

1917.
NEW ZEALAND.

PUBLIC WORKS STATEMENT,

BY THE HON. WILLIAM FRASER, MINISTER OF PUBLIC WORKS.

MR. SPEAKER,—

When I prepared my Public Works Statement last year I was under the impression that I would be able to expend within the financial year the most of the money I was asking Parliament to vote for road and bridges. Acting on this belief I authorized for expenditure the whole of this sum to either the local bodies or to my District Engineers on the basis of one-half of the unauthorized items on the estimates for each county.

Owing, however, to the impossibility of obtaining sufficient labour, I was unable to secure the expenditure of much more than one-half of the sum so authorized. The result is that from the sum I now propose asking Parliament to vote for roads and bridges—viz., £420,000—I have first to deduct £60,000 for the flood-damage vote, and then the unexpended authorities issued prior to the 31st March, 1917, amounting to £195,000. This will leave £165,000, which will be only sufficient to provide for about one-half of those items on last year's estimates which were not authorized, and also enable a few of the most urgent new applications to be dealt with.

If the war continues for another twelve months it can hardly be expected of me that I shall be able to expend the whole of the money proposed to be appropriated for roads and bridges ; still, I consider it advisable that I should be empowered to meet any contingency that may arise.

The extraordinary and continuous rainfall that has been experienced over the greater part of the North Island during the last twelve months has caused an enormous amount of damage to roads and bridges. The country became water-logged, and wherever the roads had not been metalled they were quite unable to bear any traffic and soon became quagmires, causing very serious inconvenience. I have endeavoured as far as it lay in my power to assist in repairing this damage, but the loss accruing from this deluge of rain has been very serious.

The following table shows the brief particulars of the expenditure of the year, and also the total under each class of work from the inauguration of the public-works policy up to the 31st March last :—

TOTAL EXPENDITURE.

Class of Work.	Expenditure.	
	Expenditure for Year ended 31st March, 1917.	Total Expenditure to 31st March, 1917.
Railways—	£	£
New construction	335,404	25,176,466
Additions to open lines	285,543	9,539,536
Roads	220,845	11,261,098
Public buildings	256,131	6,880,681
Immigration	6,533	2,338,272
Purchase of Native lands ... ..	...	2,061,963
Lighthouses, harbour-works, and harbour-defences	3,767	1,140,075
Tourist and health resorts... ..	1,094	258,509
Telegraph-extension ... ..	...	3,207,722
Development of mining	4,592	896,014
Defence-works (general)	9,742	1,036,977
Departmental	131,701	1,194,654
Development of water-power ... ..	...	18,451
Irrigation and water-supply	16,049	20,405
Payment to Midland Railway bondholders ... ..	...	150,000
Lands-improvement	Cr. 2,731	137,770
Minor works and services ... ..	...	312,607
Plant, material, and stores	9,778	84,196
Cost and discount, raising loans, &c.	35	1,253,072
	1,278,483	66,968,468
Wellington-Hutt Railway and Road Improvement { Railway	...	228,374
Account { Road ...	...	101,658
Railways Improvement Account ... ..	...	641,275
Railways Improvement Authorization Act 1914 Account	225,597*	365,351
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	24,730	165,679
National Endowment Account—Roads to open up endowment lands	6,787	53,401
Aid to Water-power Works Account	49,032*	356,570
Irrigation and Water-supply Account	4,745	115,000
Waihou and Ohinemuri Rivers Improvement Account... ..	10,407	52,592
Telegraph Extension Account	203,311*	203,311
Totals	1,803,092	70,155,713

* Including £1, cost of raising loan.

WAYS AND MEANS.

On the 1st April, 1916, the available ways and means for public-works purposes were	£	1,293,102
And further funds were received as under :—		
Under the Aid to Public Works and Land Settlement Act, 1914	500,000	
Other receipts and recoveries	6,906*	
Making a gross total of	1,800,008	
The ordinary expenditure of the year amounted to £1,278,448, plus the expenses of raising loans £35, thus bringing the total disbursements up to	£1,278,483*	

* Exclusive of expenditure of £439 under Ellesmere Land Drainage Act, 1908.

This leaves a balance to the credit of the Ways and Means Account at the end of the year of	£ 521,525
For the current year it is proposed to provide additional funds as under :—	
Balance of authorized loan-money still to be raised—	
Under the Aid to Public Works and Land for Settlements Act, 1914	45,100
Under the Finance Act, 1916, section 49 (Public Works)	700,000
Under the Finance Act, 1917	850,000
Making the total ways and means for 1917–18	<u>£2,116,625</u>

The estimated expenditure for public works for the current year (excluding separate accounts having their own ways and means) amounts to £1,881,715, leaving an estimated balance of £234,910 to be carried forward to next year (1918–19).

In addition to the amounts described above, we have authority to raise the following sums :—

	£
Under the Aid to Water-power Act, 1910	136,000
Under the Waihou and Ohinemuri Rivers Improvement Act, 1910	50,000

RAILWAY-CONSTRUCTION.

No sections of railway were opened for regular traffic during the financial year. Several sections are, however, almost complete as far as construction is concerned, and on some of them the Public Works Department is running a goods and passenger service.

The total expenditure on railway construction and improvement work during the last financial year amounted to £846,544, as under :—

	£
Construction of new lines	335,404
Addition to open lines	285,543
Railways Improvement Accounts	225,597

The following is a summary of the works which have been in progress during the year just closed :—

KAIHU VALLEY EXTENSION.

No work has been done on this line during the year, with the exception of a few small repairs to river-protection works.

KAWAKAWA-HOKIANGA.

Work was resumed on the Okaihau Section at the end of September last. Construction-work by co-operative labour is now in progress. One large cutting it is proposed to excavate by means of a steam navvy. The navvy has been ordered, but has not yet come to hand. Owing to the heavy rainfall experienced during the year floods were frequent, and caused much damage to both railway and roads in the vicinity. The permanent line has been pegged for a further distance of nine miles, and plans for same are nearly completed.

WHANGAREI—NORTH AUCKLAND MAIN TRUNK.

The first four miles of this line are being constructed by contract. The whole of the formation, with the exception of the south approach to the Otaika River bridge and a small cutting, is practically completed. It is expected that the contract will be completed in about three months' time. The scarcity of labour and the bad weather experienced during the last twelve months have greatly interfered with the progress of the work.

Construction-work is in hand by co-operative parties from 4 to 5½ miles.

During the year platelaying was commenced from Kioreroa Station, and one mile and a half has been laid. It is proposed to continue the platelaying to Portland Station as soon as possible, and to complete this portion of the line so that it may be opened for traffic. On the Tauraroa Section the whole of the formation has been completed. Rails have been laid the whole length of the section, and ballasting is in progress. The bridges over the Tauraroa River and Moewhare Creek have been completed, with the exception of the plate girders, which have not yet come to hand. Temporary stringers have been placed on the piers to carry the ballast-train.

On the Waiotira Section earthworks are in various stages of progress for about two miles.

NORTH AUCKLAND MAIN TRUNK.

Construction-work has been continued from Huarau northwards. Owing to the exceptional rainfall during the year very heavy slips occurred, interfering very considerably with the progress of the works. The passenger and goods traffic between Ranganui and Huarau has been maintained. On the Paparoa Section ballasting has been carried out to the rail-head.

Fair progress, under difficult conditions, has been made with the Huarau and Golden Stairs Tunnels. A tramway has been working constantly conveying goods and materials to these two tunnels.

No work was done during the year from Kirikopuni southwards.

WAIUKU BRANCH.

Construction-work on this line has proceeded steadily during the year. All the formation-work at Patumahoe and Helvetia Stations is practically completed. Over four miles and a half of rails, including sidings at Helvetia and Patumahoe Stations, have been laid, and good progress has been made with the ballasting.

HUNTLY-AWAROA.

A few minor works, including the completion of the access road to Pukemiro Station and the construction of a concrete dam for a water-supply, were carried out.

EAST COAST MAIN TRUNK.

Northern Section.—With the exception of the mile through Waihi Township, work was continued on this section—over a length of six miles—until March, when the works were closed down.

Tauranga Section.—Formation-work on this section is practically completed to Matata Station yard. The rail-head is now about three miles and a quarter from Matata Station yard.

Both passenger and goods traffic is run by the Public Works Department between Mount Maunganui and Paengaroa. No further progress has been made with the erection of the permanent bridge over the Kaituna River owing to the inability of the contractor to procure the necessary steelwork.

The only work done during the year in connection with the bridge across the Tauranga Harbour was the casting and partial sinking of cylinders at piers A and B.

Gisborne Northward.—The ballasting of the main line between Matawai and Motuhora Road Terminal Station, also the erection of the bridge over the Motu River, have been completed. A contract is in progress for the erection of the station buildings at Motuhora, and, with the exception of this, little work other than the usual finishing-up remains to be done.

The goods service between Matawai and Motuhora has been maintained throughout the year.

Gisborne Southward.—Concrete piers and abutments for three bridges have been erected, and concrete piles driven for another bridge. Some fencing and culverts have been erected. All platelaying has been completed, and ballasting is in progress.

A bi-weekly passenger and goods service between Makaraka and Ngatapa has been maintained by the Public Works Department during the year.

Napier Northward.—The work in connection with the erection of the West-shore Bridge has been steadily proceeded with. Further necessary plant and supplies

of steel and concrete have been brought to the site, and good progress has been made with the pile-driving. At the end of the year six 50 ft. spans and one 25 ft. span were completely finished.

No further work has been done by the Napier Harbour Board on the North Embankment. In April of last year the dredge was moved to the South Embankment and worked for about eight months of the year, the rest of the time being occupied in removal, overhaul, and repairs.

STRATFORD — MAIN TRUNK.

At the western end a limited number of men have been employed throughout the year on the varied classes of work necessary to carry the line from Whangamomona to Tahora. Heavy slips occurred, but have been removed. Two tunnels of about 24 chains each have been excavated and lined, and cuttings and banks up to Tahora Station are approaching completion. Rails are laid and ballasting completed up to Kohuratahi, four miles and a half beyond the terminus, and a temporary tramway service to Tahora is still in operation. Another twelve months should see the line completed to Tahora, where the terminus will probably remain for some years.

At the eastern end earthworks have been in progress over a length of $10\frac{1}{2}$ miles. The reinforced-concrete piers for the bridge over the Ongarue River have been completed. Progress on the Okahu Tunnel contract has been very slow. The total length of tunnel lined at the end of last March was 19 chains, leaving $55\frac{1}{2}$ chains yet to be done.

The contract let last year for the tunnels at 7 miles 55 chains and 8 miles 35 chains was determined in August last owing to the inability of the contractor to carry out the contract. The bottom headings and 2 chains of lining in brick were completed when the contract was determined.

OPUNAKE BRANCH.

Formation-work during the year has been restricted to the seven-mile section from Te Roti junction to Kapuni Station, on which banks and cuttings are nearly completed. Concrete piers for the bridge which will carry the line over the Waingonoro River are well in hand, but the construction of this and two other bridges on the first section will occupy the available staff for another year at least. The route of the branch line to serve Manaia has been cleared, several culverts put in, and road-deviations formed and metalled.

RAETIHI BRANCH.

The earthwork and platelaying is practically completed, and good progress has been made with the ballasting. Three bridges have been completed and a water-supply installed at Raetihi Station yard.

A goods service which is run by the Public Works Department was inaugurated in August last between Ohakune and Makaranui Stations, and has been well patronized, timber comprising the principal freight.

SOUTH ISLAND MAIN TRUNK.

Beyond the terminus at Wharanui Station formation-work, platelaying, and ballasting is completed for a distance of three miles and a quarter, but it was quite impossible during the year just closed to make any progress with the construction of two small steel bridges on this length. Formation-work on the line is practically suspended owing to shortage of labour.

WESTPORT—INANGAHUA.

No work has been done on this line during the past year.

NELSON—WESTLAND.

At the Nelson end construction-works were continued with a limited number of men until the end of February last, when all work was suspended.

ARTHUR'S PASS TUNNEL.

Work in connection with the construction of Arthur's Pass Tunnel has proceeded steadily throughout the year. At the Otira end the work has been carried out by day labour, 32½ chains of bottom heading has been driven through slate-rock and 17½ chains of excavation and lining completed. From the Bealey end 15½ chains of bottom heading has been driven through greywacke rock, and 3½ chains of excavation and lining completed.

Owing to the shortage of labour, the process of enlargement and lining has been considerably retarded, the average number of men working per shift being 26·8 at the Otira end and 12·9 at the Bealey end. The position at the end of March is that the bottom heading has been driven nearly 4 miles 46 chains, and the tunnel lined and excavated about 3 miles 60 chains. A distance of about 60 chains remains to be driven to connect the headings from each end of the tunnel.

CULVERDEN-WAIAU.

The whole of the formation, with the exception of about 5 chains at the Waiau end, has been completed. Rails have been laid to within 4 chains of the terminus. The first lift of ballasting has been completed to the rail-head, and the second lift is in progress.

Since the beginning of October last a goods service has been run by the Public Works Department between Culverden and Waiau, and *vice versa*, since the end of February last.

WAIMATE BRANCH EXTENSION.

No work has been done on this railway during the past year.

TUAPEKA MOUTH BRANCH.

Two trial surveys to connect the Hillend district with the main line were completed during the year, but further trials will have to be made before a route can be definitely selected.

OTAGO CENTRAL.

Formation-work on the extension from Clyde to Cromwell has been completed, and extensive damage caused by a thunderstorm in November last repaired. Three concrete bridges have been built, rails laid, and the line partially ballasted to within two miles of the Cromwell Station. A goods service has been maintained during the year between Clyde and the Half-way Station in the Gorge. The repair of washouts caused by the November floods will delay the opening of this extension.

WAIAU-ORAWA.

No construction-work has been undertaken during the year, but a few workmen were retained to do bush-clearing work over about one mile of the route.

OTHER RAILWAY-WORKS.

The expenditure out of the Public Works Fund under the heading "Additions to Open Lines" amounted to £285,543. Of this sum £250,321 was expended in the provision of additional rolling-stock, Westinghouse brake, steam-heating gear, electric light for cars and workshop machinery. The balance covered expenditure on improvements to station accommodation and yards, installation of tablet, telegraph, and telephone facilities, signalling and interlocking, improvements to wharves, and purchase of land.

ROADS ON GOLDFIELDS (MINES DEPARTMENT).

The total allocations under this head last year amounted to £41,766, on account of which a vote for £30,000 was taken. The expenditure during the year was £17,099, and the sum proposed to be allocated for the current year is £28,258, on account of which a vote of £20,000 is asked for.

DEVELOPMENT OF MINING.

The value of the mineral-output for the year was £2,978,436, being a decrease of £396,087 when compared with the output during the previous year. In addition to the mineral-output 1,331,003 tons of stone was obtained from quarries subject to inspection under the Stone-quarries Act.

The expenditure under the heading of "Development of Mining" during last year was £4,592. A vote of £1,450 is proposed to be taken this year.

PUBLIC BUILDINGS.

The total amount voted and expended on construction of public buildings during the last financial year amounted to—

New Buildings (Class XVIII, Public Works Fund)	Voted.	Expended.
	£364,000	£251,431

For the current year the following appropriation is proposed :—

New Buildings	£310,000
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GENERAL.

Under this heading the new Parliament Buildings still accounts for the heaviest item of expenditure. Considering the unfavourable labour conditions ruling at present, fair progress has been made with the work during the past year.

Substantial additions to the Government Printing Office have been completed.

JUDICIAL.

Courthouses.—During the past year no new buildings were erected, but an addition was made to the Courthouse at Napier.

Prisons.—An extension to the south wing of the Auckland Prison has been completed and occupied. The new north wing of the Invercargill Prison has been completed, and is now ready for occupation. Subdivisional walls at Auckland and the main walls at Invercargill have been proceeded with, and progress has been made in the erection of the first wing of the Paparua Prison buildings at Templeton. During the current year the major works being carried on are the buildings at Templeton, the provision of a kitchen block, offices, and subdivisional walls at Invercargill, and of an administration block and dairy buildings at Waikeria.

Police-stations.—New buildings were erected at Waipukurau and Caversham, and a site for a police-station was purchased at Devonport. Good progress has been made with the erection of the new headquarters station at Wellington, which is now nearing completion. Additions to the Auckland Central Station to provide much-needed office and lock-up accommodation are also in course of construction.

POST AND TELEGRAPH.

Owing to the war conditions, expenditure on new buildings and additions and alterations to existing buildings has been kept down as much as possible.

During the year small post-offices were erected at Kaitieke, Ruatorea, Mokau, and Waituna West; and automatic exchanges built at St. Albans and South Dunedin. Additions were made to the office buildings at Te Awamutu, Hanmer Springs, Waitara, Whakatane, and Wanganui.

In addition to the appropriations previously authorized but not expended, it is proposed to make provision for a new post-office building at Henderson, a line-man's cottage at Kahukura, a motor-garage at Napier, store buildings at Wellington, and alterations and additions at Ferry Road, Christchurch.

MENTAL HOSPITALS.

At Porirua the block of buildings designed for receiving and hospital wards is nearly completed, and in its "hospital" character, with ease of administration and observation, marks a decided advance. A nurses' home is part of this building.

A survey has been made and materials have been collected for piping the septic-tank effluent into the harbour.

At Sunnyside a receiving and hospital block on the same general plan as at Porirua is nearing completion. A further contribution has been made to electrifying the machinery, and the Vigilant automatic fire-alarm system is being installed. An auxiliary farm of 338 acres has been acquired at Templeton.

At Tokanui the erection of a third unit was completed, and satisfactory progress is being made on a fourth. The permanent water-mains have replaced the temporary service. Four additional cottages for the married staff are nearly ready.

At Nelson a brick kitchen has been erected as a first instalment to the rebuilding of the institution. The removal of the old kitchen will allow the drainage system to be remodelled to connect with the new sewer.

The current year's estimates provide for a substantial contribution to the scheme for further classification and increase of accommodation and other urgent works.

AGRICULTURE.

The expenditure under this heading for the past year was not large.

For the current year some further necessary improvements at experimental farms and quarantine stations are provided for, together with an item to cover the cost of the purchase of land for an experimental farm in Westland.

HOSPITALS.

Considerable expenditure is required this year in order to provide the necessary facilities at St. Helens Hospitals. Land has been purchased adjoining St. Helens Hospital, Auckland, on which it is proposed to erect new wards, utilizing the present building as an administrative block and nurses' quarters. It is proposed to proceed immediately with the erection of new buildings at Christchurch, and to erect new wards at St. Helens Hospital, Dunedin, utilizing the present hospital as an administrative block and nurses' quarters. A suitable building has been purchased for the purpose of a St. Helens Hospital at Invercargill, and provision is made for this expenditure, together with the necessary alterations thereto. Additions are also required at Townley St. Helens Hospital, Gisborne.

Considerable extension is required to the accommodation at present available for consumptives. This has been more especially necessitated owing to institutional treatment having to be afforded to returned soldiers. Extensions and improvements are required at both Otaki and Te Waikato Sanatoria, and this is provided for. An item has also been renewed to enable grants to be made to Hospital Boards to provide accommodation for consumptives.

WORKERS' DWELLINGS.

Of last year's vote of £50,000 only £35,437 was expended: there were also liabilities incurred of £295 for dwellings in course of erection and for land the purchase of which was being arranged. For the current year a vote of only £20,000 is proposed, as owing to the high cost of materials it is unlikely that many dwellings will be erected.

DEVELOPMENT OF WATER-POWER.

The Lake Coleridge electrical-power undertaking has now completed its second year of operation. The maximum load reached 6,250 horse-power, which is in excess of the rated capacity of the three power units then installed at Lake Coleridge. Since the completion of the financial year, however, the fourth unit has been put in service, making a total installed capacity of 8,000 horse-power. An additional unit of machinery is on order having a capacity of 4,000 horse-power, and also material for a pipe-line. The manufacture of the turbine and the generator is well advanced, but there is very little prospect of getting delivery of the plates for the pipe-line, and efforts to obtain a permit for the manufacture from the Home authorities have been unavailing.

During the year the additional consumers connected comprised the Christchurch Tramway Board, the Islington Freezing-works, Borthwick's Freezing-works (Belfast), the North Canterbury Farmers' Freezing-works at Kaiapoi, and two flour-mills.

The financial results of the year's operations may be considered satisfactory, and a balance of £7,865 was carried to the net revenue account. The prospects for the present year are promising, and there is every indication at present that the undertaking will earn sufficient to meet interest charges and depreciation as well as working-expenses.

During the year the feeder lines have been extended from Belfast to Kaiapoi, but owing to the lack of material and other considerations extensions in other directions have had to be postponed. Urgent requests have been received from Akaroa, Southbridge, Leeston, Timaru, and other municipalities and districts on the route of the transmission-line from Christchurch to Timaru, but it has been impossible to comply with these requests. The demand for power threatens to exceed the capacity of the present machinery, and, having regard to the difficulty of obtaining delivery of machinery and plant on order to cope with the demand, the Department have declined for the present to enter into fresh contracts of any magnitude. A request has also been addressed to the Christchurch City Council and other local authorities taking a supply from the Department to exercise restraint in making new contracts.

In order to tide over the difficulty of shortage of plant and to enable the Department to place the whole of the machinery in Lake Coleridge in service, a contract is being negotiated with the Christchurch Tramway Board and with the Christchurch City Council for the use of their steam plant for stand-by purposes.

During the year considerable progress has been made with the surveys and other preliminary work in connection with the development of hydro-electric works in the North Island. Surveys have been completed for headworks on the Mangahao River, at Arapuni on the Waikato River, and a survey of the transmission-line between Shannon and Wellington has been completed, whilst a survey of a transmission-line between Auckland and the Waikato River is in progress.

Investigations have been directed towards determining the best method of providing a general supply of electricity for the North Island. The indications point to the advisability of developing three sources—namely, the Waikato River, Waikaremoana, and the Mangahao in the south. Other water-power sources will, in all probability, be developed in course of time, but the three sources mentioned above would constitute the principal sources.

A start has been made with the work of ascertaining the power requirements in the Wellington District, and a systematic canvass is being made of the power-users and their requirements ascertained.

A total of thirty-seven licenses has been issued during the year for electric light and power purposes.

IRRIGATION.

Only minor works in connection with the Ida Valley scheme in Central Otago were carried out during the year, consisting of a diverting-weir at the Manorburn Dam and the completion and repair of some of the distributing-races. A few settlers in the valley were again supplied with water from the dam for irrigation on a small scale.

Considerable progress has been made with the scheme to serve the country between Alexandra and Clyde from the Manuherikia River. The site of the intake has been fixed, and the construction of a tunnel in the river-gorge commenced. The locality is particularly rough, and a special service road, with tram-line to the intake, has to be constructed. Slow progress is being made with the excavation of the main race to lead the water out of the gorge, and slips on the steep hillside are of frequent occurrence.

WAIHOU AND OHINEMURI RIVERS IMPROVEMENT.

The dredge has been employed principally on excavating the Ngararahi Cut, which is 63 chains in length. At the end of March last there still remained about 12 chains to excavate through to the upper Waihou River. By means of the dredge about 26 chains of stop-bank was constructed between Paeroa and Netherton.

Four contracts were let for the construction of about 1 mile 60 chains of stop-banks on the left bank of the Waihou River above the Ngararahi Cut, but the work has not yet been completed.

A considerable amount of survey-work in connection with further proposed stop-banks and drains has been done. The abnormal rainfall experienced in the district during the period under review has greatly hampered the progress of the works.

WANGANUI RIVER.

At the request of the Wanganui River Trust an exhaustive inspection was made of the Wanganui River from Raorikia, a few miles above Wanganui, to Taumarunui, with the object of ascertaining what is necessary to properly maintain the works which have already been carried out by the Wanganui River Trust; also as to what further works are required to make the river navigable by the river-steamers at all times of the year.

TOURIST AND HEALTH RESORTS.

No public works of any importance were undertaken during the year. The total amount expended was £1,094, compared with £5,167 for the previous year, and more than half of this amount was expended on drainage and water-supply works in Rotorua.

TELEGRAPH EXTENSION.

During the past year the extension of telegraph and telephone lines has resulted in the opening of forty new offices and ten new exchanges.

The total expenditure amounted to £203,310.

All construction-work has been considerably hampered on account of the short supplies of materials and limited staffs. Among the larger works undertaken were the construction of the following lines: Auckland-Dargaville M.C., Hamilton-Auckland M.C., Tauranga-Whakatane M.C., Gisborne-Opotiki telephone circuit, Wanganui-Wellington M.C., Glenavy-Christchurch M.C., Dunedin-Glenavy M.C., Middlesmarch-Alexandra, Auckland-Pukekohe, Stratford-Hawera, Waitotara-Orangimea telephone extensions, and Christchurch-Kaiapoi.

Two hundred and twelve miles of line and 2,268 miles of wire were added to the telegraph system, and 460 miles of line and 13,944 miles of wire to the telephone exchange system.

The number of telephone-exchange connections increased by 3,547. Underground cables were put down in several of the larger towns, and arrangements are in hand to extend this method. Thirty-nine new slot telephones were installed, bringing the total in use up to 237.

LIGHTHOUSES.

The automatic light on Okuri Point, to indicate the position of the dangerous Beef Barrel rocks, near the French Pass, has been completed, and was first exhibited on the 24th June, 1916. The light is giving satisfaction to mariners.

Incandescent lights have been installed at Cape Foulwind and Manakau South Head. These lights are now installed at Cape Maria van Diemen, Cape Brett, Tiritiri, Cuvier Island, Castle Point, Cape Palliser, Pencarrow Head, Cape Egmont, Brothers, Cape Campbell, Godley Head, Akaroa Head, Jack's Point, Cape Saunders, Nugget Point, Waipapapa Point, Centre Island, Puysegur Point, Kahurangi Point, Farewell Spit, Stephen Island, Manukau Head, and Cape Foulwind. By their installation improved lights have been obtained, and also a considerable saving in the expenditure for oil, as these lights burn kerosene, which is cheaper than the paraffin used in the old lights.

The tower of the lighthouse at Dog Island was found to be insecure, and it has been decided to encase the existing masonry tower in concrete, and the necessary plans are now in course of preparation.

It has also been decided to erect new dwellings for the keepers at Puysegur Point Lighthouse, and some of the material required has been taken to the station by the s.s. "Hinemoa," but the erection of the buildings will not be put in hand until the summer.

