SESS. II.—1884.

NEW ZEALAND.

REPORT

ON THE

SURVEYS OF NEW ZEALAND,

FOR THE YEARS

1883-84.

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

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SURVEYS OF NEW ZEALAND.

(REPORT FOR 1883-84.)

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

The SURVEYOR-GENERAL to the Hon. the MINISTER of LANDS.

SIR,— General Survey Office, Wellington, 8th August, 1884.

I have the honour to report the survey operations for the twelve months ended the 30th June, 1884.

The various classes and processes of the New Zealand survey have been so fully treated in former annual reports that it will be unnecessary to describe them again at present. It will be of more interest to review, shortly, the principal surveys executed or in progress during the year, the full particulars of which are given in the reports of the Chief Surveyors and in the tables of the Appendix. Before doing so, the following summary shows in a succinct form the general field-work of the twelve months:—

	Area.	Rate per Acre. £ s. d.	Cost. £ s. d.
Major triangulation	1,481,700 acres	0 0 0·68	4,229 10 4
Minor triangulation	631,806 ,,	0 0 1·09	2,878 4 10
Topographical and trigonometrical	2,251,125 ,,	0 0 1·13	10,573 2 5
Rural and suburban	439,400 ,,	0 1 9·56	39,495 16 2
Town survey	736 ,, = 716 allots.	0 19 4·2 per lot	692 13 4
Native Land Court surveys...	556,628 acres	0 0 3·7	6,424 3 7
Native Land Court purchase surveys ...	72,583 ,,	0 0 4·69	1,420 13 5
Gold-mining surveys	2,753 ,,	0 12 9·7	1,763 1 6
Roads, railways, and water-races, 790·9 miles, £12 5s. 7·4d. per mile			9,712 18 10
Miscellaneous work, detention by Native opposition, &c.			12,710 5 4

TRIANGULATION.

The areas of country brought under trigonometrical and topographical survey during the year aggregate 4,500 square miles.

The more important of these surveys in the North Island are those of Mr. L. Cussen in that part of the Auckland District known as the King country, and of Mr. C. A. Baker, contract surveyor, who completed the maps of about one thousand square miles of the wild bush Native territory to the east of Opotiki, in the Urewera country, thereby giving a very good start to the topographical survey of the extensive East Cape District—an important work, long delayed through Native opposition, but now arranged to be gone on with by a member of the staff, with reasonable hope of meeting no serious obstruction from the Natives; many of whom, on the contrary, are eager for the survey to proceed, so that they may have their titles investigated by the Native Land Court.

Mr. Cussen's major triangulations of the King country will cover an area of nearly five thousand square miles. The net work of triangles is already over one-half, and the remainder should be completed during the ensuing season. He has, in laying out the work, reconnoitred the country and furnished a very interesting report on its natural resources (see Appendix No. 2). The area is about three million acres, lying principally between the Puniu, Lake Taupo, and

Mokau, generally easily accessible, well watered, abounding in timber, with outcrops of brown coal, and having within it from three to four hundred thousand acres of good, open agricultural land, consisting of limestone, volcanic, and alluvial soils. Over this valuable and extensive area the Native population is estimated at only four thousand.

In the Middle Island Mr. A. D. Wilson is engaged in extending the triangulation of the Wairau Valley to a close on the Nelson triangulation. Previous to entering on this work, he completed a major triangulation across Cook Strait. The principal stations on the opposite side of the Strait, although upwards of fifty miles apart, were very successfully observed by a 6-inch theodolite to heliotrope signals. The diagram of the triangles (see Appendix) shows a satisfactory close on the Wellington triangulation, the greatest discrepancy on a common side being ·7 link per mile, and the least ·06 per mile. In the largest triangle, after correcting for the spherical excess, the error in the summation of the angles was only1″·6. This triangulation across the Strait binds the surveys of the two Islands together thoroughly, so that all the geodesic computations for latitude and longitude of points in New Zealand can now be referred to the one initial standard station at the Survey Observatory, Mount Cook, Wellington. An incidental result of this connection across the Strait is that the latitude and longitude of the lighthouses on the Brothers, on Cape Campbell, and the light on Pencarrow Head can now be given accurately.

Mr. F. S. Smith completed the extension of triangulation from Amuri District, Nelson, across the dividing range to a close on Mr. G. F. Roberts's triangles in the Teremakau, Westland. The difference between the two surveys on the common side was 1·5 links on 32826·5 links, or ·36 link per mile; difference of altitudes, 3ft.; difference of bearing between computed and observed convergence, 1″·46; distance between the measured bases of the two triangulations, 120 miles. It is but due to Messrs. Smith and Roberts to state that they are two most skilful and indefatigable surveyors, with whom correct work is a passion. Mr. Smith's topographical maps abound with information as to the altitudes of mountain peaks, passes, and valleys, the geological formations, the varieties of timber and natural vegetation, the best routes for futures lines of communication, and give a very accurate representation of the country surveyed.

The closures of Mr. P. E. Cheal on Te Aroha, of Mr. R. T. Sadd on the triangulation of Messrs. Ellison and Carkeek in Nelson District, and the connection of Mayor Island with the main land, Tauranga District, by Mr. E. C. Goldsmith, are worthy of notice and commendation.

Geodesic.

Longitude.—The arrangements referred to in last year's report for finding the difference of longitude between Sydney and Wellington having been completed, time signals were successfully exchanged through the cable on four nights in December, 1883, between Mr. Russell, at the Observatory, Sydney, and Mr. Adams, at the Survey Observatory, Mount Cook, Wellington. A report by Mr. Adams, in the Appendix, gives full details of his observations at Mount Cook, also the results of observations at Sydney, furnished by Mr. Russell.

	H.	M.	S.
The difference of longitude between Sydney and Mount Cook is found to be	1	34	16·98
Telegraphic difference, Greenwich and Sydney	10	4	48·47
Longitude of Survey Observatory, Mount Cook	11	39	05·45

But, as Mr. Russell is not quite satisfied with the telegraphic longitude of the Sydney Observatory, he would for the present, and until the differences of longitude between Sydney and the other Australian Observatories are revised, prefer to abide by the longitude derived from his observations of moon culminations, viz.:—

	H.	M.	S.
From moon culminations at Sydney Observatory, by Mr. Russell (see "Sydney Observatory Astronomical Results, 1877–78," pp. 16–17)	10	4	50·81
The longitude of Mount Cook on this basis will be	11	39	7·79

The other determinations of the longitude of Mount Cook have been derived as follows :—

	H.	M.	S.
From moon culminations at Rockyside, by J. T. Thomson, and telegraphic and trigonometric connections (see *N.Z. Gazette*, 20th May, 1878, p. 635)	11	39	9·92
From meridional transits and azimuths of the moon, by Major Palmer, R.E., at Burnham (see Transit of Venus, 1874, p. 493)	11	29	13·10
Telegraphic difference between Burnham and Wellington Observatory (see *N.Z. Gazette*, 30th March, 1876, p. 231) ...		9	52·37
Trigonometrical difference between Wellington Observatory and Survey Observatory, Mount Cook			1·21
Mount Cook long. based on Burnham (connection by telegraph) ...	11	39	6·68
Longitude of Burnham	11	29	13·10
Trigonometrical difference of longitude, Burnham and Mount Cook		9	53·88
Mt. Cook long. based on Burnham (connection by triangulation) ...	11	39	6·98

The difference between these two determinations is ·3 of a second of time, or in space 343 feet, at Wellington.

The extreme difference between these various values of the longitude of Mount Cook is 4·47 seconds in time, or, expressed in space, a difference of nearly a mile in the distance, measured on the earth's surface, between Greenwich and Mount Cook—a matter really of no practical moment except for astronomical purposes. The chart longitudes of New Zealand are those given by the Admiralty Surveyors. Pipitea Point, Wellington Harbour, 11 hr. 39 min. 11·53 sec. east of Greenwich is their standard longitude, and, allowing for the difference of easting, is almost identical with 11hr. 39min. 9·92sec., the longitude of Mount Cook determined independently by Mr. J. T. Thomson, late Surveyor-General.

In 1876 the Ven. Archdeacon Stock, at the Wellington Observatory, exchanged signals through the cable with Mr. Russell, at Sydney, for the determination of the difference of longitude between the two Observatories, with the following result :—

	H.	M.	S.
Difference between Sydney and Wellington Observatories (Appendix to the Journals of the House of Representatives, 1876, H.–6A, p. 2)	1	34	15·9949
Difference between Mount Cook and Wellington Observatories ...			1·21
Difference between Mount Cook and Sydney by Stock and Russell	1	34	17·204
Difference between Mount Cook and Sydney by Adams and Russell	1	34	16·984

Difference between the two determinations ... ... = ·22
or expressed in space = 252 feet in the latitude of Wellington.

As the ultimate longitude to be accepted will be that derived from the exchange of time-signals, it will be interesting to note the successive steps in the connection between Greenwich and Mount Cook. These are—1st, Greenwich to Mokattam, near Cairo, in Egypt; 2nd, Mokattam to Suez; 3rd, Suez to Aden; 4th, Aden to Bombay; 5th, Bombay to Madras; 6th, Madras to Singapore; 7th, Singapore to Port Darwin; 8th, Port Darwin to Melbourne; 9th, Melbourne to Sydney; 10th, Sydney to Mount Cook, Wellington. At each of these stations the time had to be determined with the greatest attainable accuracy, and the exchange of time-signals between the several ten pairs of stations was for each pair an independent operation. The result for any station is therefore affected by the minute residual errors of the intermediate exchanges between it and Greenwich. If all cumulative they should not affect the result at Mount Cook more than one second. The probabilities are in favour of them correcting each other, or nearly so. Were it possible to have the signals sent direct from Greenwich to Mount Cook without a break the result would be free from the errors of the intermediate stations. This, however, could not be done, because of the great distance, and the combination of submarine cables and land lines necessitating the work being taken in sections. Indeed, for that reason, the first

step, Greenwich to Mokattam, was divided into three subsections, one for the cable in the centre, and two for the land lines at the Greenwich and Mokattam ends.

Although, as already stated, the results have not been finally accepted for Sydney, and upon which of course depends the longitude of Mount Cook, yet it will be as well to record here the results so far as tabulated by Mr. Baracchi, the gentleman who conducted the operations at Port Darwin for the Australian Observatories:—

	H.	M.	S.
Longitude of Singapore, determined by Professor Ondemans (1870), Flagstaff of Government Hill	6	55	22·714
Reduction to Captain Darwin's station			1·510
Longitude of Singapore (Captain Darwin's station)	6	55	24·224
Difference Port Darwin–Singapore	1	47	57·512
Longitude of Port Darwin (Baracchi's station)	8	43	21·736
Difference Melbourne–Port Darwin		56	31·640
Longitude of Melbourne (observatory)	9	39	53·376
Difference Sydney–Melbourne		24	55·098
Longitude of Sydney (observatory)	10	4	48·474
Difference Mount Cook, Wellington–Sydney	1	34	16·984
Longitude of Survey Observatory, Mount Cook, Wellington ...	11	39	5·458

In transmitting signals between distant points the sending and receiving are not instantaneous, a measurable interval of time being occupied by the galvanic current in overcoming the retardation of land and cable lines. Between Sydney and Wellington this amounted to nearly half a second, giving for the velocity of the current about 3,500 miles a second. Were there no such retardation, and the transmition of signals instantaneous, then the apparent difference between the times of the two meridians would be the same for signals sent from west to east as from east to west. But the apparent difference is always greater in the former case. This is due to the fact that the nominal time of the eastern clock being in advance of the western, the retardation of signal increases the apparent interval between the two clocks by its own amount; while for signals going west the retardation of signal has the opposite effect, diminishing the apparent interval, because the western clock is ever making up, so to speak, on the time of the eastern. In other words, the signals going east have to overtake the clock time, while those going west are met by it.

As the true position of the Mount Cook Observatory might get obliterated or become uncertain owing to the prison buildings now in progress, a diagram showing the connection with the stations of the trigonometrical survey is attached to this report, so that, in any future determinations of longitude, comparison may be had with that now determined. The position of the transit pier will, of course, be carefully marked on the ground by a stone block should it be found necssary to remove the Observatory.

The most cordial acknowlegments are due to Mr. Russell, Government Astronomer, Sydney, and Mr. Shapley, the Superintendent of the Cable Company, for their invaluable services to the colony in this work, given, as they were, without fee or reward; also to Dr. Lemon for skilful advice and direction, and for the services of Mr. Gell and other officers of the Telegraph Department, rendered with the greatest readiness and goodwill.

Latitude.—The computation of the latitude of Marsland Hill, New Plymouth, through the triangulation from Mount Cook, Wellington, having revealed a discrepancy of 10″ from the latitude obtained from astronomical observation, Mr. T. Humphries, by means of the 12-inch alt-azimuth, observed stars N. and S. of zenith at Marsland Hill and Pukearuhe, two stations on the north side of Mount Egmont, and at Hawera and Patea, two stations south of that mountain, with the result that the stations on the north side of Mount Egmont both show the astronomical latitudes to be about 10″ in excess of geodesic latitudes, while the two stations south show an excess of 20″ each. These discrepancies clearly point to the deflection of the line of gravity by the mountain mass, and also to

the unequal density of the earth's crust. Other similar discrepancies in astronomical and geodesic latitudes have been reported before as due to the same cause; and it is possible that a discrepancy of more than 30″ between the latitudes of Maketu and Poverty Bay Initial Stations, hitherto attributed to imperfect observation, may be found due to the above cause on the re-observation of these stations by Mr. Adams with the zenith telescope during the ensuing season.

The astronomical latitudes of the following list of stations in the Middle Island show a pretty close agreement with the latitudes of the same stations computed through the triangulation from Mount Cook:—

Station.	Astronomically-observed Latitude.	Latitude calculated through the Triangulation from Mount Cook.	Difference between Astronomical and Triangulation Latitude.	Triangulation Latitude, how obtained.
	° ′ ″	° ″	° ′ ″	
Mount Cook Observatory	41 18 00·59	...	...	
Goulter's Hill	41 32 39·87	41 32 35	0 0 04·87	Wellington and Marlborough triangulation.
Isolated Hill	42 41 19·5	42 41 16·3	0 0 03·2	Ditto.
		42 41 16·5	0 0 03·0	Wellington, Marlborough, and Nelson triangulation.
Koiterangi	42 52 55	42 53 06·1	0 0 11·1	Ditto, eastern route.
		42 53 06·2	0 0 11·2	Ditto, western route.
Buller	41 48 29·5	41 48 33·5	0 0 4·0	Ditto, western route.
Mount Pleasant ...	43 35 23	43 35 22·3	0 0 0·7	Wellington, Marlborough, Nelson, and Canterbury triangulation.
Burnham	43 36 48·4 by Major Palmer	43 36 43·2	0 0 5·2	Ditto.

Reconnaissance Survey.

The knowledge of topography of the bush country inland from the coast-line between Jackson's Bay and Martin's Bay back to the main range having long been felt to be very meagre and unreliable, the country never having been surveyed, Mr. G. Mueller, in connection with the West Coast triangulation now in progress, which he is directing, made an exploration of the district last summer, and furnished a report and sketch map (see Appendix). The country is a series of narrow valleys and bush hills, through which, Mr. Muller reports, it is practicable to have a continuous line of road opening out the interior valleys whenever desired.

This country has long been supposed to be auriferous, from the fact that for many years a few adventurous men have made a living, washing the gold from the sands along the sea-beach and from the beds of the streams; but the difficulties of communication with populous centres, of penetrating the West Coast bushes even for a few miles, and at the same time of keeping up supplies, have hitherto prevented this isolated district from attracting a population to settle in it and test its capabilities. Mr. Mueller's report and map are an important contribution towards that end. The settlements at Jackson's Bay and Martin's Bay, after combating for many years with the difficulties referred to, have at length, according to Mr. A. Barron's report (see Appendix), who visited them last summer, got a residuum of hardy settlers, adapted to the conditions of the country, and who are undoubtedly the nuclei of what, with a little judicious expenditure in opening roads or tracks, may soon become important settlements.

Settlement Surveys on Rural and Suburban Lands.

An area of 439,400 acres has been marked off on the ground into 4,043 sections, at an average cost of 1s. 9½d. per acre. This average is higher than in any former year, and is mainly attributable to a greater proportion of bush surveys on the whole area surveyed than ever before. An additional expense is also incurred by a careful selection of roads and running of grade wherever the ground is uneven or hilly; and it is now the rule to put in the back pegs of all sections,

bush as well as open. In very broken bush country, such as the block fronting on the coast line north of the Mokau River, the side boundaries are traversed along the dividing ridges and spurs. To lay off such country on the rectangular system would simply be giving for boundaries a series of lines, crossing precipices and gorges on utterly impracticable fencing-lines.

Another very material cause of expense in the settlement surveys is the finding the boundaries of old surveys, which have either become obliterated or previously only existed on paper, but which nevertheless must now be defined on the ground before the purchases of adjacent lands can be marked off. This source of expense will, of course, diminish as the old boundaries get fixed and connected trigonometrically.

The land systems in vogue in several of the land districts have also a very material effect towards increasing the cost of survey. Thus, in the Auckland District, although the law is that land for cash can only be sold by public auction after survey, there is virtually in operation a system of free selection before survey; because, on any one making known his desire to have a certain area of Crown lands exposed for sale, the Land Board as a rule approve, and a survey has to be made. Hence the surveys are very scattered, in small areas, and necessarily always in arrear, for it is impossible, especially in bush districts, to send a surveyor whenever wanted to some remote valley, it may be, fifty or a hundred miles from any other survey. At present there are surveys in the Auckland Land District waiting execution in 400 localities, and yet only covering in all about 77,000 acres.

In Nelson Land District free selection before survey also prevails, in terms of Section 8, Appendix E, of "The Land Act, 1877." But the cost of the survey per acre is kept partially under by the surveyor sectionizing the adjacent Crown lands that may lie contiguous to the land applied for.

The most economic method of settlement survey is that known as the block and section system. In it the surveyor has a whole country side assigned to him, it may be of five thousand or twenty thousand or more acres. His duty is to study the country, and, having made the best disposition of road-lines, to design and mark off the sections according to the lay of the land. This is in every way the most satisfactory system of survey, and is, with the approval of the Land Boards of the two districts named, being gradually introduced. It is the system in operation in most of the other land districts of the colony.

Native Surveys.

For the purpose of enabling the Land Court to investigate and adjudicate title, 191 blocks, containing an area of 556,528 acres, were surveyed. Of these, 21 blocks, containing 137,735 acres, were surveyed at the cost of the Native owners, and for the survey of the balance—170 blocks, of 418,893 acres—the Government advanced the payment, amounting to £6,424 3s. 9d., or a rate of 3¾d. per acre.

For land purchases there were surveyed 15 blocks, containing an area of 72,583 acres, costing £1,420 13s. 5d., or 4¾d. per acre, out of the funds of the Land Purchase Department.

The south boundary of the King country, from Ruapehu to White Cliffs, was surveyed and marked on the ground by Messrs. Edgecumbe, Spencer, and Skeet, each taking a section. The line passes over some very broken country. They were occupied about four months on the work, which was necessarily of an arduous nature.

The surveys of the subdivisional orders of the Native Land Court are for the most part executed by authorized private surveyors, and paid for by those interested. As the subdivision of a Native block may not, and often does not, take place for long after the issue of the grant, it frequently happens that, by the time the surveys of the subdivisions are made, the right of taking land for roads in terms of section 106 of "The Native Land Act, 1873," and section 14 of the amending Act, 1878, has lapsed, and consequently roads for public convenience rendered necessary by the subdivision, and for the subsequent settlement of the block, cannot be surveyed and dedicated by Governor's warrant.

What is wanted is a very considerable extension of the fifteen years from date of grant within which road-lines may be taken up to a limit of 5 per cent. of the total area of the block. Indeed, no limit in time should be fixed; for, since the right is assumed to take land for roads through Native lands, it should not be hampered with a restriction, which in many cases virtually closes the opportunity of taking roads before it can be known where they are wanted. The proviso in section 106, preventing the taking of roads through cultivations and plantations, pas, &c., is a reasonable protection to the improvements of settlers, but no such argument applies to the land in its wild natural state. Unless the law be amended in the manner indicated, very great future inconvenience is likely to ensue.

Mining, Road, and Land Transfer Surveys.

The surveys of mining-leases, water-races, and other survey work in connection with the gold and coal mines are well in hand, there being no arrears of long standing to dispose of.

The road surveys have been principally in the exercise of rights reserved in Crown grants through lands sold without any definition of road-lines at the time of sale. This class of work has proved a very troublesome and costly legacy, for, although settlers are all eager for good road-lines, no one wishes his property intersected by them. There is often great difficulty in deciding what is best to be done as between public and private interests, for the latter cannot be ruthlessly ignored. Under the existing system in the survey of Crown lands every section fronts on to a practicable road-line, and consequently any future severance of properties is avoided.

Land Transfer surveys, as explained in former reports, are executed by private authorized surveyors, in accordance with regulations issued by the department, and in harmony with the system of survey and record of the Crown lands. As much difficulty arises in town and suburban lands, more especially in obtaining suitable points of reference to which the Land Transfer surveys may be connected, standard traverses have been made of the principal streets and road-lines of several towns and districts during the year, and blocks placed in position to afford starting and closing points. Some delay in dealing with plans has arisen in the Auckland District from the want of standard points, thereby often necessitating the investigation of the boundaries of all the surrounding properties before the plan of the property being dealt with can be certified as accurate for purposes of land transfer.

Pioneer Road Construction.

The opening-out of Crown lands by road clearings in the bush, by culverts and bridges, and by side cuttings and formations where the surface is broken or hilly, has received a great deal of attention since the introduction in 1878 of the system of improvement of Crown lands before sale. The maps of the North and Middle Islands attached indicate the localities where road-lines have been opened. The maps are on too small a scale to show any detail, but a total length of 1,330 miles has been rendered fit for horse-traffic, and, of that, about one-half is passable for drays. The cost of these operations, inclusive of certain drainage and water-race works, up to the 30th June last, has been £296,800, and an area of 1,750,000 acres has been rendered more or less accessible to the settler. During the twelve months 334 miles have been under clearing and formation, and 290 miles have been lined out and graded preparatory to being opened out.

The opening-out of Crown lands by road clearings and formations before sale becomes more and more an indispensable preliminary as settlement extends into the bush and the back-lying districts. The object in these works being simply in the first instance to enable the settler to go on to the ground with a pack-horse, a great deal remains to be done before the ideal of a macadamized road is attained. But, as the first works are laid out on practicable grades, every subsequent piece of work, from the first benching, tells towards the formation of the ultimate road.

In the Appendix will be found reports by the Chief Surveyors on the various works executed or in progress in their respective districts. Although the works are under their direction, acknowledgment must be made of the valuable assistance of the officers of the Public Works Department and of the local bodies.

The works which are now more urgently required in the interests of future settlement have been already reported. Unless they are put in hand soon the area under sectional survey may be curtailed, because it is simply impossible for the ordinary class of settlers to obtain a footing on land until it has been made in some degree accessible. Further, the cost of survey is greatly enhanced in bush land if pushed much in advance of the road clearings. It would be more economical, and in every way better, to have the principal road-lines opened out before entering on the sectional survey.

Publication of Maps.

The main effort of the department in this branch has been devoted to the production, by photo-lithography, of survey district maps to the one-inch scale. The maps of twenty-five districts have been issued, but, as the sectional surveys in many unpublished districts have been completed for some time, it is desirable that the out-turn of district maps should be at a more rapid rate than twenty-five per year. Hitherto, the one-inch scale has been confined to survey districts subdivided into sections, but, recognizing the great convenience that the publication of the topographical features of some of the survey districts would be, a beginning was made this year by the issue of four of that class of maps on the one-inch scale.

The supply of geographical, land tenure, and sale maps has been regulated by the demand.

The publication of the plans and graphic illustrations for the other departments of the public service are also undertaken by this branch; the whole being under the able direction of Mr. Barron, from whose report in the Appendix it will be seen that, for the Survey Department, 169 maps were put to the stone and 127,127 copies struck off; for the other departments, 564 plans or subjects, and 195,107 copies. The inconvenience of restricted room and restricted mechanical appliances, referred to in former reports, still continues, and cannot be remedied until a new printing office is built.

Miscellaneous.

The Government, charged as it is with the settlement of a population over an extensive territory, and undertaking the conduct of so many great national services—railways, telegraph, education, defence, also the oversight of mines, hospitals, asylums, local government, and generally maintaining a close connection with the public in many other ways—is necessarily almost continually in want of some survey service which does not come within the ordinary category of Crown or Native lands: such as supervision and grading of road-works; levels for drainage; railway land surveys; exploration of railway routes; definition of boundaries of Native and other reserves; standard surveys for purposes of land transfer; back-pegging of former land purchases; surveys of foreshores, of compensation awards, of school, cemetery, and other sites; Native Land Court attendance; plans for evidence in Courts of justice; valuations of improvements on runs; descriptions of districts; reports; and other works that need not be further enumerated, but in all of which the department has been engaged during the year.

Future Departmental Operations.

The trigonometrical and topographical surveys will be continued in the King country, in the Urewera and other districts, for the purpose of the Native Land Court, unless prevented by Native opposition, which is not likely. Extension of minor triangulation is also required in several districts of the North Island, for the control of settlement and Land Transfer surveys. In the Middle Island this class of survey will, for the current year, be chiefly confined to the Westland, Nelson, and Marlborough Districts.

Of Native blocks an estimated area of 717,016 acres awaits survey of exterior boundaries prior to investigation of title.

In settlement survey, blocks of Crown lands in nearly every land district are available for subdivision. The extent to which this can be done, or rather should be done, will depend very much on what money may be available for expenditure in opening roads and tracks through such unoccupied country as the extensive and valuable area lying between Masterton, Woodville, and the confines of Hawke's Bay, known as the Forty-Mile, Puketoi and Tautane bushes; or the equally-extensive areas of open fern country lying between Napier, Wairoa, and Gisborne; or the still more extensive area of open and bush land abutting on the coast-line between Catlin's River and the Bluff.

There are at present 79 surveyors on the permanent staff and 34 surveyors on the temporary list, as against 86 permanent and 40 temporary twelve months ago. The decrease is due to the disposal of the West Coast Commission surveys, the great body of arrears in Canterbury, and the completion of the sectional surveys of the blocks withheld from the Otago runs.

In the survey offices there are 78 draughtsmen on the permanent staff and 21 on the temporary list engaged in the reduction of the survey plans and their record on the property plans, and preparation of certificates of title. This important work proceeds on a settled system of routine and check, which assures correctness for the thousands of titles which pass through in the course of a year. There are 9 draughtsmen engaged in the Head Office upon maps for publication and the general requirements of the Government.

The compilation of the topographical information into the geographical maps for publication proceeds as quickly as spare time from the other work will permit.

It affords me great satisfaction to state that in the staff of surveyors and draughtsmen now in the department the colony has a very effective means of preparing the country for settlement, and of making known its resources in that respect far and wide, through the numerous maps which are annually produced and distributed extensively both at Home and abroad.

I have, &c.,

JAMES MCKERROW,
Surveyor-General.

The Hon. W. Rolleston, Minister of Lands.

RETURN of FIELD-WORK executed by STAFF and CONTRACT SURVEYORS, and of the COST of the SURVEY DEPARTMENT of NEW ZEALAND, from the 30th June, 1883, to the 30th June, 1884.

District.	Major Triangulation.		Minor Triangulation.		Topographical and Trigonometrical Survey.		Rural and Suburban.			Town Section Survey.			Native Land Court Survey.			Native Land Purchase Survey.			Gold-Mining Survey.			Roads, Railways, and Water-races.		Detention by Native Opposition or other Causes.	Miscellaneous Work.	Total Charges against the Survey Votes for Twelve Months.	
	Acres.	Cost per Acre.	Acres.	Cost per Acre.	Acres.	Cost per Acre.	Acres.	No. of Sections.	Cost per Acre.	Acres.	No. of Allotments.	Cost per Allotment.	Acres.	No. of Sections or Divisions.	Cost per Acre.	Acres.	No. of Blocks.	Cost per Acre.	Acres.	No. of Sections.	Cost per Acre.	Miles.	Cost per Mile.	Cost.	Cost.	Field-work.	Supervision, Inspection, and Office-work.
		d.		d.		d.			s. d.			£ s. d.			d.			d.			s. d.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Head Office and General	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5,893 13 10
Photo-Litho. Branch	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2,838 12 5
Auckland ..	827,519	0·89	445,457	0·92	197,250	0·95	98,794	871	2/0	52·2	28	2 2 10	361,970	149	3·5	72,583	15	4·7	..	..	..	234	12 1 11·7	430 4 0	3,883 18 0	28,721 8 1	8,668 4 10
Hawke's Bay	..	..	126,370	0·77	70,600	1	28,068	194	1/4	22·5	54	0 15 0	..	..	..	..	..	..	..	..	..	47·5	9 9 7	..	637 19 7	4,931 18 7	1,788 4 9
Taranaki ..	121,000	0·9	..	..	79,000	1·9	13,725 *28,092 †17,409	80 184 110	2/7·4 2/3·4 1/5·8	..	..	..	..	..	..	..	..	..	..	..	..	45·5	25 1 5	98 1 8	3,037 14 3	10,216 1 0	2,661 18 2
Wellington ..	..	..	10,979	0·53	550,540	1·23	16,305	89	1/10·5	14·25	7	5 13 8	‡106,308	21	4·5	..	..	..	..	..	..	277·75	8 8 0	17 4 1	2,079 14 1	8,734 0 5	5,421 10 4
Nelson ..	..	..	42,000	0·8	220,067	1·4	67,790	474	1/9·6	0·75	6	1 5 0	‡88,350	..	..	..	..	..	1,202	74	13/1·3	48	18 3 1	..	2,418 6 1	9,928 5 4	2,731 1 9
Marlborough	363,905	0·25	..	..	363,905	0·46	1,470	18	1/9	..	..	..	..	..	..	..	..	..	A. R. P. 31 3 30 Acres.	3	18/4	30·25	21 4 1	..	62 18 6	1,423 19 0	642 15 0
Westland ..	169,276	0·45	..	..	185,756	1·84	9,300	219	2/8·61	32	126	0 11 8	..	..	..	..	..	..	510·5	54	14/9	59·5	13 0 6	..	823 7 11	4,635 1 2	1,850 6 3
Canterbury ..	..	..	..	..	236,518	0·85	41,967	901	2/4·5	..	..	..	..	..	..	..	..	..	231	14	13/4	3·67	58 3 4	..	307 8 7	7,606 0 0	7,788 11 9
Otago ..	..	..	..	..	347,489	1·09	81,310	507	1/1·37	431	252	0 19 10	..	..	..	..	..	..	778	59	10/8·2	37·87	9 10 10	..	1,738 18 3	9,962 15 8	4,812 0 10
Southland ..	..	..	7,000	0·34	..	..	35,170	396	1/7·5	184	243	0 18 2·5	..	..	..	..	..	..	..	..	..	7	12 8 7	..	22 3 0	3,004 12 9	1,770 7 2
Totals and Averages	1,481,700	0·68	631,806	1·09	2,251,125	1·13	439,400	4,043	1/9·56	736·7	716	0 19 4·2	556,628	170	3·7	72,583	15	4·69	2,753·44	204	12/9·7	790·9	12 5 7·4	545 9 9	15,012 8 3	89,164 2 0	46,867 7 1

* Surveys for West Coast Commission. † Surveys for Native Reserves Trustee. ‡ At expense of owners.

	£ s. d.
Total expenditure for the year	136,031 9 1
Less credits	16,677 9 8
Net cost	£119,353 19 5

JAMES McKERROW
Surveyor General.

INDEX
TO THE STATE OF THE PUBLIC SURVEYS IN NEW ZEALAND

SCALE OF MILES
20 10 0 40 80 120 160

NORTH ISLAND

MIDDLE ISLAND

SOUTH ISLAND

STEWART ISLAND

REFERENCE

Standard Survey ..... shewn thus
Minor Triangulation ..... " "
Section Survey under check ..... " "
Section Survey built ..... " "

JUNE 1884

Photolithographed at the General Survey Office, Wellington, N.Z. August 1884.

JAMES McKERROW
Surveyor General.

MAP OF THE
NORTH ISLAND,
NEW ZEALAND.
SHEWING THE LAND TENURE,
JUNE 30TH 1884.

