intake road for the transportation of the 24 in. pipes and other materials. A store and two temporary shelter-sheds have been built for housing stores and machinery. Two cookhouses have been erected.

MANGAHAO HYDRO-ELECTRIC SCHEME.

No. 1 tunnel has been driven during the period a distance of 2,651 ft., of which 729 ft. has been completely lined and a further 270 ft. partly lined. The total amount driven to date in this tunnel is 3,361 ft. No. 2 tunnel has advanced 1,770 ft., of which 1,038 ft. has been completely lined and a further 400 ft. partly lined. In addition to this, 625 ft. of adit has been driven. The total amount of tunnelling to date under this heading is 3,496 ft. Considerable delay was caused in progress of these tunnels by a strike of the co-operative parties over the first "wages-cut."

In the foundations of the Mangahao Dam No. 1 6,000 yards have been excavated, and the by-pass tunnel heading has been driven 422 ft., the gate-shaft 78 ft., and the incline drive 52 ft. The start of this work was delayed for some considerable time owing to foundations not being so favourable as had been expected. The same conditions were found at the Tokomaru dam, and the quantity of excavation here during the period was 7,500 cubic yards. Crushing plant and bins for concrete-work at both dams are nearly completed.

The pipe-line excavation is approaching completion. Ninety concrete pedestals have been erected, and contracts have been let for the supply and erection of pipes. A tram-line and 100 h.p. electric hauler for conveying the material up to the pipe-line has been completed and in operation for some months.

Satisfactory progress has been made with the excavation of the surge-chamber, 8,000 cubic yards having been excavated.

A start has been made with the erection of the power-house, the concreting of the tail-race being completed, the building itself in hand, and good progress generally being made. The crusher, screen, bins, and concrete-mixer have been erected for use at the power-house.

The work on the transmission-line is in hand, a large number of main-line and telephone poles having been delivered at the various railway-stations along the line, and erection contracts prepared for advertising.

Six permanent cottages for the accommodation of the regular staff have been completed to date, and ninety-eight buildings, including single huts, married men's quarters, cookhouses, recreation-halls, canteens, billiard-rooms, &c., have been erected for the accommodation of workmen.

The sawmill has been in operation throughout the period, and all timber required on the works has been sawn locally.

LAKE COLERIDGE POWER SCHEME.

The permanent work in connection with the diversion of the Harper River into the lake has been proceeded with, a large dam and a netted groyne having been constructed. This portion of the work is now practically completed, and a considerable improvement has taken place in the lake-level.

The erection of the third pipe-line was completed and the fifth unit put into operation, and a contract was let for the erection of the fourth pipe-line, which was also completed during the period.

The erection of the main transmission-line poles from Coleridge to Timaru was completed.

Five miles of additional 11,000-volt reticulation was erected in the North Canterbury district, and 7½ miles of 33,000-volt line.

WAIHOU AND OHINEMURI RIVERS IMPROVEMENT.

This work has been carried on during the year. The following are the principal operations:—

Rotokohu Drainage.—This work is nearing completion, the principal unfinished work being the construction of the main outfall drain and flood-gates into the Ohinemuri River.

Ngahina Bridge Extension.—This work is well in hand.

Upper Waihou Stop-banks.—Considerable progress has been made with the stop-banks on this sector, chiefly by the Waihou suction dredge and recently by a drag-line scraper.

Lower Waihou Stop-banks.—A drag-line has been working on this sector constructing stop-banks between Waimarie Bend and Netherton.

Ohinemuri River Stop-banks.—The survey of these stop-banks is nearing completion. Construction has been started as a relief work.

Komata Creek.—A drag-line scraper has been working continuously throughout the year, and good work has been done straightening the channel and constructing stop-banks.

Culverts.—A four-barrel concrete culvert has been completed at drain H outlet, near Netherton, and several smaller culverts built.

TRAMWAYS.

Auckland.—Proposals for alterations to tram-tracks in Manukau Road and for the Main South Road extension were examined and approved. A number of new cars were tested, and works inspected generally.

Napier.—The Hastings Street tramway extension was inspected and passed. Plans of alterations to car-bodies to suit them for this section were examined and dealt with.

Wanganui.—Cars and trailers have been examined, and tests made where required.

New Plymouth.—One-man cars have been adopted for portions of this system, and have been examined and tested before being put into commission.

Wellington.—Plans have been examined for sidings, Waitoa Road, and duplications and cross-overs at Athletic Park and Berhampore—Island Bay. The works were inspected when completed. A number of cars have been tested and passed.

Christchurch.—Plans were received and examined for a number of alterations and extensions, the principal ones being balloon loop at Papanui, Riccarton Road duplication, Lichfield Street line, Cashmere Hills duplication, and car-shed siding, Moorhouse Avenue. The works have been inspected while under construction, and certificates issued where completed. Several new cars were tested, and inspections made generally.

Dunedin.—Proposals were examined for a new balloon loop at Queen's Gardens, and the completed work was inspected. New cars were tested and passed on the various lines.

Invercargill.—A number of the new one-man cars have been brought into operation on this system, and have been carefully examined and tested to ensure their safe and efficient working.

MARINE.

Cape Maria van Diemen.—The erection of two new keepers' dwellings has been completed.

Cape Brett.—A new oil-engine winch has been installed for hauling up stores, &c. The tramway has been overhauled and repaired, and new tracks graded to the residences.

East Cape.—Owing to the unstable nature of the island on which this light is situated, it was decided to shift on to the mainland, and the work is well in hand. So far two lightkeepers' cottages have been erected, approximately one mile of road constructed, and the excavation for foundation of the light is in hand. Material has been procured and delivered for the erection of carpenter's shop, paint-shop, &c., and a considerable amount of joinery-work is in hand. A start has been made with the dismantling of the old light, and a temporary light has been erected in its place.

Kaipara Head Beacons.—New beacon has been erected at the South Head, and proposals are in hand for repairs to North Head beacon.

Gable Island.—A site has been selected for the installation of a light on Gable Islet, and plans were prepared accordingly. It is proposed to utilize a lantern-house which is at present available, but it has been necessary to order a new lens to suit the locality. A contract has been let for excavating the site and preparing foundation for lantern-house. Contract has also been let for the manufacture of a landing-crane.

Okena Island (Mercury Bay).—A light has been procured, and surveys are being made and plans prepared for its erection. Meanwhile the light has been installed as a temporary light for East Cape.

Ninepins (Chetwode Island).—A new Aga light, with lantern-house, tower, landing-crane, &c., was erected during the year. This is an unwatched white light showing a flash of three-quarters of a second, followed by an eclipse of three seconds. It is 55 ft. above high water, and should be visible for at least ten miles in clear weather.

Cape Campbell.—Two new lightkeepers' dwellings have been completed.

Motueka Wharf. Plans and specifications have been prepared.

Kaikoura Boat-harbour.—Considerable improvements have been effected in the boat-harbour. A new slip and dingy-landing has been constructed, and a number of rocks which interfered with the boat-moorings have been blown out.

Karamea Harbour.—Repairs have been carried out to the training-wall.

Chatham Islands Wharf.—Plans have been prepared.

GENERAL.

The following proposals, submitted for approval, have been dealt with as below :—

Wharves.—Castlecliff Wharf: Construction of wharf approved. Hicks Bay Wharf: Erection of wharf authorized. Kaikoura Wharf: Erection of goods-shed approved. Freeman's Bay: Erection of jetties approved; also a number of smaller wharves in various localities.

Foreshore Leases.—Dargaville foreshore vested in local body. Evans Bay: Yacht-slip and club-house. Kaihu Creek: Launch-shed. Kohukohu mud-flats vested in Town Board. Napier: Launch-landing. Paterson's Inlet: Boat-shed. Purakanui: Boat-shed. Wairoa River: Metal-landing.

Reclamations.—Mahurangi River: Reclamation of mud-flat approved. Opuā: Mangrove reclamation. Pukapuka River: Reclamation of mud-flat approved. Onerahi Beach: Proposal for groynes examined.

Harbour-works.—Gisborne Harbour: Proposal for outer harbour approved. Muturoa Harbour, New Plymouth: Extension of breakwater approved. Wanganui Harbour: Proposals *re* wharf-extension approved.

Hokianga Boatman's Residence.—A contract was let and completed for the transference of this residence to Rawene.

F. W. FURKERT, M.Inst.C.E., Assoc.M.I.Mech.E.,
Engineer-in-Chief.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1922—continued.
NORTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Siding.	Total.	State of Line									
							Surveyed.	Under Formation.	Under Plate-laying.	Opened.						
										Date.	—	1918-19.	1919-20.	1920-21.	1921-22.	Total.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Whangarei Branch Railway	Whangarei Branch..	M. ch 19 79	Kioreroa-Portland .. Portland-Waiotira ..	M. ch. 5 23 14 56	M. ch. 0 37 1 39	M. ch. 5 60 16 15	M. ch.	M. ch. .. 14 56	M. ch.	3 April, 1920 ..	M. ch.	M. ch.	M. ch.	M. ch. 5 23 ..	M. ch.	M. ch. 5 23 ..
Waipua Branch	Waipua Branch Rly.	16 45	Oakleigh-Waipu ..	16 45	0 25	16 70	5 45	11 0	..	..	..	..	..	..	..	..
Kaipara-Whangarei	Kaipara-Newmarket Onehunga Branch ..	35 73 2 73	Helensville-Newmarket Penrose - Onehunga Wharf	35 73 2 73	6 66 1 70	42 59 4 63	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	.. ..	35 73 2 73
Waikato	Auckland-Waikato ..	100 13	Auckland-Te Awamutu	100 13	16 66	116 79	..	..	..	..	..	..	..	..	..	100 13
	Auckland-Penrose— Deviation via Beach	6 50	Deviation via Beach	6 50	..	6 50	6 50	..	..	..	..	..	..	..	..	..
	Auckland City Branch —Kingsland Station to Auckland Station via Western Park and Freeman's Bay	2 60	Auckland City Branch	2 60	..	2 60	2 60	Prelim.	..	..	..	..	..	..	..	..
Waikato Branch	Waikato Branch Railway	12 69	(Paerata-Paumahoe Paumahoe-Waikato Huntly-Awaroa ..	4 20 8 49 9 0	0 78 1 3 ..	5 18 9 52 9 0	.. .. ..	.. 7 23 1 50	.. 1 26 ..	10 Dec., 1917 .. ..	.. .. ..	.. .. ..	.. .. ..	.. .. ..	.. .. ..	4 20 .. 7 20
Huntly-Awaroa	Huntly-Awaroa ..	9 0	Waikowai	8 25	..	8 25	8 25	..	..	..	..	..	..	..	..	..
Survey, new lines	Waikowai Branch Railway	8 25	Paeroa-Pokeno ..	8 25	..	8 25	40 15	..	..	..	..	..	..	..	..	..
Survey, new lines	Paeroa-Pokeno ..	40 15	Paeroa-Pokeno ..	40 15	..	40 15	40 15	..	..	..	..	..	..	..	..	..
Waikato-Thames	Waikato-Thames ..	62 58	Frankton Junction- Thames	62 58	10 17	72 75	..	..	..	..	..	..	..	..	..	62 58
Hamilton-Cambridge	Hamilton-Cambridge	12 2	Ruakura Junction- Cambridge	12 2	3 14	15 16	..	..	..	..	..	..	..	..	..	12 2
Paeroa-Waihi	Paeroa-Waihi ..	12 40	Paeroa-Waihi ..	12 40	1 30	13 70	..	..	..	9 Nov., 1905	..	..	..	..	..	12 40
East Coast Railway	Waihi - Opotiki, or East Coast Railway	142 43	Waihi-Tauranga ..	38 71	..	38 71	18 66	20 05	..	..	..	..	..	..	..	..
	Tauranga-Te Maunga Junction	3 75	Tauranga-Te Maunga Junction	3 75	..	3 75	..	0 56	3 19	..	..	..	..	..	..	..
	Te Maunga Junction- Te Puke	9 00	Te Maunga Junction- Te Puke	9 00	1 23	10 23	..	..	9 00	..	..	..	..	..	..	..
	Te Puke-Paengaroa- Paengaroa - Pongakawa	5 67 4 13	Te Puke-Paengaroa- Paengaroa - Pongakawa	5 67 4 13	1 16 0 47	7 03 4 60	.. ..	.. ..	5 67 4 13	..	..	..	..	..	..	..
	Pongakawa-Otamara- kau	7 05	Pongakawa-Otamara- kau	7 05	0 26	7 31	..	..	7 05	..	..	..	..	..	..	..
	Otamara-kau-Matata	8 11	Otamara-kau-Matata	8 11	0 43	8 54	..	..	8 11	..	..	..	..	..	..	..

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1922—continued.
NORTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line									
							Surveyed.	Under Formation.	Under Plate-laying.	Date.	Opened.					Total.
											—	1918-19.	1919-20.	1920-21.	1921-22.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
East Coast Railway— <i>contd.</i>	Waihi-Opotiki— <i>ctd.</i>	M. ch.	Matata-Taneatua ..	M. ch. 20 64	M. ch. ..	M. ch. 20 64	M. ch. ..	M. ch. 6 55	M. ch. 14 09	..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..
	Branch Lines	..	Taneatua-Opotiki ..	30 0	Prelim. Survey	30 0	14 0	Prelim.	..	..	..	..	..	..	..	..
			Mount Maunganui - Te Maunga Junction	4 27	0 67	5 14	..	..	4 27	..	..	..	..	..	..	..
			Te Puke Quarry ..	3 0	0 20	3 20	..	..	3 0	..	..	..	..	..	..	..
Thames Valley - Rotorua			Moturiki Quarry† ..	1 0	0 10	1 10	..	..	..	..	..	..	..	..	..	..
			Whakatane Branch	7 5	..	7 5	7 5*	..	..	..	..	..	..	..	..	..
		69 33	Morrinsville-Rotorua	69 33	5 27	74 60	..	..	..	..	..	..	..	..	..	69 33
Gisborne - Rotorua		92 44	Gisborne Wharf-Kaiteratahi	13 10	2 45	15 55	..	..	..	..	..	..	..	..	..	..
			Kaiteratahi-Karaka	5 5	0 71	5 76	..	..	..	13 April, 1905	..	..	..	..	..	..
			Karaka-Puha ..	1 75	0 24	2 19	..	..	..	20 May, 1907	..	..	..	..	..	..
			Puha-Waikohu Bridge	3 29	..	3 29	..	..	..	28 May, 1908	..	..	..	..	..	..
New survey			Waikohu Bridge-Waikohu	0 35	0 32	0 67	..	..	..	1 April, 1909	..	..	..	..	..	49 32
			Waikohu-Otoko ..	7 75	0 32	8 27	..	..	..	6 April, 1912	..	..	..	..	..	..
			Otoko-Rakauaroa ..	6 60	0 32	7 12	..	..	..	2 Nov., 1914	..	..	..	..	..	..
			Rakauaroa-Matawai ..	5 65	0 50	6 35	..	..	..	2 Nov., 1914	..	..	..	..	..	..
			Matawai-Motuhora	4 78	0 61	5 59	..	..	..	26 Nov., 1917	..	..	..	..	..	..
			Motuhora-Motu ..	2 10	..	2 10	2 10	..	..	..	..	..	..	..	..	..
			Motu-Opotiki ..	41 2	..	41 2	41 2	Estim.	..	..	..	..	..	..	..	..
		129 76	Napier-West Shore ..	3 07	0 58	3 65	..	2 39	0 48	..	..	..	..	..	..	..
			West Shore-Petane ..	3 63	..	3 63	..	3 63	..	..	..	..	..	..	..	..
			Petane-Eskdale ..	4 65	..	4 65	..	4 65	..	..	..	..	..	..	..	..
			Eskdale-Tutira ..	17 47	..	17 47	13 71	3 56	..	..	..	..	..	..	..	..
			Tutira-Wairoa ..	28 54	..	28 54	14 14	Prelim.	..	..	..	..	..	..	..	..
			Wairoa River-Gisborne	72 0	..	72 0	3 40†	2 17	..	..	..	..	..	..	..	..
			Gisborne Station-Makaraka	3 5	..	3 5	44 0	2 17	..	..	..	..	..	..	..	..
		72 42	Makaraka-Ngatapa ..	11 51	1 29	13 00	..	..	11 51	..	..	..	..	..	..	..
			Ngatapa-Wharekopae	4 69	..	4 69	0 19	3 00	1 50	..	..	..	..	..	..	..
		Wharekopae-Waikura	5 40	..	5 40	5 40	..	..	..	..	..	..	..	..	..	..

* Preliminary. † Rails taken up.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31st MARCH, 1922—continued.
NORTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line											
							Surveyed.	Under Formation.	Under Plate-laying.	Opened.								
										Date.	—	1918-19.	1919-20.	1920-21.	1921-22.	Total.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
New survey —contd.	Napier-Gisborne— <i>ctd.</i>	M. ch.	Waikura-Waterfall ..	6 66	..	6 66	M. ch. (5 06 1 60 Prelim.	M. ch. Perm.	M. ch. ..	..	M. ch.	..	..	..	..	..		
			Waterfall-Hangarua	4 00	..	4 00	"	..	..	..	..	..	..	..	..	..	..	
			Hangarua-Te Reinga	17 11	..	17 11	"	..	..	..	..	..	..	..	..	..	..	..
			Te Reinga-Marumaru	9 40	..	9 40	"	..	..	..	..	..	..	..	..	..	..	..
Napier-Woodville and Palmerston North Wellington-Woodville	Wairoa-Waikokopu.. Napier-Woodville ..	24 72 96 65	Marumaru-Wairoa ..	10 00	..	10 00	(4 00 6 00 Prelim.	M. ch. Perm.	M. ch. ..	..	..	..	..	..	..	..		
			Wairoa-Nuhaka ..	18 65	..	20 46	..	..	..	..	..	..	..	..	..	..	..	
			Nuhaka-Waikokopu	6 7	..	6 7	..	..	6 7	..	..	..	..	..	..	..	..	
			Napier Spit-Woodville	96 65	..	15 5	111 70	..	..	..	..	..	..	..	..	..	..	96 65
Rimutaka Incline Deviation Surveys	Woodville-Palmerston North Woodville-Wellington Greytown Branch .. Featherston - Martin- borough Greytown - Martin- borough Coach road Route .. Tauherenikau Route .. Wairu-i-o-mata Route Coast Route Coast Route	17 21 115 79 3 7 11 50 4 62 9 0 21 30 31 40 52 0 70 0	Woodville-Palmerston North	17 21	0 51	17 72	..	..	..	..	..	..	..	..	17 21			
			Woodville-Wellington [Te Aro]	115 79	21 73	137 72	..	..	..	..	..	..	..	..	..	..	115 79	
			Greytown - Martin- borough	3 7	0 64	3 71	..	..	..	..	..	..	..	..	..	..	3 7	
			Featherston - Martin- borough	11 50	..	11 50	11 50	..	..	..	..	..	..	..	..	..	..	..
Foxton-New Plymouth	Wellington-Manawatu .. Foxton-Patea .. Route Improvement .. Surveys	83 37 120 44 26 7	Greytown - Martin- borough	4 62	..	4 62	4 62*	..	..	..	..	..	..	..	..	..		
			Coach road Route ..	9 0	..	9 0	9 0	..	..	..	..	..	..	..	..	..	..	
			Tauherenikau Route ..	21 30	..	21 30	21 30	..	..	..	..	..	..	..	..	..	..	
			Wairu-i-o-mata Route	31 40	..	31 40	31 40	..	..	..	..	..	..	..	..	..	..	..
Foxton-New Plymouth	Wellington-Manawatu .. Foxton-Patea .. Route Improvement .. Surveys	83 37 120 44 26 7	Petone - Pigeon Bush	52 0	..	52 0	52 0	..	..	..	..	..	..	..	..	..		
			Petone - Carterton, via Martinborough	70 0	..	70 0	70 0	..	..	..	..	..	..	..	..	..	..	
			Wellington-Longburn	83 37	15 76	99 33	..	..	..	..	..	..	..	..	..	..	..	..
			Foxton-Patea ..	120 44	14 75	135 39	..	..	..	..	..	..	..	..	..	..	..	..
Foxton-New Plymouth	Wellington-Manawatu .. Foxton-Patea .. Route Improvement .. Surveys	83 37 120 44 26 7	Turakina-Matarawa	11 67	..	11 67	11 67	..	..	..	..	..	..	..	..	..		
			Aramoho - Goat Valley Tunnel	7 40	..	7 40	7 40	..	..	..	..	..	..	..	..	..	..	
			Kai Iwi - Okehu ..	3 60	..	3 60	3 60	..	..	..	..	..	..	..	..	..	..	..
			Nukumaru-Waitotara	3 0	..	3 0	3 0	..	..	..	..	..	..	..	..	..	..	..

* Trial survey. † Date of purchase.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31st MARCH, 1922—continued.
NORTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Siding.	Total.	State of Line										
							Surveyed.	Under Formation.	Under Plate-laying.	Date.	Opened.						Total.
											1918-19.	1919-20.	1920-21.	1921-22.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Foxton-New Plymouth— <i>contd.</i>	Patea - Waitara and New Plymouth	M. ch. 72 29	Patea-New Plymouth Breakwater	M. ch. 72 29	M. ch. 11 52	M. ch. 84 1	M. ch. ..	M. ch. ..	M. ch. ..	..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. 72 29	
	Bull's Branch	3 79	Bull's Branch	3 79	..	3 79	3 79	Prelim.	..	..	..	..	..	..	..	..	
	Wanganui Branch	3 29	Aramoho-Wanganui	3 29	2 23	5 52	..	..	..	..	..	..	..	..	..	3 29	
Stratford-Main Trunk	Stratford-Main Trunk	112 47	Stratford-Toko	6 26	0 40	6 66	..	..	..	1 Mar., 1905	..	..	..	..	..	..	
			Toko-Oruru	4 72	0 36	5 28	..	..	..	1 April, 1908	..	..	..	..	..	..	
			Oruru-Huiroa	4 50	0 35	5 5	..	..	..	20 June, 1910	..	..	..	..	..	..	
			Huiroa-Te Wera	6 77	1 16	8 13	..	..	..	1 Aug., 1912	..	..	..	..	..	..	
			Te Wera-Pohokura	8 55	0 65	9 40	..	..	..	1 July, 1914	..	..	..	..	..	..	
			Pohokura - Whangamomona	6 13	0 45	6 58	..	..	..	..	..	..	..	..	..	..	
			Whangamomona-Kohurutahi	4 53	0 29	5 02	..	..	..	7 Jan., 1918	..	..	..	..	..	..	
			Kohurutahi-Tahora	5 14	0 37	5 51	..	..	5 14	..	..	..	..	..	..	..	
			Tahora-Raekohua	3 20	..	3 20	1 46	1 54	..	..	..	..	..	..	..	..	
			Raekohua-Heao	6 20	..	6 20	3 40	..	..	..	..	..	..	..	..	..	
			Heao-Matiere	35 57	..	35 57	35 57	m.	..	..	..	..	..	..	..	..	
			Okahukura-Matiere	10 23	0 75	11 18	..	..	..	10 23	..	..	..	..	..	..	
Stratford - Ongaue—Deviations		33 40	Matiere-Ohura	9 47	..	9 47	7 47	2 0	..	..	..	..	..	..	..	..	
		14 0	Mangaroa-Puketutu	33 40	..	33 40	33 40	Prelim.	..	..	..	..	..	..	..	..	
Puketutu - Mangaroa Deviation		30 0	Aramatai-Hangatiki	14 0	..	14 0	14 0	Prelim.	..	..	..	..	..	..	..	..	
				30 0	..	30 0	30 0	Prelim.	..	..	..	..	..	..	..	..	
Opunake-Mountain Rd		23 10	Opunake-Eltham	23 10	..	23 10	23 10	..	..	..	..	..	..	..	..	..	
Te Roti-Moturoa		55 65	Te Roti-Kapuni	7 0	1 19	8 19	..	6 55	0 25	..	..	..	..	..	..	..	
			Kapuni-Auroa	5 0	0 33	5 33	..	5 0	..	..	..	..	..	..	..	..	
			Auroa-Pihama	4 42	..	4 42	..	4 42	..	..	..	..	..	..	..	..	
			Pihama-Opunake	5 68	..	5 68	5 68	..	..	..	..	..	..	..	..	..	
Manaiia Branch			Opunake-Stony River	18 70	..	18 70	18 70	..	..	..	..	..	..	..	..	..	
		5 50	Stony River-Moturoa	14 45	..	14 45	14 45	..	..	..	..	..	..	..	..	..	
Mount Egmont Branch			Manaiia-Kapuni	5 50	0 78	6 48	..	5 50	..	..	..	..	..	..	..	..	
		8 77	Manganui Section	5 74	2 3	7 77	..	..	..	1 April, 1908	..	..	..	..	..	..	
			Quarry Section	3 3	0 60	3 63	..	1 58	1 25	..	..	..	..	..	..	6 0	

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1922—*continued*.
NORTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Buildings.	Total.	State of Line										
							Surveyed.	Under Formation.	Under Plate-laying.	Opened.							
										Data.	1918-19.	1919-20.	1920-21.	1921-22.	Total.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
North Island Main Trunk Railway	Marton-Te Awamutu	M. ch. 209 69	Marton Junction - Mangaweka-Taihape	M. ch. 31 67	M. ch. 4 61	M. ch. 36 48	M. ch. ..	M. ch. ..	M. ch. ..	..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	
			Mangaweka-Taihape	13 1	1 61	14 62	..	..	..	10 Sep., 1904	..	..	..	..	..	..	50 58
			Taihape Mataeroa	5 70	0 61	6 51	..	..	..	1 June, 1907	..	..	..	..	..	..	..
			Mataeroa Waiohuru	18 10	..	..	..	..	..	30 June, 1908	..	..	..	..	..	..	84 58
			Waiohuru-Erua	30 63	12 50	97 28	..	..	..	13 Feb., 1909	..	..	..	..	..	..	..
			Erua Taumarunui	35 65	..	..	..	..	..	9 Nov., 1908	..	..	..	..	..	..	74 33
			Taumarunui-Te Awamutu	74 33	6 20	80 53	..	..	..	..	..	..	..	..	..	..	..
	Waipa Gravel Access Branch	7 40	Otorohanga	7 40	..	7 40	..	..	..	..	..	..	..	..	..	..	..
	Raetihi Branch	8 50	Raetihi Section	8 50	1 7	9 57	..	..	..	18 Dec., 1917	..	..	..	..	..	..	8 50
	Central Route Deviation Surveys	30 0	Ohakune to Mokau-Retaruke Divide	30 0	..	30 0	30 0	Prelim.	..	..	..	..	..	..	..	..	..
		34 0	Makatote Gorge - Marae-Kowhai Valley	34 0	..	34 0	34 0	Prelim.	..	..	..	..	..	..	..	..	..
		20 0	Marae-Kowhai-Ohura Valley	20 0	..	20 0	20 0	Explor.	..	..	..	..	..	..	..	..	..
	Ngaire-Ongarue	103 58	Ngaire Section	38 73	..	38 73	38 73	..	..	..	..	..	..	..	..	..	..
			Tangarakau Section	26 0	..	26 0	26 0	..	..	..	..	..	..	..	..	..	..
			Heao Section	10 70	..	10 70	10 70	..	..	..	..	..	..	..	..	..	..
Waikara-Tangarakau	46 75	Ohura Section	27 75	..	27 75	27 75	..	..	..	..	..	..	..	..	..	..	
Urenui Route	12 0	Waitara Section	46 75	..	46 75	46 75	..	..	..	..	..	..	..	..	..	..	
		Urenui to Tangitu River	12 0	..	12 0	12 0	Prelim.	..	..	..	..	..	..	..	..	..	
Hastings-Te Awamutu	170 0	Hastings-Te Awamutu	170 0	..	170 0	170 0	Prelim.	..	..	..	..	..	..	..	..	..	
Totals	2757 06	..	..	2757 06	212 06	2969 12	1143 43	118 04	150 33	..	1278 26	..	..	11 53	..	1289 79	

NOTE.—Taonui and Lichfield Branches not mentioned above, as the rails have been taken up.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1922—continued.
SOUTH ISLAND.

NOTE.—Column 11: For detail information as to dates of openings of such portions of lines as are not given in this table see tables of lengths of lines in Public Works Statements, 1904-18.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Siding.	Total.	State of Line										
							Surveyed.	Under Formation.	Under Plate-laying.	Date.	Opened.						
											—	1918-19.	1919-20.	1920-21.	1921-22.	Total.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Nelson-Roundell Midland Railway	Nelson-Belgrove ..	M. ch. 22 73	Nelson-Belgrove ..	M. ch. 22 73	M. ch. 2 52	M. ch. 25 45	..	..	..	..	..	..	..	..	M. ch. ..	M. ch. 22 73	
	Stillwater - Belgrove 147 (via Tadmor)	7	Stillwater-Reefton S. Reefton S.-Reefton N. Reefton N.-Cronadun Cronadun-Landing .. Landing-Inangahua Inangahua-Kawatiri ..	37 30 1 30 5 38 8 40 6 0 46 43	4 79 1 0 0 56 6 14 0 10 46 43	42 29 2 30 6 14 9 5 6 10 46 43	..	..	..	31 Mar., 1907 7 Aug., 1908 June, 1914	..	..	..	..	..	57 32	
			Glenhope-Kawatiri .. Glenhope-Tui .. Tui-Kiwi .. Kiwi-Tadmor Tadmor-Kohatu .. Kohatu-Belgrove .. Brunner-Otira .. Otira-Arthur's Pass Arthur's Pass-Cass .. Cass - Broken River .. Broken River - Otarama Otarama-Springfield	4 5 9 42 3 17 5 9 10 29 9 44 0 62 10 26 42 27 8 14 14 67 15 22 7 40 4 58	0 15 0 55 0 34 3 51 0 29 5 38 11 18 2 68 45 15 8 14 0 20 15 07 1 29 16 51 0 30 7 70	4 20 10 17 3 51 5 38 11 18 45 15 8 14 15 07 16 51 7 70 4 74	0 32 3 53	..	..	2 Sep., 1912 18 Dec., 1908 7 Aug., 1906	..	..	..	..	..	37 61	
	Brunner-Springfield	92 68					..	..	8 14	1 July, 1914 10 Dec., 1910 29 Oct., 1906	..	..	..	..	..	42 27	
							..	..	..	29 Oct., 1906	..	..	..	..	..	*42 27	
							..	..	..	..	29 Oct., 1906	..	..	..	..	..	..
							..	..	..	..	16 July, 1910	..	..	..	..	..	3 40
							..	..	..	..	..	..	..	..	..	..	7 51
							..	..	..	..	..	..	..	..	..	..	19 56
							..	..	..	..	..	..	..	..	..	..	7 12
						..	..	..	..	..	..	..	..	..	..	3 69	
						..	..	..	..	1 April, 1912	..	..	..	..	..	5 74	
						..	..	..	..	..	..	..	..	..	..	..	

* Including 8 chains of tunnel contract.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1922—continued.

SOUTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line										
							Surveyed.	Under Formation.	Under Plate-laying.	Date.	Opened.						
											—	1918-19.	1919-20.	1920-21.	1921-22.	Total.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
		M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	
Hurunui - Waitaki —contd.	Branches,—																
	Rangiora - Oxford	21 76	Rangiora-Oxford West	21 76	2 36	24 32	..	..	..	..	..	..	..	..	..	..	
	Eyreton (from Main Line)	20 7	Main Line - West	20 7	1 61	21 68	..	..	..	..	..	..	..	..	..	..	
	Lytelton	6 26	Eyreton-Bennett's church	6 26	..	6 26	..	..	..	..	..	..	..	..	..	..	
	Southbridge	25 31	Hornby-Southbridge	25 31	3 17	28 48	..	..	..	..	..	..	..	..	..	..	
	Little River-Akaroa	42 10	Lincoln-Little River	22 46	2 5	24 51	..	..	..	..	..	..	..	..	..	..	
	Springfield	30 60	Reconnaissance	19 44	..	19 44	19 44	Prelim.	..	..	..	..	..	..	..	..	
	Whitecliffs	11 38	Rollston-Springfield	29 63	3 7	33 67	..	..	..	..	..	..	..	..	..	..	
	Rakaitia - Ashburton Forks	22 20	Springfield-Coal-mine	0 77	..	..	..	..	..	..	..	..	..	..	..	..	..
	Ashburton	29 46	Darfield-Whitecliffs	11 33	1 53	13 11	..	..	..	..	..	..	..	..	..	..	..
Canterbury Interior Main Line	Opawa and Albury to Fairlie Creek and Burke's Pass	55 8	Whitecliffs to Bridge	0 5	..	..	..	..	..	..	..	..	..	..	..	..	..
	Waimate	17 43	Rakaia-Methven	22 20	2 65	25 5	..	..	..	..	..	..	..	..	..	..	..
			Tinwald-Springburn Extension	27 29	1 52	29 1	..	..	..	..	..	..	..	..	..	..	..
			Washdyke-Eversley	36 5	2 45	38 50	..	..	..	..	..	..	..	..	..	..	..
			Preliminary survey	19 3	..	19 3	19 3	Prelim.	..	..	..	..	..	..	..	..	..
			Studholme-Waimate	4 42	1 3	5 45	..	..	..	..	..	..	..	..	..	..	..
			Waimate-Waihao Downs	8 21	0 54	8 75	..	..	..	..	..	..	..	..	..	..	..
			Waihao Downs-Serpentine	2 65	..	2 65	..	2 65	..	..	..	..	..	..	..	..	..
			Serpentine-Kelcher's	1 75	..	1 75	..	1 75	..	..	..	..	..	..	..	..	..
			Oxford-Sheffield	11 44	0 27	11 71	..	..	..	..	..	..	..	..	..	..	..
Waitaki-Bluff and Branches		83 0	Surveyed	21 7	..	21 7	21 7	..	..	..	..	..	..	..	..	..	..
			Reconnaissance	50 29	..	50 29	50 29	Prelim.	..	..	..	..	..	..	..	..	..
		246 69	South Waitaki-Bluff	246 69	59 13	306 2	..	..	..	..	..	..	..	..	..	..	..
		37 33	Pukeuri-Dunroon	21 75	1 35	23 30	..	..	..	..	..	..	..	..	..	..	..
			Dunroon - Hakateramea	15 38	1 5	16 43	..	..	..	..	..	..	..	..	..	..	..
			Waiareka-Ngapara	14 76	1 31	16 27	..	..	..	..	..	..	..	..	..	..	..
			Windsor-Tokorahi	12 0	0 50	12 50	..	0 5	..	..	..	..	..	..	..	..	..
			Survey (trial)	4 40	..	4 40	4 40	Prelim.	..	..	..	..	..	..	..	..	..
			Palmerston-Dunback	8 55	0 54	9 29	..	..	..	..	..	..	..	..	..	..	..
			Surveyed	0 65	..	0 65	0 65	..	..	..	..	..	..	..	..	..	..