DEPARTMENTAL.

The total number of permanent officers and employees in the Public Works Department on the 31st March, 1917, was 680, and of these ten have been discharged from the Expeditionary Forces as unfit for active service, and 150 are either in camp or serving abroad with the Expeditionary Forces.

The total casualties suffered by the permanent officers of the Department since the outbreak of war are as follows: Died of wounds, 10; died of sickness, 2; wounded, 30; gassed, 1.

In place of permanent officers and employees who have joined the Forces, the Department has taken on forty-eight officers, most of whom are employed in a temporary capacity.

CONCLUSION.

Let me state how greatly I appreciate the patriotism of those local bodies and settlers throughout the Dominion who have refrained from pressing their demands for expenditure during the war, on works which in normal times would be considered very important.

I regret exceedingly that I have not been able to do more to relieve many cases of hardship, especially in the blackblocks; but as soon as the war is over and our boys return, ample means will be then available to provide employment for all who need it. The construction of roads, bridges, and railways will be pushed ahead, and thus facilities will be afforded for increased settlement and for increased production.

It is on these two factors that New Zealand has to depend to enable it to bear the heavy burden it has so readily assumed in aiding the Empire to win this appalling war.

PUBLIC WORKS STATEMENT, 1917.

INDEX.

TABLES.

	Page
No. 1.—TOTAL EXPENDITURE: Summary showing Total Expenditure out of Public Works Fund to 31st March, 1917, and Liabilities at that Date	2
No. 2.—YEARLY EXPENDITURE OUT OF PUBLIC WORKS FUND, 1895 TO 1917	3
No. 3.—RAILWAYS: Statement showing Expenditure on Construction of Railways to 31st March, 1917, and Liabilities at that Date	7
No. 4.—EXPENDITURE OUT OF SEPARATE ACCOUNTS UNDER THE CONTROL OF THE PUBLIC WORKS DEPARTMENT	10
No. 5.—DEVELOPMENT OF WATER-POWER: Statement of Accounts as at 31st March, 1917	11

APPENDICES.

Appendix A.—EXPENDITURE FOR THE YEAR: Audited Statement of Expenditure out of the Public Works Fund for the Year 1916-1917	17
" B.—ANNUAL REPORT ON PUBLIC WORKS, by the Engineer-in-Chief	19
" C.—ANNUAL REPORT ON PUBLIC BUILDINGS, by the Government Architect	43
" D.—ANNUAL REPORT ON ELECTRICAL WORK AND POWER SCHEMES, by the Chief Electrical Engineer	46
E.—HYDRO-ELECTRIC DEVELOPMENT—NORTH ISLAND SCHEME, by the Chief Electrical Engineer	49

TABLE NO. 1.
SUMMARY SHOWING THE TOTAL EXPENDITURE ON PUBLIC WORKS AND OTHER SERVICES OUT OF PUBLIC WORKS FUND TO 31ST MARCH, 1917, AND THE LIABILITIES ON THAT DATE.

Number of Table containing Details.	Works.	Total Net Expenditure to 31st March, 1916.	Expenditure during Twelve Months ended 31st March, 1917.	Recoveries on Account of Services of Previous Years.	Total Net Expenditure to 31st March, 1917.	Liabilities on 31st March, 1917.	Total Net Expenditure and Liabilities.	Works.
3	Railways* ..	£ 34,099,900	£ 620,947	£ 4,845	£ 34,716,002	£ 233,271	£ 34,949,273	Railways.
..	Roads ..	11,040,253	220,845†	..	11,261,098	116,564	11,377,662	Roads.
..	Development of mining ..	841,422	4,592	..	846,014	..	846,014	Development of mining.
..	Telegraphs ..	3,207,722	..	..	3,207,722	..	3,207,722	Telegraphs.
..	Public buildings ..	6,624,550	256,131‡	..	6,880,681	150,935	7,031,616	Public buildings.
..	Lighthouses, harbour-works, and harbour-defences ..	1,136,308	3,767	..	1,140,075	140	1,140,215	Lighthouses, harbour-works, and harbour-defences.
..	Departmental ..	1,062,953	131,701§	..	1,194,654	1,316	1,195,970	Departmental.
..	Development of water-power|| ..	18,451	..	..	18,451	..	18,451	Development of water-power.
18 of 1878	Coal-exploration and mine-development ..	10,835	..	..	10,835	..	10,835	Coal-exploration and mine-development.
11 of 1877	Aiding works on Thames goldfields ..	50,000	..	..	50,000	..	50,000	Aiding works on Thames goldfields.
..	Immigration ..	2,331,739	6,533	..	2,338,272	..	2,338,272	Immigration.
..	Purchase of Native lands ..	2,062,831	..	..	2,061,963	..	2,061,963	Purchase of Native lands.
..	Defence ..	1,027,235	9,742	..	1,036,977	113	1,037,090	Defence.
..	Charges and expenses of raising loans ..	1,253,037	35	..	1,253,072	..	1,253,072	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 ..	257,415	1,094	..	258,509	190	258,699	Tourist and health resorts.
..	Lands improvement ..	140,501	Cr. 2,731	..	137,770	..	137,770	Lands improvement.
..	Payment to Midland Railway bond-holders ..	150,000	..	..	150,000	..	150,000	Payment to Midland Railway bond-holders.
..	Irrigation and water-supply¶ ..	4,356	16,049	..	20,405	1,424	21,829	Irrigation and water-supply.
..	Plant, material, and stores ..	74,418	9,778	..	84,196	2,980	87,176	Plant, material, and stores.
..	Totals ..	65,695,698	1,278,483	5,713	66,968,468	506,933	67,475,401	Totals.

* Exclusive of expenditure on Hutt Railway and Road Improvement, and Railways Improvement Accounts. † Includes £1,050 charged to "Unauthorized." ‡ Includes £4,700 charged to "Unauthorized." § Includes £17 charged to "Unauthorized." ¶ Expenditure subsequent to 1911-12 is under separate special account. † Expenditure 1911-12 to 1915-16 and part 1916-17 is under separate special account.

TABLE NO. 2.
GENERAL SUMMARY.

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND, 1895-96 to 1916-17.

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, 1895.	Expenditure.										
		1895-96.	1896-97.	1897-98.	1898-99.	1899-1900.	1900-1.	1901-2.	1902-3.	1903-4.	1904-5.	1905-6.
Immigration	£ 2,146,654	Cr. 10	£ 301	£ 70	£ 105	£ 385	£ 214	£ 139	£ 142	£ 7	£ 6,481	£ 8,753
Public Works Departmental	384,841	14,300	14,892	9,689	10,090	12,572	12,932	17,771	13,949	16,088	12,814	13,517
Development of Water-power .. .. .	..	..	..	..	..	..	..	..	..	..	468	2,901
Irrigation and Water-supply .. .. .	..	..	..	..	..	..	..	..	..	..	..	..
Railways	14,902,572	197,105	207,231	351,600	374,192	417,937	717,723	1,333,940	759,752	828,704	779,891	1,021,265
Payment to Midland Railway Bondholders .. .. .	..	..	..	..	..	..	..	..	..	150,000	..	..
Roads :—												
Miscellaneous Roads and Bridges	3,705,312	45,261	15,691	241,209	248,934	237,351	267,374	354,687	230,349	316,248	202,850	306,065
Roads on Goldfields	241,213	Cr. 573	Cr. 365	Cr. 365	Cr. 365	Cr. 347	48,417	47,573	51,690	45,594	26,112	45,139
Development of Thermal Springs and Natural Scenery .. .. .	..	21,513	32,578	49,569	46,550	48,039	..	..	..	..	..	..
Lands Improvement Account*	89,207	108,168	16,023	..	..	..	..	..	..	..	..	..
Total, Roads	4,035,732	174,369	167,482	290,413	295,119	285,043	315,791	402,260	282,039	361,842	228,962	351,204
Development of Mining	578,306	9,345	10,508	33,117	17,355	21,815	15,907	15,326	24,213	16,278	6,258	18,533
Purchase of Native Lands	1,297,854	..	Cr. 37	61,503	53,182	32,025	28,688	18,261	15,782	5,352	6,281	13,777
Native Lands Purchase Account	199,569	163,411	129,000	..	..	..	..	..	..	..	..	..
Total, Land Purchases	1,497,423	163,411	128,963	61,503	52,957	32,025	28,688	18,261	15,782	5,352	6,281	13,777
Telegraph Extension	699,022	35,538	36,791	29,384	28,551	26,771	50,101	31,729	68,578	47,228	79,298	77,186

* 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, 1895-96 to 1916-17—continued.

Description of Services.	Total Net Expenditure to 31st March, 1895.	Expenditure.										
		1895-96.	1896-97.	1897-98.	1898-99.	1899-1900.	1900-1.	1901-2.	1902-3.	1903-4.	1904-5.	1905-6.
Public Buildings :—												
General (including Miscellaneous)	£ 198,909	£ 3,724	£ 8,178	£ 14,797	£ 8,764	£ 3,957	£ 5,594	£ 12,513	£ 9,031	£ 10,964	£ 9,021	£ 2,231
Parliamentary	20,993	27,341	9	466	20,636	9,883	3,039	4,424	1,503	602	697	71
Judicial	294,832	6,194	14,806	12,727	11,109	19,682	29,630	28,728	33,224	25,978	13,083	15,899
Post and Telegraph	158,134	6,194	7,504	5,888	5,168	13,483	20,954	40,361	74,686	53,918	16,008	38,419
Customs	5,872	647	16	385	..	107	875	2,066	6,630	8,719	13,018	7,903
Quarantine-stations	3,834	..	..	..	..	..	2,607	424	..	..	..	..
Mental Hospitals	363,132	10,935	16,404	14,130	17,667	17,712	18,872	16,743	10,167	15,812	15,949	16,235
Public Health	..	..	..	..	..	..	..	..	..	6,315	4,265	7,926
Hospitals and Charitable Institutions	41,183	6,561	700	..	..	899	5,141	1,200	3,540	4,291	1,204	4,786
School Buildings	857,014	20,000	22,143	23,864	43,403	49,256	33,681	38,606	57,790	87,089	42,721	69,223
Agricultural	997	1,127	819	1,328	520	447	971	535	883	2,504	1,362	2,618
Workers' Dwellings	..	..	..	..	..	..	..	..	..	..	..	..
Total, Public Buildings	1,944,900	76,529	70,579	73,585	107,267	115,426	121,364	145,600	197,454	216,192	117,328	165,311
Lighthouses, Harbour-works, and Harbour-defences :—												
Lighthouses..	128,820	234	6,067	2,180	3,727	3,333	1,017	2,080	6,082	6,206	2,167	962
Harbour-works	310,757	3,861	866	568	1,777	365	1,540	3,421	1,373	1,773	1,308	2,684
Harbour-defences	470,527	3,314	4,667	2,547	10,158	5,328	3,960	6,678	6,126	2,885	2,515	1,300
Total, Lighthouses, &c.	910,104	7,409	11,600	5,295	15,662	9,026	6,517	12,159	13,581	10,864	5,990	4,946
Rates on Native Lands	61,634	340	332	156	347	744	673	571	471	666	631	548
Contingent Defence	429,719	5,000	10,554	10,360	13,867	42,810	37,650	146,875	37,005	38,723	46,588	35,569
Tourist and Health Resorts	..	..	..	..	..	..	..	11,260	10,949	15,643	17,508	15,888
Lands Improvement*	..	..	..	..	..	..	..	1,741	2,349	2,019	2,248	1,052
Charges and Expenses of raising Loans	1,026,828	..	943	5	224	28,322	1,460	5,620	88,180	87,249	10,764	236
			Cr. 6	Cr. 5				Cr. 5 1/6				
Interest and Sinking Funds	218,500	..	..	..	..	..	..	..	..	..	..	..
Coal-exploration and Mine-development	10,835	..	..	..	..	..	..	..	..	..	..	..
Thermal Springs	14,600	..	..	..	..	..	..	..	..	..	..	..
Total Ways and Means Credits	28,861,220	573	705	370	500	347	1,309,020	2,142,736	1,514,444	1,796,841	1,321,510	1,730,686
Grand Total—Net Expenditure	..	683,336	659,836	865,172	915,736	992,876	1,309,020	2,142,736	1,514,444	1,796,841	1,321,510	1,730,686

* 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, 1895-96 to 1916-17—continued.

Description of Services.	Expenditure.										Total Net Expenditure to 31st March, 1917.
	1906-7.	1907-8.	1908-9.	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.	1916-17.
Immigration	£ 14,353	£ 9,132	£ 15,075	£ 17,003	£ 9,441	£ 11,681	£ 14,694	£ 33,914	£ 33,219	£ 10,010 Cr. 10	£ 6,533
Public Works Departmental*	16,710	18,219	24,512	41,176	42,733	49,864	57,426	66,650	100,719	111,489	†131,701
Development of Water-power*	4,664	315	..	..	1,021	9,082	†	†	†	†	†
Irrigation and Water-supply‡ .. .. .	..	..	..	..	1,562	2,794	||	||	||	||	||16,049
Railways	1,227,880	1,093,635	1,116,184	1,128,400	1,104,071	1,125,905	1,148,832	1,104,897	2,146,753	1,065,171	620,947
Payment to Midland Railway Bondholders .. .. .	..	..	..	..	..	..	..	..	..	..	Cr. 4,845
Roads:—	..	..	..	..	..	..	..	..	..	..	..
Miscellaneous Roads and Bridges	308,500	285,248	422,174	297,932	229,537	383,511	337,584	(353,836 Cr. 515	484,365	400,062	**203,746
Roads on Goldfields	38,970	38,494	47,375	40,830	25,626	41,067	36,761	24,143	30,065	24,432	17,099
Development of Thermal Springs and Natural Scenery .. .. .	..	..	..	..	..	..	..	..	..	..	..
Lands Improvement Account .. .. .	..	..	..	..	..	..	..	..	..	..	..
Total, Roads	347,470	323,742	469,549	338,762	255,163	424,578	374,345	377,464	514,430	424,494	220,845
Development of Mining	11,064	8,633	32,859	18,597	10,845	21,244	10,644	4,889	2,384	6,602	4,592
Purchase of Native Lands	9,135	2,190	2,099	30,567	2,976	Cr. 2,466	Cr. 917	Cr. 857	Cr. 1,060	Cr. 972	Cr. 868
Native Lands Purchase Account .. .. .	..	..	..	..	..	..	..	..	..	..	..
Total, Land Purchases	9,135	2,190	2,099	30,567	690	Cr. 2,466	Cr. 917	Cr. 857	Cr. 1,060	Cr. 972	Cr. 868
Telegraph Extension	114,068	155,491	163,033	123,423	111,867	147,692	251,375	392,648	288,395	249,554	††
											3,207,722

* Expenditure on Development of Water-power, 1903-4, £2,561; 1908-9, £101 included in Class Public Works Departmental.

from 1912-13 is under the Aid to Water-power Works Account.

under the Irrigation and Water-supply Account.

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

†† Expenditure is under "Telegraph Extension Account."

† Includes "Unauthorized," £17.

|| Expenditure from 1912-13 to 1915-16 and part of 1916-17 is

** Includes £1,050

TABLE NO. 2—continued.

GENERAL SUMMARY—continued.

Showing NET YEARLY EXPENDITURE out of PUBLIC WORKS FUND, 1895-96 to 1916-17—continued.

Description of Services.	Expenditure.											Total Net Expenditure to 31st March, 1917.
	1906-7.	1907-8.	1908-9.	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.	1916-17.	
Public Buildings:—												
General (including Miscellaneous)	£ 14,216	£ 16,260	£ 39,635	£ 41,964	£ 44,044	£ 34,721	£ 44,719	£ 43,199	£ 52,239	£ 22,050	£ 12,648	£ ..
Parliamentary ..	1,047	4,119	5,172	3,157	237	2,004	18,806	23,612	31,478	17,133	22,586	..
(Courthouses ..	..	..	..	..	..	..	..	..	..	..	299	..
Judicial { Gaols ..	35,192	28,938	37,211	31,606	22,295	44,133	45,431	28,445	38,808	17,786	15,685	..
(Police-stations ..	..	..	..	..	..	..	..	..	..	..	..	..
Post and Telegraph ..	43,918	43,724	62,262	68,574	117,815	130,815	122,999	78,815	60,838	25,484	21,147	..
Customs ..	414	47	2,507	233	..	..	..	..	..	35,258	22,744	..
Quarantine-stations ..	..	..	..	..	..	..	..	..	..	..	..	..
Mental Hospitals ..	8,049	7,987	15,296	19,839	12,707	8,809	46,181	26,001	53,996	54,898	44,602	..
Public Health ..	1,765	7,497	4,402	319	..	..	376	..	..	Cr. 15	..	..
Hospitals and Charitable Institutions ..	10,259	15,576	11,153	7,259	1,484	12,745	8,750	1,435	998	1,426	*7,570	..
School Buildings ..	109,459	100,197	102,340	98,103	124,926	90,535	105,000	121,954	122,940	97,972	70,367	..
Agricultural ..	2,707	1,690	5,543	6,103	1,160	3,684	6,475	4,398	2,428	2,972	3,046	..
Workers' Dwellings ..	..	..	..	..	..	22,644	46,455	41,741	68,275	55,893	35,437	..
Total, Public Buildings ..	227,026	226,035	285,521	277,157	324,668	350,090	445,192	369,600	431,966	335,759	256,131	6,880,681
Lighthouses, Harbour-works, and Harbour-defences:—												
Lighthouses ..	..	1,417	7,481	6,762	1,470	5,428	9,031	5,174	3,887	1,415	449	..
Harbour-works ..	2,963	2,867	4,439	4,548	4,092	6,004	7,415	3,346	12,563	9,355	2,280	..
Harbour-defences ..	1,541	2,579	7,297	5,372	2,865	1,144	339	539	681	2,903	1,038	..
Total, Lighthouses, &c. ..	4,504	6,863	19,217	16,682	8,427	12,576	16,785	7,297	17,131	13,673	3,767	1,140,075
Rates on Native Lands ..	695	837	27	..	..	..	..	..	..	..	..	68,672
Contingent Defence ..	14,874	18,574	10,766	4,977	6,071	10,437	23,790	30,186	15,221	37,619	9,742	1,036,977
Tourist and Health Resorts ..	42,271	45,048	24,286	14,507	5,912	13,361	12,906	14,989	8,232	5,167	1,094	258,509
Lands Improvement† ..	5,605	9,561	19,542	6,910	11,125	20,394	22,550	16,996	13,810	5,936	Cr. 2,731	137,770
Charges and Expenses of raising Loans ..	Cr. 5,175	Cr. 8,487	575	17,715	66,367	67,470	72,950	105,449	35,495	5,037	35	1,253,072
Interest and Sinking Funds ..	..	..	..	..	..	..	..	..	..	..	..	218,500
Coal-exploration and Mine-development ..	..	..	..	..	..	..	..	..	..	..	..	10,835
Thermal Springs ..	..	..	..	..	..	..	..	..	..	..	..	14,600
Plant, Material, and Stores ..	..	..	..	..	..	..	..	..	..	74,418	9,778	84,196
Total Ways and Means Credits ..	5,175	8,487	2,183,245	2,022,876	1,891,918	2,190,731	2,347,965	2,421,464	2,565,019	11,160	5,713	..
Grand Total—Net Expenditure ..	2,035,144	1,909,688	2,183,245	2,022,876	1,891,918	2,190,731	2,347,965	2,421,464	2,565,019	2,333,784	1,278,483	66,968,468

* Includes £4,700 charged to "Unauthorized."

† 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, 1917, AND LIABILITIES ON THAT DATE.

Lines of Railway.	Total Expenditure by General Government to 31st March, 1916.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1916-17.						Expenditure under Special Acts during Year 1916-17. *	Amounts previously charged to New Lines, now charged to Individual Lines.	Total Expenditure by General Government to 31st March, 1917.	Valuation of Works constructed by Provinces and Midland Railway Company.	Liabilities.	Total Expenditure and Liabilities, 31st March, 1917.
			New Works.			Works on Open Lines.	Land Claims and other Old Liabilities.							
			Construction and Surveys.	Permanent- way.	Total New Works.									
								£						
Kaihu Valley ..	104,113	£	50	£	50	£	..	£	..	104,163	£	..	£	104,163
Otaria to Hokianga ..	188,067	..	7,876	..	7,876	..	..	..	..	195,943	..	1,605	..	195,943
Opua Wharf to Whangarei and Onerahi ..	522,088	3	..	..	..	318	..	145	..	522,548	..	..	..	522,548
Whangarei to North Auckland Main Trunk (Waiohira)	87,953	..	36,383	10,905	47,288	..	..	..	..	135,241	..	6,238	..	141,479
Helenesville Northwards ..	792,461	..	33,778	1,019	34,797	1,945	..	250	..	829,453	..	1,200	..	830,653
Waipu Branch ..	369	..	..	..	..	3,506	..	..	..	369	..	..	..	369
Helenesville to Te Awamutu ..	1,981,524	..	..	..	..	..	..	197,310	..	2,182,340	..	97,296	..	2,279,636
Waikua Branch (Paerata to Watuku)	40,447	..	11,736	10,441	22,177	..	..	..	..	62,624	..	296	..	62,920
Huntly to Awaroa ..	104,324	..	2,837	..	2,837	..	..	441	..	107,602	..	72	..	107,674
Waikato to Thames— Frankton to Te Aroha ..	152,734	..	..	..	..	4	..	934	..	153,672	..	..	..	153,672
Te Aroha to Thames ..	207,649	..	..	..	..	..	..	..	..	207,649	..	..	..	207,649
Cambridge Branch (Ruakura Junction to Cambridge)	51,500	..	..	..	..	..	..	..	..	51,500	..	..	..	51,500
Paeroa to Waihi and Tauranga ..	176,754	..	6,174	..	6,174	..	..	..	..	182,928	..	320	..	183,248
Thames Valley to Rotorua— Morrisville to Lichfield ..	166,750	..	..	..	..	11	9	..	..	166,750	..	..	..	166,750
Putaruru to Rotorua ..	199,791	..	..	..	..	..	..	434	..	200,245	..	..	..	200,245
Marton to Te Awamutu ..	2,713,508	1,312	..	..	..	3,639	..	2,666	..	2,718,501	..	..	..	2,718,501
Raetihi to Ohakune ..	52,555	..	10,869	5,041	15,910	..	..	..	..	68,465	..	1,585	..	70,050
Tauranga to Taneatua, including Te Maunga— Maunganui Branch ..	255,719	..	31,376	22,278	53,654	..	..	..	413	309,786	..	8,000	..	317,786
Gisborne to Motu ..	602,841	..	5,335	478	5,813	6,161	..	276	..	615,091	..	7,551	..	622,642
Gisborne to Ormond Tramway ..	4,975	..	..	..	..	..	..	..	..	4,975	..	..	..	4,975
Napier to Gisborne— Gisborne Southwards ..	163,519	..	8,000	927	8,927	..	..	..	..	172,446	..	447	..	172,893
Wairoa Northwards ..	990	..	643	..	643	..	..	..	..	1,633	..	15	..	1,648
Napier Northwards ..	33,924	..	8,778	..	8,778	..	..	..	..	42,702	..	1,890	..	44,592
Wellington to Napier— Napier to Woodville and Palmerston North ..	918,232	..	..	..	..	839	..	1,777	..	920,848	..	..	..	920,848
Wellington to Woodville, including Te Aro Extension	1,617,816	..	..	..	..	2,561	50	5,920	..	1,626,347	..	..	..	1,626,347
Featherston to Martinborough ..	399	..	..	..	..	..	..	..	..	399	..	..	..	399
Wellington to Waitara— Wellington to Longburn ..	987,319	..	..	..	..	17,979	..	2,926	..	1,008,224	..	..	..	1,008,224
Foxton to Waitara ..	1,554,498	3,530	..	..	..	965	..	3,906	..	1,555,839	..	..	..	1,555,839
Mount Egmont Branch ..	72,103	..	..	..	..	..	..	..	..	72,099	..	..	..	72,099
Opunake Branch (Te Rofi to Opunake)	31,258	..	..	..	..	..	..	..	..	45,221	..	710	..	45,931
Mania Branch (Kapuni to Mania)	1,131	..	983	80	13,963	..	..	..	80	2,194	..	..	..	2,194
Rangitikei River Quarry Line ..	206	..	..	..	..	..	..	..	..	206	..	..	..	206

* Railways Improvement Authorization Act 1914 Account.

TABLE NO. 3—continued.
EXPENDITURE ON RAILWAYS TO 31ST MARCH, 1917, AND LIABILITIES ON THAT DATE—continued.