Scale of Miles.

10 5 0 10 20 40 60 80

Reference.

Chief Towns ..... shewn thus	WELLINGTON ○
Minor Towns and Post Offices	HAMILTON ○
Roads	
Railways constructed ——— proposed - - - -	
Boundaries of Provincial Districts	
Lands owned by Europeans, purchased or leased by private individuals from the Natives	
Lands owned by Europeans, purchased from the Crown & Old Land Claims	
Confiscated Lands unsold	
Lands reserved for Native purposes	
Lands held by Natives, under Certificate of Title, Memorial of Ownership, or Crown Grant	
Lands in the hands of the Natives over which the Native Title has not been extinguished	
Lands under negotiation to purchase by Government, and proclaimed under "The Government Native Land Purchases Act, 1877"	
Crown Lands	
Thermal Springs District	

General Survey Office, Wellington N. Z., July, 1881.

JAMES McKERROW
Surveyor General.

MAP OF THE
MIDDLE ISLAND,
NEW ZEALAND.

SHEWING THE LAND TENURE,

JUNE 30TH 1884.

Scale of Miles.

10 5 0 20 40 60 80

Reference.

Chief Towns ..... shewn thus	DUNEDIN
Minor Towns and Post Offices	AKAROA
Roads	
Railways proposed ..... constructed	
Boundaries of Provincial Districts	
Lands sold or otherwise disposed of	
Crown Lands held under Pastoral Lease or otherwise, not open for sale or free selection	
Lands reserved temporarily	
do. do. permanently	
Crown Lands open for sale or free selection	
Lands temporarily withdrawn from sale	
Crown Lands held under Pastoral Lease, open for free selection	

Tasman Bay

Karamea Bight

Canterbury Bight

Pegasus Bay

Banks Peninsula

Golden Bay

D'Urville I.

Cloudy Bay

NELSON

WELLINGTON

CHRISTCHURCH

DUNEDIN

NEW PLYMOUTH

WANGANUI

HASTINGS

NAPIER

GISBORNE

INVERCARGILL

GREYMOUTH

HOKITIKA

TIMARU

OAMARU

WESTPORT

BLENHEIM

NORTH ISLAND

MIDDLE ISLAND

SOUTH ISLAND

STEWART ISLAND

TASMAN SEA

PACIFIC OCEAN

SOUTHERN OCEAN

FOVEAUX STRAIT

COOK STRAIT

CHATHAM ISLANDS.

Scale 2.5 Miles to an Inch.

Native land sold to Europeans
" " leased
Land held or occupied by Natives

General Survey Office Wellington, N.Z., November 1882.

South Latitude

166° 167° 168° 169° 170° East Longitude 171° 172° 173° 174°

40° 41° 42° 43° 44° 45° 46° 47° 48°

SOMES ISLAND

37606·4

256° 22' 46"5
35317·5

254° 32' 20"8
40816·9

North Lamp

82° 00' 29"

Pipitea Point
(Stoke's Stn.)

22228·0

56° 18' 13"5
36014·8

14559·6

WELLINGTON OBSERVATORY

RECLAIMED LAND

LAMBTON HARBOUR

16447·8

310° 05' 50"

Point Halswell

Point Jerningham

KING'S OBSERVATORY

88° 02' 09"

11743·5

268° 02' 09"

314° 08' 35"5
13065·6

9314·3

215° 41' 04"

245 06 51·2
14560·4

6614·2

339° 43' 57"

35° 41' 10"

302° 14' 38"

Mount Victoria

254° 48' 31"

7542·3

74° 48' 31"

Mt COOK OBSERVATORY

EVANS BAY

NEW ZEALAND SURVEY

JAMES McKERROW
Surveyor General.

PLAN OF
Mt COOK OBSERVATORY, WELLINGTON
and its connection with the Triangulation 1884

Scale of Chains

20 15 10 5 0 20 40 60 80 100 120

Table of Meridian and Perpendicular distances, and Latitudes and Longitudes of Observatories

Stations	On Meridian N	On Meridian S	On Perpendicular E	On Perpendicular W	Latitude	Longitude
Mt Cook Initial Station	0	0	0	0	41° 17' 59"3	174° 47' 28"8
Mt Cook Observatory		198·38			41° 18' 00"59	174° 47' 28"8
King's "	6944·6			598·1	41° 17' 14"01	174° 47' 23"6
Wellington "	11076·0			2097·2	41° 16' 47"07	174° 47' 10"65
Pipitea Point	18640·2		2918·4		41° 16' 30"12	174° 47' 52"95

H.A.R. Farquhar delt.

291° 37' 20"

21° 36' 20"

111° 32' 30"

201° 33' 20"

Initial Point of New Zealand Surveys

Observatory

0° 00' 00"
198·38

177·61

84·19

Trig Pipe

Trig Pipe

ENLARGED PLAN
Shewing Position of the Old and New Sites and their Relation to the Foundations of
Mt COOK PRISON

SCALE
60 40 20 0 60 120 180 Lks

Initial Station to Centre of Gaol S.7·32 ; W.25·15 } links
Observatory to Centre of Gaol N.191·06 W.25·15 }

TABLE OF LATITUDES AND LONGITUDES.

Station	Astronomical obsd Latitude	Geodesical Latitude	Geodesical Longitude	Route
Mt COOK INITIAL STN	41°17'59"3		174°47'28"8	Observed
GOULTER	41°32'39"87	41°32'35"0	173°49'00"0	
BOTANICAL HILL		41°16'23"2	173°18'49"8	
SLIPS		41°45'10"9	172°47'28"3	
ROSEMOUNT		41°51'13"6	171°56'38"3	
BULLER	41°48'29"5	41°48'33"5	171°35'44"4	
AHAURA		42°19'56"5	171°33'50"3	By Slips & Rosemount.
"		42°19'56"6	171°33'49"3	" Highfield & Elliott.
SEWELL'S PEAK		42°24'30"3	171°21'23"0	" " "
KOITERANGI	42°52'55"0	42°53'06"2	170°59'38"6	" Goulter, Rosemt. Ahaura.
"		42°53'06"3	170°59'37"6	" Goulter. Highfield. Elliott.
TARNDALE		42°09'39"4	172°54'14"2	
HIGHFIELD		42°38'18"6	173°06'29"6	
ISOLATED HILL	42°41'19"5	42°41'16"5	173°01'28"2	" Goulter & Highfield
"		42°41'16"5	173°01'27"7	" Goulter & Tarndale
GRANTHAM		42°33'40"5	172°43'27"3	" Goulter & Highfield.
ELLIOTT		42°29'49"3	171°51'21"2	" " "
HURUNUI PASS		42°43'45"8	171°53'48"6	" " "
Mt ALEXANDER		42°54'27"2	172°49'38"0	" " "
Mt PLEASANT	43°35'23"0	43°35'22"4	172°44'29"5	" " "
BURNHAM	43°36'46"4	43°36'43"3	172°19'00"6	" " "

PLAN OF LATITUDES & LONGITUDES OF TRIGONOMETRICAL STATIONS.

(THE GEODESICAL RESULTS BASED ON Mt COOK INITIAL STATION.)

SCALE.

0 10 20 30 40 50 60

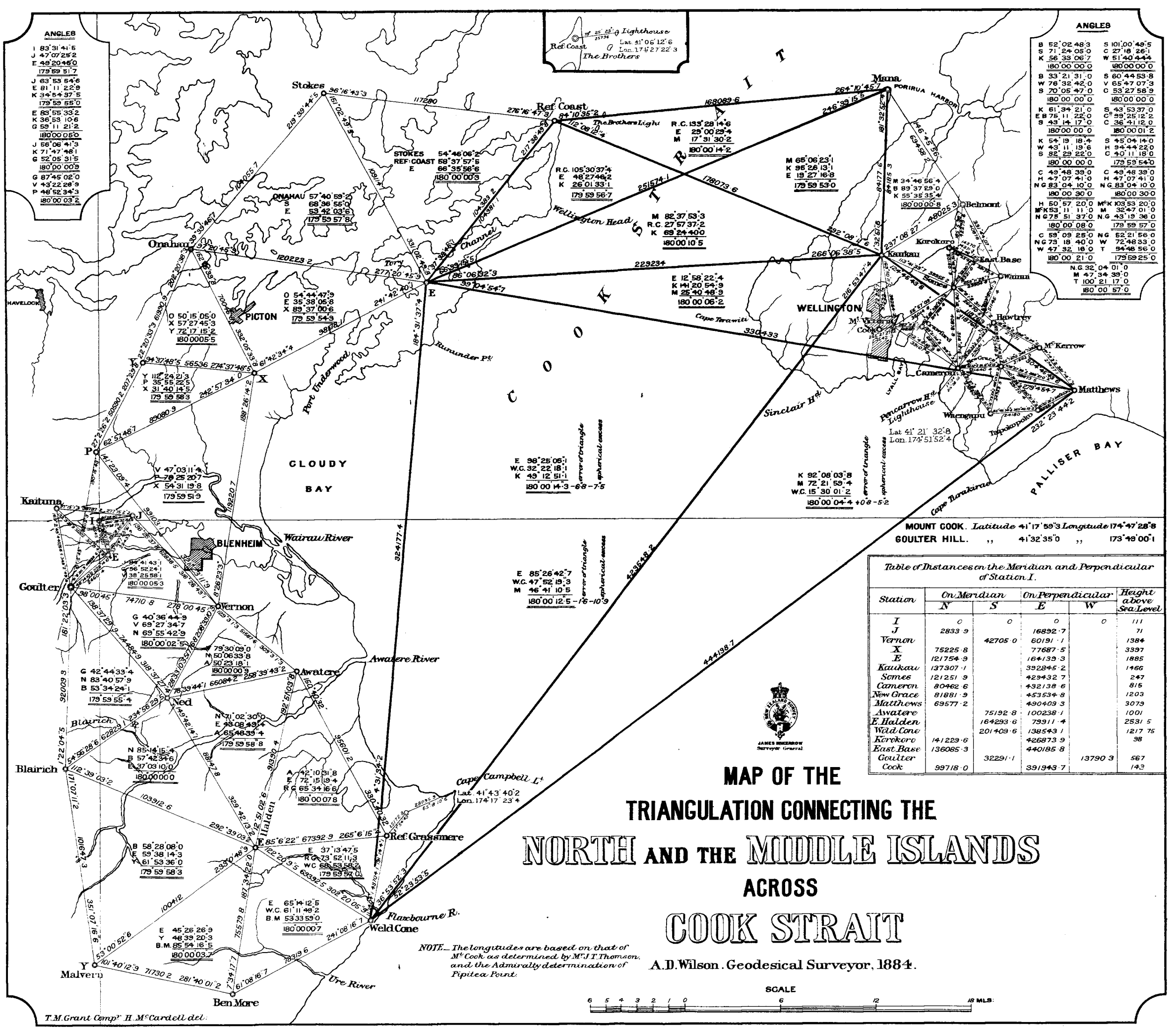
MILES.

1884

JAMES McGREGOR Surveyor General

Drawn by T.M. Grant.

Photolithographed at the General Survey Office, Wellington, N.Z. September 1884.


ANGLES
I 83°31'41"5
J 47°07'25"2
E 49°20'46"0
179°59'51"7
J 63°53'54"6
E 81°11'22"9
K 34°54'37"5
179°59'55"0
E 83°55'33"2
K 36°53'10"6
G 59°11'21"2
180°00'05"0
J 56°06'41"3
K 71°47'48"1
G 52°05'31"5
180°00'00"9
G 87°45'02"0
V 43°22'26"9
P 48°52'34"3
180°00'03"2
Ref Coast Lighthouse
Lat. 41° 06' 12"6
Lon. 174° 27' 22"3
The Brothers
Stokes
Ref Coast
Mana
PORIRUA HARBOR
The Brothers Light
STOKES 54°46'06"2
REF:COAST 58°37'57"5
E 66°35'56"6
180°00'00"3
R.C. 133°28'14"6
E 29°00'29"4
M 17°31'30"2
180°00'14"2
R.C. 105°30'37"4
E 48°27'46"2
K 26°01'33"1
179°59'56"7
M 65°06'23"1
K 95°26'13"1
E 19°27'16"8
179°59'53"0
ONAHAU 57°40'59"2
S 68°36'55"0
E 53°42'03"6
179°59'57"8
Wellington Head
M 82°37'53"3
R.C. 27°57'37"2
K 69°24'40"0
180°00'10"5
M 34°46'56"4
B 89°37'29"0
K 55°35'35"4
180°00'00"8
Belmont
Onahau
Tory Channel
Karokoro
Kaukau
East Base
Wainui
HAVELOCK
PICTON
O 50°15'05"0
X 57°27'45"3
Y 72°17'15"2
180°00'05"5
O 54°44'47"9
E 35°38'05"8
X 89°37'00"6
179°59'54"3
E 12°58'22"4
K 141°20'54"9
M 25°40'48"9
180°00'06"2
WELLINGTON
Mt Victoria
Cobb
Hawtrey
Cape Terawiti
Runaunder Pt
Port Underwood
Sinclair Hd
Pencarrow Hd Lighthouse
Lat. 41° 21' 32"8
Lon. 174° 51' 52"4
McKerrow
Cameron
Matthews
Waingaru
Tapokopoko
CLOUDY BAY
COOK STRAIT
PALLISER BAY
Cape Turakirae
Kaituna
BLENHEIM
Wairau River
Goulter
Vernon
Awatere River
Awatere
Ned
Blairich
Cape Campbell L.t
Lat. 41° 43' 40"2
Lon. 174° 17' 23"4
Ref Grassmere
Flaxbourne R.
Weld Cone
Malvern
Ben More
Ure River
E 98°25'05"1
W.G. 32°22'18"1
K 49°12'51"1
180°00'14"3 -6"8 -7"5
error of triangle
spherical excess
K 92°08'03"8
M 72°21'59"4
W.C. 15°30'01"2
180°00'04"4 +0"8 -5"2
E 85°26'42"7
W.C. 47°52'19"3
M 46°41'10"5
180°00'12"5 -1"6 -10"9
ANGLES
B 52°02'48"3
S 71°24'05"0
K 56°33'06"7
180°00'00"0
S 101°00'49"5
C 27°18'26"1
W 51°40'44"4
180°00'00"0
B 33°21'31"0
W 76°32'42"0
S 70°05'47"0
180°00'00"0
S 60°44'53"8
V 65°47'07"3
C 53°27'58"9
180°00'00"0
K 61°34'21"0
E B 75°11'22"0
S 43°14'17"0
180°00'00"0
S 43°53'37"0
C 99°25'12"2
C 36°41'12"0
180°00'01"2
K 54°19'18"4
W 43°11'19"6
S 82°29'22"0
180°00'00"0
S 45°04'14"0
H 94°44'22"0
C 40°11'18"0
179°59'54"0
C 49°48'39"0
H 47°07'41"0
N G 83°04'10"0
180°00'30"0
C 49°48'39"0
H 47°07'41"0
N G 83°04'10"0
180°00'30"0
H 50°57'20"0
M K 53°11'11"0
N G 75°51'37"0
180°00'08"0
M K 103°53'20"0
M 32°47'01"0
N G 43°19'36"0
179°59'57"0
C 59°09'25"0
N G 73°18'40"0
W 47°32'16"0
180°00'21"0
N G 52°21'56"0
W 72°48'33"0
T 94°48'56"0
179°59'25"0
N.G. 32°04'01"0
M 47°34'39"0
T 100°21'17"0
180°00'57"0
Table of Distances on the Meridian and Perpendicular of Station I.
Station | On Meridian N | On Meridian S | On Perpendicular E | On Perpendicular W | Height above Sea Level
I 0 0 0 0 111
J 2833·9 16892·7 71
Vernon 42705·0 60191·1 1384
X 75225·8 77687·5 3397
E 121754·9 164139·3 1885
Kaukau 137307·1 392845·2 1466
Somes 121251·9 429432·7 247
Cameron 80462·6 432138·6 815
New Grace 81881·9 453534·8 1203
Matthews 69577·2 490409·3 3079
Awatere 75192·8 100238·1 1001
E. Halden 164293·6 79911·4 2531·5
Weld Cone 201409·6 138543·1 1217·75
Kerokoro 141229·6 426873·9 98
East Base 136085·3 440185·8
Goulter 32291·1 13790·3 567
Cook 99718·0 391943·7 143
MOUNT COOK. Latitude 41° 17' 59"3 Longitude 174° 47' 28"8
GOULTER HILL. ,, 41° 32' 35"0 ,, 173° 49' 00"1
NOTE.—The longitudes are based on that of Mt Cook as determined by Mr J. T. Thomson, and the Admiralty determination of Pipitea Point.
JAMES HOGGARROW Surveyor General
MAP OF THE
TRIANGULATION CONNECTING THE
NORTH AND THE MIDDLE ISLANDS
ACROSS
COOK STRAIT
A.D. Wilson. Geodesical Surveyor, 1884.
SCALE
6 5 4 3 2 1 0 6 12 18 MLS.
T.M. Grant Comp.r H. McCardell del.
Photolithographed at the General Survey Office, Wellington N.Z. September 1884.

APPENDICES.

APPENDIX No. 1.

REPORT ON THE DIFFERENCE OF LONGITUDE BETWEEN SYDNEY OBSERVATORY, NEW SOUT WALES, AND SURVEY OBSERVATORY, MOUNT COOK, WELLINGTON, NEW ZEALAND.

Mr. ADAMS to the SURVEYOR-GENERAL.

SIR,— Wellington, 1st July, 1884.

I have the honour to report as follows on the observations taken in December, 1883, for the determination of the difference of longitude between Sydney and Wellington:—

The successful observation of the last transit of Venus on the 7th December, 1882, by Colonel Tupman, at Burnham, Canterbury, New Zealand, and also by yourself and other observers throughout New Zealand, made it a matter of importance that the longitudes of the various stations of observation should be obtained with the greatest possible accuracy.

The account of the observation of the transit of Venus by the members of the Survey Department is given in the annual report for 1882–83 on the surveys of New Zealand; so I need not refer further to it here.

Before Colonel Tupman left this country he exchanged several sets of time-signals with Sydney, with the object of determining the difference of longitude, but, the weather being unfavourable, the results were not satisfactory, so it was decided that the Survey Department of New Zealand should undertake a fresh set of observations for the purpose. Before these observations were commenced it was necessary that the New Zealand and Sydney observers should meet and take observations to determine their relative personal equation.

With this object I visited the Observatories of Melbourne and Sydney during the months of September and October, 1883, and took observations at both places on several nights.

At Sydney the weather was very cloudy, but good observations were obtained on five nights, when Mr. H. C. Russell, B.A., F.R.A.S., Government Astronomer, Mr. H. A. Lenehan, First Assistant, and myself compared observations.

The determination of the relative personal equation of the above observers in observing transits of stars is given in the following table, where the letters R, L, and A stand for Messrs. Russell, Lenehan, and Adams respectively:—

The equation A−L=+·07*s*. signifies that A's clock correction−L's clock correction = +·07*s*.; or that A makes the clock ·07*s*. more slow than does L: that is, A observes before L.

A−R.			A−L.		
		s.			s.
1883.	Oct. 2,	−·03	1883.	Oct. 2,	·00
	„ 4,	−·02		„ 4,	+·05
	„ 9,	+·01		„ 11,	+·06
	„ 12,	−·01		„ 12,	+·08

The adopted personal equations are as follow:—

A−R=·00*s*.; A−L=+·07*s*.

Owing to some unavoidable delays, it was not found possible to exchange signals with Sydney till the beginning of December, 1883. But during that month signals were successfully exchanged with Sydney on the nights of December 5, 15, 16, and 18, 1883, good star observations being also obtained on each of these nights.

The star observations at Sydney Observatory were made by Mr. H. A. Lenehan, and the time-signals were sent and received by Mr. H. C. Russell.

All observations at the Survey Observatory, Mount Cook, Wellington, New Zealand, were made by myself, and I also sent and received all time-signals. The period of time over which the star observations at Mount Cook extend is from December 3, 1883, to January 11, 1884.

A full account of the Sydney Observatory, with description of instruments, methods of observation, &c., is given in a publication entitled "Results of Astronomical Observations made at the Sydney Observatory, New South Wales, in the Years 1877–78," and published in Sydney in 1881, which I forward herewith.

The following description relates to the instruments in the Survey Observatory, Mount Cook, Wellington:—

The sidereal clock (Dent, 38415) was electrically connected with a barrel chronograph designed by Mr. R. L. J. Ellery, Government Astronomer of Victoria.

No alteration in the adjustments of the clock, transit instrument, or electrical apparatus was made during the whole of the observations.

The transit instrument was made by Troughton and Simms, and the telescope has an aperture of 3 inches, with a focal length of 3 feet. The length of the axis from shoulder to shoulder (that is, exclusive of pivots) is 18 inches. The pivots are $1\frac{1}{4}$ inches long and $1\frac{1}{4}$ inches in diameter.

The transit instrument is provided with a reversing apparatus, by which the telescope can be reversed in a few seconds, without any of the risk that always attends the operation of reversing by hand. There are two finding circles, 4 inches in diameter, one on each side of the telescope. They are graduated to minutes, and can be set to show either altitudes or zenith distances. There are nine fixed vertical wires and one movable micrometer wire; seven of the fixed vertical wires are at intervals of about $3\frac{1}{2}'$ apart; besides which there is one extra wire on each side of the middle wire, and distant about $2'$ from it.

There are also two parallel horizontal wires about $3\frac{1}{2}'$ apart. The integer revolutions of the micrometer are read from a comb in the field of view, and the micrometer head is divided into one hundred parts.

The equatorial intervals of the wires have been computed from 60 transits of clock stars recorded by chronograph, and 30 transits of circumpolar stars recorded chiefly by "eye and ear." The means of these 90 transits give the following results: The wires are numbered 1 to 9, the wire No. 1 being nearest the clamp, so that with Clamp W. stars above the Pole will cross the wires in the order in which they are numbered. Wire No. $1 = +41{\cdot}763s.$; $2 = +27{\cdot}877s.$; $3 = +14{\cdot}012s.$; $4 = +9{\cdot}219s.$; $5 = -{\cdot}034s.$; $6 = -9{\cdot}294s.$; $7 = -14{\cdot}026s.$; $8 = -27{\cdot}846s.$; $9 = -41{\cdot}650s.$

The value of one revolution of the micrometer screw has been determined from four sets of observations on σ Octantis (S.P.), comprising 154 observations in all, giving 88 results. The mean value of these 88 results gives $57{\cdot}943''$ as the value of one revolution.

The value of one division of the striding level was found by causing it to ride on the zenith telescope, in which position I took 200 observations to the south meridian mark. The results proved that the curve of the bubble-tube was not regular, the value of one division varying from $\frac{2}{3}''$ at one part to $1\frac{1}{3}''$ at another. The value at the centre has been adopted, and is $=1{\cdot}28''$. The correction of the level-error, as found by spirit-level, for inequality of the diameters of the pivots, was found to be $p = -{\cdot}590''$ for Clamp W. The level-error as found and adopted is given in Table 2.

The error of collimation is given in Table 1. In the provisional calculations the mean value as obtained by observations of the meridian mark $= +6{\cdot}04''$ for Clamp W. was used throughout, but in the final reductions the collimation error for each night's work was found from the observations themselves, by comparing the results from clock stars Clamp E. with those from Clamp W.

The azimuth error was found in the usual way, by combining observations of circumpolar and clock stars, or by two circumpolar stars, one above and the other below the Pole. In applying the azimuth error, I have always adopted the error as found by the method of "least squares," in preference to taking the mean of the various values obtained. In using the method of "least squares" I have introduced weights on account of imperfect transits whenever the star was not observed on all the wires. I ought also to state that in all my calculations for azimuth error I have rejected a^2 Centauri, as its R.A., as given in the Nautical Almanac for 1883, is evidently in error. This may be seen by comparing "clock slow," as obtained from a^2 Centauri in Table 4, with "clock slow" in Table 5. Judging from the results in Tables 4 and 5, it would appear that the R.A. of a^2 Centauri, as given in the Nautical Almanac for 1883, would require a correction of about $+{\cdot}9s.$

The azimuth error for each night is given in Table 3.

Table 4 gives the meridional transits of all the stars observed. In reducing the star transits, the correction for diurnal aberration has always been applied to the observed times of transit, using the $-$ sign for upper transits and the $+$ sign for lower transits.

The tabular right ascensions of the Nautical Almanac have been corrected according to a list supplied by the Sydney Observatory.

The adopted errors and rates of the transit clock are given in Table 5. In taking the mean of the clock stars observed on each night, weights have been applied for incomplete transits and also for the position of the star. Thus, if $p =$ the weight due to the number of wires observed according to formula (129), page 198, Vol. 2, Chauvenet, then the weight given to each clock star $= p$ cos. dec.

The rates on the exchange days, as given in Table 5, have been deduced from the curves shown on the diagram opposite that table.

With regard to the personal equations given at the bottom of Table 5, I have already explained how the personal equation $A - L = +{\cdot}07s.$ has been obtained. With regard to my own personal equation in receiving time-signals, the following explanation is necessary:—

In receiving longitude signals at Wellington by cable, the comparatively slow motion of a beam of light was observed in two different ways. During the interchange of signals with Sydney, on the night of December 5, 1883, the first movement of the spot of light was noted, but during the interchanges on the nights of December 15, 16, and 18, 1883, a screen was fixed at 200 divisions to the left of the zero of the scale, so that the spot of light was not visible to the person receiving the signals until it had passed this screen.

In order to ascertain the observer's personal equation, or loss of time in noting these signals, several trials were made in the following manner: The sid. clock (Dent, 38415) at Mount Cook Observatory was made to send a weak current to influence the reflecting galvanometer as nearly as possible in the same manner that the cable influenced it. These currents were sent at intervals of 8, 10, or 12 seconds, and were recorded simultaneously on the chronograph. The observer tapped an ordinary Morse key (which also recorded on the chronograph) as soon as possible after noting the signal, and this was generally continued for 50 or 100 signals.

On November 28 and December 19, 1883, the first movement of the spot of light was observed, and on December 16, 17, and 19, the first appearance of the spot of light was noted after passing the screen fixed at 200 divisions to the left of zero, with the following results:—

	s.
November 28, 1883: First movement of spot observed, 66 signals noted; mean loss of time or personal equation	=·296
December 19, 1883: First movement of spot observed, 140 signals noted; mean loss of time or personal equation	=·306
Mean using weights proportionate to the number of observations in each case	=·302

In the following trials the first appearance of the spot of light was noted after passing the screen fixed at 200 divisions to the left of zero, and it will be seen that the loss of time was considerably more than in the first method:—

	s.
December 16, 67 signals; mean loss of time in receiving signals ...	=·443
" 17, 53 " " " ...	=·480
" 19, 114 " " " ...	=·432
Mean of the above values, using weights proportional to the number of observations in each case	=·446

Therefore, in computing the difference of longitude between Sydney and Wellington by signals going east, an allowance of ·302*s.* will have to be made for loss of time in noting the galvanometer signals received at Wellington on December 5, and an allowance of ·446*s.* will have to be made in regard to the signals received at Wellington on December 15, 16, and 18.

NOTE.—The following results were obtained in Sydney, and are recorded here for the sake of comparison, but have not been made use of:—

						s.
September	25, 1883:	Mean of	43	observations by	C. W. Adams ...	0·286
"	26, "	"	50	"	" ...	0·274
October	10, "	"	39	"	" ...	0·271
"	10, "	"	40	"	by H. C. Russell ...	0·271

With regard to Mr. Russell's personal equation in receiving signals, he informed me, by letter dated April 8, 1884, that he had determined it with the instruments as used for longitude and found it to be ·341*s.* from 58 signals.

In exchanging time-signals with Sydney the following arrangement was adopted:—

(1.) *Sydney to New Zealand.*—Mr. Russell sent the following signals by hand, viz., 1*s.*, 10*s.*, 20*s.*, 30*s.*, 40*s.*, 50*s.*, 1*s.*, &c., for 9 minutes, or 55 signals in all. These signals were all recorded on the Sydney chronograph. I received them at Wellington by reflecting galvanometer, but, instead of noting each signal by "eye and ear," I simply tapped the key and recorded each signal on my chronograph.

(2.) *New Zealand to Sydney.*—I sent time-signals by hand at the following intervals, viz., 60*s.*, 11*s.*, 21*s.*, 31*s.*, 41*s.*, 51*s.*, 60*s.*, &c., for 9 minutes, or 55 signals in all, each signal being recorded on the Mount Cook chronograph. Mr. Russell received the signals at Sydney by reflecting galvanometer, and made contact each time, by which means all signals received were recorded on the Sydney chronograph.

Two more sets, similar to the above, generally completed the exchanges for each night.

Owing to the manner of sending and receiving, it will be seen that there was no personal equation in sending signals, but only in receiving them.

Table 6 gives all the exchanges in detail with a summary of means at the end; also the probable error of each exchange, and the probable error of the mean of each night's exchanges.

These so-called "probable errors" have been obtained in the usual way, by means of the residuals, or differences of each exchange from the mean.

Table 7 gives the clock times of sending and receiving each set of time-signals, with all the necessary corrections.

In getting the final difference of longitude the weights for each night's work have been calculated by two different methods.

By the first method the probable errors have been found for each night's "clock slow" at Wellington and Sydney, and also the probable error of each night's exchange of time-signals. Then the probable error of each night's work has been assumed equal to the square root of the sum of the squares of the above probable errors, and the weight for each night's work has been made reciprocally proportional to the square of its probable error.

By the second method weights have been applied according to the number of clock stars observed on each exchange night at Sydney and Wellington. It will be seen that the results by each method are practically the same, and, taking the mean of the two results as the most probable value, we get for the difference of longitude between Sydney and Wellington 1*h.* 34*m.* 16·984*s.* ± ·020*s.*

The course of the electric current from Sydney to Wellington was as follows:—

		Miles.
Sydney Observatory to La Perouse (Botany Bay)	... Land-line ...	9
La Perouse (Botany Bay) to Wakapuaka (N.Z.)	... Cable ...	1,478
Wakapuaka to White's Bay	... Land-line ...	75
White's Bay (South Island) to Lyall Bay (North Island)	Cable ...	51
Lyall Bay to Mount Cook Observatory, Wellington	... Land-line ...	3
Total		1,616 miles.

The mean time of transmission of the electric signals along this 1,616 miles was $x = \cdot 462s.$, which is equivalent to a speed of only 3,498 miles per second; but the above time of transmission includes the charge and discharge of the condensers at each end of the cable, and also the retardation of the cable itself.

Before I finish this report I wish to place on record the hearty manner in which all the telegraphic arrangements were carried out by the officers who took part in the work, both in New South Wales and New Zealand. The Eastern Extension Telegraph Company with great liberality gave the free use of their cable connecting New Zealand with Sydney.

The telegraphic arrangements at the Sydney end of the cable were under the personal supervision of Mr. J. S. Shapley, the Superintendent of the Cable Company, while Dr. Lemon, General Manager of the New Zealand Telegraphs, and the various officers of his department, cordially co-operated in this colony. The electrical instruments in Mount Cook Observatory were placed in charge of Mr. John Gell (of the New Zealand Telegraph Department), whose willing assistance contributed materially to the success of our operations.

In conclusion, I wish to express my acknowledgments to Mr. Arthur Beverly, of Dunedin, who has kindly given the benefit of his valuable services. He has taken a lively interest in the work from its commencement, and I am indebted to him for many useful suggestions. Table 5, giving errors and rates by curves, is due to him alone, besides which he has kindly revised the whole of the reductions. I therefore consider that the final result will carry greater weight by having the stamp of his approval.

I have, &c.,

C. W. Adams,

Geodesical Surveyor.

J. McKerrow, Esq., Surveyor-General.

LIST OF OBSERVATIONS TAKEN AT MOUNT COOK OBSERVATORY, WELLINGTON, NEW ZEALAND.