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31st MARCH, 1922—*continued*.
SOUTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line									
							Surveyed.	Under Formation.	Under Plate-laying.	Opened.					Total.	
										Date.	1918-19.	1919-20.	1920-21.	1921-22.		
1 Waitaki-Bluff and Branches— <i>contd.</i>	2 <i>Branches—contd.</i> Inch Valley Railway Port Chalmers .. Green Island .. Green Island to Brighton Fernhill Colliery Line Kaikorai Valley Railway Outram .. Lawrence .. Lawrence - Roxburgh Lovell's Flat - Tuapeka Mouth Balcutha - Tuapeka Mouth Crichton-Tuapeka Mouth Stirling - Hill End (via Stoney Creek) Balcutha - Appleby Junction or Catlin's - Seaward Bush Waipahi - Heriot Burn Extension to Roxburgh, via Rae's Junction and Ettrick Via Spylaw	3 M. ch. 2 29 1 9 2 44 4 65 1 60 2 60 8 78 21 76 37 10 23 20 22 0 11 60 11 43 105 49 26 23 28 10 25 70	4 Inch Valley-Lime Kiln Glendernid - Port Chalmers Burnside-Saddle Hill Surveyed .. Abbotsford to Fernhill Colliery Surveyed .. Mosgiel-Outram Clarksville-Lawrence Lawrence-Big Hill Big Hill-Beaumont Beaumont-Roxburgh Surveyed .. Surveyed .. Trial Survey Surveyed .. Trial Survey Balcutha-Owaka Owaka-Catlin's Catlin's-Houipapa Houipapa-Puketiro Puketiro-McLennan McLennan-Tahakopa Tahakopa-Marinui Marinui-Tokanui Tokanui-Waimahaka Waimahaka-Appleby Waipahi-Heriot Heriot-Edievale Surveyed Surveyed	5 M. ch. 2 29 1 9 2 44 4 65 1 60 2 60 8 78 21 76 7 33 5 36 24 21 23 20 7 0 15 0 11 60 11 43 19 20 3 38 2 30 7 11 5 29 5 19 23 63 6 0 8 27 24 52 20 3 6 20 28 10 25 70	6 M. ch. 0 23 3 40 0 52 .. 0 24 .. 0 68 2 2 0 44 0 45 1 63 0 30 0 9 0 43 0 59 0 38 0 64 1 50 2 3 0 45	7 M. ch. 2 52 4 49 3 16 4 65 2 4 2 60 9 66 23 78 7 77 6 1 24 21 23 20 7 0 15 0 11 60 11 43 21 3 3 68 2 39 7 54 6 8 5 57 23 63 6 0 9 11 26 32 22 6 6 65 28 10 25 70	8 M. ch. 4 65 .. 2 60 24 21 23 20 11 60 .. 									

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1922—continued.
SOUTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Siding.	Total.	State of Line									
							Surveyed.	Under Formation.	Under Plate-laying.	Opened.					Date.	Total.
										12	13	14	15	16		
							M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.	M. ch.		
1 Waitaki-Bluff and Branches—contd.	2 Branches—contd. Waimea Plains District Ry. Kelso-Gore	3 M. ch.	4	5 M. ch.	6 M. ch.	7 M. ch.	8 M. ch.	9 M. ch.	10 M. ch.	11	12 M. ch.	13 M. ch.	14 M. ch.	15 M. ch.	16 M. ch.	17 M. ch.
		36 39	Gore-Lumsden ..	36 39	1 34	37 73	..	..	..	..	..	..	..	..	..	36 39
		24 0	Surveyed	9 58	..	9 58	9 58	..	..	..	..	..	..	..	..	..
		12 65	Preliminary survey ..	14 22	..	14 22	14 22	Prelim.	..	26 Nov., 1908	..	..	..	..	..	12 65
Otago Central	Gore-Waikaka ..	13 70	Waikaka Section ..	12 65	1 51	14 36	..	..	..	1 Oct., 1909	..	..	..	..	..	13 70
	Riversdale-Switzers	19 30	Riversdale-Waikaka	13 70	1 40	15 30	..	..	..	..	..	..	..	..	..	9 36
	Edendale-Toitois ..	182 45	Edendale-Glenham	9 74	0 72	10 28	9 74	..	..	..	..	..	..	..	..	..
	Waitaki Bluff Main Line to Lake Hawea	13 20	Surveyed	98 18	5 62	104 0	..	..	..	1 Sept., 1904	..	..	..	..	..	147 27
Invercargill-Kingston Branch, Lumsden-Mararoa	Winton - Heddon Bush	11 0	Wingatui-Ida Valley	13 20	1 16	14 36	..	..	..	14 July, 1906	..	..	..	..	..	12 29
	Winton to Hedgehope	12 40	Ida Valley-Omakau	7 36	0 34	7 70	..	..	..	15 Dec., 1906	..	..	..	..	..	..
	Orepuki-Waiau ..	60 64	Omakau-Chatto Creek	10 39	1 6	11 45	..	..	..	27 Mar., 1907	..	..	..	..	..	..
			Chatto Ok.-Alexandra	5 45	0 77	6 42	..	..	..	10 July, 1921	..	..	..	..	..	..
Forest Hill Railway Western Railways, Orepuki-Waiau River	Winton - Hedgehope	12 40	Alexandra-Clyde	12 29	0 69	13 18	..	..	..	..	..	..	..	..	..	..
	Orepuki-Waiau ..	60 64	Clyde-Cromwell	35 18	..	35 18	..	..	..	..	..	..	..	..	..	..
			Surveyed	87 4	5 15	92 19	..	..	..	..	..	..	..	..	..	87 4
			Invercargill-Kingston Wharf	10 40	1 0	11 40	..	..	..	..	..	..	..	..	..	10 40
Totals	Lumsden-Mararoa ..	30 0	Lumsden-Mossburn	8 20	..	8 20	8 20	..	..	..	..	..	..	..	..	..
			Surveyed ..	11 20	..	11 20	11 20	Prelim.	..	..	..	..	..	..	..	..
			Reconnaissance ..	11 0	..	11 0	11 0	..	..	..	..	..	..	..	..	..
			Surveyed ..	12 40	0 65	13 25	..	..	..	..	..	..	..	..	..	12 40
Totals	Orepuki-Waiau ..	60 64	Winton - Hedgehope	35 41	6 37	41 78	..	..	..	..	..	..	..	..	..	..
			Makarewa-Orepuki ..	4 48	0 58	5 26	..	..	..	1 Oct., 1909	..	..	..	..	..	48 16
			Orepuki-Waiboaka ..	8 7	1 10	9 17	..	..	..	..	..	..	..	..	..	..
			Waiboaka-Tuatapere	8 8	..	8 17	..	8 8	..	..	..	..	..	..	..	..
Totals	Tuatapere-Orawia ..	22 15	Tuatapere-Orawia	22 15	..	22 15	..	..	..	..	..	..	..	..	..	22 15
			Orawia-Clifden	11 0	..	11 0	11 0	..	..	..	..	..	..	..	..	..
			Thornbury-Wairio	11 0	..	11 0	11 0	..	..	..	..	..	..	..	..	..
			Surveyed ..	2351 23	257 56	2608 79	493 55	32 19	11 65	..	1714 57	13 00	..	12 29	1740 06	..

APPENDIX C.

ANNUAL REPORT ON BUILDINGS, BY THE GOVERNMENT ARCHITECT.

The GOVERNMENT ARCHITECT to the Hon. MINISTER OF PUBLIC WORKS.

SIR,—

I have the honour to submit the following report on the various building operations of the Department for the year ended 30th June, 1922.

GOVERNMENT HOUSES.

Auckland.—A benzine-store was erected, and general renovations carried out.

Wellington.—The main alterations and additions were completed early in the year. A new fire service was installed on the first floor, and various alterations, renovations, and repairs carried out.

NEW PARLIAMENT BUILDINGS.

The buildings were practically carried to completion before the end of the year. The balance of exterior marble was placed in position, and the whole of the interior marble work, including marble floor of main entrance and first floor, and the marble stairs, was completed. A large amount of plastering, tiling, carpentering, painting, plumbing, asphaltting, &c., was required to finish the building, and this was practically all done before the end of the year. Granite steps to Public Gallery, Legislative Council, &c., were set in position. Three oak "Van Kannel" doors were erected at front entrances, and the handsome panelling of Cabinet-room completed. Two electric lifts were installed, and the electric lighting, bells, telephones, &c., were practically completed.

All carpets ordered came to hand and were laid. A large quantity of furniture was supplied by various firms, but a larger quantity was made in the Public Works workshops, of better quality and at no greater cost. The seating contract for the Legislative Council was satisfactorily completed. The heating contract was practically completed.

Various other works were carried out, and a large amount of rubbish, &c., removed from the grounds, while all machinery was dismantled and removed. Lawns and gardens were laid, and paths metalled. Only lawns and gardens on Museum Street frontage remain to be done.

OLD PARLIAMENT BUILDINGS.

Various alterations and repairs were carried out.

DEPARTMENTAL BUILDINGS.

The maintenance and general upkeep of public buildings has been carried out as far as funds would permit, including renovations, repairs, fittings, &c., to Departmental Buildings at Auckland, Hamilton, Whangarei, Taumarunui, Tauranga, Napier, Gisborne, New Plymouth, Wanganui, Wellington, Nelson, Greymouth, Christchurch, Timaru, Dunedin, and Invercargill.

POST-OFFICES, ETC.

Te Kopuru.—A new building was erected during the year.

Waiotemarama.—A new office was erected.

Alterations, repairs, &c., were carried out to various offices in the Whangarei district.

Manurewa.—New brick building completed and fittings supplied.

Morrinsville.—Addition of telephone exchange and mail-room in wood.

Henderson.—New building, in wood, commenced and completed. Residence attached. Fittings and furniture provided.

Onehunga, Takapuna, and Devonport.—New automatic-telephone exchanges, in brick, completed.

Aria.—New building, in wood, erected, and fittings supplied.

Mangapehi.—Old building purchased and converted into post-offices; fittings supplied.

Whakahora.—New building erected.

Owhango, Piopio, and Taumarunui.—Alterations, &c., carried out.

Te Teko.—New building (on skids) erected and fittings supplied.

Whakatane.—Postmaster's residence erected.

Tauranga, Te Puke, Otakiri, Ngongotaha, Whakatane, Waimana, Rotorua, Katikati, and Mokui.—Renovations, alterations, &c., carried out.

Rata.—New building, in wood, just completed.

Taihape.—New telephone exchange, in wood, completed.

Wellington: New Telephone Exchange, Stout Street.—The whole of the concrete foundations, including exterior walls up to street-level, have been completed, and asphalt damp-course put on.

General Post Office, Kelburn Telephone Exchange, and Post and Telegraph Stores.—Sundry alterations, repairs, &c., have been carried out.

Post and Telegraph Workshops, Pipitea Point.—New workshops, in concrete, well advanced. Electric lighting, heating, &c., installed.

Rangiotu and Paraparaumu.—New buildings have been erected with material from Featherston Camp.

Sundry alterations, repairs, renovations, &c., have been carried out at twenty-eight other offices in Wellington District.

Pikomanu.—A new building, in wood, has been erected.

Wakefield, Nelson.—Alterations and additions.

Motueka.—Electric-light installed. Minor repairs and renovations to nine other offices in Nelson District.

Greymouth.—No new buildings. Repairs and renovations carried out at many offices.

Christchurch.—New building, Hereford Street: Outside of building now complete, and inside plastering and the heating well in hand.

Chatham Islands.—New Superintendent's residence has been erected.

Amberley.—Lineman's residence, in wood, has been erected.

Duvauchelle.—New building with residence attached, in brick, erected; fittings and furniture provided, and electric light installed.

Hovorata.—New building erected, and furniture and fittings supplied.

Timaru.—Extensive additions and alterations, in brick, carried almost to completion.

Cave.—A four-roomed cottage moved to new site and fitted up as post-office.

Mayfield.—An old building renovated and altered to form post-office and quarters.

Alexandra.—New building, in reinforced concrete, erected, and furniture and fittings supplied.

Garston, Lumsden, Nightcaps, and Ranfurly.—New buildings erected, and furniture and fittings supplied.

Dunedin, Hawea Flat, Invercargill, and Ophir.—Alterations and additions carried out.

Minor repairs and renovations to twelve other offices in Dunedin district.

COURTHOUSES, ETC.

Wanganui.—Native Land Court—large new building in brick, plaster finish inside and out; contains Court-room, offices, strong-room, and outbuildings: buildings completed.

Waipukurau and Pukekohe.—New building completed and furnishings provided.

No other new buildings were erected, but renovations, repairs, alterations, &c., were carried out at eighteen other Courthouses throughout the Dominion.

POLICE-STATIONS AND GAOLS.

Paparua Prison.—Two new cottages have been erected; old original cells have been converted into an up-to-date farmsteading, complete with electric light throughout, and the old stable has been converted into a store; new piggery completed; water-supply largely augmented, and a septic tank built; new East Cell-range has progressed very favourably; general repairs and renovations have been carried out.

Waikari.—New residence erected, with office, stable, and cells.

Palmerston North.—Sergeant's residence, new building in brick, completed.

Dannevirke.—Police-station completed.

Hokitika.—New police-station and sergeant's residence have been completed.

Fortrose, Invercargill, and Tuatapere.—Dwellings purchased and removed, &c.

Bull's.—New residence in wood, with cells, completed.

Mount Eden Prison.—Six new cottages in concrete blocks were completed by prison labour, assisted by Public Works Department.

Mohaka.—New building nearing completion.

No other new buildings were erected, but extensive repairs and renovations have been carried out in several districts and minor repairs in others, and several houses purchased and renovated for use as police-stations.

MENTAL HOSPITALS.

Tokanui.—A male admission block, in brick, was completed, giving accommodation for twenty patients.

Avondale.—General repairs: brick addition to Auxiliary No. 2 (female), to accommodate eighty patients, was completed and handed over.

Wolff Home, Auckland.—A new roof built on.

Porirua.—Electric lighting, &c., overhauled, and sundry repairs and renovations carried out, including a new roof on the old laundry.

Nelson.—New reception block, in brick, was completed, and electric light is being installed.

Hokitika.—Extensive additions provide for a bakehouse, store, dining-room, billiard-room, and nurses' quarters.

Sunnyside.—Additions comprising a day-room and a dining-room were erected, and repairs and renovations carried out as required.

Hornby.—Extensive alterations and additions have been made.

Seacliff.—Alterations, renovations, &c., were carried out.

Waitati.—A new unit was added for female patients.

EDUCATION.

Whangarei District.—Various additions, alterations, &c., were carried out to twelve Native schools.

Tauranga District.—New Native school at Matata completed, and alterations and renovations done to six others.

Gisborne District.—Renovations, &c., done to three Native schools.

Greenmeadows.—Various repairs, &c., carried out at Receiving-home.

Wellington.—Extensive excavations were carried out at proposed site of Girls' College, and various repairs, alterations, &c., were carried out at other schools, receiving-homes, &c.

AGRICULTURE.

Tauranga.—New accommodation arranged for Stock Inspector, and furniture provided.

Whakatane.—New residence for Meat Inspector completed.

Te Puia.—Additions to Stock Inspector's residence carried out.

Waipukurau and Hastings.—Renovations and repairs carried out.

Wellington.—Alterations carried out at Dominion Laboratory and Biological Laboratory.

Wallaceville.—Alterations and repairs carried out.

Lumsden and Palmerston.—Various works done to offices.

GENERAL.

In addition to the foregoing, various works, alterations, repairs, &c., were carried out in a large number of offices for different Departments, including Defence, Tourist, Immigration, Public Health, Government Life Insurance, Public Trust, Pensions, Marine, State Advances, and Labour; also to Ministerial residences.

Twelve workers' dwellings were erected at Petone.

A large quantity of furniture and fitting was made at the Public Works workshops and supplied to various offices.

JOHN CAMPBELL, F.R.I.B.A.,
Government Architect.

APPENDIX D.

ANNUAL REPORT OF CHIEF ELECTRICAL ENGINEER.

The CHIEF ELECTRICAL ENGINEER to the Hon. MINISTER OF PUBLIC WORKS.

SIR,—

I beg to report on the position of the development of electric power in the Dominion for the past year as follows :—

The demand for electric power generally is still very urgent, both in the districts already partially supplied and in those in which a supply is not yet available. The fall in prices of our primary products which took place during 1921 resulted in a financial stringency amongst the primary producers which rendered it necessary for them to look very carefully into the cost of conversion of their premises to electric working, and for the time being caused a check in the demand in many directions. But the check has been only temporary. The lower prices both for primary products and manufactured goods have necessitated every effort being made to reduce the cost of production. The supply authorities—particularly the Power Boards—have realized the difficulty with which the consumer is faced in financing the conversion to electric power owing to the reduction in prices and in many cases this has been met by the provision of a special loan to make advances to consumers towards the costs of conversion. This is being largely taken advantage of by intending consumers and the demand for electric power for essential industries and for domestic supply is as urgent as ever.

The power available is still generally deficient, owing to the delays which occurred during the war period in making necessary extensions to plant both in the State and in the local installations. The accessions to the generating-capacity of the electric-power stations of New Zealand made during the year under review were the addition of one unit of 1,000 kw. at Invercargill (Borough Council, steam), and one unit of 650 kw. at Tauranga Borough plant (water-power), and of new local stations at Motueka (50 kw., gas), Kaikoura (37 kw., gas), Tamaki West (40 kw., gas), Havelock North (144 kw., water), Murchison (80 kw., water), Kaponga (90 kw., water).

The total installed plant capacity of the generating-stations of New Zealand—omitting standby provisions—at the end of the year was 51,749 kw., as compared with 49,630 kw. at the beginning of the year. But every important station is being extended, and orders have been placed for the following additions :—

	Kilowatts.			
Lake Coleridge (Public Works Department), water	..	..	..	6,000
Horahora (Public Works Department), water	..	..	..	4,000
Auckland (Electric-power Board), steam	..	..	..	13,000
Wellington (City Council), steam	..	..	..	5,000
Dunedin (City Council), water	..	..	..	3,000
New Plymouth (Borough Council), water	..	..	..	1,000
Pukekohe (Borough Council), gas	..	..	..	120
				32,120

In addition, work is well under way for the following new stations, which will all be in operation by 1925 :—

	Kilowatts.			
Mangahao (Public Works Department), water	..	..	..	20,000
Waikaremoana (Public Works Department), water	..	..	..	700
Monowai (Southland Power Board), water	..	..	..	4,000
Palmerston North (Borough Council), gas	..	..	..	900
Teviot (Power Board), water	..	..	..	250
Wairarapa (Power Board), water	..	..	..	300
Whakatane (Borough Council), water	..	..	..	300
Opunake (Power Board), water	..	..	..	120
				26,570

By 1925 the electric power available in the Dominion will thus be more than doubled as compared with the present installed capacity.

The growth in the installed capacity of electric-power stations of New Zealand since 1910 is shown in Fig. 4 herewith. The unsatisfied demand has for the whole period been substantially in advance of the developed power.

INDUSTRIAL DEVELOPMENTS.

No marked changes have taken place in the industrial position since Mr. Parry's report of 1918.

Electric power in dairying is making satisfactory progress. There are now about 548 electric milking plants in operation in New Zealand, distributed as follows:—

Thames Valley Electric-power District	257
Te Awamutu Electric-power District	48
Cambridge Electric-power District	50
Central Electric-power District	59
Tai Tapu Dairy Company's district	36
Eyre County	4
Rangiora County	32
Murchison County	4
Stratford District	8
Hawera District	50
Total	548

This does not include any plants supplied from private installations of which no records are available. The largest use of electric milking will be in the electric-power district areas, only a few of which are yet supplying power, and when the power districts now being formed are in a position to supply, this number will be largely increased. There are 12,468 power milking plants in operation in New Zealand, mainly driven by oil-engines, and as soon as the electric mains are available practically every one of these will be changed over to electric drive.

The treatment of phosphates for the production of artificial manure has made important progress, owing mainly to the interest acquired by the Government in the Nauru Island deposits. During the year large treatment-works have been put into operation at Auckland and Christchurch—the first supplied with power in the meanwhile from its own steam plant and the latter from the Lake Coleridge system. These plants take 200 to 300 h.p. each, and thus constitute an important load. Works for the treatment of phosphates are now established in Auckland, Christchurch, Dunedin, and Invercargill. The Wellington District is not provided for so far, and it is anticipated that when Mangahao power is available this industry will also be undertaken in this district.

One electric steel-furnace has been established during the year, supplied from the Lake Coleridge mains, and, after considerable difficulties of initiation, is now successfully converting pig iron into steel castings. A proposal has been made to utilize 3,000 h.p. for the smelting of Taranaki ironsands, and extensive and successful trials have been carried out in England on samples of the ironsands. Negotiations are now in hand as to a suitable source of electric power for this industry.

It is anticipated that when the extensions and new stations now under construction are generally completed—say, in 1925—there will be, on the whole, sufficient surplus of power to justify a campaign to develop the demand by encouraging the extension of existing industries and the establishment of new industries. Until this surplus is available the main advantage of electric power in attracting new industries cannot be realized.

It is important that every development should be laid out and the capital expenditure arranged so that the installation will prove remunerative to the supply authority. But it is equally important, from the public point of view, that the layout in every case should be capable of extension at the smallest possible capital outlay up to the full capacity of the site, whether from water or steam power, in order to meet the inevitable expansion in the industry.

Owing to the financial stringency, the question of electrification of the suburban railways has made no further progress, though the electrification of the Otira Tunnel is in hand. A special power-station with 2,400 kw. of steam-power and 250 kw. of water-power is being installed for this purpose. Automatic electric-power signalling for the railways has been introduced on the Wellington-Hutt line, and it is proposed for other sections. Though small, the demand for power for this purpose will be important as the system extends.

SAVING EFFECTED BY WATER-POWER.

With regard to the saving that is effected by the use of hydro-electric power, the actual costs of supply, including capital and operating costs of the power-stations in operation in New Zealand last year, were as follows:—

	Water.	Steam.	Gas.	Oil.
Number of stations	27	10	22	2
Average capacity (horse-power)	1,200	2,600	170	540
Average load-factor (per cent.)	48	32	25·5	32·5
Capital outlay per horse-power	£104	£69	£108	£84
Working-costs per horse-power year	£6·1	£17	£23·4	£29·4
Capital charges per horse-power year	£5·6	£6·9	£6·1	£6·5
Total costs per horse-power year	£11·7	£23·9	£29·5	£35·9

Compared with the water-power stations, at the same load-factor (48 per cent.), the fuel stations would have cost much more to operate. Moreover, the load-factor of most of the water-power plants can be largely increased at no increase in the cost of supply.

There is thus a saving in the cost of supply from the twenty-seven existing water-power plants of New Zealand as compared with the ten steam plants of £12·2 per horse-power year, and as compared with the twenty-two gas-engine plants of £17·8 per horse-power year. It must be noted that of these twenty-seven water-power plants more than one-half are old, small, and inefficient plants of 200 horse-power or less, so that the comparison is not unduly favourable to water-power.

As compared with the cost of generating power by small steam or oil engines, now used in districts in which electric supply is not available, the saving is still greater. Each water horse-power operating on a 48-per-cent. load-factor supplies 4,200 horse-power hours per year. The same number of horse-power hours developed in numerous small steam-engines using an average of 9 lb. of coal per horse-power hour, worth £3 per ton delivered into the boiler, would cost £50·7 in fuel alone, showing, compared with £11·7 for water-power, a saving of £39 per year per horse-power of power-station output. Compared with small oil and kerosene engines using 1 pint of oil per horse-power hour, costing 16s. per case delivered, the value of oil required to generate 4,200 horse-power hours is £52·5 per year, as compared with the average cost of water-power of £11·7—a saving of £40·8 per horse-power year. The actual saving in practice is about the average of these four figures—viz., £12·2 as compared with large steam plants, £17·8 as compared with gas-engine plants, £39 as compared with small steam-engines, and £40·8 as compared with small kerosene-engines; i.e., an average saving over the whole output of £27 per horse-power year.

Of the average capital outlay of the water-power systems of New Zealand—viz., £104 per horse-power—more than one-half is in the reticulation, which would be required in any case, leaving the capital cost of the power plant and transmission less than £52 per horse-power. The actual capital costs of the power-plant main transmission-lines and main substations in a few typical cases of hydro-electric stations are as follows: Lake Coleridge, £39 per horse power; Waipori Falls, £32·5 per horse-power; Horahora, £35 per horse-power; Wairua Falls, £29 per horse-power.

The actual saving to the consumer after paying the whole cost of hydro-electric supply, including interest, depreciation, operating-expenses, maintenance, distribution and management charges at the actual average cost of the twenty-seven water-power stations of New Zealand—viz., £11·7 per horse-power year—is thus £27 per horse-power year, and is sufficient to pay off the whole of the capital cost of the power plant within two years. The actual revenue of the water-power stations is only £13·2 per horse-power year, so that, of the £27 saving, the supply authority realizes only £1 10s. and the consumer the remaining £25 10s. But this is none the less a real saving to the community in reducing the cost of production by this amount.

ULTIMATE DEMAND TO BE PROVIDED FOR.

The ultimate demand to be provided for is a very important question which must be kept constantly in view in considering the development both of the large Government schemes and the smaller local schemes designed to supply the local demand until the comprehensive Government system is available.

The basis of the general system laid out for the Dominion as a whole is a supply of 1 horse-power to each 5 head of population, or 0·2 h.p. per head. This was the basis laid down by Mr. Parry in 1918, and no reason has been found to depart from it. It is admittedly ample for all present purposes, but is not excessive considering the possible and probable development of electric cooking and special electrical industries; and in advantageous circumstances it is exceeded elsewhere. For instance, in Tasmania, with a population of 213,887 persons, the power already developed by the State in its first water-power station at Waddamana is 66,000 h.p.—a provision of 1 in 3·1 or 0·32 h.p. per head of population; and work is now in hand on a supplementary station higher up on the Shannon River for 15,000 h.p., which will bring the proportion up to 0·38 h.p. per head. The justification for this large development is, of course, the sale of a single block of 30,000 h.p. to the Electrolytic Zinc Company, and of another of 5,000 h.p. for the manufacture of carbide of calcium. It is anticipated that the provision of a surplus supply of electric power in New Zealand would attract similar large industries here.

In addition to this evidence, the following are the amounts of electric power actually installed in the various provinces of Canada as compared with the supply available in the four metropolitan districts of New Zealand:—

	Total Electric Horse-power installed.	Horse-power per Head of Population.
Ontario	1,212,650	0·41
Quebec	1,015,385	0·43
British Columbia	305,315	0·58
Manitoba	97,247	0·17
Nova Scotia	46,948	0·09
Alberta	33,187	0·05
New Brunswick	30,180	0·08
Yukon	13,199	3·17
Prince Edward Island	1,869	0·21
Saskatchewan	Nil	Nil.
Canada (total)	2,762,880	0·31
Tasmania	66,000	0·32
New Zealand	74,000	0·06
Canterbury District	10,000	0·09
Dunedin District	8,000	0·11
Auckland City	17,200	0·20
Wellington City	10,000	0·12

The Canadian figures for the various provinces are particularly instructive, illustrating both the large proportion of power per head of population in the industrial provinces and the comparatively small proportion in the purely agricultural and pastoral provinces. As compared with the proposed allowance for New Zealand of 0·2 h.p. per head of population, the large industrial provinces of Canada now use 0·41 to 0·58 h.p. per head, whereas the agricultural and pastoral provinces use from 0·05 to

0.08 h.p. per head. The demand over the whole Dominion of Canada is 0.31 h.p. per head. The relative proportion of industrial to agricultural industries in New Zealand will be approximately the same as in Canada, and the provision of 0.2 h.p. per head is thus a comparatively conservative provision.

On this basis the allowance, based on the 1916 census, is 130,000 h.p. for the North Island and 90,000 h.p. for the South Island. Allowing for transmission and distribution losses and for normal increase, the total power now required is 160,000 h.p. for the North Island and 110,000 h.p. for the South Island. The Government Statistician forecasts a population of the Dominion in 1930 of 1,573,000, which on the one-in-five basis indicates a demand of 300,000 h.p. delivered, about 180,000 for the North Island and 120,000 for the South Island, plus the necessary allowance for standby plant and transmission losses.

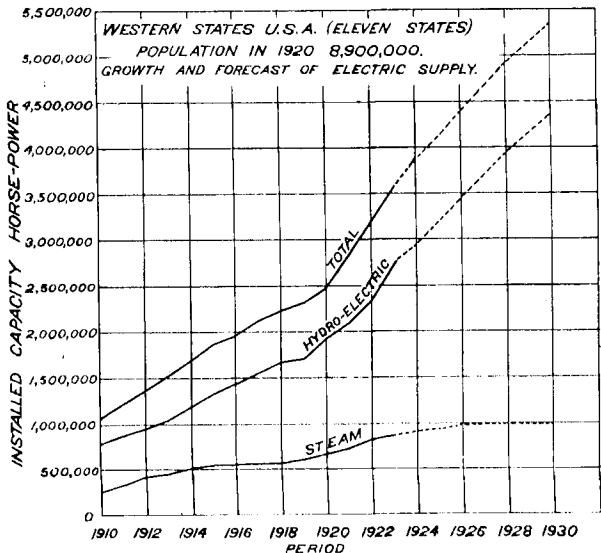


FIG. 3.

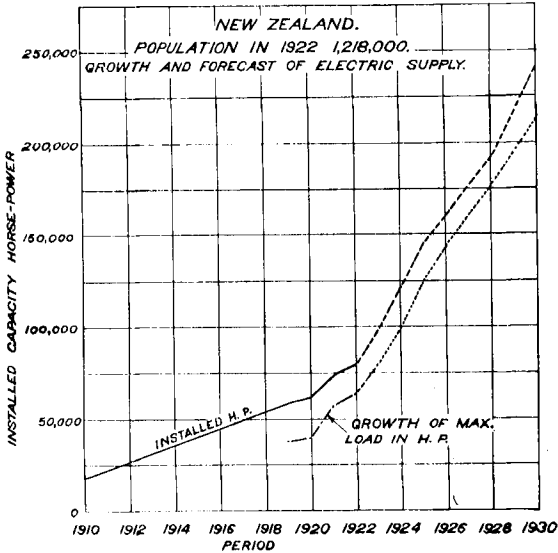


FIG. 4.

The curve shown in Fig. 3 gives the output of electric power in the eleven western States of America in which the conditions are generally fairly comparable with those in New Zealand, and a forecast to 1930, based on developments actually in hand (*Journal of Electricity*, vol. 46, p. 601). Fig. 4 gives similar curves for New Zealand, the forecast up to 1926 being based on actual commitments and to 1930 on the development in view. This gives the following results :—

Year.	Horse-power installed.	Estimated Population.	Horse-power per Head.
1921	74,000	1,218,000	0.061
1922	79,000	1,273,000	0.062
1924	122,000	1,342,000	0.091
1925	146,000	1,378,000	0.106
1926	160,000	1,415,000	0.112
1928	190,000	1,492,000	0.127
1930	240,000	1,573,000	0.156

The forecast of the development is conservative, and will still leave in 1930 an unsatisfied demand of 60,000 h.p. In fact, based on the experience in Canada and the Western States of America, a much larger development is required than is included in the present programmes of the Government and the present local authorities.

ELECTRO-CHEMICAL INDUSTRIES.

Apart from the normal development of the general systems of electric-power supply, the main justification for the development of the largest and most economical sources of New Zealand will be the establishment of large electro-chemical industries taking 10,000 h.p. to 30,000 h.p., such as the alkali and nitrate industries of Norway and Germany, or the zinc-extraction and carbide industries of Tasmania. There are several sites in New Zealand, particularly on the western fiords of the South Island, quite as favourably situated for such industries, and it is important that these should be surveyed and the results advertised abroad, from whence the capital for these industries will come.

LAKE COLERIDGE ELECTRIC-POWER PLANT.

The year under review is the seventh year of operation, and, in spite of the fact that serious turbine troubles developed, necessitating the calling into service of the steam standby plant, and entailing a period of restricted service, a small credit balance is shown after paying operating and capital charges. The year was again abnormally dry, but lake-level conditions were steadily improved as a result of temporarily diverting a portion of the Harper River into the lake (Fig. 6). Insulator troubles are still unduly frequent, but a decided improvement is shown as the original stock is weeded out and replaced by later designs of insulators. The plant operated under heavy overload throughout the year.