Lines of Railway.	Total Expenditure by General Government to 31st March, 1916.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1916-17.						Expenditure under Special Acts during Year 1916-17. *	Amounts previously charged to "Surveys of New Lines," now charged to Individual Lines.	Total Expenditure by General Government to 31st March, 1917.	Valuation of Works constructed by Provinces and Midland Railway Company.	Liabilities.	Total Expenditure and Liabilities, 31st March, 1917.
			New Works.			Works on Open Lines.	Land Claims and other Old Liabilities.							
			Construction and Surveys.		Total New Works.									
			Permanent way.	£				£						
Stratford to Okahukura (East End)	£ 133,450	£ ..	£ 26,112	£ ..	£ 26,112	£ ..	£ ..	£ ..	£ ..	£ 159,562	£ 57,408	£ ..	£ 216,970	
Stratford to Okahukura (West End)	662,463	..	23,081	..	24,290	..	..	..	..	686,753	1,053	..	687,806
Nelson to Roundell	199,741	..	..	..	..	230	Cr. 7	..	..	199,964	..	..	199,964
Midland Railway—	..	..	..	..	..	..	..	..	..	..	..	..	..
Belgrove to Inangahua	259,910	..	1,806	..	1,806	..	5	..	..	261,721	100	78,307	340,128
Stillwater to Inangahua	203,765	..	Cr. 35	..	Cr. 35	..	209	..	..	203,939	4,862	543,574	1,527,177
Brunnerton to Bealey	718,457	..	56,338	7	56,345	..	..	..	..	774,802	..	61,579	804,614
Springfield to Bealey	742,851	..	184	..	184	..	..	..	..	743,035	..	..	188,009
Westport to Ngakawan	188,009	..	..	..	..	..	..	..	..	188,009	..	..	152,589
Westport to Inangahua	152,419	..	156	..	156	..	5	..	..	152,575	14	..	147,532
Ngahere to Blackball	147,537	..	..	..	..	..	..	..	..	147,532	..	..	254,999
Greyouth to Point Elizabeth	255,056	..	Cr. 57	..	Cr. 57	..	..	..	..	254,999	..	..	150,651
Greyouth to Brunnerton.	150,651	..	..	..	..	73	..	..	..	150,651	..	..	338,274
Greyouth to Ross and Mikonui	338,201	..	..	..	..	..	..	..	..	338,274	..	..	651,012
Pictou to Waipara—	..	..	..	..	..	..	..	..	..	..	..	..	374,377
Pictou Southwards	643,875	..	2,867	1,112	3,979	3,051	..	..	..	650,905	107	..	374,377
Waipara Northwards	374,133	..	71	173	244	..	..	..	..	374,377	..	..	3,834
Culverden to Hamner (motor-cars and sheds)	3,834	..	..	..	..	..	..	..	..	3,834	..	..	3,834
Culverden to Waiau	26,023	..	7,802	77	7,879	..	..	..	..	33,902	398	..	34,300
Hurumu to Waitaki—	..	..	..	..	..	..	..	..	..	..	..	..	..
Main Line (Culverden—Waitaki)	1,850,687	..	..	..	..	5,068	..	..	3,407	1,859,162	..	316,135	2,175,297
Oxford Branch (Rangiora to Oxford West)	51,521	..	..	..	..	..	..	..	..	51,521	..	..	51,521
Eyreton Branch (Kaipoi to Bennett's)	44,277	..	..	..	..	..	..	..	..	44,277	..	..	44,277
Lyttelton Branch	80,908	..	..	..	..	..	..	..	..	80,908	..	340,500	421,408
Southbridge Branch (Hornby to Southbridge)	89,524	..	..	..	..	1,036	..	..	..	90,560	..	..	90,560
Springfield and Whitecliffs Branches	95,860	..	..	..	..	..	..	..	..	95,860	..	..	95,860
Fairlie Creek Branch (Washdyke Junction to Fairlie)	67,251	..	..	..	..	..	..	..	..	67,251	..	75,124	142,375
Waimate Branch	68,819	..	1,475	..	1,475	4	..	..	..	70,298	5	..	70,303
Rakaia to Methven	74,640	..	..	..	..	..	..	..	..	74,640	..	..	74,640
Ashburton to Springfield	61,639	..	..	..	..	..	..	..	..	61,639	..	..	61,639
Little River Branch (Lincoln to Little River)	108,438	..	..	..	..	86	..	..	..	108,524	..	..	108,524
Canterbury Interior Main Line—	..	..	..	..	..	19	..	..	..	..	..	..	..
Oxford to Malvern	53,649	..	..	..	..	..	..	..	..	53,668	..	..	53,668
Whitecliffs to Rakaia	542	..	..	..	..	..	..	..	..	542	..	..	542
Temuka to Rangitata	5,152	..	..	..	..	..	..	..	..	5,152	..	..	5,152
Waitaki to Bluff—	..	..	..	..	..	..	..	..	..	..	..	..	..
Main Line, including Port Chalmers Branch	3,278,366	..	..	..	..	6,813	..	..	5,205	3,290,384	..	82,259	3,372,643
Duntroon Branch (Pukeuri to Kurow)	97,099	..	..	..	..	..	..	..	..	97,099	..	37,500	134,599
Ngapara Branch (Waiakeka Junction to Ngapara)	26,090	..	..	..	..	..	..	..	..	26,090	..	58,009	84,099

* Railways Improvement Authorization Act 1914 Account.

TABLE NO. 3—continued.

EXPENDITURE ON RAILWAYS TO 31ST MARCH, 1917, AND LIABILITIES ON THAT DATE—continued.

Lines of Railway.	Total Expenditure by General Government to 31st March, 1916.	Recoveries on Account of Expenditure of Previous Years.	Expenditure out of Public Works Fund during Year 1916-17.						Expenditure under Special Acts during Year 1916-17.*	Amounts previously charged to "Surveys of New Lines," now charged to Individual Lines.	Total Expenditure by General Government to 31st March, 1917.	Valuation of Works constructed by Provinces and Midland Railway Company.	Liabilities.	Total Expenditure and Liabilities, 31st March, 1917.
			New Works.		Works on Open Lines.	Land Claims and other Old Liabilities.								
			Construction and Surveys.	Permanent-way.										
							£	£						
Waitaki to Bluff—continued.	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Livingstone Branch (Windsor to Tokarahi)	82,785	..	..	..	..	..	..	..	..	82,785	..	..	..	82,785
Walhemo Branch (Palmerston to Dunback)	33,191	..	..	..	..	..	..	..	..	33,191	..	..	..	33,191
Fernhill Railway Purchase	1,415	..	..	..	..	..	..	..	..	1,415	..	..	..	1,415
Brighton Road Branch	6,474	..	..	..	..	..	..	..	..	6,474	12,829	..	..	19,303
Outram Branch (Mosgiel to Outram)	11,951	..	..	..	..	..	..	..	..	11,951	29,691	..	..	41,642
Lawrence Branch	305,293	..	..	..	..	..	..	..	..	305,285	..	..	..	305,285
Balcutha—Tuapeka Mouth	1,258	..	Cr. 703	..	..	..	..	..	..	1,961	..	..	..	1,961
Catlin's River Branch (Balcutha to Tahakopa)	462,840	..	Cr. 221	..	83	..	..	..	..	462,702	..	..	..	462,702
Heriotburn Branch (Waipahi to Edievale)	123,788	..	..	..	..	..	..	..	..	123,788	..	..	..	123,788
Waikaka Branch (McNab to Waikaka)	67,821	..	..	..	..	..	..	..	..	67,821	..	..	..	67,821
Gore to Lumsden	111,966	..	..	..	..	..	..	..	..	111,966	..	..	..	111,966
Edenvale to Glenham	52,743	..	..	..	..	..	..	..	..	52,743	..	..	..	52,743
Riversdale to Switzer's	82,304	..	..	..	..	..	..	..	..	82,304	..	..	..	82,304
Kelso to Gore	602	..	..	..	..	..	..	..	..	602	..	..	..	602
Seaward Bush to Catlin's	184,881	..	..	..	..	..	..	..	..	184,881	..	..	..	184,881
Appleby to Tokanui	1,318,013	..	13,335	8,557	21,892	..	..	..	..	1,339,905	..	1,748	..	1,341,653
Otago Central (Wingatui to Cromwell)	358,842	..	..	..	..	..	..	..	..	358,842	91,937	..	..	450,779
Invercargill to Kingston—	27,217	..	..	..	..	..	..	..	..	27,217	..	..	..	27,217
Main Line	231	..	..	..	..	..	..	..	..	231	..	..	..	231
Mararoa Branch (Lumsden to Mossburn)	336,181	..	..	..	..	..	..	..	..	336,181	60,297	..	..	396,950
Winton to Heddon Bush	22,984	..	226	..	246	..	..	..	..	22,984	..	..	..	22,984
Makarewa to Orepuki and Waiau	10,337	..	..	..	..	..	..	..	..	10,337	..	..	..	10,337
Thornbury to Wairio	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Forest Hill (Winton to Hedgehope)	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Expenses of Railway Commissions and other Expenditure not chargeable to Individual Lines	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Surveys of New Lines—	..	..	..	..	..	..	..	..	..	..	..	..	..	..
North Island	35,701	..	692	..	..	..	..	..	..	35,900	..	..	..	35,900
Middle Island	5,752	..	..	..	..	..	..	..	..	5,752	..	..	..	5,752
Rolling-stock	6,304,188	..	..	..	230,906	..	..	..	..	6,535,094	..	79,395	..	6,614,489
Stock of Permanent-way Materials, 31st March, 1915	118,190	..	..	..	..	..	..	..	..	..	..	..	..	..
..£118,190	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stock of Permanent-way decreased by £40,385	35,109,302	..	..	..	..	..	..	..	..	..	..	..	..	..
..40,385	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Stock of Permanent-way Materials, 31st March, 1915	..	..	..	..	..	..	..	..	..	77,805	..	58,252	..	136,057
..£77,805	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	35,068,917	4,845	313,224	62,304	375,528	285,543	261	225,597	..	35,951,001	1,787,741†	330,567	..	38,069,309

* Railways Improvement Authorization Act, 1914, Account.

† Also includes value for £150,900 paid to debenture-holders under the Midland Railway Petitions Settlement Act Amendment Act, 1903.

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.	Aid to Water-power Works Account. Development of Water-power.	Irrigation and Water-supply Account. Irrigation and Water-supply.	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						
1899-00 ..	31,363						
1900-01 ..	37,390						
1901-02 ..	31,979						
1902-03 ..	18,578						
1903-04 ..	25,753						
1904-05 ..	28,895						
1905-06 ..	38,801						
1906-07 ..	47,871						
1907-08 ..	38,524						
1908-09 ..	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	35,009	14,689	9,555
1913-14 ..	..	63,245	..	4,282	142,828	33,602	9,632
1914-15 ..	..	..	92,975	9,151	74,291	32,090	10,004
1915-16 ..	..	..	47,974	13,344	55,410	29,874	9,225
1916-17 ..	..	..	24,730	6,787	49,032	4,745	10,407
	697,408	206,626	165,679	53,401	356,570	115,000	52,592

* 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 Land 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.

DEVELOPMENT OF WATER-POWER.

STATEMENT OF ACCOUNTS AT 31ST MARCH, 1917.
GENERAL BALANCE-SHEET AT 31ST MARCH, 1917, COMPARED WITH POSITION AT 31ST MARCH, 1916.

1915-16.		1916-17.		1915-1916.		Assets.		1916-17.	
£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.
25,331	18 3	..	..	332,450	17 4	Lake Coleridge—	..	388,080	14 10
				18,572	1 2	Assets as per separate balance-sheet	..	30,528	5 11
				86	14 0	Profit and Loss Appropriation Account	..	151	3 4
				351,109	12 6	Accident Insurance Fund	..		
								418,760	4 1
2,661	17 10	2,661	17 10			Other Schemes: Surveys and Investigation—			
18,450	14 1	18,450	14 1	803	1 9	Clarence River	..	803	1 9
21,112	11 11	21,112	11 11	368	9 6	Horahora	..	653	13 3
				2,915	8 6	Huka Falls	..	378	9 6
				5	0 0	Hutt River (including purchase of dam-site)	..	2,868	19 3
309,000	0 0	..	..	38	9 0	Kanieri Lake	..	5	0 0
				335	7 8	Makuri River	..	38	9 0
				519	12 7	Mangahao River	..	745	15 8
5,853	4 10	12,165	19 8	1,105	19 7	Ophi River	..	519	12 7
2,731	10 6	2,847	18 10	879	16 8	Rotoiti-Kaituna	..	1,105	19 7
				17	7 0	Tauherenikau	..	879	16 8
				76	16 6	Toaroha	..	17	7 0
				11	19 0	Teviot	..	76	16 6
				..	..	Upper Taieri	..	11	19 0
				236	6 8	Waikaremoana	..	362	3 11
				7,313	14 5	Wairua	..	236	6 8
								8,703	10 4
£364,029	5 6	£439,039	5 1			General expenditure not chargeable to any individual scheme			
				4,144	5 6	Cash balance in the Aid to Water-power Works	..	4,145	5 6
				1,461	14 1	Account	..	7,430	5 2
				£364,029	5 6			£439,039	5 1

P. S. WALDIE, Acting-Accountant.

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY.

PROFIT AND LOSS ACCOUNT FOR YEAR ENDED 31ST MARCH, 1917, COMPARED WITH YEAR ENDED 31ST MARCH, 1916.

Gross Revenue Account.

1915-16.		1916-17.		1915-16.		1916-17.	
£	s. d.	£	s. d.	£	s. d.	£	s. d.
To Generating expenses, headworks, and power-house—							
Salaries ..	2,071 14 9	..	..	7,722 19 9	..	..	..
Wages ..	452 18 6	..	..	532 18 8	..	..	..
Supplies ..	84 10 8	..	..	8,255 18 5	..	..	19,989 5 5
Maintenance and repairs—							
Headworks ..	26 4 10	..	..	4 6 0	..	..	5 16 7
Pipe-lines ..	4 7 6	..	..	..	..	..	8 19 0
Power-house building ..	7 13 11	..	..	..	..	..	..
Power-house machinery ..	108 17 2	..	..	244 15 3	..	..	465 15 3
Roads and fences ..	226 14 11	..	..	..	..	..	52 10 10
Staff residences, &c. ..	214 15 6	..	..	..	..	..	30 10 6
	3,197 17 9		3,741 2 7	244 15 3			548 16 7
Transmission-line—							
Salaries ..	346 13 4	..	..	..	..	7 0 0	..
Wages ..	105 0 10	..	..	..	..	27 13 7	34 13 7
Transport, including upkeep of horses, traps, cars, and cycles ..	959 17 4	..	..	..	..	..	66 13 4
Repairs to power-lines ..	527 18 2	..	..	..	..	..	100 0 0
Repairs and alterations to telephone-system ..	119 18 11	..	..	..	..	..	..
	2,059 8 7		2,558 9 11	12 14 8	..	..	..
Substation, Addington—							
Salaries ..	659 12 10	..	..	865 4 8	..	..	..
Wages ..	274 3 11	..	..	..	..	..	..
Supplies ..	223 1 6	..	..	..	..	..	..
Maintenance and repairs—							
Buildings ..	28 8 8	..	..	..	..	..	..
Buildings and yards, including water-supply and drainage ..	..	..	..	..	..	..	..
Machinery ..	37 17 10	..	..	..	..	..	..
	1,223 4 9		1,660 18 11	..	..	..	..
Distribution—							
Salaries ..	71 13 4	..	..	..	..	..	..
Wages ..	3 7 4	..	..	..	..	..	..
Supplies ..	18 14 4	..	..	..	..	..	..
Transport, including upkeep of motor lorry and car ..	352 7 5	..	..	..	..	..	..
Repairs to feeder cables ..	288 13 11	..	..	..	..	..	..
	734 16 4		1,723 12 0	..	..	..	..

LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY—continued.

PROFIT AND LOSS APPROPRIATION ACCOUNT.

1915-16.	1916-17.	1915-16.	1916-17.
£ s. d. 922 12 9 17,649 8 5 £18,572 1 2	£ s. d. 18,572 1 2 11,956 4 9 £30,528 5 11	£ s. d. 18,572 1 2 £18,572 1 2	£ s. d. 30,528 5 11 £30,528 5 11
To Balance from previous year's statement Balance from Net Revenue Account	By Balance to balance-sheet		

ACCIDENT INSURANCE FUND ACCOUNT.

£ s. d. 527 4 6 3 6 8 £530 11 2	To Balance from previous year's statement .. Payment of accident compensation .. Interest at 4 per cent. per annum ..	£ s. d. 86 14 0 569 10 0 18 2 9 £674 6 9	£ s. d. 137 17 2 306 0 0 443 17 2 86 14 0 £530 11 2	By Amount set aside in respect to workmen, &c., employed on— Operating and maintenance, as shown in Profit and Loss Account .. £209 1 5 Capital extensions, and charged to Capital Account .. 314 2 0 Balance to balance-sheet	£ s. d. 523 3 5 151 3 4 £674 6 9
--	---	--	--	---	---

DEPRECIATION FUND ACCOUNT.

£ s. d. 5,853 4 10 £5,853 4 10	To Balance to balance-sheet	£ s. d. 12,165 19 8 £12,165 19 8	£ s. d. 449 0 0 17 19 3 5,386 5 7 £5,853 4 10	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. 5,853 4 10 234 2 5 6,078 12 5 £12,165 19 8
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LAKE COLERIDGE HYDRO-ELECTRIC-POWER SUPPLY—continued.

BALANCE-SHEET AT 31ST MARCH, 1917—continued.

D.—1.

16

1915-16.		Liabilities.		1916-17.		1915-16.		Assets.		1916-17.	
£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.
351,109	12 6	Brought forward ..	..	..	..	244,061	16 4	Brought forward ..	..	257,677	4 1
								Primary distribution—	..		
								Supply cables—	..		
						8,546	17 1	Christchurch City ..	..	8,755	12 7
								Christchurch Tramways	..	2,889	5 2
						5,157	17 0	Lytelton ..	..	5,584	5 1
						2,415	16 7	Northern ..	..	10,743	19 3
						5,655	18 1	Southern ..	..	6,467	5 5
						622	9 9	Lightning-arresters	..	622	9 9
						835	4 8	Tools and equipment	..	1,276	4 3
						675	19 8	Alterations to public telegraph-lines	..	984	5 1
						23,910	2 10		..	37,323	6 7
								Secondary distribution—	..		
						8,723	8 7	Supply cables and reticulation	..	14,819	14 1
						2,871	12 0	Local substations	..	5,425	6 5
						11,595	0 7		..	20,245	0 6
								Service transformers and meters	..	10,925	11 1
						3,433	1 10	Motor cars, lorry, and cycles, &c.	..	2,816	8 10
						1,753	7 0	Public telephones to the lake	..	1,654	6 2
						1,654	6 2	Telephones to Christchurch City Council and	..		
								Tramway Board ..	..	161	19 5
						191	12 6	Christchurch office—Furniture and fittings	..	84	2 1
						18	8 6	Engineering, office, and general expenses on	..		
						13,786	1 11	preliminary surveys and during construction ..	..	14,753	2 6
								Salaries of Engineers and others on preliminary	..		
						6,731	7 5	surveys and during construction	..	8,194	17 9
						13,095	0 0	Interest during construction	..	13,148	14 0
									..		
						320,230	5 1	Stocks of material, &c., on hand at date	..	366,984	13 0
						9,803	12 4	Telephone subscriptions and fire insurance paid	..	12,628	18 1
								in advance	..		
						55	14 9	Material lost on s.s. "Rangatira," covered by	..	76	3 6
								insurance but not yet adjusted	..		
						2,028	4 4	Sundry debtors for current and rent ..	..	634	10 0
						333	0 10	Sundry debtors for work carried out, &c.	..	4,423	16 6
									..	3,332	13 9
						332,450	17 4		..	7,756	10 3
								Balance from Profit and Loss Appropriation	..	388,080	14 10
						18,572	1 2	Account	..		
						86	14 0	Balance from Accident Insurance Fund Account	..	30,528	5 11
									..	151	3 4
						£418,760	4 1		..	£418,760	4 1

P. S. WALDIE, Acting-Accountant.
E. PARRY, Chief Electrical Engineer.

APPENDICES TO THE PUBLIC WORKS STATEMENT, 1917.

APPENDIX A.

AUDITED STATEMENT OF EXPENDITURE ON PUBLIC WORKS
OUT OF THE PUBLIC WORKS FUND FOR THE YEAR 1916-17.*Prepared in compliance with Section 8 of the Public Works Act, 1908.*

SIR,—

Public Works Department, Wellington, 8th June, 1917.

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.,

W. FRASER,
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 FOR THE YEAR 1916-17.

Class.	Votes.	Summary.	Appropriation.	Expenditure.			Credits.			Net Expenditure.		
		PUBLIC WORKS FUND.										
			£	£	s.	d.	£	s.	d.	£	s.	d.
XVI	91	Public Works, Departmental ..	144,100	139,322	14	1	7,637	14	3	131,684	19	10
XVII	92-93	Railways	800,000	673,849	15	4	52,903	1	8	620,946	13	8
XVIII	94-103	Public Buildings	364,000	253,362	7	10	1,931	7	3	251,431	0	7
XIX	104-106	Lighthouses, Harbour-works, and Harbour-defences	14,000	3,771	9	7	3	14	0	3,767	15	7
XX	107	Tourist and Health Resorts ..	5,000	1,464	8	11	370	7	5	1,094	1	6
XXI	108	Immigration	15,000	14,777	4	8	8,244	3	1	6,533	1	7
XXII	109-110- 111	Roads, Bridges, and other Public Works	420,250	236,926	12	3	17,132	2	9	219,794	9	6
XXIII	112	Development of Mining	6,000	4,591	13	2	..	..	..	4,591	13	2
XXIV	113	Contingent Defence	30,000	9,741	3	6	..	..	..	9,741	3	6
XXV	114-115	Lands Improvement	15,000	2,018	13	0	4,749	3	2	Cr. 2,730	10	2
XXVI	116	Irrigation and Water-supply ..	40,000	16,747	12	2	699	0	4	16,048	11	10
XXVII	117	Plant, Material, and Stores ..	20,000	20,667	12	2	10,889	6	5	9,778	5	9
		Unauthorized .. ..	..	6,838	11	6	1,071	18	2	5,766	13	4
		Total Public Works Fund ..	1,873,350	1,384,079	18	2	105,631	18	6	1,278,447	19	8

P. S. WALDIE,
Acting-Accountant.

W. S. SHORT,
Under-Secretary.

Examined and found correct.

ROBERT J. COLLINS,
Controller and Auditor-General.

NOTE.—Charges and expenses of raising loans not included in above figures.
(Details on next page.)

APPENDIX A—continued.

	Name of Vote.	Appropriation.	Expenditure.	Credits.	Net Expenditure.
		£	£ s. d.	£ s. d.	£ s. d.
91	PUBLIC WORKS FUND.				
	Public Works, Departmental	144,100	139,322 14 1	7,637 14 3	131,684 19 10
	Railways—				
	Railway-construction—				
	Kaihu Railway Extension	1,000	104 11 5	55 1 2	49 10 3
	Kawakawa-Hokianga	10,000	8,355 9 3	478 12 4	7,876 16 11
	North Auckland Main Trunk—				
	Kirikopuni, Southwards	1,000	22 3 10	0 17 11	21 5 11
	Kaiwaka, Northwards	30,000	35,172 10 11	1,415 7 6	33,757 3 5
	Whangarei—North Auckland Main Trunk	50,000	36,485 3 4	102 6 6	36,382 16 10
	Waipu Branch	1,000	.. .. .	.. .. .	.. .. .
	Waiuku Branch	15,000	11,760 18 3	24 12 7	11,736 5 8
	Huntly-Awaroa	2,000	2,855 10 1	18,14 3	2,836 15 10
	East Coast Main Trunk—				
	Waihi-Tauranga	10,000	6,333 1 2	159 3 0	6,173 18 2
	Tauranga—Te Maunga	10,000	5,252 1 1	52 15 0	5,199 6 1
	Maunganui-Taneatua	25,000	31,867 12 11	5,690 19 7	26,176 13 4
	Gisborne-Motu	6,000	6,549 9 0	1,214 7 10	5,335 1 2
	Napier-Gisborne—				
	Gisborne-Wairoa	20,000	8,639 14 6	640 5 9	7,999 8 9
	Wairoa-Gisborne	10,000	643 1 3	.. .. .	643 1 3
	Wairoa-Napier	1,000	.. .. .	.. .. .	.. .. .
	Napier-Wairoa	20,000	15,009 8 4	6,231 6 6	8,778 1 10
	Mount Egmont Branch	100	Cr. 4 0 0	.. .. .	Cr. 4 0 0
	Opunake Branch	25,000	14,950 1 10	83 14 2	14,866 7 8
	Stratford—Main Trunk—				
	East End	50,000	27,589 2 4	1,477 8 6	26,111 13 10
	West End	20,000	24,276 4 10	1,195 10 8	23,080 14 2
92	Raetihi—Main Trunk	15,000	12,316 10 7	1,447 10 2	10,869 0 5
	Stone Quarry Line, Rangitikei River	100	.. .. .	.. .. .	.. .. .
	Featherston-Martinborough	100	.. .. .	.. .. .	.. .. .
	South Island Main Trunk	10,000	3,559 13 6	622 1 7	2,937 11 11
	Midland Railway—				
	Nelson End	8,000	1,940 7 0	133 18 9	1,806 8 3
	Reefton End	100	124 2 9	158 9 6	Cr. 34 6 9
	Otira-Bealey	60,000	57,187 11 5	849 16 6	56,337 14 11
	Broken River—Bealey	1,000	183 14 0	.. .. .	183 14 0
	Westport-Inangahua	200	233 12 4	77 15 7	155 16 9
	Greymouth—Point Elizabeth	100	.. .. .	57 6 6	57 6 6
	Culverden-Waiatu	20,000	8,149 13 11	347 15 0	7,801 18 11
	Waimate Branch Extension	2,000	1,475 2 0	.. .. .	1,475 2 0
	Lawrence-Roxburgh	500	1 2 0	9 0 0	Cr. 7 18 0
	Otago Central	15,000	13,898 13 2	564 0 4	13,334 12 10
	Balclutha—Tuapeka Mouth	200	733 5 7	30 5 0	703 0 7
	Catlin's-Waimahaka	200	22 5 0	243 8 3	Cr. 221 3 3
	Winton—Haddon Bush	6,000	.. .. .	.. .. .	.. .. .
	Orepuki—Waiatu Extension	1,200	266 0 10	39 14 5	226 6 5
	Land Claims, &c.	1,000	276 6 8	15 0 0	261 6 8
	Surveys, New Lines of Railways	2,000	691 15 1	.. .. .	691 15 1
	Permanent-way Materials	70,200	22,373 19 11	455 1 0	21,918 18 11
	Total	520,000	.. .. .	.. .. .	.. .. .
	Total Vote, Railway-construction	500,000	359,296 0 1	23,892 5 10	335,403 14 3
93	Additions to Open Lines	300,000	314,553 15 3	29,010 15 10	285,542 19 5
	Public Buildings—				
94	General	50,000	35,843 12 7	609 2 11	35,234 9 8
95	Courthouses	2,000	298 17 0	.. .. .	298 17 0
96	Gaols	16,000	15,744 11 0	59 14 1	15,684 16 11
97	Police-stations	25,000	21,149 16 7	3 4 0	21,146 12 7
98	Postal and Telegraph	35,000	23,360 9 4	616 7 0	22,744 2 4
99	Agricultural	4,000	3,086 7 7	40 10 0	3,045 17 7
100	Mental Hospitals	55,000	44,629 0 9	26 16 7	44,602 4 2
101	Hospitals and Charitable Institutions	2,000	2,869 10 9	.. .. .	2,869 10 9
102	School Buildings	125,000	70,442 16 3	75 12 8	70,367 3 7
103	Workers' Dwellings	50,000	35,937 6 0	500 0 0	35,437 6 0
	Lighthouses, Harbour-works, and Harbour-defences—				
104	Lighthouses	1,500	449 2 0	.. .. .	449 2 0
105	Harbour-works	11,000	2,283 15 1	3 14 0	2,280 1 1
106	Harbour-defences	1,500	1,038 12 6	.. .. .	1,038 12 6
107	Tourist and Health Resorts	5,000	1,464 8 11	370 7 5	1,094 1 6
108	Immigration	15,000	14,777 4 8	8,244 3 1	6,533 1 7
	Construction and Maintenance of Roads, Bridges, and other Public Works—				
109	Roads, &c.	300,250	175,456 6 5	16,345 6 4	159,111 0 1
110	Backblocks Roads, &c.	90,000	44,340 9 11	755 6 9	43,585 3 2
111	Road and other Works on Goldfields and Mineral Lands	30,000	17,129 15 11	31 9 8	17,098 6 3
112	Development of Mining	6,000	4,591 13 2	.. .. .	4,591 13 2
113	Contingent Defence	30,000	9,741 3 6	.. .. .	9,741 3 6
	Lands Improvement—				
114	Improved-farm Settlements	6,000	924 13 10	3,931 15 9	Cr. 3,007 1 11
115	Lands, Miscellaneous	9,000	1,093 19 2	817 7 5	276 11 9
116	Irrigation and Water-supply	40,000	16,747 12 2	699 0 4	16,048 11 10
117	Plant, Material, and Stores	20,000	20,667 12 2	10,889 6 5	9,778 5 9
	Unauthorized—Services not provided for .. .. .	.. .. .	6,838 11 6	1,071 18 2	5,766 13 4
	Total Public Works Fund	1,873,350	1,384,079 18 2	105,631 18 6	1,278,447 19 8

APPENDIX B.