—		Clamp.	N. or S.
MONDAY, 3RD DECEMBER, 1883.			
α Andromedæ	... ...	E.	N.
Level	... ...	E.	...
β Cham.	... ... *S.P.*	E. W.	S.
β Hydri	... ...	W. E.	S.
Level	... ...	E.	...
Level	... ...	E.	...
δ Piscium	... ...	E.	N.
ϵ Piscium	... ...	E.	N.
β Andromedæ	... ...	W.	N.
Level	... ...	W.	...
θ Ceti	... ...	W.	N.
η Piscium	... ...	W.	N.
Level	... ...	W.	...
α Eridani (Achernar)	...	W.	S.
Level	... ...	W.	...
β Arietis	... ...	W.	N.
β Centauri	... *S.P.*	W.	S.
Level	... ...	W.	...
WEDNESDAY, 5TH DECEMBER, 1883.			
β Hydri	... ...	W.	S.
ϵ Piscium	... ...	W.	N.
Level	... ...	W.	...
θ Ceti	... ...	W.	N.
η Piscium	... ...	W.	N.
Level	... ...	W.	...
α Eridani (Achernar)	...	W.	S.
ν Piscium	... ...	W.	N.
o Piscium	... ...	W.	N.
Level	... ...	E.	...
β Arietis	... ...	E.	N.
Level	... ...	E.	...
α Arietis	... ...	E.	N.
Level	... ...	E.	...
67 Ceti	... ...	E.	N.
Level	... ...	E.	...
ξ^2 Ceti	... ...	E.	N.
Level	... ...	E.	...
α^2 Centauri	... *S.P.*	E.	S.
γ^2 Ceti	... ...	E.	N.
Exchange of Time-signals with Sydney.			
β Orionis (Rigel)	... ...	E.	N.
Level	... ...	E.	...
β Tauri	... ...	E.	N.
δ Orionis	... ...	E.	N.
α Columbæ	... ...	E.	N.
κ Orionis	... ...	E.	N.
α Orionis	... ...	W.	N.
Level	... ...	W.	...
ν Orionis	... ...	W.	N.
Level	... ...	W.	...
η Geminorum	... ...	W.	N.
μ Geminorum	... ...	W.	N.
α Argûs (Canopus)	...	W.	S.
σ Octantis	... *S.P.*	W.	S.
Level	... ...	W.	...
SUNDAY, 9TH DECEMBER, 1883.			
β Hydri	... ...	W. E.	S.
Level	... ...	E.	...
β Ceti	... ...	E.	N.
Level	... ...	E.	...

—		Clamp.	N. or S.
SUNDAY, 9TH DECEMBER, 1883—*continued.*			
δ Piscium	... ...	E.	N.
ϵ Piscium	... ...	E.	N.
Level	... ...	E.	...
β Andromedæ	... ...	E.	N.
Level	... ...	W.	...
θ Ceti	... ...	W.	N.
Level	... ...	W.	...
η Piscium	... ...	W.	N.
Level	... ...	W.	...
α Eridani (Achernar)	...	W.	S.
β Arietis	... ...	W.	N.
Level	... ...	W.	...
β Centauri	... *S.P.*	W.	S.
α Arietis	... ...	W.	N.
67 Ceti	... ...	W.	N.
Level	... ...	E.	...
ξ^2 Ceti	... ...	E.	N.
Level	... ...	E.	...
α^2 Centauri	... *S.P.*	E.	S.
FRIDAY, 14TH DECEMBER, 1883.			
Level	... ...	E.	...
β Andromedæ	... ...	E.	N.
Level	... ...	E.	...
θ Ceti	... ...	E.	N.
η Piscium	... ...	E.	N.
Level	... ...	E.	...
α Eridani (Achernar)	...	E.	S.
ν Piscium	... ...	E.	N.
o Piscium	... ...	E.	N.
Level	... ...	E.	...
β Arietis	... ...	W.	N.
Level	... ...	W.	...
α Arietis	... ...	W.	N.
Level	... ...	W.	...
67 Ceti	... ...	W.	N.
Level	... ...	W.	...
ξ^2 Ceti	... ...	W.	N.
Level	... ...	W.	...
γ^2 Ceti	... ...	W.	N.
σ Arietis	... ...	W.	N.
Level	... ...	W.	...
α Ceti	... ...	W.	N.
δ Arietis	... ...	E.	N.
Level	... ...	E.	...
γ Hydri	... ...	E.	S.
A Tauri	... ...	E.	N.
Level	... ...	E.	...
SATURDAY, 15TH DECEMBER, 1883.			
Level	... ...	W.	...
ϵ Piscium	... ...	W.	N.
β Andromedæ	... ...	W.	N.
Level	... ...	W.	...
θ Ceti	... ...	W.	N.
Level	... ...	W.	...
η Piscium	... ...	W.	N.
α Eridani (Achernar)	...	W.	S.
o Piscium	... ...	W.	N.
Level	... ...	W.	...
Level	... ...	E.	...
β Arietis	... ...	E.	N.

LIST OF OBSERVATIONS TAKEN AT MOUNT COOK OBSERVATORY—*continued.*

—		Clamp.	N. or S.
SATURDAY, 15TH DECEMBER, 1883—*continued.*			
Level		E.	...
β Centauri ...	*S.P.*	E.	S.
α Arietis		E.	N.
Level		E.	...
67 Ceti		E.	N.
δ Hydri (9 Jahn)		E.	S.
ξ^2 Ceti		E.	N.
Level		W.	...
α^2 Centauri ...	*S.P.*	W.	S.
γ^2 Ceti		W.	N.
Level		W.	...
σ Arietis		E.	N.
Level		E.	...
ν Hydri (Gill's Cat. 1211 Stone)		E.	S.
α Ceti		E.	N.
Level		E.	...
δ Arietis		E.	N.
Level		E.	...
o Tauri		E.	N.
Level		E.	...
Exchange of Time-signals with Sydney.			
β Tauri		E.	N.
Level		E.	...
δ Orionis		E.	N.
ϵ Orionis		E.	N.
Time-signals, Extra Set.			
Level		E.	...
μ Geminorum		E.	N.
α Argûs (Canopus) ...		E.	S.
σ Octantis ...	*S.P.*	E. W.	S.
Level		E.	...
θ Canis Majoris		W.	N.
ϵ Canis Majoris		W.	N.
γ Canis Majoris		W.	N.
Level		W.	...
δ Geminorum		W.	N.
δ Volantis (23 Jahn) ...		W.	S.
β Canis Minoris		W.	N.
Level		W.	...
SUNDAY, 16TH DECEMBER, 1883.			
Level		E.	...
α Eridani (Achernar) ...		E.	S.
ν Piscium		E.	N.
o Piscium		E.	N.
Level		E.	...
Level		E.	...
β Arietis		E.	N.
Level		E.	...
β Centauri ...	*S.P.*	E.	S.
α Arietis		E.	N.
67 Ceti		E.	N.
Level		E.	...
δ Hydri (9 Jahn)		E. W.	S.
Level		W.	...
α^2 Centauri ...	*S.P.*	W.	S.
γ^2 Ceti		W.	N.
Level		W.	...
σ Arietis		W.	N.
ν Hydri (Gill's Cat. 1211 Stone)		W.	S.
α Ceti		W.	N.
Level		W.	...
δ Arietis		W.	N.
Exchange of Time-signals with Sydney.			
Level		W.	...
η Tauri		W.	N.
Exchange of Time-signals with Sydney.			

—		Clamp.	N. or S.
SUNDAY, 16TH DECEMBER, 1883—*continued.*			
γ Apodis (Gill's Cat. 8896 Stone) ...	*S.P.*	W.	S.
Level		W.	...
α Tauri (Aldebaran) ...		W.	N.
α Triang. Aust. ...	*S.P.*	W.	S.
Level		W.	...
μ Eridani		W.	N.
ι Aurigæ		W.	N.
Level		W.	...
ϵ Leporis		W.	N.
β Orionis (Rigel) ...		W.	N.
Level		W.	...
Level		E.	...
MONDAY, 17TH DECEMBER, 1883.			
θ Ceti		E.	N.
Level		E.	...
η Piscium		E.	N.
α Eridani (Achernar) ...		E.	S.
ν Piscium		E.	N.
o Piscium		E.	N.
Level		E.	...
β Arietis		W.	N.
Level		W.	...
β Centauri ...	*S.P.*	W.	S.
Level		W.	...
α Arietis		W.	N.
Level		W.	...
67 Ceti		W.	N.
δ Hydri (9 Jahn)		W.	S.
α^2 Centauri ...	*S.P.*	W.	S.
Level		W.	...
γ^2 Ceti		W.	N.
Level		W.	...
TUESDAY, 18TH DECEMBER, 1883.			
Level		E.	...
η Piscium		E.	N.
α Eridani (Achernar) ...		E.	S.
ν Piscium		E.	N.
o Piscium		E.	N.
Level		E.	...
β Arietis		E.	N.
Level		E.	...
β Centauri ...	*S.P.*	E.	S.
α Arietis		E.	N.
Level		E.	...
67 Ceti		W.	N.
δ Hydri (9 Jahn)		W.	S.
Level		W.	...
γ^2 Ceti		W.	N.
Level		W.	...
σ Arietis		W.	N.
ν Hydri (Gill's Cat. 1211 Stone)		W.	S.
α Ceti		W.	N.
δ Arietis		W.	N.
Level		W.	...
ρ Octantis ...	*S.P.*	W. E.	S.
Level		W.	...
Level		E.	...
ϵ Eridani		E.	N.
Exchange of Time-signals with Sydney.			
Level		E.	...
β Orionis (Rigel)		E.	N.
β Tauri		E.	N.
Level		E.	...

LIST OF OBSERVATIONS TAKEN AT MOUNT COOK OBSERVATORY—*continued.*

—	Clamp.	N. or S.
TUESDAY, 18TH DECEMBER, 1883—*continued.*		
δ Orionis	E.	N.
Level	E.	...
α Orionis	E.	N.
Level	W.	...
FRIDAY, 11TH JANUARY, 1884.		
Level	W.	...
α Ceti	W.	N.
δ Arietis	W.	N.
Level	W.	...
ρ Octantis ... *S.P.*	W. E.	S.

—	Clamp.	N. or S.
FRIDAY, 11TH JANUARY, 1884—*continued.*		
Level	E.	...
ε Eridani	E.	N.
Level	E.	...
η Tauri	E.	N.
γ Hydri	E.	S.
γ^1 Eridani	E.	N.
A Tauri	E.	N.
Level	E.	...
o^1 Eridani	W.	N.
γ Tauri	W.	N.
Level	W.	...

TABLE 1.

ERROR OF COLLIMATION OF THE TRANSIT INSTRUMENT AT MOUNT COOK OBSERVATORY, WELLINGTON, NEW ZEALAND.

NOTE.—The sign is considered positive when it implies an additive correction to the time of observed transits of stars above the pole with the clamp west.

Date.	Stars.	For Clamp W.	For Clamp W. By Mer. Mark.
1883.		″	″
Nov. 11 ...	β Chamæleontis ... ... *S.P.*	+3·68	
,, 11 ...	β Hydri	+4·21	
,, 22 ...	β Hydri	+2·80	
,, 27 ...	β Chamæleontis ... ... *S.P.*	+6·31	
,, 27 ...	β Hydri	+5·18	
,, 28 ...	β Chamæleontis ... ... *S.P.*	+6·49	
,, 28 ...	β Hydri	+5·12	
,, 29 ...	β Chamæleontis ... ... *S.P.*	+7·61	
,, 29 ...	β Hydri	+3·35	
Dec. 3 ...	β Chamæleontis ... ... *S.P.*	+4·07	
,, 3 ...	β Hydri	+6·19	
,, 4 ...	β Chamæleontis ... ... *S.P.*	+5·48	
,, 4 ...	β Hydri	+5·90	
,, 8 ...	... ...	...	+6·44
,, 9 ...	β Hydri	+3·77	
,, 15 ...	σ Octantis ... ... *S.P.*	+5·69	
,, 16 ...	δ Hydri (9 Jahn)	+4·25	+6·25
,, 17 ...	... ...	...	+5·96
,, 18 ...	ρ Octantis (Gill's Catalogue 8363 Stone) ...	+5·22	+5·93
,, 19 ...	...	...	+5·63
,, 19 ...	...	...	+6·06
		17)85·32	6)36·27
	Means=	+5·02	+6·04

TABLE 2.

LEVEL ERROR OF THE TRANSIT INSTRUMENT AT MOUNT COOK OBSERVATORY, WELLINGTON, NEW ZEALAND.

NOTE.—The sign + indicates that the West Pivot is high.

Date.	Sid. Time of Level Determination.	Clamp.	Level Error corrected for Inequality of Pivots.
1883.	H. M.		"
Dec. 3 ...	0 05	E.	+ 3·66
" 3 ...	0 25	E.	+ 1·17
" 3 ...	0 50	E.	+ 1·36
	80		6·19
Mean =	0 27	E.	+ 2·06
Dec. 3 ...	1 10	W.	+ 2·64
" 3 ...	1 30	W.	+ 2·37
" 3 ...	1 45	W.	+ 2·26
" 3 ...	1 55	W.	+ 1·04
	1 40		8·31
Mean =	1 35	W.	+ 2·08
Dec. 5 ...	1 10	W.	+ 3·57
" 5 ...	1 30	W.	+ 3·47
	40		1·04
Mean =	1 20	W.	+ 3·52
Dec. 5 ...	1 45	E.	+ 2·83
" 5 ...	1 55	E.	+ 2·51
" 5 ...	2 05	E.	+ 2·80
" 5 ...	2 15	E.	+ 2·99
" 5 ...	2 25	E.	+ 3·09
" 5 ...	5 15	E.	+ 2·93
	15 40		17·15
Mean =	2 37	E.	+ 2·86
Dec. 5 ...	5 50	W.	+ 2·32
" 5 ...	6 05	W.	+ 2·26
" 5 ...	6 45	W.	+ 1·52
	40		6·10
Mean =	6 13	W.	+ 2·03
Dec. 9 ...	0 25	E.	+ 3·95
" 9 ...	0 40	E.	+ 3·95
" 9 ...	1 00	E.	+ 3·73
	2 05		See below.
Mean =	0 42	E.	+ 3·91
Dec. 9 ...	1 15	W.	+ 3·47
" 9 ...	1 24	W.	+ 3·12
" 9 ...	1 40	W.	+ 4·15
" 9 ...	1 50	W.	+ 3·57
	1 29		14·31
Mean =	1 32	W.	+ 3·58

Date.	Sid. Time of Level Determination.	Clamp.	Level Error corrected for Inequality of Pivots.
1883.	H. M.		"
Dec. 9 ...	2 15	E.	+ 4·08
" 9 ...	2 30	E.	+ 3·82
	45		19·53
Mean =	2 22	E.	+ 3·91
Dec. 14 ...	0 55	E.	+ 4·37
" 14 ...	1 10	E.	+ 3·37
" 14 ...	1 30	E.	+ 3·02
" 14 ...	1 45	E.	+ 3·57
	5 20		14·33
Mean =	1 20	E.	+ 3·58
Dec. 14 ...	1 50	W.	+ 3·31
" 14 ...	2 05	W.	+ 2·99
" 14 ...	2 15	W.	+ 3·09
" 14 ...	2 30	W.	+ 2·19
" 14 ...	2 45	W.	+ 1·91
	11 25		13·49
Mean =	2 17	W.	+ 2·70
Dec. 14 ...	3 10	E.	+ 2·35
" 14 ...	4 05	E.	+ 2·51
	7 15		·86
Mean =	3 38	E.	+ 2·43
Dec. 15 ...	0 50	W.	+ 3·22
" 15 ...	1 05	W.	+ 2·87
" 15 ...	1 30	W.	+ 2·32
" 15 ...	1 40	W.	+ 1·55
	5 05		9·96
Mean =	1 16	W.	+ 2·49
Dec. 15 ...	1 45	E.	+ 2·00
" 15 ...	1 50	E.	+ 1·74
" 15 ...	2 05	E.	+ 2·41
	5 40		6·15
Mean =	1 53	E.	+ 2·05
Dec. 15 ...	2 28	W.	+ 2·64
" 15 ...	2 40	W.	+ 3·44
	68		6·08
Mean =	2 34	W.	+ 3·04

TABLE 2.—LEVEL ERROR OF THE TRANSIT INSTRUMENT, MOUNT COOK OBSERVATORY—*continued.*

Date.	Sid. Time of Level Determination.	Clamp.	Level Error corrected for Inequality of Pivots.
1883.	H. M.		"
Dec. 15 ...	2 45	E.	+ 3·66
" 15 ...	3 00	E.	+ 4·27
" 15 ...	3 10	E.	+ 4·21
" 15 ...	3 25	E.	+ 4·56
	20		·70
Mean =	3 05	E.	+ 4·18
Dec. 15 ...	5 27	E.	+ 3·15
" 15 ...	6 12	E.	+ 2·64
" 15 ...	6 45	E.	+ 1·01
	57		3·65
Mean =	6 28	E.	+ 1·82
Dec. 15 ...	7 05	W.	+ 1·97
" 15 ...	7 25	W.	+ 1·71
	30		3·68
Mean =	7 15	W.	+ 1·84
Dec. 16 ...	1 30	E.	+ 1·65
" 16 ...	1 40	E.	+ 1·42
" 16 ...	1 45	E.	+ 1·87
" 16 ...	1 58	E.	+ 1·71
" 16 ...	2 15	E.	+ 3·15
	9 08		9·80
Mean =	1 50	E.	+ 1·96
Dec. 16 ...	2 25	W.	+ 1·62
" 16 ...	2 40	W.	+ 1·55
" 16 ...	3 00	W.	+ 2·10
" 16 ...	3 35	W.	+ ·95
" 16 ...	4 25	W.	+ 2·42
" 16 ...	4 45	W.	+ 3·35
" 16 ...	4 55	W.	+ 2·96
" 16 ...	5 25	W.	+ 2·64
	31 10		17·59
Mean =	3 54	W.	+ 2·20
Dec. 16 ...	5 55	E.	+ 2·54
Dec. 17 ...	1 20	E.	+ 3·25
" 17 ...	1 45	E.	+ 1·87
	65		5·12
Mean =	1 32	E.	+ 2·56

Date.	Sid. Time of Level Determination.	Clamp.	Level Error corrected for Inequality of Pivots.
1883.	H. M.		"
Dec. 17 ...	1 50	W.	+ 0·75
" 17 ...	1 58	W.	+ 1·78
" 17 ...	2 05	W.	+ 1·04
" 17 ...	2 35	W.	+ 1·17
" 17 ...	2 40	W.	+ 1·36
	11 08		6·10
Mean =	2 14	W.	+ 1·22
Dec. 18 ...	1 20	E.	+ 1·33
" 18 ...	1 45	E.	+ 2·16
" 18 ...	1 50	E.	+ 1·45
" 18 ...	2 05	E.	+ 2·06
	7 00		7·00
Mean =	1 45	E.	+ 1·75
Dec. 18 ...	2 25	W.	+ 2·07
" 18 ...	2 40	W.	+ 2·26
" 18 ...	3 08	W.	+ 2·10
" 18 ...	3 12	W.	+ 1·68
	11 25		8·11
Mean =	2 51	W.	+ 2·03
Dec. 18 ...	3 20	E.	+ 1·55
" 18 ...	5 05	E.	+ 1·52
" 18 ...	5 25	E.	+ 2·32
" 18 ...	5 40	E.	+ 2·03
	19 30		7·42
Mean =	4 52	E.	+ 1·86
Dec. 18 ...	5 55	W.	+ 2·19
1884.			
Jan. 11 ...	2 55	W.	+ 2·00
" 11 ...	3 12	W.	+ 1·33
	6 07		3·33
Mean =	3 04	W.	+ 1·66
Jan. 11 ...	3 20	E.	+ 1·07
" 11 ...	3 35	E.	+ 1·49
" 11 ...	4 00	E.	+ 2·29
	10 55		4·85
Mean ...	3 38	E.	+ 1·62
Jan. 11 ...	4 15	W.	+ 2·58

TABLE 2.—LEVEL ERROR OF THE TRANSIT INSTRUMENT, MOUNT COOK OBSERVATORY—*continued.*

TABLE OF MEANS.

NOTE.—These mean values were used in reducing the observations.

Date.	Sid. Time of Level Determination.	Clamp.	Level Error corrected for Inequality of Pivots.	Date.	Sid. Time of Level Determination.	Clamp.	Level Error corrected for Inequality of Pivots.
1883.	H. M.		″	1883.	H. M.		″
Dec. 3 ...	0 27	E.	+ 2·06	Dec. 15 ...	5 27	E.	+ 3·15
″ 3 ...	1 35	W.	+ 2·08	″ 15 ...	6 28	E.	+ 1·82
″ 5 ...	1 20	W.	+ 3·52	″ 15 ...	7 15	W.	+ 1·84
″ 5 ...	2 37	E.	+ 2·86	″ 16 ...	1 50	E.	+ 1·96
″ 5 ...	6 13	W.	+ 2·03	″ 16 ...	3 54	W.	+ 2·20
″ 9 ...	0 42	E.	+ 3·91	″ 17 ...	1 32	E.	+ 2·56
″ 9 ...	1 32	W.	+ 3·58	″ 17 ...	2 14	W.	+ 1·22
″ 9 ...	2 22	E.	+ 3·91	″ 18 ...	1 45	E.	+ 1·75
″ 14 ...	1 20	E.	+ 3·58	″ 18 ...	2 51	W.	+ 2·03
″ 14 ...	2 17	W.	+ 2·70	″ 18 ...	4 52	E.	+ 1·86
″ 14 ...	3 38	E.	+ 2·43	1884.			
″ 15 ...	1 16	W.	+ 2·49	Jan. 11 ...	3 04	W.	+ 1·66
″ 15 ...	1 53	E.	+ 2·05	″ 11 ...	3 38	E.	+ 1·62
″ 15 ...	2 34	W.	+ 3·04	″ 11 ...	4 15	W.	+ 2·58
″ 15 ...	3 05	E.	+ 4·18				

TABLE 3.

AZIMUTH ERROR OF THE TRANSIT INSTRUMENT AT MOUNT COOK OBSERVATORY, WELLINGTON, NEW ZEALAND.

NOTE.—The sign + signifies that the optic axis points E. of N.

Date.	Sid. Time of Obs.	Stars observed (and Number of Wires).	Clamp.	Apparent Error of Azimuth.	Remarks.
1883.	H. M.				
Dec. 3	0 15	β Cham. *S.P.* (7) and β Hydri (8) ...	E. W. W. E.	+ ·68	
″ 3	1 10	β Andromedæ (7) and θ Ceti	W.	+ 5·81	
″ 3	1 29	η Piscium and α Eridani (Achernar) ...	W.	− ·75	
″ 3	1 52	β Arietis and β Centauri *S.P.* (3) ...	W.	− 2·21	
		Least Squares	...	+ ·56	Adopted.
″ 4	0 15	β Cham. *S.P.* (8) and β Hydri (8) ...	W. E. E. W.	+ 1·34	Adopted.
″ 5	0 38	β Hydri (1) and ϵ Piscium (7)	W.	− ·33	
″ 5	1 29	η Piscium and α Eridani (Achernar) (8) ...	W.	+ 2·47	
″ 5	1 36	α Eridani (Achernar) (8) and o Piscium ...	W.	+ ·68	
″ 5	2 06	α Arietis (8) and 67 Ceti (4)	E.	+ 1·85	
″ 5	5 14	β Orionis (Rigel) and β Tauri	E.	+ 3·43	
″ 5	6 15	η Geminorum and α Argûs (Canopus) (8)...	W.	− 2·09	
″ 5	6 23	μ Geminorum (5) and σ Octantis *S.P.* (7)	W.	− ·57	
		Least Squares	...	− ·36	Adopted.
″ 9	0 29	β Hydri (8) and β Ceti	W. E. E.	− ·32	
″ 9	1 29	η Piscium and α Eridani (Achernar) ...	W.	+ ·97	
″ 9	1 52	β Arietis and β Centauri *S.P.*	W.	+ 4·26	
″ 9	1 58	β Centauri *S.P.* and α Arietis	W.	+ 2·62	
		Least Squares		− ·03	Adopted.
″ 14	1 10	β Andromedæ (7) and θ Ceti	E.	+ 3·26	
″ 14	1 29	η Piscium and α Eridani (Achernar) (8) ...	E.	+ ·22	
″ 14	1 34	α Eridani (Achernar) (8) and ν Piscium (8)	E.	+ ·48	
″ 14	3 27	δ Arietis and γ Hydri	E.	+ 4·02	
″ 14	3 53	γ Hydri and A Tauri	E.	+ 3·71	
		Least Squares	...	+ 2·87	Adopted.

TABLE 3.—AZIMUTH ERROR OF THE TRANSIT INSTRUMENT, MOUNT COOK OBSERVATORY—*contd.*

Date.	Sid. Time of Obs.		Stars observed (and Number of Wires).	Clamp.	Apparent Error of Azimuth.	Remarks.
1883.	H.	M.			"	
Dec. 15	1	10	β Andromedæ and θ Ceti	W.	+ 5·81	
" 15	1	29	η Piscium and α Eridani (Achernar) ...	W.	+ 7·42	
" 15	1	36	α Eridani (Achernar) and o Piscium ...	W.	+ 5·80	
" 15	1	58	β Centauri *S.P.* and α Arietis (7) ...	E.	+ 5·54	
" 15	2	15	67 Ceti and δ Hydri (9 Jahn) (7) ...	E.	+ 2·48	
" 15	2	21	δ Hydri (9 Jahn) (7) and ξ^2 Ceti ...	E.	+ 3·12	
" 15	2	48	σ Arietis (6) and ν Hydri (Gill) ...	E.	+ 4·01	
" 15	2	53	ν Hydri (Gill) and α Ceti	E.	+ 4·75	
" 15	6	18	μ Geminorum and α Argûs (Canopus) (7)	E.	+ 8·26	
" 15	6	42	σ Octantis *S.P.* (7) and ϵ Canis Majoris ...	E. W. W.	+ 3·22	
" 15	7	15	δ Geminorum and δ Volantis (23 Jahn) ...	W.	+ 4·01	
" 15	7	19	δ Volantis (23 Jahn) and β Canis Minoris	W.	+ 2·77	
			Least Squares	...	+ 3·45	Adopted.
" 16	1	34	α Eridani (Achernar) (7) and ν Piscium ...	E.	+ 4·64	
" 16	1	36	α Eridani (Achernar) (7) and o Piscium ...	E.	+ 6·70	
" 16	1	52	β Arietis and β Centauri *S.P.* (6) ...	E.	− 1·03	
" 16	1	58	β Centauri *S.P.* (6) and α Arietis (8) ...	E.	+ 1·23	
" 16	2	15	67 Ceti and δ Hydri (8)	E. E. W.	+ ·56	
" 16	2	28	δ Hydri (8) and γ^2 Ceti	E. W. W.	+ ·15	
" 16	2	48	σ Arietis (8) and ν Hydri	W.	+ 1·93	
" 16	2	54	ν Hydri and α Ceti	W.	+ 1·11	
" 16	4	22	γ Apodis (Gill) *S.P.* (4) and α Tauri ...	W.	+ 2·67	
" 16	4	38	α Triang. Aust. *S.P.* (8) and μ Eridani ...	W.	− ·15	
" 16	4	54	ι Aurigæ (7) and ϵ Leporis (8)	W.	− ·37	
			Least Squares	...	+ 1·96	Adopted.
" 17	1	29	η Piscium and α Eridani (Achernar) (7) ...	E.	+ 3·33	
" 17	1	34	α Eridani (Achernar) (7) and ν Piscium ...	E.	+ 1·78	
" 17	1	52	β Arietis (8) and β Centauri *S.P.* ...	W.	− 1·76	
" 17	1	58	β Centauri *S.P.* and α Arietis (8) ...	W.	− 1·08	
" 17	2	15	67 Ceti and δ Hydri (9 Jahn)	W.	− 2·00	
" 17	2	28	δ Hydri (9 Jahn) and γ^2 Ceti	W.	− 2·76	
			Least Squares	...	− ·64	Adopted.
" 18	1	29	η Piscium and α Eridani (Achernar) ...	E.	+ 2·90	
" 18	1	36	α Eridani (Achernar) and o Piscium ...	E.	+ 2·27	
" 18	1	52	β Arietis (7) and β Centauri *S.P.* ...	E.	− 1·18	
" 18	1	58	β Centauri *S.P.* and α Arietis	E.	0·00	
" 18	2	16	67 Ceti and δ Hydri (9 Jahn) (8) ...	W.	− 4·16	
" 18	2	28	δ Hydri (9 Jahn) (8) and γ^2 Ceti ...	W.	− 4·78	
" 18	2	48	σ Arietis and ν Hydri (Gill) (8) ...	W.	− ·63	
" 18	2	54	ν Hydri (Gill) (8) and α Ceti	W.	− 1·26	
" 18	3	11	δ Arietis and ρ Octantis *S.P.* (Gill) (8) ...	W. W. E.	+ ·41	
" 18	3	22	ρ Octantis *S.P.* (8) and ϵ Eridani ...	W. E. E.	+ ·33	
" 18	5	14	β Orionis and β Tauri	E.	+ 2·57	
			Least Squares	...	− ·16	Adopted.
1884.						
Jan. 11	3	11	δ Arietis and ρ Octantis *S.P.*	W. W. E.	+ 5·00	
" 11	3	22	ρ Octantis *S.P.* and ϵ Eridani	W. E. E.	+ 5·06	
" 11	3	45	η Tauri and γ Hydri (8)	E.	+ 6·47	
" 11	3	53	γ Hydri and Λ Tauri	E.	+ 5·64	
			Least squares		+ 5·31	Adopted.

TABLE 4.

MERIDIONAL TRANSITS OF STARS OBSERVED AT MOUNT COOK OBSERVATORY, WELLINGTON, NEW ZEALAND, AND INFERRED ERROR OF THE TRANSIT CLOCK.