LAKE COLERIDGE HYDRO-ELECTRIC POWER SUPPLY CURVES OF MAXIMUM WEEKLY LOAD

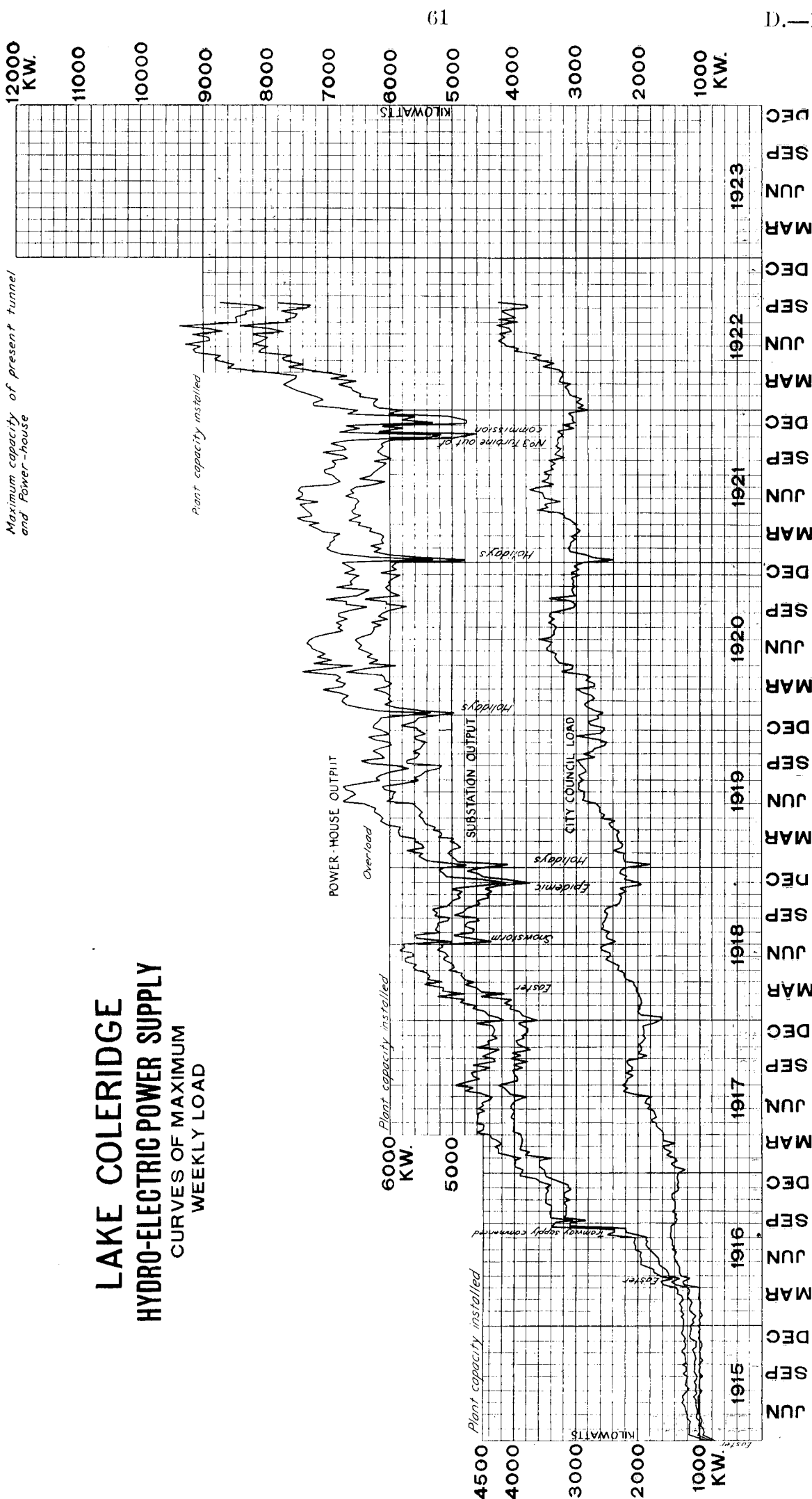


Fig. 3.

The capital outlay at the end of the year was £671,608, as against £499,957 at the beginning of the year. The revenue for the year was £56,814, being £1,498 in excess of all charges, including interest at $4\frac{1}{4}$ per cent. and depreciation at 2 per cent. Financial results of operation and load records are given in Table A herewith.

The power-house maximum load reached 7,600 kw. on a rated plant capacity of 6,000 kw.—i.e., 26·7 per cent. overload—and an increase of 2·5 per cent. over the previous year. The output reached 37,929,750 units, an increase of 4·5 per cent. on that of the previous year. The annual load factor was 57·3 per cent., and the average weekly load factor was 62·9 per cent. The growth of load since the inception of the installation is shown in Fig. 5.

Generating-costs per unit still show an upward tendency, being 0·02d. in excess of the previous year's cost; but this increase should not recur, as it was more than accounted for by expenditure on maintenance of the temporary diversion of the Harper River and the demands made on the steam standby plant as a result of breakdown of two of the turbines.

Extensions.—The erection of the third pipe-line was completed in July, and preliminary runs on the fifth unit made the following month, but, owing to trouble with the foundations and turbine, this unit was not put into service until April last. A contract was let for the fourth pipe-line of 52 in. diameter, and work commenced on it in November. Very satisfactory progress was made: the pipe-line has since been completed. A three-unit exciter of 330 h.p. capacity was completed and put into operation in October. Work on the erection of the switching-station at Windwhistle for the Timaru line tap-off was proceeded with, and orders placed for all the necessary switching equipment. In November a contract was let for the erection of the transmission-line poles from Windwhistle switch-station to Timaru, a distance of eighty-five miles, and this work has since been completed. A third transmission line, from the power-house to Hororata, was put into service in February, and a commencement made on the reconstruction of the south main transmission-line from Lake Coleridge to Christchurch.

The permanent diversion of the Harper River was commenced in the middle of August, a staff of thirty men being employed on this. This work is now completed.

A 1,500 k.v.a. synchronous condenser was installed at Addington substation in December, with great improvement to the service in general. In fact, without this it would have been impossible to carry the heavy overloads experienced.

Power Boards were created to reticulate Banks Peninsula and Springs-Ellesmere Counties. The former completed and put into service the first portion of its system in December, and by the end of the year had completed the reticulation over fully one-half of the district. To supply this Board a 33,000-volt line has been run from Tai Tapu to Motukarara, and put into service temporarily at 11,000 volts. The Springs-Ellesmere Power Board has also commenced reticulation, and is already giving a partial supply. The 11,000-volt feeder was extended from Lincoln to the Selwyn River to supply this Board.

A Power Board to reticulate and supply Ashburton district has also been formed, and is proceeding apace with the development of the reticulation. It will take supply from the Timaru line at Methven and at Ashburton.

The Department's 11,000-volt reticulation has been increased during the year from $77\frac{1}{4}$ miles to $82\frac{1}{4}$ miles.

Connected Load.—The total connected load increased to 39,957 kw., as set out in Table D herewith, an increase of $16\frac{1}{2}$ per cent. on that of the previous year. The maximum demand on the substation was 6,720 kw., showing a diversity factor of 5·94.

Operation.—The plant has been heavily overloaded throughout the year, the position being considerably accentuated by the breakdown of two of the turbine-casings. On the 24th October a crack developed in the casing of one of the 1,500 kw. units, and during repair the available plant capacity was reduced to 4,500 kw., the steam standby plant being called into service.

On the 8th November the new 3,000 kw. set was put into operation, but on the 27th it developed a crack almost identical with that which had occurred on the 1,500 kw. set. The steam standby plant was again called into operation, and in the meantime the casing of the first set sent to Christchurch for repairs. These were completed, and the set put into operation on the 21st December, when the whole load was again carried by the station. The casing for the sixth unit (3,000 kw.) arrived early in March, and was immediately installed in place of No. 5, and put into operation on the 30th of that month, bringing the capacity of the station up to 9,000 kw.

Throughout the whole period of trouble the public bodies and wholesale consumers co-operated loyally with the Department in its endeavour to maintain the service, and only this co-operation made it possible for the Department to carry out its obligations with a minimum of inconvenience to the general public.

Transmission-system.—Three complete interruptions to service occurred during the year, on each occasion the south line failing whilst the north line was under repair. The breakdowns in question occurred—(1) 16th July, from 7.30 p.m. to 11.45 p.m.; (2) 30th August, from 8.53 a.m. to 12.40 p.m.; (3) 26th February, from 5.18 a.m. to 8.51 a.m. The total period of complete interruption in supply for the year was thus eleven hours and a half, of which only four hours and three-quarters occurred between 8 a.m. and 5 p.m.—the ordinary industrial day. On each occasion the Tramway Board's standby plant of 2,000 h.p. was called upon and essential services were maintained.

In addition to these three complete interruptions, single-line breakdowns took place on forty-three occasions, involving the replacement of ninety-five insulators, or 1·8 per cent. of those in service and a breakage of the line wire on five occasions. Compared with experiences elsewhere, ranging from 10 to 20 per cent. of insulator failures per year, this record is satisfactory. With the replacement of the balance of the original insulators, manufactured in 1913, by modern types of insulators, and the replacement of the aluminium wire by copper wire of a larger section (19/13 S.W.G.), it is anticipated that these accidental interruptions will be reduced to a minimum.

Water-storage.—The temporary diversion of a portion of the Harper River at the end of the preceding year resulted in a substantial rise in the lake-level, and a corresponding increase in the available head at the intake in spite of the increased demand. At the end of the year the lake-level stood at 1,661.1 ft., as against 1,658.8 ft. at the beginning of the year, a rise for the year of 2.3 ft. (fig 6).

LAKE COLERIDGE.
Variations in Lake-level, 1916-22.



FIG. 6.

Industrial Developments.—Owing to the overloaded condition of the plant and the delay in getting the fifth generator into service restrictions were still in force at the end of the year, but were entirely removed on the final test of the fifth generator in April, 1922, which brought the plant capacity up to 9,000 kw. (12,000 h.p.). Since then supply has been given to the Canterbury Frozen Meat Company (making the fourth large freezing-works connected to the mains), Kempthorne-Prosser's new super-phosphate-works, the new woollen-mill erected by the Kaiapoi Woollen Company at Woolston, and several other consumers who had been waiting for supply. Moreover, the restriction on the use of ironing and heating points was removed, resulting in an increase of the city demand from 3,750 kw. to 4,290 kw.

Future Extensions.—In addition to the extensions now in hand, which will bring the plant up to the full capacity of the existing headworks—viz., 12,000 kw. (16,000 h.p.)—plans and specifications are in hand for a further extension, consisting of an additional tunnel, 11 ft. in diameter (as compared with the present 8 ft. tunnel), and an extension of the power-house to take at first two and finally three units each of 7,500 kw. (10,000 h.p.). This extension will provide for the whole of the water available from Lake Stream, the Harper River, and the Acheron River—in fact, the whole of the economical capacity of the site—and involves raising the lake-level from the present overflow level of 1,667.5 ft. to 1,670 ft. by means of a small outflow weir.

Third Pipe-line Contract.—A valuable experience was gained during the year in a new form of contract for this work. During the war a great many works were let on the basis of 10-per-cent. commission on the cost. This is an undesirable form of agreement, in that it gives the contractor every inducement to wasteful and extravagant expenditure. For the erection of the third pipe-line a tender was received in the following form: The Department to pay the actual cost (estimated in the tender at £8,500), and the contractor to receive a commission of £850, reducible by 15 per cent. of any excess in the actual cost over £8,500, and increased by 15 per cent. of any saving below £8,500 in the actual cost of the work. As the next lowest tender was very much higher, and as the above arrangement gave the contractor every inducement to do the work at the lowest possible cost, it was accepted. The actual result was that a very hearty degree of co-operation was attained between the Department and the contractor, both being interested in keeping down the cost to a minimum; and, after all services offered by the Department, such as electricity, transport, &c., had been charged up, the actual cost worked out at £7,184—a saving of £1,316 on the estimate—thus increasing the commission to the contractor accordingly, and giving a result eminently satisfactory to both parties.

WAIKATO ELECTRIC-POWER SUPPLY.

The Horahora power plant has now completed its second complete year of operation since it was purchased from the Waihi Gold-mining Company, and the results have been very satisfactory indeed.

The capital outlay at the end of the year under review was £353,808, as compared with £249,499 at the beginning of the year, an increase of £104,309. Of the total the sum of £212,500 represents the amount paid to the Waihi Gold-mining Company for the power-house and transmission-line to Waihi and substation at Waikino as taken over, and the balance, the amount expended on new lines to supply Hamilton, Cambridge, and Te Awamutu. The result of the year's operation shows a revenue of £28,207, against which are chargeable £7,986 working-expenses and £17,699 to cover interest and depreciation, leaving a net profit of £2,522, as compared with a loss of £6,282 in the previous year. The revenue has been derived as follows: Three mining services, £19,779; four dairy factories, £2,455; four Power Boards, £3,208; one borough, £1,391; rents, &c., £1,374: total, £28,207. This satisfactory result is due largely to an increase of over £5,000 in the revenue from the mines, due mainly to the supply given to the Grand Junction Company at a very small additional capital outlay, and to the energy of the district staff in getting additional business elsewhere.

But the provision of the 50,000-volt lines and substations necessary to supply future requirements entails considerable additional capital cost. It is expected that the general demand, apart from the mining load, in the district will increase sufficiently in a year or two to pay the additional capital charges, as well as the additional maintenance and working-expenses involved in these extensions; but for the current year the revenue from the mining load has fallen off at a rate of £300 per month as compared with last year. The revenue from other consumers can hardly be expected to increase sufficiently to offset this as well as the increased charges referred to above, so that unless the mining load and revenue recover the financial results for the current year will probably be less favourable.

Arrangements have been made to supply the Railway Department with 400 h.p. to 600 h.p. for its large house-building factory at Frankton.

Tenders, closing about the end of the year, are being called for an extension of the power-house capacity by 4,000 kw., making a total installed capacity of 10,300 kw., which is sufficient to utilize the minimum low-water flow in dry years and allow one spare unit. To enable the whole of the low-water flow of the river to be taken through the head-race the extension of the existing weir across the river has been put in hand. It is proposed to reserve 2,000 kw. of this for supply to the Auckland Power Board. Sufficient material is on hand to enable the construction of the line to Auckland to be gone on with.

The maximum load on the power-house has been 5,800 kw., which dropped, owing to reduction in the mining load, to 5,000 kw. at the end of the year. If the mining load increases again it is probable that the plant will be overloaded before the extensions above can be installed, but the supply contracts entered into with five of the large consumers who had previously installed their own steam plants permit the Department to make use of these plants if required, and if necessary to call on them to feed back up to 3,000 h.p. of steam power, so that there is no need to fear a shortage before the extensions now in hand are completed.

The following additional 11,000-volt lines have been put into operation during the year :—

	Number of Circuits.	Size of Wire.	Length (Miles).
Horahora-Leamington	2	7/14	12.54
Leamington-Hamilton	2	7/16	15.86
Hamilton-Frankton	4	7/16	3.47
Total route-miles			31.87

The following 50,000-volt lines have been constructed but are not yet in operation, though portions are being used temporarily at 11,000 volts :

	Number of Circuits.	Size of Wire.	Length (Miles).
Waiorongomai-Waihou	1	7/12	5.22
Horahora-Leamington	1	7/12	11.24
Leamington-Mystery Creek	1	7/12	9.60
Mystery Creek-Te Awamutu	1	7/14	9.50
Total route-miles			35.56

In addition to the above, a section of 50,000-volt line from Mystery Creek to Hamilton, 6.52 miles long, to complete the line from Horahora to Hamilton, is nearly completed, and it is proposed to build a 50,000-volt line to connect up from Hamilton to Waihou. When completed the 50,000-volt system will consist of a ring main from Horahora via Hamilton, Waihou, Te Aroha, and Matamata back to Horahora, with single-line branches to Waikino and Te Awamutu, thus giving the advantage of an alternative line to Te Aroha and Hamilton in case of trouble. This will assist substantially in ensuring continuity of supply to Waihi and Waikino. The 11,000-volt lines from Horahora to Hamilton via Cambridge and Matangi will then become 11,000-volt distributors for Cambridge, Matangi, and other consumers *en route*, as well as providing a third emergency feed of limited capacity from Horahora to Hamilton.

In addition a 50,000-volt line is being surveyed from Horahora to Arapuni and on to Te Kuiti, which will probably be joined up later on to Te Awamutu, giving another ring main and an alternative route for that district.

The 50,000-volt to 11,000-volt substations at Hamilton, Te Awamutu, and Waihou are well in hand, the buildings being completed and the transformers and switch-gear all delivered. In the meanwhile supply is being given temporarily at each point at 11,000 volts.

Operation.—The power-house was shut down from 7 a.m. to 3 p.m. on the 28th, 29th, and 30th December to examine the race and to enable alterations to the screens to be completed. These alterations have been effective in preventing blockage of the screens, and no trouble has been experienced in operating the plant at practically full load. During the above hours of shut-down, power was supplied to essential industries from the Grand Junction Company's steam plant at Waihi and dairy factory steam plant at Hautapu. The breakdown of condenser-bushings on the 50,000-volt oil switches necessitated these being cut out of service, causing some inconvenience in operation.

The only line breakdowns during the year consisted of three pin insulators and two sets of strain insulators, which was replaced. In order to reduce the electrostatic strain on the insulators, which are now over ten years old, the transformer neutral at the power-house has been earthed, and four elements instead of three inserted in the strain insulators. It is expected that these changes will render the service still more reliable.

The painting of all towers from the ground up to the telephone cross-arm was completed during the year. Examination of the towers showed that they were generally in good order. A number were painted from the telephone cross-arm up to the top during the three days shut-down at Christmas week, but the time available for cutting power off for this work is small, and bad weather made it impossible to do much this year.

Apart from the shut-down for overhaul for three days during the Christmas holidays for a total time of 31 hours 20 minutes, power was off the 50,000-volt lines owing to accidental interruptions on seventeen occasions for a total period of 35 hours 6½ minutes, and on five occasions, at prearranged hours, for minor repairs for a total time of 11 hours 16 minutes. Most of the above accidental stoppages were momentary, only two being of more than one hour's duration. One on the 2nd January was for a period of 11 hours 46 minutes, and one on the 2nd March for 22 hours 12 minutes. The Grand Junction Company's steam plant provided standby service on both these occasions.

There was only one interruption on the 11,000-volt lines due to insulator failure, one strain insulator having broken down, due to lightning. There were a number of momentary interruptions due mainly to lightning and birds causing grounds, and thus opening the circuit-breakers; and also a number of prearranged stoppages, amounting in all to about fifty hours, to allow of work being done on the lines, new consumers being connected, or new apparatus installed.

MANGAHAO ELECTRIC-POWER SUPPLY.

This plant will have an ultimate capacity of 24,000 h.p., the whole of which is included in the first installation, consisting of three 6,000 h.p. and two 3,000 h.p. pelton wheels, operating at a head of 825 ft., and driving generators operating at 11,000 volts, three-phase. The energy from these will be stepped up to 110,000 volts by means of two banks of transformers, each of 12,000 kw. capacity, for transmission to Wellington, Bunnythorpe, Marton, Dannevirke, Pahiataua, and Masterton. In Wellington the distribution will be undertaken by the City Council, which is already supplying 11,000 lighting and 7,000 heating and power consumers with a maximum load of 3,500 kw. on the A.C. system, and 3,300 kw. on the D.C. tramway-power system. In the other districts the distribution

will be undertaken by Electric-power Boards, of which seven are already constituted, covering the whole area which can be reached from Mangahao and the whole of the available power, which has been allocated as follows:—

	Population.	Horse-power allocated.
Wellington District	93,030	12,000
Hutt Valley Electric-power District	22,594	2,000
Horowhenua Electric-power District	12,000	1,200
Manawatu-Oroua Electric-power District	36,642	3,300
Rangitikei Electric-power District	12,222	1,800
Wairarapa Electric-power District	22,159	2,000
Tararua Electric-power District	10,090	1,000
Dannevirke Electric-power District	13,082	1,300
		24,600

Negotiations are now in hand for the supply to Wellington City. The Power Boards covering the balance of the district to be supplied have all been constituted, and are making provision for the erection of the necessary reticulation in each case, but have not yet entered into contracts for the supply of the necessary power.

The above allocations of power available from Mangahao are only one-half of the ultimate demand anticipated from each district, and the full output of the plant is thus assured apart from any agreements to take power. In fact, Mangahao will be overloaded and will require supplementing from other sources as early as when the Lake Coleridge plant has reached the same position. It is anticipated that, pending the installation of the large plant at Waikaremoana for this purpose, this relief will be available from the steam stations being installed by the Wellington City Council at Evans Bay (10,000 kw.) and by the Wanganui Borough Council (1,750 kw.).

ARAPUNI ELECTRIC-POWER SUPPLY.

The proposed installation at Arapuni consists of an ultimate equipment of twelve units each of 12,000 h.p., of which eight are required to complete Mr. Parry's scheme (96,000 h.p.). The first installation proposed will consist of four of these units (48,000 h.p.), and the plant will not pay its way until the load reaches about 36,000 h.p. In the meanwhile the load will be built up by means of the Horahora plant (14,000 h.p.) and Auckland City steam-power plant (26,000 h.p.) and smaller installations at Te Kuiti, Huntly, Ngaruawahia, Pukekohe, Tamaki, and Rotorua, amounting in all to about another 1,000 h.p. But the Arapuni works are in an entirely different position from Lake Coleridge and Mangahao, in that without the Auckland City load (estimated to reach 26,000 h.p. by 1928) it was impossible to develop the scheme on a commercially sound basis. It was therefore necessary to arrange a definite contract with the Auckland authorities before putting the works at Arapuni in hand. This was accordingly done. This contract anticipates that the Auckland Electric-power Board, which has taken over the obligations, will have a demand of at least 15,000 kw. (20,000 h.p.) in 1928, when the works are expected to be completed. The Board is extending its existing steam plant from 6,500 kw. up to 19,500 kw. capacity, and it is now anticipated that this plant will be loaded up to 16,500 kw. by 1925. Allowing one unit of 3,000 kw. as spare, this is considered the full load of the plant, and it is anticipated that the load will grow considerably in excess of this by 1928, if power is available.

WAIKAREMOANA ELECTRIC-POWER SUPPLY.

The ultimate development proposed at this site will consist of three power-houses, taking the regulated flow from the lake of 540 cusecs, and giving the following outputs on a 50-per-cent. load-factor:—

	Horse-power.
Upper power-house (450 ft. head)	40,000
Middle power-house (675 ft. head)	60,000
Lower power-house (344 ft. head)	30,000

Mr. Parry's scheme requires only 40,000 h.p. at this site, for which the middle power-house will be installed, being the most economical.

In the meanwhile a small temporary plant has been erected for construction purposes and to give a supply to the Wairoa Electric-power Board. For this purpose the two three-unit exciters with their synchronous motors and water-wheels each of 500 h.p. capacity, intended ultimately for the main power-house, have been installed, the motors being operated as generators, giving a capacity of 1,000 h.p.

An arrangement has been entered into with the Wairoa Power Board to operate the plant and supply power to the Department as required for construction work on the main plant. Supply will be available within a few weeks.

Apart from this small plant, the greater portion of the capital outlay has been expended on the permanent improvement of the road and bridges to give access to the main power-house site and pipe-line intake, the road in the meanwhile serving also to improve the access for the settlers of the district.

Surveys for the main scheme and foundation investigations have also been carried out, as well as a survey for a sawmill tram-line. Continuous river and lake gaugings have been made during the year.

ELECTRIC-POWER BOARDS.

The reticulation of the electric power supplied in bulk from the Government power-stations is intended to be undertaken by the Electric-power Boards, and twenty-three such Boards have now been constituted, as detailed in the attached table. These cover a total area of 31,141 square miles, or 30 per cent. of the area of the Dominion, and include a population of 470,087, or 38·5 per cent. of the total population of the Dominion; so that about one-third of the Dominion is provided for by the Power Boards already formed.

The subdivision of the whole Dominion into suggested electric-power districts as outlined in the last Statement provides for forty-one districts, and nineteen of the above twenty-three correspond closely to the subdivisions proposed.

Electric-power Boards of New Zealand as constituted on 1st September, 1922.

Name of Electric-power District.	Proclamation constituting District gazetted.	Number of Members on Board.	Approximate Area of District.	Population.	Value of Rateable Property (unimproved).	Amount of Loan.	Voting for Loan Poll.	
							For.	Against.
			Sq. Miles.		£	£		
Southland ..	19/11/19	12	9,986	65,450	13,600,471	1,500,000	6,516	415
Thames Valley ..	8/1/20	12	2,304	16,000	6,814,993	550,000	1,503	28
Te Awamutu ..	8/1/20	10	309	6,000	1,759,558	120,000	359	..
Cambridge ..	8/1/20	8	104	5,000	1,683,632	60,000	198	3
Banks Peninsula ..	8/1/20	7	372	3,500	3,430,817	100,000	331	23
Wairarapa ..	25/3/20	9	2,073	21,800	3,114,718	260,000	1,704	225
Central ..	8/7/20	7	300	9,110	3,667,904	200,000	515	19
Wairoa ..	29/7/20	10	1,369	3,900	2,417,251	100,000	504	31
Springs-Ellesmere ..	8/7/20	7	242	5,400	2,627,468	60,000	302	16
Teviot ..	22/7/20	7	120	1,800	169,137	35,000	191	27
Opunake ..	18/8/21	7	240	3,227	536,153	70,000	170	20
Auckland ..	1/4/22	12	227	128,000	21,502,118	600,000	4,179	288
Ashburton ..	17/11/21	12	2,542	16,691	9,346,863	296,500	1,590	96
Manawatu-Oroua ..	1/12/21	12	1,301	38,330	12,944,573	500,000	1,144	96
Dannevirke ..	11/8/21	10	676	11,848	3,555,382	175,000	651	93
Horowhenua ..	1/12/21	9	630	11,795	3,403,255	260,000	973	26
Wanganui-Rangitikei	1/12/21	12	2,614	41,564	10,864,130	Poll not yet	taken.	
Taranaki ..	23/3/22	10	700	8,485	2,859,070	"	"	
Taranaki ..	19/5/22	7	1,969	34,558	2,865,396	"	"	
Hutt Valley ..	6/7/22	9	471	22,450	2,659,074	"	"	
Buller ..	11/5/22	5	1,818	10,057	686,209	"	"	
Westland ..	28/10/20	9	750	3,272	196,268	"	"	
Reefton ..	30/6/21	5	24	1,850	59,316	"	"	
Totals ..	..	..	31,141	470,087	110,763,756	4,886,500	20,830	1,406

In addition to the twenty-three districts already constituted, petitions have been circulated or other preliminary steps taken to constitute Electric-power Boards in the following districts:—

	Population.	Area (Square Miles).
Waipawa ..	8,534	1,235
Tauranga ..	6,197	651
Marlborough ..	16,967	437
South Canterbury ..	40,657	5,100
Otago ..	108,604	4,126
Te Kuiti ..	8,568	1,115
Selwyn ..	10,455	2,281
Grey Valley ..	11,953	1,452
Otago Central ..	5,121	2,684
Wairere Falls ..	..	..
Totals ..	217,056	19,081

With regard to the sources of supply of the twenty-three districts constituted, four are now taking supply from Horahora, three have arranged to take supply from Lake Coleridge, seven propose to take supply from Mangahao, one has arranged to take supply from Arapuni, one has arranged to take supply from Waikaremoana, three have arranged to construct their own power-stations, and four have not yet decided upon their source of supply but will require to make their own arrangements: that is to say, sixteen out of the twenty-three have been formed to take supply in bulk from the Government, and the other seven will probably also take such supply as soon as it is available.

Out of the twenty-three districts sixteen have already laid out their schemes of reticulation and taken their loan polls. The total amount of the loans is £4,886,500. This amounts to 5·4 per cent. of the unimproved rateable value of the districts concerned, and £14 per head of population of the districts concerned. It is anticipated that each Board will so arrange its scale of charges that the whole of the annual costs, both working-costs and capital charges, will be paid out of the revenue received from consumers; but if the whole of the interest at an average rate of 6 per cent. were a charge against rates it would amount to about 3d. in the pound on the unimproved value, and proportionately less on the capital value. It will be noted that the loan polls in the various districts have been passed by an average majority of fifteen to one—in other words, the ratepayers have been practically unanimous in approval of the loans.

Of the twenty-three districts constituted the majority have included the whole of the area concerned as rateable inner area, the presumption being that it is intended to supply over the whole area as soon as it proves remunerative to do so: these are, particularly, Southland, Thames Valley, Banks Peninsula, Central, Wairoa, Springs-Ellesmere, Auckland, Manawatu-Oroua, Dannevirke, Horowhenua, Tararua, Hutt Valley, and Buller Power Districts. Five others—viz., Te Awamutu, Cambridge, Teviot, Opunake, Reefton—have limited their area to a small district, the whole of which it is intended to reticulate. The remaining five districts—viz., Ashburton, Wairarapa, Wanganui-Rangitikei, Taranaki, and Westland—have taken advantage of the provisions of the Act for including the more sparsely settled districts as outer areas, only the more closely settled portion being included in the rateable district at present. But provision is made in the Act for the inclusion of additional areas in the rateable district on petition, and this has already been taken advantage of in two cases.

On the whole, the legislation, as far as can be judged at present, is proving quite successful in relieving the Government of the detail work of reticulation, in throwing the responsibility of this reticulation on to the shoulders of the local ratepayers, and leaving to the prospective consumers, as ratepayers, the decision as to which areas can be reticulated remuneratively and which should be postponed until the prospects are more promising.

LOCAL ELECTRIC-SUPPLY SYSTEMS.

Including the Government stations, there are now sixty-one electric-power stations in operation in the Dominion, as detailed in Tables K and L herewith.

Four new stations commenced operation during the year under review, viz.: Motueka (50 kw., gas-power); Kaikoura (37 kw., gas-power); Tamaki (40 kw., gas-power); Murchison (80 kw., water-power). The following will commence operation during the current year: Fairlie (40 kw., water-power); Havelock North (144 kw., water-power); Whakatane (250 kw., water-power); Opunake (120 kw., water-power); Teviot (250 kw., water-power).

Extensions were made to existing stations during the year as follows: Invercargill (1,000 kw., steam-power); Tauranga (650 kw., water-power); Kaponga (90 kw., water-power); Raetihi (32 kw., water-power); Hawera (180 kw., water-power); Oamaru (150 kw., gas-power); Patea (40 kw., water-power); Martinborough (50 kw., gas-power); Stratford (90 kw., oil-power). In addition extensions and new stations are in hand to the extent of 32,000 kw., as already detailed.

The sum of the maximum outputs of all stations has increased during the year from 42,157 kw. to 48,866 kw., an increase of 6,709 kw., or 16 per cent., and the number of consumers in the Dominion has increased from 73,151 to 88,838, an increase of 15,687 consumers, or 21 per cent.

The total installed capacity of the sixty-one power-stations has increased from 49,630 kw. to 51,749 kw. of main plant, and is distributed according to source as follows:—

	Stations.	Kilowatts.	Proportion per Cent.
Water-power	27	25,125	49
Steam-power	10	22,470	43
Gas-power	22	3,343	6·5
Oil-power	2	811	1·5
	61	51,749	100·0

In addition there are 7,247 kw. of subsidiary or standby plant, distributed as follows: Water-power, 110 kw.; steam-power, 4,753 kw.; gas-power, 310 kw.; and oil-engines, 2,074 kw.

The total of the maximum loads was 48,866 kw., as compared with the installed capacity of 51,749 kw., apart from the 7,247 kw. of standby plant, showing a margin in main generating plant of 2,883 kw., or 5·6 per cent. of the installed capacity. The water-power plants as a whole were actually overloaded by 500 kw., and the extensions in hand are thus urgently required to meet the increasing demand.

The load-factor for the year, based on a maximum load of 48,866 kw., and an output of 171,943,546 units, is 40 per cent.; and the load-factors for each type of plant are—Water-power, 48 per cent.; steam-power, 32 per cent.; gas-power, 25·5 per cent.; oil-power, 32·5 per cent. These figures in each are high, due to the extensive use of electric power for tramways, industrial, and domestic purposes.

The units sold per consumer (exclusive of tramways) was 1,210 units, as compared with 1,246 units per consumer in the previous year.

The maximum demand per head of population in the areas actually supplied was 0·067 kw., or 0·089 h.p., inclusive of tramways, and the units sold per head of population were 146, exclusive of tramway load. Both of these figures show an increase over the previous year.

The total length of distribution-line is 2,814 route-miles (apart from 400 miles of transmission-line), as compared with 2,260 miles in the previous year. The power-demand supplied per mile of line was 14 kw., the sales 38,500 units, and the revenue £327 per mile, excluding tramways in each case. The number of consumers per route-mile of line is 31·4, as compared with 32·3 last year. These figures are of considerable importance in considering the question of the construction of new lines, and the probability of their proving as remunerative as the average returns from the existing lines of the Dominion. It is usually considered that country lines costing £250 to £300 per mile will pay with two farms connected per mile, each with a milking plant, and taking a maximum demand of about 4 kw., yielding a revenue of £50 per year or more per mile of line.