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

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

SIR,—

Wellington, 1st April, 1917.

I have the honour to submit the following report upon the various works completed and in progress throughout the Dominion during the period from the 1st April, 1916, to the 31st March, 1917.

There has been a further considerable reduction in the amount of work in hand, the number of men employed upon the works under my control having decreased by about one-third during the year. This is mainly due to the great reduction in the supply of suitable labour owing to the operation of the Military Service Act, but the position has in no way improved as regards the obtaining of certain classes of material and plant, notably rails and fastenings and structural steel. The staff has been further depleted by enlistments and resignations, but is still sufficient for present requirements.

RAILWAYS.

ABSTRACT.

The following table shows the expenditure and liabilities on Government railways in New Zealand up to the 31st March, 1917:—

Name of Railway.	Total Length of Railway or Section.	Open for Traffic.	Expenditure to 31st March, 1917.	Liabilities on 31st March, 1917.
	M. ch.	M. ch.	£	£
Kaihu Valley	24 30	19 58	104,163	..
Kawakawa-Hokianga	45 25	16 25	195,943	1,605
Opua Wharf - Grahamtown (Onerahi)	58 6	58 6	522,548	..
Whangarei southward	19 77	..	135,241	6,238
North Auckland Main Trunk Railway (from Helensville)	86 22	47 77	829,822	1,200
Helensville - Te Awamutu, with Branches	163 48	146 19	2,352,566	97,664
Hamilton-Thames, with Branches	127 35	87 20	595,749	320
Thames Valley - Rotorua	69 33	69 33	366,995	..
Tauranga-Opotiki, with Branches	138 27	..	309,786	8,000
Gisborne-Opotiki	93 45	44 34	615,091	7,551
Napier-Gisborne	206 39	..	216,781	2,352
Wellington-Napier and Palmerston North (including Te Aro Extension and Greytown and Martinborough Branches)	249 44	233 12	2,547,594	..
Wellington-Waitara, with Branches	350 11	285 59	2,683,783	710
Stratford-Okahukura	101 27	37 53	846,315	58,461
North Island Main Trunk (Marton-Te Awamutu), including Raetihi Branch	218 42	209 69	2,786,966	1,585
Picton-Waipara (South Island Main Trunk Railway)—				
Picton southwards	92 38	56 6	650,905	107
Waipara northwards	90 45	44 14	374,377	..
Nelson-Belgrove	22 73	22 73	199,964	..
Midland Railway*	239 75	179 67	1,983,497	4,962
Westport-Ngakawau	19 56	19 56	188,009	..
Westport-Ngakawau Extension to Mokihinui†	7 12	7 12	..	..
Mokihinui Colliery Line‡	3 69	3 69	..	..
Westport-Inangahua	26 0	5 74	152,575	14
Ngahere-Blackball	3 40	3 40	147,532	..
Greymouth-Coal Creek	8 70	8 70	254,999	..
Greymouth-Brunner	7 51	7 51	150,651	..
Greymouth-Waitaha	50 32	38 68	338,274	..
Culverden-Hammer Motor-cars and Sheds .. .. .	..	..	3,834	..
Hurunui-Waitaki, with Branches	501 52	443 8	2,638,542	403
Canterbury Interior Main Line—Oxford-Temuka	83 0	11 44	59,362	..
Waitaki-Bluff, with Branches	600 21	546 16	4,943,442	..
Otago Central	182 51	134 78	1,339,905	1,748
Invercargill-Kingston, with Mararoa Branch	117 4	97 44	386,290	..
Forest Hill Railway—Winton-Hedgehope§	12 40	12 40	22,984	..
Western Railways	94 8	70 31	336,653	..
Preliminary Surveys .. .. .	..	..	41,652	..
Miscellaneous .. .. .	..	..	10,337	..
Stock of Permanent-way on hand .. .. .	..	..	77,805	58,252
Rolling-stock .. .. .	..	..	6,535,094	79,395
Total	4,116 48	2,970 46	|| 35,946,026	330,567

* The amount shown as expenditure represents the net amount charged against the Dominion.

† 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.

ABSTRACT—continued.

Name of Railway.	Total Length of Railway or Section.	Open for Traffic.	Expenditure to 31st March, 1917.	Liabilities on 31st March, 1917.
	M. ch.	M. ch.	£	£
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	4,116 48	2,970 46	37,738,742	330,567

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

No sections of railway have been handed over to the Railway Department during the year, though several are approaching completion, and in some cases the Public Works Department is handling goods and passenger traffic.

KAIHU VALLEY RAILWAY.

No work has been done on this line during the year, with the exception of a few small repairs to river-protection works.

KAWAKAWA-HOKIANGA RAILWAY.

Omapere Section, 16 m. 25 ch. (Kaikohe) to 24 m. 42 ch. (Okaihau).—From 16 m. 25 ch. to 18 m. 64 ch. the formation has been finished for some time, but slips are of frequent occurrence, and these have been removed from time to time.

The length from 18 m. 64 ch. to 19 m. 44 ch., including a tunnel and some heavy earthworks, has been constructed under contract. The work was completed at the end of April, 1916, about ten months after due date, the contractors having been hindered by slips, shortage of labour, &c. A considerable quantity of slipped material was left in the cuttings on conclusion of the contract, and this has since been removed.

From the 31st March, 1916, to the 30th September, 1916, the Department had no men at work on this line. Since the beginning of October a few men have been employed on earthworks, culverts, &c. A stone-crushing plant is at work near 21 m., and has provided broken metal for all the culverts up to 22 m., as well as road-deviations and the main road between Kaikohe and Okaihau, which is in use as a service road.

The weather has been exceptionally wet, and floods have been very frequent, causing much damage to the railway-works and the roads in the vicinity.

A large cutting between 19 m. 58 ch. and 19 m. 74 ch. is the principal item of work to be done on this section. A steam-navvy will be set to work here early in the spring, and an endeavour will be made to take out the whole of the cutting during the dry weather.

WHANGAREI—NORTH AUCKLAND RAILWAY.

Oakleigh Section (0 m. to 7 m. 60 ch.).—The Kioreroa contract (0 m. to 4 m.) is still in hand, its completion being considerably overdue. The delay is partly owing to scarcity of good workmen and the very bad weather which has been experienced. The Otaiaka River Bridge (1 m. 76 ch.) is completed, including some protective works, but there is still a gap of 4 chains in the south approach, and a good deal of stone-pitching remains to be done on both approach banks. The remaining works comprised in the contract are practically completed.

Platelaying was commenced from Kioreroa, and the rail-head is now at 1 m. 40 ch. Arrangements have been made with the Railway Department for a supply of ballast, and it is proposed to complete the permanent-way to Portland Station (5 m. 10 ch.) as soon as the Kioreroa contract is out of hand. With this object in view co-operative works on the section have been confined to the formation of the length between 4 m. and 5 m. 10 ch., which is practically completed. Rails have also been laid in the main line at Oakleigh Station yard, with one siding and a back shunt to the wharf.

Tauraroa Section (7 m. 60 ch. to 14 m. 73 ch.).—The formation of this section was completed during the year, with the exception of some filling in the Tauraroa Station yard, which is being done with material from the works ahead. Bridges over the Tauraroa River (10 m. 19 ch.) and Moewhare Creek (13 m. 30 ch.) were completed with the exception of the plate girders, which have not yet come to hand. Temporary stringers have been placed to carry the ballast-train. Rails have been laid on the entire section and on to 15 m., with sidings at Mangapai and Tauraroa Stations. A siding has also been laid into the ballast-quarry at Tauraroa. This siding involved the construction of a bridge over the Tauraroa River and considerable formation work. Air-drills and a stone-crusher are in operation at the quarry, and ballast is being run out for use on the line. A second stone-crusher is available, but cannot be used, as the two steam-engines required which were on order have been commandeered by the Imperial Government. Six miles of fencing were erected on the section, leaving only 70 chains to complete, and a telephone-line has been erected throughout. Very heavy slips have occurred in many cuttings on this section, and about 30,000 cubic yards of slipped material have been removed by the ballast-train. The section will not be satisfactory until it is ballasted.

Waiohira Section (14 m. 73 ch. to 19 m. 79 ch.).—The cutting from 14 m. 73 ch. to 15 m. has been taken out with ploughs and scoops. The cuttings and banks from 15 m. to 15 m. 47 ch. have been completed by a steam-navvy, which was also engaged for four months in obtaining material for Tauraroa Station yard. During the remaining eight months the steam-navvy excavated 23,300 cubic yards (solid measurement), an average of 140 cubic yards per day, at a cost less than that of pick-and-shovel work. Most of the material had to be carried a considerable distance, a small locomotive being employed for this purpose. Several small cuttings and banks between 15 m. 50 ch. and 16 m. 20 ch. are being formed to enable the steam navvy to proceed to the larger cuttings beyond. The cutting at 17 m. 65 ch. was nearly completed with ploughs and scoops, but no earthworks are now in hand beyond 16 m. 55 ch., the number of men available being insufficient to cover the remaining length.

Good progress has been made on this line, considering the continual wet weather that has been experienced. The rainfall at Whangarei for the period was 86·7 in. Heavy slips in nearly every cutting have been very troublesome and caused a great deal of delay in the work, especially in connection with the platelaying and ballasting.

NORTH AUCKLAND MAIN TRUNK RAILWAY.

Kirikopuni Section (114 m. 40 ch. to 115 m.).—No work has been done on this section since November, 1915.

Bickerstaffe Section (83 m. 75 ch. to 88 m. 40 ch.).—Platelaying and ballasting have been completed, and stockyards have been erected at Maungaturoto Station. Slips from the batters of cuttings have practically ceased, but certain banks are still slipping and subsiding, requiring some attention during the year. The section generally has been maintained, and a goods and passenger service has been run between Huarau Station and Ranganui, the terminus of the opened line.

Paparoa Section (88 m. 40 ch. to 92 m. 16 ch.).—Platelaying in Huarau Station yard (90 m. 15 ch.) has been completed, and ballasting has been carried out to the rail-head at 91 m. 25 ch., with the exception of part of the third lift, the line being in good running-order. Quarrying and crushing of metal at Hoteo ballast-pit was discontinued at the end of September. A railway-bridge is being erected over Paparoa Road (90 m. 35 ch.). Slips in cuttings have been numerous, owing to the exceptional rainfall, but the banks, with one exception, have caused no trouble. Some fencing has been done, but posts are difficult to obtain, owing to the absence of settlers' sons at the front. Beyond the rail-head the service tramway has been working constantly conveying goods and materials to the Huarau and Golden Stairs Tunnels. At the south end of the Huarau Tunnel the reinforced-concrete approach has been completed from 91 m. 36·96 ch. to 39·52 ch., and a short length of tunnel is also completed. Headings are driven ahead, and enlargement is in progress. The ground is very rotten and wet, requiring careful mining and close timbering, while the continual wet weather has made working-conditions most difficult and unpleasant. At the north end of the tunnel sinking from the surface for the portal and wing walls have been done, and concrete placed in position. The approach cutting was taken out and timbered where necessary to hold back slips. The invert between the wing walls was then completed and breaking-down started. Two lengths of lining were completed, and excavation is proceeding ahead. The ground is similar to that at the south end, and requires careful handling.

Mareretu Section (92 m. 16 ch. to 96 m. 38 ch.).—The principal work in hand here is the construction of the Golden Stairs Tunnel. At the south end the approach cutting was taken out, sinking for the parapet completed, and concrete placed, wing walls and invert concreted, and breaking-down started. Concrete lining was completed from the face (93 m. 48 ch.) for a distance of 1 chain, and further excavation is in hand. Similar operations have been carried out at the north end. The ground at both ends is heavy and wet, as at the Huarau Tunnel. Apart from this tunnel, very little work has been done on this section.

Generally, the works on this line have been greatly hampered by unfavourable weather and difficulty in obtaining sufficient labour.

WAIUKU BRANCH RAILWAY.

Earthwork is in progress at various points up to 10 m., the work done during the year being equal to about one mile of completed line. Rails have been laid from 0 m. 19·50 ch. to 4 m. 33 ch., including sidings at Helvetia and Patumahoe Stations. The sidings at the junction (Paerata) are only partly laid. Ballasting is practically completed up to and including Patumahoe Station yard (4 m. 7 ch.), and a little beyond. Bridges have been erected at 0 m. 18 ch. and 5 m. 30 ch. Generally, satisfactory progress has been made, considering the very small number of men available.

HUNTLY-AWAROA RAILWAY.

This line was handed over to the Railway Department in December, 1915, but some additional work has been carried out by this Department. The Waitawhara Road, which connects Pukemiro Station with the Huntly-Raglan Road, has been formed and metalled throughout, a distance of 63½ chains, and two small bridges have been erected. Fencing, gates, and cattle-stops are being constructed at Pukemiro, and a water-service has been provided, comprising a concrete dam in the Waitawhara Stream and an hydraulic ram, with the necessary pipe-lines.

EAST COAST MAIN TRUNK RAILWAY.

Waihi-Tauranga.

Athenree Section (0 m. to 12 m. 35 ch.).—Work was continued between 2 m. and 8 m. with a small force of workmen until March, 1917, when the Engineer in local charge joined the Expeditionary Forces, and as a sufficient number of men are not available to continue economically the work was closed down.

Tauranga-Opotiki.

Te Maunga Section (41 m. to 45 m.).—From Te Maunga Junction back to the site of the large bridge over Tauranga Harbour the formation is practically completed. Some concrete cylinders have been made and sunk to form two of the piers for the bridge, but little can be done here until the return of normal conditions enables the steel for the superstructure to be obtained. A little formation-work is being done at the site of the Tauranga Station yard, with material obtained from the cutting at 40 m. 19 ch.

Maunganui-Te Puke Section (Maunganui to Te Maunga, Branch Line, 0 m. to 4 m. 27 ch.; Te Maunga to Te Puke, 45 m. to 54 m.).—This is practically an open section, the Department handling goods and passenger traffic from the wharf at Maunganui, on Tauranga Harbour, to Paengaroa, a total distance of $18\frac{3}{4}$ miles. Since January last mails have been carried as far as Paengaroa, connecting with the Rotorua and Matata coach services.

In October, 1916, extraordinarily heavy rains caused severe floods in the swampy area traversed by the railway between 50 m. 50 ch. and 52 m. 28 ch. The Atuaroa Stream overflowed its banks, and a great volume of water was diverted into the Kopuaroa Stream, which crosses the railway at 51 m. 22 ch., causing a serious washout. This has been repaired, but in order to prevent a repetition of this trouble it is proposed to stop-bank the Atuaroa Stream for some distance, and the necessary survey is in hand.

Paengaroa Section (54 m. to 59 m. 65 ch.).—This section is also complete, with the exception of the Kaituna River Bridge. This cannot be completed until the steelwork, which has been on order for many months, can be obtained. A temporary bridge is in use in the meantime, and a regular train service has been handled throughout the year. The traffic is considerable and increasing, and it was found necessary to make some additions to the station buildings at Paengaroa.

Pongakawa Section (59 m. 65 ch. to 64 m. 10 ch.).—During the year bridges were erected at 61 m. 13 ch. and 63 m. 7 ch., also an overbridge at 62 m. 5 ch. The section is practically completed.

Otamarakau Section (64 m. 10 ch. to 71 m. 5 ch.).—The earthwork on this section is practically finished, with the exception of a portion along a cliff at 69 m. 76 ch. to 70 m. 8 ch.; this is in hand, the material being used to make up subsidences in the banks across the swamps from 67 m. to 68 m. 70 ch., which have been troublesome, but now show signs of consolidating. A bridge with concrete pile piers has been erected at Waitahanui Stream (70 m. 33 ch.), and platelaying has been carried forward to the end of the section. A first lift of ballast has been applied on all firm ground. Points and crossings and part of the sidings have been laid in Otamarakau Station yard. Fencing with concrete posts manufactured on the works is in progress on the right of the railway from Waitahanui Stream.

Matata Section (71 m. 5 ch. to 79 m. 18 ch.).—Earthworks were practically completed to Matata Station yard, but as a result of the heavy floods in the latter part of last year it was deemed advisable to raise the formation-level along a considerable portion of the section. This work is now in hand, the material being brought by train from the vicinity of 70 m. Platelaying has been continued, with temporary structures over the streams, the rail-head being 75 m. 53 ch.

General.

A second steam-navvy has been obtained for use on this line. This is of a later pattern than the one already in use, and has shown excellent results. Unfortunately, just as the men were getting used to the machine and the work it was found necessary to cease operations owing to a prospect of a coal shortage. The old steam-navvy, which was in need of repairs, has been overhauled and will be put in commission again shortly.

A small addition to our railway workshop at Maunganui has been made, and some additional machine tools have been obtained. This shop deals with the whole of the ordinary repair work in connection with the plant and rolling-stock on the line, besides manufacturing ironwork for bridges, &c.

Gisborne-Motu.

Motu Section—44 m. 10 ch. (Matawai) to 49 m. 8 ch. (Motuhora).—A considerable amount of bushwork has been done at the terminal station-yard (Motuhora), and the yard has been completely formed. A quantity of slipped material has been removed from various cuttings, and the formation has been maintained. Seven concrete-pipe culverts were laid complete. All fencing was completed, six 12 ft. gates erected, and existing fences repaired where necessary. Concrete inlets and outlets were built on to thirty pipe culverts, and sundry drains made and maintained. Twenty-five chains of roads have been made and metalled. The Motu River Bridge (48 m. 36 ch.), consisting of one 80 ft. truss span and four 20 ft. stringer spans, was completed, the contractor having been greatly hindered in his work through difficulty in obtaining steel. Rails have been laid throughout, including the Motuhora Station sidings, and the main line is completely ballasted. A contract has been let for the erection of station buildings and four platelayers' cottages, and the work is in hand. With the exception of these buildings, the section is practically complete. Goods-trains have been running over the line during the year.

An overbridge, to take the place of a level crossing, was erected at 32 $\frac{1}{2}$ m. on the opened line.

Gisborne-Napier (North End).

Ngatapa Section (0 m. to 10 m. 40 ch.).—The bank between 2 m. 5 ch. and 2 m. 20 ch. was raised and widened, and stop-banks were built across temporary cuts to the river at 1 m. 79 ch. and 2 m. 5 ch. A good deal of fencing has been erected, with cattle-stops, gates, and notice-boards, completing the fencing on the section; also a 3 ft. culvert at 8 m. 60 ch. Eight concrete

piers and six concrete abutments were constructed for bridges at 0 m., 5 m. 74 ch., and 9 m. 66 ch., and concrete piles were driven for a bridge at 5 m. 38 ch. Ngatapa Station approach roads were partly metalled. Rails are laid throughout. First lift of ballast was placed from 1 m. 63 ch. to 2 m. 33 ch., and second lift on sidings at Patutahi and Ngatapa. A loading-bank front, in concrete, was built at Patutahi, and a temporary engine-shed and water-service installed at Ngatapa. A bi-weekly passenger and goods service was carried on between Makaraka Junction and Ngatapa.

Work beyond Ngatapa was suspended in October, 1915, owing to scarcity of labour, and has not yet been resumed.

Gisborne Napier (South End).

Eskdale Section (0 m. to 10 m., approx.).—Apart from the Westshore Bridge and approaches, no construction-work has been done on this section during the year. Floods in the early part of August damaged some portions of the fencing and formation constructed some years ago.

The construction of the Westshore Bridge has been pushed on at a gradually increasing rate throughout the year. For a time there was difficulty in obtaining suitable labour, but more men have since been obtained, and as the men have become more experienced much better progress has resulted. Reinforcing-rods for 201 piles were fabricated and 300 piles made, completing the total of 600. A further 172 tons of steel have been bent, labelled, and stacked. The gravel-screening plant was unfortunately destroyed by fire on the 27th February, 1917, but the shingle was hand-screened for a time, and a new screening plant is now in working-order. Pile-driving has been continued throughout the year, 398 concrete piles having been driven, as well as 326 temporary piles to carry the profiling for the reinforced-concrete superstructure. Up to the 31st March piles had been driven from pier 28 back to pier 10 inclusive, and six 50 ft. spans and one 25 ft. span were completed, and several others in various stages. The quantity of steel worked into the bridge is 192 tons, and of concrete 1,856 cubic yards. Prior to August, 1916, materials for concrete were brought from the bins ashore to the concrete-mixer at the bridge by punts, but a tramway has since been laid along the approach bank, and the materials are hauled out by a small locomotive.

The approach banks are being formed by the Napier Harbour Board under contract with the Department. In April, 1916, the Board's dredge was moved from the north to the south approach, the former being practically complete, and during the year the dredge has worked for about eight months on the formation of the bank, the remainder of the time being occupied in removal, overhaul, and repairs. The bank can now be seen at low-water from about 1 m. 65 ch. to 2 m., while at high-water only about 3 chains is visible. Temporary stone retaining-walls have been built on the right of the line, from 1 m. 60 ch. to 2 m. 7 ch., up to the level of high water. The quantity of material placed in the bank during the year is about 9,000 cubic yards.

STRATFORD—MAIN TRUNK RAILWAY.

West End.

Tahora Section (37 m. 53 ch. to 47 m. 40 ch.).—The line is complete to Kohuratahi (42 m. 28 ch.), some ballasting having been done during the year. A considerable quantity of slipped material has been removed. Toi Road crossing has been widened and metalled, and cattle-stops constructed. Beyond Kohuratahi the cuttings and banks are practically complete to 46 m. 78 ch. At No. 1 tunnel (44 m. 30 ch. 50 lks. to 44 m. 54 ch. 50 lks.), which was practically finished last year, the western face wall has been completed, but a wing wall will be required on account of the unstable character of the papa. No. 2 tunnel (44 m. 76 ch. 50 lks. to 45 m. 9 ch. 50 lks.) was completed by the enlargement and lining of 6½ chains, except the western portal. Numerous water-tunnels have been driven, and six culverts laid. Three stream-diversions and two road-diversions have been completed, and a road-diversion at Tahora Station is partly formed. Rails are laid to 45 m. 19.50 ch., and partly ballasted. Ballast is supplied by the Railway Department from Mount Egmont, but a temporary cessation of supplies has recently occurred. About 100 chains of fencing have been erected, and the telephone-line is being extended to No. 1 tunnel. Four cottages have been erected at Tahora Station.

East End.

Matiere Section (0 m. to 11 m.).—The reinforced-concrete piers for the Ongarue River Bridge at 0 m. 7 ch. were completed, and the bridge is ready for the steel superstructure when it can be obtained. The Okahu Tunnel contract is progressing slowly. A heading was driven through last year, and during the period under review the enlargement and lining have been completed for a length of 19 chains, leaving 55½ chains to be done. In the approach cuttings the contractors have excavated 13,500 cubic yards of material. In the short tunnels at 7 m. 55 ch. and 8 m. 35 ch. bottom headings have been driven through, and enlargement and lining with brickwork were in hand under contract, but the contract was determined in August, 1916, owing to inability of the contractor to continue work. The lining was completed for a distance of about 2 chains. Owing to the absence of materials for concrete a brickmaking plant was established at 7 m., and this has been enlarged during the year. A twelve-chamber continuous kiln was completed in June, and the first lot of bricks for use on the works was drawn in September. Since then there has been a satisfactory output of bricks suitable for tunnel lining and building, also hard waste for concrete. A little earthwork has been done at various places, and two 6 ft. culverts are in hand, but very little labour is available in this district.

RAETIHI BRANCH RAILWAY.

Work on this railway was interrupted and disorganized during May, 1916, by the lamentable accident at the Ohakune ballast-quarry, whereby the Engineer in charge of the works, his assistant, the overseer, and three workmen lost their lives. During the remaining nine months of the year the work has been pushed on as vigorously as circumstances permitted. Earthworks and platelaying are practically completed throughout ($8\frac{3}{4}$ miles), also first lift of ballast; second lift and boxing-in for about three-fourths of the length. Fencing was erected for a distance of 140 chains, and sundry cattle-stops were constructed. Bridges at 1 m. 12 ch., 1 m. 61 ch., and 2 m. 6 ch. were completed. A water-service, comprising a dam opposite 8 m. 10 ch. and 12 chains of pipe-line was completed to supply the Raetihi Station. Goods traffic has been handled by the Department between Ohakune and Makaranui (4 m. 53 ch.) since August last, amounting to about 10,400 tons, mostly timber.

OPUNAKE BRANCH RAILWAY.