Date.	Stars observed and (Number of Wires).	Clamp.	Clock Time of Transit over the Mean Wire.	Seconds of True Transit over the Meridian.	Seconds of Stars assumed apparent. R.A.	Clock apparently Slow.
1883.			H. M. S.	s.	s.	s.
Dec. 3	α Andromedæ	E.	0 02 21·58	21·25	24·56	3·31
" 3	β Chamæleontis (7) *S.P.*	E. W.	0 11 31·84	31·63	34·88	3·25
" 3	β Hydri (8)	W. E.	0 19 34·54	35·04	38·23	3·19
" 3	δ Piscium (8)	E.	0 42 37·50	37·24	40·66	3·42
" 3	ϵ Piscium	E.	0 56 53·11	52·85	56·45	3·60
" 3	β Andromedæ (7)	W.	1 03 11·82	12·31	15·88	3·57
" 3	θ Ceti	W.	1 18 10·66	11·15	14·48	3·33
" 3	η Piscium	W.	1 25 13·98	14·44	17·84	3·40
" 3	α Eridani (Achernar) ...	W.	1 33 20·16	21·03	24·55	3·52
" 3	β Arietis	W.	1 48 11·47	11·93	15·37	3·44
" 3	β Centauri (3) ... *S.P.*	W.	1 55 35·38	34·73	37·98	3·25
" 4	β Chamæleontis (8) *S.P.*	W. E.	0 11 31·17	31·32	35·00	3·68
" 4	β Hydri (8)	E. W.	0 19 34·30	34·47	38·14	3·67
" 5	β Hydri (1)	W.	0 19 31·84	34·30	38·05	3·75
" 5	ϵ Piscium (7)	W.	0 56 52·22	52·67	56·43	3·76
" 5	θ Ceti (8)	W.	1 18 10·28	10·78	14·46	3·68
" 5	η Piscium	W.	1 25 13·73	14·16	17·83	3·67
" 5	α Eridani (Achernar) (8) ...	W.	1 33 20·07	21·09	24·50	3·41
" 5	ν Piscium (5)	W.	1 35 20·92	21·37	24·32	3·45
" 5	o Piscium	W.	1 39 13·39	13·83	17·33	3·50
" 5	β Arietis	E.	1 48 11·67	11·38	15·36	3·98
" 5	α Arietis (8)	E.	2 00 36·23	35·93	39·61	3·68
" 5	67 Ceti (4)	E.	2 11 09·61	09·41	13·03	3·62
" 5	ξ^2 Ceti (2)	E.	2 21 57·53	57·29	00·88	3·59
" 5	α^2 Centauri (8) ... *S.P.*	E.	2 31 39·19	39·75	42·24	2·49
" 5	γ^2 Ceti	E.	2 37 15·27	15·04	18·75	3·71
" 5	Exchange of Time-signals with Sydney.					
" 5	β Orionis (Rigel)	E.	5 08 55·77	55·57	59·36	3·79
" 5	β Tauri	E.	5 18 55·89	55·54	59·47	3·93
" 5	δ Orionis	E.	5 26 02·84	02·61	06·41	3·80
" 5	α Columbæ	E.	5 35 25·09	24·91	28·64	3·73
" 5	κ Orionis	E.	5 42 13·31	13·12	16·86	3·74
" 5	α Orionis (7)	W.	5 48 50·64	51·02	55·10	4·08
" 5	ν Orionis	W.	6 00 54·36	54·74	58·58	3·84
" 5	η Geminorum	W.	6 07 50·06	50·43	54·21	3·78
" 5	μ Geminorum (5)	W.	6 15 53·73	54·10	58·25	4·15
" 5	α Argûs (Canopus) (8) ...	W.	6 21 20·17	20·91	24·84	3·93
" 5	σ Octantis (7) ... *S.P.*	W.	6 30 31·59	03·68	07·02	3·34
" 9	β Hydri (8)	W. E.	0 19 31·56	32·65	37·68	5·03
" 9	β Ceti	E.	0 37 41·62	41·61	46·58	4·97
" 9	δ Piscium (8)	E.	0 42 35·82	35·75	40·60	4·85
" 9	ϵ Piscium	E.	0 56 51·44	51·37	56·40	5·03
" 9	β Andromedæ	E.	1 03 10·89	10·67	15·82	5·15
" 9	θ Ceti	W.	1 18 09·06	09·47	14·43	4·96
" 9	η Piscium	W.	1 25 12·40	12·75	17·80	5·05
" 9	α Eridani (Achernar) ...	W.	1 33 18·62	19·44	24·40	4·96
" 9	β Arietis	W.	1 48 10·10	10·44	15·34	4·90
" 9	β Centauri ... *S.P.*	W.	1 55 33·54	33·04	38·23	5·19
" 9	α Arietis	W.	2 00 34·24	34·57	39·59	5·02
" 9	67 Ceti	W.	2 11 07·58	07·99	13·01	5·02
" 9	ξ^2 Ceti	E.	2 21 55·98	55·90	00·87	4·97
" 9	α^2 Centauri ... *S.P.*	E.	2 31 37·34	37·71	42·38	4·67
" 14	β Andromedæ (7) ...	E.	1 03 10·51	10·38	15·76	5·38
" 14	θ Ceti	E.	1 18 09·07	09·01	14·38	5·37
" 14	η Piscium	E.	1 25 12·46	12·39	17·75	5·36
" 14	α Eridani (Achernar) (8) ...	E.	1 33 19·00	18·66	24·26	5·60
" 14	ν Piscium (8)	E.	1 35 19·41	19·35	24·75	5·40
" 14	o Piscium	E.	1 39 11·91	11·85	17·27	5·42
" 14	β Arietis (8)	W.	1 48 09·19	09·80	15·30	5·50
" 14	α Arietis	W.	2 00 33·36	33·98	39·55	5·57

TABLE 4.—MERIDIONAL TRANSITS OF STARS OBSERVED AT MOUNT COOK OBSERVATORY—*contd.*

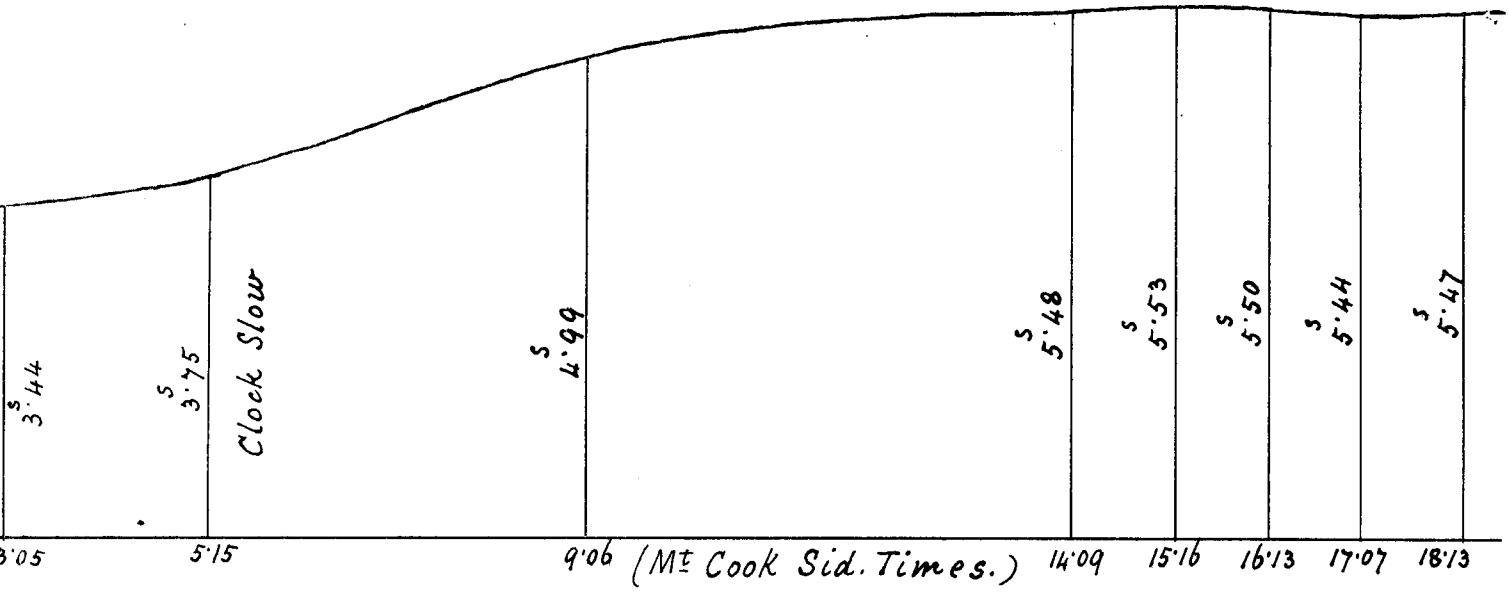
Date.	Stars observed and (Number of Wires).	Clamp.	Clock Time of Transit over the Mean Wire.	Seconds of True Transit over the Meridian.	Seconds of Stars assumed apparent. R.A.	Clock apparently Slow.
1883.			H. M. S.	S.	S.	S.
Dec. 14	67 Ceti	W.	2 11 06·93	07·51	12·97	5·46
" 14	ξ^2 Ceti	W.	2 21 54·79	55·38	00·85	5·47
" 14	γ^2 Ceti	W.	2 37 12·77	13·35	18·73	5·38
" 14	σ Arietis	W.	2 45 00·77	01·36	06·82	5·46
" 14	α Ceti	W.	2 56 08·29	08·88	14·36	5·48
" 14	δ Arietis	E.	3 04 55·89	55·77	01·47	5·70
" 14	γ Hydri	E.	3 49 02·00	00·76	06·24	5·48
" 14	A Tauri	E.	3 57 46·52	46·39	52·04	5·65
" 15	ϵ Piscium	W.	0 56 50·20	50·74	56·33	5·59
" 15	β Andromedæ	W.	1 03 09·53	10·17	15·74	5·57
" 15	θ Ceti	W.	1 18 08·37	08·89	14·36	5·47
" 15	η Piscium	W.	1 25 11·59	12·15	17·74	5·59
" 15	α Eridani (Achernar) ...	W.	1 33 18·33	19·01	24·23	5·22
" 15	o Piscium	W.	1 39 11·29	11·84	17·27	5·43
" 15	β Arietis	E.	1 48 09·76	09·72	15·29	5·57
" 15	β Centauri ... *S.P.*	E.	1 55 31·93	32·91	38·55	5·64
" 15	α Arietis (7)	E.	2 00 34·08	34·04	39·55	5·51
" 15	67 Ceti	E.	2 11 07·57	07·51	12·97	5·46
" 15	δ Hydri (9 Jahn) (7) ...	E.	2 19 37·98	37·19	42·77	5·58
" 15	ξ^2 Ceti	E.	2 21 55·34	55·31	00·84	5·53
" 15	α^2 Centauri ... *S.P.*	W.	2 31 38·29	38·14	42·66	4·52
" 15	γ^2 Ceti	W.	2 37 12·88	13·45	18·72	5·27
" 15	σ Arietis (6)	E.	2 45 01·44	01·49	06·82	5·33
" 15	ν Hydri (Gill's Cat. 1211 Stone)	E.	2 51 11·96	11·18	16·40	5·22
" 15	α Ceti	E.	2 56 08·82	08·89	14·36	5·47
" 15	δ Arietis (7)	E.	3 04 55·67	55·71	01·47	5·76
" 15	o Tauri	E.	3 18 30·27	30·33	35·89	5·56
" 15	Exchange of Time-signals with Sydney.					
" 15	β Tauri	E.	5 18 54·09	54·08	59·60	5·52
" 15	δ Orionis (5)	E.	5 26 01·04	01·05	06·53	5·48
" 15	ϵ Orionis (7)	E.	5 30 15·74	15·75	21·31	5·56
" 15	Exchange of Time-signals with Sydney.					
" 15	μ Geminorum	E.	6 15 52·76	52·72	58·44	5·72
" 15	α Argûs (Canopus) (7) ...	E.	6 21 20·06	19·69	24·99	5·30
" 15	σ Octantis (7) ... *S.P.*	E.W.	6 29 52·50	59·23	03·90	4·67
" 15	θ Canis Majoris	W.	6 48 43·59	44·07	49·69	5·62
" 15	ϵ Canis Majoris	W.	6 53 59·76	00·26	05·83	5·57
" 15	γ Canis Majoris	W.	6 58 26·24	26·73	32·36	5·63
" 15	δ Geminorum	W.	7 13 07·11	07·67	13·39	5.72
" 15	δ Volantis (23 Jahn) ...	W.	7 16 50·74	51·46	57·10	5·64
" 15	β Canis Minoris	W.	7 20 47·11	47·63	53·18	5·55
" 16	α Eridani (Achernar) (7) ...	E.	1 33 19·41	19·12	24·20	5·08
" 16	ν Piscium	E.	1 35 19·49	19·42	24·73	5·31
" 16	o Piscium	E.	1 39 11·83	11·76	17·26	5·50
" 16	β Arietis	E.	1 48 09·82	09·75	15·28	5·53
" 16	β Centauri (6) ... *S.P.*	E.	1 55 32·59	33·28	38·60	5·32
" 16	α Arietis (8)	E.	2 00 34·24	34·17	39·54	5·37
" 16	67 Ceti	E.	2 11 07·58	07·52	12·96	5·44
" 16	δ Hydri (9 Jahn) (8) ...	E. W.	2 19 36·91	37·10	42·72	5·62
" 16	α^2 Centauri ... *S.P.*	W.	2 31 38·27	38·04	42·71	4·67
" 16	γ^2 Ceti	W.	2 37 12·93	13·34	18·72	5·38
" 16	σ Arietis (8)	W.	2 45 00·89	01·29	06·81	5·52
" 16	ν Hydri (1211 Stone) ...	W.	2 51 09·79	10·82	16·34	5·52
" 16	α Ceti	W.	2 56 08·59	08·99	14·35	5·36
" 16	δ Arietis	W.	3 04 55·53	55·95	01·47	5·52
" 16	Exchange of Time-signals with Sydney.					
" 16	η Tauri	W.	3 40 31·30	31·73	37·24	5·51
" 16	Exchange of Time-signals with Sydney.					
" 16	γ Apodis (Gill's Cat.) (4) *S.P.*	W.	4 15 32·82	31·96	37·71	5·75
" 16	α Tauri (Aldeb.)	W.	4 29 11·71	12·11	17·70	5·59
" 16	α Tri. Aust. (8) ... *S.P.*	W.	4 36 16·27	15·89	21·21	5·32
" 16	μ Eridani	W.	4 39 37·82	38·22	43·82	5·60
" 16	ι Aurigae (7)	W.	4 49 22·45	22·90	28·50	5·60
" 16	ϵ Leporis (8)	W.	5 00 28·60	29·01	34·74	5·73

TABLE 4.—MERIDIONAL TRANSITS OF STARS OBSERVED AT MOUNT COOK OBSERVATORY—*contd.*

Date.	Stars observed and (Number of Wires).	Clamp.	Clock Time of Transit over the Mean Wire.	Seconds of True Transit over the Meridian.	Seconds of Stars assumed apparent. R.A.	Clock apparently Slow.
1883.			H. M. S.	S.	S.	S.
Dec. 16	β Orionis (Rigel)	W.	5 08 53·36	53·76	59·46	5·70
" 17	θ Ceti	E.	1 18 09·00	08·85	14·34	5·49
" 17	η Piscium	E.	1 25 12·40	12·17	17·72	5·55
" 17	α Eridani (Achernar) (7) ...	E.	1 33 19·18	18·99	24·17	5·18
" 17	ν Piscium	E.	1 35 19·53	19·34	24·72	5·38
" 17	o Piscium	E.	1 39 12·03	11·83	17·25	5·42
" 17	β Arietis (8)	W.	1 48 09·47	09·73	15·27	5·54
" 17	β Centauri ... *S.P.*	W.	1 55 33·78	33·19	38·65	5·46
" 17	α Arietis (8)	W.	2 00 33·78	34·04	39·53	5·49
" 17	67 Ceti	W.	2 11 07·22	07·51	12·95	5·44
" 17	δ Hydri (9 Jahn)	W.	2 19 36·12	37·07	42·68	5·61
" 17	α^2 Centauri ... *S.P.*	W.	2 31 38·87	38·27	42·75	4·48
" 17	γ^2 Ceti	W.	2 37 13·11	13·38	18·71	5·33
" 18	η Piscium	E.	1 25 12·51	12·30	17·71	5·41
" 18	α Eridani (Achernar) ...	E.	1 33 19·29	19·02	24·14	5·12
" 18	ν Piscium (3)	E.	1 35 19·60	19·40	24·72	5·32
" 18	o Piscium	E.	1 39 12·11	11·91	17·25	5·34
" 18	β Arietis (7)	E.	1 48 09·89	09·66	15·27	5·61
" 18	β Centauri ... *S.P.*	E.	1 55 32·72	33·16	38·70	5·54
" 18	α Arietis	E.	2 00 34·24	34·00	39·53	5·53
" 18	67 Ceti	W.	2 11 07·12	07·45	12·95	5·50
" 18	δ Hydri (9 Jahn) (8) ...	W.	2 19 35·64	36·64	42·64	6·00
" 18	γ^2 Ceti	W.	2 37 13·01	13·33	18·71	5·38
" 18	σ Arietis	W.	2 45 00·94	01·24	06·81	5·57
" 18	ν Hydri (Gill's Cat.) (8) ...	W.	2 51 09·16	10·55	16·22	5·67
" 18	α Ceti	W.	2 56 08·58	08·90	14·35	5·45
" 18	δ Arietis	W.	3 04 55·71	56·01	01·47	5·46
" 18	ρ Octantis (8363 Stone) (8) *S.P.*	W. E.	3 16 33·01	32·47	38·19	5·72
" 18	ϵ Eridani	E.	3 27 24·03	23·86	29·35	5·49
" 18	Exchange of Time-signals with Sydney.					
" 18	β Orionis (Rigel)	E.	5 08 54·16	53·98	59·47	5·49
" 18	β Tauri	E.	5 18 54·31	54·05	59·63	5·58
" 18	δ Orionis (4)	E.	5 26 01·24	01·05	06·56	5·51
" 18	α Orionis	E.	5 48 49·96	49·76	55·28	5·52
1884.						
Jan. 11	α Ceti	W.	2 56 08·21	08·76	14·16	5·40
" 11	δ Arietis	W.	3 04 55·11	55·73	01·28	5·55
" 11	ρ Octantis (8363 Stone) (8) *S.P.*	W. E.	3 16 35·19	37·69	43·09	5·40
" 11	ϵ Eridani	E.	3 27 23·64	23·65	29·17	5·52
" 11	η Tauri	E.	3 40 31·39	31·50	37·11	5·61
" 11	γ Hydri (8)	E.	3 49 00·58	59·21	04·58	5·37
" 11	γ^1 Eridani	E.	3 52 33·03	33·03	38·39	5·36
" 11	A Tauri	E.	3 57 46·47	46·58	52·02	5·44
" 11	o^1 Eridani	W.	4 06 07·62	08·18	13·64	5·46
" 11	γ Tauri	W.	4 13 07·13	07·76	13·28	5·52

Diagram for finding Clock Rates. (To face Table 5.)

Scale for Sidereal Times. – 24^h = Half an inch.
Scale for Clock Slow. – 1^s = Half an inch.



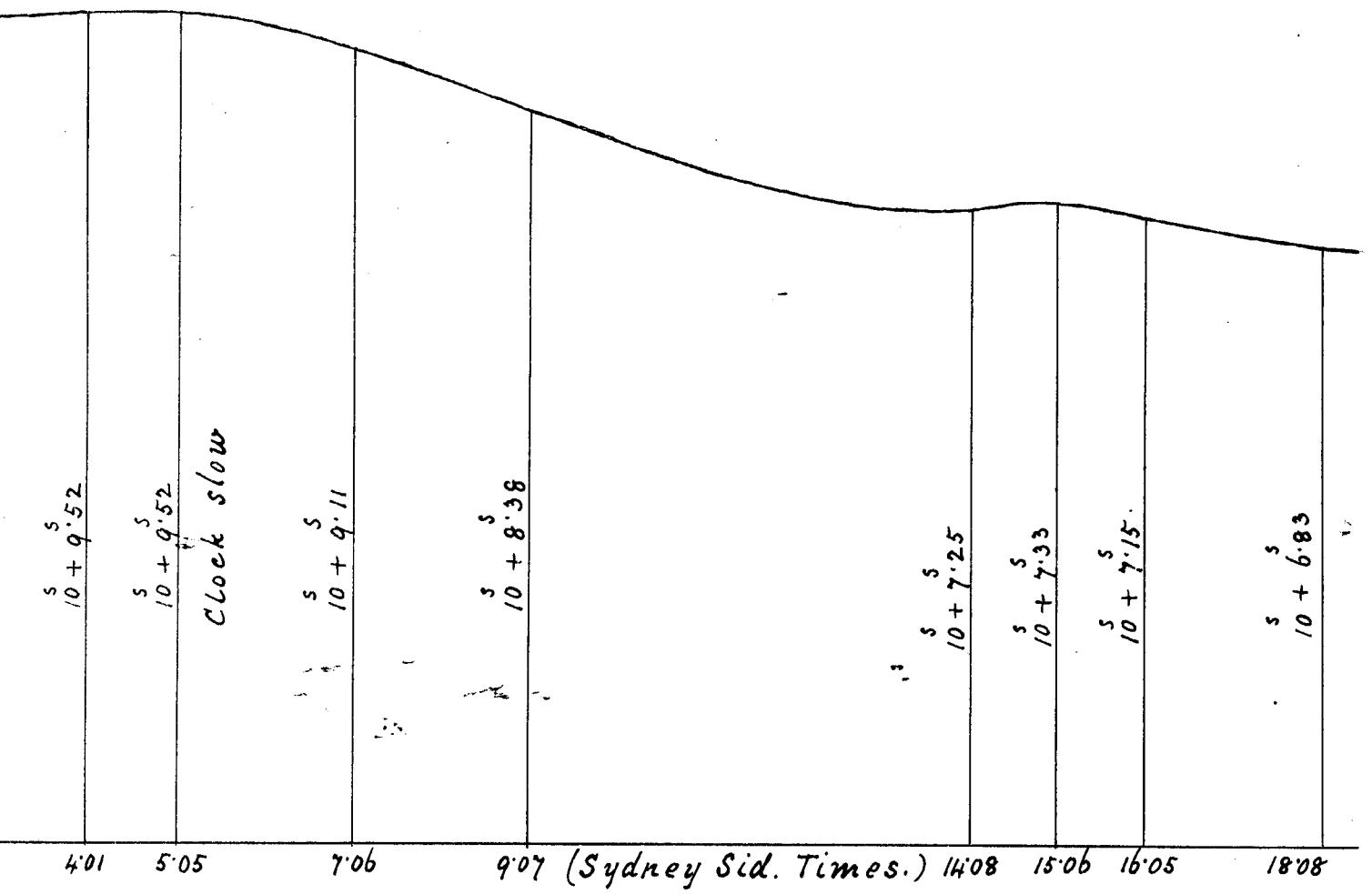


TABLE 5.

CLOCK ERRORS, AND RATES ON EXCHANGE DAYS, FROM CURVES.

MOUNT COOK, WELLINGTON.						SYDNEY.					
Date.	Number of Clock Stars observed.	Sid. Time.	Clock Slow.	Loses per Day.	Loses per Hour.	Date.	Number of Clock Stars observed.	Sid. Time.	Clock Slow.	Loses per Day.	Loses per Hour.
1883.		H. M.	S.	S.	S.	1883.		H. M.	S.	S.	S.
Dec. 3	8	1 06	3·442								
						Dec. 4	...	0 19	19·52		
„ 5	20	3 33	3·754	+·212	+·0088	„ 5	4	1 07	19·515	−·098	−·0041
						„ 7	8	1 33	19·106		
„ 9	11	1 27	4·989			„ 9	2	1 36	18·380		
„ 14	15	2 09	5·477			„ 14	11	1 54	17·250		
„ 15	25	3 48	5·528	+·007	+·0003	„ 15	9	1 23	17·329	−·038	−·0016
„ 16	16	3 08	5·496	−·048	−·0020	„ 16	7	1 11	17·150	−·212	−·0088
„ 17	9	1 48	5·437								
„ 18	16	3 03	5·466	+·027	+·0011	„ 18	11	1 54	16·834	−·096	−·0040
1884.											
Jan. 11	8	3 40	5·483								

CLOCK CORRECTIONS AT TIMES OF EXCHANGES, DEDUCED FROM THE ABOVE.

MOUNT COOK, WELLINGTON.			SYDNEY.		
Date.	Sidereal Time.	Clock Slow.	Date.	Sidereal Time.	Clock Slow.
1883.	H. M.	S.	1883.	H. M.	S.
December 5	4 00	3·758	December 5	2 26	19·510
„ 5	4 11	3·760	„ 5	2 36	19·509
„ 5	4 35	3·763	„ 5	3 00	19·507
„ 5	4 49	3·765	„ 5	3 14	19·506
„ 15	4 07	5·528	„ 15	2 32	17·327
„ 15	4 34	5·528	„ 15	3 00	17·326
„ 15	4 57	5·528	„ 15	3 23	17·326
„ 15	5 09	5·528	„ 15	3 34	17·326
„ 15	5 57	5·529	„ 15	4 23	17·324
„ 16	3 15	5·496	„ 16	1 41	17·146
„ 16	3 27	5·495	„ 16	1 53	17·144
„ 16	3 51	5·495	„ 16	2 17	17·140
„ 16	4 04	5·494	„ 16	2 29	17·139
„ 18	3 48	5·467	„ 18	2 14	16·833
„ 18	4 01	5·467	„ 18	2 26	16·832
„ 18	4 24	5·468	„ 18	2 50	16·830
„ 18	4 36	5·469	„ 18	3 01	16·830

PERSONAL EQUATIONS.

	S.
Lenehan observes after Adams	·07.
Russell records after signal	·341 each day.
Adams records after signal	·302 on 5th December.
„ „ „	·446 on other days.

TABLE 6.

THE following Time-signals were exchanged between Sydney Observatory, New South Wales, and Mount Cook Observatory, Wellington, New Zealand.

Sydney sending.	New Zealand receiving.	Difference.
5TH DECEMBER, 1883.		
H. M. S.	H. M. S.	H. M. S.
2 21 30·13	3 56 03·8	1 34 33·67
40·13	13·8	33·67
50·15	23·7	33·55
2 22 1·13	34·6	33·47
10·13	43·6	33·47
20·13	53·6	33·47
30·20	3 57 03·8	33·60
40·14	13·5	33·36
50·11	23·6	33·49
2 23 1·14	34·6	33·46
10·12	43·5	33·38
20·11	53·6	33·49
30·12	3 58 03·6	33·48
40·13	13·7	33·57
50·13	23·5	33·37
2 24 0·63	34·1	33·47
10·06	43·6	33·54
20·00	53·6	33·60
30·12	3 59 03·6	33·48
40·14	13·7	33·56
—	—	—
2 25 1·00	34·5	33·50
10·14	43·8	33·66
20·14	53·7	33·56
30·00	4 00 03·5	33·50
40·13	13·5	33·37
50·14	23·7	33·56
2 26 1·00	34·5	33·50
10·13	43·7	33·57
20·12	53·6	33·48
30·12	4 01 03·6	33·48
40·13	13·8	33·67
50·13	23·5	33·37
2 27 1·14	34·7	33·56
10·00	43·6	33·60
20·06	53·6	33·54
30·00	4 02 03·6	33·60
40·11	13·7	33·59
50·14	23·7	33·56
2 28 1·14	34·7	33·56
10·13	43·9	33·77
20·02	53·7	33·68
30·02	4 03 03·6	33·58
40·12	13·7	33·58
50·13	23·7	33·57
2 29 1·15	35·0	33·85

New Zealand sending.	Sydney receiving.	Difference.
5TH DECEMBER, 1883.		
H. M. S.	H. M. S.	H. M. S.
4 06 00·0	2 31 28·13	1 34 31·87
11·0	39·20	31·80
21·05	48·96	32·09
31·0	59·14	31·86
41·0	2 32 9·00	32·00
51·0	18·87	32·13
4 07 00·0	28·00	32·00
11·0	38·96	32·04
21·05	49·00	32·05
31·0	58·88	32·12
41·0	2 33 9·00	32·00
51·0	18·88	32·12
4 08 00·0	27·86	32·14
11·0	39·00	32·00
21·05	49·13	31·92
31·0	58·90	32·10
41·0	2 34 8·90	32·10
51·0	18·88	32·12
4 09 00·0	27·88	32·12
11·0	39·02	31·98
21·05	49·00	32·05
31·00	59·00	32·00
41·0	2 35 9·00	32·00
51·1	19·10	32·00
4 10 00·0	27·87	32·13
11·0	39·10	31·90
21·05	49·00	32·05
31·0	58·90	32·10
41·0	2 36 8·96	32·04
51·0	19·02	31·98
4 11 00·0	28·14	31·86
11·0	39·00	32·00
21·0	48·95	32·05
31·0	59·12	31·88
41·0	2 37 9·00	32·00
51·0	19·00	32·00
4 12 00·0	27·90	32·10
11·0	39·14	31·86
21·0	49·00	32·00
31·05	58·90	32·15
41·05	2 38 9·00	32·05
51·0	18·95	32·05
4 13 00·0	27·90	32·10
11·05	39·13	31·92
21·0	49·05	31·95
31·05	58·90	32·15
41·0	2 39 9·00	32·00
51·0	18·86	32·14
4 14 00·0	28·40	31·60
11·0	39·00	32·00
21·05	49·00	32·05
31·0	59·00	32·00
41·0	2 40 9·30	31·70
51·0	19·00	32·00
4 15 00·0	28·00	32·00

Sydney sending.	New Zealand receiving.	Difference.
5TH DECEMBER, 1883.		
H. M. S.	H. M. S.	H. M. S.
2 55 29·70	4 30 03·45	1 34 33·75
——	——	——
——	——	——
——	——	——
——	——	——
2 56 19·90	4 30 53·60	33·70
30·14	4 31 03·8	33·66
39·86	13·5	33·64
50·02	23·6	33·58
2 57 1·13	34·55	33·42
10·15	43·65	33·50
20·02	53·8	33·78
30·13	4 32 03·6	33·47
40·19	13·7	33·51
50·14	23·6	33·46
2 58 1·13	34·6	33·47
10·14	43·8	33·66
20·15	53·8	33·65
30·13	4 33 03·6	33·47
40·14	13·7	33·56
50·14	23·6	33·46
2 59 1·13	34·5	33·37
10·20	43·85	33·65
20·16	53·75	33·59
——	——	——
40·18	4 34 13·7	33·52
50·17	23·7	33·53
3 0 1·15	34·65	33·50
10·14	43·6	33·46
20·15	53·65	33·50
——	——	——
40·15	4 35 13·75	33·60
50·19	23·8	33·61
3 1 1·00	34·45	33·45
10·14	43·7	33·56
20·16	53·70	33·54
30·13	4 36 03·8	33·67
40·13	13·75	33·62
50·19	23·75	33·56
3 2 1·02	34·45	33·43
10·14	43·75	33·61
——	——	——
30·13	4 37 03·75	33·62
40·15	13·75	33·60
50·14	23·7	33·56
3 3 1·00	34·65	33·65
10·13	43·8	33·67
20·13	53·6	33·47
30·13	4 38 03·7	33·57
——	——	——
50·00	23·65	33·65
3 4 1·11	34·6	33·49

TABLE 6.—The following Time-signals were exchanged between Sydney Observatory and Mount Cook Observatory—*continued.*

New Zealand sending.	Sydney receiving.	Difference.	New Zealand sending.	Sydney receiving.	Difference.	Sydney sending.	New Zealand receiving.	Difference.
5TH DECEMBER, 1883.			15TH DECEMBER, 1883.			15TH DECEMBER, 1883.		
H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.
4 44 00·0	3 9 28·02	1 34 31·98				2 56 1·14	4 30 30·7	1 34 29·56
11·05	39·13	31·92	4 02 11·1	2 27 43·14	1 34 27·96	10·26	39·8	29·54
21·05	48·97	32·08	21·1	53.12	27·98	20·24	50·0	29·76
31·0	58·97	32·03	31·1	2 28 3·14	27·96	30·32	4 31 00·1	29·78
41·0	3 10 8·96	32·04	41·1	13·13	27·97	40·19	10·0	29·81
51·05	18·98	32·07	51·05	23·00	28·05	50·25	20·0	29·75
4 45 00·0	28·13	31·87	4 03 00·1	32·11	27·99	2 57 0·30	30·1	29·80
11·1	38·96	32·14	11·0	43·14	27·86	10·17	39·85	29·68
21·05	48·85	32·20	21·05	53·00	28·05	20·21	50·0	29·79
31·0	58·86	32·14	31·05	2 29 3·14	27·91	30·26	4 32 00·25	29·99
41·0	3 11 8·87	32·13	41·1	13·14	27·96	40·24	10·0	29·76
51·0	18·85	32·15	51·0	22·96	28·04	50·14	19·95	29·81
4 46 00·0	27·87	32·13	4 04 00·0	32·19	27·81	2 58 1·17	30·9	29·73
11·0	39·10	31·90	11·1	43·15	27·95	10·17	39·8	29·63
21·0	48·92	32·08	21·1	53·15	27·95	20·14	49·95	29·81
31·0	58·87	32·13	31·05	2 30 2·97	28·08	30·20	4 33 00·1	29·90
41·0	3 12 8·87	32·13	41·05	12·95	28·10	40·15	09·95	29·80
51·0	19·00	32·00	51·05	23·11	27·94	50·20	20·0	29·80
4 47 00·0	27·88	32·12	4 05 00·0	32·15	27·85	2 59 1·15	30·7	29·55
11·1	39·00	32·10	11·05	43·16	27·89	10·15	40·0	29·85
21·05	48·90	32·15	21·0	52·94	28·06	20·13	50·0	29·87
31·0	58·89	32·11	31·05	2 31 2·93	28·12	30·15	59·95	29·80
41·0	3 13 8·87	32·13	41·05	13·00	28·05	40·20	4 34 10·0	29·80
51·0	18·87	32·13	51·0	23·13	27·87	50·21	20·0	29·79
4 48 00·0	28·00	32·00	4 06 00·05	32·20	27·85	3 0 1·13	30·95	29·82
11·0	38·96	32·04	11·1	43·12	27·98	10·16	40·0	29·84
21·05	49·02	32·03	21·1	53·13	27·97	20·16	50·0	29·84
31·05	59·02	32·03	31·1	2 32 3·12	27·98	30·12	59·9	29·78
41·05	3 14 8·97	32·08	41·05	13·13	27·92	40·15	4 35 10·0	29·85
51·0	18·96	32·04	51·0	23·00	28·00	50·13	19·95	29·82
4 49 00·0	27·84	32·16	4 07 00·0	32·00	28·00	3 1 1·13	31·0	29·87
11·0	38·84	32·16	11·1	43·13	27·97	10·14	40·0	29·86
21·05	48·87	32·18	21·1	53·13	27·97	20·14	49·9	29·76
31·0	58·86	32·14	31·1	2 33 3·28	27·82	30·13	59·95	29·82
41·0	3 15 8·88	32·12	41·1	13·00	28·10	40·13	4 36 09·9	29·77
51·0	19·50	31·50	51·05	23·53	27·52	50·21	20·1	29·89
4 50 00·0	27·87	32·13	4 08 00·05	32·14	27·91	3 2 1·13	30·9	29·77
11·05	38·95	32·10	11·05	43·13	27·92	10·17	40·0	29·83
21·05	48·98	32·07	21·05	53·13	27·92	20·18	50·0	29·82
31·0	59·20	31·80	31·1	2 34 2·96	28·14	30·20	4 37 00·0	29·80
41·0	3 16 8·88	32·12	41·05	12·95	28·10	40·18	09·95	29·77
51·0	18·87	32·13	51·05	23·12	27·93	50·18	20·0	29·82
4 51 00·0	27·86	32·14	4 09 00·0	32·03	27·97	3 3 1·15	30·95	29·80
11·05	38·89	32·16	11·05	43·10	27·95			
21·05	49·00	32·05	21·1	53·00	28·10			
31·0	58·88	32·12	31·1	2 35 3·00	28·10			
41·0	3 17 9·13	31·87	41·1	13·13	27·97			
51·0	19·08	31·92	51·0	22·96	28·04			
4 52 00·0	27·94	32·06	4 10 00·0	32·40	27·60			
11·0	38·97	32·03	11·0	43·00	28·00			
21·1	49·00	32·10	21·1	53·14	27·96			
31·05	58·98	32·07	31·05	2 36 2·97	28·08			
41·05	3 18 9·00	32·05	41·05	12·98	28·07			
51·0	18·98	32·02	51·1	23·20	27·90			
4 53 00·0	28·01	31·99	4 11 00·05	32·02	28·03			