The average return (excluding tramways) was £24 per kilowatt of output—also a very important figure in estimating the return from a new plant. It will be noted that this includes the lower return of £17·6 per kilowatt from the large water-power plants. The steam, gas, and oil stations, which represent average retail conditions, show a revenue of £33·7 per kilowatt of output, which is the figure

which may be taken in forecasting the return from ordinary general retail business, excluding such large consumers as freezing-works, &c. The revenue per kilowatt from the twenty-two gas-engine stations is £41 per kilowatt of output, and from the output of the two oil-driven stations is over £52 per kilowatt; but these are obtained at high retail rates, ranging from 8d. to 1s. for light and 3d. to 5d. for power, as compared with usual retail prices of 6d. and 7d. for light and 1½d. to 3d. for power.

Out of the total number of sixty-one stations and twenty-one bulk distributing authorities, twenty-seven made a loss last year, as compared with thirty which incurred a loss in the previous year. Costs are now falling again, and it is anticipated that hereafter only those that are in the first two or three years of operation will show losses.

Over the whole Dominion the electric-supply business involves a capital outlay of £5,224,629 for an installed capacity of 51,749 kw.—i.e., £101 per kilowatt; and the revenue, after paying all working-expenses (£534,642) and capital charges, including depreciation (£305,838), which work out at an average of 5·85 per cent. on the capital outlay, yields a net profit of £82,688, or 1·6 per cent. on the capital outlay. The business on the whole is thus remunerative, as well as supplying a public necessity to 88,838 consumers.

The table herewith gives a full analysis of the results of operation of the sixty-one stations, separating the returns from water-power, steam, gas, and oil stations. The most significant figures are, of course, the low costs per unit and per kilowatt output of the water-power stations. It must be noted that these figures include the returns from a number of quite small water-power plants, only five out of the twenty-seven installations being over 1,000 h.p. capacity.

The comparison of the capital cost per kilowatt is also instructive. In comparing the costs of the steam and gas stations it must be noted that the average size of the ten steam stations is sixteen times as large as the average size of the twenty-two gas stations, and this has more to do with the higher working-costs of the gas stations than the nature of the fuel. On the same average size of plant the gas stations would probably show a better result than the steam stations.

It is noticeable that the publication of these details of each of the power-stations of the Dominion is already resulting in a very healthy competition between individual stations to show good results, to the substantial benefit of the public.

Electric-power Supply of New Zealand for the Year ended 31st March, 1922.

	Water.	Steam.	Gas.	Oil.	Total.
Number of stations	27	10	22	2	61
Average capacity (kilowatts)	925	1,992	128	406	800
Number of consumers	47,357	28,570	9,376	3,535	88,838
Installed capacity (kilowatts), (main plant only)	25,125	22,470	3,343	811	51,749
Maximum load (kilowatts)—					
General supply stations	25,543	9,916	2,506	601	38,566
Special tramway stations	..	10,000	300	..	10,300
Units generated	107,674,949	56,244,921	6,303,129	1,720,547	171,943,546
Annual load-factor (per cent.)	48·0	32·0	25·5	32·5	40·0
Units sold to tramways	9,894,562	25,099,034	1,132,602	..	36,126,198
Units sold—General supply	79,134,631	24,210,925	3,084,324	1,216,201	107,746,081
Total capital outlay*	£3,506,427	£1,148,824	£478,271	£91,107	£5,224,629
Total capital per kilowatt installed* ..	£139	£92	£143	£112	£101
Total annual working-costs	£206,221	£226,193	£78,733	£23,495	£534,642
Total annual working-cost per unit sold ..	0·56d.	2·25d.	4·5	4·28d.	1·18d.
Total annual working-cost per kilowatt, maximum load	£8·1	£22·8	£31·2	£39·3	£13·8
Total annual capital charges	£189,072	£91,353	£20,200	£5,213	£305,838
Total annual capital charge per unit sold ..	0·51d.	0·91d.	1·15d.	0·96d.	0·68d.
Total annual capital charge per kilowatt, maximum load	£7·4	£9·2	£8·1	£8·7	£7·95
Total annual percentage of capital outlay ..	5·4	7·9	5·15	5·7	5·9
Total annual costs	£395,293	£317,546	£98,933	£28,708	£840,480
Total annual cost per unit sold	1·07d.	3·16d.	5·65d.	5·24d.	1·87d.
Total annual cost per kilowatt, maximum load	£15·5	£32·0	£39·3	£48	£21·8
Total annual revenue	£450,055	£338,923	£102,755	£31,435	£923,168
Total annual revenue per unit sold	1·22d.	3·4d.	5·88	5·74d.	2·05d.
Total annual revenue per kilowatt, maximum load	£17·6	£34·0	£41·0	£52·5	£24
Net profit	£54,762	£21,377	£3,822	£2,727	£82,688

* Includes distribution.

INSPECTION OF ELECTRIC LINES.

During the year the following electric-supply systems were inspected: Havelock, Banks Peninsula Power Board (part), Springs-Ellesmere Power Board (part), Rangiora County (extensions), Murchison, Motueka, Tamaki, Kaikoura, Blenheim (Hospital), Blenheim (F. O. Linstrom), Picton, Oamaru, Kaitangata, Invercargill (extensions), Gore, Maitaura, Bluff, Winton, Hikurangi (collieries), Whangarei, Devonport, Raetihi, Waiuku, Ohakune, Portland Cement Company, Wairua Falls, Pukekohe, Napier, Havelock North, Hastings, Waverley, Stratford, Patca, Inglewood, Waitara, Bull's, Eketahuna, Pahiatua, Fairlie, Wellington (extensions), Sumner, Heathcote, Ngaurawahia, Huntly, Te Aroha, Thames, Te Kuiti, Te Puke, Hamilton, Hokitika, Waiuta, Central Power Board (extensions), Te Awamutu Power Board (extensions), Thames Valley Power Board (extensions),

Cambridge Power Board (extensions). The number of route-miles of electric lines at the end of the year under review is approximately 3,200. With the constitution of the seven electric-power districts in connection with Mangahao, together with Ashburton, South Canterbury, and Southland, and other Power Board areas, all being reticulated in the near future, the volume of the work will necessarily be considerable for some time to come.

During the year steps were taken to inaugurate a "safety campaign" in connection with the general use of electricity, and advantage was taken of the columns of the *School Journal* to broadcast some information on the care and use of electrical appliances, and the dangers in unauthorized interference with same or in touching any broken wires lying on the ground, &c. It is anticipated that this avenue of giving publicity to the need for safety precautions will produce good results in educating the rising generation, concurrent with the increasing use and applications of electric power.

All local authorities throughout the Dominion were also circularized drawing attention to the prevalence of electrical accidents. A list of the electrical accidents which have occurred in New Zealand during the past twenty years was compiled from existing records on this Department's files, totalling sixty-seven accidents, of which thirty-three were fatal, and this was distributed to all concerned. The various electric-supply authorities are becoming alive to the necessity of constantly keeping before the public the risks which exist if proper precautions are not observed, and have adopted various methods of propaganda accordingly.

Licenses for the erection of electric lines were issued to seventeen public bodies during the year, each involving a detailed investigation of plans, and numerous inspections were made of the plans of proposed hydro-electric works submitted under the regulations.

AUSTRALIAN WORKS.

An opportunity was afforded to me during the year to visit Australia and to look into the construction and organization of the corresponding works there.

In Sydney the general features of the large electric-power plants at Ultimo, White Bay, and Pyrmont proved very useful. The White Bay plant of the Railway Commissioners consists of three 10,000 kw. steam turbines, and runs at an operating-cost below 0.2d. per unit, consuming less than 2 lb. of coal per unit, costing £1 5s. per ton in the power-house bunkers. The circulating-water system and boiler-room equipment of this station are of special interest. The control-room and oil-switch layout are also very carefully designed. The control-room is practically separated from the engine-room, having direct communication only by a bay-window so high up and remote from the generators that all communication must be by telephone and electrical signals. In Ultimo power-house the old high-tension switchboard, now situated on a gallery in the engine-room, is to be removed, and replaced by a remote-control switchboard located in a similar operating-room shut off by windows from the engine-room. At Newport (Victorian Electric Railway) power-station the operating-room containing the switch-panels is entirely removed from the engine-room, and, it is claimed, with advantage in operating. In New South Wales I also visited the Port Kembla steam station (3,600 kw.), which is being developed by the State Government to supply power for constructing the Cordeaux and Avon dams and for permanent power-supply in the district. The most interesting feature of this station is the fact that every circuit is metered with a printometer meter, giving a perfect automatic record of the station output and its distribution. At Port Kembla I took the opportunity of examining the processes of copper refining and manufacture into wire and cable, and the Cordeaux and Avon concrete gravity dams in course of construction. The Cordeaux dam will be 177 ft. high above foundation—about the same height as the Arapuni dam—but will be much longer (1,315 ft.) owing to the flatter nature of the valley. It is a gravity section containing about 220,000 cubic yards of concrete, estimated to cost £675,000 complete.

In Melbourne I got into touch with the development of the Victorian Electricity Commissioners at Morwell brown-coal fields, consisting of a 60,000 kw. steam plant and an eighty-mile transmission at 130,000 volts, and also the Newport power-house of the Melbourne Electric Railways. This station consists of six steam-turbine units, each of 10,000 kw. to 14,000 kw. capacity, and contained many details in the boiler-room, engine-room, and switch-chambers of great value. The details of the Melbourne Electric Railway overhead construction and rolling-stocks and workshops were also instructive. Although they have had about 200 motor-car equipments, each consisting of four 150 h.p. motors, in service for about two and a half years, only two armature breakdowns had occurred in that time and a few field breakdowns. The operation of the electric trains generally has proved efficient and economical, and has increased the passenger-carrying capacity and the comfort of the railways very much.

In Adelaide I examined the tramway and lighting power-stations, and the plans of the new power-station under construction at Port Adelaide, designed for 10,000 kw. units.

In Sydney and Adelaide I examined the working of the electric steel-smelting furnaces closely. These are both small single-phase furnaces, 7 cwt. and 15 cwt. capacity, taking 200 kw. to 300 kw., and are proving very successful indeed.

In Broken Hill and Port Pirie I got into touch with the mining concentrating and smelting industries, which give the raw material for the electrolytic zinc industry which forms the basis of the Tasmanian hydro-electric-power scheme. At Port Pirie the Government wharf-cranes for handling the coal for Broken Hill and the concentrates from Broken Hill were particularly interesting. Fifty men were employed, and it is a rare example of a large wharf worked entirely by permanent labour. By keeping general repair work in hand the men are all kept fully employed without lost time, and only twice in four years have men been laid off owing to shortage of work, and that due to stoppages of work at the mines.

In Tasmania the Government hydro-electric scheme offered much valuable information, as the details of the development are similar in many ways to our own developments. The Great Lake dam is a multiple arch dam of twenty-nine spans of 40 ft each, and a maximum height from foundations of 80 ft. The area of the lake is 50 square miles, the watershed 216 square miles, and the capacity of the dam at 11 ft. draw-off is 315,000 acre-feet. The pipe-lines, both wood-stave and steel, are special features. The four wood-stave pipe-lines are each over a mile long, and run down to a maximum head of 400 ft., the pipes being 4 ft. and 5 ft. in diameter. The steel pipes are gas-welded pipes with muff joints, and the total head is 1,130 ft. or 480 lb. pressure. The power-house is equipped with nine pelton wheels and generators, of a total capacity of 66,000 h.p. The transmission-lines to Hobart are carried on two lines of double-circuit steel towers, a distance of sixty-two miles, at a pressure of 88,000 volts.

Many of the details of construction and experiences of operation gained in Tasmania will be of the utmost value in putting the new lines into service here. The two main consumers of the power are the Electrolytic Zinc Company, who are now taking 15,000 h.p., to be increased under contract to 30,000 h.p., for zinc-refining, and the Electrona Carbide Works, now taking 2,500 kw. to be increased to 5,000 kw., for the manufacture of carbide of calcium. The huge carbon electrodes for the carbide-furnaces are each 20 in. by 15 in. by 7 ft. long, and are made on the premises by means of a 3,000 ton press. In the trials of electro-chemical industries in Christchurch during the war the production of the necessary electrodes proved the main stumbling-block.

In addition to the above main works numerous smaller works and industries were visited and noted in detail.

In addition to the opportunity of visiting engineering and industrial works, the visit enabled me to get into direct touch with the development and organization of electric-power supply and distribution under four distinct systems of control, viz.: (1) By a branch of the Public Works Department in New South Wales; (2) by a special Government Department set up for the purpose in Tasmania; (3) by a special Electric-power Commission responsible direct to Parliament in Victoria; (4) by private enterprise in South Australia. All four are meeting a very large demand, and facing such developments as are before us in New Zealand, and the organizations which are actually meeting the demand most effectively are the Electric-power Commission of Victoria and the Hydro-electric Department of Tasmania.

The visit proved most valuable, and it is very essential that the members of the staff engaged in the detail design and layout of the hydro-electric works should have opportunity from time to time of making similar visits to the corresponding works being carried out in other countries, particularly America, Sweden, and Switzerland.

STAFF.

The hydro-electric work of the Dominion has developed rapidly, and the present staff deserve the highest commendation for the loyal and efficient manner in which they have coped with extra duties; but the personnel will have to be materially supplemented to maintain the efficiency that is imperative with the growth of this important work. A few additions have been made, and two officers made prolonged visits to America for the purpose of gaining experience, with most satisfactory results. However, urgent work is waiting to be done, and it will be necessary to obtain additional experienced officers in this class of work at an early date.

LAWRENCE BIRKS, B.Sc., M.Inst.C.E., &c.,
Chief Electrical Engineer.

TABLE A.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—RESULTS OF OPERATION.

	Fourth Year, March, 1919.	Fifth Year, March, 1920.	Sixth Year, March, 1921.	Seventh Year, March, 1922.
	£	£	£	£
Capital outlay	403,157	422,076	499,957	671,608
Costs—				
Working-costs	17,138	17,759	21,341	25,911
Interest	15,692	16,863	18,639	20,981
Depreciation, 2 per cent.	7,329	7,624	7,946	8,424
Total costs	40,159	42,246	47,926	55,316
Revenue—				
City Council	13,556	16,029	17,700	18,890
Tramways	6,885	7,660	7,835	7,957
Wholesale consumers	14,090	18,735	22,339	26,019
Retail consumers	1,529	1,952	1,785	1,880
Miscellaneous	1,264	1,455	1,714	2,068
Total revenue	37,324	45,831	51,373	56,814
Profit (P.) or loss (L.)	(L.) 2,835	(P.) 3,585	(P.) 3,447	(P.) 1,498
Accumulated deficiency	37,707	34,121	30,674	29,175
Accumulated Depreciation Fund	27,393	35,389	44,751	54,537
Maximum load (kilowatts)—				
Power-house	5,900	7,066	7,412	7,600
Substation	5,340	6,260	6,712	6,720
City Council	2,625	2,966	3,601	3,750
Tramways	1,580	1,760	1,840	2,120
Units output—				
Power-house	27,495,720	33,010,130	36,309,580	37,929,750
Substation	24,548,554	29,572,160	32,588,320	33,947,100
Units sold—				
City Council	10,886,290	12,936,340	14,700,000	15,419,100
Tramways	5,485,370	6,417,900	6,379,717	6,499,258
Wholesale consumers and local bodies	6,770,488	8,348,174	10,051,734	10,746,697
Retail consumers	245,398	315,562	270,900	278,897
Total units sold	23,387,546	28,017,976	31,402,351	32,943,934
Losses—				
Transmission-line losses	2,947,166	3,437,960	3,728,190	3,982,650
Percentage	10.7	10.1	10.27	10.5
Distribution losses	1,161,008	1,472,414	1,185,969	1,003,166
Percentage	4.7	4.4	3.64	3
Annual power-house load-factor (per cent.)	53.3	53.3	55.6	57.3
Average weekly load-factor (per cent.)—				
Power-house	59.1	59.9	61.4	62.9
Substation	58.4	58.6	60.5	62.0
City	52.6	53.1	53.8	53.6
Working-costs—				
Per kilowatt (power-house maximum)	£2.90	£2.51	£2.87	£3.40
Per kilowatt (substation maximum)	£3.21	£2.83	£3.17	£3.85
Per unit generated	0.149d.	0.129d.	0.140d.	0.161d.
Per unit sold	0.176d.	0.152d.	0.150d.	0.188d.
Capital charges—				
Per kilowatt (power-house maximum)	£3.90	£3.46	£3.58	£3.87
Per kilowatt (substation maximum)	£4.31	£3.91	£3.96	£4.37
Per unit generated	0.201d.	0.178d.	0.174d.	0.184d.
Per unit sold	0.236d.	0.209d.	0.203d.	0.214d.
Total cost—				
Per kilowatt (power-house maximum)	£6.80	£5.98	£6.46	£7.27
Per kilowatt (substation maximum)	£7.52	£6.75	£7.14	£8.23
Per unit generated	0.350d.	0.307d.	0.314d.	0.350d.
Per unit sold	0.412d.	0.361d.	0.366d.	0.403d.
Revenue—				
Per kilowatt (power-house maximum)	£6.32	£6.48	£6.93	£7.47
Per kilowatt (substation maximum)	£7.00	£7.32	£7.65	£8.45
Per unit generated	0.326d.	0.333d.	0.337d.	0.354d.
Per unit sold	0.383d.	0.393d.	0.392d.	0.414d.
Per unit sold (city)	0.299d.	0.297d.	0.288d.	0.295d.
Per unit sold (trams)	0.301d.	0.286d.	0.294d.	0.293d.
Per unit sold (wholesale consumers)	0.5d.	0.538d.	0.533d.	0.585d.
Per unit sold (retail consumers)	1.50d.	1.50d.	1.58d.	1.61d.

TABLE B.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—ANALYSIS OF CAPITAL OUTLAY.

Item.	Capital Outlay.		Expenditure during Year.
	31st March, 1921.	31st March, 1922.	
	£	£	£
Land, roading and fencing	17,393	17,393	..
Harper River diversion	12,778	17,355	4,577
Tunnel and headworks	115,397	146,424	21,027
Power-house and machinery	78,203	99,641	21,438
Staff village	14,182	14,298	116
Transmission-lines	61,264	136,743	75,479
Addington substation	27,095	41,143	14,048
Primary distribution	46,569	51,932	5,363
Secondary distribution	27,869	42,420	14,551
Service transformers and meters	16,148	16,745	597
Vehicles and loose equipment	17,398	19,070	1,672
Telephone-lines	1,903	1,903	..
Office furniture	237	247	10
Surveys, preliminary expenses, &c.	37,174	44,348	7,174
Interest during construction	16,347	21,946	5,599
Totals	499,957	671,908	171,651

TABLE C.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—OPERATING OR WORKING COSTS.

Expenditure.	1921.		1922.	
	Cost.	Per Unit sold.	Cost.	Per Unit sold.
	£	d.	£	d.
Harper diversion maintenance	..	..	1,002	0-007
Generation	6,003	0-046	6,299	0-046
Transmission	3,137	0-024	3,155	0-023
Main distribution station	2,576	0-020	2,282	0-017
H.T. distribution	1,728	0-013	2,040	0-015
L.T. distribution	1,296	0-010	1,306	0-010
Standby plant	2,688	0-020	4,586	0-033
Management and general expenses	3,913	0-030	5,241	0-032
Totals	21,341	0-163	25,911	0-183

TABLE D.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—CONNECTED LOAD IN KILOWATTS AT 31ST MARCH, 1922.

	Light.	Heat.	Power.	Total.
<i>Local Bodies.</i>				
Christchurch City Council	7,516	1,760	14,994	24,270
Riccarton Borough Council	47	64	51	162
Lyttelton Borough Council	146	44	192	382
Lyttelton Pumping Station	..	..	116	116
Sumner Borough Council	151	153	54	358
Woolston Borough Council	141	146	30	317
Kaiapoi Borough Council	101	144	41	286
Rangiora Borough Council	110	52	107	269
Heathcote County Council	206	238	34	477
Paparua County Council	124	134	48	306
Halswell County Council	46	49	38	134
Eyre County Council	31	52	44	127
Tai Tapu Dairy Company	62	98	83	243
Rangiora County Council	44	62	112	218
Waimairi (Hillmorton)	2	2	..	4
Springs Ellesmere Power Board	45	83	3	131
Lake Coleridge	29	162	63	255
Power Station and Substation	8	30	66	104
<i>Direct Wholesale Consumers.</i>				
Tramways	85	..	5,642	5,727
Freezing-works (4)	121	20	2,273	2,414
Flour-mills (6)	6	..	337	343
Dairy factories (1)	3	..	56	59
Quarries (2)	2	1	169	172
Tanneries, &c. (6)	29	7	634	670
Seed-cleaning (4)	5	1	175	181
Brickyard (1)	..	..	91	91
Railway workshop (1)	31	..	210	241
Harbour Board (1)	55	..	113	167
Institutions (6)	120	234	147	500
Soapworks (1)	3	..	34	37
Steelworks (1)	3	600	21	623
Glueworks (1)	3	..	87	90
Sawmill (1)	..	1	23	23
Woollen-mill (1)	..	..	4	4
Aviation Company (1)	5	10	6	21
Twine-mill (1)	..	..	118	118
Railway-stations (2)	40	..	28	68
Chemical-works (1)	..	..	196	196
Racing club (1)	24	1	27	53
Totals	9,344	4,147	26,467	39,957

Substation maximum output = 6,720 kw.

Diversity factor = 6.

TABLE E.—LAKE COLERIDGE ELECTRIC-POWER SUPPLY.—GROSS FINANCIAL RESULTS OF DISTRIBUTION OF ENERGY FOR YEAR ENDED 31ST MARCH, 1922.

Distributing Authority.	Number of Consumers.	Capital Outlay.	Revenue from Consumers.	Paid for Electricity.	Maintenance Expenses.	Interest.	Sinking Fund.	Depreciation.	Balance.	
									Profit.	Loss.
		£	£	£	£	£	£	£	£	£
Public Works Department	466	671,608	30,991*	..	25,911	20,981	..	8,423	1,498	..
†Christchurch City Council	15,153	392,864	87,643*	18,890	26,198	14,172	..	20,266	10,523	..
Halswell County Council	125	5,403	1,103	405	177	263	50	..	208	..
Heathcote County Council	646	14,570	3,441	1,604	836	422	327	..	252	..
Kaiapoi Borough Council	370	4,500	2,061	834	467	236	45	225	254	..
Lyttelton Borough Council	230	5,000	2,082	676	944	250	100	..	112	..
Riccarton Borough Council	499	6,824	2,370	{ P.W. 328 } { C.C. 466 }	887	305	..	..	384	..
Rangiora Borough Council	250	7,266	1,740	516	254	349	55	218	348	..
Rangiora County Council	198	12,207	1,608	637	359	536	100	..	..	24
Sumner Borough Council	440	9,398	2,431	647	718	315	60	144	547	..
Tai Tapu Dairy Company	120	4,569	1,779	879	541	282	..	300	..	223
Waimairi County Council	1,816	42,400	9,349	{ P.W. 141 } { C.C. 1,939 }	2,577	2,032	..	..	2,660	..
Eyre County Council ..	108	5,160	614	266	58	118	15	..	157	..
Totals ..	20,421	1,181,769	147,212	28,228	59,927	40,261	752	29,576	16,943	247

* After deducting amount of sales to other distributing bodies, totalling £25,823 to Public Works Department, and £2,405 to Christchurch City Council. † Woolston Borough included in Christchurch City Council return. P.W. = Paid to Public Works Department. C.C. = Paid to Christchurch City Council.

Net profit of the whole Lake Coleridge system, £16,696.

TABLE F.—WAIKATO ELECTRIC-POWER SUPPLY.—RESULTS OF OPERATION.

	First Year, March, 1921.	Second Year, March, 1922.		First Year, March, 1921.	Second Year, March, 1922.
Capital outlay	£ 249,499	£ 353,808	Maximum load— <i>continued</i>	£	£
Annual costs—			Central Power Board (k.v.a.)	..	80
Working-expenses	6,452	7,986	Hamilton Borough (k.v.a.) ..	..	270
Interest	10,675	13,187	Units output—		
Depreciation	3,960	4,512	Power-house	16,729,050	25,659,550
Total costs	21,087	25,685	Units sold—		
Annual revenue—			Waihi Gold-mining Company	14,477,387*	15,383,006
Mines	..	19,779	Grand Junction Company ..	738,613	5,449,870
Dairy factories	..	2,455	Other consumers	160,000*	*2,260,719
Power Boards, &c. ..	..	4,599	Total units sold	15,376,000*	*23,093,595
Miscellaneous (rents, &c.) ..	86	1,374	Units lost	1,338,450*	*2,565,955
Total revenue	14,804	28,207	Percentage loss	8*	*10
Profit (P.) or loss (L.) ..	(L.) 6,282	(P.) 2,522	Load-factor—		
Accumulated debit balance ..	8,404	5,882	Annual	..	..
Accumulated depreciation fund	5,653	10,210	Average weekly	71·0	71·3
Maximum load—			Working-costs—		
Power-house for year (kilowatts)	3,500	5,800	Per kilowatt (power-house average weekly maximum)	£2·38	£1·95
Power-house average weekly (kilowatts)	2,675	4,080	Per unit sold	0·100d.	0·083d.
Waihi Gold-mining Company (kilowatts)	2,800	3,334	Capital charges—		
Grand Junction Company (kilowatts)	550	1,700	Per kilowatt (power-house average weekly maximum)	£5·47	£4·34
Thames Valley Power Board—			Per unit sold	0·228d.	0·184d.
Waikato (k.v.a.)	..	571	Total costs—		
Horahora (k.v.a.)	..	369	Per kilowatt (power-house average weekly maximum)	£7·85	£6·29
Cambridge Power Board (k.v.a.) ..	..	116	Per unit sold	0·327d.	0·267d.
Te Awamutu Power Board (k.v.a.)	..	127	Revenue—		
			Per kilowatt (power-house average weekly maximum)	£5·48	£6·91
			Per unit sold	0·229d.	0·293d.

* Assessed.

TABLE G.—WAIKATO ELECTRIC-POWER SUPPLY.—DETAILS OF CAPITAL OUTLAY, HORAHORA SCHEME.

Item.	Capital Outlay.		Increase.
	31st March, 1921.	31st March, 1922.	
	£	£	£
Land, roading, and fencing at Horahora	2,968	3,125	157
Headworks	86,308	86,700	392
Generating-station, transformers, and machinery ..	46,988	58,065	11,077
Staff village, Horahora	7,436	9,538	2,102
Transmission-lines	59,077	106,476	47,399
Distribution-lines	536	716	180
Main substations	17,940	30,846	12,906
Distribution substations	..	6,078	6,078
Vehicles and loose construction equipment ..	5,184	7,812	2,628
Land, stores, and siding, Ruakura	1,533	9,917	8,384
Staff residences, Ruakura	..	2,612	2,612
Office furniture, Hamilton	363	427	64
Surveys, supervision, preliminary expenses, &c. ..	5,546	12,180	6,634
Interest during construction	15,620	19,316	3,696
Totals	249,499	353,808	104,309

TABLE H.—WAIKATO ELECTRIC-POWER SUPPLY.—OPERATING OR WORKING COSTS.

Expenditure.	1921.		1922.	
	Cost.	Per Unit sold.	Cost.	Per Unit sold.
	£	d.	£	d.
Generation	3,844	0-0600	3,735	0-0388
Transmission	957	0-0149	911	0-0095
Main substations	789	0-0123	740	0-0077
H.T. distribution	..	..	504	0-0053
Management and general	862	0-0135	2,084	0-0216
Totals	6,452	0-1007	7,974	0-0829

TABLE J.—WAIKATO ELECTRIC-POWER SUPPLY.—CONNECTED LOAD IN KILOWATTS (31st MARCH, 1922).

	Light.	Heat.	Power.	Total.
Waihi Gold-mining Company	164	100	4,461	4,725
Grand Junction Company	38	38	2,452	2,528
Cambridge Dairy Company	5	2	403	410
New Zealand Dairy Company, Frankton ..	6	..	400	406
State Farm, Ruakura	8	1	12	21
Cambridge Power Board	150	152	229	531
Central Power Board	114	131	154	400
Te Awamutu Power Board	137	190	81	408
Thames Valley Power Board	..	..	..	2,887
Hamilton Borough Council	438	174	471	1,083
Horahora Village	6	73	..	79
Total	..	..	..	13,478

Maximum load, 5,800.

Diversity factor = 2.3.

TABLE K.—ELECTRIC-SUPPLY STATIONS OF NEW ZEALAND AT 31ST MARCH, 1922.

(G = gas; O = oil; S = steam; W = water.)

Station.	Ownership.	Population supplied.	Capacity, in Kilowatts.			Units generated or purchased.	Units sold.	Units non-productive.	Per-centage of Non-productive Units.	Annual Load-factor Per-centage.	System of Supply.	Supply Voltage.	Route-miles of Lines.	Static Head, in Feet.
			Main Plant.	Standby Plant.	Maximum Load. (K.watts.)									
Steam Stations.														
1. Auckland (lighting) (tramways)	City	108,000	8,533	6,900	4,975	14,815,845	12,012,826	2,803,019	18.9	34.0	D.C./A.C.	460/400/230	90.0	..
2. Wellington (lighting) (tramways)	City	90,000	13,655	6,000	6,400	15,113,950	15,113,950	..	..	28.8	D.C.	550	..	..
3. Invercargill	Borough	24,000	2,167	4,000	3,600	9,149,676	7,180,112	1,969,564	21.5	30.0	A.C.S.P.	105	190.0	..
4. Gisborne	Borough	10,930	1,988	1,225	700	13,034,855	11,621,495	1,413,360	10.8	41.2	D.C.	550	74.5	..
5. Hamilton	Borough	12,750	1,150	350	300 (O.)	2,350,710*	1,993,767	356,943	15.2	38.5	A.C.	400/230	33.0	..
6. Huntly	Town Board	2,500	318	170†	460	901,438	287,762	24.2	29.6	D.C.	460/230	27.0	..	
7. Bluff	Borough	1,399	292	50	216	454,252†	363,400†	90,852	20.0	24.0	A.C.	400/230	7.0	..
8. Kaitangata	Borough	1,720	8	50	70	74,341	63,591	10,750	14.4	12.0	D.C.	460/230	6.5	..
Totals	..	251,499	28,570	22,470	19,916	56,244,921	49,309,959	6,934,962	12.3	32.0	..	..	430.0	..
Gas Stations.														
1. Napier	Borough	13,000	2,017	850	656	1,693,491*	1,487,784	205,707	12.2	29.5	D.C.	460/230	10.0	..
2. Wanganui	Borough	16,000	24	485	500	973,838*	137,200	..	..	..	D.C.	550	..	..
3. Ashburton	Company	6,172	693	186	251	431,688	317,632	114,056	26.4	19.6	D.C./A.C.	460/400/230	62.0	..
4. Timaru	Borough	14,500	1,257	425	310	1,092,418	620,925	471,493	43.0	40.2	D.C.	460/230	48.5	..
5. Devonport	Company	9,304	1,070	200	204	592,960	434,246	158,714	26.5	33.0	D.C.	460/230	18.0	..
6. Feilding	Borough	5,000	1,023	160	187	412,259	345,529	66,730	16.2	25.0	A.C.	230 S.P.	26.0	..
7. Te Kuiti	Borough	2,500	487	170	115	263,760	208,050	55,710	21.1	26.0	D.C.	460/230	10.0	..
8. Pictou	Borough	1,300	280	83	79	219,000†	175,200	43,800	20.0	31.5	D.C.	460/230	10.0	266
9. Pukekohe	Borough	1,500	302	74	72	67,500†	54,000†	13,500	20.0	10.6	D.C.	460/230	9.5	..
10. Waitara	Borough	1,500	309	62	60	72,940	56,564	16,376	22.4	13.8	D.C.	460/230	9.0	293
11. Opoitiki	Private	1,100	262	86	65	84,540	69,540	15,000	17.7	14.4	D.C.	460/230	10.0	..
12. Waeroa	Borough	1,600	284	56	56	85,936	74,837	11,099	13.0	17.5	D.C.	460/230	6.5	..
13. Winton	Borough	600	148	37	27	24,238	21,820	2,418	10.0	10.2	A.C.	400/230	3.5	..
14. Ngaurawahia	Borough	1,200	207	70	33	69,160	40,224	28,936	42.0	23.8	D.C.	460/230	7.0	..
15. Martinborough	Town Board	952	235	77	30	68,012	49,188	18,824	27.7	25.8	D.C.	230	4.5	..
16. Pahiatua	Borough	1,360	208	85	47	63,520	55,400	8,120	12.8	15.6	D.C.	460/230	9.5	..
17. Eketahuna	Borough	874	225	62	29	39,000	31,400	7,600	19.4	15.4	D.C.	230	7.0	230
18. Bulls	Town Board	505	147	27	22	25,570	19,412	6,158	24.0	13.2	D.C.	230	4.5	..
19. Waikou	Town Board	700	131	30	37	18,313	13,735	4,578	25.0	56.5	A.C.	400/230	7.5	..
20. Kaikoura (started March, 1922)	County	..	..	38	..	..	..	..	..	..	A.C.	400/230	..	..
21. Motueka (started Dec. 1921)	Borough	1,487	67	40	26	4,986	4,240	746	14.9	8.7	A.C.	400/230	6.5	..
22. Tamekiki West (started Mar., 1922)	Road Board	..	..	40	..	..	..	..	..	..	A.C.	400/230	..	..
Totals	..	81,154	9,376	3,343	2,806	6,303,129	4,216,926	1,249,565	21.5	25.5	..	..	269.5	..
Oil Stations.														
1. Hastings	Borough	10,000	2,410	576	432	1,338,173	1,070,538	267,635	20.0	35.3	D.C.	460/230	31.0	..
2. Stratford	Borough	9,000	900	235	169	382,374	245,663	136,711	13.5	20.6	A.C.	400/230	10.0	..
Totals	..	20,500	3,535	811	601	1,720,547	1,316,201	404,346	23.5	32.5	..	250/110 S.P.	25.0	27

† Public Works Department, bulk supply since June, 1921.