Kapuni Section (0 m. to 7 m.).—Earthwork is in hand at various places up to 6 m. 38 ch., a steam-navvy being employed with satisfactory results, in addition to several co-operative parties. A considerable quantity of earthwork remains to be done on this section. All culverts and drains were completed last year, and the fencing is also practically completed. No work has been done on the Mangatoki and Kapuni Bridges. At the Waingongoro River (0 m. 25 ch.) piers are being constructed for a concrete arch bridge, a total of 582 cubic yards of concrete having been placed in two piers and two abutments. The foundation for one of the remaining piers appears unsatisfactory, and the design will require to be amended to suit. At 2 m. 4 ch. a private-crossing overbridge, consisting of one concrete arch, has been completed, with approaches.

Auroa Section (7 m. to 12 m.).—Practically nothing has been done on this section during the year. Culverts had already been constructed up to 8 m. 46 ch. Shingle has been carted to the various culvert-sites up to 11 m., and a settler's house and outbuildings were removed from the railway reserve to a new site.

Mania Branch (0 m. to 5 m. 50 ch.).—Clearing has been completed to 1 m. 62 ch., and fencing has been erected to 2 m. 59 ch., except a few gaps. Twelve culverts have been constructed between 0 m. and 3 m. 50 ch. Two deviations of the Kapuni-Mania Road, totalling 34 chains in length, have been formed and metalled.

SOUTH ISLAND MAIN TRUNK RAILWAY (NORTH END).

Kekerangu Section (56 m. 5 ch. to 63 m. 6 ch.).—Very little work has been done on this section during the year. Ballasting is complete to the rail-head at 59 m. 25 ch. Some earthwork, fencing, &c., have been in hand up to 60 m. 44 ch., and three culverts have been laid. Piers have been constructed for a bridge over Woodside Creek (56 m. 50 ch.), but the steel superstructure is unobtainable at present.

MIDLAND RAILWAY.

Nelson-Westland (North End).

Kawatiri Section (59 m. 17 ch. to 63 m. 10 ch.).—The number of men employed here has been very small. Earthworks have been in hand up to 61 m. 60 ch., and not very much remains to be done to complete this length. At 61 m. 35 ch. four concrete piers were erected for a bridge, but steel for the superstructure is not available. A concrete retaining-wall at 61 m. 87 ch. was completed, and another at 61 m. 9 ch. nearly so. Owing to scarcity of labour the work on this section was closed down at the end of February, 1917.

Arthur's Pass Tunnel.

At the Otira end all work in the tunnel has been carried out by day labour. The rock through which the bottom heading has been driven is mostly slate; some parts stood badly, and nearly all had to be timbered either at time of excavating or shortly after. Seventy per cent. of the shifts worked were on "wet time." All the enlargement has been timbered. At the Bealey end the work was carried out by co-operative contract up to the 11th May, 1916; since then it has been done by day labour. The heading has been driven through greywacke, and has been wet in the face practically all the time, drying up about a chain back from the face. Little progress has been made with the lining, owing to shortage of men. During the year the bottom heading has been driven a total distance of 47 chains 63 links (both ends), and the tunnel has been completed for a distance of 21 chains 8 links. The total length of heading driven to date is 4 miles 45 chains 66 links; lining completed, 3 miles 59 chains 90 links. The distance between the headings is 59 chains 52 links, or just under $\frac{3}{4}$ mile. Distance between completed portions of tunnel, 1 mile 45 chains 28 links. Total length of tunnel, 5 miles 25 chains 18 links. The works have been undermanned throughout the year, a large number of our best tunnel workers being on active service with the New Zealand Tunnelling Company and other units.

The conditions affecting the electrification of the Arthur's Pass Tunnel have been investigated, and the characteristics of the service have been ascertained in considerable detail. The Railway Department has provided particulars of the traffic anticipated and a service time-table corresponding thereto. Inquiries have been directed to different manufacturers regarding the locomotive equipment and the maximum power which can be accommodated per axle. The weight of the locomotive and the principal features of the same have been determined. Several sources of power have been investigated and the extent of electrification discussed. No final conclusions have been reached in regard to any of these points, nor has the system of traction been finally determined. Further work is being conducted with a view to reaching finality on these points, and further information obtained which will enable a decision to be reached.

CULVERDEN-WAIAU RAILWAY.

This railway is 13 miles in length. Formation, including widening for station-yards, is completed to 12 m. 70 ch., the remaining length being about half-finished. A few minor works elsewhere remain to be done. Platelaying has been completed at 12 m. 76 ch., including all sidings at Achray (5 m. 15 ch.) and Rotherham (7 m.) station-yards, and one siding at Waiau. First lift of ballast is completed to the rail-head, including all sidings; second lift on main line only from 5 m. to 7 m. 20 ch. Fencing is practically completed, also private crossings, with one exception. All culverts are completed, also steel-girder bridges at 0 m. 20 ch., 9 m. 32 ch., and 11 m. 42 ch. Timber bridges at 0 m. 73 ch. and 3 m. 55 ch. are nearing completion. A telephone-line has been erected throughout. Stockyards, with holding-yards, have been constructed at Rotherham, also a loading-bank; and the approach road from Rotherham Township has been formed. Loading-races for permanent stockyards at Waiau are nearing completion. Since October, 1916, goods have been carried for the public over a portion of the line, and the service was extended to Waiau on the 28th February last. The delay in the completion of this railway is due entirely to acute shortage of labour, which still continues.

WAIMATE BRANCH RAILWAY EXTENSION.

Length, 4 miles 60 chains.—No further work has been done on this section during the year.

OTAGO CENTRAL RAILWAY.

Cromwell Section (44 m. 52 ch. to 57 m., approx.).—Formation was continued from 54 m. 77 ch. to the terminus, about 1 mile 14 chains being completed during the year, leaving some 30 chains to complete. Formation of Cromwell Station yard is in progress, also road-deviations and widening. A 10 ft. concrete arch culvert was completed at 56 m. 32 ch. Concrete bridges at Leaning Rock Creek and Sonora Creek were completed, and the Nine-mile Creek Bridge nearly so. Platelaying was extended from 50 m. 55 ch. to 55 m. 2 ch., a distance of 4 miles 27 chains. Ballasting was completed for about the same distance, first lift to 55 m. and second lift to 54 m. A goods service was maintained between Clyde and Half-way House, fruit and grain being the principal items carried. A thunderstorm in November, 1916, caused considerable damage to the railway and road. This will considerably delay the opening of the line, as bridges will be required at several washouts.

OREPUKI-WAIAU RAILWAY EXTENSION.

Construction-work on this extension ceased in November, 1915, but a few men were retained to complete the stumping on about 73 chains, and to burn off the felled timber. A settler's house was removed clear of the railway reserve. In January, 1917, bush fires destroyed the Department's store-sheds, with some tools and material, also the records of a good deal of survey-work. Fortunately, however, the bulk of this had been plotted and filed in Head Office.

SANDY BAY TRAMWAY.

This tramway, which has been built for the purpose of obtaining access to a quarry of stone for the new Parliamentary Buildings, Wellington, was completed during the year, and has since been in constant use.

SURVEYS OF RAILWAYS UNDER CONSTRUCTION, NEW LINES OF RAILWAYS, LAND-PLANS, ETC.

KAWAKAWA-HOKIANGA RAILWAY.

The permanent line has been pegged during the year from 28 m. to 37 m., and the plans are nearly completed. A trial line has been run from 38 m. to near Tio Point (43 m. 50 ch.), where the line touches deep water on Hokianga Harbour.

NORTH AUCKLAND MAIN TRUNK RAILWAY.

A contract was let for a land-plan survey from 107 m. 25 ch. to 111 m. 25 ch. Alterations have been made in the permanent-line survey near 112 m., and at Waiohira, the junction with the branch line to Whangarei.

WAIUKU BRANCH RAILWAY.

A land-plan survey from 3 m. 75 ch. to 12 m. 15 ch. has been completed, and the plans have been approved by the Survey Department.

HUNTLY-AWAROA RAILWAY.

A contract has been let for the survey of land required for this railway from 7 m. 25 ch. to 8 m., also for the Waitawhara Road.

EAST COAST MAIN TRUNK RAILWAY.

Land-plan surveys for the first four miles of the Athenree Section, also for the Paengaroa Section, were completed by the Department's staff. The survey of the permanent line of railway beyond Matata has been continued as opportunity permitted, but little progress has been made. A great deal of detailed survey work is required on this swamp section. On the Motu Section two small areas were surveyed for a road-deviation and a station water-supply. On the line southward of Gisborne the Wharekopae deviation was surveyed from 14 m. to 22 m. 47 ch., and plans completed. Further survey work was carried out in connection with the location of the

railway-line northward and southward of Wairoa, and the sidings to the wharf and to a ballast-pit site, until January, 1917, when it was found necessary to transfer the Assistant Engineer to more urgent work. Northward of Napier the survey of the centre-line was extended to 10 m. 60 ch., and a land-plan survey from 0 m. to 0 m. 55 ch. and from 8 m. 3 ch. to 10 m. 60 ch. is in hand.

TE ROTI—OPUNAKE—MOTUROA RAILWAY.

The permanent-line survey was completed from 46 m. to Moturoa, a distance of 10 miles 74 chains. The plans are in hand.

WELLINGTON—WAIRARAPA RAILWAY DEVIATION.

The survey in connection with the proposed deviation between Wellington and the Wairarapa has been entirely suspended, owing to the officers in charge of the survey party having joined the New Zealand Expeditionary Forces.

WELLINGTON—PAEKAKARIKI RAILWAY DEVIATION.

This survey is also suspended owing to officers joining the military forces.

TUAPEKA MOUTH BRANCH RAILWAY.

During the year trial-line surveys between Hillend and the South Island Main Trunk Railway were completed from Hillend to Crichton (about 11½ miles) and Hillend to Lovell's Flat (about 10 miles). Neither of these lines can be regarded as satisfactory, as the gradients would be steep and the formation expensive. There are at least two alternative lines which seem worthy of investigation. A line was also surveyed from Hillend onward to a junction (at Greenfield) with the surveyed line up the Clutha Valley. This work has been suspended, the Assistant Engineer being now with the military forces.

Generally, the amount of survey work carried out during the year has been much less than usual, owing to the absence of so many of our Engineers on active service.

ROADS, BRIDGES, ETC.

The construction of roads and bridges has been greatly hampered by, the scarcity of labour, and also to some extent through lack of certain materials. Only the unexpended balances of former votes were available for expenditure, and in some districts works have been deferred owing to the excessive wages demanded by the few workmen available, so that roadwork generally may be said to have been reduced to a minimum as regards both construction and maintenance. The year has been marked by a most extraordinary series of floods in various parts of the country, almost every district having suffered more or less. This has necessitated a considerable expenditure from the flood-damage vote, as well as a great deal of extra work for the Department's staff.

Some of the more important works carried out are mentioned briefly below:—

Mangamuka to Victoria Valley.—A considerable amount of work has been done on this important road. Bush has been felled for a distance of 34 chains, road widened 86 chains, dray-road formed 12 chains (11½ chains in rock), road repaired 230 chains, &c.

Roderick Road.—There were 72 chains stumped and cleared, 137 chains formed 14 ft. wide, 36 chains bush felled, &c. This road will be a feeder to the railway at Kaikohe.

Matakana River Bridge.—A concrete bridge, 37 ft. long, with 12 ft. 6 in. roadway, has been erected by the Rodney County Council to replace an old wooden structure.

Te Hana River Bridge.—Piles for this bridge have been made and driven, and work on the superstructure is in progress under the Rodney County Council.

Omaumau River Bridge.—The Rodney County Council has also made and driven the piles for this bridge, which will be of reinforced concrete, 30 ft. long and 14 ft. wide.

Taikata Creek Bridge.—The Waitemata County Council has completed this bridge, which is situated on the Great North Road Deviation, 2½ miles north of Henderson Railway-station. The structure is of reinforced concrete, one 35 ft. and two 27 ft. 6 in. spans, with 16 ft. roadway. The formation of 36 chains of 16 ft. approach roads is in progress and nearing completion.

Brooklyn Bridge.—The Department is constructing a reinforced-concrete bridge of one 35 ft. and two 22 ft. 6 in. spans, with 12 ft. roadway. The piles have been made, and work on the superstructure is being commenced.

Hingaia and Glasson Creek Bridges.—These two bridges, in reinforced concrete, the former of seven 50 ft. spans and the latter of six 50 ft. spans, 15 ft. wide, have been erected by the Karaka Road Board.

Tamaki River Bridge (Panmure).—This is a reinforced-concrete bridge on the main road from Panmure to Howick. It consists of fourteen 50 ft. and one 20 ft. spans, carried on four rows of concrete columns built up on reinforced-concrete piles. There is a 21 ft. roadway, with footpaths on either side, the width over all being 32 ft. The work was carried out by the Manukau County Council.

Piako River Bridge (Orchard).—This bridge will consist of ten stringer spans of 25 ft. each, and a central lifting span of 36 ft. 9 in., all in timber with the exception of the lifting gear, which is of mild steel. The work, which is being carried out by the Thames County Council, is well in hand, nearly all the piles having been driven and the superstructure constructed,

Waikato River Bridge (Rangiriri).—This new bridge is practically completed by contract. It comprises thirty-three 25 ft. stringer spans and three 123 ft. truss spans, in hardwood, on reinforced-concrete pile piers. The total length of the bridge is 1,194 ft., and the width between trusses 13 ft. 4 in.

Waihou River Bridge (Tirohia).—A contract has been let for the erection of a timber bridge consisting of one 9 ft., four 25 ft., and one 24 ft. platform spans, and one 62 ft. truss span on hardwood pile piers.

Waikato River Bridge (Ngaruawahia).—A contract has been let for the erection of this bridge, which consists of three 123 ft., one 43 ft., and one 20 ft. spans, with 13 ft. roadway. The superstructure is of Australian hardwood, and will be carried on reinforced-concrete piles and cylinders. All the piles have been made, and staging piles have been driven around the positions of the cylinders in readiness to commence sinking.

Whatawhata to Raglan.—The proposals of the Raglan County Council for re-forming, culverting, and metalling about 15 miles of this road, at an estimated cost of £16,000, have been approved. The Council has completed the whole of the formation and culverting and about 5½ miles of metalling. When this work is completed the road between Whatawhata and Waitetuna will be metalled throughout.

Hamilton to Rotorua.—The Matamata County Council has carried out, under Government grants, a considerable amount of raising, re-grading, culverting, and metalling on this road, effecting a very satisfactory improvement.

Mangapiko Stream Bridge.—A reinforced-concrete bridge of two 15 ft. spans has been erected by the Rangiohia Road Board.

Pirongia to Kawhia.—This road has been re-formed and metalled for a distance of 45 chains, under contract with the Department, and a timber bridge has been erected over the Kawaroa Stream.

Waipa County Roads.—The Waipa County Council has carried out the metalling of nearly 11 miles of the following roads under Government subsidies, as well as over 9 miles on its own account: Pirongia to Te Awamutu, Te Awamutu to Ohaupo, Te Awamutu to Pirongia (Frontier Road), Te Rore to Pirongia, Whatawhata Swamp Road, and Kawa Road.

Mangarapa Stream Bridge.—The Waitomo County Council has erected a platform bridge, 30 ft. span by 12 ft. wide, on rolled-steel joists, on the Hangatiki to Waitomo Road.

Wharepuhunga Extension, No. 3 Block.—The Department has completed the construction of 2 miles 20 chains of dray-road, 12 ft. wide, also two timber bridges and sundry culverts.

Wairoa River Bridge (Tauranga).—Owing to a subsidence in the river-bank one abutment of this ferro-concrete bridge settled down about 1 ft. This was raised by means of an hydraulic jack, and two additional piles were driven, restoring the bridge to its proper level.

Pongakawa Stream Bridge.—Timber and ironwork for a truss bridge of one 61 ft. span have been prepared, and erection will be commenced at once.

Mangatoi Road.—Bush has been felled for a distance of 43 chains, and a 14 ft. road formed for 58 chains through heavy bush country, with a large proportion of solid rock cuttings. This work is very important to settlers.

Mimiha Stream Bridge.—A bridge consisting of three 25 ft. spans on masonry piers has been erected near Ruatahuna, in the Urewera Country, by the Department's bridge gang. The work was one of considerable difficulty, owing to the inaccessible character of the place.

Motu-Opotiki Road.—This road was maintained for a distance of 15 miles for the greater part of the year. This length, with the Waiawa Deviation (3 miles), was then handed over to the local authority.

Waioeka River to Matawai.—This road was widened from a 6 ft. track to a 12 ft. dray-road for a distance of 75 chains, and the portion already widened (5 miles 45 chains) was maintained—a work of some magnitude, owing to slips caused by the heavy rains experienced.

Te Kuiti to Mokau.—Maintenance on this road has been carried out by contributions from the Waitomo and Awakino County Councils, subsidized by the Government; but the amount available under this arrangement is hardly sufficient in view of the very heavy traffic on the road.

Waitomo County Roads.—The Waitomo County Council has formed 8 miles of Te Ahuroa Road and metalled 4 miles, as well as metalling a total length of 10 miles on Mangarino, Mangatiki, Kumara, and Ngapaenga Roads.

Mimi to Mokau.—The Clifton County Council has metalled 19 chains of dray-road, and quarried additional metal. The Department has lowered grades on Mount Messenger for 59 chains, sandstoned 12 chains of road, erected one small bridge and eight culverts, and completed 92 chains of engineering survey.

Waiwakaiho River Bridge.—A contract was let for the construction of a weir across the river to protect the foundations of this concrete bridge. Work was commenced in July, 1916, but had to be suspended in December. It will be resumed shortly.

Kotare Stream Bridge.—A girder bridge of one 30 ft. and two 16½ ft. spans has been erected, and approaches formed.

Waikawau River Bridge.—A bridge consisting of two 18 ft. and one 40 ft. spans has been erected.

Manganui-a-te-ao River Bridge (Hoikenga).—This bridge, consisting of one 121 ft. truss span, was completed under contract.

Mangatiti (West).—On this road five small contracts were completed, comprising 54 chains of dray-road formation, 50 chains of horse-road 6 ft. wide, and twenty timber culverts. The dray-road already formed has been maintained for a distance of 5 miles, but only in a fit state for horse traffic, there being numerous slips, through which a 6 ft. track has been cleared. Under the flood-damage item 2½ chains of road giving access to the steamer-landing on the Wanganui River was restored, having been destroyed by floods.

This is typical of the work carried out on a great many roads in the newly-settled bush areas along the Wanganui River and throughout the surrounding district. These new roads and tracks suffer considerable damage through slips and washouts, but such damage has been less than usual during the year under review.

Kaitieke Stream Bridge.—An understrutted bridge, 37 ft. in length, was constructed, also 19½ chains of 14 ft. road approaches.

Diggers' Creek Bridge.—A bridge consisting of two 81 ft. spans, on the main Pohangina Road, has been constructed by the Pohangina County Council from plans supplied by the Department.

Pohangina Bridge (Piripiri Crossing).—A bridge, consisting of one 100 ft. and one 41 ft. truss spans and three 25 ft. stringer spans, with 10 ft. 6 in. roadway, has been erected by the Pohangina County Council.

Napier-Wairoa Road.—This main coach-road has been maintained by the Department for a length of 29½ miles. Severe storms during the year caused considerable damage to the formation, particularly the heavy rains of July last. The Department's section of the road was closed to traffic for only a day or two. The Wairoa County Council received and expended a grant towards the repair of flood damage on their section of the road, but much more work is necessary. This Council has also metalled 48 chains of the road under Government grant.

Runanga-Pohue Road.—This main coach-road has been maintained for a length of about 26 miles, being kept open for traffic throughout the year.

Otawhao Block.—A 30 ft. reinforced-concrete road-bridge has been erected and approaches formed. Thirty-eight chains of road were metalled.

Purahotangahia Block.—An engineering survey of 30 miles of roads was completed. The block is intended for a returned soldiers' settlement, and a pack-track 1½ miles in length has been formed to enable the settlers to take fencing-posts to their sections. Half a mile of 16 ft. road was formed in heavy sideling, and a contract has been let for a length of 3 miles 11 chains, of which about 1 mile is finished.

Porangahau Block.—Work in this block has been retarded by scarcity of labour, but a little over 1 mile of road has been formed, also one temporary bridge. A contract has been let for the erection of seven road-bridges.

Devil's Creek Bridge.—A 36 ft. arch reinforced-concrete road-bridge has been erected by the Waipawa County Council.

Waipawa River Bridge (Fletcher's Crossing).—This bridge, comprising six 42 ft. spans, is being erected by the Waipawa County Council, and is nearly completed.

Matahoura Stream Bridge.—A bridge of four 25 ft. spans on concrete piers has been practically completed under the Wairoa County Council.

Rokaiwana Stream Bridge.—This bridge, consisting of one 40 ft. span in ferro-concrete, has been constructed by the Dannevirke County Council.

Turanganui River Bridge.—A reinforced-concrete bridge, consisting of three 25 ft. and two 24 ft. spans, 16 ft. wide between parapets, has been constructed by the Featherston County Council.

Wainui River Bridge (Wainuiomata Valley).—The Hutt County Council has completed a reinforced-concrete bridge of two 40 ft. spans, with reinforced-concrete wing walls.

Mangatawainui Bridge.—The Department has constructed a bridge of one 40 ft. and two 25 ft. spans, on pile piers, on the Blairgowrie Road, together with 10 chains of approaches.

Marauanga Stream Bridge.—A bridge, consisting of three 20 ft. stringer spans on pile piers, has been completed, and the approaches are in hand.

Mangatainoka Block River Protective Works.—Four pile groynes of a total length of 120 ft. have been constructed, and a length of river-bank was trimmed, fenced in, and planted with willows.

Poroporo Settlement.—The Upokongaru Stream Bridge, consisting of a truss span of 144 ft., with 12 ft. roadway, has been completed, with approaches. The roads throughout the settlement have been repaired, cleared of slips, and maintained prior to vesting in the local authority.

Opuwa River Bridge (Blenheim).—The concrete-work on this bridge, which consists of eight 70 ft. spans in reinforced concrete, is all completed. The approach from the Blenheim end is complete, and the northern approach is under way. Asphalt is being placed on the bridge-deck, and some concrete blocks are being deposited to prevent scour around the centre piers.

Branch River Bridge.—This bridge was completed last year under contract, but owing to abnormal floods before the banks had consolidated a portion of the northern approach was washed out.

Kaikoura-Parnassus Road.—Bridges over the Oaro, Goose Bay, and Okarahia Streams were completed under contract, and approaches thereto, by day labour. The Leader River Bridge was completed and can now be used, although the approaches are not quite finished. The road has been maintained throughout the year, and has given general satisfaction to the travelling public.

Kohatu-Westport-Reefton Road.—A considerable sum has been expended in the maintenance of this road, which connects the provinces of Nelson and Westland, the work comprising new metalling and improvements in alignment and grading, as well as ordinary maintenance-work.

Hope Valley Bridge.—A bridge, consisting of one 41 ft. and two 12 ft. spans on concrete piers and pile abutments, has been erected.

Matiri River Suspension Bridge.—A suspension footbridge 160 ft. in length has been erected.

Anatoki River Bridge.—A contract has been let for the erection of a bridge of two 52 ft. and two 20 ft. spans on pile piers. The work is progressing satisfactorily.

Motueka River Bridge (Motueka-Riwaka Road).—A contract has been let for the reconstruction of the eastern portion of this bridge, including nine new stringer spans, of various lengths, on new pile piers and abutment.

Maruia River Bridge (Maruia North Block Road).—A bridge, consisting of two 81 ft. Howe truss spans on concrete pier and abutments, has been erected. Road approaches have been completed for a distance of about 22 chains.

Tiraumea River Bridge.—A traffic bridge, consisting of four 25 ft. and one 61 ft. spans on piles, with 10 ft. 6 in. roadway, has been erected, and approach roads formed and metalled.

Arthur's Pass - Kumara - Ross - Waiho.—Maintenance of these main roads has involved an expenditure of over £5,000, which is less than usual. The work includes new metalling, patching existing metal, cleaning out water-tables, fords, &c., cutting overhanging scrub, re-forming road surface, and sundry minor improvements.

Lyell Creek Bridge.—A contract for the erection of this bridge, comprising one 80 ft. timber truss span, one 20 ft. span on pile piers, and one concrete abutment, is practically completed.

Ashley River Bridge.—A bridge, comprising eight 25 ft. stringer spans, 9 ft. 6 in. roadway, on pile piers, is being constructed under contract. The work is well in hand.

Hurunui River Bridge (Lower).—A bridge, comprising three 52 ft., one 51 ft., one 25 ft., and one 11 ft. spans, on pile piers, is being erected by the Waipara County Council. Three spans are practically completed, and a fourth is well in hand.

Makerikeri River Bridge.—A contract has been let for the erection of a bridge of eight 25 ft. spans on pile piers, with approach roads and extensive gabion protection. Timber is being carted to the site.

Okuku River Bridge.—This bridge is being erected under contract, and is nearly completed. It consists of thirty-seven 25 ft. stringer spans on pile piers, the roadway being 9 ft. 6 in. wide, except on four spans, where the width is increased to 19 ft. 6 in. to provide a passing-place for vehicles. A contract has been let by the Ashley County Council for the construction of the approaches and protective work, and this is nearing completion.

Orari River Bridge (Badham's Road).—A contract has been let for the erection of a bridge comprising fourteen 25 ft. stringer spans on pile piers. The work is progressing satisfactorily.

Waitaki River Protective Works.—Stone gabions were constructed and placed in position for a distance of 13½ chains along the river-frontage of the Steward Settlement. Two small groynes were also constructed, and further work is in progress.

Arthur's Point Bridge (Shotover River).—Plans of a new structure to replace the present decayed wooden bridge have been prepared, and materials have been obtained. Construction work will be put in hand shortly.

Lumsden - Te Anau Road.—This tourist motor-road was repaired and put in order as far as possible, encroaching scrub being cleared for a distance of 6 miles, and 35 miles of road generally trimmed up.

MacLennan River Bridge.—A road-bridge, comprising eight 25 ft. timber spans on concrete piers, was erected under contract.

Tautuku River Bridge.—A timber bridge of three 25 ft. spans was erected under contract.

Lumsden Protective Works.—Two gabion groynes were constructed, also 4 chains of stop-bank and sundry minor works to prevent erosion by the river. The results so far have been satisfactory.

IRRIGATION.