TABLE 6.—The following Time-signals were exchanged between Sydney Observatory and Mount Cook Observatory—*continued.*

Sydney sending.	New Zealand receiving.	Difference.	New Zealand sending.	Sydney receiving.	Difference.	Sydney sending.	New Zealand receiving.	Difference.
15TH DECEMBER, 1883.			15TH DECEMBER, 1883.			15TH DECEMBER, 1883.		
H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.
3 18 20·88	4 52 50·8	1 34 29·92	5 04 00·1	3 29 32·01	1 34 28·09	4 18 0·12	5 52 29·95	1 34 29·83
30·16	4 53 00·0	29·84	11·1	43·13	27·97	11·18	41·05	29·87
40·25	10·0	29·75	21·0	52·97	28·03	21·14	50·9	29·76
50·20	20·0	29·80	31·05	3 30 2·89	28·16	31·15	5 53 00·9	29·75
3 19 1·14	30·8	29·66	41·05	12·90	28·15	41·16	10·9	29·74
10·26	40·0	29·74	51·0	22·96	28·04	51·15	20·9	29·75
20·15	49·9	29·75	59·95	31·90	28·05	4 19 0·17	30·0	29·83
30·20	59·95	29·75	5 05 11·1	43·13	27·97	11·00	41·0	30·00
40·15	4 54 09·95	29·80	21·05	52·97	28·08	21·14	51·0	29·86
50·15	19·9	29·75	31·1	3 31 2·92	28·18	31·13	5 54 01·0	29·87
3 20 1·09	30·8	29·71	41·05	12·93	28·12	41·17	11·05	29·88
10·13	39·85	29·72	51·0	23·01	27·99	51·16	21·1	29·94
20·18	50·0	29·82	5 06 00·05	31·98	28·07	4 20 0·15	30·1	29·95
30·10	59·9	29·80	11·1	43·12	27·98	11·14	40·9	29·76
40·23	4 55 09·95	29·72	21·0	53·00	28·00	21·14	50·9	29·76
50·13	19·9	29·77	31·1	3 32 2·87	28·23	31·17	5 55 00·95	29·78
3 21 1·16	30·9	29·74	41·05	12·92	28·13	41·15	10·8	29·65
10·12	39·9	29·78	51·0	22·98	28·02	51·15	20·95	29·80
20·18	49·95	29·77	5 07 00·05	32·00	28·05	4 21 0·13	30·0	29·87
30·18	59·9	29·72	11·1	43·01	28·09	11·14	40·9	29·76
40·13	4 56 09·85	29·72	21·05	53·00	28·05	21·13	50·9	29·77
50·16	19·95	29·79	31·1	3 33 2·96	28·14	31·14	5 56 00·85	29·71
3 22 1·20	31·0	29·80	41·05	12·93	28·12	41·15	10·9	29·75
10·14	39·85	29·71	51·05	22·91	28·14	51·15	20·8	29·65
20·12	49·9	29·78	5 08 00·0	32·00	28·00	4 22 0·13	29·9	29·77
30·17	4 57 00·0	29·83	11·05	42·94	28·11	11·13	40·9	29·77
40·12	09·8	29·68	21·05	52·97	28·08	21·15	50·9	29·75
50·19	19·95	29·76	31·1	3 34 3·00	28·10	31·13	5 57 00·9	29·77
3 23 1·13	30·9	29·77	41·05	12·94	28·11	41·23	10·9	29·67
10·14	39·95	29·81	51·0	22·93	28·07	51·16	20·9	29·74
20·20	50·0	29·80	59·95	32·00	27·95	4 23 0·15	29·9	29·75
30·11	59·85	29·74	5 09 11·1	42·94	28·16	11·18	40·8	29·62
40·24	4 58 10·0	29·76	21·05	52·96	28·09	21·13	50·95	29·82
50·13	19·95	29·82	31·05	3 35 2·90	28·15	31·13	5 58 00·9	29·77
3 24 0·11	29·85	29·74	41·1	13·00	28·10	41·14	10·85	29·71
10·00	39·85	29·85	51·05	22·94	28·11	51·16	20·95	29·79
20·13	49·85	29·72	5 10 00·1	32·12	27·98	4 24 0·24	30·0	29·76
30·13	59·9	29·77	11·05	43·12	27·93	10·18	40·0	29·82
40·17	4 59 10·0	29·83	21·1	53·12	27·98	21·12	50·9	29·78
50·14	19·95	29·81	31·05	3 36 2·86	28·19	31·13	5 59 00·9	29·77
3 25 1·12	30·9	29·78	41·05	12·92	28·13	41·20	11·0	29·80
10·14	40·0	29·86	51·0	22·92	28·08	51·22	21·3	30·08
20·12	49·9	29·78	5 11 00·05	32·56	27·49	4 25 0·21	29·9	29·69
30·15	5 00 00·0	29·85	11·1	43·14	27·96	11·17	41·0	29·83
40·14	10·0	29·86	21·05	52·97	28·08	21·12	50·95	29·83
50·63	20·5	29·87	31·1	3 37 2·97	28·13	31·16	6 00 00·9	29·74
3 26 1·12	30·9	29·78	41·05	12·90	28·15	41·16	10·95	29·79
10·17	40·0	29·83	51·0	23·00	28·00	51·12	20·85	29·73
20·12	49·9	29·78	5 12 00·05	31·91	28·14	4 26 0·77	30·55	29·78
30·16	59·9	29·74	11·05	43·10	27·95	11·15	41·0	29·85
40·15	5 01 09·9	29·75	21·05	53·13	27·92	21·13	51·0	29·87
50·14	19·9	29·76	31·05	3 38 2·96	28·09	31·14	6 01 00·9	29·76
3 27 1.14	30·9	29·76	41·0	12·96	28·04	41·14	10·9	29·76
			51·0	22·94	28·06	51·20	21·05	29·85
			5 13 00·0	32·10	27·90	4 27 0·14	30·0	29·86

TABLE 6.—The following Time-signals were exchanged between Sydney Observatory and Mount Cook Observatory—*continued*.

Sydney sending.	New Zealand receiving.	Difference.	New Zealand sending.	Sydney receiving.	Difference.	Sydney sending.	New Zealand receiving.	Difference.
16TH DECEMBER, 1883.			16TH DECEMBER, 1883.			16TH DECEMBER, 1883.		
H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.
1 36 1·14	3 10 30·85	1 34 29·71	3 22 41·0	1 48 13·13	1 34 27·87	2 12 1·34	3 46 31·0	1 34 29·66
10·20	39·9	29·70	51·0	23·00	28·00	10·20	40·0	29·80
20·20	49·9	29·70	3 23 00·0	32·23	27·77	20·14	49·95	29·81
30·16	59·85	29·69	11·05	43·17	27·88	31·33	3 47 01·15	29·82
40·26	3 11 09·95	29·69	21·05	53·15	27·90	40·17	09·9	29·73
50·19	19·8	29·61	31·0	1 49 3·00	28·00	50·13	19·95	29·82
1 37 1·17	30·8	29·63	41·05	13·14	27·91	2 13 1·15	30·85	29·70
10·18	39·95	29·77	51·05	23·28	27·77	10·13	39·8	29·67
20·21	49·9	29·69	3 24 00·05	32·12	27·93	20·16	49·8	29·64
30·21	59·85	29·64	11·1	43·15	27·95	30·21	3 48 00·0	29·79
40·18	3 12 09·85	29·67	21·1	53·10	28·00	40·22	09·95	29·73
50·16	19·8	29·64	31·05	1 50 3·13	27·92	50·18	19.85	29·67
1 38 1·12	30·8	29·68	41·05	13·14	27·91	2 14 1·20	30·85	29·65
10·23	40·0	29·77	51·05	23·15	27·90	10·12	39·85	29·73
20·20	49·9	29·70	3 25 00·1	32·13	27·97	20·14	49·85	29·71
30·18	59·9	29·72	11·1	43·14	27·96	30·32	3 49 00·0	29·68
40·13	3 13 09·8	29·67	21·1	53·00	28·10	40·15	09·8	29·65
50·17	19·9	29·73	31·05	1 51 3·14	27·91	50·14	20·0	29·86
1 39 1·14	30·7	29·56	41·0	13·01	27·99	2 15 1·15	30·8	29·65
10·15	39·7	29·55	51·0	22·90	28·10	10·14	39·9	29·76
20·20	49·85	29·65	3 26 00·0	32·14	27·86	20·15	49·85	29·70
30·13	59·85	29·72	11·05	43·15	27·90	30·14	59·75	29·61
40·20	3 14 09·85	29·65	21·0	53·01	27·99	40·20	3 50 09·9	29·70
50·20	19·8	29·60	31·05	1 52 3·12	27·93	50·14	19·75	29·61
1 40 1·16	30·75	29·59	41·0	13·00	28·00	2 16 1·12	30·7	29·58
10·21	39·9	29·69	51·1	23·13	27·97	10·14	39·85	29·71
20·14	49·75	29·61	3 27 00·1	32·14	27·96	20·15	49·8	29·65
30·18	59·85	29·67	11·05	43·11	27·94	30·15	59·9	29·75
40·14	3 15 09·8	29·66	21·1	53·01	28·09	40·14	3 51 09·85	29·71
50·13	19·95	29·82	31·05	1 53 3·02	28·03	50·15	19·9	29·75
1 41 1·13	30·7	29·57	41·0	13·21	27·79	2 17 1·14	30·8	29·66
10·16	39·85	29·69	51·1	23·14	27·96	10·14	39·85	29·71
20·20	49·85	29·65	3 28 00·05	32·16	27·89	20·13	49·8	29·67
30·14	59·8	29·66	11·05	43·15	27·90	30·13	59·85	29·72
40·14	3 16 09·8	29·66	21·05	52·96	28·09	40·15	3 52 09·85	29·70
50·19	19·8	29·61	31·05	1 54 3·12	27·93	50·15	19·85	29·70
1 42 1·13	30·7	29·57	41·05	12·92	28·13	2 18 1·15	30·9	29·75
10·15	39·8	29·65	51·1	23·17	27·93	10·15	40·0	29·85
20·20	49·8	29·60	3 29 00·05	32·14	27·91	20·16	49·95	29·79
30·13	59·75	29·62	11·05	43·13	27·92	30·15	59·9	29·75
40·20	3 17 09·8	29·60	21·1	53·12	27·98	40·16	3 53 09·85	29·69
50·19	19·8	29·61	31·1	1 55 3·04	28·06	50·19	19·9	29·71
1 43 1·02	30·5	29·48	41·05	13·14	27·91	2 19 1·15	30·75	29·60
10·13	39·8	29·67	51·1	23·15	27·95	10·16	39·85	29·69
			3 30 00·1	31·93	28·17	20·17	49·9	29·73
30·13	59·75	29·62	11·1	43·18	27·92	30·14	59·8	29·66
40·15	3 18 09·95	29·80	21·1	53·15	27·95	40·19	3 54 09·9	29·71
50·13	19·9	29·77	31·05	1 56 3·00	28·05	50·17	19·75	29·58
1 44 1·00	30·8	29·80	41·0	13·00	28·00	2 20 1·14	30·7	29·56
10·16	39·9	29·74	51·05	23·14	27·91	10·14	39·9	29·76
20·13	49·9	29·77	3 31 00·1	32·15	27·95	20·15	49·9	29·75
30·14	59·9	29·76	11·05	43·17	27·88	30·15	59·8	29·65
40·17	3 19 09·9	29·73	21·05	53·16	27·89	40·15	3 55 09·8	29·65
50·15	19·9	29·75	31·1	1 57 3·13	27·97	50·14	19·8	29·66
1 45 1·15	30·85	29·70	41·0	13·12	27·88	2 21 1·12	30·8	29·68
			51·0	23·15	27·85			
			3 32 00·0	32·15	27·85			

TABLE 6.—The following Time-signals were exchanged between Sydney Observatory and Mount Cook Observatory—*continued.*

New Zealand sending.	Sydney receiving.	Difference.	Sydney sending.	New Zealand receiving.	Difference.	New Zealand sending.	Sydney receiving.	Difference.
16TH DECEMBER, 1883.			18TH DECEMBER, 1883.			18TH DECEMBER, 1883.		
H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.
3 59 00·1	2 24 32·13	1 34 27·97	2 9 0·70	3 43 30·3	1 34 29·60	3 56 00·5	2 21 32·44	1 34 27·61
11·0	43·12	27·88	10·30	39·6	29·30	11·05	43·58	27·47
21·0	53·00	28·00	20·12	49·4	29·28	21·05	53·49	27·56
31·05	2 25 3·10	27·95	30·20	59·5	29·30	31·05	2 22 3·50	27·55
41·0	13·14	27·86	40·19	3 44 09·6	29·41	41·05	13·51	27·54
51·05	22·96	28·09	50·19	19·45	29·26	51·05	23·53	27·52
4 00 01·1	33·14	27·96	2 10 1·13	30·4	29·27	3 57 00·0	32·44	27·56
11·05	43·12	27·93	10·16	39·55	29·39	11·0	43·50	27·50
21·1	53·13	27·97	20·20	49·5	29·30	21·05	53·50	27·55
31·05	2 26 2·98	28·07	30·20	59·5	29·30	31·05	2 23 3·47	27·58
41·0	13·15	27·85	40·18	3 45 09·45	29·27	41·05	13·50	27·55
51·0	22·95	28·05	50·14	19·35	29·21	51·0	23·21	27·79
4 01 00·05	32·14	27·91	2 11 1·13	30·4	29·27	3 58 00·05	32·54	27·51
11·05	43·15	27·90	10·13	39·3	29·17	11·00	43·48	27·52
21·0	52·94	28·06	20·14	49·25	29·11	21·0	53·39	27·61
31·0	2 27 2·90	28·10	30·18	59·25	29·07	31·05	2 24 3·38	27·67
41·0	13·00	28·00	40·20	3 46 09·35	29·15	41·05	13·38	27·67
51·0	23·00	28·00	50·13	19·1	28·97	51·05	23·46	27·59
4 02 00·05	32·17	27·88	2 12 1·12	30·4	29·28			
11·0	43·14	27·86	10·25	39·55	29·30	3 59 11.05	43·51	27·54
21·05	53·01	28·04	20·14	49·35	29·21	21·05	53·47	27·58
31·0	2 28 2·90	28·10	30·14	59·55	29·41	31·0	2 25 3·47	27·53
41·0	12·90	28·10	40·15	3 47 09·45	29·30	41·05	13·48	27·57
51·05	23·00	28·05	50·13	19·5	29·37	51·05	23·50	27·55
4 03 00·05	31·89	28·16	2 13 0·13	29·4	29·27	4 00 00·1	32·66	27·44
11·05	43·10	27·95	10·14	39·3	29·16	11·1	43·55	27·55
21·05	53·01	28·04	20·17	49·45	29·28	21·05	53·48	27·57
31·0	2 29 3·14	27·86	30·00	59·35	29·35	31·0	2 26 3·45	27·55
41·0	12·80	28·20	40·14	3 48 09·3	29·16	41·0	13·41	27·59
51·05	23·00	28·05	50·21	19·3	29·09	51·0	23·46	27·54
4 04 00·0	31·94	28·06	2 14 1·19	30·35	29·16	4 01 00·05	32·77	27·28
11·05	43·14	27·91	10·14	39·4	29·26	11·05	43·40	27·65
21·1	53·14	27·96	20·15	49·35	29·20	21·1	53·48	27·62
31·0	2 30 2·85	28·15	30·22	59·4	29·18	31·05	2 27 3·40	27·65
41·0	13·00	28·00	40·20	3 49 09·45	29·25	41·05	13·45	27·60
51·05	23·13	27·92	50·51	19·7	29·19	51·0	23·38	27·62
4 05 00·05	32·13	27·92	2 15 1·12	30·3	29·18	4 02 00·0	32·64	27·36
11·1	43·14	27·96	10·14	39·35	29·21	11·0	43·42	27·58
21·05	53·00	28·05	20·14	49·5	29·36	21·1	53·51	27·59
31·0	2 31 3·00	28·00	30·23	59·6	29·37	31·05	2 28 3·43	27·62
41·05	12·90	28·15	40·15	3 50 09·55	29·40	41·05	13·50	27·55
51·05	22·95	28·10	50·16	19·5	29·34	51·0	23·42	27·58
4 06 00·05	31·87	28·18	2 16 1·18	30·55	29·37	4 03 00.1	32·50	27·60
11·05	43·14	27·91	10·16	39·45	29·29	11·1	43·54	27·56
21·1	52·86	28·24	20·16	49·5	29·34	21·1	53·54	27·56
31·0	2 32 3·00	28·00	30·19	59·5	29·31	31·05	2 29 3·47	27·58
41·05	13·00	28·05	40·15	3 51 09·45	29·30	41·0	13·42	27·58
51·05	23·13	27·92	50·15	19·3	29·15	51·0	23·38	27·62
4 07 00·1	31·80	28·30	2 17 1·23	30·5	29·27	4 04 00·05	32·67	27·38
11·05	43·14	27·91	10·14	39·45	29·31	11·05	43·46	27·59
21·1	53·10	28·00	20·14	49·25	29·11	21·05	53·43	27·62
31·0	2 33 3·00	28·00	30·13	59·3	29·17	31·0	2 30 3·48	27·52
41·0	12·91	28·09	40·21	3 52 09·5	29·29	41·0	13·45	27·55
51·05	22·90	28·15	50·14	19·4	29·26	51·0	23·57	27·43
4 08 00·05	31·87	28·18	2 18 1·13	30·3	29·17	4 05 00·0	32·44	27·56

TABLE 6.—The following Time-signals were exchanged between Sydney Observatory and Mount Cook Observatory—*continued.*

Sydney sending.	New Zealand receiving.	Difference.	New Zealand sending.	Sydney receiving.	Difference.
18TH DECEMBER, 1883.			18TH DECEMBER, 1883.		
H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.	H. M. S.
2 45 20·50	4 19 49·6	1 34 29·10	4 31 00·05	2 56 32·47	1 34 27·58
30·14	59·4	29·26	11·05	43·50	27·55
40·20	4 20 09·3	29·10			
50·21	19·5	29·29	31·05	2 57 3·42	27·63
2 46 1·14	30·4	29·26	41·05	13·44	27·61
12·13	41·4	29·27	51·0	23·40	27·60
20·55	49·9	29·35			
29·92	59·15	29·23	4 32 11·1	43·55	27·55
40·13	4 21 09·4	29·27	21·05	53·48	27·57
50·14	19·35	29·21	31·0	2 58 3·45	27·55
2 47 1·00	30·2	29·20	41·1	13·31	27·79
11·23	40·5	29·27	51·0	23·45	27·55
19·92	49·2	29·28	4 33 00·0	32·43	27·57
30·12	59·3	29·18	11·0	43·50	27·50
40·13	4 22 09·5	29·37	21·1	53·54	27·56
50·15	19·3	29·15	31·05	2 59 3·49	27·56
2 48 1·18	30·3	29·12	41·1	13·52	27·58
10·15	39·4	29·25	51·05	23·47	27·58
20·12	49·3	29·18	4 34 00·1	32·48	27·62
30·12	59·3	29·18	11·1	43·53	27·57
40·20	4 23 09·6	29·40	21·1	53·44	27·66
50·17	19·35	29·18	31·1	3 0 3·50	27·60
2 49 1·00	30·0	29·00	41·05	13·44	27·61
10·14	39·45	29·31			
20·13	49·3	29·17	4 35 00·1	32·60	27·50
30·13	59·4	29·27	11·1	43·57	27·53
40·15	4 24 09·35	29·20	21·1	53·44	27·66
50·30	19·4	29·10	31·1	3 1 3·46	27·64
2 50 1·20	30·4	29·20	41·05	13·43	27·62
10·12	39·3	29·18	51·05	23·49	27·56
20·19	49·4	29·21	4 36 00·1	32·57	27·53
30·18	59·45	29·27	11·1	43·52	27·58
40·23	4 25 09·5	29·27	21·1	53·50	27·60
50·13	19·35	29·22	31·1	3 2 3·40	27·70
2 51 1·13	30·4	29·27	41·1	13·43	27·67
10·15	39·45	29·30	51·05	23·49	27·56
20·13	49·35	29·22	4 37 00·1	32·54	27·56
30·11	59·35	29·24	11·05	43·52	27·53
40·19	4 26 09·45	29·26	21·05	53·47	27·58
50·14	19·4	29·26	31·05	3 3 3·47	27·58
2 52 1·20	30·45	29·25	41·1	13·51	27·59
10·13	39·4	29·27	51·05	23·39	27·66
20·14	49·4	29·26	4 38 00·1	32·50	27·60
30·18	59·4	29·22	11·05	43·50	27·55
40·19	4 27 09·5	29·31	21·1	53·48	27·62
50·15	19·45	29·30	31·0	3 4 3·42	27·58
2 53 1·18	30·5	29·32	41·05	13·47	27·58
10·14	39·5	29·36	51·05	23·40	27·65
20·13	49·4	29·27	4 39 00·1	32·77	27·33
30·11	59·4	29·29	11·1	43·52	27·58
40·14	4 28 09·5	29·36	21·1	53·50	27·60
50·20	19·5	29·30	31·05	3 5 3·46	27·59
2 54 1·17	30·5	29·33	41·1	13·60	27·50
			51·05	23·48	27·57
			4 40 00·1	32·52	27·58

TABLE 6—*continued.*

SUMMARY OF PRECEDING EXCHANGES.

Date.	—	Mean of Clock Times.			Probable Error.
1883.		H.	M.	S.	S.
Dec. 5 ...	Sydney sending	2	25	15·829	
„ 5 ...	New Zealand receiving	3	59	49·371	
„ 5 ...	Mean of differences	1	34	33·542	·010
„ 5 ...	New Zealand sending	4	10	30·829	
„ 5 ...	Sydney receiving	2	35	58·821	
„ 5 ...	Mean of differences	1	34	32·008	·009
„ 5 ...	Sydney sending	2	59	56·651	
„ 5 ...	New Zealand receiving	4	34	30·215	
„ 5 ...	Mean of differences	1	34	33·563	·010
„ 5 ...	New Zealand sending	4	48	30·837	
„ 5 ...	Sydney receiving	3	13	58·778	
„ 5 ...	Mean of differences	1	34	32·059	·009
	Probable Error of mean of the above exchanges				=·005
Dec. 15 ...	New Zealand sending	4	06	35·892	
„ 15 ...	Sydney receiving	2	32	07·926	
„ 15 ...	Mean of differences	1	34	27·966	·009
„ 15 ...	Sydney sending	2	59	30·341	
„ 15 ...	New Zealand receiving	4	34	00·129	
„ 15 ...	Mean of differences	1	34	29·788	·007
„ 15 ...	Sydney sending	3	22	40·325	
„ 15 ...	New Zealand receiving	4	57	10·102	
„ 15 ...	Mean of differences	1	34	29·777	·005
„ 15 ...	New Zealand sending	5	08	30·867	
„ 15 ...	Sydney receiving	3	34	02·811	
„ 15 ...	Mean of differences	1	34	28·056	·008
„ 15 ...	Sydney sending	4	22	30·962	
„ 15 ...	New Zealand receiving	5	57	00·755	
„ 15 ...	Mean of differences	1	34	29·792	·007
	Probable Error of mean of the above exchanges				=·003
Dec. 16 ...	Sydney sending	1	40	27·198	
„ 16 ...	New Zealand receiving	3	14	56·869	
„ 16 ...	Mean of differences	1	34	29·671	·006
„ 16 ...	New Zealand sending	3	27	20·878	
„ 16 ...	Sydney receiving	1	52	52·930	
„ 16 ...	Mean of differences	1	34	27·948	·007
„ 16 ...	Sydney sending	2	16	30·363	
„ 16 ...	New Zealand receiving	3	51	00·066	
„ 16 ...	Mean of differences	1	34	29·703	·006
„ 16 ...	New Zealand sending	4	03	30·875	
„ 16 ...	Sydney receiving	2	29	02·857	
„ 16 ...	Mean of differences	1	34	28·017	·010
	Probable Error of mean of the above exchanges				=·004
Dec. 18 ...	Sydney sending	2	13	30·324	
„ 18 ...	New Zealand receiving	3	47	59·583	
„ 18 ...	Mean of differences	1	34	29·259	·009
„ 18 ...	New Zealand sending	4	00	32·539	
„ 18 ...	Sydney receiving	2	26	04·979	
„ 18 ...	Mean of differences	1	34	27·559	·006
„ 18 ...	Sydney sending	2	49	40·384	
„ 18 ...	New Zealand receiving	4	24	09·627	
„ 18 ...	Mean of differences	1	34	29·243	·007
„ 18 ...	New Zealand sending	4	35	40·512	
„ 18 ...	Sydney receiving	3	01	12·928	
„ 18 ...	Mean of differences	1	34	27·584	·005
	Probable Error of mean of the above exchanges				=·003

TABLE 7.

CORRECTION OF CLOCK TIMES AT THE MEAN OF EXCHANGES, AND RESULTING DIFFERENCE OF LONGITUDE.

NOTE.—The symbols have the same signification as on page 341, Vol. I., Chauvenet. The equation A−L=·070s has been applied to the sending clock for the sake of convenience.

Date.	s. (sending). R. (receiving).	Clock Time.	Clock Slow.	Personal Equation.	Corrected Time.	Difference 1h. 34m. +.	
						.	λ_2
1883.		H. M. S.	s.	s.	H. M. S.	s.	s.
Dec. 5 ...	Sydney s.	2 25 15·829	+19·510	+·070	2 25 35·409	...	17·418
„ 5 ...	N.Z. R.	3 59 49·371	+ 3·758	−·302	3 59 52·827		
„ 5 ...	N.Z. s.	4 10 30·829	+ 3·760	−·070	4 10 34·519	16·531	
„ 5 ...	Sydney R.	2 35 58·821	+19·509	−·341	2 36 17·988		
„ 5 ...	Sydney s.	2 59 56·651	+19·507	+·070	3 00 16·228	...	17·448
„ 5 ...	N.Z. R.	4 34 30·215	+ 3·763	−·302	4 34 33·676		
„ 5 ...	N.Z. s.	4 48 30·837	+ 3·765	−·070	4 48 34·532	16·589	
„ 5 ...	Sydney R.	3 13 58·778	+19·506	−·341	3 14 17·943		
		Result λ=16·996		x=·436	Means=	16·560	17·433
Dec. 15 ...	N.Z. s.	4 06 35·892	+ 5·528	−·070	4 06 41·350	16·438	
„ 15 ...	Sydney R.	2 32 07·926	+17·327	−·341	2 32 24·912		
„ 15 ...	Sydney s.	2 59 30·341	+17·326	+·070	2 59 47·737	...	17·474
„ 15 ...	N.Z. R.	4 34 00·129	+ 5·528	−·446	4 34 05·211		
„ 15 ...	Sydney s.	3 22 40·325	+17·326	+·070	3 22 57·721	...	17·463
„ 15 ...	N.Z. R.	4 57 10·102	+ 5·528	−·446	4 57 15·184		
„ 15 ...	N.Z. s.	5 08 30·867	+ 5·528	−·070	5 08 36·325	16·529	
„ 15 ...	Sydney R.	3 34 02·811	+17·326	−·341	3 34 19·796		
„ 15 ...	Sydney s.	4 22 30·962	+17·324	+·070	4 22 48·356	...	17·482
„ 15 ...	N.Z. R.	5 57 00·755	+ 5·529	−·446	5 57 05·838		
		Result λ=16·978		x=·494	Means=	16·484	17·473
Dec. 16 ...	Sydney s.	1 40 27·198	+17·146	+·070	1 40 44·414	...	17·505
„ 16 ...	N.Z. R.	3 14 56·869	+ 5·496	−·446	3 15 01·919		
„ 16 ...	N.Z. s.	3 27 20·878	+ 5·495	−·070	3 27 26·303	16·570	
„ 16 ...	Sydney R.	1 52 52·930	+17·144	−·341	1 53 09·733		
„ 16 ...	Sydney s.	2 16 30·363	+17·140	+·070	2 16 47·573	...	17·542
„ 16 ...	N.Z. R.	3 51 00·066	+ 5·495	−·446	3 51 05·115		
„ 16 ...	N.Z. s.	4 03 30·875	+ 5·494	−·070	4 03 36·299	16·644	
„ 16 ...	Sydney R.	2 29 02·857	+17·139	−·341	2 29 19·655		
		Result λ=17·066		x=·458	Means=	16·607	17·524
Dec. 18 ...	Sydney s.	2 13 30·324	+16·833	+·070	2 13 47·227	...	17·377
„ 18 ...	N.Z. R.	3 47 59·583	+ 5·467	−·446	3 48 04·604		
„ 18 ...	N.Z. s.	4 00 32·539	+ 5·467	−·070	4 00 37·936	16·466	
„ 18 ...	Sydney R.	2 26 04·979	+16·832	−·341	2 26 21·470		
„ 18 ...	Sydney s.	2 49 40·384	+16·830	+·070	2 49 57·284	...	17·365
„ 18 ...	N.Z. R.	4 24 09·627	+ 5·468	−·446	4 24 14·649		
„ 18 ...	N.Z. s.	4 35 40·512	+ 5·469	−·070	4 35 45·911	16·494	
„ 18 ...	Sydney R.	3 01 12·928	+16·830	−·341	3 01 29·417		
		Result λ=16·926		x=·446	Means=	16·480	17·371

TABLE 7.—CORRECTION OF CLOCK TIMES AT THE MEAN OF EXCHANGES, ETC.—*continued.*

To find the Weights to be given to each day's work.

Date.	New Zealand.	Sydney.	Exchange.	$\sqrt{[r_o^2]}$	$\frac{1}{100\,[r_o^2]}$	*p.*
1883.	r_o	r_o	r_o			
December 5	·027	·012	·005	·030	11	3
" 15	·017	·014	·003	·022	20	6
" 16	·024	·011	·004	·027	14	4
" 18	·018	·012	·003	·022	21	6

Difference of Longitude and Probable Error, applying weights as found above.

Date.	Difference of Longitude.	*p.*	Products.	*v.*	*vv.*	*pvv.*
1883.	H. M. S.		S.			
December 5	1 34 16·996	3	50·988	+·013	·0002	·0005
" 15	16·978	6	101·868	−·005	·0000	·0002
" 16	17·066	4	68·264	+·083	·0069	·0276
" 18	16·926	6	101·556	−·057	·0033	·0194
		19)	322·676			·0477
			16·983			

$$r_o = \sqrt{\left(\frac{·0477}{3 \times 19}\right)} \times ·6745 = ·020s.$$

Difference of Longitude, Sydney–Wellington $= 1h.\ 34m.\ 16·983s. \pm ·020s.$

Difference of Longitude and Probable Error, applying weights proportional to $\frac{S \times W}{S + W}$ where S=number of stars observed at Sydney, and W=number of stars observed at Wellington on each night of exchange.