‡ Assessed from incomplete returns.

§ From assessment by local authority.

* Including tramways.

NOTE.—Figures in brackets not included in totals.

TABLE K (continued).—SUMMARY OF RETURNS OF OPERATING RESULTS FOR THE YEAR ENDED 31ST MARCH, 1922.

Station.	Capital Outlay at 31st March, 1922.	Revenue.	Working-expenses.*	Capital Charges.†	Total Annual Costs.	Net Result.		Average Revenue.		Working-costs.*		Capital Charges.†		Total Costs.		Retail Net Selling-rates.	
						Profit.	Loss.	Per Unit sold.	Per Kw. P.H. Max.	Per Unit sold.	Per Kw. P.H. Max.	Per Unit sold.	Per Kw. P.H. Max.	Per Unit sold.	Per Kw. P.H. Max.	Lighting.	Power.
Steam Stations.																	
1. Auckland (lighting)	657,975	139,676	73,148	60,195	133,343	£ 6,333	£ ..	d. 279	£ 28-1	d. 1-46	£ 29-00	d. 1-20	£ 12-1	d. 2-66	£ 41-10	s. d. 0 6	s. d. 0 2½
2. Wellington (tramways)	260,466 (218,274)	127,576 (113,688)	95,783 (91,384)	19,312 (19,922)	115,095 (111,306)	12,481 (2,382)	..	427 2-34	37-0 31-6	3-20 1-88	27-60 25-36	0-64 0-41	5-6 5-5	3-84 2-29	33-20 30-86	0 6	0 3½
3. Invercargill	123,349	28,952	18,457	6,086	24,543	4,409	..	348	41-3	2-20	26-40	0-73	8-7	2-93	35-10	0 7½	0 3½
4. Gisborne	48,630	22,756	20,519	2,304	22,823	..	67	610	49-5	5-47	44-65	0-60	5-0	6-07	49-65	0 9	0 4
5. Hamilton†	44,802	15,161	13,735	2,617	16,352	..	1,191	10-30	70-0	9-03	63-70	1-60	11-2	10-63	74-90	0 9	0 4
6. Huntly	8,575	2,821	2,966	553	3,519	..	698	10-60	40-3	11-25	42-40	2-00	7-9	13-25	50-30	0 9	0 5
7. Bluff	4,449	1,981	1,585	286	1,871	110	..	800	49-5	6-40	39-50	1-16	7-2	7-56	46-70	0 7½	0 4
8. Kaitangata	578	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Totals	1,148,824	338,923	226,193	91,353	317,546	23,333	1,956	3-40	34-0	2-25	22-80	0-91	9-2	3-16	32-00	..	..
Gas Stations.																	
1. Napier	88,192	27,498	15,683	4,397	20,080	7,418	..	4 50	42-0	2-54	23-87	0-71	6-7	3-25	30-57	0 7½	0 4
2. Wanganui	83,951	1,964	8,958	960	9,918	..	1,060	3-40	35-0	6-78	35-65	0-72	3-8	7-50	39-45	0 5	0 4½
3. Ashburton	36,903	8,858	13,038	4,644	17,682	..	16	6-80	57-0	5-10	41-97	1-80	14-9	6-90	56-87	0 10	0 4
4. Timaru	58,054	34,376	8,814	2,408	11,222	..	2,567	4-80	42-4	4-88	43-20	1-34	11-8	6-22	55-00	0 6	0 5½
5. Devonport	34,376	8,655	7,080	1,507	8,587	890	..	6-60	50-6	4-93	37-80	1-04	8-05	5-97	45-80	0 6	0 3
6. Feilding	40,362	9,477	7,080	1,507	8,587	890	..	6-60	50-6	4-93	37-80	1-04	8-05	5-97	45-80	1 0	0 5
7. Te Kuiti	15,684	4,955	3,391	898	4,289	666	..	5-70	43-1	3-91	29-50	1-03	7-8	4-94	37-30	0 10	0 4
8. Picton	10,299	2,089	3,107	342	3,449	..	1,360	2-86	26-4	4-27	39-32	0-47	4-3	4-74	43-62	Flat rates.	..
9. Pukekohe	13,246	1,875	1,803	627	2,430	..	555	8-35	26-0	8-00	25-00	2-80	8-7	10-80	33-70	0 8	0 3
10. Waitara	8,870	2,016	1,620	534	2,154	..	138	8-60	33-3	6-87	26-80	2-27	8-9	9-14	35-70	0 10	0 5
11. Opoiki	6,522	2,780	2,510	270	2,780	..	..	9-60	42-7	8-65	38-60	0-95	4-1	9-60	42-70	0 10	0 5
12. Wairoa	11,600	3,703	2,267	748	3,015	688	..	11-85	66-0	7-25	40-44	2-40	13-4	9-65	53-84	0 10	0 6
13. Winton	4,256	1,039	733	216	949	90	..	11-40	38-5	8-03	27-16	2-38	8-0	10-41	35-16	0 9	..
14. Ngauwahia	9,076	1,770	1,548	402	1,950	..	180	10-20	53-6	9-27	46-90	2-40	12-2	11-67	59-10	0 11	0 5
15. Martinborough	9,548	2,629	2,465	298	2,763	..	134	12-80	87-6	12-02	82-30	1-46	9-9	13-48	92-20	0 10	0 5
16. Pahiatua	11,085	1,816	1,788	1,037	2,825	..	1,009	7-90	39-0	7-72	38-30	4-47	22-3	12-19	60-60	0 10	0 4
17. Eketahuna	7,288	1,697	1,798	323	2,121	..	424	13-00	58-5	13-71	62-20	2-46	11-1	16-17	73-30	0 10	0 6
18. Bull's	6,000	1,335	860	345	1,205	130	..	16-60	60-8	10-65	39-10	4-26	15-6	14-91	54-70	1 3	0 9
19. Waikou	10,132	815	736	58	794	21	..	14-15	22-0	12-82	19-80	1-00	1-6	13-82	21-40	0 8	0 4
20. Kaikoura (started Mar., 1922)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1 0	0 6
21. Motueka (started Dec., 1921)	12,827	118	534	186	720	..	602	6-70	4-5	30-30	20-55	10-50	7-2	40-80	27-75	0 9	..
22. Tamaki West (started Mar., 1922)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0 11	0 5
Totals	478,271	102,755	78,733	20,200	98,933	9,903	8,045	5-88	41	4-50	31-2	1-15	8-1	5-65	39-3	..	..
Oil Stations.																	
1. Hastings	47,376	23,490	17,631	2,072	19,703	3,787	..	5-26	54-5	3-95	40-96	0-47	4-8	4-42	45-76	0 8½	0 3
2. Havelock North	18,787	1,562	1,447	210	1,657	..	95	6-70	41-0	6-23	38-15	0-90	5-5	7-13	43-65	0 7	0 4
3. Stratford	24,944	6,383	4,417	2,931	7,348	..	965	6-25	37-7	4-32	26-15	2-86	17-4	7-18	43-55	0 8	0 5
Totals	91,107	31,435	23,495	5,213	28,708	3,787	1,060	5-74	52-5	4-28	39-30	0-96	8-7	5-24	48-00	..	..

* Includes wages, fuel, and maintenance of generating and distributing system. † Includes interest, depreciation, and sinking fund. ‡ Public Works Department, bulk supply since June, 1921.

NOTE.—Figures in brackets not included in totals.

TABLE L.—ELECTRIC-SUPPLY STATIONS OF NEW ZEALAND AT 31ST MARCH, 1922.

(G = gas; O = oil; S = steam; W = water.)

Station.	Ownership.	Population supplied.	Number of Consumers.	Capacity in Kilowatts.			Units generated or purchased.	Units sold.	Units non-productive.	Per-centage of Non-pro-ductive Units.	Annual Load-factor Per-centage.	System of Supply.	Supply Voltage.	Route-miles of Lines.	Static Head, in Feet.
				Main Plant.	Stand-by Plant.	Maximum Load. (K'watts.)									
Hydro Stations.															
1. Coleridge	Public Works Dept.	(142,200)	466	6,000	1,500 (S.)	7,600	37,929,750	32,943,934	4,985,816	13.1	57.0	A.C.	400/230	281.0	480
Banks Peninsula	Power Board	3,935	118	Bulk	..	(20)	(9,506)	Returns incomplete—three months only	..	..	48.7	A.C.	400/230	84.0	..
Christchurch	City Council	94,000	15,153	Bulk	750 (S.)	(3,645)	(15,480,400)	(13,498,724)	1,981,676	12.8	..	A.C./D.C.	460/400/230	195.0	..
"	Tramway Board	..	..	Bulk	..	(2,120)	(6,158,960)	..	..	..	..	D.C.	550	..	..
Eyre	County	1,000	108	Bulk	..	(49)	(81,336)	(65,069)	16,267	20.0	18.9	A.C.	400/230	19.0	..
Halswell	County	1,743	125	Bulk	..	(75)	(107,003)	(85,600)*	21,403	20.0	16.3	A.C.	400/230	18.0	..
Heathcote	County	4,000	646	Bulk	..	(131)	(612,999)	(490,399)	122,600	20.0	53.5	A.C.	400/230	23.0	..
Kaipoi	Borough	1,800	370	Bulk	..	(93)	(344,975)	(275,980)	68,995	20.0	42.5	A.C.	400/230	10.0	..
Lyttelton	Borough	3,744	230	Bulk	..	(59)	(189,637)	(146,615)	43,022	22.7	37.0	A.C.	400/230	9.0	..
Riccarton	Borough	3,251	499	Bulk	..	(103)	(210,865)	(178,494)	32,371	15.4	23.3	A.C.	400/230	15.0	..
Rangiora	Borough	2,000	250	Bulk	..	(58)	(135,996)	(118,630)	17,366	12.8	27.0	A.C.	400/230	11.0	..
Rangiora	County	1,000	198	Bulk	..	(40)	(225,429)	(180,343)	45,086	20.0	64.0	A.C.	400/230	30.0	..
Springs-Ellesmere	Power Board	5,527	..	Bulk	..	(8)	(465)	Returns inco mplete— One month only.	..	..	..	A.C.	400/230	30.0	..
Sumner	Borough	3,200	440	Bulk	..	(68)	(328,515)	(262,812)	65,703	20.0	55.0	A.C.	400/230	13.0	..
Tai Tapu	Company	5,000	120	Bulk	..	(120)	(382,607)	(306,085)	76,522	20.0	36.4	A.C.	400/230	30.0	..
Waimairi	County	12,000	1,816	Bulk	..	(250)	(1,073,102)	(858,482)	214,620	20.0	49.0	A.C.	400/230	104.0	..
Dunedin (Waipori)	City	75,000	11,203	6,000	860 (O.)	6,880	24,785,220†	17,615,078	7,170,142	28.9	41.0	A.C.	400/230	350.0	700
3. Horahora	Public Works Dept.	30,000	11	6,300	1,500 (S.)	5,800	25,639,550	23,093,595	2,565,955	10.0	50.5	A.C.	11,000	67.0	27
Cambridge	Power Board	5,000	378	Bulk	..	(93)	(51,630)	(41,304)	10,326	20.0	..	A.C.	400/230	50.0	..
Central	Power Board	11,000	170	Bulk	..	(64)	(129,279)	(103,423)	25,856	20.0	23.0	A.C.	400/230	45.0	..
Te Awamutu	Power Board	8,000	339	Bulk	..	(102)	(56,345)	(45,078)	11,267	20.0	11.0	A.C.	400/230	167.0	..
Thames Valley	Power Board	30,000	825	Bulk	..	(456)	..	Returns inco mplete for first year	..	..	..	A.C.	400/230	250.0	..
Wairua	Company	..	29	2,000	..	1,610	8,203,300	6,751,090	1,452,210	17.7	58.1	A.C.	400/230	31.0	130
Whangarei	Borough	4,700	983	Bulk	..	(188)	(560,401)	(322,399)	38,002	6.8†	34.0	A.C.	400/230	41.0	..
5. New Plymouth	Borough	25,000	3,511	820	..	820	3,571,275†	2,420,315	1,150,960	32.0	49.8	A.C.	400/230	199.0	130
6. Hawera	Company	5,750	1,800	625	135 (O.)	369	819,093	617,521	201,572	24.5	25.0	A.C.	400/230	62.0	57
7. Rotorua	Government	3,886	824	200	20 (O.)	200	730,002	479,995	250,007	34.2	41.7	A.C.	200/115	28.0	14
8. Tauranga	Borough	4,556	774	800	..	460	1,404,300	1,136,461	267,839	19.0	35.0	A.C.	400/230	51.0	110
Te Puke (started Dec., 1921)	Town Board	852	103	Bulk	..	(40)	(34,674)	(33,355)	1,319	3.8†	9.9	A.C.	400/230	8.0	..
9. Taihape	Borough	2,070	384	100	75 (G.)	158	443,771	405,891	37,880	8.7†	32.0	D.C.	460/230	6.5	30
10. Thames	Borough	5,000	802	100	105 (O.)	125	303,643	288,433	15,210	5.0†	27.5	D.C.	460/230	16.0	130
Te Aroha	Borough	2,109	441	135	187 (O.)	144	211,463	201,565	9,898	4.76†	16.8	A.C.	400/230	14.0	560
Gore	Borough	3,600	679	240	..	185	332,145	292,001	40,144	12.0	20.4	A.C.	400/230	28.0	23
Reefton	Company	1,450	203	75	103 (S.)	90	201,600*	161,300*	40,300	20.0	25.3	D.C.	230	7.5	27
Omamaru	Borough	7,800	725	120	150 (G.)	162	417,241	328,591	88,650	21.2	29.4	A.C.	400/230	27.0	250
Ingleswood	Borough	1,300	385	120	..	75	218,990	196,990	21,910	10.0	33.3	A.C.	400/230	9.5	38
Patea	Borough	1,700	246	90	45 (G.)	50	100,000	92,600	7,400	7.4†	22.8	A.C.	100 S.P.	12.5	72
Raetihi	Borough	4,500	284	100	..	43	102,786	93,442	9,344	9.1†	27.3	A.C.	400/230	10.25	350
Ohakune	Borough	1,670	205	120	..	75	94,265*	75,413	18,852	20.0	14.3	A.C.	400/230	6.25	42
Brightwater	Town Board	1,200	177	140	..	32	52,800*	42,242	10,558	20.0	18.7	A.C./D.C.	400/230	31.0	31
20. Waverley	Company	980	380	40	40 (G.)	48	79,140	63,500*	15,640	20.0	18.7	A.C.	230 S.P.	34.0	10
Akaroa	Town Board	650	156	40	..	17	37,060	29,650	7,410	20.0	24.7	A.C.	400/230	6.25	60
Mangaweka	Borough	1,174	200	75	..	31	96,500*	77,343	19,157	20.0	35.4	D.C.	230	7.0	310
23. Mangaweka	Borough	360	92	45	40 (O.)	45	42,745	36,553	6,192	14.5	10.8	A.C.	440/220 S.P.	5.5	23
25. Havelock (South)	Town Board	300	50	20	..	19	29,800*	23,840*	5,960	20.0	68.5	A.C.	400/230	5.5	37
26. Hokitika (Kanieri)	Town Board	2,300	229	700	150 (S.)	460	1,621,900	1,412,370	209,530	12.9	40.0	D.C.	460/230	2.0	270
27. Murchison (started Dec., 1921)	County	386	80	80	..	15	3,000	3,000	600	16.6	10.8	A.C.	400/230	17.25	250
														12.0	105

* Assessed from incomplete returns.

† Including tramways.

‡ From assessment by local authority.

§ Bulk supply from Thames Valley Power Board since the 8th October, 1921.

NOTE.—Figures in brackets not included in totals.

TABLE L (continued).—SUMMARY OF RETURNS OF OPERATING RESULTS FOR THE YEAR ENDED 31ST MARCH, 1922.

Station.	Capital Outlay at 31st March, 1922.	Revenue.	Working expenses.*	Capital Charges.†	Total Annual Costs.	Net Result.		Average Revenue.		Working costs.*		Capital Charges.†		Total Costs.		Retail Net Selling rates.	
						Profit.	Loss.	Per Unit sold.	Per Kw. P.H. Max.	Per Unit sold.	Per Kw. P.H. Max.	Per Unit sold.	Per Kw. P.H. Max.	Per Unit sold.	Per Kw. P.H. Max.	Lighting.	Power.
						£	£	d.	£	d.	£	d.	£	d.	£	s. d.	s. d.
<i>Hydro Stations.</i>																	
1. Coleridge	671,608	56,814	25,911	29,405	55,316	1,498	..	0.41	7.4	0.19	3.40	0.21	3.87	0.40	7.27	0 8	0 3
Banks Peninsula (P.B.)	55,708	166	7	1,653	1,660	..	..	..	incomplete for first year	..	..	..	..	..	..	0 6	0 3
Christchurch (C.C.)	392,864	90,049	45,088	34,438	79,526	10,523	..	1.60	24.7	0.80	12.35	0.61	9.45	1.41	21.80	0 6	0 1½
" (T.B.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Eyre	5,160	614	324	133	457	157	..	2.28	12.5	1.19	6.65	0.49	2.70	1.68	9.35	Flat rates.	..
Halverson	5,403	1,103	582	313	895	208	..	3.10	14.7	1.53	7.76	0.88	4.16	2.41	11.92	Flat rates.	..
Heathcote	14,570	3,441	2,440	749	3,189	252	..	1.68	26.1	1.19	18.60	0.37	5.70	1.56	24.30	0 6	0 3
Kaipoi	4,500	2,061	1,301	506	1,807	254	..	1.13	22.1	1.13	14.00	0.57	5.93	1.57	19.45	Flat rates.	..
Lyttelton	5,000	2,082	1,620	350	1,970	112	..	3.43	35.3	2.65	27.50	0.41	2.95	3.22	33.43	0 6	0 3
Riccarton	6,824	2,370	1,681	305	1,986	384	..	3.19	23.1	2.26	16.37	0.41	2.95	2.67	19.32	0 5	0 3
Rangiora (Borough)	7,266	1,740	770	622	1,392	348	..	3.54	30.3	1.55	13.20	1.25	10.70	2.80	23.90	0 6	0 1½
" (County)	12,207	1,608	996	636	1,632	..	24	2.15	40.1	1.32	24.80	0.85	15.90	2.17	40.70	Flat rates.	..
Sprey-Ellesmere (P.B.)	28,624	..	..	..	..	..	..	..	incomplete for first year	..	..	..	..	..	..	0 8	0 3
Sumner	9,398	2,431	1,365	519	1,884	547	..	2.22	35.7	1.25	20.00	0.47	7.65	1.72	27.65	0 6	0 1
Tai Tapu	4,569	1,779	1,420	582	2,002	..	223	1.39	14.8	1.11	11.80	0.46	4.84	1.57	16.64	Flat rates.	..
Waimari	42,400	9,349	4,657	2,032	6,689	2,660	..	1.60	37.4	..	..	0.57	8.15	..	..	0 6	0 3
2. Dunedin (Waipori)	653,334	101,651	36,193	47,181	83,374	18,277	..	1.38	14.7	0.49	5.25	0.64	6.85	1.13	12.10	0 6	0 2
3. Horahora	348,031	28,207	7,974	17,699	25,673	2,534	..	0.29	4.9	0.08	1.37	0.18	3.05	0.26	4.42	0 9	0 3
Cambridge (P.B.)	67,561	1,270	1,900	2,000†	3,900†	..	..	7.40	10.6	Returns incomplete for first year	..	..	..	..	..	0 9	0 3
Central (P.B.)	65,000†	1,328	2,000†	4,000†	4,000†	..	..	3.10	20.8	Returns incomplete for first year	..	..	..	..	..	0 8	0 3
Te Awamutu (P.B.)	74,268	3,251	2,683	2,000†	4,683†	..	..	..	..	Returns incomplete for first year	..	..	..	..	..	0 8	0 3
Thames Valley (P.B.)	270,544	5,503	220	5,000†	5,220†	..	..	..	..	Returns incomplete for first year	..	..	..	..	..	0 8	0 3
4. Wairua	87,742	10,952	5,574	5,265	10,839	113	..	0.39	6.8	0.20	3.47	0.19	3.27	0.39	6.74	0 5½	0 3
Whangarei	24,943	8,151	3,067	939	4,006	4,145	..	3.75	43.2	1.40	16.27	0.43	5.00	1.83	21.27	0 5½	0 3
5. New Plymouth	206,277	25,065	7,019	9,984	17,003	8,062	..	2.48	30.6	0.68	8.36	0.99	12.17	1.67	20.73	0 6	0 2
6. Haveria	68,074	20,320	6,233	5,487	11,720	8,600	..	7.90	55.0	2.42	16.85	2.14	14.80	4.56	31.65	0 7	0 3½
7. Rotorua	41,064	7,934	4,211	3,686	7,907	27	..	3.96	39.7	2.10	21.00	1.84	18.50	3.94	39.50	0 6	0 3
8. Tauranga	60,490	8,462	3,979	1,638	5,617	2,845	..	1.78	18.4	0.84	8.65	0.35	3.56	1.19	12.21	0 8	0 2
Te Puke (started Dec., 1921)	9,087	694	455	104	559	135	..	5.00	17.2	3.29	11.33	0.75	2.60	4.04	13.93	0 10	0 4½
9. Taihape	13,556	3,872	1,878	646	2,524	1,348	..	2.30	24.5	1.12	11.87	0.38	4.10	1.50	15.97	0 8	0 1½
10. Thames	21,918	6,637	2,974	1,268	4,242	2,395	..	5.50	53.1	2.46	23.70	1.05	10.10	3.51	33.80	0 10	0 3
11. Te Aroha	16,277	4,271	3,779	727	4,506	..	235	5.13	29.7	4.50	26.27	0.87	5.00	5.37	31.27	0 7	0 3
12. Gore	23,404	6,262	5,101	1,080	6,181	81	..	5.15	33.8	4.17	27.55	0.88	5.70	5.05	33.25	0 7	0 3
13. Reefton	6,683	3,200	3,560	330	3,890	..	690	4.80	35.6	5.30	39.52	0.49	3.66	5.79	43.18	Flat rates.	..
14. Oamaru	38,524	6,009	3,290	2,164	5,454	555	..	4.40	37.0	2.40	20.27	1.58	13.35	3.98	33.62	0 9	0 3
15. Inglewood	8,500	3,817	2,705	510	3,215	602	..	4.65	50.8	3.30	36.10	0.62	6.80	3.92	42.90	0 7	0 2
16. Patea	12,607	1,620	2,365	131	2,496	..	876	6.15	47.30	6.15	47.30	0.34	2.60	6.49	49.90	0 8½	0 4
17. Raetihi	18,379	2,322	726	1,751	2,477	..	155	5.96	54.0	1.86	16.95	4.49	41.00	6.35	57.95	0 10	0 3
18. Ohakune	10,062	2,219	1,329	470	1,799	420	..	7.10	29.6	4.23	17.70	1.49	6.25	5.72	23.95	0 9	0 4
19. Kaponga	13,338	979	422	420	842	137	..	5.60	30.5	2.40	13.25	2.38	13.10	4.78	26.35	0 9	0 4
20. Brightwater	11,500	1,620	1,118	692	1,810	..	190	6.10	33.7	4.21	23.22	2.61	14.40	6.82	37.62	0 9	0 4
21. Waverley	5,079	1,012	685	291	976	36	..	8.25	59.5	5.54	40.20	2.35	17.00	7.89	57.20	0 10	0 2
22. Akaroa	7,930	1,935	980	459	1,439	496	..	6.00	62.4	3.04	31.50	1.43	14.80	4.47	46.30	0 5	0 3
23. Mataura	4,137	928	646	120	766	162	..	6.10	20.5	4.25	14.30	0.79	2.67	5.04	16.97	0 6	0 2½
24. Mangaweka	4,894	628	545	205	750	..	122	3.52	20.8	3.06	18.10	1.15	6.85	4.21	24.95	1 0	..
25. Havelock (South)	1,932	382	335	88	423	..	41	3.85	20.0	3.38	17.66	0.88	4.60	4.26	22.26	Flat rates.	..
26. Hokitika (Kanieri)	32,441	3,875	3,963	2,080	6,043	..	2,168	0.66	8.4	0.67	8.61	0.35	4.55	1.02	13.16	0 6	0 3
27. Murchison (started Dec., 1921)	12,750	72	150	404	554	..	482	5.75	4.8	Returns incomplete for first year	..	..	..	..	..	0 4	0 3
Totals..	3,506,427	450,055	206,221	189,072	395,293	67,913	5,206	1.22	17.6	0.56	8.10	0.51	7.40	1.07	15.50	..	..

* Includes wages, fuel, and maintenance of generating and distributing system.

† Includes interest, depreciation, and sinking fund.

‡ Assessed.

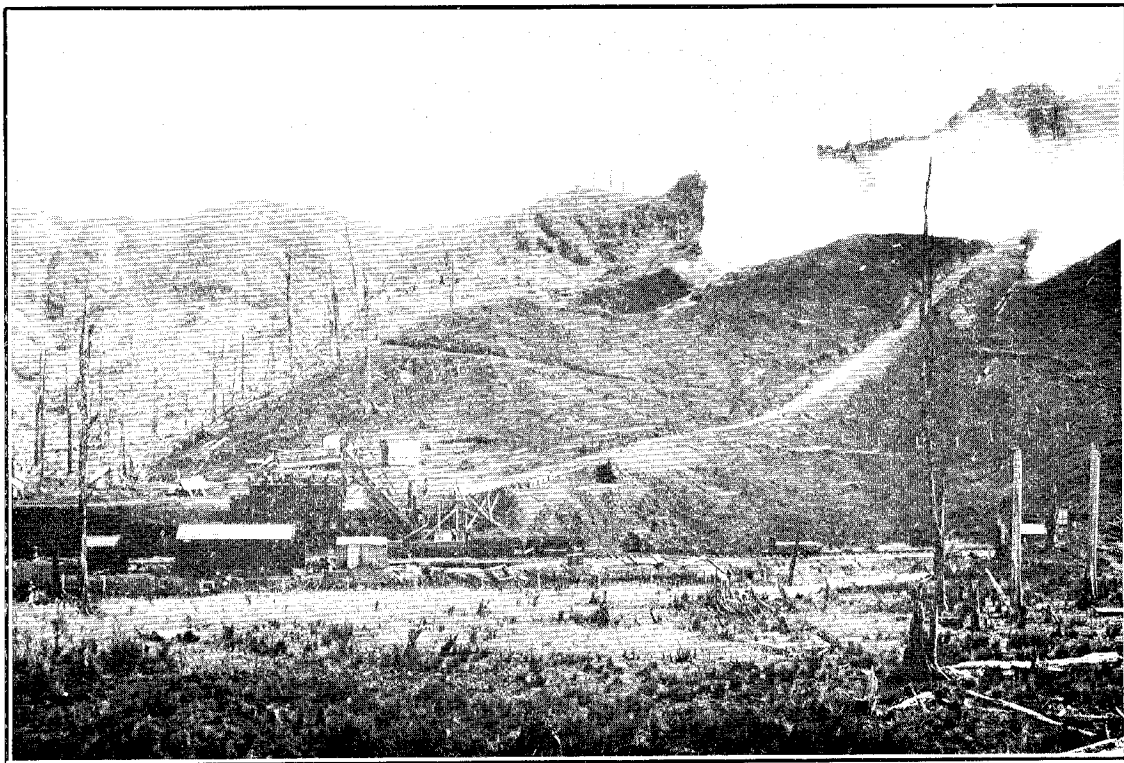
TABLE M.—AVAILABLE WATER-POWER IN NEW ZEALAND.

Source of Power.	Position of Power-house.	Available Flow: Cubic Feet per Second.	Available Head.	Average Power on 50-per-cent. Load-factor.		Nearest City, Port, or Deep Water.	Distance.
NORTH ISLAND.							
North Auckland District—			Ft.	H.p.	Kw.		Miles.
Wairua Falls	Wairua Falls	150*	130	3,200	2,400	Whangarei ..	18
Omapere	Utakura Stream ..	11*	550	1,000	750	..	..
South Auckland District—							
Kaituna	Kaituna River ..	500†	784	65,000	50,000	Tauranga ..	25
						Auckland ..	125
Wairoa River	Wairoa	420*	80	5,600	4,200	Tauranga ..	20
Waikato River	Aratiatia Rapids ..	4,400†	170	136,000	100,000	Auckland ..	154
Waikato River	Orakeikorako Rapids	4,400†	35	14,000	10,000	Auckland ..	148
Waikato River	Aniwhaniwha Falls	4,400†	80	32,000	24,000	Auckland ..	142
Waikato River	Atiamuri Rapids ..	4,400†	25	10,000	7,500	Auckland ..	139
Waikato River	Arapuni Gorge ..	5,300†	165	163,000	120,000	Auckland ..	105
Waikato River	Horahora Rapids ..	5,300†	27	13,000	10,000	Auckland ..	97
Pokaiwhenua River	Horahora Rapids ..	165*	170	4,600	3,400	Auckland ..	97
Marakopa Falls ..	Marakopa	90	420	3,100	2,300	Te Kuiti ..	27
Wairere Falls ..	Wairere Falls ..	160*	60	1,600	1,200	Te Kuiti ..	22
Hawke's Bay District—							
Waikaremoana ..	Upper Waikaretaheki	530†	1,100	97,000	75,000	Gisborne ..	50
Waikaremoana ..	Lower Waikaretaheki	530†	360	32,000	24,000	Napier ..	60
Te Reinga Falls ..	Te Reinga Falls ..	124	125	1,300	1,000	Gisborne ..	35
Waikohu River ..	Waikohu	45†	847	6,000	4,500	Gisborne ..	28
Wanganui District—							
Mangawhero River	Raukawa Falls ..	125	90	1,000	750	Wanganui ..	45
Mangawhero River	Wanganui River ..	125	680	7,100	6,950	Wanganui ..	24
Rangitikei River ..	Makohine	1,500†	300	75,000	56,000	Wanganui ..	48
Wangaehu River ..	Wangaehu River ..	260	70	1,500	1,100	Wanganui ..	25
Karioi	Karioi	300*	180	8,800	6,600	Wanganui ..	60
Taranaki District—							
Waitara River ..	Waitara River ..	400	140	4,600	3,600	New Plymouth	12
Waiwakaiho ..	Waiwakaiho ..	150†	250	6,200	4,800	New Plymouth	4
Wellington District—							
Mangahao River ..	Shannon	160†	895	24,000	18,000	Wellington ..	65
Makuri River ..	Makuri Gorge ..	100*	384	6,400	4,800	Pahiatua ..	20
Waiohine	Woodside	120*	120	2,400	1,800	Masterton ..	15
Hutt River	Mungaroa	200†	330	11,000	8,300	Wellington ..	24
Tauherenikau ..	Featherston ..	150*	440	11,000	8,300	Wairarapa ..	..
Totals—North Island		..	..	747,400	561,250		
SOUTH ISLAND.							
Marlborough District—							
Clarence	Ericaburn	640	158	8,300	6,300	Blenheim ..	45
Waihopai River ..	Waihopai Gorge ..	130*	96	2,000	1,500	Blenheim ..	28
Nelson and Buller District—							
Boulder Lake ..	Aorere River ..	50*	2,600	22,000	16,000	Golden Bay ..	10
Rotoiti Lake ..	Buller River ..	200†	600	20,000	15,000	Nelson ..	50
Rotorua Lake ..	Gowan River ..	900†	400	60,000	45,000	Nelson ..	60
Inangahua River ..	Blackwater River ..	78	125	8,000	6,000	Westport ..	20
Four-mile Creek ..	Four-mile Creek ..	24*	450	2,000	1,500	Westport ..	4
Westland District—							
Lake Brunner ..	Stillwater	1,750	200	29,000	22,000	Greymouth ..	10
Kumara Water-race	Kumara	87	330	2,400	1,800	Greymouth ..	12
Otira River	Otira	40	700	2,300	1,700	Greymouth ..	52
Rolleston River ..	Otira	36	700	2,000	1,500	Greymouth ..	52
Kanieri Lake ..	Kanieri River ..	100	330	2,800	2,100	Hokitika ..	12
Toaroha River ..	Toaroha River ..	150	760	10,000	7,500	Hokitika ..	17
Whitcombe River	Hokitika River ..	250	800	16,000	12,000	Hokitika ..	20
Kakapotahi River	Kakapotahi River	100	580	4,800	3,600	Hokitika ..	26
Wanganui River ..	Hende's Ferry ..	830	580	40,000	30,000	Hokitika ..	36
Wataroa River ..	Wataroa	1,360	700	80,000	60,000	Hokitika ..	48
Canterbury District—							
Clarence River ..	Jollie's Pass ..	200	1,160	20,000	15,000	Christchurch..	90
Clarence River ..	Conway River ..	1,150	1,050	100,000	75,000	Christchurch..	90
Waiau-ua River ..	Culverton	1,600	200	27,000	20,000	Christchurch..	75
Waimakariri River	Gorge Bridge ..	2,000	90	15,000	11,000	Christchurch..	30
Lake Coleridge ..	Rakaia River ..	100†	480	8,000	6,000	Christchurch..	65
Acheron River ..	Rakaia River ..	50†	480	4,000	3,000	Christchurch..	65
Harper River ..	Rakaia River ..	320†	480	25,000	18,000	Christchurch..	65
Wilberforce River	Rakaia River ..	1,100	480	44,000	33,000	Christchurch..	65
Rakaia River ..	Gorge Bridge ..	2,600	30	6,500	4,800	Christchurch..	50
Lake Heron ..	Rakaia River ..	300	200	4,000	3,000	Christchurch..	88
Ophi River ..	Ophi Gorge ..	200	400	6,700	5,000	Timaru ..	30
Pukaki Lake ..	Pukaki	5,000†	460	50,000	37,000	Timaru ..	85
Tekapo Lake ..	Fairlie	5,100†	900	400,000	300,000	Timaru ..	40
Ohau Lake ..	Waitaki River ..	5,000†	300	125,000	90,000	Timaru ..	85

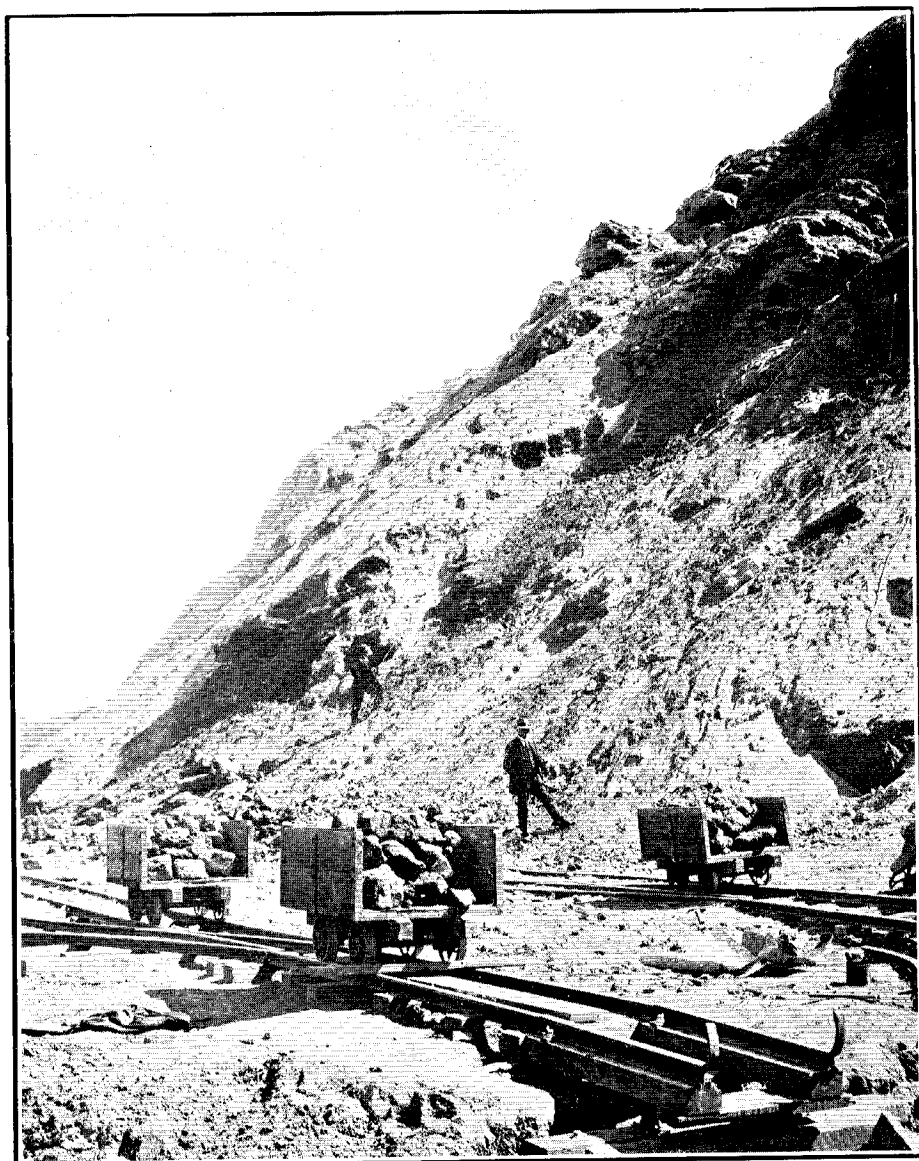
TABLE M.—AVAILABLE WATER-POWER IN NEW ZEALAND—continued.