OTEKAIKE SETTLEMENT.

This work was completed during the year.

IDA VALLEY SCHEME.

The plastering of the Manorburn Dam was completed, and a diverting weir was constructed. The upper section of the Alexandra Bonanza Water-race was lined with concrete where necessary, dry stone walls erected, spillways cut, and stock-bridges erected. This section is now complete in every detail. The lower section was deepened where necessary. Moa Creek to Black's No. 3 Race was completed. Halliday's Race was cleaned up, and a 20-ft.-span heavy-traffic bridge erected at the point where the race is crossed by the road leading to the Manorburn Dam. The Syndicate Race was acquired by the Government, and widened and deepened for a distance of about 3½ miles. A few settlers were supplied with water during the irrigation season.

MANUHERIKIA-ALEXANDRA-CLYDE SCHEME.

A survey party has been engaged throughout the year in setting out distributary races and surveying in connection with the intake in the Manuherikia Gorge and elsewhere. A considerable amount of plan work was done, and the plotting now in hand includes a 10-chain-scale plan of the whole of the country to be dealt with under this scheme. A small contract for the construction of 33 chains of water-race has made very slow progress, about 10 chains still remaining to be made. The Department has carried out earthworks on 2 miles of race-line, and removed several large slips. Preliminary work in connection with the tunnel intake was completed, including 22 chains of tramway and a service road. At the inlet end of the tunnel all loose material has been removed and a shaft sunk to formation-level. Driving has just been commenced. At the outlet end the tunnel has been driven for a distance of 3.67 chains. The total length of the tunnel is approximately 24 chains.

IRRIGATION FARMS.

The time has now arrived for the Government to establish an experimental and instructional farm to be worked wholly by irrigation, in order that farmers may be able to ascertain and study the correct methods of irrigation and the crops best suited to each particular locality. Until steps such as this are taken it is hardly possible to ensure a successful future for any broad irrigation scheme.

WAIHOU AND OHINEMURI RIVERS IMPROVEMENT.

Dredging.—During April, 1916, portion of the Waihou River between the Junction and Puke was dredged, the material being used to form stop-banks. On the 17th April the dredge commenced work at the lower end of the Ngararahi Cut, a canal 63 chains long, 80 ft. wide, and 12 ft. deep, which will cut out a large bend in the river. Work has since been fairly continuous, the output of the dredge being a total of 180,899 cubic yards of clay and sand. At the end of March, 1917, there remained 11½ chains of this cut to be excavated. The material is pumped ashore to form stop-banks. A new barge, 36 ft. by 18 ft., with lifting-gear, has been constructed, and has proved very useful. An electric lighting plant has been installed on the dredge, enabling two shifts to be worked during the summer months.

Stop-banks.—The dredge has constructed 26 chains of stop-bank near Thorp's Bend. A stop-bank in continuation of the Paeroa stop-bank has also been made for a distance of about 6 chains. A length of 1 mile 60 chains of stop-bank between Paeroa and Te Aroha has been let in small contracts at various dates, but the contractors have been greatly hampered in consequence of the abnormal rainfall, which caused the river to rise and flood the excavations repeatedly. It is expected that the completion of the Ngararahi Cut will enable these contracts to be carried out expeditiously.

Flood-gates and Drains.—At Paeroa Main Drain two reinforced-concrete barrels, 70 ft. long by 4 ft. 6 in. diameter, fitted with automatic gates, have been constructed, and a large deviation drain over 15 chains in length has been excavated. Flood-gates similar to the above were constructed at Te Tawa Stream Drain. At Wilson's Drain a single flood-gate of the same type was completed. Sundry other flood-gates have been maintained.

Ngahina Bridge.—A detailed plan of the Ngahina Bridge across the Waihou River was made, with a view to its alteration to suit the river-improvement scheme.

Ngahina Wharf.—Sundry additional buildings are being erected in connection with this new wharf.

Surveys.—A large amount of survey work has been done in locating lines of stop-banks, also in connection with a proposed canal at Pereniki's Bend, the Tirohia-Rotokohu land-drainage area, Awaiti Ridge stop-bank, &c.

General.—In addition to works and surveys, easements and land-acquisition have been dealt with. Several buildings have been removed from lines of stop-banks, punts and gear have been overhauled, and a new pile-driving derrick has been built. The whole of the works on the rivers-improvement scheme have been much hampered by local floods, the rainfall having been far above the average of recent years.

WANGANUI RIVER TRUST.

During the year an exhaustive inspection was made of the Wanganui River from Taumarunui down to Raorikia, a little above Upokongaro, by the Inspecting Engineer, assisted by the Resident Engineers of the districts through which the river passes, the object being to ascertain what is necessary in order to properly maintain works which have already been carried out, and what further works are required to render the river navigable by the river steamers at all states of the stream. The River Trust has been furnished with a copy of the report.

MUNICIPAL TRAMWAYS.

Auckland.—A siding 3½ chains in length, of single track, has been laid from the main line to the Tramways Office in Customs Street West. The alignment of 12 chains of double track in Customs Street West, between Queen Street and Hobson Street, has been altered to conform to street improvements carried out by the City Council, the result being a decided improvement in the tramway. The Queen Street extension, comprising 41 chains of double track from Wellesley Street to Karangahape Road, was completed. An automatic points-control apparatus was installed at the junction of Queen and Wellesley Streets.

Gisborne.—A new storage-battery car is under construction in Christchurch.

Wellington.—The large new car-shed in Onepu Road, Kilbirnie, has been completed, with the necessary sidings.

Christchurch.—On the Sumner route the tramway has been completed along the causeway across part of the estuary, as well as a deviation between Monck's Bay and Shag Rock, an extension of the Woolston loop, and the construction of a new loop at the junction of Sumner Road with Mount Pleasant Road. On the Worcester Street route the line has been duplicated between Manchester Street and Stanmore Road. A proposal for a new loop in Moorhouse Avenue is under consideration. The plans of seventeen new trailers have been approved.

Dunedin.—The Maryhill Cable Tramway, which had been acquired by the Dunedin City Council, was inspected and found to be unfit for traffic, and accordingly an order was issued forbidding its use. The Council's proposals to remedy the defects have since been approved.

MARINE.

As usual, the Department's district officers have made numerous inspections and reports, on behalf of the Marine Department, in connection with wharves, landings, harbour-works, reclamations, foreshore leases, &c., particularly in the Whangarei and Auckland districts. In addition the Department has carried out sundry works, including the following:—

Kohukohu Reclamation, Hokianga.—The work of restoring the damaged retaining-wall and raising the height of the reclamation has been completed.

Harbourmaster's House, Rawene, Hokianga.—Some additional excavation has been carried out, and a drainage system has been installed.

Tauranga Harbour.—The Department carried out a little dredging in the channel leading to the town wharves, but the only plant available proved unsuitable, and the work was discontinued.

Wairoa (H.B.).—A marine survey of the Wairoa roadstead was carried out, and a suitable plan supplied to facilitate the working of this port by the deep-sea vessels which will call for meat from the new freezing-works.

Hokitika Lighthouse.—The lighthouse was repaired and painted.

Cape Foulwind Lighthouse.—A new outbuilding was erected.

Avon River.—Levels and soundings were taken in connection with a proposed reclamation at New Brighton.

Puysegur Point Lighthouse.—Timber has been obtained and joinery manufactured for three new cottages. The work of erection will be commenced early in the spring.

DEFENCE WORKS.

Sundry buildings have been erected, and existing works have been maintained and improved.

A considerable amount of maintenance work and some new construction were carried out during the early part of the year at the military camps. These have since been taken over entirely by the Defence Department.

I have, &c.,

R. W. HOLMES, M.Inst. C.E.,
Engineer-in-Chief.

The Hon. the Minister of Public Works.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1917—continued.
NORTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.														Total.
							Surveyed.			Opened.											
							Under Formation.	Under Plate-laying.	Date.	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	—				
Whangarei - North Auckland Railway Kaipara-Newmarket Onehunga Branch .. Auckland-Waikato .. Auckland-Penrose— Deviation via Beach Auckland City Branch —Kingsland Station to Auckland Station via Western Park and Freeman's Bay Waikato Branch Rly.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
	Whangarei - North Auckland	M. ch. 19 77	Kioreroa-Waikiekie..	M. ch. 19 77	M. ch. 1 76	M. ch. 21 73	M. ch. 1 77	M. ch. 9 0	M. ch. 9 0	..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	M. ch. ..	
	Kaipara-Newmarket	35 73	Helensville-Newmarket	35 73	6 66	42 59	..	..	..	..	..	..	..	..	..	..	..	..	..	35 73
	Onehunga Branch ..	2 73	Penrose - Onehunga Wharf	2 73	1 70	4 63	..	..	..	..	..	..	..	..	..	..	..	..	..	2 73
	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	2 60	Auckland City Branch	2 60	..	2 60	2 60	Prelim.	..	..	..	..	..	..	..	..	..	..	..	..
	—Kingsland Station to Auckland Station via Western Park and Freeman's Bay																				
	Waikato Branch Rly.	12 69	Paerata-Waikato	12 69	2 1	14 70	2 22	4 40	6 07	..	..	..	..	..	..	..	..	..	..	..
	Huntly-Awaroa	9 0	Huntly-Awaroa	9 0	..	9 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Paeroa-Pokeno Waikato-Thames Hamilton-Cambridge Paeroa-Waihi Waihi - Opoitiki, or East Coast Railway	..	40 15	Paeroa-Pokeno	40 15	..	40 15	40 15	..	..	..	..	..	..	..	..	..	..	..	..	7 20
	Paeroa-Pokeno	40 15	Paeroa-Pokeno	40 15	..	40 15	40 15	..	..	..	..	..	..	..	..	..	..	..	..	..
	Waikato-Thames	62 58	Frankton Junction-Thames	62 58	10 17	72 75	..	..	..	..	..	..	..	..	..	..	..	..	..	62 58
	Hamilton-Cambridge	12 2	Ruakura Junction-Cambridge	12 2	3 14	15 16	..	..	..	..	..	..	..	..	..	..	..	..	..	12 2
	Paeroa-Waihi	12 40	Paeroa-Waihi	12 40	1 30	13 70	..	..	..	9 Nov., 1905	..	..	..	..	..	..	..	..	..	12 40
	Waihi - Opoitiki, or East Coast Railway	138 27	Waihi-Tauranga	41 60	..	41 60	{ 18 0 } { 23 60* }	8 0	..	..	..	..	..	..	..	..	..	..	..	..
			Tauranga-Te Maunga Junction	3 20	..	3 20	..	..	3 20	..	..	..	..	..	..	..	..	..	..	..
			Te Maunga Junction-Te Puke	8 65	1 23	10 8	..	..	8 65†	..	..	..	..	..	..	..	..	..	..	..
			Te Puke-Paengaroa..	5 65	1 16	7 01	..	..	5 65	..	..	..	..	..	..	..	..	..	..	..
			Paengaroa - Pongakawa	4 30	0 47	4 77	..	..	4 30	..	..	..	..	..	..	..	..	..	..	..
		Pongakawa-Otamara-kau	6 72	0 26	7 18	..	..	6 72	..	..	..	..	..	..	..	..	..	..	..
		Otamara-kau-Matata	9 8	0 36	9 44	..	..	0 44	8 44	..	..	..	..	..	..	..	..	..	..	..

* Trial survey. † Completed all but Te Maunga yard.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1917—continued.

NORTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.															Total.
							Surveyed.	Under Formation.	Under Plate-laying.	Opened.												
										Date.	—	1910-11	1911-12	1912-13	1913-14	1914-15	1915-16	1916-17	—			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
New survey —contd.	Napier-Gisborne—ctd.	M. ch.	Waikura-Waterfall	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.	M. ch.	M. ch.	M. ch.		
		5 0	5 0	5 0	5 0	5 0	4 0	4 0	4 0	..	..	..	..	..	..	..	..	..	..	..
		4 0	4 0	4 0	4 0	4 0	17 11	17 11	17 11	..	..	..	..	..	..	..	..	..	..	..
		17 11	17 11	17 11	17 11	17 11	12 40	12 40	12 40	..	..	..	..	..	..	..	..	..	..	..
		12 40	12 40	12 40	12 40	12 40	7 0	7 0	7 0	..	..	..	..	..	..	..	..	..	..	..
Napier-Woodville ..	Napier-Woodville ..	96 65	Wairoa Wharf Siding	1 64	..	1 64	1 64	..	..	..	..	..	..	..	..	..	..	..	..	..
		2 55	Wairoa-Napier ..	2 55	2 55	2 55	15 5	111 70	..	..	..	..	..	..	..	..	..	..	..	..
		96 65	Napier Spit-Woodville	96 65	15 5	111 70	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		17 21	Woodville-Palmerston North	17 21	0 51	17 72	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		115 79	Woodville-Wellington	115 79	21 73	137 72	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rimutaka Incline Deviation Surveys	Greytown Branch ..	3 7	Woodside-Greytown	3 7	0 64	3 71	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		11 50	Featherston - Martinborough	11 50	..	11 50	11 50	11 50	..	..	..	..	..	..	..	..	..	..	..	..
		4 62	Greytown - Martinborough	4 62	..	4 62	4 62*	..	..	..	..	..	..	..	..	..	..	..	..	..
		9 0	Kaitake-Featherston	9 0	..	9 0	9 0	Prelim.	..	..	..	..	..	..	..	..	..	..	..	..
		21 30	Upper Hunt-Woodside	21 30	..	21 30	21 30	21 30	..	..	..	..	..	..	..	..	..	..	..	..
Foxton-New Plymouth	Wellington-Manawatu	52 0	Petone-Pigeon Bush	52 0	..	52 0	52 0	..	..	..	..	..	..	..	..	..	..	..	..	..
		70 0	Petone-Carterton, via Martinborough	70 0	..	70 0	70 0	..	..	..	..	..	..	..	..	..	..	..	..	..
		83 37	Wellington-Longburn	83 37	15 76	99 33	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		120 44	Foxton-Patea ..	120 44	14 75	135 39	..	..	..	..	..	..	..	..	..	..	..	..	..	..
		26 7	Turakina-Matarawa	11 67	..	11 67	11 67	11 67	..	..	..	..	..	..	..	..	..	..	..	..
Foxton-New Plymouth	Route Improvement Surveys	7 40	Aramoho-Coat Valley Tunnel	7 40	..	7 40	7 40	..	..	..	..	..	..	..	..	..	..	..	..	..
		3 60	Kai Iwi - Okehu ..	3 60	..	3 60	3 60	..	..	..	..	..	..	..	..	..	..	..	..	..
		3 0	Nukumarua-Waitotara	3 0	..	3 0	3 0	Prelim.	..	..	..	..	..	..	..	..	..	..	..	..
			
		

* Trial survey. † Date of purchase.

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1917—continued.
NORTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.														Total.	
							Surveyed.			Under Formation.		Under Plate-laying.		Opened.								
							8	9	10	Date.	12	13	14	15	16	17	18	19	20	—		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
Foxton-New Plymouth —contd.	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. ..	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	101 27	Stratford-Toko	6 26	0 40	6 66	..	..	..	1 Mar., 1905	..	..	..	..	..	..	..	..	..	37 53
			Toko-Oruru	4 72	0 36	5 28	..	..	..	1 April, 1908	..	..	..	..	..	..	..	..	..	..
			Oruru-Huiroa	4 50	0 35	5 5	..	..	..	20 June, 1910	..	6 77	..	..	..	..	..	..	..	..
			Huiroa-Te Wera	6 77	1 16	8 13	..	..	..	1 Aug., 1912	..	..	..	8 55	..	..	..	..	..	..
			Te Wera-Pohokura	8 55	0 65	9 40	..	..	..	1 July, 1914	..	..	..	..	..	6 13	..	..	..	..
			Pohokura - Whangamomona	6 13	0 45	6 58	..	..	..	..	..	..	..	..	..	..	..	..	..	..
			Whangamomona - Tahora	9 67	0 60	10 47	..	2 20	7 47	..	..	..	..	..	..	..	..	..	..	..
			Tahora-Heao	1 40	..	1 40	1 40	..	..	..	..	..	..	..	..	..	..	..	..	..
			Heao-Matiere	35 57	..	35 57	35 57	Prelim.	..	..	..	..	..	..	..	..	..	..	..	..
			Okahukura-Matiere	10 23	0 75	11 18	11 18	10 23	1 17	..	..	..	..	..	..	..	..	..	..	..
Stratford - Ongarue— Deviations Puketutu - Mangaroa Deviation Opunake-Mountain Rd. Opunake-Eltham Te Roti-Moturoa Manaia Branch Mount Egmont Branch	Stratford - Ongarue— Deviations	33 40 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.	..	..	..	..	..	..	..	..	..	..	..	..
	Opunake-Mountain Rd.	23 10	..	30 0	..	30 0	30 0	..	..	..	..	..	..	..	..	..	..	..	..	..
	Opunake-Eltham	23 10	Opunake-Eltham	23 10	..	23 10	23 10	..	..	..	..	..	..	..	..	..	..	..	..	..
	Te Roti-Moturoa	55 65	Te Roti-Kapuni	7 0	0 19	7 19	..	7 0	..	..	..	..	..	..	..	..	..	..	..	..
			Kapuni-Auroa	5 0	..	5 0	5 0	1 0	..	..	..	..	..	..	..	..	..	..	..	..
			Auroa-Pihama	4 42	..	4 42	4 42	..	..	..	..	..	..	..	..	..	..	..	..	..
			Pihama Opunake	5 68	..	5 68	5 68	..	..	..	..	..	..	..	..	..	..	..	..	..
			Opunake-Stony River	18 70	..	18 70	18 70	..	..	..	..	..	..	..	..	..	..	..	..	..
			Stony River-Moturoa	14 45	..	14 45	14 45	..	..	..	..	..	..	..	..	..	..	..	..	..
Mount Egmont Branch	Manaia Branch	5 50	Manaia-Kapuni	5 50	..	5 50	5 50	2 0	..	..	..	..	..	..	..	..	..	..	..	..
	Mount Egmont Branch	8 77	Manganui Section	5 74	2 3	7 77	..	..	..	1 April, 1908	..	..	..	..	..	..	..	..	..	6 0

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31st MARCH, 1917—continued.
SOUTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.													
							Sur- veyed.	Under For- mation.	Under Plate- laying.	Date.	Opened.							Total.		
											1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.	1916-17.		—	
							8	9	10	11	12	13	14	15	16	17	18	19	20	
				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.	M. ch.	M. ch.	M. ch.	M. ch.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total.
State Col- liery, or CoalCreek Railway	Greymouth-Point Elizabeth Col- lieries Extension	5 1	Greymouth-Runanga Colliery	5 1	2 10	7 11	..	..	..	1 Dec., 1904	..	..	..	..	..	..	..	..	..	21 M. ch. 5 1
Greymouth- Hokitika Branch	..	3 69	Runanga Colliery-Point Elizabeth Collieries	3 69	2 20	6 9	..	..	..	21 Jan., 1914	..	..	..	..	3 69	..	..	..	..	3 69
Greymouth- Hokitika Branch	..	24 37	Greymouth-Hokitika	24 37	2 10	26 47	..	..	..	..	..	..	..	..	..	..	..	..	..	24 37
Hokitika- Ross	..	4 10	Kumara Branch	4 10	..	4 10	4 10	..	..	..	..	..	..	..	..	..	..	..	..	..
Newsurvey Picton- Waipara	..	15 75	Hokitika-Ruatapu	7 10	0 61	7 71	..	..	..	9 Nov., 1906	..	..	..	..	..	..	..	..	..	7 10 7 21
	..	92 38	Ruatapu-Ross	7 21	0 69	8 10	..	..	..	1 April, 1909	..	..	..	..	..	..	..	..	..	7 21
	..	10 0	Survey to Ross Town- ship	1 44	..	1 44	1 44	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	10 0	Ross-Waitaha	10 0	..	10 0	2 54	..	..	..	..	..	..	..	..	..	..	..	..	..
	..	92 38	Picton-Seddon	33 45	3 26	36 71	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Seddon-Kaparu	6 30	0 76	7 26	..	..	..	13 April, 1911	..	6 30	8 15	..	..	..	..	..	..	56 6
	Kaparu-Ward	8 15	1 20	9 35	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Ward-Mirza	3 38	0 30	3 68	..	..	..	..	..	..	..	..	..	..	3 38	4 38	..	..
	Mirza-Wharanui	4 38	0 34	4 72	..	..	..	4 Dec., 1915	..	..	..	..	..	..	..	..	..	..
	Wharanui-Kekerangu	7 0	..	7 0	7 0	1 18	3 20	..	..	..	..	..	..	..	..	..	..	..
	Kekerangu - Hapuka River	29 32	..	29 32	29 32	..	4 38	..	..	..	..	..	..	..	..	..	..	..
Hapuka River- Mendip Hills	..	40 50	Hapuka River-Lime- stone Creek	23 0	..	23 0	23 0	Prelim.	..	..	..	..	..	..	..	..	..	..	..	..
	Limestone Creek-Con- way River	7 0	..	7 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Conway River - Men- dip Hills	10 50	..	10 50	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mendip Hills-Par- nassus	..	5 61	Mendip Hills	5 61	..	5 61	2 0	3 61	..	..	..	..	..	..	..	..	..	..	..	..
Parnassus - Wai- para	..	44 14	Parnassus-Mina	8 43	1 14	9 57	..	..	..	1 Sept., 1912	..	..	..	8 43	..	..	..	..	..	..
	Mina-Domett	3 63	0 70	4 53	..	..	..	1 Aug., 1910	..	3 63	..	..	..	..	..	..	..	..
	Domett-Tormore	3 10	0 66	9 24	..	..	..	14 Nov., 1906	..	..	..	..	..	..	..	..	..	44 14
	Tormore-Ethelton	5 28	..	..	..	..	..	21 Mar., 1907	..	..	..	..	..	..	..	..	..	..
	Ethelton-Scargill	8 51	0 51	9 22	..	..	..	3 Nov., 1905	..	..	..	..	..	..	..	..	..	..
	Scargill-Waipara	14 59	1 2	15 61	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Culverden-South Wai- taki	206 7	64 68	270 75	..	..	..	..	..	..	..	..	..	..	..	..	..	206 7
Main Line	..	206 7	Culverden-Flintoff's	5 23	0 10	5 33	..	..	5 23	..	..	..	..	..	..	..	..	..	..	..
	..	13 0	Flintoff's-Rotherham	1 75	0 43	2 38	..	..	1 75	..	..	..	..	..	..	..	..	..	..	..
	Rotherham-Waiu	5 62	1 1	6 63	..	..	5 62	..	..	..	..	..	..	..	..	..	..	..

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1917—continued.
SOUTH ISLAND—continued.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.																	
							Sur-veyed.	Under For-mation.	Under Plate-laying.	Date.	Opened.													Total.
											1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.	1916-17.	1917-18.	1918-19.	1919-20.	1920-21.	1921-22.	1922-23.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21				
Waitaki-Bluff and Branches—contd.	Branches—contd.	M. ch.	Inch Valley-Lime Kiln	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.	M. ch.	M. ch.	M. ch.				
	Inch Valley Railway	2 29		2 29	0 23	2 52				
	Port Chalmers..	1 9	Glendermid - Port Chalmers	1 9	3 40	4 49				
	Green Island ..	2 44	Burnside-Saddle Hill	2 44	0 52	3 16				
	Green Island to Brighton	4 65	Surveyed ..	4 65	..	4 65	4 65				
	Fernhill Colliery	1 60	Abbotsford to Fernhill Colliery	1 60	0 24	2 4				
	Kalkorai Valley Railway	2 60	Surveyed ..	2 60	..	2 60	2 60				
	Outram ..	8 78	Mosgiel-Outram	8 78	0 68	9 66				
	Lawrence ..	21 76	Clarksville-Lawrence	21 76	2 2	23 78				
	Lawrence-Roxburgh	37 10	Lawrence-Big Hill ..	7 33	0 44	7 77	1 Aug., 1910	7 33				
			Big Hill-Beaumont..	5 36	0 45	6 1	15 Dec., 1914				
			Beaumont-Roxburgh	24 21	24 21	24 21	..	24 21				
			Surveyed ..	23 20	23 20	..	23 20	23 20				
		Lovell's Flat -	23 20	Surveyed ..	23 20				
		Tuapeka Mouth	22 0	Surveyed ..	7 0	..	7 0				
	Balclutha - Tuapeka Mouth	15 0	Trial Survey	15 0	..	15 0	..	..	..	..	..	..	..	..	..	..	..	..	..
	Crichton-Tuapeka Mouth	11 60	Surveyed ..	11 60	..	11 60	11 60	..	..	..	..	..	..	..	..	..	..	..	..
	Balclutha-Appleby Junction, or Catlin's - Seaward Bush	105 49	Balclutha-Owaka	19 20	1 63	21 3	..	..	..	..	..	..	..	..	..	..	..	..	..
			Owaka-Catlin's	3 38	0 30	3 68	..	..	..	1 Aug., 1904	..	..	..	..	..	..	..	..	..
			Catlin's-Houipapa	2 30	0 9	2 39	..	..	..	17 Dec., 1909	..	..	..	..	..	..	..	..	..
			Houipapa-Puketiro..	7 11	0 43	7 54	..	..	..	1 Feb., 1915	..	..	..	..	..	7 11	..	..	..		
			Puketiro-McLennan	5 29	0 59	6 8	..	..	..	1 Feb., 1915	..	..	..	..	..	5 23	..	..	..		
			McLennan-Tahakopa	5 19	0 38	5 57	..	..	..	1 Feb., 1915	..	..	..	..	..	5 19	..	..	..		
			Tahakopa-Marinui ..	23 63	..	23 63	23 63	Prelim.	..	..	..	..	..	..	..	..	..	..	..
			Marinui-Tokanui ..	6 0	..	6 0	6 0	..	..	..	..	..	..	..	..	..	..	..	..
			Tokanui-Waimahaka	8 27	0 64	9 11	..	..	..	20 Sept. 1911	..	..	..	..	..	..	..	..	..
			Waimahaka-Appleby	24 52	1 50	26 22	..	..	..	..	..	..	..	..	..	..	..	..	..
			Waipahi-Heriot ..	20 3	2 3	22 6	..	..	..	..	..	..	..	..	..	..	..	..	..
	Waipahi - Heriot Burn	20 3	Surveyed	20 3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Heriot Extension	6 20	Heriot-Edievale	6 20	0 45	6 65	..	..	..	..	..	..	..	..	..	..	..	..	..
	Extension to Roxburgh, via Rae's Junction	28 10	Surveyed	28 10	..	28 10	28 10	Prelim.	..	..	..	..	..	..	..	..	..	..	..
	Rae's Junction and Ettrick	25 70	Surveyed	25 70	..	25 70	25 70	Prelim.	..	..	..	..	..	..	..	..	..	..	..
	Via Spylaw ..	25 70	Surveyed	25 70	..	25 70	25 70	Prelim.	..	..	..	..	..	..	..	..	..	..	..