Date.	Difference of Longitude.	Number of Clock Stars observed.		*p.*	Products.	*v.*	*vv.*	*pvv.*
1883.	H. M. S.	S.	W.		S.			
December 5	1 34 16·996	4	20	2	33·992	+·011	·0001	·0002
" 15	16·978	9	25	4	67·912	−·007	·0000	·0002
" 16	17·066	7	16	3	51·198	+·081	·0066	·0197
" 18	16·926	11	16	4	67·704	−·059	·0035	·0139
				13)	220·806			·0340
					16·985			

$$r_o = \sqrt{\left(\frac{·0340}{3 \times 13}\right)} \times ·6745 = ·020s.$$

Difference of Longitude, Sydney–Wellington $= 1h.\ 34m.\ 16·985s. \pm ·020s.$

APPENDIX No. 2.

EXTRACTS FROM THE REPORTS OF CHIEF SURVEYORS IN CHARGE OF SETTLEMENT OPERATIONS IN DISTRICTS.

AUCKLAND.

Mean Degree of Precision attained in Survey for the Period.—In pursuance of the system initiated two years ago, the surveyors were required to attach to their annual returns a fair selection of their trigonometrical and chain closures for the past twelve months, the result of which is appended hereto, together with those previously obtained, from which it will appear that the character of the work is very uniform, taken as a whole, and that in no single instance is the limit of closure allowed by regulation, either in triangulation or traverse, approached. To the use of the steel band in lieu of the ancient form of Gunter's chain is undoubtedly due the near approach of the chain closures to those of the triangulation, and, when the general nature of the country over which, as a rule, the chainages have to be made is taken into consideration, it must be acknowledged that great credit is due to the surveyors who produce these results.

AUCKLAND TRIGONOMETRICAL and CHAIN CLOSURES, 1883-84.

Surveyor.	Trigonometrical.			Chain.			
	Number of Closures.	Mean Difference of Bearing of Closures.	Mean Difference of Closure per Mile in Links.	Number of Closures.	Number of Traverse Lines.	Total Length of Traverse Lines in Miles.	Mean Errror of Closure per Mile in Links.
G. W. Williams*	...	...	...	...	25	2·9	0·4
S. Weetman	...	...	...	23	449	43·2	2·02
E. C. Goldsmith	...	...	...	7	93	14·34	1·75
L. Cussen	5	8″	0·39	23	534	50·2	2·22
F. Simpson	...	...	...	20	400	26·0	2·1
J. Baber	...	...	...	10	190	32·8	1·2
F. H. Edgecumbe	...	...	...	11	162	43·5	1·1
R. Neumann	...	...	...	...	57	3·5	3·3
P. E. Cheal...	...	...	...	5	159	14·2	0·51
W. J. Parris	4	70″	0·95	6	114	12·1	0·76
G. A. Martin	...	...	...	6	118	11·8	1·50
E. H. Hardy	27	7″·5	0·45	4	72	14·7	0·57
H. M. Smith	1	4″	1·1	6	633	37·9	1·9
J. I. Philips	...	...	...	25	469	53·3	2·26
C. Stevens	9	8″	2·6	8	123	28·1	0·4
J. Hannah	...	...	...	6	135	13·4	2·5
D. W. Gillies	...	...	...	5	253	12·2	2·0
C. W. Macfarland	...	...	...	11	196	15·2	4·1
H. D. Haszard	...	...	...	2	63	12·5	2·6
H. G. Price...	5	...	1·14	3	184	7·8	4·4
H. A. Martin	...	...	...	2	112	10·4	0.75
	51	97″·5	6·63	183	4,541	460·1	38·35
Means and totals, 1883–84	51	19″·5	1·10	183	4,541	460·1	1·91
Means and totals, 1881–82	54	10″·7	1·03	98	1,705	265·9	1·92
Means and totals, 1882–83	15	6″·6	0·62	146	3,022	390·0	1·67
Means and totals, 1881–84	120	15″·6	0·90	427	9,268	1116·0	1·83

* Standard Survey.

Major Triangulation.—In past annual reports frequent reference has been made to the long-delayed triangulation of the King country, and the hope expressed that it would shortly be commenced. Happily the natives' objections, which have hitherto proved a barrier to this work, have been in a great measure removed, and as a consequence a very large area of country has been brought under the ruling process of major triangulation, the result of which, however, will not appear in the returns until next report. In December last, in the presence of the Hon. the Native Minister, a large meeting took place at Kihikihi, when the preliminary arrangements were made, and early in January Mr. District-Surveyor Cussen, with two assistants, was able to make a start into

this almost unknown country, where, notwithstanding some few delays caused by the objections of petty chiefs, he has pushed forward the work with great energy, until at the present time he has covered an area of one and a half million acres with major and secondary triangles, the angles of which are observed and topographical features sketched, and has, in addition, erected stations ready for observing over nearly another million acres. The work has so far advanced that Mr. Cussen has "exchanged shots" with Mr. Skeet, working from the Taranaki side. This is a result which must be deemed highly satisfactory, and great credit is due to Mr. Cussen for the energy and determination with which he has pushed on the work in the face of no ordinary difficulties, and for the tact he has displayed in dealing with the Natives. Appended hereto is a copy of his report on the work and the country passed over. The work done by Mr. Williams was the revision of a few triangles in the Rotorua district, necessitated by the removal of one of the stations (supposed to be) by the Natives, which has caused us an immense deal of trouble in reconciling and revising surveys based on an erroneous position of the station removed. Mr. Cheal's work was the observation of a triangle which closes in two portions of the triangulation meeting on top of Te Aroha, which shows a closure in the rectangular elements of 9·2 links in meridian and 78·1 links on the perpendicular in a distance of 180 miles, whilst the heights close to one foot in the same distance, thus furnishing another illustration of the remarkable manner in which the errors in hypsometrical observations cancel one another in this country. Mr. Hardy's major work is also a revision of some former faulty observations, which results in a better closure than that heretofore accepted. The last item under this head is an area of 667,569 acres, covered by major and partly minor work, executed by Mr. C. Alma Baker for the department, in the mountainous district extending from Opotiki to Hicks' Bay, undertaken specially in connection with a series of Native block-surveys, and which has given us a capital topographical map of a territory hitherto quite blank on the maps, together with a further check on the two independent triangulations of Bay of Plenty and Poverty Bay. The following are the results arrived at, showing a satisfactory close in lengths, but not so good in bearings. The distance between the two bases is 125 miles :—

Bay of Plenty meridian	°	′	″			°	′	″	
139A to Orowhana =	232	3	37	= 68187·6	Orowhana to Kapua =	19	25	12	= 74215·2
Convergence =	0	53	33		Convergence =		53	33	
	231	10	4			18	31	39	
Poverty Bay meridian =	231	7	57	= 68184·0		18	28	40	= 74218·5
$a = \sim =$	0	2	7	~ 3·6	$b = \sim =$	0	2	59	~ = 3·3

Bay of Plenty meridian	°	′	″	
Kapua–Hikurangi =	62	14	37	= 71680·1
Convergence =	0	53	33	
	61	21	4	
Poverty Bay meridian =	61	17	50	= 71684·0
$c = \sim =$	0	3	14	~ = 4·1

a=0·42lk. per mile; b=0·36lk. per mile; c=0·45lk per mile.

Minor Triangulation.—Nearly all the 445,457 acres returned as completed has been done directly in the interests of the section surveys, its lengths being deduced by the Ray Trace system from the major sides.

Topographical and Trigonometrical Surveys.—The return shows 197,250 acres as completed under this heading; the largest item, that of 115,660 acres, was done by Mr. E. H. Hardy during the process of defining scattered applications in the Tokatoka and other districts. His map is beautifully drawn, and gives a large amount of very useful information, much more so indeed than is usual.

Rural and Suburban Sections.—This class of work, which has the most interest for the public and brings the department into more immediate contact with it, shows an apparent decrease of about 13,000 acres, but an increase of 259 sections in number when compared with last year's work; but there are nearly 26,000 acres surveyed, but not yet mapped, still in the hands of the surveyors, and consequently not included in the returns. The cost of survey per acre has risen from 1s. 3d. to 2s., this being due to the smaller size of sections, and to that fertile source of delay and expense—the redefining of old boundaries adjacent to the lands applied for. Some of these surveys have been especially difficult during the past season, owing to the absence of the proper data to work from. Where the record of the dimension of land sold consists of the meagre information given on old grants, and where the ground-marks have been lost or do not agree with the grants, the surveyor has before him a most difficult task to satisfy all the conditions, resulting in very slow progress at a very great cost. Mr. Weetman has been particularly unfortunate in this respect during the past season, for his district is more wanting in old maps than most others. Mr. J. I. Philips has the largest output of section work, much of which is mixed up with old surveys, and is therefore the more creditable to him. Notwithstanding the large staff engaged almost exclusively on preparing lands for sale, I regret to say there are large arrears of applications, some of them of long standing. Were it not for the great loss of time caused by the difficulty in defining old boundaries the staff could easily keep pace with the requirements of the public for new lands, notwithstanding the scattered nature of the applications, and these form the bulk of the lands which are sought for. The blocks of Crown lands which are of any extent and at the same time suitable otherwise for settlement are so situated that until they are opened up with roads it would be premature to survey them. During the past year an area of 8,573 acres was surveyed, at a cost of £1,335 14s. 11d., for the purpose of issuing grants, the old plans of which were either deficient or altogether wanting, and a further sum

of £1,037 15s. was spent in defining the boundaries of lands sold and granted many years previously. These two items represent provincial liabilities. In addition to the area shown in the return, twenty-six sections, containing 3,061 acres, were surveyed, under the fee-deposit system, by authorized surveyors under the homestead clauses of the Land Act.

Town Section Survey.—No new town or village has been laid out during the past season. The items shown are additions to existing towns.

Native Land Court Surveys.—Engaged as the official staff of surveyors is on settlement and on other more strictly speaking Government surveys, we have done but little under this heading. Mr. Goldsmith made the only survey of any size, and that was one of Mayor Island. His interesting descriptive report of the island has been forwarded to you. To insure the correct position of this survey with respect to the other surveys of the colony, he, with the aid of Messrs. Cheal and Turner, observed angles of a triangle whose sides are 32·7 and 26·2 miles respectively, the heliostats being used to sight on. To meet the wants of Native applicants to have their claims surveyed and the requirements of the Native Land Court the aid of the authorized surveyors was obtained for the survey of 137 blocks containing 355,384 acres, the cost of which was advanced by Government, on the application of the Natives, to the amount of £5,006 4s., all of which is secured by registered lien on the land. The average size of these blocks is 2,430 acres, and they were surveyed at an average cost of $3\frac{8}{10}$d. per acre, a price which will bear favourable comparison with that which the Natives ordinarily have to pay to private surveyors. In addition to the blocks above mentioned, there were 294 other blocks, with an area of 720,896 acres, the surveys of which were paid for by Natives or private individuals, received during the year, and are now ready for the operations of the Native Land Court. A considerable portion of these areas are of course subdivisions of old blocks, made in pursuance of the orders of the Court. Of the above area, 457,009 acres on ninety-three plans have been received at the Gisborne office, representing mostly subdivision orders. Mr. Barnard speaks in high terms of the general excellence of the work of the authorized surveyors engaged on this kind of work. At the Native meeting held at Kihikihi in December last, already referred to, arrangements were completed for the survey of the external boundaries of the Aotea Block, comprising the greater part of the so-called King country, and early in January Mr. F. H. Edgecumbe and Mr. W. C. Spencer proceeded to undertake the work. The former started from the Whanganui River near the 39th parallel, and ran the line south-easterly till he connected on to surveys lying immediately at the west base of Ruapehu; whilst the latter, starting from the same place on the Whanganui, worked westwards until he effected a junction with the confiscation-line east of the White Cliffs, which had been defined by Mr. Skeet, of the Taranaki staff. Mr. Edgecumbe had a good deal of trouble with some of the Natives on more than one occasion, but effected the purpose for which he was sent. Mr. Spencer is now defining another portion of the boundary running from a point on the coast between Kawhia and Aotea to the confiscation-line south of Pirongia. On the completion of this, and Mr. Skeet's work at Mokau, a plan can be made to enable the Court to deal with this large block, which is roughly estimated to contain 3,200,000 acres. It will be seen from the above that 377 blocks, containing 1,082,866 acres, have been surveyed for the Native Land Court, though much of it is not new country now for the first time to be brought under the Act, but old blocks subdivided and the title individualized.

Land-purchase Surveys.—The department has directed several surveys for the above purpose, principally in the Ohinemuri Gold Field Block, where the work consisted in defining the reserves made by the Natives at the time of sale to the Government. The work has proved to be very difficult and tedious, but has been well done by Mr. Nepean Kenny. The other surveys are blocks and Native reserves in purchased blocks in the Bay of Plenty and other districts. The cost has been defrayed by the Land Purchase Department, with the exception of that for a block of about 12,000 acres at Aotea the survey of which is in hand by Mr. Haszard.

Roads, Railways, &c.—Of the 234 miles of road laid out, nearly 200 miles were in exercise of the reserved rights in Native grants. The exercise of these rights is a matter which requires very careful handling and will yet give the department an immense deal of trouble. As a rule the Natives are all bitterly opposed to the roads, and look upon the taking of them as unwarrantable proceedings on behalf of the Government, a feeling which has become much intensified by their having acquired a knowledge of the provisions of the Crown and Native Lands Rating Act. During the past year we have been reluctantly obliged to proceed against the Natives on three occasions for obstructing surveyors laying out roads, and, though successful so far as obtaining verdicts against them, this cannot be looked at as a satisfactory way of carrying out the provisions of the Act. A difficulty of another kind, which is inherent in the Native Lands Act, under which these road rights are exercised, is likely also to occur wherever the lands are so valuable or so situated as to induce the owners to subdivide into small blocks, thus rendering the 5 per cent. taken from each of no value as a road, or, on the other hand, it has the effect of forcing the roads into such positions as to render them useless. Immediately these small divisions fall into the hands of Europeans they naturally require roads. In addition to the roads shown in the return, $29\frac{3}{4}$ miles of railway have been surveyed under the direction of the department for purposes of Proclamation, at the cost of the Public Works Department.

Detention by Native Opposition, &c.—The principal item under this heading was due to a temporary stoppage of the triangulation in the King country, which has already been reported. Two of the others are the equivalent of time lost through the obstruction referred to in the preceding paragraph.

Other Works, &c.—The column headed as above includes items which cannot be included in the preceding ones, such as cost of field inspection, supervision of road works, connecting old surveys, standard surveys, leave of absence of surveyors, surveying King country boundaries, exploration for roads, value of work on hand, survey of foreshore, &c.

Standard Survey of Towns.—Mr. Williams has made a further extension of this very necessary work in the suburbs of Auckland, the results of which are all published and in the hands of

licensed surveyors, so that little or no trouble now arises in at once placing the city and suburban surveys in their places on the standard working plans. Mr. F. Simpson has also made a standard survey of the Town of Whangarei, which will enable us to compile a proper map of that town for publication, and towards the cost of which the Town Board contributed. All the points are marked with solid stone blocks.

Land Transfer Surveys.—Mr. Foster has passed 175 plans, containing 43,846 acres, and Mr. Buscke, at Gisborne, fifty-six, with an area of 190,174 acres. The character of the surveys as surveys is always good, but the omission of many matters required by the regulations is very frequent indeed, rendering a reference back to the surveyor a matter of every-day occurrence. The trouble and delay that this gives rise to is very serious. There are four draughtsmen engaged in this branch of the department, two in Auckland and two at Gisborne, but they are not able to keep the work up to date, as already reported to you.

Inspection.—Mr. Williams has inspected a large number of surveys by the authorized surveyors during the year, and reports that on the whole he found them fairly accurate, with a great improvement on the ground-marking since last year. His diagrams are transmitted to you from time to time. From the long distances he has had to travel, and the difficulty of reaching many of the surveys inspected, the expenses are very heavy. Mr. Barnard, in addition to his other duties, has made twenty-seven inspections, covering an area of 54,793 acres, and reports (as before mentioned) that the surveys are generally faithfully done. The extent of the district in which surveys are going on prevents so complete a field-inspection as would be desirable: as a matter of fact, scarcely 10 per cent. of them are checked, and then only in cases when the office examination tends to show its necessity.

Examination of Surveyors.—The Inspector held one examination for young men desiring to be placed on the authorized list during the year, when ten candidates came up, but only three passed. The points in which most of them fail are those where a more intelligent study of the regulations and system of record would have enabled them to pass. The number of surveyors in the province is now more than equal to the requirements of the public, and therefore greater stringency in the examinations may well be insisted on without interfering with the question of supply and demand.

Office Work.—The chief draughtsman and indoor staff have got through a commendable amount of work, both at Auckland and Gisborne, the latter branch being under Mr. Featon's direct management; but, notwithstanding, there are large arrears in all branches. There are now 1,275 block-sheets prepared, on which more or less work is shown, being an increase of ninety for the year; and in addition there are 150 record maps and the same number of trig. maps of survey districts prepared. We have drawn thirty-five plans for lithographing, of which 5,250 copies were struck off: they are principally 20-chain maps of survey blocks, which, being carefully prepared, can easily be joined together to form general plans, for which purpose they are very useful. The cost of lithographing was £50 2s., whilst the sales amounted to £65. Twenty-four tracings of survey districts for photo-lithographing to the 80-chain scale have been sent to you, but only thirteen have been published during the last two years. Three maps of meridian circuits, showing all the major triangulation in them, have been sent to you for photo-lithographing, two of which are published. The second sheet of the four-mile map of the province is in hand. The Crown Grant Draughtsman, Mr. Kennedy, has placed on the forms 1,894 marginal plans of grants, certificates, and Native titles, in addition to eighty-six Native titles prepared at Gisborne; Mr. Sturtevant has drawn 1,704 marginal plans on the District Lands Registrars' forms: thus making a total of 3,684 diagrams of title for the year. There are on hand passing through the office 503 various forms of titles, of which 152 are Crown grants or certificates of titles, which cannot be prepared for want of surveys, and 207 are Native Lands Court subdivisions or orders, also waiting for survey, and, as the department has no means of urging on these latter surveys, they are likely to remain as arrears. The Crown grants will be worked off when the surveyors are in the district where they lie. In the clerical branch, Mr Johnston has passed 1,830 vouchers, representing a sum of £65,523 12s. 8d., which includes expenditure on surveys, roads to open up Crown lands, Great North roads and wharves, homestead surveys and land-purchase surveys. The sum received for refunds on Native surveys during the year is £514 4s. 6d., leaving a balance due by Natives of £22,175 9s. 9d., secured on the land. The correspondence connected with the various duties of the department, both in English and Maori, continues to increase. There are considerably over five thousand letters and telegrams received and an equal number despatched during the year. Should the records continue to accumulate during the next few years at the same rate as they have done during the past six or seven, if will soon be necessary to provide a special "muniment room" for their safe-keeping, there being no space for them in the safe, which is already overcrowded with maps.

Work for the ensuing Season.—The surveyors have already completed in the field, but the maps of which are not yet in and therefore not shown in the return, 26,400 of rural sections, 1,608,800 acres of triangulation, 12,000 acres of land-purchase block, 10·75 miles of road, and 14 miles of boundary-line, all of which will come in during the ensuing year. You will observe from the monthly abstract forwarded herewith that, including the above, the surveyors have had instructions issued to them for 3,002 square miles of triangulation, 62,280 acres of section work, 17,300 acres of Native Land Court blocks, and 279 miles of road; whilst there is on hand 77,180 acres of Crown land to be surveyed in 404 localities for sale, and for issue of Crown grants, 141 sections = 15,790 acres, for which instructions have not been issued as yet to the surveyors. Most of this will be worked off during the season if the staff remains at its present strength. In these figures, however, are not included any estimate of the applications which are likely to be received from the Land Board during the year. These no doubt will be considerable, but, as the best lands for settlement in the province have already been dealt with, it is likely to be a diminishing quantity until the large areas of good land now totally inaccessible to the settlers for want of roads is rendered available. It would be useless to attempt to form any estimate of the area of Native land that will be surveyed

JAMES McKERROW
Surveyor General.

SKETCH MAP
OF THE
"KING COUNTRY"
BASED UPON
TRIGONOMETRICAL & TOPOGRAPHICAL SURVEY

BY L. CUSSEN
F. H. EDGECUMBE & W. C. C. SPENCER

Scale 8 Miles to an Inch

Drawn by C. R. Pollen Auckland August 22nd 1884

S. Percy Smith, Assistant Surveyor General

Photolithographed at the General Survey Office, Wellington N.Z. September, 1884.

during the next season; but, as the first steps have been taken towards solving the difficulties in the King country, it is not unlikely that a very large area may be dealt with. The applications received through the Native Land Court already cover several hundred thousand acres in that locality. In the Poverty Bay district a large area of both new lands and subdivisions will be prepared for the Court by the thirteen surveyors at work there under Mr. Barnard's supervision. I trust that the Geodesical Surveyor will find time to re-observe the Bay of Plenty latitude during this season: that at present recorded is very unsatisfactory, and causes considerable trouble now that the surveys from other circuits are closing in on it on all sides. The new season will probably see a complete closure between the provincial triangulations of Auckland and Taranaki, and will thus afford a double check by triangulation on the electric longitude of Auckland from Wellington. On the completion of this work there will then only remain the north part of the mountainous Urewera country, the country near the East Cape, and the narrow neck between Awanui and the North Cape to be major-triangulated to finish the whole province. As much time as possible will be devoted to the laying-out of roads before the rights expire, but I anticipate a considerable amount of trouble and delay in so doing.

During the past year four of the cadets have completed their term of service in that grade, and have passed their examinations; three of them are engaged in the field as surveyors. Two others will finish their three years in the field and office during the ensuing season.

S. Percy Smith, Assistant Surveyor-General.

Mr. Lawrence Cussen to the Assistant Surveyor-General.

I have the honour to send you herewith a sketch showing the triangulation now in progress in the King country, and to submit for your information a short report of the work, the character of the country, and the attitude of the Natives in respect to the survey.

The triangulation was commenced in the last week of December, 1883. Forty-three stations have been erected, covering an area of 2,500,000 acres. The major work, with sides from twelve to twenty-three miles, covers the country in regular polygons; and a secondary series of five- to eight-mile sides on Ray trace between the major stations covers nearly the whole area, but not all in polygons. There are seventeen major and twenty-five minor stations: seventeen are in the forest and twenty-five in the open country; the bush work was very heavy and expensive. Seven stations were cleared by the Natives by contract at reasonable prices, which was a great advantage in expediting the work, and in preventing opposition from other Natives who might endeavour to stop Europeans. The angles have been observed at twenty stations, the topographical sketches being made as the work proceeds. I need scarcely mention that there is a great advantage in carrying on the minor work with the major: it takes less time, and costs less than if done separately, whilst the knowledge gained in the progress of the major work enables one to execute the minor more satisfactorily at the same time. There is an area of about two hundred square miles, lying to the southward of the Rangitoto Ranges, and between the Mokau and Waimeha Rivers, which it will be very difficult to minor triangulate, the hills being all pretty much the same height, and heavily timbered, with table-land on top. I estimate that to complete the work as we are now doing it will take about twelve months from now; the cost of the major and minor triangulations will not, I think, exceed ½d. per acre, and I expect to see it under that.

My assistant, Mr. Mace, with a party of five Europeans, and occasionally some Natives when the bush work was heavy, has been entirely engaged in the erection of stations: having selected a hill, he would leave a party to clear the bush, under an experienced chainman, and proceed to select other stations ahead. Mr. Mace and his party have worked well, and have had rough times occasionally.

Mr. W. Cussen commenced work on the west of Lake Taupo in the beginning of April. He has covered the country west of the lake, and the downs on the west of the Waikato River, comprising an area of nearly 500,000 acres, with a minor triangulation of four- to six-mile sides.

During the winter I purpose visiting the old stations east of the Waikato River, with which our present work will close. There are fourteen of these to visit. I hope also to complete the survey of the country from Kihikihi to Mokau, so as to be ready in the spring to go on with the West Coast between Raglan and the Mokau River, and work which remains unfinished to the southward. The country is generally a bad one to get about in, and it is very hard on horses, the tracks being rough and feed very scarce. It has consequently cost a great deal to get our provisions packed out to central dépôt.

Native Opposition.—It was not to be expected that such a work as the triangulation of the King country would be carried on without meeting some opposition from the Natives, and, although the delays from this cause were considerable, and cost £250 or more, they were not so serious as might be expected considering the magnitude of the work, and certainly not more than I have met with in triangulating Native country for years past. The obstructionists might be divided into three classes: Those who obstructed to show their claim to the land and to protest against any one else authorizing the survey over it, and who were jealous of the chiefs: these were not many and gave us but little trouble. Secondly, the remnants of Tawhiao's followers, who opposed us to show their loyalty to the cause of the King: their opposition was feeble and half-hearted, and was only by way of a protest against the work; they would order us back and threaten to destroy the trig. stations; they did pull down two stations, but on our replacing them they have not again been disturbed. The third class were the most numerous, the most troublesome and difficult to deal with: they are those who, from various causes, are distrustful of the objects of the trig. survey, and the ultimate intentions of the Government with regard to their land, or who desire to have their land surveyed otherwise. The chief actors are men who mix a good deal with Europeans attending Land

Courts, &c., and who are land-sellers. On beginning the trig. work I got letters from Rewi Maniapoto, Wahanui, Taonui, and Hitere te Paerata to their people. The first case of obstruction occurred at Kakapuku, close to Kihikihi, where the trig. station was destroyed by Pahe and his people, a small hapu of the Ngatimaniapoto's called Ngatingawairoa. Their object was partly to assert their claim to the land and partly to uphold Tawhiao's authority. This station was twice pulled down by the same hapu, though not by the same men; but finally they gave way and allowed the station to remain there. I saw that we would probably meet with frequent interruptions in this neighbourhood and in the Wharepapa district, where it was said the Ngatihauas and Ngatiraukaua would show determined opposition. There was also a rumour that twenty armed men of the Ngatiraukaua were waiting at the Rangitoto Ranges to stop us. In consequence of these rumours, and in order to avoid the probability of having recourse to law to punish the obstructionists, which, by rendering the action of the chiefs unpopular, might weaken their influence and lead to further delays, I took the liberty of suggesting that we should begin the work at Taupo, and, by working northwards, have the greater part of the country surveyed when we reached the part where the opposition was strongest. We therefore removed to Taupo, with your concurrence, arriving there on the 21st March. I met Te Heuheu, Matuahu, and about thirty others—Ngatituwharetoas—at Waihi on my arrival; they refused to allow the work to go on because they said they had not been communicated with by the Government beforehand. Unfortunately they had not received the letters which the Hon. Mr. Bryce had written to them, and which were lying at the post office at Tapuaeharuru under cover to me. Neither had your letter to Te Heuheu and the others come to hand. However, when Te Heuheu and his people received these letters they were quite satisfied and allowed us to go on with the survey. There were a few other men in the South Taupo districts who were objecting, but Te Heuheu and Matuahu used their influence with these and they waived their objections. On reaching the Tuhua district we were met with a more serious and troublesome opposition. The Natives said they were told Government would take large areas of land from them to pay for the trig. survey; that the maps would be used to investigate the titles to the land; taxation would follow, and Government would "lock up" their lands until they could secure it all for themselves; that the big chiefs were managing everything. A Committee was formed in Tuhua to manage local matters. They decided to prevent us from putting any more stations on their land; they would allow none of their people to accompany me or assist in any way, and no information, such as names of rivers, hills, &c., was to be afforded us. Kingi te Herekeikei, of the Ngatituwharetoas, was with the Tuhua Natives, and advised this course. He and Te Hiahia, who was chairman of the Committee, had just returned from Kihikihi. I wrote to Wahanui and Taonui, informing them of the state of affairs. Wahanui came himself to Tuhua and met the Natives. He succeeded in arranging matters, and the work was allowed to go on again, after a fortnight's delay. The next place we met with any serious obstruction was at Wharepuhanga, in the Wharepapa district, about thirty miles from Kihikihi. I sent a party to put up a station there, and they were met by sixteen of the Ngatiraukaua, who were camped on the ground to obstruct the survey: they ordered my party off at once. I then went on to Wharepuhanga with sixteen men, including five Natives who were interested in the land. We were accompanied by Te Paihua and Kapu te Kohika, from Taupo. I met the Natives at Wharepuhanga on the 3rd of June. They said they were sent there by Whiti Patato to stop us; if we refused to go off they were to tear up our tents and bring us off the ground. I refused to leave, and after some talking they asked me to wait for two days to give them time to telegraph to the Government. I consented to do so, lest there might be trouble between my party and the Natives. The Maoris who were with me were prepared to resist if the obstructionists attempted to take our tents. The Natives informed me that Rewi and Hitire had written to the tribes telling them to stop the survey. I got two of these letters, which I forwarded to you. I met the Ngatiraukaua subsequently at Kihikihi: Rewi and Hitire were present. Rewi denied all knowledge of the letter bearing his name, and stated at the meeting that "the survey was his work: he had given his consent to Mr. Bryce, and he would see that the work went on." Hitire admitted having signed Rewi's name without his knowledge, and that he had got the letter written entirely on his own responsibility, his reason being that, "as the Government intended to lock up their land under the pre-emption right, he wished all surveys to cease until the intentions of the Government were made known to the Maoris." He used Rewi's name to secure the co-operation of his people in stopping us. The result of the meeting was that the opposition was removed and the survey is now going on again, some of those who obstructed assisting in the work. Wahanui and Taonui have consistently helped on the work throughout. Taonui himself accompanied me to Te Kuiti, and there appointed men to take us over the Tuhua country. He told me to send for him at any time he could be of service to us. I might also mention that Mr. Robert Ormsby, brother to Mr. John Ormsby, of the Native Committee, who was attached to my survey party, has rendered me a good deal of assistance with the Natives.

Native Population.—Taking all the settlements which I have seen in the King country—and I believe this would include nearly all of any importance within the boundaries under survey, viz., from Maungatautari by the Waikato River to Taupo, by the west side of Taupo Lake to Takaawe, by the Tongariro Ranges to Ruapehu, thence by the Wanganui River to Taumaranui, from there in a direct line to Tautoro, on the Mokau, and thence by the broken, wooded country lying between the Pirongia Ranges and Tautoro, including an area of nearly three million acres—I do not think, in all, I met five hundred Maoris. Natives travel about so much—attending meetings, Native Land Courts, &c.—that it would not be safe to estimate the population by the numbers to be met with in travelling about the district; but, from what I have learned from various sources—the statements of the Natives themselves, the opinions of others who have been through the country, &c.—I should say that the present population in the King country does not exceed four thousand. One is struck, in travelling through the country, with the evidence everywhere to be met with of a once large Native population. The remains of extensive settlements and cultivations going to

ruin can be seen everywhere that the land was suitable, and one feels surprised what food is grown even for the few who remain now.