Source of Power.	Position of Power-house.	Available Flow: Cubic Feet per Second.	Available Head.	Average Power on 50-per-cent. Load-factor.		Nearest City, Port, or Deep Water.	Distance.
SOUTH ISLAND—continued.							
Otago and Southland District—							
Ahuriri River	Waitaki River	600	200	10,000	7,500	Oamaru ..	62
Waitaki River	Waitaki River	15,000	30	37,000	28,000	Oamaru ..	60
Waipori Falls	Waipori River	230†	700	26,800	20,000	Dunedin ..	30
Lee Stream	Outram	15*	750	1,800	1,300	Dunedin ..	18
Deep Stream	Taieri River	110	900	8,400	6,300	Dunedin ..	20
Taieri River	Deep Stream	700	220	12,000	9,000	Dunedin ..	44
Talla Burn	Clutha River	30	890	2,200	1,600	Dunedin ..	60
Teviot River	Roxburgh	100†	1,900	30,000	21,000	Dunedin ..	90
Manuherika River ..	Chatto Creek	200	350	5,800	4,400	Dunedin ..	127
Hawea Lake	Wanaka Lake	2,500†	205	80,000	60,000	Dunedin ..	170
Shotover	Wakatipu Lake	500	250	10,000	7,500	Invercargill ..	112
Lake Hall	Doubtful Sound	220	2,625	48,000	36,000	On seaboard..	..
Lake Cecil	Lake Te Anau	200	900	15,000	11,200	On seaboard..	..
Lake Hilda	Lake Te Anau	1,550	1,190	55,000	41,080	On seaboard..	..
Lake Te Anau	George Sound	12,630	694	750,000	560,000	On seaboard..	..
Lake Manapouri	Smith Sound	8,400†	600	840,000	630,000	On seaboard..	..
Bowen Falls	Milford Sound	700	600	35,000	25,000	On seaboard..	..
Lake Monowai	Waiau River	500†	160	16,000	12,000	Invercargill ..	60
Lake Hauroto	Tewaewae Bay	2,300	514	100,000	75,000	Invercargill ..	51
Totals—South Island	..	..	..	3,229800 2,411,180			

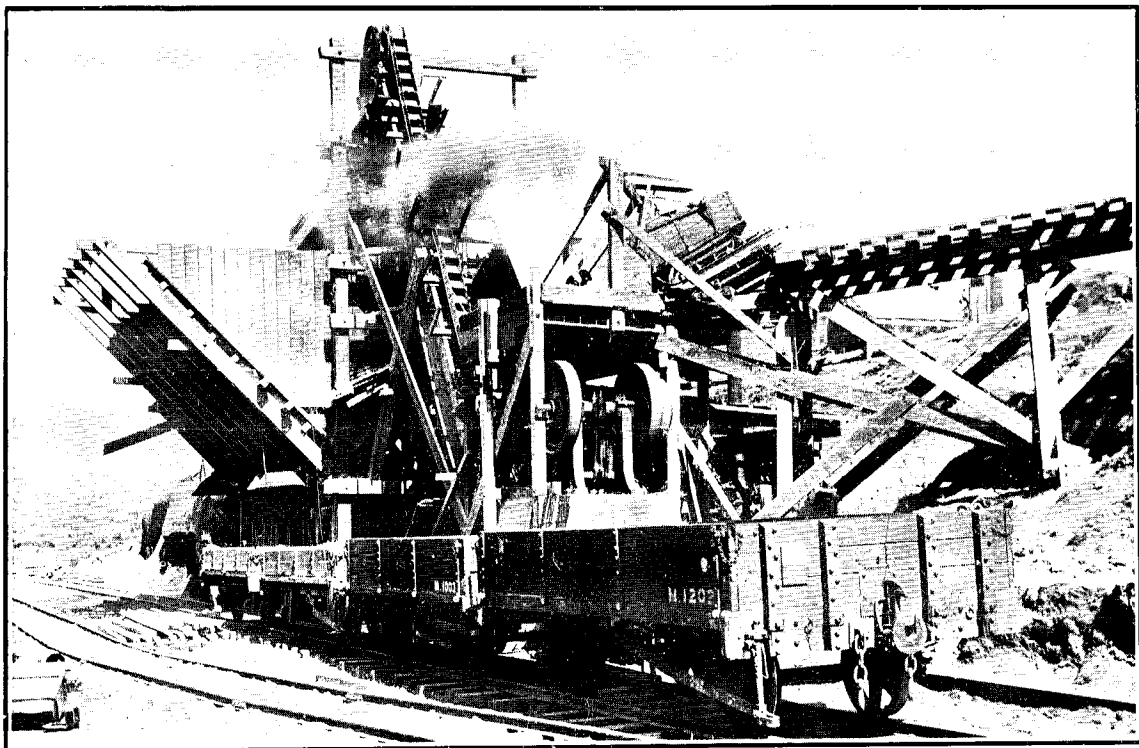
* Signifies daily storage available to utilize 50-per-cent. load-factor. † Signifies seasonal storage made available.



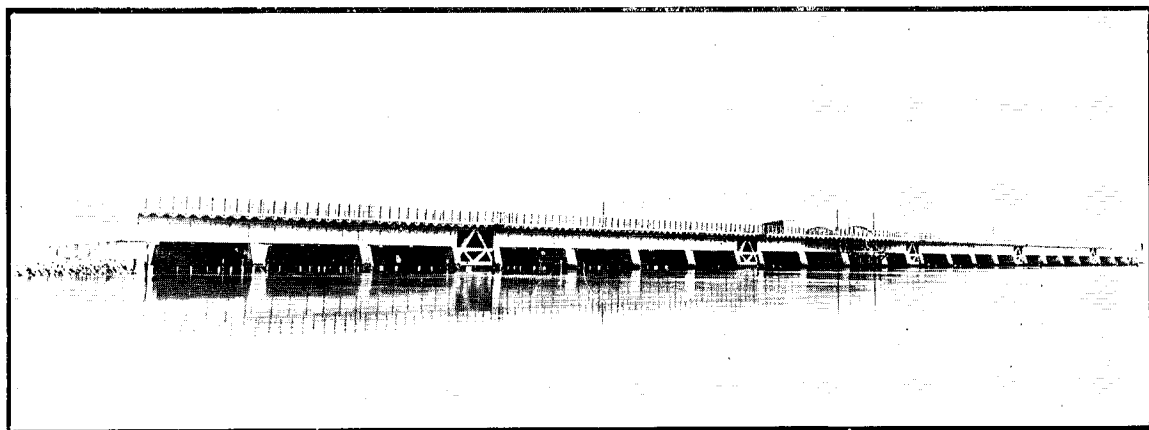
TE WERA QUARRY: GENERAL VIEW.



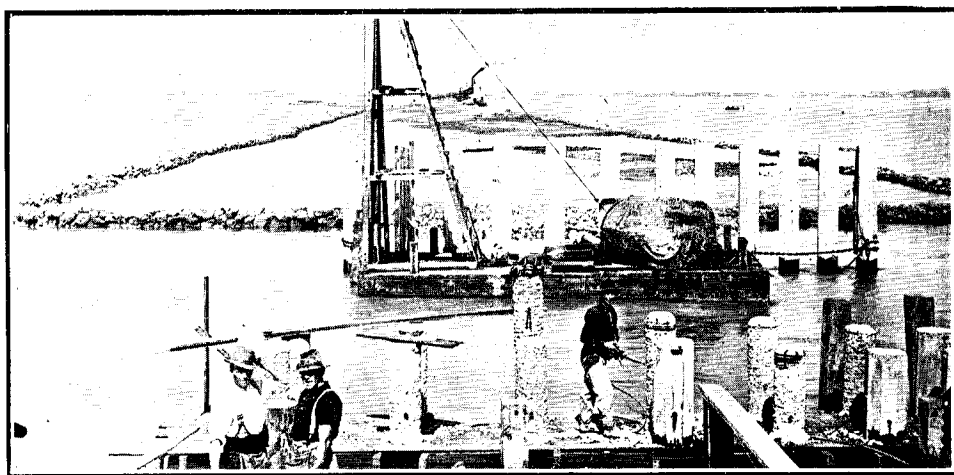
TE WERA QUARRY.



TE WERA QUARRY : CRUSHING AND SCREENING PLANT.

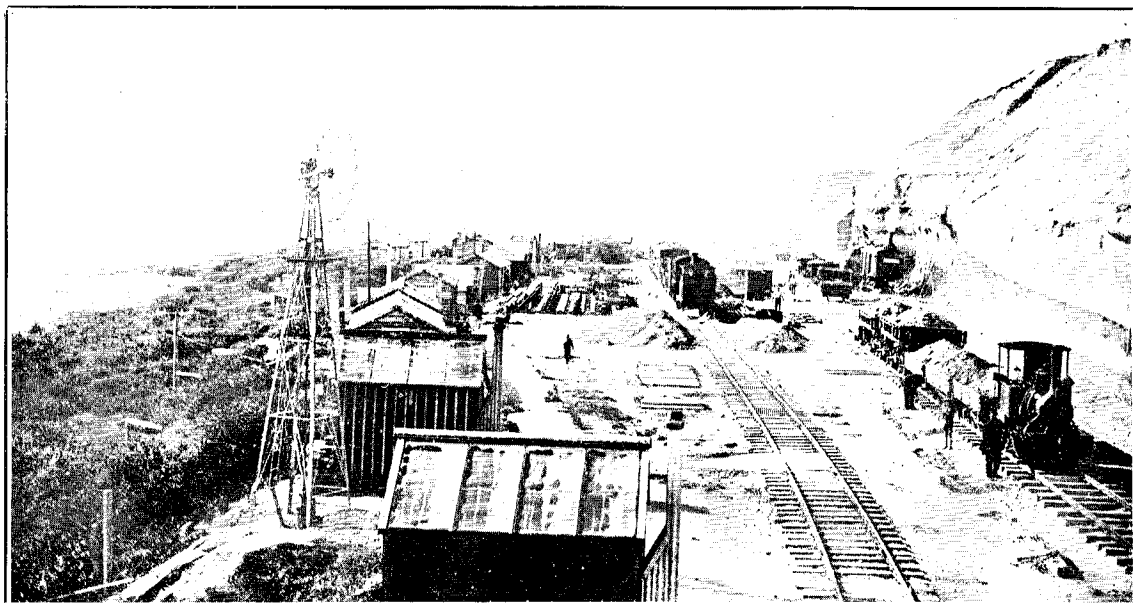


NAPIER-WAIROA RAILWAY. WESTSHORE BRIDGE : GENERAL VIEW.

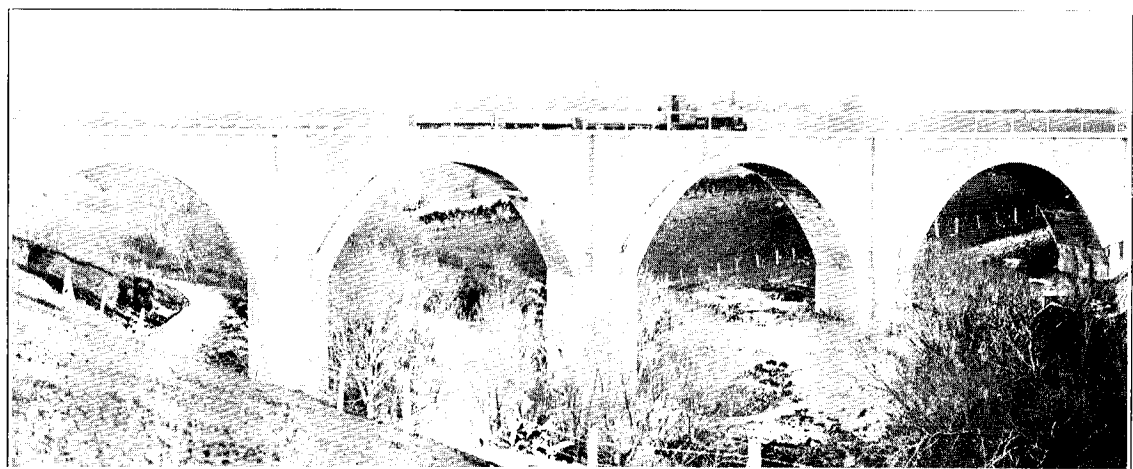


NAPIER-WAIROA RAILWAY : WESTSHORE BRIDGE.

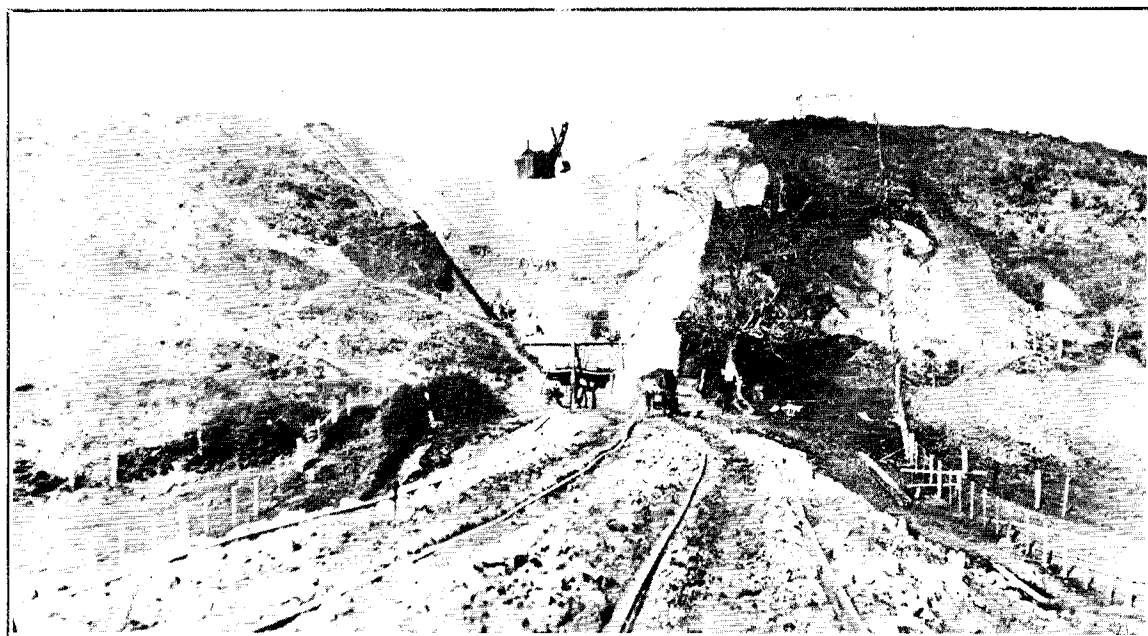
Stripping pile-heads by compressed air, also plant for driving temporary piles, and Harbour Board dredge in background.



EAST COAST MAIN TRUNK RAILWAY: PASSENGER-TRAIN PASSING WORK-TRAIN, STEAM SHOVEL AT WORK, AND PILE MAKING DEPOT.

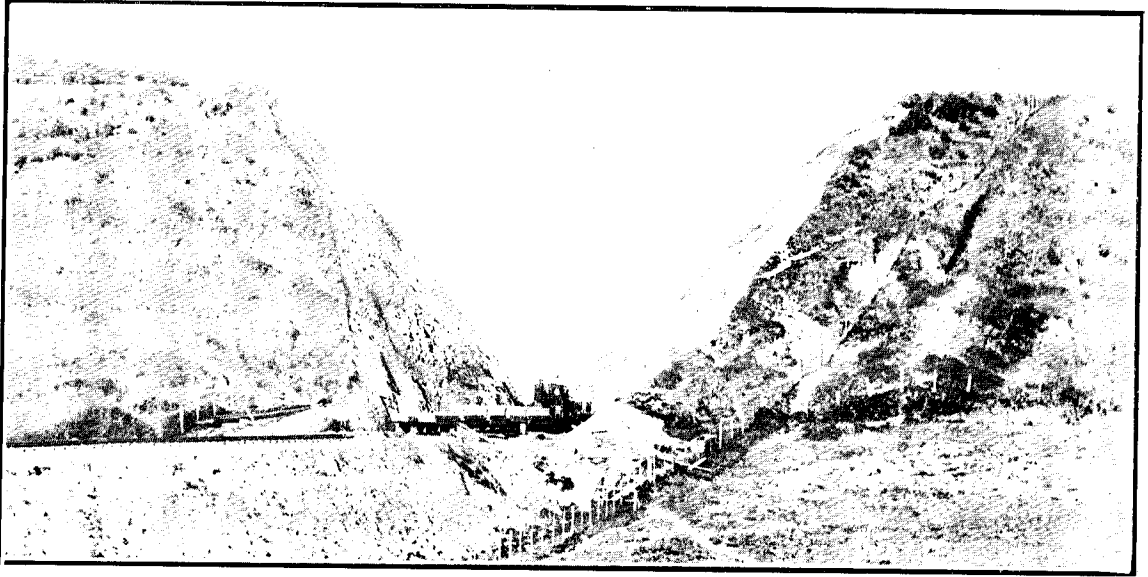


TE ROTI OPUNAKE RAILWAY: WAINGONGO RO BRIDGE.
Four 63 ft. spans and one 21 ft. span.

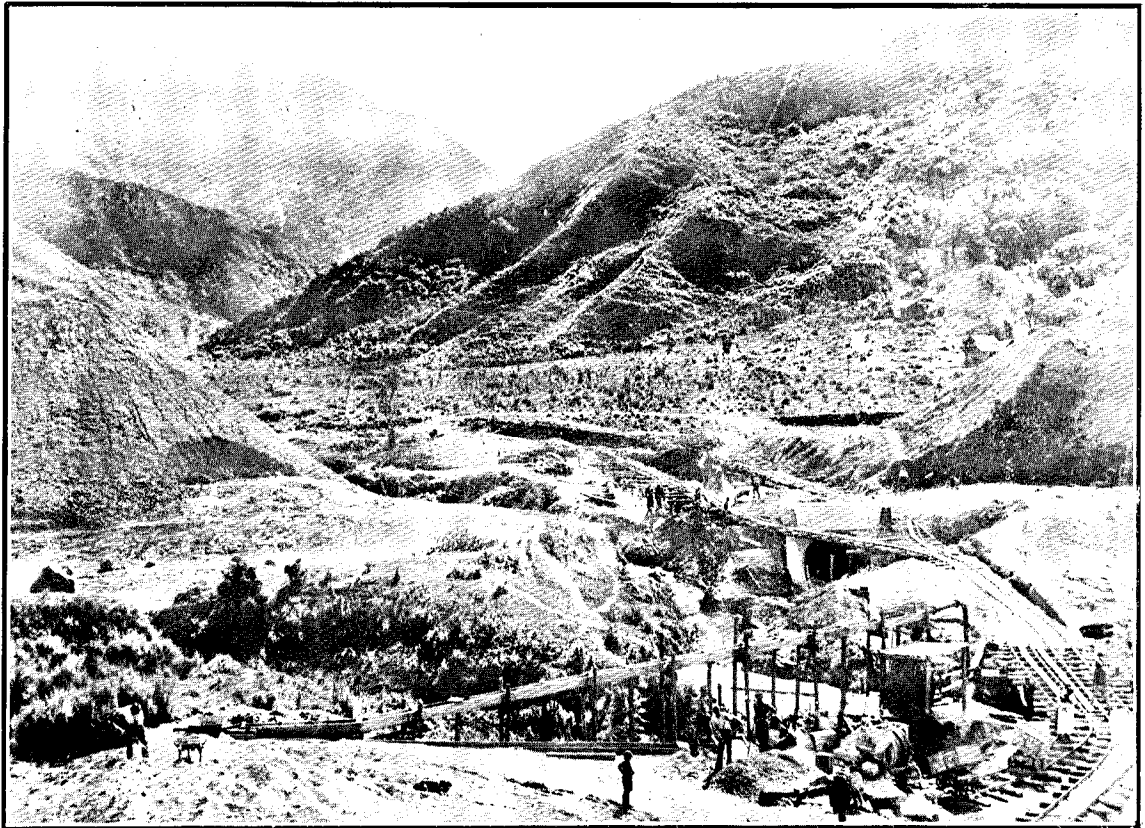


WAIROA WAIKOKOPU RAILWAY: STEAM-SHOVEL AT WORK IN TE UHI CUTTING, NEAR WAIROA.

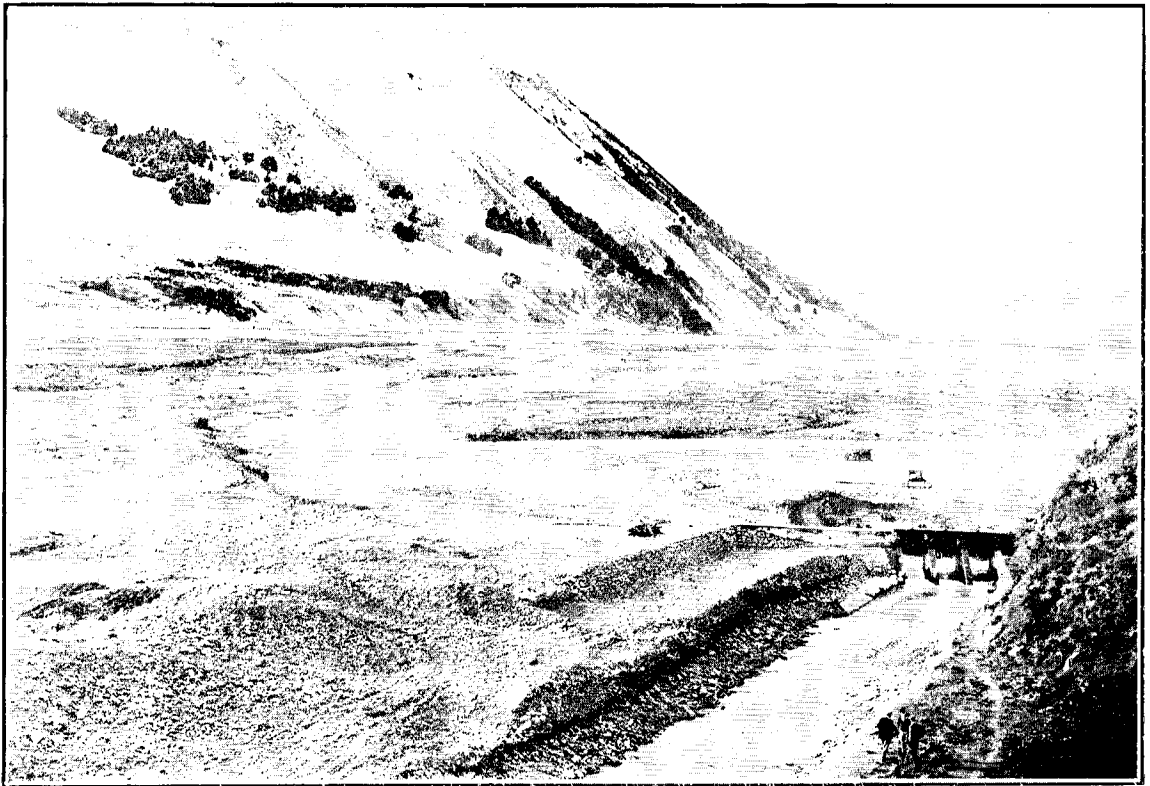
D. 1.



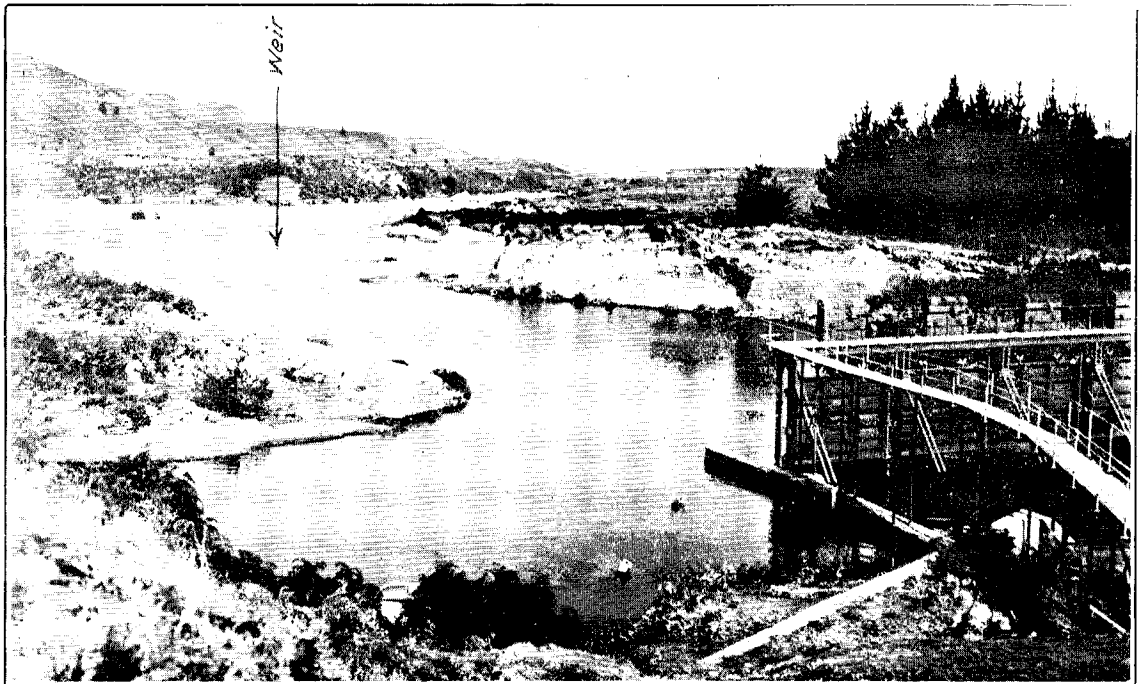
Wairoa Waikopu Railway: Construction Train in Te Uhi Cutting, near Wairoa.



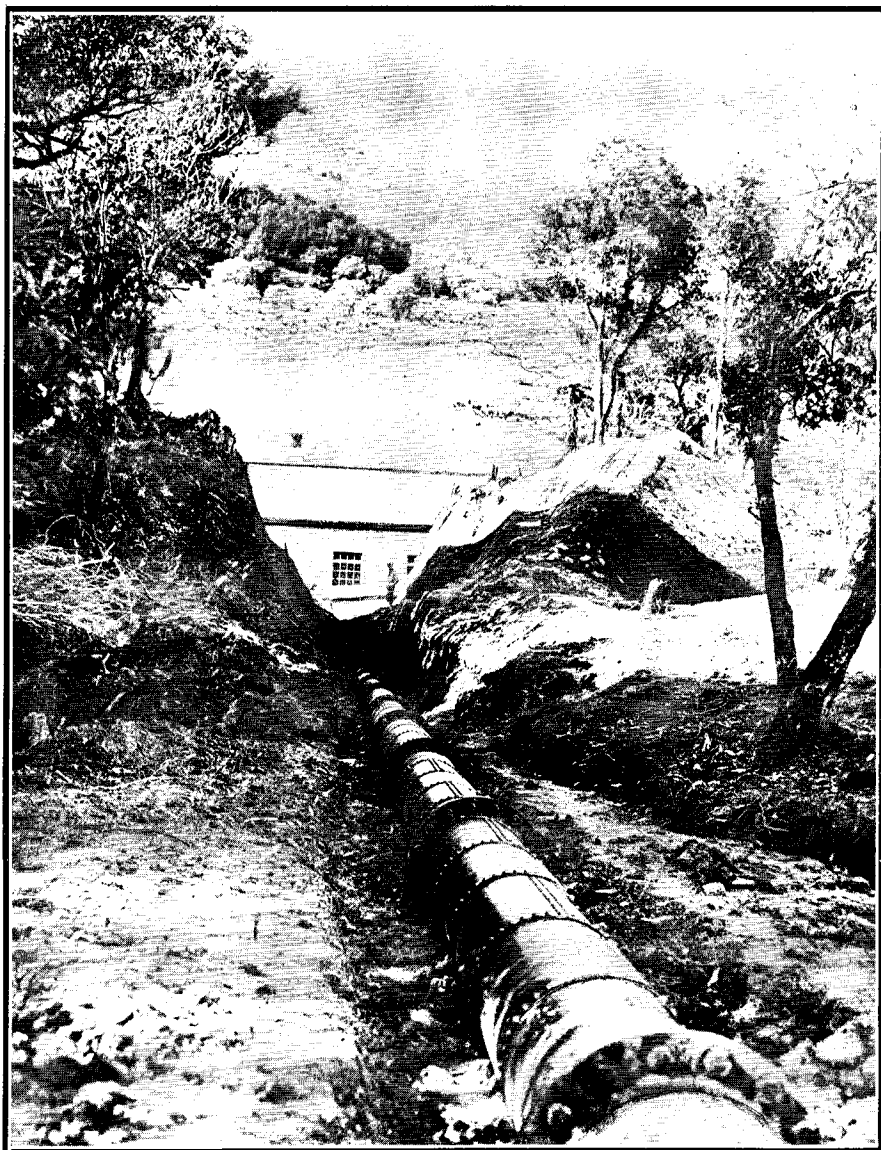
Wairoa Waikopu Railway: 12 ft. Culvert at 22 Miles 30 Chains, showing Gravel-washing Plant and Filling-in Progress.