TABLE OF LENGTHS OF GOVERNMENT LINES AUTHORIZED, CONSTRUCTED, AND SURVEYED UP TO 31ST MARCH, 1917—*continued*.
SOUTH ISLAND—*continued*.

Appropriation.	Division.	Mileage.	Section.	Main Line.	Sidings.	Total.	State of Line.															
							Sur- veyed.	Under For- mation.	Under Plate- laying.	Date.	Opened.										Total.	
											—	1910-11.	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.	1916-17.	—			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
Waitaki- Bluff and Branches — contd.	Branches—contd. Waimea Plains District Ry. Kelso-Gore	36 39	Gore-Lumsden	36 39	1 34	37 73	..	..	M. ch.	..	..	..	..	..	..	..	..	..	..	M. ch.	
				9 58	..	9 58	9 58
				14 22	..	14 22	14 22	Prelim.
				12 65	1 51	14 36	14 36	26 Nov., 1908	12 65
Otago Cen- tral	Gore-Waikaka Riversdale-Swit- zers Edendale-Toitois	13 70	Riversdale-Waikaka	13 70	1 40	15 30	..	..	..	1 Oct., 1909	..	..	..	..	..	..	..	..	..	13 70	
				9 36	0 72	10 28	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9 36
				9 74	..	9 74	9 74
				98 18	5 62	104 0	..	..	..	1 Sept., 1904	..	..	..	..	..	..	..	..	..	..	134 78
Invercar- gill-King- ston and Branch, Lumsden- Mararoa	Main Line to Lake Hawea	7 36	Omakau-Chatto Creek Chatto Ok-Alexandra Alexandra-Clyde Clyde-Cromwell Surveyed Invercargill-Kingston Wharf	7 36	0 34	7 70	..	..	..	14 July, 1906	..	..	..	..	..	..	..	..	..
				10 39	1 6	11 45	..	..	..	15 Dec., 1906	..	..	..	..	..	..	..	..	..	..	..
				5 45	0 77	6 42	..	..	..	27 Mar., 1907	..	..	..	..	..	..	..	..	..	..	..
				12 35	0 79	13 34	..	2 0	10 35	87 4
Forest Hill Railway Western Railways	Winton - Heddon Bush Winton to Hedge- hope Orepuki Branch Otatau Branch Orawia Branch	11 0	Surveyed Reconnaissance Surveyed	11 0	..	11 0	11 0	..	..	..	..	..	..	..	..	..	..	..	..
				8 20	..	8 20	8 20	..	..	..	..	..	..	..	..	..	..	..	..	..	..
				11 20	..	11 20	11 20	Prelim.
				12 40	0 65	13 25	12 40
Orepuki- Waiau River	Orepuki-Waiau Waiohaka-Tuatapere Orawia-Clifden	35 41 22 15 11 0	Makarewa-Orepuki Thornbury-Wairio Surveyed	35 41	6 37	64 13	..	..	..	..	..	..	..	..	..	..	..	..	..
				22 15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	35 41
				11 0	..	11 0	11 0	..	..	..	..	..	..	..	..	..	..	..	..	..	22 15
				4 48	0 58	5 26	1 Oct., 1909	4 48
Totals	..	2337 11	..	2337 11	257 64	2594 75	489 28	30 64	32 15	..	1,371 54	29 78	22 72	27 16	3 69	51 16	7 76	..	..	1714 61	

APPENDIX C.

ANNUAL REPORT ON BUILDINGS, BY THE GOVERNMENT ARCHITECT.

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

SIR,—

Public Works Office, Wellington, 1st April, 1917.

I have the honour to submit the following report on the various building-works throughout the Dominion during the twelve months ended 31st March last :—

NEW PARLIAMENT BUILDINGS.

Fair progress is being made on this contract under present unfavourable labour conditions. The quality of the marble coming to hand is improving, and very few flaws are now met with. The stonework of Molesworth Street frontage is nearly completed to ceiling-level of first floor, with exception of columns of colonade and parts of central feature. In Museum Street front the stonework is up to ceiling-level of principal floor.

The House of Representatives has been roofed in and gallery platforms are being framed by carpenters. The promenade roof over lounge lobby is constructed, and the ceiling of the latter is plastered. Plastering in rooms under lounge lobby and House of Representatives and in a portion of the rooms in northern wing has been done. A considerable quantity of external plastering has been carried out. All steel-construction work has been executed excepting about 17 tons. Heating and ventilation contract is proceeding slowly, following up as closely as possible the constructional work. Drainage-work has been done. Owing to shortage of labour only fair progress is being made with the electrical work.

GENERAL.

Government House, Auckland.—The restoration of the portion damaged by fire in July last was completed in March of this year, and was carried out by day labour. During the year general maintenance and repairs have also been attended to.

Government House, Wellington.—New cottage erected; residence painted and general maintenance carried out.

Auckland Departmental Buildings.—Alterations to provide extra accommodation have been carried out, and fittings and equipment for same made and installed.

New Plymouth Departmental Buildings.—New brick destructor and benzine-store erected.

Gisborne.—Electric motor installed in Public Works Workshops.

Government Printing Office, Wellington.—Extensive additions in brick carried out. Five new motors installed, and electric light now being installed in the new additions.

Nelson Departmental Buildings.—Caretaker's residence erected.

Westport Departmental Buildings.—Drainage installation carried out by contract.

Dunedin.—Erection of magazines and caretaker's residence at Chain Hills in progress.

Cambridge.—A new ward for returned soldiers, providing accommodation for twenty patients, erected.

Maungatapu Native School.—An addition of an open-air class-room made.

Whakarewa Native School.—School and residence, with necessary outbuildings, erected.

Tikitiki Native School.—Additions made.

Mangatuna Native School.—Additions erected and teacher's residence renovated.

Hiruharama Native School.—Additions and repairs to school and residence carried out.

Tokomaru Bay Native School.—Extensive renovations to school building and teacher's residence were made.

Nuhaka Native School.—Renovations in progress.

Mount Cook.—Erection of Haast Memorial Hut completed.

Otekaike Special School.—Workshops erected.

POST-OFFICES.

Awanui Radio Station.—Residence for Engineer erected in wood.

Kaitiaki.—Extensive additions put in hand and lineman's shed erected.

Kohukohu.—Extensive additions carried out.

Torua.—Tender accepted for erection of new building in wood.

Te Awamutu.—Additions in brick, consisting of telephone exchange, ladies' retiring-room and lavatory, erected.

Morrinsville.—Additions in wood have been erected.

Wellesley Street.—A contract has been let for excavating site.

Whakatane.—Alterations and additions carried out.

Port Awanui.—Erection of new building in hand.

Ruatorea.—New building in wood erected.

Kahukura.—Building removed from Port Awanui and re-erected at Kahukura on new site.

Motu.—New building erected.
Piopia.—A new building in wood is in course of erection.
Te Kuiti.—Contract for alterations and additions in progress.
Taumarunui.—Contract for additions in hand.
Mokau.—Contract for erection of new building approaching completion.
Waitara.—Additions and renovations carried out.
Wanganui.—Additions, including ladies' retiring-room, carried out.
Taradale.—Septic tank built and drainage installed.
Napier.—Extensive alterations and renovations carried out.
Waituna West.—New building erected.
Palmerston North.—Extensive additions carried out.
Tokomaru.—New building erected.
Heretaunga.—Tenders invited for erection of new building.
Petone.—Alterations to buildings and drainage carried out; new destructor erected.
Wellington.—Alterations to radiators, lights, &c., and renovations carried out; lavatory accommodation extended; ventilators installed and minor repairs effected.
Wellington (Bulk Store).—Automatic fire-alarm system and two electric lifts and two motors installed.
Wellington South.—Electric light, power, and heating installed.
Courtenay Place.—Electric light installed in telephone exchange.
Upper Moutere.—New building in wood erected.
St. Albans.—New building for automatic-telephone exchange erected.
Dunedin Garrison Hall.—Alterations to provide temporary quarters for chief post-office carried out.
Dunedin South.—Automatic-telephone exchange erected.
Roslyn.—Erection of new building for automatic-telephone exchange in progress.
Queenstown.—Extensive renovations and repairs effected.

COURTHOUSE.

Napier.—Two additional rooms built and extensive repairs effected.

POLICE-STATIONS.

Auckland Central.—A tender has been accepted for the erection of an addition to this building in brick.
Te Aroha.—New two-cell lock-up erected in wood.
Whakatane.—Alterations and additions, including drainage, carried out.
Wairoa.—Tenders invited for erection of sergeant's residence.
Waipukurau.—New building erected.
Wellington Headquarters.—Contract for erection of this building nearing completion.
Caversham.—New station, with quarters, erected under contract.
Dunedin.—Gaol building converted to police-station.
South Dunedin.—Old post-office building converted into police-station.

PRISONS.

Auckland.—Equipment of south wing built last year completed.
Waikeria.—Portion of the office quarters of Administrator's wing completed.
Point Halswell.—New fire service and water-supply installed.
Templeton.—Work of erection of new buildings is proceeding satisfactorily.
Addington.—A new laundry and washhouse has been erected.
Invercargill.—North-wing extension completed.

MENTAL HOSPITALS.

Tokanui.—The erection of unit No. 4 is in hand. Framework has been erected and is partly covered in.
Porirua.—The new receiving-ward is nearing completion. A survey has been made in connection with the diversion of the drainage to Porirua Harbour.
Sunnyside.—The erection of a new receiving-block is in progress. The plastering of exterior has been completed, and of the interior is well on the way to completion.
Nelson.—The erection of a large kitchen in brick, together with cook's quarters, &c., is in hand.

AGRICULTURAL.

Motuihi Island Quarantine Station.—Four-roomed cottage erected.
Te Kawhata.—New office and fruit-store erected; also alterations to roof of wine-cellar carried out.
Cambridge.—Two small offices erected.
Weraroa Experimental Farm.—Contracts for erection of Manager's residence, Biologist's residence, and wool-shed and piggeries are in progress.
Somes Island.—New bull-shed erected.
Ranfurly.—Contract for Stock Inspector's residence in hand.
Tapanui.—Stock Inspector's residence erected.

MILITARY BUILDINGS.

Devonport.—Four new buildings have been erected at the Maori Military Camp at Narrow Neck, and general maintenance and repairs carried out.

Motuihi Island Internment Camp.—An additional hut erected.

Hamilton.—The section round the Artillery Barracks has been roaded and drained, and a concrete gun-washing emplacement laid.

New Plymouth.—Alterations to Defence Offices were made.

Hawera.—Repairs and alterations to Defence Office.

Napier.—Extensive repairs effected to Artillery Barracks.

Palmerston North.—New ammunition-store, office, and store-room erected.

Featherston and Trentham Military Camps.—The erection of hutments which were in progress last year have been completed.

Wellington.—New buildings for Base Records and War Pensions erected in wood and iron. The large block of additions in wood and iron to the Defence Stores which were put in hand last year have been completed. At Defence Headquarters offices in brick have been erected, and at the Garrison Hall a building for the Army Service Corps and new motor-lorry shed have been completed.

Somes Island.—Two hutments erected.

Mahanga Bay.—New kitchen and store-room erected and extensions made to barracks.

Taumarua.—At the Convalescent Home additions were made to the nurses' quarters and a destructor provided.

Hammer.—Military Convalescent Home, including doctor's residence, laundry, and meat-store, completed.

In addition to the works specially mentioned in the foregoing report, a large number of minor works, comprising small buildings, additions, alterations, installation of lighting, water, and drainage services, have been carried out by petty contract, day labour, or the Department's artisans. Renovations, painting, and repairs to buildings throughout the Dominion owned by the Government have been attended to as required, and fittings and furniture supplied, mostly from the Department's workshops in the principal centres.

I have, &c.,

JOHN CAMPBELL,

Government Architect.

APPENDIX D.

ANNUAL REPORT ON ELECTRICAL WORK AND POWER-SUPPLY UNDERTAKINGS, BY THE CHIEF ELECTRICAL ENGINEER.

The CHIEF ELECTRICAL ENGINEER to the MINISTER OF PUBLIC WORKS.

SIR,—

Public Works Department, Wellington, 20th August, 1917.

I have the honour to submit the following report respecting the development of water-power by the State, the issue of licenses for the utilization of water-power by other parties, and for the distribution of electricity.

LAKE COLERIDGE WORKS.

The Lake Coleridge hydro-electric power supply completed its second year of operation on the 31st March last, and has now yielded definite industrial and financial results.

The total capital outlay was increased during the year from £320,330 to £366,984, the main item of expenditure under the heading being the installation of a fourth generating unit of 1,500 kilowatts capacity, raising the total power-house capacity from 4,500 kilowatts to 6,000 kilowatts, equivalent to 8,000 horse-power. A fifth turbine and generator set of 3,000 kilowatts capacity, together with material for an additional pipe-line, have been on order from some time. The manufacture of the turbine and generator is well advanced, but the prospects of getting delivery of the pipe-line are somewhat remote. As every effort to obtain a permit for the manufacture from the Home authorities has failed, efforts were made in Australia, in Canada, and in the United States to obtain a supply of steel plates for this purpose, but without success. Whenever we succeeded in obtaining quotations the prices were found to be prohibitive and delivery uncertain. The possibility of using wood-stave pipe for the upper portion of the pipe-line has been considered, and experiments are now being conducted with a view to testing the suitability of this class of pipe for the requirements. It is true that wood-stave pipe requires as much steel in the form of bands as an all-steel pipe, but the steel is in a form which is more readily procurable under present conditions. The delay in obtaining delivery of the fifth unit and pipe-line will cause a shortage of plant to meet the demand which will be felt very acutely in 1919, and to a lesser extent in 1918.

The rainfall over the year has been below the average, whilst the rainfall during the season has been abnormally low. This, following upon a succession of dry seasons, has resulted in the ground waters being drained, which will require time to replenish. The supply, however, has been adequate for the requirements up to the present, but in view of the growth in the demand for power it is deemed advisable to make preparations for augmenting the supply of water, and a scheme has been prepared for diverting a portion of the Harper River when and as required, at a total cost of £12,600, of which £5,150 is for a water-race and intake works, together with land-purchase, roading, and accommodation for workmen, the remainder being for river-diversion works designed to confine and maintain the river in a channel suitable for the purpose in view. The proposed diversion works would provide for about two and a half times the present output from the power-station, and is deemed to be ample for a long time to come.

During the last dry season the storage in the lake was drawn upon to a depth of 2·2 ft., at which level it remains at the present time, and in order to restore the level the rainfall between this and December must be above the average. In view of a possible deficiency in the rainfall, and in view also of the growth in the power-output, it is desirable that the work of constructing the intake works and water-race should proceed as soon as possible and be completed during the coming summer. The completion of the diversion-works is not an urgent matter, but a commencement should be made with willow-planting, &c., next season, with a view to confining the river to its present channel, which is favourable for our purpose.

No extension has been carried out to the main transmission-lines during the year, but the existing lines have been thoroughly overhauled. Insistent demands for supply of power have been received from Timaru and other localities on the main route between Lake Coleridge and Timaru, but owing to a scarcity of men and material due to the war the construction of the necessary transmission-lines has had to be postponed.

Considerable extensions were made during the year to the primary distribution-lines from the Addington Substation, which now extend to Kaiapoi on the north, Lincoln and Tai Tapu on the south, Lyttelton on the east, and Templeton on the west, comprising a total route mileage of 57½ miles. Applications for an extension of the primary distribution-lines have been received from Rangiora, Akaroa County, and Ellesmere County, but their requests have had to be declined for the present owing to stringency caused by the war.

During the year retail reticulations have been erected in Lyttelton, Kaiapoi, Cashmere, Riccarton, Hornby, and Templeton, and in most cases arrangements have been completed for the sale of these local reticulations to the local authorities, the Department reserving only the wholesale consumers and the bulk supply to the retail authorities.

The results of the operation for the year have been very gratifying. The demand grew rapidly, and at the end of the year the connected load reached a total of 17,083 kilowatts, made up of 7,013 kilowatts in wholesale consumers and 10,070 kilowatts distributed over thirteen local retail reticulations, of which the largest is that of the Christchurch City Council (8,817 kilowatts).

The total energy issued from the power-house during the year amounted to 14,774,960 kilowatt-hours, to obtain which 20,000 tons of coal would be required if generated in the most economical way by means of a steam-power plant of the size of the Lake Coleridge plant. The saving in coal is, however, much greater than this, as small-power plants are much less economical, and the saving may certainly be put at 30,000 tons per annum, and probably 35,000 tons. In addition to this saving the power-user obtains his power for one-third to one-half the previous cost, so that the saving to the community is considerable.

The maximum demand on the power-house rose during the year from 1,372 kilowatts to 4,366 kilowatts, and was thus still within the capacity of the original three generating units (4,500 k.w.), leaving the fourth unit of 1,500 kilowatts recently installed as a stand-by in the meantime and to cover extensions to the business during the current year.

A number of new consumers have been connected up during the year, amongst them being the Christchurch Tramway Board's system, which is now independent of the coal-supply; three large freezing-works, at Islington, Belfast, and Kaiapoi; and two large flour-mills, at Addington and Kaiapoi. In addition the demand within the city has grown from 1,020 kilowatts to 1,850 kilowatts, including 200 kilowatts for water-supply pumping and 60 kilowatts for sewerage pumps, both of which important services are now operated by Lake Coleridge power. Provisional agreements have been entered for the supply of power for the production of caustic soda and hydrochloric acid by electro-chemical means, and the production of steel castings by electro-thermal means, both industries being the direct results of a cheap supply of hydro-electric power.

The supply again proved fairly reliable. The total number of interruptions to supply from all causes during the year was fifteen, totalling in all sixty minutes' interruption. But of these the majority were only momentary, only three exceeded one minute's duration, and only one exceeded ten minutes' duration. The latter stop was due to causes which have now been entirely overcome. The continuity and reliability of hydro-electric supply for practical purposes has thus been thoroughly established.

Arrangements have been made with the Christchurch Tramway Board for the use of the whole of their steam plant, amounting to 2,000 kilowatts, for standby purposes. This provision will enable the Department to dispense with a spare unit at the power-house and to utilize the whole of the plant for revenue-earning purposes. It also enables the Department to maintain a local supply up to 1,000 kilowatts in the event of a breakdown of the transmission-lines. The rental to be paid compares favourably with the capital charges on an additional unit of generating plant, and is much less than would be the cost to the Department of providing and maintaining a stand-by plant of its own in Christchurch. Incidentally a saving is effected in the capital expenditure, inasmuch as use is made of an existing power plant. A similar arrangement is under consideration for the use of some spare plant belonging to the Christchurch City Council, and which they are putting in order for standby purposes. These two provisions will result in considerable economy, and will be of great service in view of the threatened shortage of plant.

The financial results are satisfactory. It was not anticipated that the plant, which is designed for an ultimate capacity of 12,000 kilowatts, would prove self-supporting until the output reached at least one-half of this—viz., 6,000 kilowatts. With an output rising during the year from 1,372 to 4,366 kilowatts, the revenue obtained amounted to £20,754, the working-expenses to £12,889, leaving a balance of £7,865 to the credit of the net revenue account. The capital charges amounted to £13,743 in interest and £6,078 in depreciation, so that there was a loss of £5,878 on interest account, and a total loss, including depreciation, of £11,956, compared with a loss of £12,263 on interest account and a total loss, including depreciation, of £17,649 as the result of the previous year's working.

The rapid growth of the business indicates that by the end of the current year, which is the third year of operation, the plant will be earning sufficient to meet both interest charges and working-expenses, and will yield a surplus for depreciation and reserve.

The works have been well maintained during the year, and the plant is in good order.

The staff is working efficiently and rendering very good service. Two of the power-house engineers resigned during the year. Two other members of the staff joined the Expeditionary Forces; three more were selected by ballot, but of these two were rejected. With few exceptions, the present staff are members of the Second Division, and in view of the forthcoming application of the ballot to the Second Division it has been deemed advisable to train men who are not eligible for service, and who have the necessary qualifications, for duties at the power-house and sub-station, and advertisements have already been issued. This will entail a considerable addition to the annual expenditure, but the circumstances demand it, and the expenditure must be faced.

A summary of data relating to the year's operation is appended hereto, together with the result of last year's operation, for comparison:—

						Year ended 31st March,	
						1916.	1917.
Completed years of operation	..	..	..	..	..	1	2
Capital outlay	..	..	..	..	..	£320,230	£366,984
Revenue—							
Wholesale consumers	..	..	..	..	..	£7,723	£19,021
Retail consumers	..	..	..	..	..	£537	£983
Other sources	..	..	..	..	..	£258	£750
Total	..	..	..	..	..	£8,518	£20,754
Working-expenses	..	..	..	..	..	£9,383	£12,889
Interest at 4 per cent.	..	..	..	..	..	£11,398	£13,743
Depreciation at 2 per cent.	..	..	..	..	..	£5,386	£6,078
Total annual cost	..	..	..	..	..	£26,167	£32,710
Maximum load in power-station (kilowatts)	..	..	..	..	..	1,372	4,366
Average weekly load factor (per cent.)	..	..	..	..	..	44.3	52.9
Energy issued from power-house (kilowatt-hours)	..	..	..	..	..	4,860,260	14,774,960
Energy sold (kilowatt-hours)	..	..	..	..	..	3,994,767	11,664,961

ELECTRICITY SUPPLY IN THE NORTH ISLAND.

Further to my interim report on this subject dated the 19th February, 1917: The survey of the transmission-line between Shannon and Wellington has been completed, and the survey staff transferred to the Auckland District, where they are now engaged in completing a survey of a transmission-line between Auckland and Cambridge, on the Waikato River. A survey for a transmission-line from Shannon, through Palmerston North, to Wanganui should be the next in order.

In the interim report reference was made to the development of water-power on the Waikato River at the Arapuni Gorge. The source has a good deal in its favour to recommend it. The capital cost for the ultimate development is remarkably low, whilst it is within the economical limit for the initial stages, and it is favourably situated as regards the principal market and as a supplementary or even principal source of supply to the Wellington District. The development, however, necessitates the construction of a dam 146 ft. high, involving difficulties and unknown risks; and, following the advice of the Engineer-in-Chief, the possibility of utilizing the Kaituna River, or the Waikato River at the Aratiatia Rapids, is being further investigated. Neither compares favourably with the Arapuni development as regards capital cost per horse-power developed, provided, of course, that no abnormal difficulties are encountered. On the other hand, the capital cost can be ascertained more definitely in the two former cases, and further investigations are proceeding in the meantime. On the advice of the Engineer-in-Chief a report was obtained from the Mines Department on the geological features of the Arapuni Gorge. The survey was made by Dr. Henderson, and his report is on the whole favourable from a geological standpoint, and geological faults are absent.

In view of the possibilities of this development it would seem desirable to carry out extensive prospecting-works for the purpose of ascertaining the nature of the foundations and sides and of testing the suitability of the rock to withstand water-pressure.

A survey of the power requirements of the Wellington District has been put in hand, and up to date the power requirements have been ascertained for the following districts—namely, the Hutt Valley, and the Manawatu district between Wellington and Palmerston. A visit has been paid to the works of every power-user, their power requirements ascertained, and particulars obtained of the fuel consumed, cost of maintenance, and particulars of engine and boilers. These have been tabulated and located, so that the power-demand can be determined to a very close approximation, and the cost of transmission and distribution estimated within fairly narrow limits. This work will be continued and completed as soon as possible, the next district to receive attention being that between Palmerston North and Wanganui, after which the Wairarapa district will receive attention, and also the Hawke's Bay District as far as Napier.

ELECTRIC LIGHT AND POWER LICENSES.

The following electric light and power licenses have been issued during the year:—

Electric Lines.—James Thomason (Murchison Township), Robert Ellis (portion Waimea County), Invercargill Borough (cancelling portion), Pahiatua Borough Council (Pahiatua Borough), F. N. Adams (Christchurch, revoking license), Hampstead Town Board (Hampstead Town District), Collinson and Cunningham (across King Street, Palmerston North), Wellington City Council (trolley-wire to Doyle Bros., Kent Terrace), John Barnett (Leeston, altering clause *re* charge), Christchurch Tramway Board (trolley-wire to Holmes's premises, Nayland Street, Sumner), Heathcote County Council (Heathcote Valley and Bromley Ridings, Heathcote County), Wellington City Council (trolley-wire to Munt, Cottrell, and Co., Tinakori Road), Wellington City Council (trolley-wire to Excelsior Laundry Company, Adelaide Road), Rising Sun Gold-mining Company (portion of Aroha and Ohinemuri Survey Districts), Wellington City Council (trolley-wire to Welbilt Heel Company, Hopper Street), Nelson Bros. (across railway-line, Heretaunga Survey District), Wellington City Council (trolley-wire to South Wellington Picture and Investment Company), Kaitangata Borough Council (Kaitangata Borough), Martinborough Town Board (portion of Featherston County), Waimairi County Council (Waimairi County), Hamilton Borough Council (Hamilton Borough), Riccarton Borough Council (Riccarton Borough), D. J. Barry (Tokomaru Bay), Wellington City Council (portion Wellington City), Kanieri Power Company (Kanieri Forks to pumping-station on Hokitika River), Te Kuiti Borough Council (Te Kuiti Borough), Wairoa Farmers' Co-operative Meat Company (Wairoa Borough to Wairoa River), Westport Borough Council (Palmerston Street, Westport), Kaponga Town Board (amending), Wairoa Borough Council (Wairoa Borough), Wanganui Brewery Company (power-house of Meat Company to Castlecliff Hotel), Lyttelton Borough Council (Lyttelton Borough), Collinson and Cunningham (across King Street, Palmerston North).