Description of the Country.—The triangulation has not sufficiently advanced to give a detailed description of the country, which, of course, will be supplied when my maps are sent in. The following curtailed sketch may prove useful in the meantime, as I think the quality and quantity of agricultural land in the King country has been over-estimated by most people: The open country lying between the Puniu and Mokau Rivers, through which the Waipa and its tributaries flow, contain the only extensive area of good agricultural land that I have seen. This comprises an area of about 700,000 acres, bounded to the east by the Rangitoto, Ranginui, and Wharepuhanga Ranges, and to the westward by the broken, wooded country extending southward from the Pirongia Ranges to the Mokau River at Tautoro. This country contains a variety of excellent land for all agricultural purposes, comprising limestone, rich volcanic loam, and, along the rivers and streams, extensive and fertile alluvial flats. Timber for all purposes is easily available. The district is well watered. Roads can be made at a slight cost. Brown coal is to be found in the Hauturu Ranges, to the west of Otorohanga about nine miles; it is also to be found near Te Kuiti, and probably will be got elsewhere when the district is more known, as many of the rivers and streams have particles of coal in them. Between the Mokau and Waimeha Rivers the country is very broken, and the land variable in quality. There is some limestone on the Mokau, near Te Kuiti; but the limestone land is limited in this neighbourhood, and very broken. The valleys are generally open, and the ranges and hills covered with mixed timber, containing rimu, totara, &c., though the totara is not plentiful. There is a considerable area of table-land amongst the hills in this district that is nearly all under forest, and the soil is good; but it is generally difficult of access. About fifteen miles to the westward of Te Kuiti the pumice-country begins, though after this there is good land in the bush and on the table-lands. The valley of the Ongarue and Waimeha Rivers is very poor—thousands of acres of wretched pumice-flats, covered with stunted scrub and dried tussock-grass, with pumice all over the surface. From the Waimeha to Taumaranui some better land is met with. There are small alluvial flats along the banks of the Ongarue, where the Natives have cultivated: on the sides and tops of the fern-ridges the soil is good, but the country generally is very broken. About the Tuhua Mountain there is some good land and plenty of valuable timber, which can be made accessible from Ongarue Valley. Lying between the west of Taupo Lake and the valley of the Ongarue, and extending from Pureora, the most northern peak of the Hurakia Ranges, there is about 300,000 acres of broken country, including the heavily-wooded ranges of Hurakia and Hauhangaroa. The land is very variable in quality, a small stream sometimes dividing a good volcanic loam and a sterile pumice tract; I noticed this even in the table-lands on the mountains. This district is cut up by deep gullies and streams, with table-land between. There is a great deal of valuable timber, including totara, though not a great deal of the latter. The timber would be accessible—at least a good portion of it—from the Te Awamutu and Marton railway-line. Between Taringamutu and South Taupo there is some good bush-land, though broken; there is also a good deal of useful timber, but it will be difficult of access, and roads through this country will cost a great deal to form. On the west of the Waikato River, and extending about twenty miles north from the Hurakia Ranges, is a broken tract of open country, called the Kaiangaroa, containing about 100,000 acres. It is intersected by deep gullies and ravines. The land is poor: bare rocks and landslips everywhere visible. The Maraeroa Plains, at the head of the Waimeha River, comprise about sixty to eighty thousand acres of fairly-good open country, though some of it is poor, with pumice lying on the surface. A great deal of the country around here is level and undulating. The bush-land is variable, some of it good and some a light pumice surface. Finally, outside the area of 700,000 acres before mentioned, lying between the Mokau River and Kihikihi, &c., I have not seen any considerable area of land suitable for general agricultural purposes, though much of the country might be profitably occupied by settlers holding one thousand acres and upwards, and here and there a small farmer would find enough of good land to settle upon.

LAURENCE CUSSEN.

HAWKE'S BAY.

General Remarks.—There is a considerable falling-off in the area covered by the different classes of surveys during the past year. This is to be accounted for by the exceptionally wet season that has been experienced. In the Seventy-Mile Bush district the loss of time from the cause named has been very great, so much so that it raises the question whether or not it is expedient to keep a working party out in the field in bush country during the winter months.

Triangulation.—The area triangulated is 196,970 acres, cost £598 8s. 1d., or 0·77d. per acre for triangular, and 1d. per acre for trig. and topographical surveys. During five months Mr. Hallett has completed 108,500 acres; the other surveys that make up the total have been carried forward piecemeal in connection with section and road surveys in different districts. The triangles observed by Mr. Price in the Mohaka and Waihua districts close on sides of the Poverty Bay circuit.

Settlement or Section Survey.—The average cost of this class of surveys is 1s. 4d. per acre, the bush surveys averaging about two-thirds more than those in open country. Out of the 28,068 acres laid off, 25,794 acres, including 10,000, for the Governors of Napier High School, have been prepared for sale and settlement; the remainder consists of the surveys of applications. The village of Danevirke has been re-surveyed, the pegs of the first survey, made about ten years ago, having been burnt or destroyed.

Roads.—Forty-seven and a half miles have been laid off in exercise of the road rights under the

Crown grants and other Acts, the average cost, £9 4s. 8d. per mile, being, within a few shillings, the same as for the past three years.

Standard Surveys.—Mr. Hallett has laid down bench marks and standard traverses in the Villages of Kaikora, Waipawa, and Waipukurau. The maps of the standard survey of the Town of Napier have been delayed through the ill-health of Mr. Rochfort, and through his unfortunately losing the services of the assistant surveyor engaged with him on the field-work.

Native Land Court Surveys.—Sketch plans of seven claims, covering 80,229 acres, have been drawn from our topographical and record maps, in readiness for the investigations of the Court. Several other surveys are in progress and well advanced towards completion.

OFFICE.

Land Transfer Surveys.—In this branch of the work of the department there has been a steady increase every year for the past five years, with the exception of 1881-82, when the area dealt with fell off to 18,406 acres. During the past year Mr. Dennan has examined and recorded sixty-two plans, covering an area of 55,042 acres. The plans of trig., section, and road surveys, received number eighty-three. The work done for other departments again mounts up to the salary of a draftsman. The plans drawn on certificates of title or grants number 196, covering 20,186 acres. Seven sale plans and a plan of the Mohaka district have been prepared for printing.

Proposed Operations and Work on Hand, 1884-85.—The minor triangulation on hand for survey is 667,440 acres, extending over the open lands which have not yet been triangulated, and over 64,000 acres of bush lands which are being surveyed for settlement. The triangulation standing over from last season in the Maungaharuru and other districts will be carried out in connection with the revision surveys of the Waikare-Mohaka Block. It is proposed to employ Mr. Rich on the triangulation of the Pourere and other districts to the southward, who will at the same time make several road surveys. The other triangulations named in the list are wanted to control Native Land Court and road surveys. The settlement surveys on hand are—Applications and revision surveys, 2,752 acres; educational reserves, 7,000 acres; lands for settlement, 99,563 acres: in all, 109,315 acres. At present four surveyors, Messrs. Hallett, Wilson, Price, and McNicol, are engaged in settlement surveys, and Mr. Tone is daily expected to join Mr. McNicol in the Tautane Reserve. There will be prepared for the market within the next four months 14,000 acres of pastoral land, and by next autumn 30,000 acres of bush-land in the Woodville and Tautane districts. There are 167 miles of roads on hand for survey, which includes nearly all the new lines of roads that are likely to be required in this district. In the Waikare-Mohaka Block alone some eighty miles of roads are wanted to open up the country and give access from one block to another. The Native Land Court surveys on hand amount to 521,928 acres. It is proposed to employ Mr. Hallett on the Waikare-Mohaka Block directly he can be spared from the more pressing settlement surveys. The blocks in the Seventy-Mile Bush that passed the Native Land Court on a sketch-plan some ten years back have never been surveyed, and, as the Government has refused to advance the cost of the surveys, it is quite likely they will remain on hand for some considerable time. I anticipate that 80,000 acres will pass the Native Land Court at an early date and be surveyed, but as to when the remaining 304,928 acres will be surveyed seems very uncertain.

HORACE BAKER, Chief Surveyor.

TARANAKI.

Astronomical.—On the completion of the triangulation from Wellington a remarkable discrepancy became apparent between the geodesical and astronomical latitudes, or, in other words, the latitude deduced from triangulation in terms of Mount Cook, Wellington, and the astronomical value assigned to Marsland Hill by my observations in 1874 with a 7-inch transit theodolite. It amounted to nearly 13″, representing about a quarter of a mile on the surface of the earth. In December last I obtained the 12-inch altazimuth belonging to the department and observed at Marsland Hill, New Plymouth. The result of eleven nights' work, during which fifty-four pairs of stars were taken, gave 10″ discrepancy, slightly reducing it from what I made ten years previously with the 7-inch theodolite. As New Plymouth is about sixteen miles due north of Mount Egmont I was anxious to see what effect it would have on the plumb-line. I proceeded to Hawera, which is about twenty-three miles distant from the mountain, but not quite due south of it. Here, to my surprise, the discrepancy increased from 10″·03 at Marsland Hill to 19″·94. Further south I went and observed at Patea, expecting to decrease the amount, which I did, but to a very small degree, making 19″·27. Finding that these two stations, which were much further removed from Mount Egmont than Marsland Hill, gave tolerably accordant results, I looked upon them as probably being about the normal for the locality; but on observing at Pukearuhe, forty miles to the north-east of Mount Egmont, I was again met with a surprise by finding the astronomical latitude of that place almost in terms with that at Marsland Hill. The investigation as far as I have at present pursued it reveals this: that the deflection of the plummet is southwards along the northern coast and northward on the southern coast, and that the cause is not to be looked for in Mount Egmont alone, but in the interior of the district generally. I intend pushing this interesting and important investigation further by observing at Midhurst and Pungarehu, both of which places the previous results would point to as being along the central line of the cause of the disturbance. It may be remarked that the density is not seaward, as has so often been observed. The instrument used has proved that it is capable of giving good results, as will be seen from the attached details of the observations. It cannot be expected to compare with a zenith telescope, but it may be reasonably presumed that the final results are but a fraction of a second from the truth. The "probable error" at the different stations works out from 0″·13 to 0″·15.

Pukearuhe Observatory.

Inst. 12in. Altazimuth. Observer, T. Humphries.

Date.	Pairs.		Latitude.	Diff. from Mean.	Nightly Mean.
1884.			° ′ ″	″	′ ″
June 23..	585	595	38 53 57·60	·82	
	608	613	53 58·40	3·38	
	639	622	53 57·10	·32	
	639	657	54 00·05	3·27	
	660	657	53 56·05	·73	
	677	689	53 54·95	1·83	
	692	695	53 57·60	·82	
	705	695	53 57·35	·57	
	712	709	53 59·20	2·42	
	705	723	53 55·10	1·68	38 53 56·66
	727	732	53 57·50	·72	
	746	736	53 57·50	·72	
	746	754	53 55·95	·83	
	774	776	53 56·15	·63	
	774	770	53 56·25	·53	
	783	770	53 56·25	·53	
	791	789	53 56·40	·38	
	797	810	53 55·15	1·63	
	804	810	53 56·50	·28	
24..	567	559	53 59·20	2·42	
	567	622	53 57·95	1·17	
	639	628	53 57·35	·57	
	654	657	53 59·65	2·87	
	660	689	53 55·85	·93	
	692	695	53 56·65	·13	
	705	695	53 58.95	2·17	
	712	709	53 56·40	·30	
	712	723	53 58·70	1·92	38 53 57·19
	727	732	53 57·50	·72	
	746	736	53 54·90	1·88	
	746	754	53 55·70	1·08	
	774	770	53 53·30	3·48	
	783	789	53 56·25	·53	
	791	789	53 58·10	1·32	
	797	810	53 57·45	·67	
	804	810	53 58·40	1·62	
25..	567	559	53 55·55	1·23	
	585	595	53 58·50	1·72	
	608	613	53 57·25	·47	
	639	622	53 57·00	·22	
	654	657	53 57·15	·37	
	660	657	53 56·75	·03	
	660	709	53 54·85	1·93	
	712	709	53 58·15	1·37	
	712	723	53 58·10	1·32	38 53 56·55
	727	732	53 55·45	1·33	
	774	754	53 58·65	1·87	
	774	770	53 59·80	3·02	
	783	789	53 55·10	1·68	
	791	789	53 55·65	1·13	
	797	810	53 55·15	1·63	
	804	810	53 56·45	·33	
	818	820	53 53·95	2·83	
	818	824	53 52·95	3·83	
	834	838	53 58·00	1·22	
			55) 372·80	73·40	
			38 53 56·78	1·33	

Probable error ± 0″·15.

Marsland Hill Observatory.

Inst. 12in. Altazimuth. Observer, T. Humphries.

Date.	Pairs.		Latitude.	Diff. of Mean.	Nightly Mean.
1883.			° ′ ″		° ′ ″
Dec. 29..	144	141	39 3 59·9	2·05	
	170	166	3 55·9	1·95	39 3 58·07
	190	179	3 58·41	·55	
30..	170	166	3 58·6	·75	
1884.					39 3 56·70
Jan. 18..	195	202	3 54·8	3·05	
	243	229	3 59·8	1·95	39 3 58·00
	270	254	3 56·2	1·65	
22..	243	229	3 58·1	0·25	
	270	254	3 56·5	1·35	39 3 57·00
	270	273	3 56·4	1·45	
24..	243	229	3 58·5	·65	
	248	254	3 58·4	·55	
	270	254	3 55·9	1·95	39 3 58·05
	270	273	3 59·4	1·55	
25..	243	229	3 58·0	·15	
	244	254	3 59·4	1·55	
	248	254	3 57·3	·55	
	270	254	4 00·0	2·15	
	277	273	3 55·5	2·35	39 3 57·81
	283	287	3 56·5	1·35	
	311	287	3 55·4	2·45	
	320	318	3 59·2	1·35	
	320	332	3 59·0	1·15	
29..	248	287	4 00·5	2·65	
	283	287	3 56·8	1·05	
	311	287	3 57·9	·05	
	311	314	3 57·8	·05	39 3 58·06
	318	314	3 54·9	2·95	
	320	332	3 59.8	1·95	
	320	333	3 58·7	·85	
Feb. 1..	248	254	3 58·9	1·05	
	270	254	3 59·0	1·15	
	270	273	3 57·2	·65	
	277	273	3 58·4	·55	39 3 58·24
	277	287	3 56·5	1·35	
	283	287	3 56·3	1·55	
	311	314	3 59·4	1·65	
	320	332	4 00·2	2·35	
2..	248	287	3 58·9	1·05	
	277	287	3 57·8	·05	39 3 57·87
	283	287	3 56·8	1·05	
	283	314	3 58·0	·15	
3..	270	273	3 57·4	·45	
	277	273	3 59·1	1·25	39 3 57·86
	283	287	3 57·1	·75	
6..	248	254	3 57·4	·45	
	270	254	3 57·7	·15	
	277	287	3 57·5	·35	
	283	287	3 56·0	1·85	
	311	314	3 58·6	·75	39 3 57·73
	318	314	3 58·4	·55	
	320	332	3 59·5	1·65	
	320	333	3 56·7	1·15	
	338	333	3 57·8	·05	
			424·1	63·30	
			39 3 57·85	1·172	

Probable error ± 0″·13

For tables of Astronomical and Geodesical Latitudes see page 36.

Latitude of Hawera.

Inst. 12in. Altazimuth. Observer, T. Humphries. Trig.-station LV.

Date.	Pairs.		Latitude.	Diff. from Mean.	Nightly Mean.
1884.			° ′ ″		° ′ ″
May 2 ..	443	430	39 35 41·50	·11	
	468	459	42·25	·64	
	468	469	42·20	·59	
	474	469	39·30	2·31	
	474	479	39·30	2·31	
	521	530	41·15	·46	
	554	540	41·85	·24	39 35 41·25
	554	559	41·75	·14	
	567	559	40·25	1·36	
	585	595	41·00	·61	
	585	628	39·40	2·21	
	639	622	40·70	·91	
	654	657	42·05	·44	
	660	657	44·80	3·19	
5 ..	567	595	42·40	·79	
	585	595	45·35	3·74	
	608	613	42·00	·39	
	639	622	43·45	1·84	39 35 42·73
	654	622	40·75	·86	
	660	689	43·00	1·39	
	677	689	42·20	·59	
	435	438	39·90	1·71	
	443	459	42·90	1·29	
	468	459	44·05	2·44	
	474	479	41·20	·41	
	474	488	39·55	2·06	
	491	507	41·35	·26	
	493	498	41·55	·16	
	493	496	41·60	·11	
	505	496	42·15	·54	39 35 41·37
	521	530	42·05	·44	
	554	530	39·90	1·71	
	567	559	40·20	1·41	
	567	595	40·90	·71	
	608	595	41·45	·16	
	608	613	39·75	1·86	
	655	628	39·85	1·76	
	660	689	43·80	2·19	
	677	689	42·60	·99	
12 ..	468	469	42·45	·84	
	474	469	40·55	1·06	
	474	479	40·95	·66	
	493	488	43·80	2·19	
	493	496	40·90	·71	
	505	496	41·65	·04	
	521	530	43·85	2·24	
	521	540	44·10	2·49	
	554	540	43·15	1·54	
	554	559	39·90	1·71	
	585	595	42·85	1·24	39 35 41·67
	608	595	42·55	·94	
	608	613	40·90	·71	
	639	657	38·90	2·71	
	660	657	40·60	1·01	
	677	689	41·40	·21	
	692	689	39·55	2·06	
	692	695	43·05	1·44	
	705	700	40·35	1·26	
	705	695	43·60	1·99	
	712	743	39·95	1·66	
			60) 2496·40	73·84	
			39 35 41·61	1·23	

Probable error of final result ± ″·13

Patea Observatory.

Inst. 12in. Altazimuth. Observer, T. Humphries.

Date.	Pairs.		Latitude.	Diff. from Mean.	Nightly Mean.
1884.			° ′ ″		° ′ ″
June 2 ..	774	766	39 45 35·80	2·20	
	774	770	35·40	1·80	
	783	789	33·75	0·15	
	791	789	31·50	2·10	
	797	810	32·20	1·40	39 45 33·67
	804	789	36·10	2·50	
	818	820	32·50	1·10	
	818	824	32·65	0·95	
	834	789	33·10	0·50	
3 ..	567	559	34·25	0·65	
	585	595	33·25	0·35	
	608	613	35·10	1·50	
	608	622	33·65	0·05	
	639	622	34·05	0·45	
	654	657	32·30	1·30	
	660	657	33·30	0·30	
	677	689	36·60	3·00	
	692	695	30·40	3·20	
	705	695	32·05	1·55	
	705	700	32·80	0·80	
	712	700	33·20	0·40	39 45 33·51
	712	723	32·65	0·95	
	705	732	33·10	0·50	
	746	736	33·25	0·35	
	746	754	36·35	2·75	
	774	766	33·40	0·20	
	783	789	33·45	0·15	
	791	789	32·05	1·55	
	797	810	32·95	0·65	
	804	789	35·55	1·95	
	818	820	33·45	0·15	
	818	824	33·55	0·05	
4 ..	639	622	35·10	1·50	
	639	628	35·15	1·55	
	654	657	32·25	1·35	
	660	657	32·40	1·20	
	677	657	32·90	0·70	
	677	689	36·75	3·15	
	692	695	30·80	2·80	
	705	695	34·55	0·95	
	712	700	35·10	1·50	
	712	723	36·15	2·55	
	727	732	34·70	1·10	
	746	736	34·25	0·65	39 45 33·68
	766	770	35·20	1·60	
	774	770	31·05	2·55	
	783	770	33·65	·05	
	783	789	36·70	3·10	
	791	789	34·00	·10	
	797	810	31·30	2·30	
	804	789	34·95	1·35	
	818	820	31·45	2·15	
	818	824	32·45	1·15	
	834	838	30·05	3·55	
			54) 194·60	72·70	
			39 45 33·60	1·35	

Mean error of single observation 1″·35
Probable error of final result ″·15

Standard.—The true bearings have now been carried to Mokau, the northern boundary of the district, and eastward from Pukearuhe to the Wanganui River. The bearing has been thrown direct to Mokau from Marsland Hill, New Plymouth, a distance of forty miles, and this without the aid of heliostats. Our major triangulation, embracing 120,000 acres, has been extended by Mr. H. M. Skeet across to the Wanganui River; and next season we hope to complete all in that direction, closing on to several stations in the Auckland District. We have already connected with one of the points, but not to a side, consequently have as yet no comparison. Topography has been combined as far as it can be achieved in a densely-wooded and rugged country with triangles ranging from seven- to ten-mile sides. Thus we have most valuable information as to the general lay and character of a portion of the district which hitherto was unexplored and unknown.

Minor Triangulation.—This has also been forest-work, and covers 79,000 acres. It extends northward to Mokau, and then fifteen miles into the Auckland District. This latter portion was done in connection with the settlement surveys we are undertaking for that district. Topography has been combined, as is usual here.

Settlement Surveys.—The completed work under this head is low, viz., 13,725 acres. This is

due to our strength having been mainly directed to the completion of the West Coast Commission surveys and those of the Native Reserves Trustee, which, in both cases, were for settlement purposes, but are not so classed, being tabled under separate headings. The whole has been forest-work: 9,581 acres of it lies at the foot of Mount Egmont and behind the Waimate Plains. The cost per acre appears high, but there are several causes combining to produce this. It is in a locality where there is no triangulation within ten miles. This means extra labour on all the circuit traverses, and, besides this, back-lines have been cut, and pegs put in at all corners of the sections, which heretofore had not been done in forest lands. The remaining 4,144 acres is north of Mokau, in the Auckland District. The cost has been increased by its out-of-the-way position, and the difficulties attendant upon Native interference as to boundaries, reserves, &c., but which are of such a nature as could not be classed under the head of "Native detention." We have on hand at the present time of rural work about twenty thousand acres, some of which will be completed shortly. The small amount finfshed during the year has in no way retarded settlement, we being well ahead of the market at the present time. There are about fifty thousand acres that have been offered still unsold. Had it not been for the advantages offered by and the ready acquirement of the Native leases in the open land along the coast we should doubtless have had to push this class of work faster.

Native Land Court Surveys.—There is only one block in hand, comprising thirty thousand acres. The plan of this is in the office, but there is a little more to do in the field before the work can be passed, so that it will not appear in this year's return. A few months since we intended to make the surveys of the Mokau-Mohakatino and Mokau-Parininihi Blocks, which were before the Native Lands Court at Waitara. But the Natives, for reasons of their own, objected to its being undertaken at present. I have, however, little doubt that during the ensuing year their objections will be removed and the work go on.

West Coast Commission.—Here we have 28,092 acres, costing 2s. 3d. per acre. As I predicted in my report of last year, the work has a high rate, and I feel it necessary to again point out some of the causes. First, a number of the allotments are isolated and very much scattered. They are mainly burial-grounds, sacred places, and old favourite haunts. The areas vary from a quarter of an acre upwards. These have naturally necessitated much loss of time in rough travelling, as they are all in the forest and distant from our settlement surveys. Second, nearly the whole of the remainder has been the locating of Compensation Court awards, a large number of which were only thirty-seven acres each; and the locality in which they had to be placed as directed by the Court was such as, owing to its ruggedness, was quite unfit for sections of such areas, more especially as it was forest-land. In the open land a large number were as small as twelve and a half acres. Taking the foregoing into consideration, it is only surprising that the rate is not higher.

Reserves Trustee.—This year we have subdivided 17,409 acres of the reserves on the coast set apart for Natives by the West Coast Commission. It has been cut into sections averaging 150 acres each, at a cost of about 1s. 6d. per acre. I do not anticipate any more of this work being required during the coming year, as, notwithstanding that there are considerable areas of these lands not yet subdivided, they are either in places the Natives wish to hold to cultivate or are some miles in the forest.

Roads.—A road has been surveyed for a main line from Pukearuhe to Mokau. The Parininihi Range was the greatest obstacle, as it rises very abruptly on both sides, and terminates at the coast in a cliff of 800ft. Last year we had succeeded in getting through about four miles inland with a great detour, but have now, after numerous trials, found a line two miles from the sea, with steepest grade 1 in 10. The exploring has been costly, but the advantages it affords over the former one in avoiding about nine miles of bush road and shortening the main road by at least four miles quite justifies the outlay.

Other Work.—The amount, £3,037 14s. 3d., appearing on the return of field-work for "Other work" requires some explanation. It includes a sum of £1,563 already expended on the survey of twenty thousand acres of settlement-work in progress, and £802 for back-pegging the sectional work in the forest at the back of the Waimate Plains and Mountain Road. Part of the back-pegging above referred to has been done with an ordinary survey party, but the greater portion by aid of the settlers' labour. The total area back-pegged is 25,227 acres, costing the department £802, or 7¾d. an acre. The department undertook the provisioning of the survey parties sent in to explore for the railway route to Te Awamutu, which required a good deal of attention and management. The stores had to be sent from New Plymouth to Tongaporutu, thence taken up that river by canoe, and subsequently carried to a dépôt in the interior by Natives. I went down and made the preliminary arrangements, contracts with the Natives, &c., and left Mr. O'Donahoo on the ground to carry them out, which he was successful in doing. With the exception of the first dépôt being robbed by the Wanganui Natives, all went smoothly. This transport service was a great advantage, as it left the explorers free for their particular work. All expenses were paid by the Public Works Department through me, so that none of them are included in the return, further than Mr. O'Donahoo's salary during the time he was away exploring the Mimi Valley to Waitara and the coast railway route over Parininihi Range.

Inspection.—During the year I have made thirty-one inspections, visiting every survey party, with one exception. I have also visited the various road parties several times. The surveys generally I may speak of with confidence and state that, as a whole, it is first-class, and reflects great credit on both staff and temporary officers. Those surveys executed some time since in the bush country at the back of Waimate have of late stood the severest test in the cutting of the back lines of sections for back-pegging. In the 25,000 acres done there has not been found a single serious discrepancy, thus proving to a certainty that the circuit traverses upon which the whole was based are excellent. The mean error in traverse closes for the year is 1·8 links per mile; the maximum, 5 links. Besides travelling on inspection, I have been about the district at different times with members of the West Coast Commission and the Reserves Trustee on matters connected with their particular work.

Office Work.—At the commencement of this year we were quite overwhelmed by the amount of field-work that came in just before last report. It took some months before any material impression was made on it; but it is nearly all clear now, together with that completed this year. We are now applying ourselves to the arrear work of block sheets, bringing the maps of early surveys on to sheets, and general work that has of necessity been laid aside while the rapid influx of surveyors' field maps continued. There have been 81 surveyors' plans checked; 45 block sheets compiled; 25 plans drawn for Public Works Department and Crown Lands Commissioner; 492 tracings; 1,099 plans placed on Crown grants, 1,216 on certificates of title, 476 on Native leases, and 21 on perpetual leases; and 27 surveyors' maps (land transfer) checked and passed. During the ensuing year I will endeavour to have the whole of the district lithographed on a scale of one mile to an inch. This is work that has been purposely delayed, as, owing to the amount of new work and rapid changes in all parts, the district has been in a state of transition. Lithographs of the triangulation will be prepared, and I hope to be able, in my report next year, to state that in this respect we have nearly all the district brought up to date.

Proposed Future Operations.—Mr. Skeet will extend the triangulation northwards, meeting that of the Auckland District. It will be a work of a very arduous nature, as the country is rugged and covered with forest, moreover it will present many difficulties in the way of getting in supplies. In the settlement-work we have to complete what we have in hand at Mokau, Egmont, and Kaupokonui. Our attention will also be given to preparing lands for sale eastward of Inglewood at Ngatimaru, in the Waitara Valley, a few thousand acres eastward of the Mountain Road near Te Roti, and a further quantity may be inland of Whareroa or Whakamara. The back-pegging of the sold land in the forest betweed Inglewood and Waimate will engage two surveyors at least, as there are about 130,000 acres to deal with. At present we have three surveyors at the work, the settlers finding the labour.

I have, &c.,

THOS. HUMPHRIES, Chief Surveyor.

ASTRONOMICAL AND GEODESICAL LATITUDES.

Station.	Relative Position of Mount Egmont.	Number of Nights.	Number of Pairs of Stars.	Extreme Range of Nightly Means.	Mean Diff. of each Observation from General Mean.	Probable Error.	Astronomical Latitudes.	Latitude, in Terms of Wellington Astronomical.	Diff. Astronomical and Geodesical.
North Coast.	Bearing. Mls.			"	"	"	° ′ ″	° ′ ″	"
Pukearuhe ..	222° 36½	3	55	0·64	1·33	0·15	38 53 56·78	38 53 45·38	11·50
Marsland Hill, N. Plymouth	180° 16	11	54	1·54	1·17	0·13	39 3 57·85	39 3 47·82	10·03
South Coast.									
Hawera ..	330° 23½	4	60	1·48	1·23	0·13	39 35 41·61	39 35 21·67	19·94
Patea	326° 38	3	54	0·17	1·35	0·15	39 45 33·60	39 45 14·33	19·27

WELLINGTON.

Triangulation.—Several members of the staff were employed in extending the trigonometrical surveys over back country, in accordance with your general instructions. Mr. Llewellyn Smith performed this duty in the North-west Wairarapa district, from the summit of the Tararua Ranges to the Tiraumea River, and has thus prepared the way for settlement surveys in an excellent class of country. Mr. J. D. Climie succeeded in covering and mapping nearly a quarter of a million of acres, completing our knowledge of the country at the sources of the Wainuiomata, Hutt, Tauherenikau, and Waiohine Rivers. The other officers who materially aided to advance this important class of survey—the Messrs. John and Joseph R. Annabell—carried it over the district lying inland of the Waitotara coast settlements. The out-turn of work is up to the average area, and has been accomplished at a low cost, the country operated upon being generally of a broken and inaccessible character, rendered intricate and costly to work in by the dense forest growth. A comparison of the duplicate values of common sides of 49 closures made during the year gives a mean discrepancy in distance of 1·1 link per mile, the greatest difference being 2·9 links per mile, and the least 0·0 link per mile. The mean error in the summation of the angles of the triangulation executed during the year is 13″, the greatest being 48″, and the least 0″. The comparison between the meridians of Mt. Cook and Opaki initial points obtained through the minor triangulation gives a mean convergence of 34′ 53″, the computed convergence is 34′ 22″, the greatest difference between the computed and observed convergence being 39″ and the least 19″.

Settlement Surveys.—The small area sectionized was due to there being insufficient funds devoted to road construction, it being considered inadvisable to carry on the sectional pegging in advance of the clearing and forming of the road-lines. Large areas in the Wanganui, Manawatu, Makuri, and Kaiwhata districts were explored, and roads laid off and graded. Twenty miles of lines were levelled over and plans and specifications for contract prepared in a complete manner by Mr. A. Dundas. Messrs. Northcroft and Ashcroft are credited with the bulk of the area actually pegged off; the former's survey comprised the hills between the Kopuaranga and Wangaehu Rivers, north of Mr. Stuckey's estate; and that of Mr. Ashcroft included the Paratieke and Karewarewa Blocks, in the Mangawhero district. The whole area is covered with bush. As a rule the back pegs of sections were inserted. The low cost of Mr. Ashcroft's work is worthy of note. A full comparison of traverse circuit and trig. check closures have been scheduled, for your information, which will be found to indicate the requisite attention to precision, having regard to expedition and economy.

Native Land Court Surveys.—In explanation of the limited area defined, account must be taken of the operations of former years which enabled the Native Land Courts to determine the ownership of the tribal lands throughout and adjacent to the settled districts in this part of the North Island.

The larger claims were defined by Mr. J. A. Thorpe, authorized surveyor, being the Murimotu, Ngarukehu, and Te Kapua Blocks. Messrs. Llewellyn Smith, John Annabell, and Ashcroft surveyed the Taumatakaihuka, Waipuna, and Otamoa Blocks. The remaining unsurveyed Native lands include the great central territory between the Wanganui River and the Ruahine Ranges, and a few tracts in the Wairarapa District.

Road- and Railway-line Surveys.—You will observe that the mileage of these important surveys exceeds that of any previous year; credit has been taken for Mr. J. A. Robertson's work in the Chatham Islands, which amounts to ninety-two miles. Messrs. Annabell, Sicely, and Tone were the other chief contributors to the total.

Miscellaneous Surveys.—The amount expended in compliance with the demands of public departments, County Councils, and Road Boards amounted to £3,747. You are fully conversant with the practical utility and importance of the services thus rendered by this office.

Office.—Mr. Mackenzie, the Chief Draughtsman, and the office staff made such headway with the arrears of mapping that, after attending to the ordinary routine duties of recording, reducing, and compiling the plans received from the field officers, some time was devoted to preparing maps for publication. Plans of several of the survey districts about Wanganui were finished, the standard plan of Marton was published, and an excellent map of the Tuhirangi and Upper Wanganui districts was constructed. The land-transfer branch, under Mr. Mason's charge, had a reduced amount of work to attend to, due no doubt to the general depression; but what had to be done was efficiently performed. The correspondence and accounts were managed by Mr. Wright in a satisfactory manner: exclusive of enclosures, ordinary returns, &c., the number of letters received and despatched amounted to 4,183; in addition, much of the Land Office business devolved upon him, and was well and promptly attended to and kept under by working overtime.

Inspection.—In the course of my visits to the field I found that the surveyors were conforming closely to the principles of survey set forth in the regulations, and that they worked with evident zeal, care, and ability, with a close attention to thoroughness and completeness in every detail. Several members of the staff, including Mr. Dundas, gave me valuable assistance in inspecting the work of authorized surveyors.