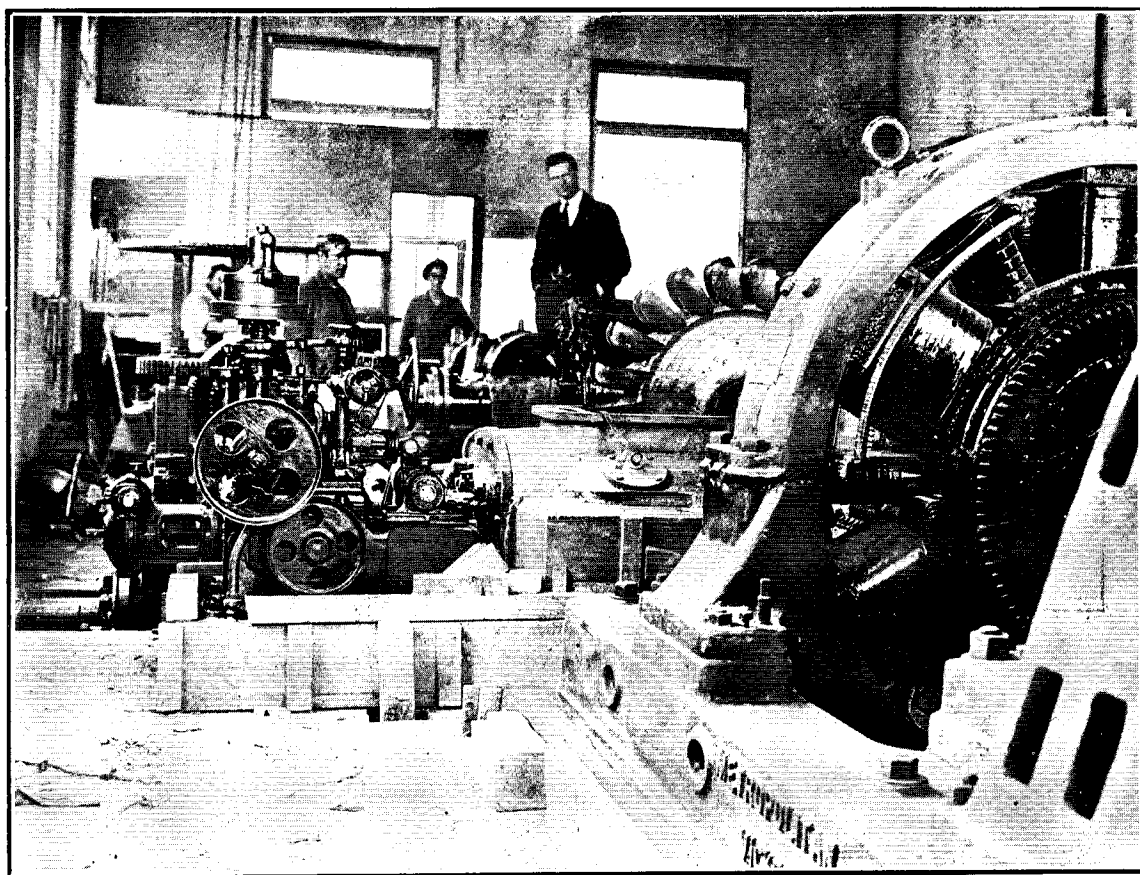
HARPER RIVER DIVERSION RACE AND GATES: GENERAL VIEW.



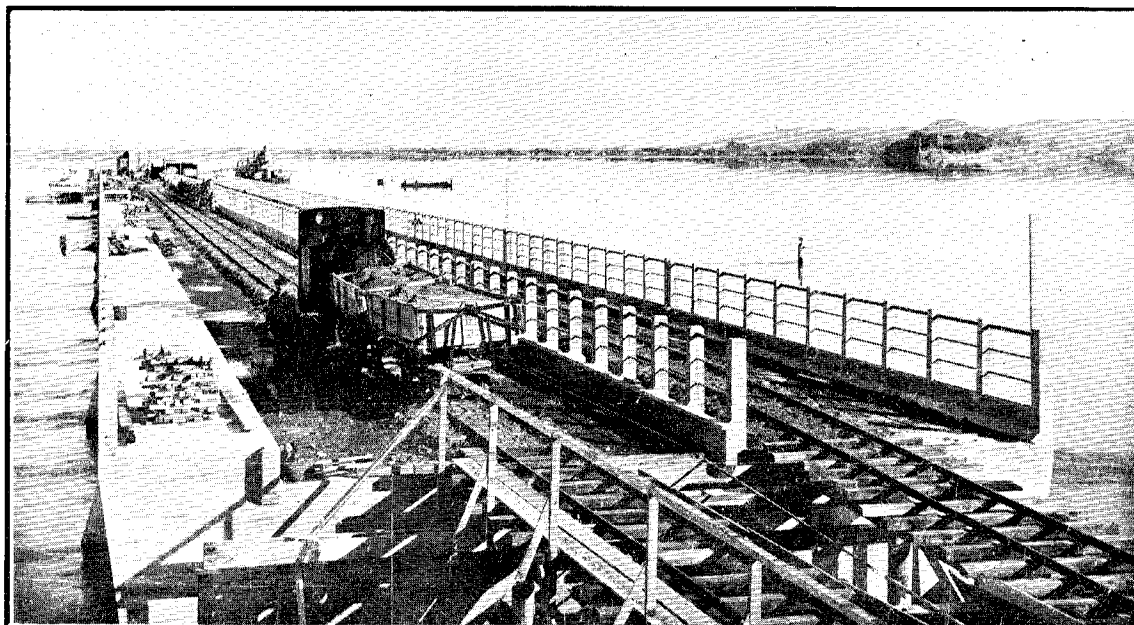
HOROHORO POWER SCHEME: GENERAL VIEW SHOWING POSITION OF NEW RIVER.



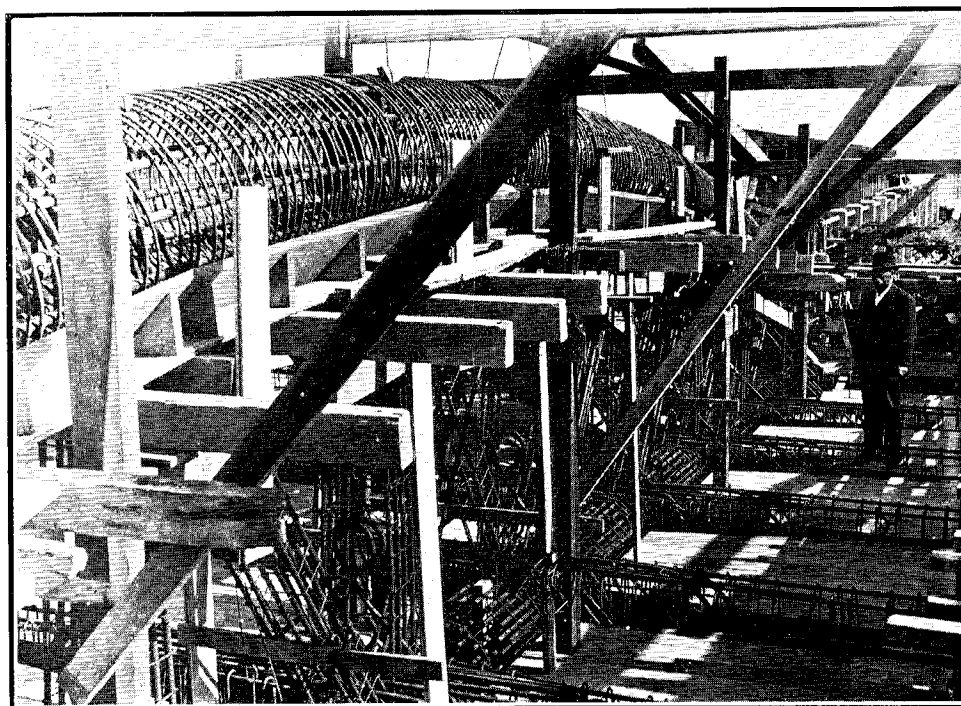
WAIKAREMOANA POWER SCHEME : LOWER END OF PIPE-LINE AND PORTION OF POWER-HOUSE.



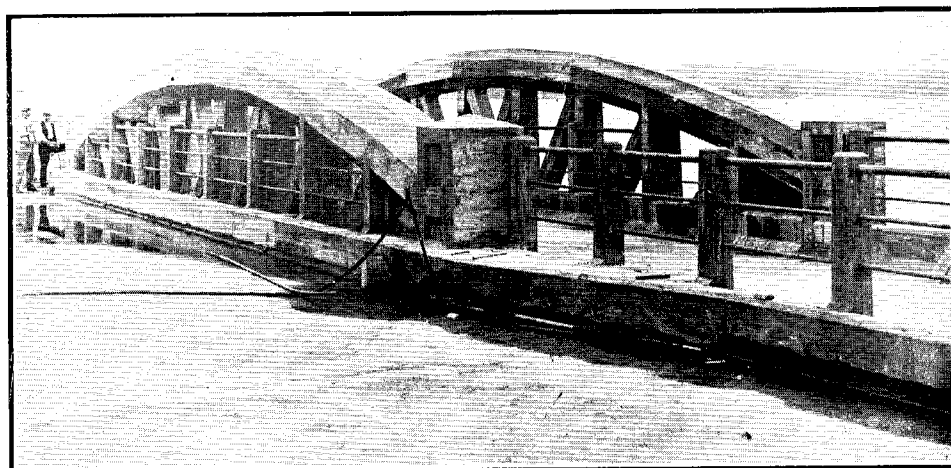
WAIKAREMOANA POWER SCHEME : A VIEW IN THE POWER-HOUSE.



NAPIER WAIROA RAILWAY.—WESTSHORE BRIDGE: MATERIAL-TRAIN.
Concrete-mixing plant and Harbour Board dredge in background.

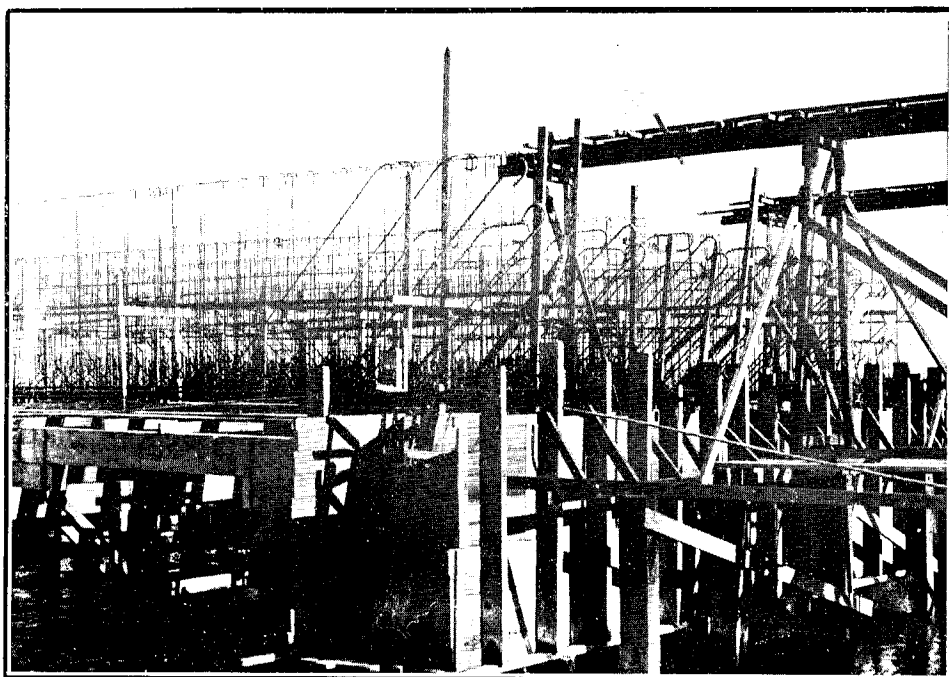


NAPIER WAIROA RAILWAY. WESTSHORE BRIDGE: REINFORCEMENT OF BOWSTRING SPAN.

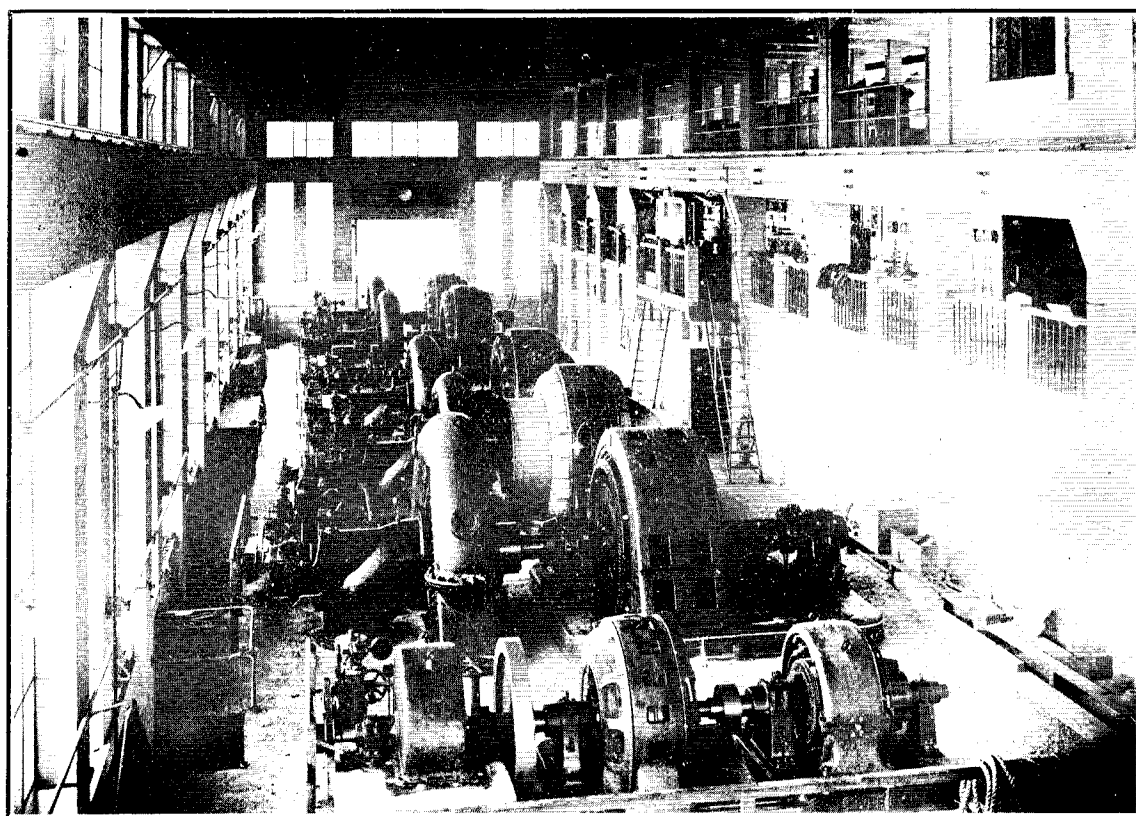


NAPIER WAIROA RAILWAY.—WESTSHORE BRIDGE: COMPLETED BOWSTRING SPAN.

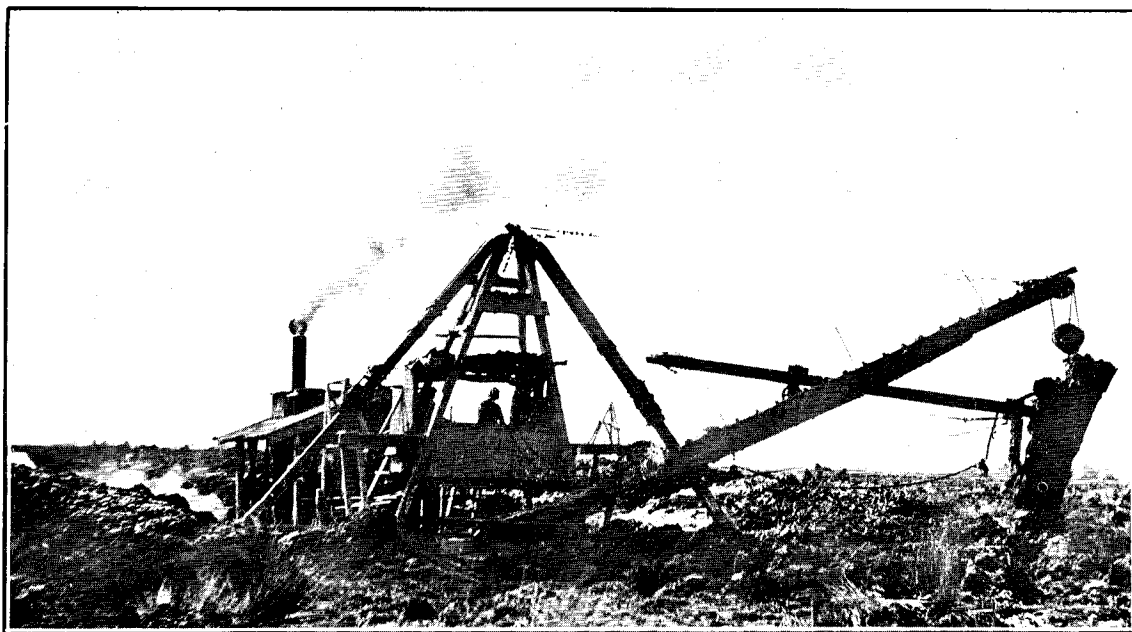
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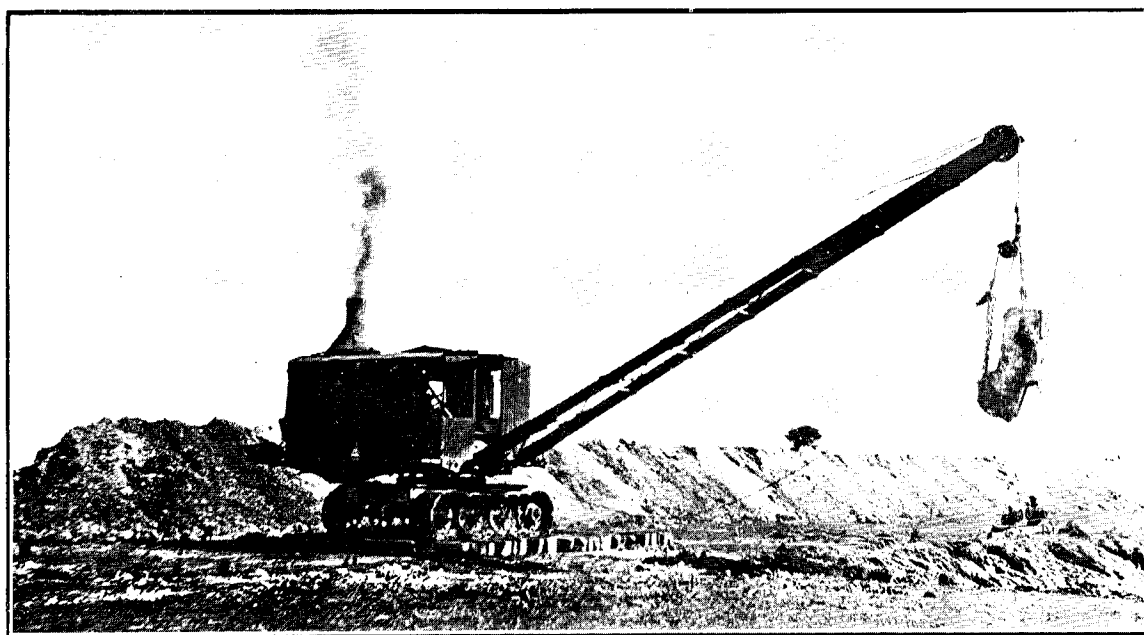
NAPIER WAIROA RAILWAY. WESTSHORE BRIDGE: REINFORCEMENT OF 50 FT. BEAM SPAN.



INTERIOR OF LAKE COLERIDGE POWER-HOUSE.

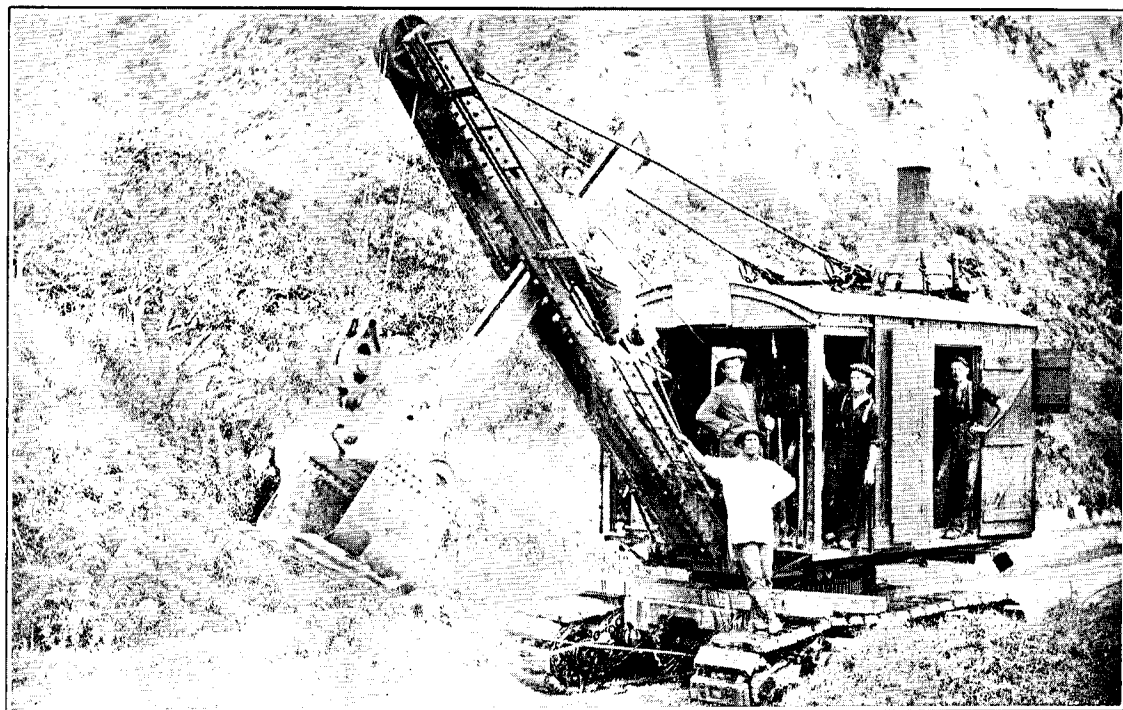


WAIHOU AND OHINEMURI RIVERS IMPROVEMENT. DRAIN H: VIEW OF DIPPER DREDGE AT WORK.

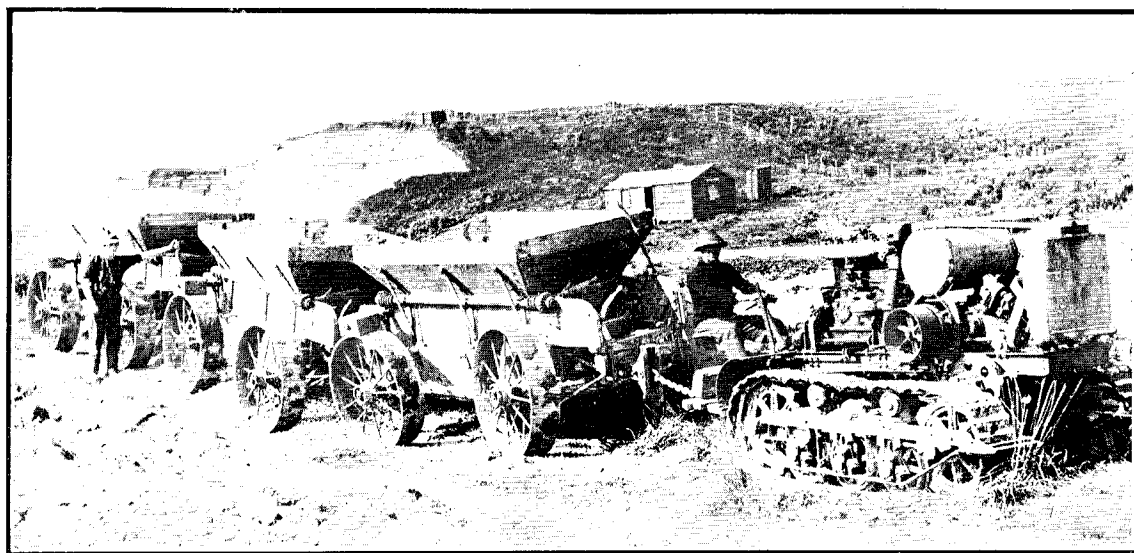


WAIHOU AND OHINEMURI RIVERS IMPROVEMENT: NO. 2 DRAG-LINE EXCAVATOR, MANGAITI-TIROTHA.
Left hand: View showing completed stop-bank.

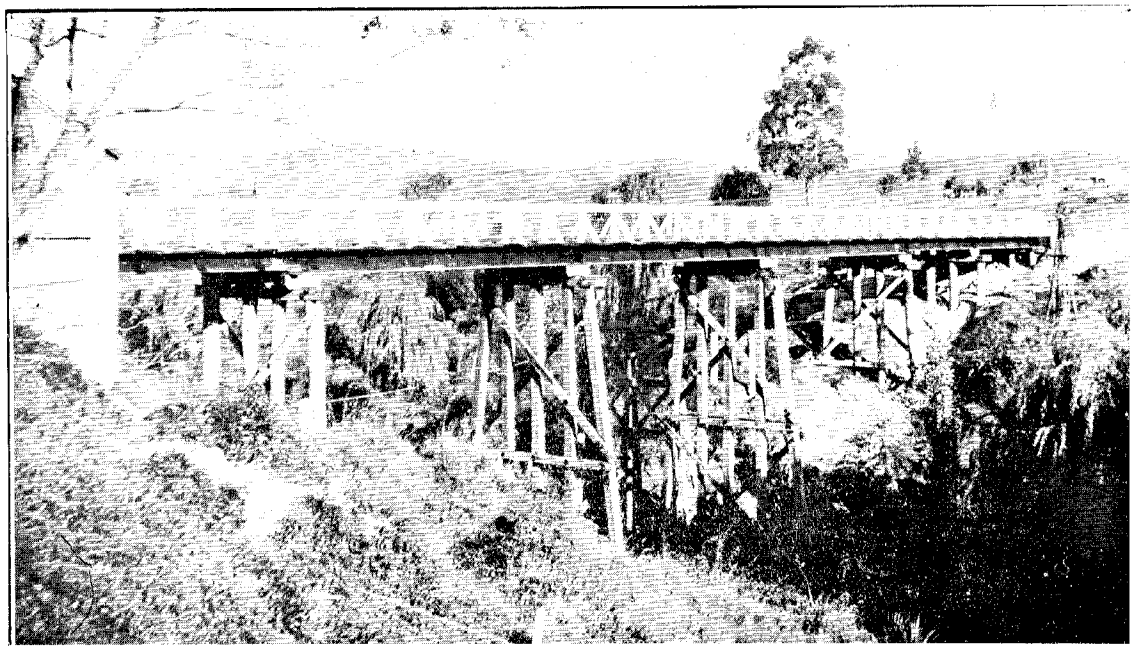
D.—1.



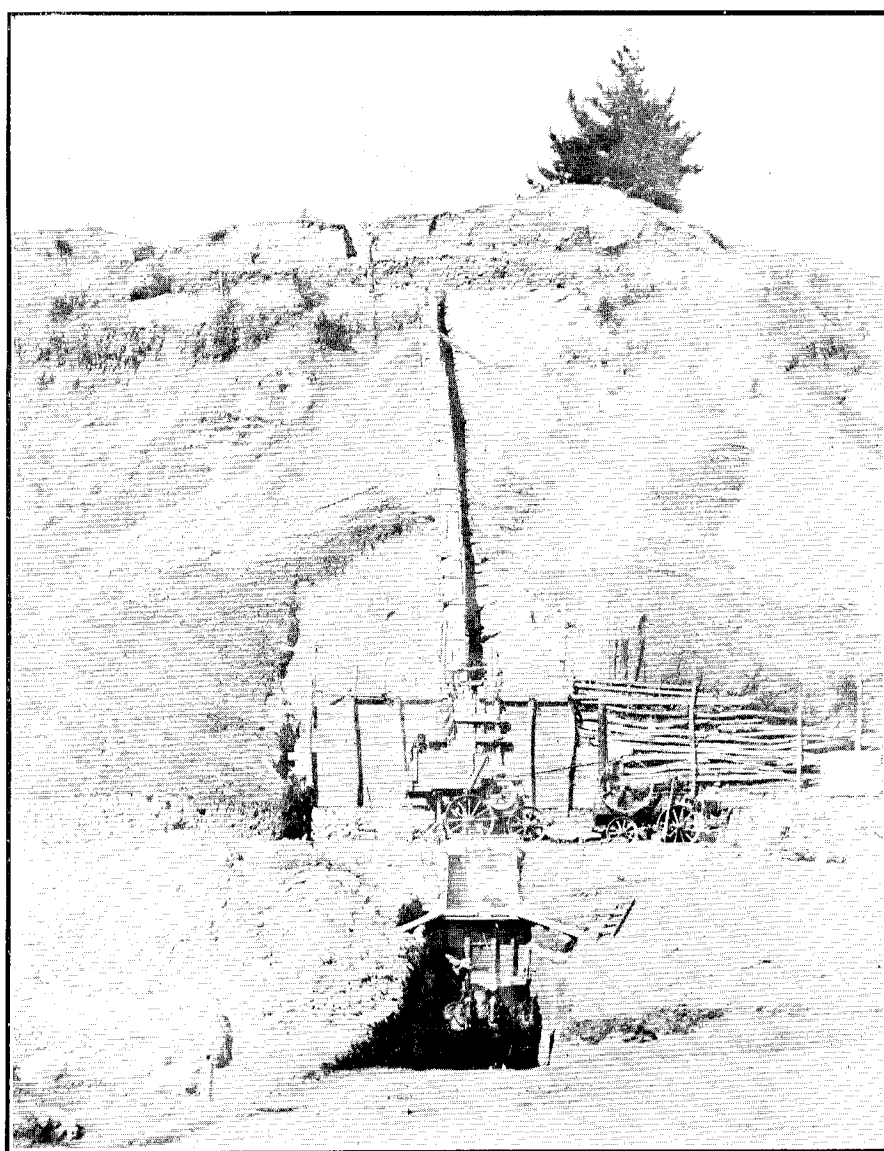
EAST COAST MAIN TRUNK RAILWAY : STEAM-SHOVEL MOVING UNDER ITS OWN POWER FROM ONE JOB TO ANOTHER.



EAST COAST MAIN TRUNK RAILWAY : DUMPING "TROY" TRAILERS, FILLED BY STEAM NAVVY AND HAULED BY TRACTOR.

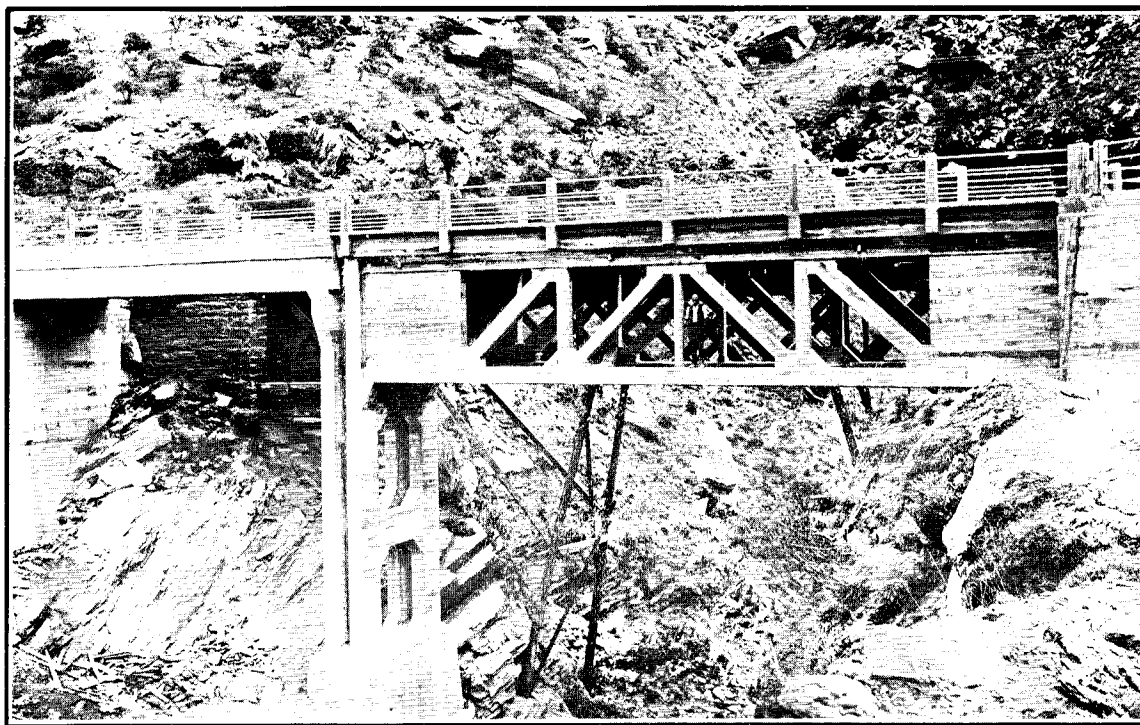


WAIKAREMOANA ROAD : SCAMPERDOWN BRIDGE.