Water-power and Electric Lines.—Wairoa Borough Council (power-house to Borough boundary), Inglewood Borough Council (Inglewood Borough), Kaupokonui Co-operative Dairy Factory (portion Waimate Survey District), Raetihi Town Board (portion Manganui and Makotuku Survey Districts).

The standard regulations to which the electric light and power licenses must conform are being revised, and will possibly be completed and issued during the present year. Several modifications have been found desirable, mainly in view of the rapid growth of the application of electricity to cooking and other domestic purposes. Opportunity is taken to incorporate a number of special regulations issued with permits for the use of bare wire, which have become standardized. This has the advantage that applicants for the use of bare wire will know beforehand the conditions to which they must conform. Four fatal accidents have occurred during the year in connection with electric lines, but in no instance could these be averted by regulations.

I have, &c.,

EVAN PARRY,

Chief Electrical Engineer.

APPENDIX E.

HYDRO-ELECTRIC DEVELOPMENT—NORTH ISLAND SCHEME.

INTERIM REPORT.

Public Works Department, Wellington, N.Z., 19th February, 1917.

MEMORANDUM for Hon. MINISTER OF PUBLIC WORKS, Public Works Department.

I HEREBY submit, as requested by you, an interim report regarding the present position of the investigation into the scheme of developing the water-power resources of the North Island. Before relating the actual position of the work of investigation I wish to put on record some underlying principles which govern my actions in preparing the scheme.

The fundamental principle involved is that of centralizing the power-generating plant and concentrating it into a few large units where the energy can be generated under more economical conditions than in small units, and transmitting the power so generated to the individual power-users. By this means both labour and fuel are economized even where the centralized power plant depends on fuel for its motive power, and much more so where water is available as a motive power. This concentration and the ability to transmit and to distribute has been made possible through the agency of electricity. At first the concentration was on a small scale and limited to comparatively small areas—usually the boundary of a local authority—but for the last fifteen years the process of further concentration has been going on at an increasing rate, and the local generating plant superseded by a larger centralized plant in the same way that the individual power plant was superseded by the local generating plant. That the advantages are substantial is proved by the rapid growth of power-supply undertakings and the enormous dimensions to which they have attained. The conclusion one arrives at on regarding this evolutionary process and the principles involved is that the generation of electricity should be concentrated to the greatest possible extent.

Bearing this principle in mind, and having regard to the state of the art of transmission of energy at the present time, it may be stated that, regarded as a purely engineering proposition, it is quite possible and feasible to supply the whole of the North Island from one single source, more or less centrally situated, but there are several objections to this course which render it inadvisable. One is that there is no single source of power in the North Island which can be regarded as sufficient for all time, so that even if one source were to be selected for the time being, sooner or later it would require to be supplemented by the development of other sources. Another objection is that the distances of transmission resulting from the development of a single source, whilst not excessive, are yet somewhat great for the amount of power at present to be transmitted. This objection, whilst valid, is not a vital one; but another objection which is vital, and is really the determining factor in the question, is the nature of the country through which a great deal of the transmission-lines would require to be brought. A single source of supply would involve the erection of some hundreds of miles of transmission-lines over broken country of such a nature as to offer a serious obstacle in the way of repair and maintenance; and, having in view the importance of maintaining a continuous and uninterrupted supply, it is an essential condition that the transmission-lines should be as accessible as possible.

It is, I think, clear that a supply from a single source is not the best solution of the problem of a general supply for the North Island; and the question arises as to what is the next largest possible concentration which can be effected, having regard to all circumstances. It is quite obvious that the unit should be as large as possible not only on general principles, but also on the special ground that small water-power developments are unduly costly. Generally speaking, a water-power source of less than about 10,000 horse-power cannot be economically developed. It is quite true that there exist quite a number of small water-power plants that are more economical than steam in their respective districts, depending upon the price of coal and the extent to which the power is used; but when it comes to a general supply to a large district which carries with it the necessity of adequate storage to maintain the supply at all times, a small-power plant is found to be unduly expensive in first cost, whilst the cost of operation, attendance, &c., is much the same for a small plant as for a large plant. All things considered, the capital cost of headworks, power-station, and plant, including everything up to the point of transmission, should not exceed £20 per horse-power of plant, otherwise, when account is taken of the cost of transmission, the extent of the capital expenditure will tend to swamp the advantages to be derived from substituting water-power for fuel.

Having in view the principles set forth, the scheme which best satisfies all requirements is one in which, at the outset, three water-power sources would be developed for supplying respectively the Auckland District, the Hawke's Bay District, and the Wellington District. These sources would in the ordinary course of development be linked up together, and by reinforcing each other provide additional guarantee of continuity of supply.

Regarding the source of power for Hawke's Bay District, undoubtedly the best is Waikaremoana. The amount of power obtainable from this source is greatly in excess of the requirements of this district, and it should be regarded as a supplementary source for supplying the

Wellington District. Very complete surveys have been carried out during last year and accurate measurements made of the flow, and all the necessary information obtained to enable the most economical method of development to be prepared and carried out.

Next, as regards the supply to the Auckland District: Consideration has been given to the plan of taking over the Horahora works of the Waihi Company, which the Government has power to do under the license. There is about 9,000 horse-power obtainable from the source on the lines of the present development, of which the company at present utilize about 4,000 horse-power, leaving a surplus of 5,000 horse-power which would be available for general supply purposes. The available surplus, however, is not nearly adequate enough for the needs of the Auckland District, which demands a source capable of supplying at least 30,000 horse-power in order to provide for growth and developments, but even this cannot be regarded as sufficient for ultimate requirements.

Surveys have been made with a view to supplementing the power at Horahora locally, and a scheme has been prepared which shows that by damming the Pokaiwhenua River and diverting the Waipa Stream into the channel of the former, and piping the water from the dam to an extension of the present power-house, an additional 7,000 horse-power can be obtained. This provides for a total of 16,000 horse-power at an overall cost of £330,000 for the headworks and power plant. Of this 16,000 horse-power it would be necessary to reserve about 5,000 horse-power for the use of the Waihi Company, and considering that there is a prospective market in the mining districts and on the route of the existing transmission-line from Horahora to Waihi there would not be enough left to warrant the cost of a transmission system as far as Auckland.

There are several other possible sources, but the best source so far is found to be the Arapuni Gorge, on the Waikato River, where 120,000 horse-power can be obtained on the basis of a 50-per-cent. load factor based upon the minimum observed flow of the Waikato River during a phenomenally dry season, which occurred in 1915. The gorge is about eight miles from Horahora, and complete surveys have been made during last year to enable a scheme of development to be planned. This scheme involves the construction of a dam on the Waikato River, and before coming to a final conclusion it will be necessary to take prospects to prove the suitability of the foundations. One objection to this scheme is that, whilst the development is an exceptionally economical one for the full development, the initial cost of the large hydraulic works required makes it unduly expensive for partial development of under 40,000 horse-power; but if it can be found that within reasonable time there is a prospective market for this amount, the development of this scheme would be justified on an economical basis. Some further investigation is necessary before a final decision can be come to regarding the best source of supply for the district.

As regards the extent of the initial installation of power and works, I would propose for the Auckland District a power plant of 30,000 horse-power, with trunk lines to Auckland on the north and Te Kuiti and Rotorua on the south, with depots at intervals, and a system of primary distribution to serve the intermediate towns and surrounding districts. In order to provide for this plant and equipment a sum of £1,200,000 will be required.

As regards a source of supply for the Wellington District, considerable difficulty has been encountered in finding a source which satisfies all the requirements, because, although the rivers are numerous, they do not lend themselves to economical development, and as a rule the power to be derived from any one source is small compared with the requirements.

It has been suggested that the Hutt River would form a suitable source for supplying the southern end of the Wellington District. The amount of water is barely adequate for the needs of Wellington City if provision is to be made for natural growth and progress, whilst for the amount of power available the cost of development is excessive. In any case the amount of power obtainable is not large enough to supply an extended district, whilst a power-station in the Manawatu district is well situated for supplying Wellington, Wairarapa, and parts of the Hawke's Bay and Taranaki districts, having regard to the distances and the power to be supplied in each locality.

After considerable investigation the most suitable source for the supply of the southern district is found to be the Mangahao River. This river rises on the slopes of Mount Dundas on the Tararua Ranges, and flows into the Manawatu near Woodville, and it is found that by diverting through the hills for a total distance of three miles there is made available the fall of 1,040 ft. in the sixty-five miles of river between the Mangahao and the loop of the Manawatu near Shannon. It is proposed to develop this source by tunnelling through the range from the Mangahao into the Tokomaru Valley, there diverting a part of the Tokomaru, and then from the Tokomaru Valley through into the valley of the Mangaore, with a power-station situated within three miles of the railway at Shannon.

Observations of the flow were made during last season, which was exceptionally dry, and are also being made during the present season, and based upon the dry-season flow it is possible to obtain 25,000 horse-power on a 50-per-cent. load-factor basis by impounding the waters and taking advantage of the natural features of the country for the purpose. This is sufficient to satisfy the power requirements of the district which it is intended to serve for some time to come, but will require to be supplemented in due course as the country develops. The natural extensions of the transmission-lines from three sources will ultimately link them together, so that by this means security will be obtained, and also additional supply obtained for the Wellington District from the other sources. It is possible, however, that in course of time the requirements will be so great as to require another development in the Taranaki District, where there is more than one promising source.

In the design of this scheme I propose to adopt a new principle in regard to the provision for a stand-by. It is necessary to provide an additional power unit over and above the power

obtainable from the source, so as to permit of the overhaul and repair of machinery. The usual method is to install an extra unit of water plant in the power-house. In the present instance I propose that the stand-by unit should be a complete steam set. The advantage of a steam stand-by set in this scheme is that not only does it serve the purpose of a spare unit, but it also provides means of tiding over short periods of exceptional or abnormal low water, thus enabling the available water to be used to a larger extent. The additional cost of the steam unit over a water-power unit is not great, and the cost of running on infrequent occasions would be a negligible proportion of the total operating cost, whilst the additional security and value conferred on the water-power plant is out of all proportion to the added expense.

I would propose further, instead of installing the steam unit at the power-house, to take advantage of the fact that Wellington City has already a steam plant installed which is of the capacity required for the purpose aforesaid, and as they will deem it advisable and prudent to maintain this in running condition to provide against temporary interruptions of the supply, which are inevitable on every transmission system, there should be no difficulty about coming to terms for the use of this plant for relieving the load on the water-power plant in case of necessity. Some modification of the existing Wellington plant may be necessary to fit in with this scheme, but this is a detail about which there should be no difficulty in a matter which is to the advantage of both parties.

The cost of providing headworks, power-station, and plant for 25,000 horse-power would be at normal prices £420,000, which is under the limit of £20 per horse-power specified above. This illustrates the advantage of concentrating the power-supply for a considerable district in one source. If, for instance, we sought to provide for the needs of Wellington City and immediate neighbourhood only from this source the cost of hydraulic works for the power required would be excessive, whereas when developed for the full capacity and for the benefit of a larger area and population it becomes a sound commercial proposition.

As regards the area to be supplied, there is an economic limit to the area over which a given amount of power can be distributed, and one of the obstacles to a satisfactory scheme of power-supply in New Zealand at present is the small amount of power required per square mile of area supplied. Having regard to this principle, and stretching it to the limit, we should be working on economical lines in serving the following districts from this source: the whole of the Wellington Province as far north as Taihape and Wanganui, and the southern portion of Hawke's Bay. I would propose, in the first place, to run trunk lines to Wellington, Palmerston North, Wanganui, and Masterton as chief centres, and from these centres, as well as from intermediate points on the trunk line, to provide the necessary distribution-lines and substations to serve the surrounding districts.

The cost of providing the trunk lines, distribution-lines, substations, and other services to give a supply in bulk to local distributing authorities and to large power-users throughout this area would be £580,000, making a total of £1,000,000, which expenditure is at the rate of £40 per horse-power.

The capital charges on this expenditure at $7\frac{1}{2}$ per cent., to include interest, depreciation, and sinking fund, work out at £3 per horse-power per annum; the annual cost of maintenance and operation would amount to £25,000 per annum, or the equivalent of £1 per horse-power per annum. Both charges require a return of £4 on the average per horse-power per annum in order to provide for all charges with a reasonable provision for depreciation. We know by experience in Christchurch that we can secure this revenue without difficulty, even where economical fuel plants are already installed.

The development of the Mangahao would help Wellington out of a difficulty, and from the Government's point of view Wellington alone would provide an immediate load on the station of about one-third its capacity, and would enable the large area outlined above to be supplied at the same time both economically and advantageously, and the prospective markets in these districts, combined with the natural increase in Wellington, should absorb the balance of the power available in a very short time.

Complete surveys have been made of the Mangahao scheme and plans and estimates prepared. A survey of the transmission-line between Shannon and Wellington is proceeding and will shortly be completed, and the position of the substation to serve Wellington and the Hutt Valley has been located.

Summarizing the foregoing, the scheme of development recommended is that three sources of water-power should be developed in the first place—i.e., Lake Waikaremoana for the Hawke's Bay District; Arapuni Gorge, or some other to be selected, for the Auckland District; and the Mangahao River for the Wellington District. These three sources in a natural course of extension will get linked up together, thereby enhancing the value of each source by adding to the security of supply and enabling a continuous output to be maintained throughout the whole of the Island.

The position in regard to the investigation now is that detailed surveys have been made of the Mangahao River, of Aratiatia Rapids on the Waikato, of the Arapuni Gorge, and the Waikato, Pokaiwhenua, and Waipa Rivers near Horahora, and of Lake Waikaremoana. Further investigations and calculations utilizing existing survey information have been made of the Hutt River, Huka Falls, Kaituna River, and other schemes. Observations of flow made during the recent sequence of dry seasons have necessitated a modification of previous estimates of the power obtainable from the various sources.

A survey staff is at present engaged on the transmission-line between Shannon and Wellington, and will shortly be transferred to the Auckland District in order to survey a route for the trunk line between the Waikato and Auckland.

Considerable difficulty has been found in maintaining the staff for survey purposes, and we have at present only one survey party at work, whereas there should be three or four, with corresponding office staff, in order to carry out the work expeditiously; but under present conditions it is found impossible to keep the parties together for long, and we have to be content with slower progress.

As regards the order of development, Waikaremoana scheme should be deferred for the present. The development of this source should, to my mind, be made dependent upon the construction of the Napier-Gisborne Railway. The railway should open up a better road for the transmission-lines and render them more accessible for the construction and maintenance. At present this country is most difficult, especially from a maintenance point of view. There is every reason also in favour of operating this railway electrically.

The Auckland and Wellington schemes should proceed simultaneously. The work in connection with the latter, however, is more advanced, and if labour is obtainable, which is very doubtful, the headworks could be put in hand at once and prepared in readiness for machinery and pipe-lines, which, however, could not be obtained during the continuance of the war. A beginning could be made perhaps by constructing roadways for access to the headworks.

The schemes outlined above provide for the need of the more settled portions of the country, and inaugurates a general scheme of distribution which will in course of time embrace the whole country.

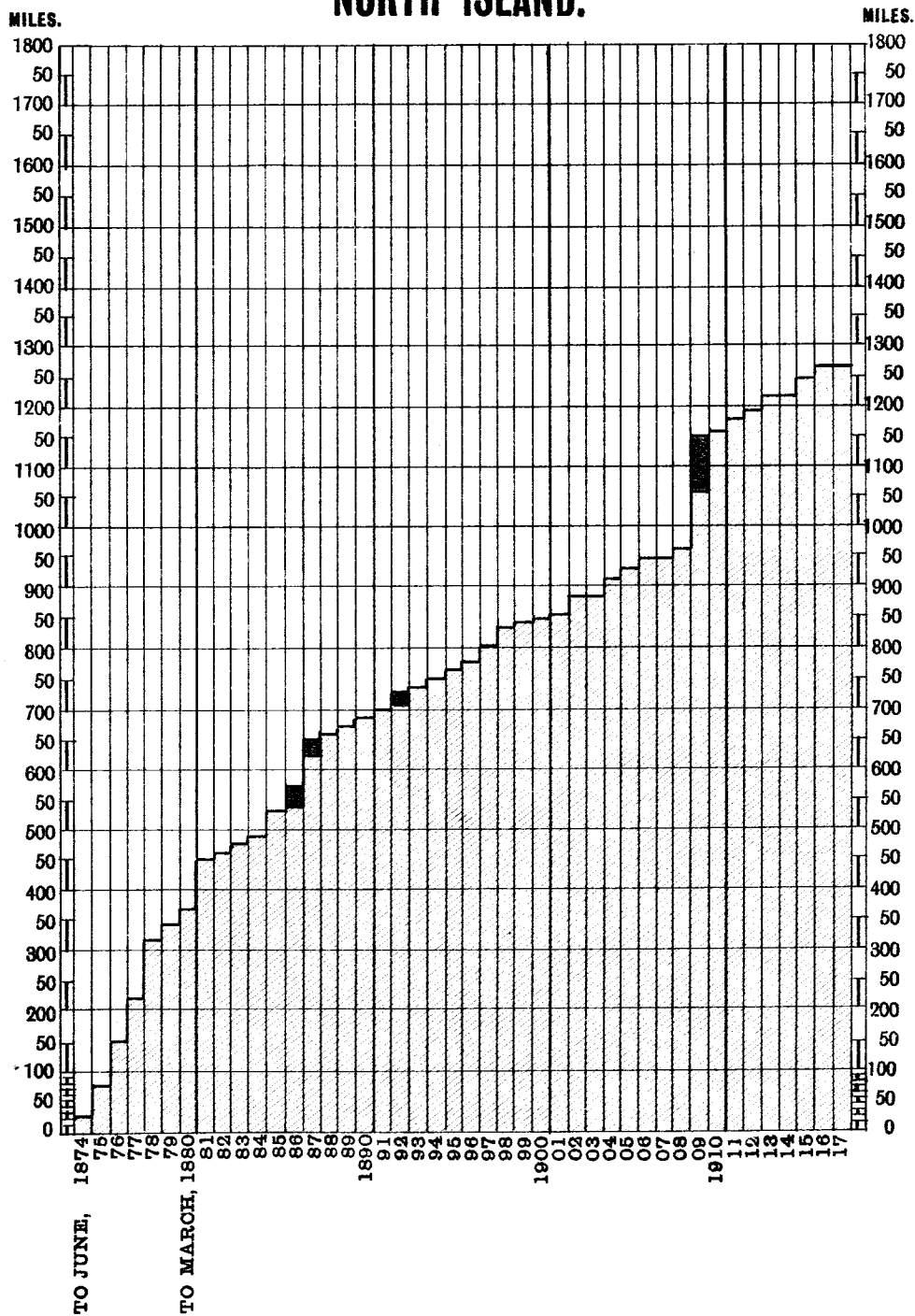
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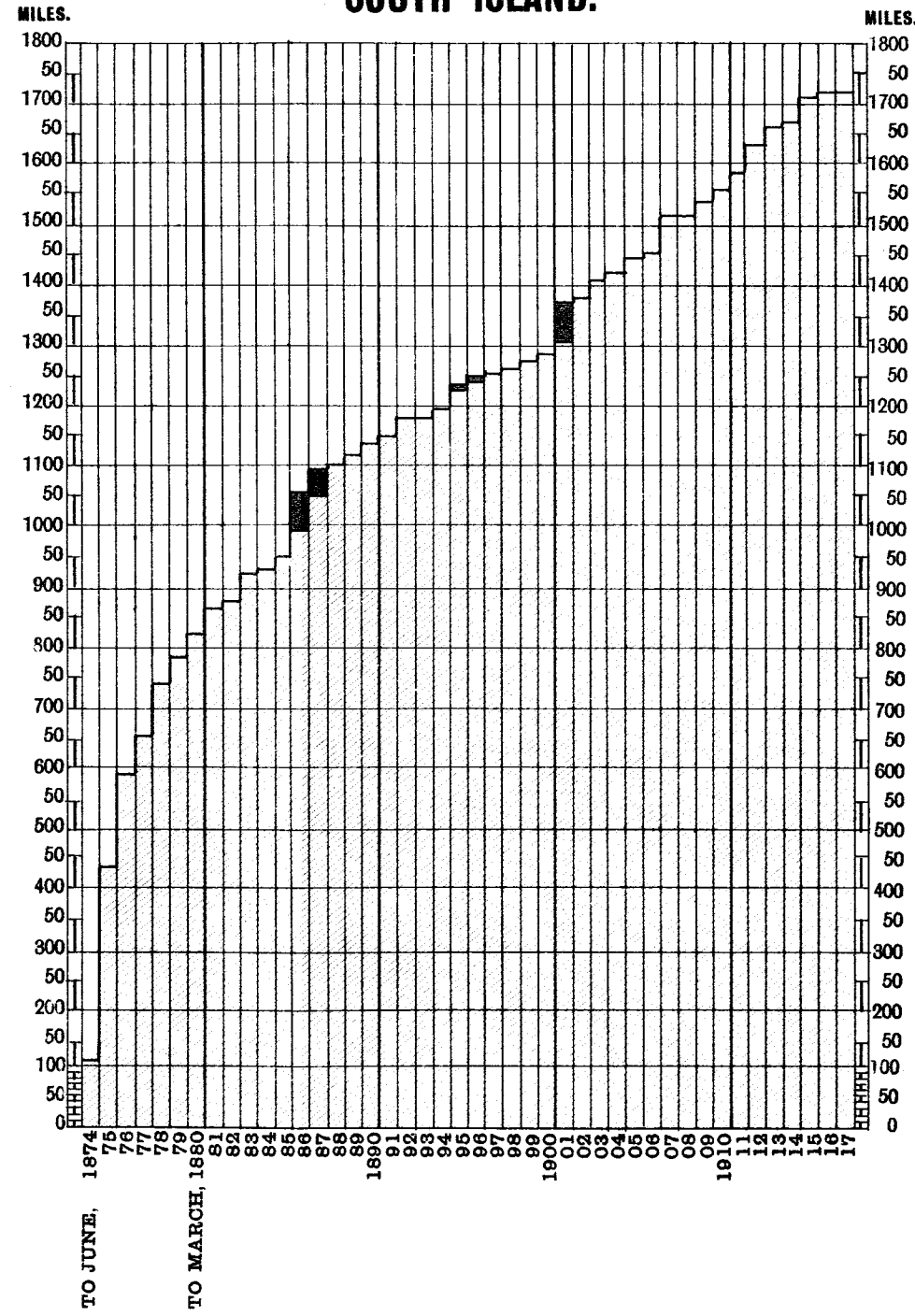
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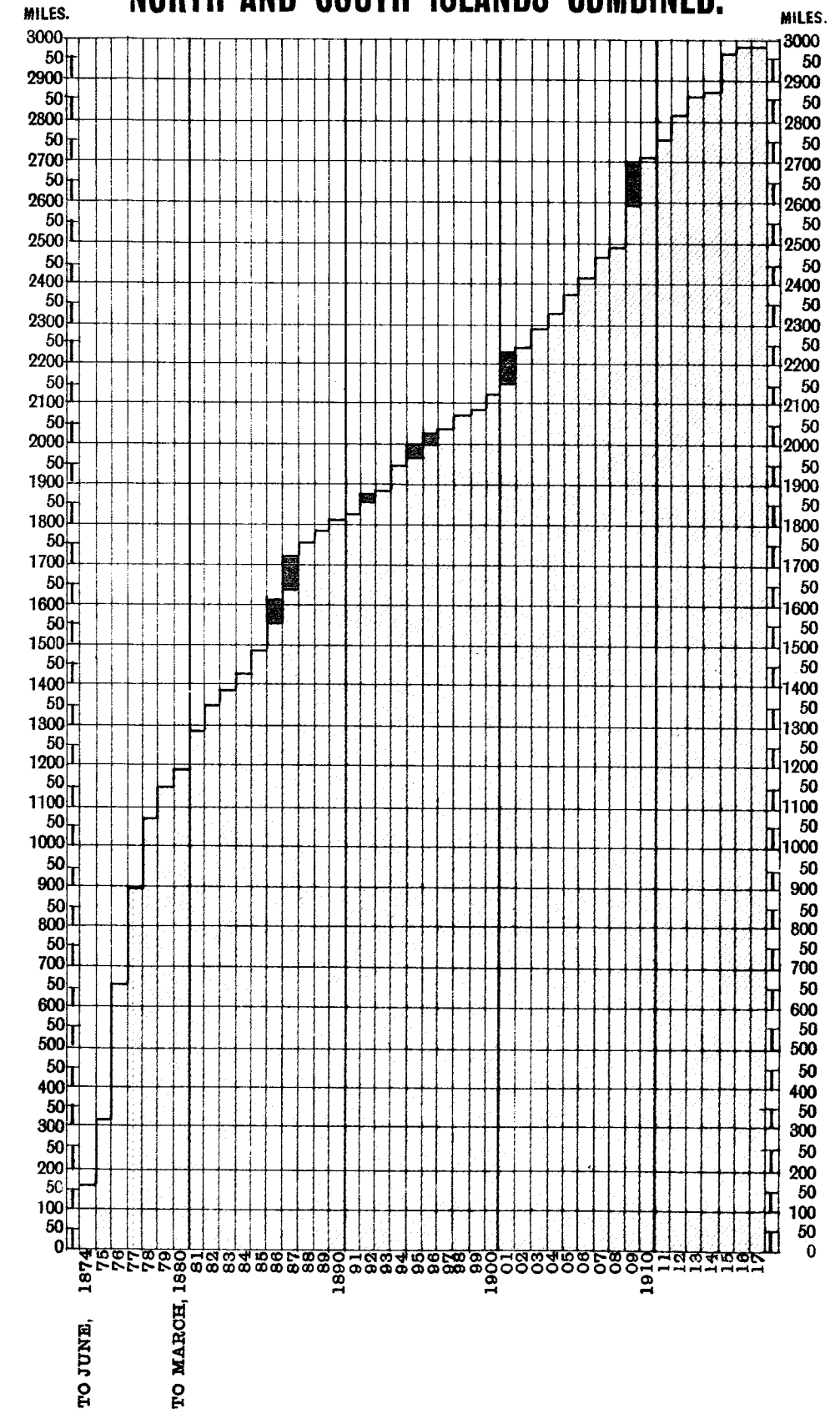


NUMBER OF MILES OPEN
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SOUTH ISLAND.



NUMBER OF MILES OPEN
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