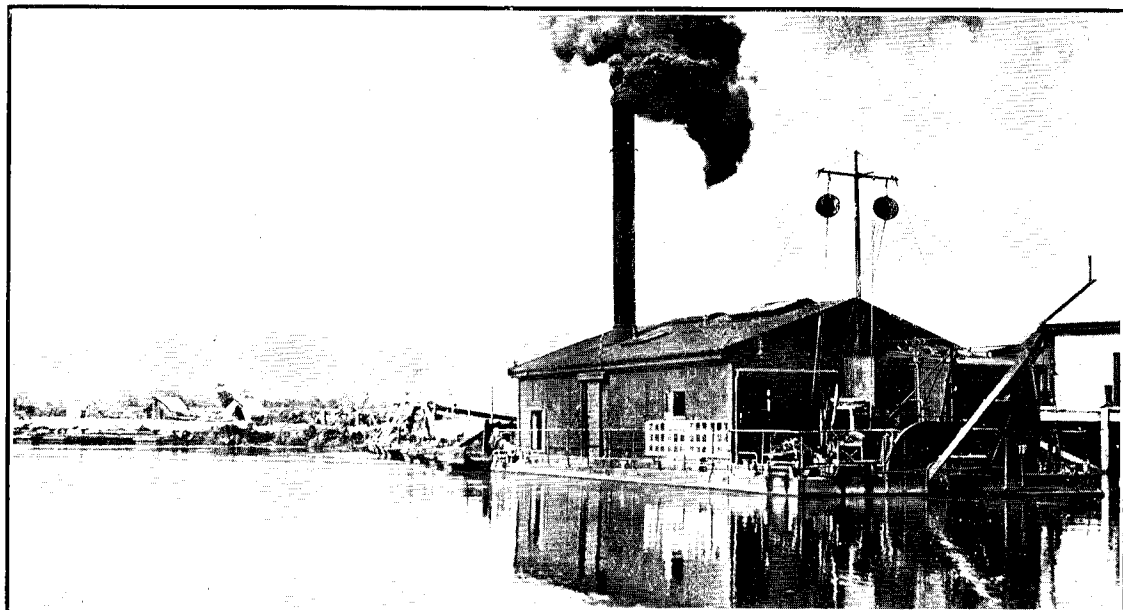


WAIKAREMOANA ROAD : STONE-CRUSHING PLANT AT 26½ MILES.

D.—1.



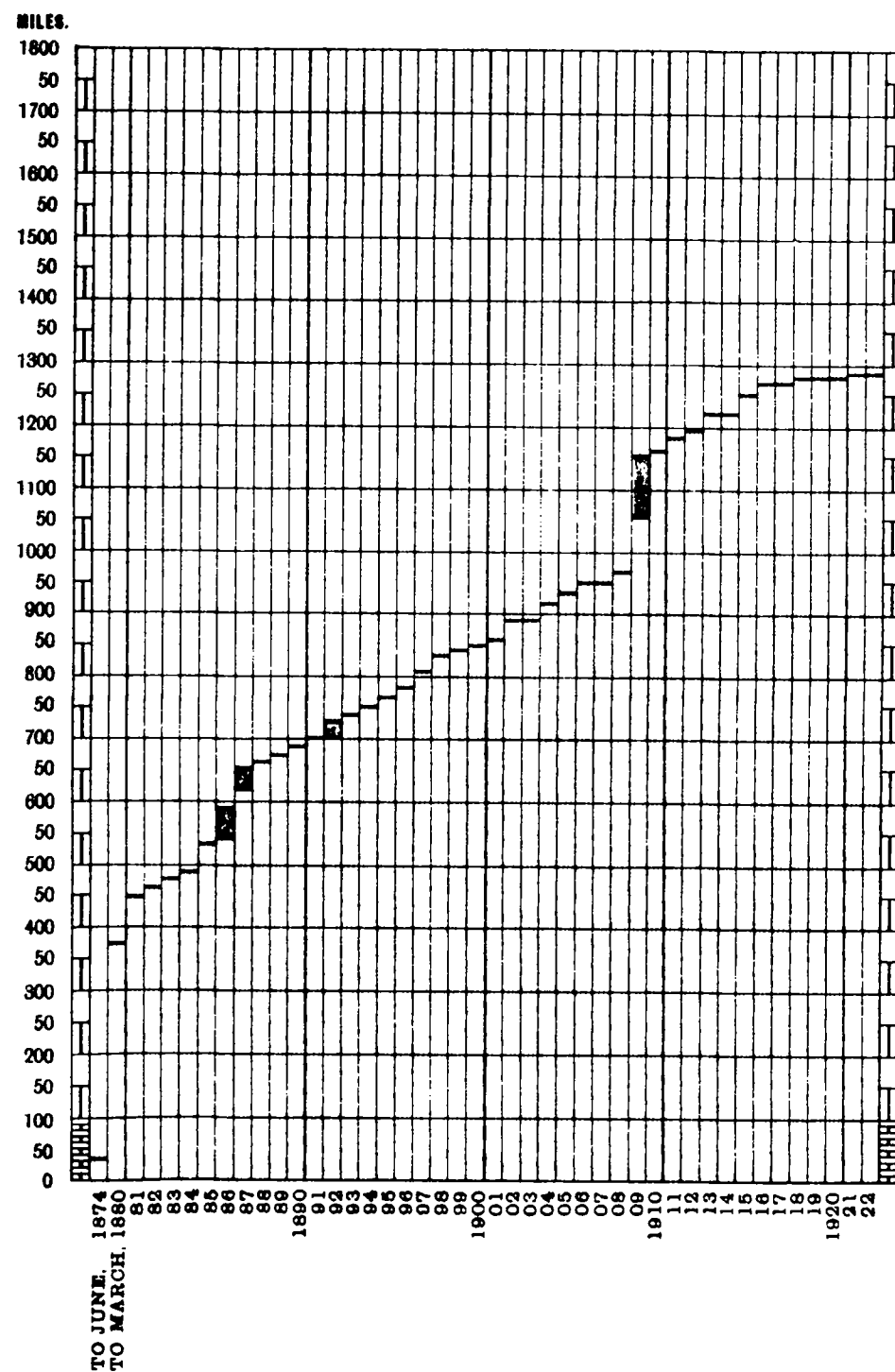
GENTLE ANNIE BRIDGE, KAWARAU GORGE: REINFORCED CONCRETE.



WAIHOU AND OHINEMURI RIVERS IMPROVEMENT: VIEW OF WAIHOU DREDGE AT NGAHINA WHARF

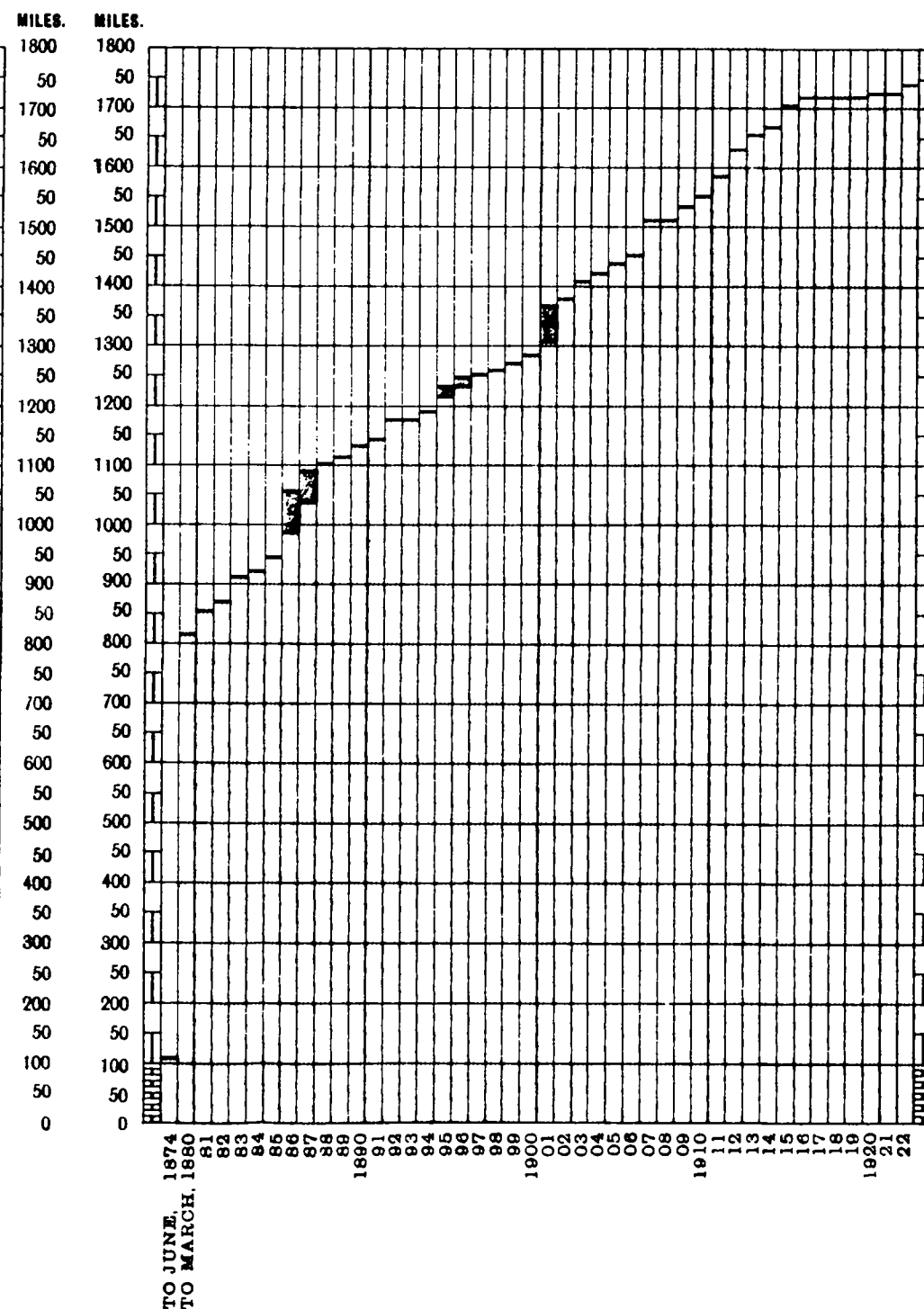
NUMBER OF MILES OPEN
OF
GOVERNMENT LINES.

NORTH ISLAND.

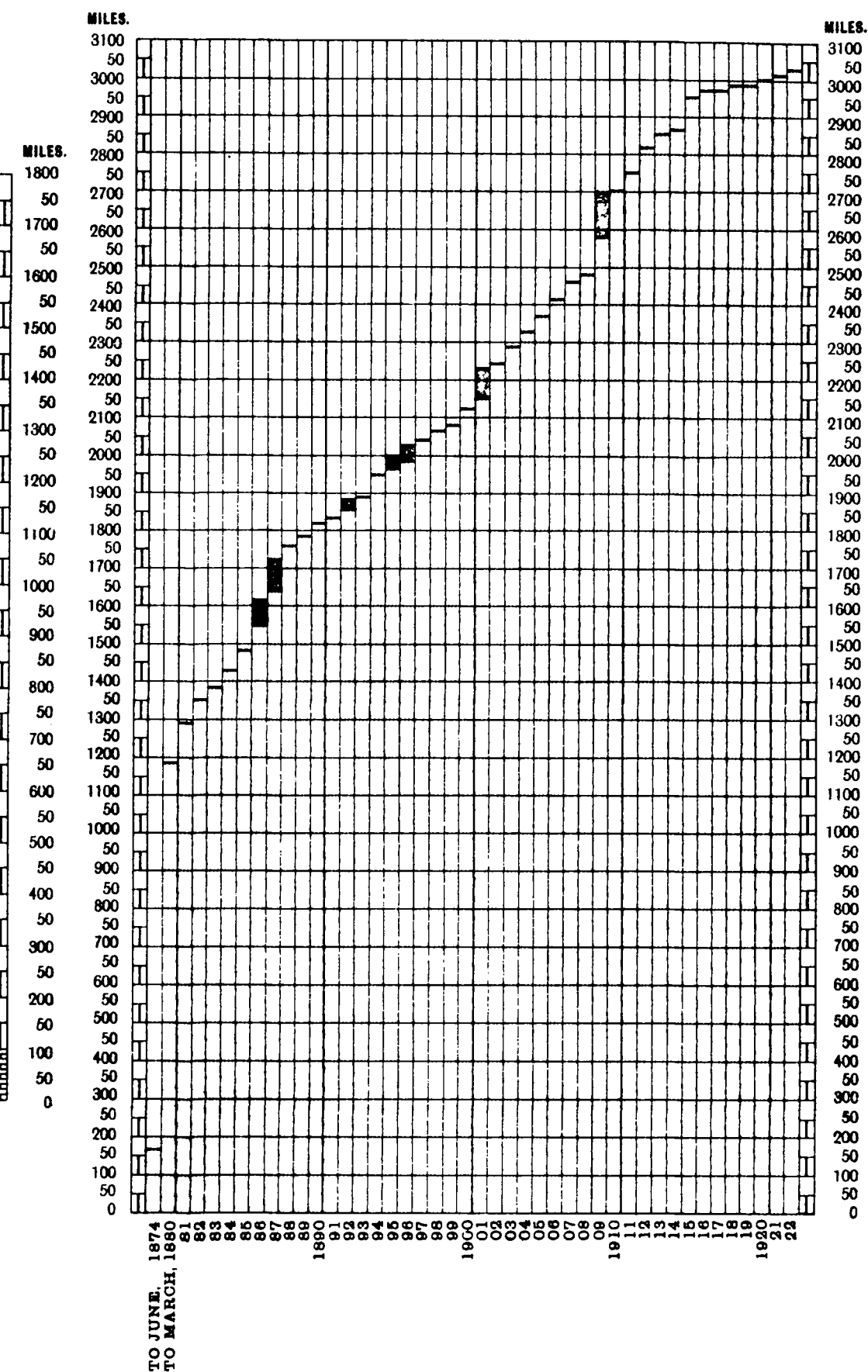


NUMBER OF MILES OPEN
OF
GOVERNMENT LINES.

SOUTH ISLAND.



NUMBER OF MILES OPEN
OF
GOVERNMENT LINES.
NORTH AND SOUTH ISLANDS COMBINED.



PRIVATE RAILWAYS ACQUIRED BY THE GOVERNMENT SHOWN ■■■■■

NUMBER OF MILES OPEN

GOVERNMENT LINES

AND 100% LANDS COMBINED

1910

1911

1912

1913

1914

1915

1916

1917

1918

1919

1920

1921

1922

1923

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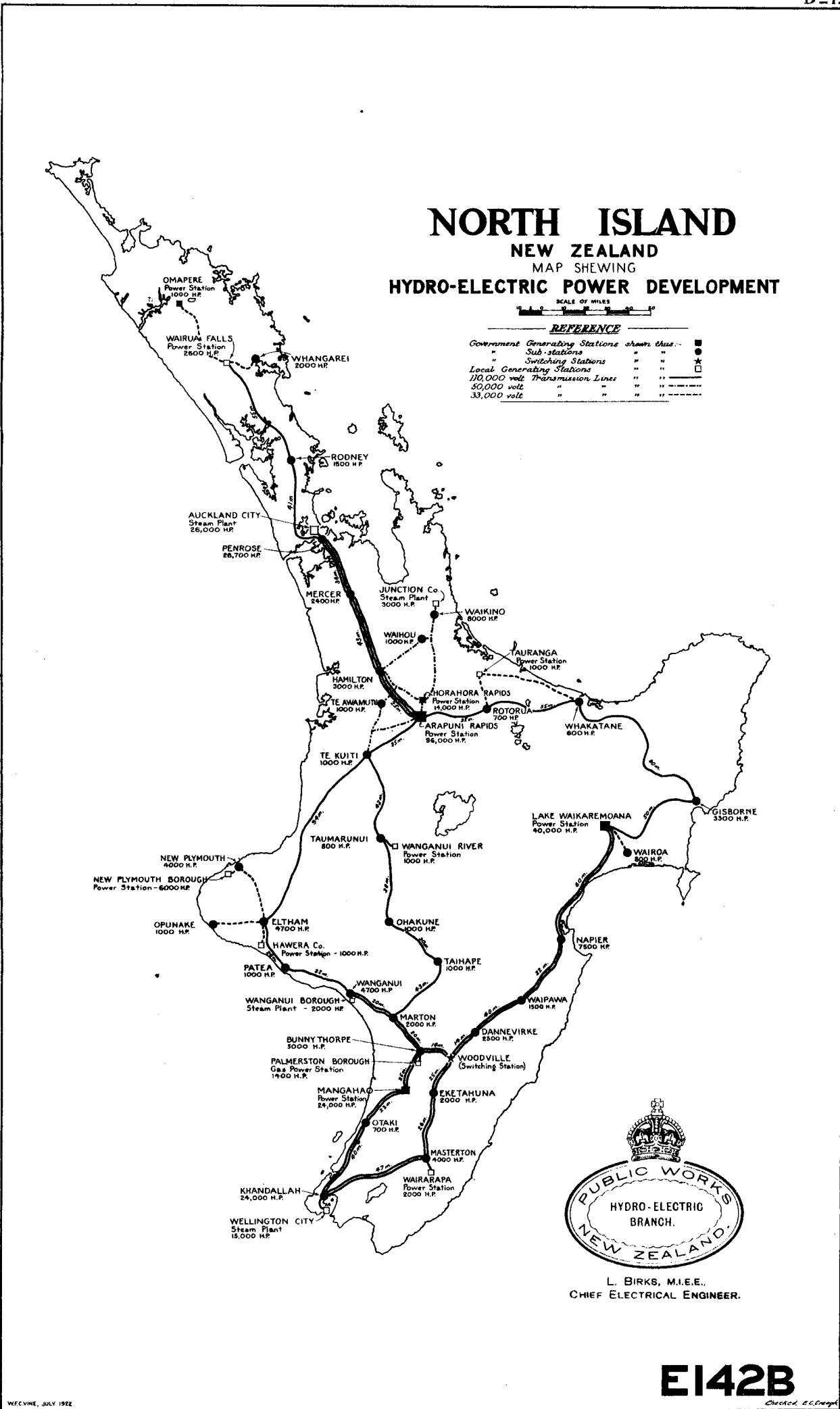
2039

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2043



SOUTH ISLAND

NEW ZEALAND

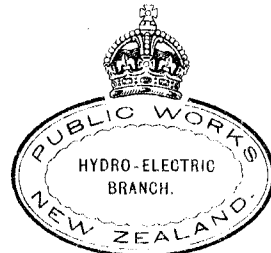
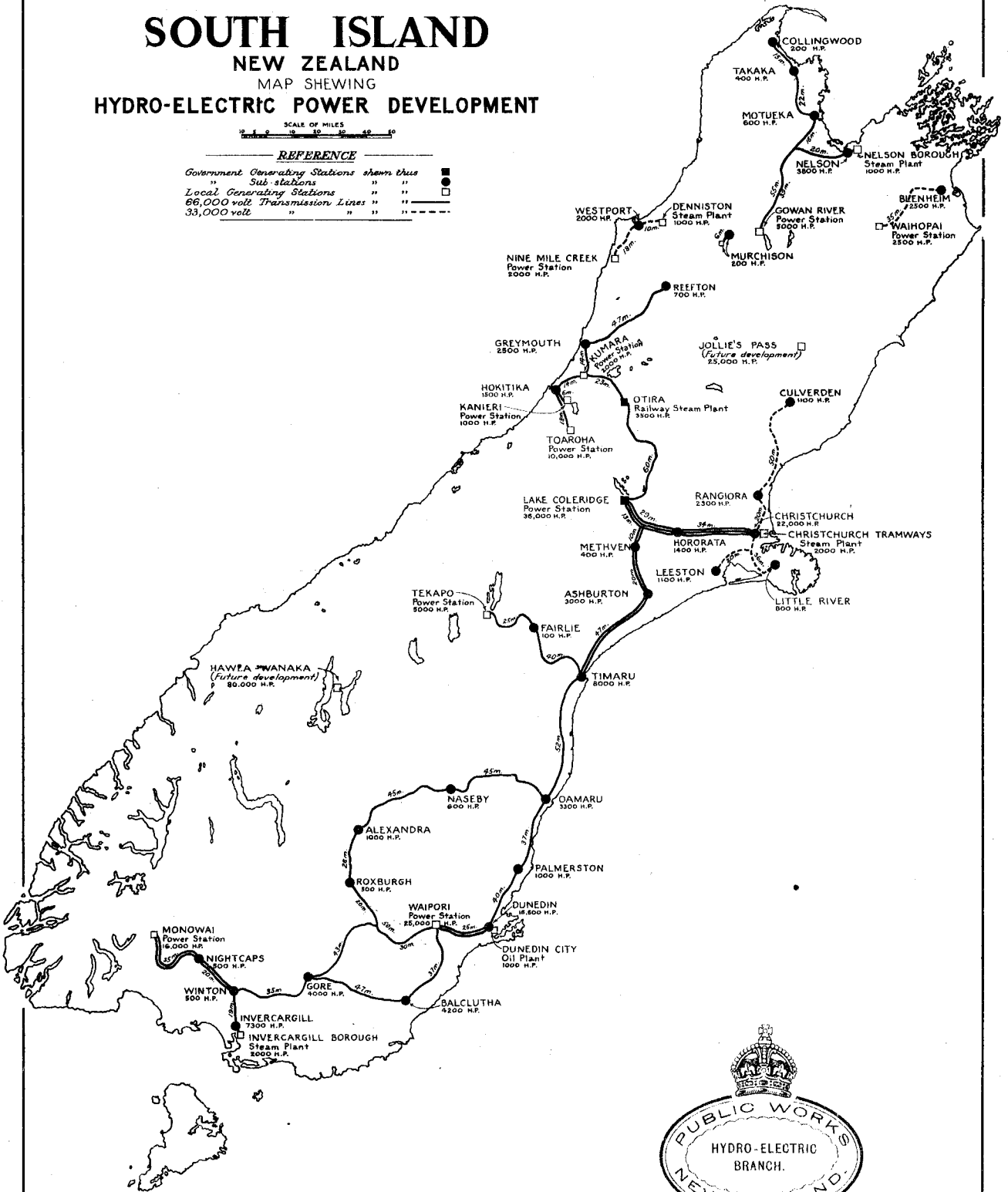
MAP SHEWING

HYDRO-ELECTRIC POWER DEVELOPMENT

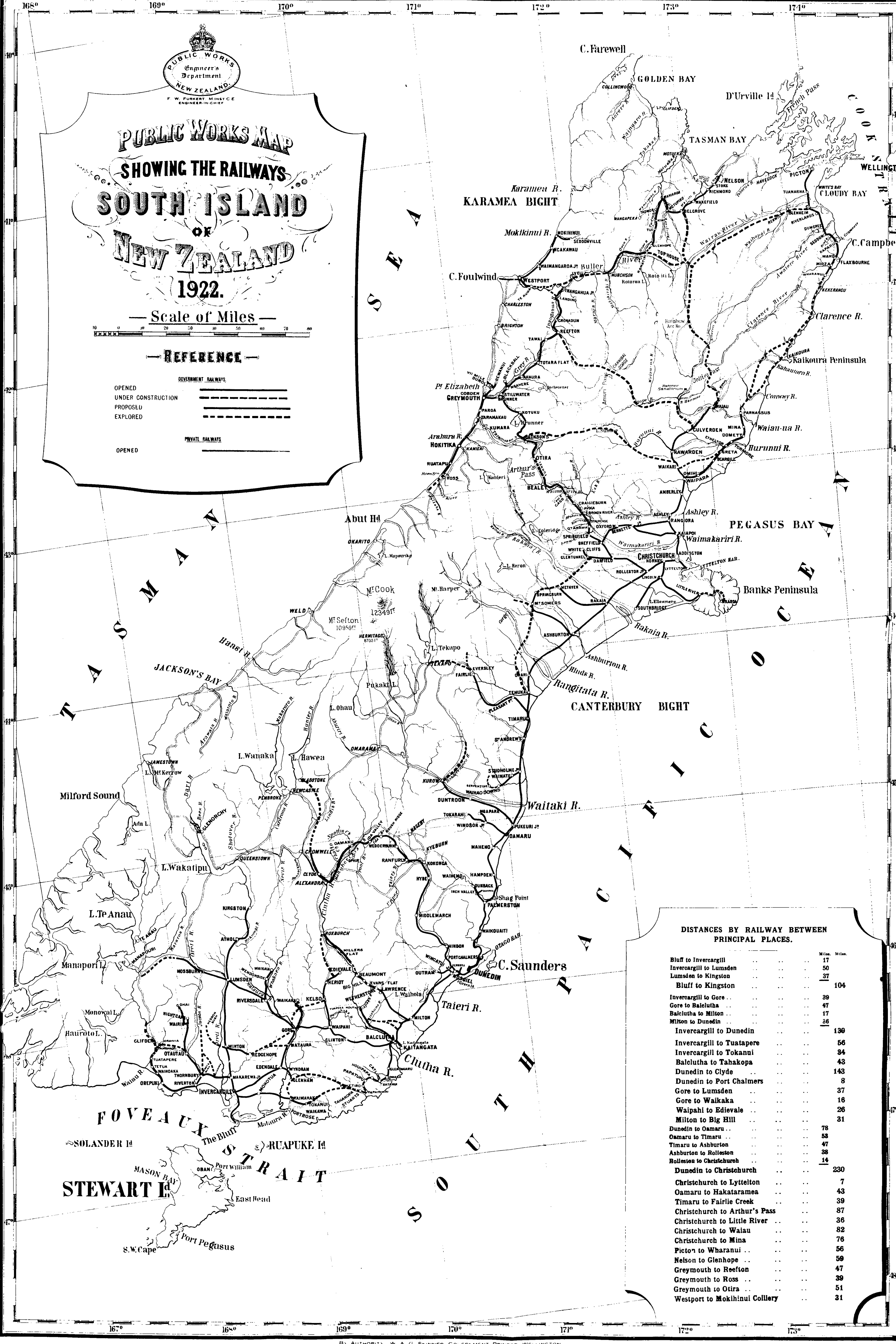
SCALE OF MILES
0 10 20 30 40

REFERENCE

Government Generating Stations shown thus 
 " Sub stations " " 
 Local Generating Stations " " 
 66,000 volt Transmission Lines " " 
 33,000 volt " " " " 

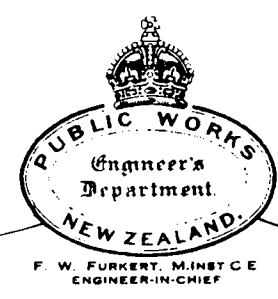
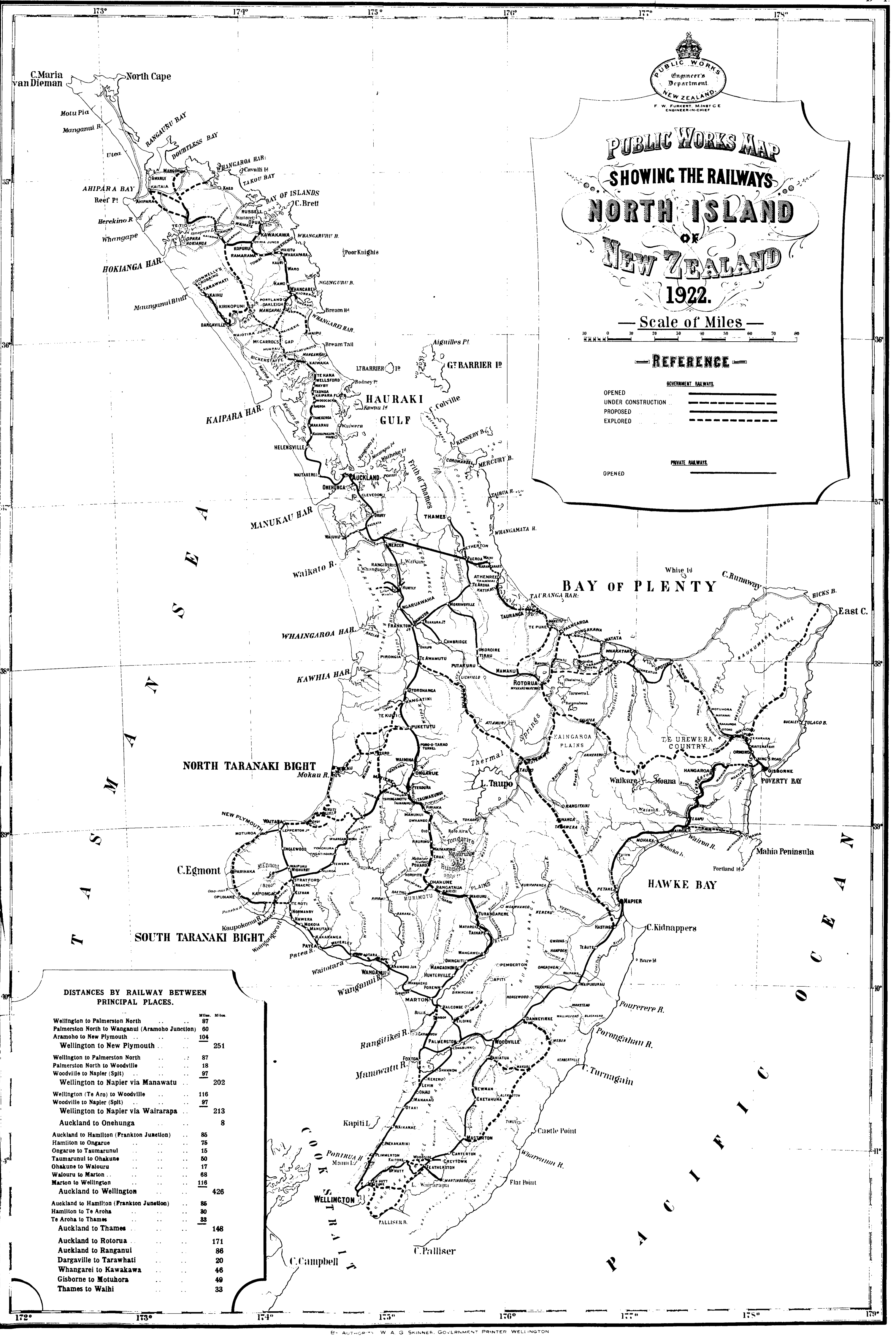


L. BIRKS, M.I.E.E.,
CHIEF ELECTRICAL ENGINEER.

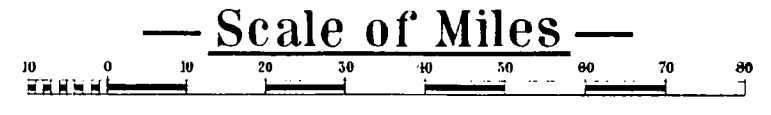


DISTANCES BY RAILWAY BETWEEN PRINCIPAL PLACES.

	Miles.	Miles.
Bluff to Invercargill	17	
Invercargill to Lumsden	50	
Lumsden to Kingston	37	
Bluff to Kingston	104	
Invercargill to Gore	39	
Gore to Balclutha	47	
Balclutha to Milton	17	
Milton to Dunedin	36	
Invercargill to Dunedin	139	
Invercargill to Tuatapere	56	
Invercargill to Tokanui	34	
Balclutha to Tahakopa	43	
Dunedin to Clyde	143	
Dunedin to Port Chalmers	8	
Gore to Lumsden	37	
Gore to Waikaka	16	
Waipahi to Edievale	26	
Milton to Big Hill	31	
Dunedin to Oamaru	78	
Oamaru to Timaru	53	
Timaru to Ashburton	47	
Ashburton to Rolleston	38	
Rolleston to Christchurch	14	
Dunedin to Christchurch	230	
Christchurch to Lyttelton	7	
Oamaru to Hakataramea	43	
Timaru to Fairlie Creek	39	
Christchurch to Arthur's Pass	37	
Christchurch to Little River	36	
Christchurch to Waiau	82	
Christchurch to Mina	76	
Pictou to Wharanui	56	
Nelson to Glenhope	59	
Greymouth to Reefton	47	
Greymouth to Ross	39	
Greymouth to Otira	51	
Westport to Mokihinui Colliery	31	



PUBLIC WORKS MAP
SHOWING THE RAILWAYS
NORTH ISLAND
OF
NEW ZEALAND
1922.



— REFERENCE —

GOVERNMENT RAILWAYS

OPENED

UNDER CONSTRUCTION

PROPOSED

EXPLORED

PRIVATE RAILWAYS

OPENED

DISTANCES BY RAILWAY BETWEEN PRINCIPAL PLACES.

	Miles.	Miles.
Wellington to Palmerston North	87	
Palmerston North to Wanganui (Aramoho Junction)	60	
Aramoho to New Plymouth	104	
Wellington to New Plymouth	251	
Wellington to Palmerston North	87	
Palmerston North to Woodville	18	
Woodville to Napier (Spit)	97	
Wellington to Napier via Manawatu	202	
Wellington (Te Aro) to Woodville	116	
Woodville to Napier (Spit)	97	
Wellington to Napier via Wairarapa	213	
Auckland to Onehunga	8	
Auckland to Hamilton (Frankton Junction)	85	
Hamilton to Ongarue	75	
Ongarue to Taumarunui	15	
Taumarunui to Ohakune	50	
Ohakune to Wairoa	17	
Wairoa to Marton	68	
Marton to Wellington	118	
Auckland to Wellington	426	
Auckland to Hamilton (Frankton Junction)	85	
Hamilton to Te Aroha	30	
Te Aroha to Thames	33	
Auckland to Thames	148	
Auckland to Rotorua	171	
Auckland to Ranganui	86	
Dargaville to Tarawhiti	20	
Whangarei to Kawakawa	46	
Gisborne to Motuhora	49	
Thames to Waihi	33	