Proposed Operations for 1884-85.—Subject to your approval it is proposed to extend triangulation and topographical surveys inland of Wanganui, Otairi, and Otamakapua on the West Coast, through the agency of Messrs Dundas and Annabell; and in the Porirua, Maungaraki, Kaiwhata, and Makuri districts by utilizing the services of Messrs. J. D. Climie, Greville, and Crombie: it is also intended to obtain data for completing topographical plans of the settled districts near Wanganui, Porirua, and Masterton. It is proposed, with regard to settlement surveys, to employ Mr. John Annabell on West Tokomaru; Mr. Ashcroft on Otairi; Mr. Dundas on Waitapu; Mr. Greville on the Makuri-Puketoi Block; Mr. Llewellyn Smith on the Crown lands between Mangaone Block and Mauriceville, and, with assistance, upon sectionizing the Alfredton Education Reserve, the Wangaehu-Rangitumau Block, and the hills west of Masterton and Carterton. Mr. Climie will cut up any suitable lands west of Greytown and Featherston which would be likely to be occupied if put up to competition; Mr. Crombie will continue the subdivision of the Kaiwhata and Wainuioru Crown lands, which surveys are already well advanced. The completion of these settlement surveys depends upon the appropriation and prompt expenditure of funds in road construction, and in some instances upon the location of the railway-lines. Messrs. Smith and Climie have also to cut and peg some back lines for settlers in the Kopuaranga and Mungaroa Blocks. Townships or village settlements will have to be laid off sooner or later at Pahiatua, Makuri, Otairi, and in the Upper Pohangina district. It is probable that Messrs. Dundas, Llewellyn Smith, Climie, Annabell, and Crombie will be called upon to define Native land claims in the Waitotara, Upper Rangitikei, Taueru, Kaiwhata, and South-east Wairarapa districts. Standard surveys of Palmerston North and Masterton suburbs have to be completed, important lines of traffic have to be surveyed, and lines of road have to be laid off and legalized in various localities by the surveyors in charge of the districts, as empowered by warrants which have been issued to them. The usual amount of miscellaneous surveys must be anticipated on requisitions from the Public Works, Native Land Purchase, and Education Departments.

J. W. A. MARCHANT, Chief Surveyor.

TABLE showing TRAVERSE CLOSURES, 1883–84, Wellington.

Surveyor.	District.	Number of Closures.	Number of Traverse Lines	Total Length of Closed Traverse Miles.	Mean Ratio of Error per Mile.		Class of Country.
					Mer.	Perp.	
					link	links	
J. Annabell	Waipakura, Ikitara, Wairoa	24	407	28·5	1·6	1·3	Mostly open and hilly.
A. E. Ashcroft ..	Waipakura, Mangawhero	23	923	33·4	2·8	1·7	Mostly bush hills.
J. D. Climie ..	Wellington Town ..	2	67	3·2	0·7	1·2	Open hills.
..	Port Nicholson ..	3	436	4·3	6·25	..	Rough bush hills.
C. Crombie ..	Wainuioru, Kaiwhata ..	8	378	15·5	2·4	2·0	Rough bush hills.
R. Greville	Port Nicholson, Kopuaranga, Mangaone ..	14	567	20·5	4·1	2·9	Fair bush country.
H. J. Lowe	Otahoua	3	280	18·0	1·4	2·5	Fair bush country.
G. Northcroft ..	Kopuaranga ..	13	667	22·1	1·8	1·3	Rough bush country.
L. Smith	Kopuaranga, Mangaone	2	53	9·7	1·2	1·6	Fair bush country.
N. J. Tone	Otahoua, Tiffin ..	16	186	46·2	1·6	2·1	Mostly open country.
	Totals	108	3,964	201·4			
	Mean	..	..	..	1·9	1·9	

MARLBOROUGH.

UNDER the pricipal headings of the general return it will be seen that the work of the year in the field consists of major and minor triangulation, with topography, 505,983 acres; section survey, 1,470; gold-mining surveys, 31 acres 3 roods 30 perches; roads, 30¼ miles.

Triangulation.—During the past season 505,983 acres of major and minor triangulation, with topography, have been completed by Mr. Wilson, viz., 363,905 acres of major and 142,078 acres of minor, at a total cost of £979 18s. 9d., at the rate of 0·25d. per acre for the major and 0·64d. per acre for the minor. This triangulation was commenced on the 21st October, 1882, and finished on the 18th October, 1883. The general features of the country covered by this work, and the survey districts embraced therein, as well as the results of the check with the base of verification at Kaikoura and the closings with the Amuri circuit in Nelson District on sides Highfield-Cookson and Highfield-Percival respectively, have already been given, in my report for 1882-83.

Connection of North and Middle Islands' Triangulation.—This was the next work taken in hand, in December last, by Mr. Wilson (on his return after two months' leave of absence), by means of observations taken to heliotrope signals, the results in every instance being satisfactory, and most creditable to the surveyor intrusted with the duty of taking the observations for this important work. The data used in calculating the connection across the Strait was line E–Weld cone, derived from the co-ordinate distances of the major triangulation. With this calculated base and checking through a series of triangles on E,-Ref. coast, a side of the major trig., the difference was 2·1 links in a distance of 104,383 links. Again, when applied to line Kaukau-Mana, a side common to Marlborough and Wellington surveys, the difference was found to be 7·7 links less than Wellington in a distance of 84,177 links, or 0·75 links in a mile; further, when continued to the Wellington base line at Korokoro and compared with the actual measured distance, the difference was 1·3 links less in 14,270 links, or 0·73 links in a mile; and the line Kaukau-Matthews, a side of the major trig., showed only a difference of 0·8 links in 118,768 links, when calculated from Mr. Climie's co-ordinate distances. Taking side E–Ref. coast, as the basis of calculation, the result gives a still nearer agreement with the Wellington survey. The following shows the differences of the various checks, with their different bases :—

E–Weld cone	...	324177·4—Base from co-ordinates of major trig., Marlborough	
E–Ref. coast	...	104383·2—Side of major trig.	=0·16 link per mile.
		104381·1—From co-ordinates	
Mana–Kaukau	...	84177·6—From base, Marlborough... ...	=0·75 " "
		84185·3—From Korokoro base, Wellington ...	
Korokoro–East base		14270·0—From base, Marlborough... ...	=0·73 " "
		14271·3—Measured base, Korokoro, Wellington	
Kaukau–Mathews...		118768·2—From base, Marlborough... ...	=0·054 " "
		118769·0—From base, Wellington	

During the last three months of the season Mr. Wilson has been pushing forward major and minor triangulation up the Wairau Valley to connect with Nelson circuit near Tophouse. At present there are about 370,000 acres of major and 57,500 acres of minor triangulation sufficiently advanced for observation, at a cost to date of £283 17s. These triangulations cover parts of the Onamalutu, Avon, Pine Valley, Mount Olympus, Patriarch, Leatham, Raglan, Spray, and Hodder Survey Districts. This work was commenced on the 26th March, 1884, and the country over which it is carried is generally rough and high, with bush in parts. No cadet assisting.

Section Surveys.—The eleven sections under this heading are separate selections in eight different localities. Ten of these adjoin old magnetic surveys, the inefficient ground-marking of which has in this, as in all similar cases, been the cause of much loss of time to the surveyor in identifying and re-establishing. The remaining seven sections are revision surveys of unconnected old surveys in various bays in the Pelorus Sound. The cost per acre of these surveys includes the cost of connection to trig. stations, and they are all heavily timbered. In these section and revision surveys there were four closed traverses; average length of each 1½ miles; greatest closing error, 1·6 link per mile; mean ditto, 1·1 link.

Mining Surveys.—Of gold-mining surveys 31 acres 3 roods 30 perches, in three sections only, have been applied for and surveyed. In this district surveys of this character have hitherto been very limited, and, as they are generally situated in inaccessible timber country, requiring a special journey as applications are sent in, the cost of survey is therefore much greater than ordinary section survey.

Roads.—Thirty miles and a quarter of road surveys have been completed during the year. Twenty-eight miles of the above have been surveyed through the Kaituna and Pelorus Valleys, for the purpose of acquiring the lands trespassed on by the present line of road, and making the necessary exchanges of the old roads for the new ones. About twenty-four miles pass through partially-cleared bush and the remainder through open fern land. Throughout the whole distance this road abuts on and intersects freehold lands, 110 sections in all (chiefly granted from old defective surveys), the position of which had to be determined afresh before the intersections of the section boundaries with the road-line could be arrived at and pegged off. As the original surveys of the timbered lands were all done on independent needle bearings, and nearly all the original lines and marks were lost or obliterated, a great deal of the surveyors' time was taken up in the preliminary work of re-establishing these lines and putting them on true bearings. The office work, too, was very considerable in adjusting the old and new work, and plotting the work to three chains as well as ten chains to an inch. With these difficulties to contend with, it is not a matter of surprise that surveys of this nature are expensive to execute. Sixteen miles of this road were returned in last year's report as partly done, the field-work only being completed, at a cost of £281 15s. 4d. The balance, 2¼ miles, of the above is an engineering road survey, put in hand with as little delay as possible after the receipt of instructions. The particulars of the country traversed

by this line are given in my report on roads to open up Crown lands. The road has been levelled and graded with ascending grades all the way, the steepest grade being 1 in 15 and the mean grade 1 in 80.

Other Work.—This comprises miscellaneous work not returnable under the general return, such as sub-triangulation, 11,800 acres, at 1¼d. per acre, nearly all in forest country, with a great deal of cutting in breaking down from the hills. Also two sections (2 roods 23 perches), business-area allotments, at Deep Creek, laid off for the Warden of the gold fields.

Office Work.—From the detailed returns it will be seen that twenty certificates of title in lieu of Crown grants, in triplicate (which completes the Crown grants of land alienated in the district up to October, 1883), and ninety-eight ordinary certificates, in duplicate, containing in all 216 allotments, and representing 216 marginal plans, have been prepared during the year. Twenty-five deposited plans of sixty-three allotments were examined, passed, and traced. These, with the addition of 110 transfers, fifteen applications and seventy-six mortgages examined, represent the work done for the Land Transfer branch. The work done for the Crown Lands Department includes the preparation of deferred-payment licenses, gold-mining leases, pastoral leases and licenses and tracings. Seventeen surveyors' plans were received and examined. They have been plotted on to their respective block-sheets, and eight new block-sheets were constructed. One Land Transfer and five Crown-grant record-maps were constructed this year, and, together with those previously constructed, have all been brought up to date. These maps have necessarily been confined to the districts in which the surveys are in connection with the triangulation, and the compilation of fresh record-maps can only be proceeded with by degrees as points become determined and tied to the triangulation in the course of section or Land Transfer surveys. It is found quite impracticable to compile maps of the settled districts where the whole surveys are detached and based on magnetic meridian with no fixed points to control them. The work done for other departments includes maps and other information supplied to Road Boards, Sheep Department, Postal Department, Property-Tax Commissioner, &c. Assistance was rendered Mr. A. D. Wilson in completing the plans of his last season's triangulation. In conformity with your request, a map of the Marlborough District was compiled, to a scale of four miles to an inch, in which all the latest information was given. A considerable amount of difficulty was experienced in joining the districts that have been triangulated with those that have not; nevertheless, when published, it will be by far the most accurate and useful map of this district that has yet appeared.

Proposed Operations for 1884–85.—This year commences with major and minor triangulation over the upper part of the Wairau Valley: stations partly erected and ready for observing; 170 acres of section survey, and 165 acres near the mouth of the Hapuka River to be subdivided into one- to ten-acre sections for sale under village-settlement conditions. Upon the completion of the above triangulation I propose, with your concurrence, that Mr. Wilson extend major triangulation over the Waihopai and upper part of the Awatere Valleys, as recommended in my last report. I also propose, during the coming season, if Mr. Goulter can be spared for the work, to commence a standard survey of the principal road-lines in the settled districts of the Wairau Plains. At present the only points of reference for the Land Transfer surveyors are the trig. stations, and these, from their distance apart, the flatness of the country and the planting of trees and other obstacles, entail a large amount of survey in determining the bearings and distances in every separate survey of a property, and are most difficult of check. The erection of the standard points will obviate these difficulties, afford convenient reference stations on lines on true bearing in connection with the trig. points, facilitate the demarcation of properties, and be much appreciated by the surveyors and the public in reducing the cost of these surveys. The determination of these positions will also be of material service in compiling the Crown-grant and Land Transfer record-maps, a work at present, so far as the old surveys are concerned, impossible, for want of fixed points in connection therewith to control their compilation.

HENRY G. CLARK, Chief Surveyor.

NELSON.

Minor Triangulation without Topography.—An area of 42,000 acres, at a cost of ¾d. per acre, has been done by Messrs. Smith and Murray, for the purpose of fixing points in connection of sectional work.

Topographical and Trigonometrical.—During the year 220,067 acres have been surveyed, at an average cost of 1·4d. per acre. Of this area 149,000 acres have been executed by Messrs. Smith and Thompson in the Amuri Circuit, and comprises a portion of last season's work. Mr. F. Smith carried triangles over the main range down the Ahaura Valley, connecting with the Westland triangulation on side Granite to Bell Hill, with a difference of 1·5 in a length of 32826·5 links, or an error of 0·366 per mile, the distance between the two bases, Hanmer Plain, Amuri Circuit, and Westland Circuit, being about 120 miles. The difference of the altitudes of stations on the two sides of the main range was found, on closing on Bell Hill, to be 3ft. The observed convergence between the meridians of the Amuri and Grey Circuits was 59′ 17″·10, and the computed convergence from the triangulation 59′ 15″·64, a difference of 1″·46. In twenty-four triangles the mean summation error is 5″·8, and in five polygons the mean closing error is 1″·6. Mr. F. Thompson carried on triangulation northerly, between the eastern side of the main range and the Upper Clarence River, as far as Lake Tennyson, in the Maling District. By this work he has been enabled to lay down the boundaries of several large leases not laid down, and to determine some disputed run boundaries. The work of these officers (assisted by Mr. F. Greenfield, cadet, who has been in charge of a working party during the year) has been very arduous, and involved much privation on account of snow and bad weather, and the difficulty of carrying provisions and tools in a very rough country, mostly covered with bush to a height of nearly 4,000ft. In the Hope and Tadmor Districts 57,217 acres, at a cost of ½d. per acre, has been done by Mr. T. Sadd, in order to give the necessary checks on settlement surveys, and the sectionizing of a block of land in the

latter district. A close was made on Mr. Ellison's triangulation, side C–F, Motupiko District, with a difference of 3″ in bearing and 1·6 links per mile in length; and on Mr. Carkeek's work, side L–S, of 3″ in bearing and 0·7 links per mile in length; in altitude, in closing on L, a difference of 2·8 feet. In the Reefton district 140,000 acres have been in progress during the year by Mr. G. Bullard. Most of the field-work has been completed, but, owing to the party having kept the field so late, the work cannot be returned for this year. This officer, formerly a cadet, deserves mention for the perseverance he has shown in carrying triangles over a rough and high district, and for careful field-work. In the Buller District 13,850 acres, at a cost of ½d. per acre, has been done by Mr. J. Snodgrass, extending triangulation northerly to the Mokihinui, for the purposes of sectional work.

Sectional Surveys.—There have been 474 sections surveyed, comprising 67,790 acres, averaging 143 acres per section, being 195 sections more than in previous year. There being less demand for mining surveys during the past season has enabled more progress to be made with sectional surveys. Owing to the freedom of selection before survey in a mountainous and heavily-timbered district such as this, in which mining is carried on in isolated localities where there is no other settlement, there must necessarily be a certain number of applications for land made which are both difficult to reach and costly of survey; these have to await the opportunity of being attended to, and sometimes for a considerable time. It is generally some of these cases which are brought forward as instances of "delay in survey" against the department. In those parts of the district where real settlement would be materially hindered by delay every effort has been made, both to overtake arrears and to dispose of current applications with the staff at our disposal. At the end of last season the arrears amounted to 90,873 acres in 618 sections; at the close of the past season, on 30th June, the arrears were 72,922 acres, comprised in 411 sections. The largest proportion of these are situated in the bays of the Nelson Circuit and in Amuri, and I hope to dispose of most of these during next year. Mr. T. Sadd has been employed during the latter part of the year in sectionizing a block of 10,000 acres in the Tadmor district, through which a dray-road has been constructed under the vote for opening up Crown lands: 2,700 acres have been done, and the remainder is in progress. Mr. A. W. Carkeek completed a survey of the Taitapu (Native land) Block, Collingwood district, comprising 88,350 acres, for the purposes of the Native Lands Court. Inspection was made of the work, and the usual necessary checks forwarded.

Gold-mining Surveys.—Owing to the extra efforts made in the previous year to overtake the rush for these surveys, and fewer applications having been made during the year, the arrears on the West Coast have now been disposed of, and affairs are very quiet in that part. Triangulation still needs extension in the Buller district to check mining surveys up the Mokihinui River, which, at present, are yet isolated, and which must be done next season if possible.

Mineral Leases.—There has been a demand for mineral-lease surveys about the Aniseed Valley and ranges near Nelson, principally with a view to copper, for which ore a good deal of prospecting has been done, both in driving and sinking. One or two companies have been formed and are carrying on operations, which have been so far successful as to lead to sanguine anticipations for the future. A contract is in hand for opening up a dray-road in the valley, towards the cost of which the Government have given a subsidy, the construction being supervised by the department.

Town Survey.—Mr. J. Montgomerie has been engaged on a standard survey of part of the Town of Reefton, which has become necessary on account of Land Transfer work, and also on an extension of sections; the whole of the original plan of the town not having been surveyed, and now required. This work is returnable during next year.

Land Transfer.—There have been 161 plans examined and passed, and 466 plans placed on certificates of title, and the work recorded on the record-maps.

Road Surveys and Construction.—The details of these works form the subject of a separate report attached.

Office Work.—During the year one cadet has entered the department. I have to regret the sudden decease of Mr. J. Thomson, Computing Draughtsman, the loss of whom is much felt in the office, and whose place has not yet been supplied. There have been 410 leases and licenses prepared for an area of 123,051 acres, including renewals. A map of the district has been compiled on a scale of four miles to an inch, based on the triangulation as far as it has been executed. Lengths of standard-bearing lines, connecting geodesical stations between initial stations of circuits, have been determined, differences of latitudes and longitudes, convergence of meridians have been computed, on which the map has been constructed and a copy forwarded to head office for publication. Forty-two new block plans have been made, on which more or less new work has been plotted, six plans for printing have been prepared, and revised application-maps for district offices. Mr. H. Trent, Chief Draughtsman, was absent on leave for two months, being the first leave for ten years, and Mr. Carrington one month. Much work is yet required to be done in the office in compiling Crown-grant record-maps, district application-maps from new surveys, to replace the old ones, and preparation of plans for publication, which cannot yet be undertaken, as the staff cannot keep pace with the current work, which is beginning to get into arrear.

Future Operations.—Messrs. Smith and Thompson have seventy thousand acres of triangulation, the field work of which is completed, but not plotted. During next season with this work they will be enabled to locate the boundaries of some large leases not yet laid down on the ground, and which are necessary to locate other applications in the Amuri Circuit. A block of land of about ten thousand acres in the Maruia Valley, Grey Circuit, will require to be sectionized for lease or sale. It is proposed that Mr. G. Bullard should extend the triangulation he has in hand over this block, connecting with the stations on the main range of the island erected by Mr. F. Thompson, and joining the triangulation brought up by that officer from the eastward; Mr. T. Sadd to complete the sectionizing of the ten-thousand acre block in the Tadmor District. Mr. W. D. Murray to survey the Wakapuaka Block of fifteen thousand acres, Native land, and extend triangulation northerly to the bays and sounds connecting with Marlborough. In these are situated old applications of some

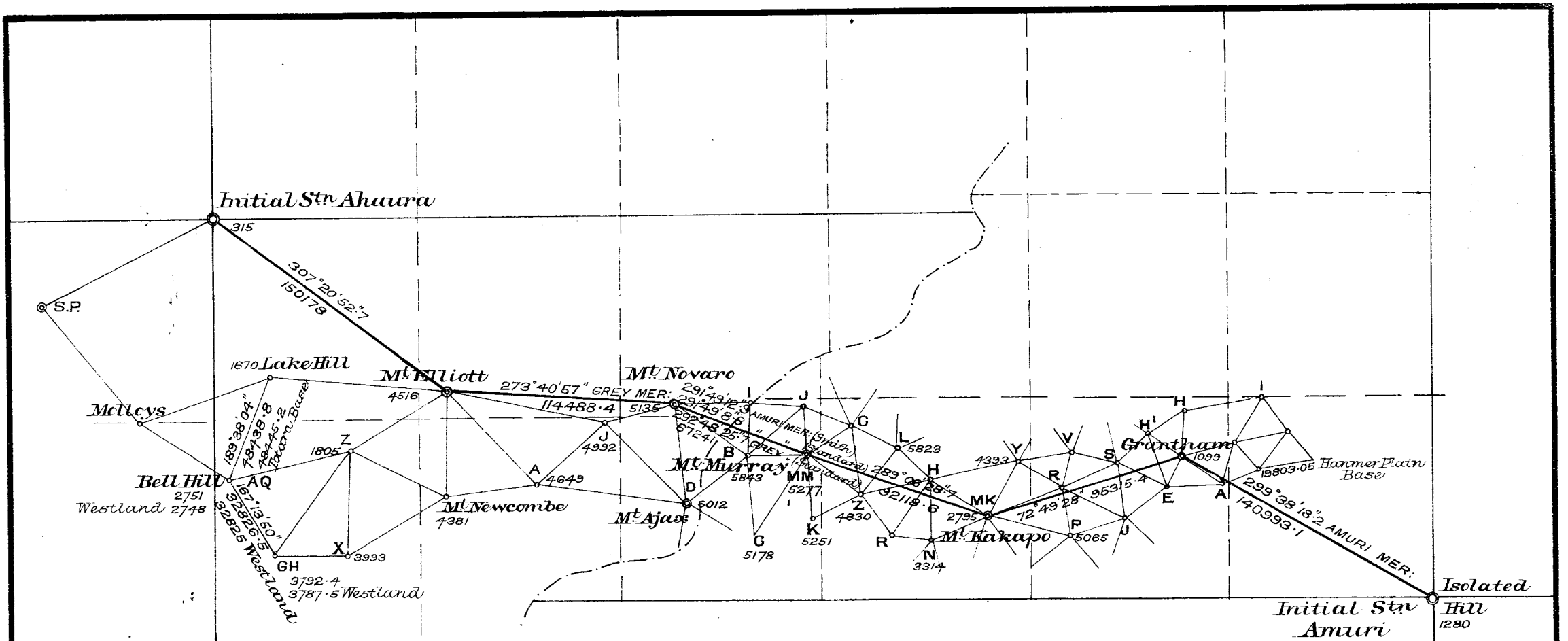


DIAGRAM SHEWING CLOSINGS OF TRIANGULATION

from the Hanmer Plains Base, Amuri District East Coast,

on sides of triangles from Grey and Westland Bases, on West Coast.

F. S. Smith, District Surveyor, F. A. Thompson, Assistant Surveyor; 1884.

8 7 6 5 4 3 2 1 0 8 16 24 MLS:

H. McCardell Litho: Wellington Sept. 1884.

J. S. Browning Chief Surveyor, Nelson

years standing not yet surveyed, which he will locate. Mr. J. Snodgrass to bring up arrears of isolated applications in the Buller Valley, and to extend triangulation northerly from Westport to the quartz-reefing localities of the Mokihinui and Tumble-down Creek, connecting with the Karamea Circuit. Mr. C. Galwey to survey the isolated applications in the Ahaura Valley, revising and connecting old sectional work at the Haupiri with Mr. F. Smith's triangulation, recently carried over that part. Mr. J. Montgomerie to complete standard surveys and extension of Towns of Reefton and Black's Point. The remainder of the staff on arrears and current sectional and mining work, as may be required. JOHN S. BROWNING, Chief Surveyor.

WESTLAND.

Major Triangulation.—Area completed, 169,270 acres, at a cost of 0·45d. per acre. It covers the Okuru and Arawata and portions of the Matakitaki, Governor's Pass, Turnbull, and Cascade Survey Districts. The work was executed by Mr. G. J. Roberts in his usual careful and thorough style, and his closures are again very satisfactory. This major triangulation extends to the Open Bay Islands abreast the Okuru River and halfway between Jackson's Head and Arnott Point, thus including an area of 55,500 acres covered by water, and not comprised in the above 169,270 acres. If allowance for it is made, the cost of his survey will be reduced to 0·3d. per acre.

Topographical and Trigonometrical Survey.—Area completed, 185,750 acres, at a cost of 1·84d. per acre. Of these, 140,950 acres (within the Jackson's Bay Circuit) of minor triangulation, with topography, were the work of Mr. Roberts; while the rest, about 45,000 acres, comprise circuit traverse work by Messrs. Murray, Smyth, and Wither. The closures in the latter work are satisfactory: the average error is three links per mile, as against 3·4 links per mile returned last year. The details of traverse closures are as under:—

TABLE OF CLOSURES, 1883 TO 1884.

SURVEYOR.	Length of Traverse in Miles.	Total Error in Links.	Error per Mile in Links.	Total Number of Trav. Lines.	Number of Trav. Lines per Mile.	Length of Traverse in Miles.	Total Error in Links.	Error per Mile in Links.	Total Number of Trav. Lines.	Number of Trav. Lines per Mile.
W. G. Murray	1·3	7·1	5·4	5	3·9					
	2·0	3·8	1·9	6	3·0					
	2·0	1·4	0·7	9	4·5					
	2·6	3·7	1·4	17	6·5					
	1·7	3·0	1·8	12	7·1					
						11·9	22·1	1·8	67	5·8
E. I. Lord	2·1	7·6	3·6	77	36·7					
	6·4	24·3	3·8	36	5·6					
	3·0	10·8	3·6	66	22·0					
	3·0	10·8	3·6	36	12·0					
	0·6	1·9	3·2	11	18·3					
						15·1	55·4	3·6	226	15·0
J. N. Smyth	6·6	36·3	5·5	84	12·7					
	1·0	2·9	2·9	13	13·0					
	2·0	7·5	3·7	14	7·0					
	3·2	8·0	2·5	30	9·4					
	2·5	8·0	3·2	30	12·0					
	2·5	3·5	1·4	22	8·8					
	3·3	5·0	1·5	27	8·2					
	5·7	16·0	2·8	33	5·8					
						26·8	87·2	3·2	253	9·4
R. Wither	1·7	7·0	4·1	23	13·5					
	2·7	12·4	4·6	37	13·7					
	1·9	5·0	2·6	46	24·2					
	3·0	8·7	2·9	26	8·7					
	2·2	1·5	0·7	12	5·5					
	2·4	10·6	4·4	18	7·5					
	3·1	3·1	1·0	3	1·0					
						17·0	48·3	2·8	165	9·7
Totals for district ...	...	...	...	...	...	70·8	213·0	3·01	711	10·0

Rural and Suburban.—9,300 acres, at a cost of 2s. 8·6d. per acre. The land surveyed consists to a great extent of small and isolated sections, and in many cases the labour involved in connecting with trig. stations has been very great, and thus the cost of survey is higher this year than at any of the previous years.

Town Section Surveys.—In the Borough of Ross, 126 allotments, at a cost of 11s. 8d. per allotment. Simultaneously with this survey twenty-eight permanent reference marks were fixed twenty-five links off the frontage lines at the intersection of all the streets. The Towns of Hokitika and Kumara remain still to be supplied with these standard reference marks. I hope to be able to attend to this during the current year.

Gold-mining Surveys.—510 acres, at 14s. 9d. per acre. Work in this department had fallen off considerably until about two months ago, when the discovery of a gold-bearing quartz-reef in Cedar

Creek, one of the tributaries of the Totara River, was made. Since then outcrops of quartz showing gold have been found in various places on the Mikonui and Totara slopes of the Greenland Range, which caused the usual feverish excitement amongst the population in the Totara and adjoining districts. The country where these reefs are situated is mountainous, broken and difficult of access, and it will be some time before the value of the discovery can be fairly tested. Meanwhile twenty-seven quartz-mining leases, ranging from seven to sixteen acres each, have been applied for; eighteen of these are already surveyed, and nine remain on hand. The receipts from mining surveys during the year amount to £328 3s. 6d.

Roads, Railways, and Water-races.—59½ miles, at £13 0s. 6d. per mile, comprising constructed-road traverses and surveys of new lines for construction. Amongst the latter are fifteen miles of which specifications, plans, and sections are prepared in triplicate ready for calling for tenders. The only railway survey was that of the Brunnerton line, ordered by you on the request of the Public Works Department. This survey was peculiar; it involved the pegging-off of centre line of rails with iron pegs at every chain, the survey of proposed deviations to take out curves, and the survey of the lands purchased from section-holders some ten years ago. The survey of the purchased lands was of all shapes and sizes, with areas rigidly fixed, and the position of their boundaries in many cases given in relation to works which were obliterated years ago. It gave a great deal of trouble, and proved expensive. In accordance with agreement entered into, the Public Works Department defray the greater part of the cost of this survey.

Office Work.—Attached hereto are miscellaneous returns giving particulars as to Crown grants and certificates of title prepared, Land Transfer work, and lithographs. The ordinary mapping work has kept pace fairly with the field-work completed. The block-maps are nearly up to date, but the triangulation maps and the topographical maps of many of the survey districts, as well as the preparation of a new set of application maps embodying the past two years' surveys, are in arrear. Plans of field-work done are furnished by every surveyor before he can take credit for it in his monthly returns, but, as you are aware, it is perfectly impossible for them to produce maps in their tents which can be accepted as standard record maps for the office. The damp climate, the dense bush, and the constant shifting about in districts generally devoid of roads or bridges, make it impossible to do so, and hence the greater part of what may be called the original mapping is thrown upon the few draughtsmen in the office. The plans the surveyors send in are little better than a guide to the draughtsman, who has to replot the whole from the traverse tabulations and the field-books.

General.—Field inspection has been attended to. Each of the field surveyors has been visited repeatedly, and on almost every occasion I remained a few days at their camp and applied checks upon their work. Diagrams and particulars of eight of these field checks I have forwarded to you. The road-construction works also had my personal supervision as occasion required. My absence from office during the year amounted to 120 days, seventy-two of which I spent in connection with the above duties, and forty-eight at a reconnaissance survey of the country between Cascade Plateau and Jackson's River on the north and Lake McKerrow and the Hollyford River on the south, upon which you find enclosed a separate report, and at the measurement of the base-line on Cascade Plateau. The latter, owing to the roughness of the ground and the bad weather at that time, has been a work of considerable difficulty; however, the result is satisfactory. The three measurements, after applying the corrections for temperature, reduction to sea-level, &c., are 16247·54, 16247·22, and 16247·26, the mean 16247·34 feet. The temperature was very variable: it ranged from 48° to 96° Fahr. during the measurements; and, as to the surface of the ground (the best line that could be found on the plateau), it was pretty rough, and a succession of "ups" and "downs" for a great part of its length. At one place the rise is 63ft. in 6 chains, at another 139ft. in 20 chains, and the difference in altitude between the east end and west end of base-line is 417ft., and the difference between the highest and lowest point in the base-line is 449ft. I note these circumstances in connection with the result of the measurements above given simply as an additional proof of the value of the appliances I make use of at this kind of work—neither cutting, grubbing, clearing, nor surface-levelling is necessary, the measurements are taken over every obstacle less than 4ft. high, and the result of the measurement of four different base-lines (Wataroa, Rakaia, Paringa, and Cascade Plateau) in that way has been uniformly satisfactory. I regret to say that Mr. Roberts found it impossible to close upon the Cascade base-line before the 30th of June, but he must have done so by this time, and I shall be able probably to inform you of the result in my next monthly report.

Proposed Operations, 1884–85.—The extension of the triangulation to Martin's Bay, even if for no other purpose than to rectify the errors which my late reconnaissance survey proves to exist in the coast-line on the old Canterbury maps, should be proceeded with. There must be a discrepancy of about a mile and a half between Cascade Head and Big Bay, and on the latest Admiralty chart some of the headlands of that part of the coast will be found from four to five miles out of position. However, as Mr. Roberts has now nearly overtaken the party employed at erecting the trig. stations, and as the country is getting more and more difficult, owing to the absolute want of anything in the shape of roads or tracks south of Cascade Plateau, I have decided upon giving the party erecting the stations a season's start, and employing Mr. Roberts instead at the triangulation of the north-east corner of Westland, to fill up the gap left between Arthur's Pass, Hurunui Saddle, and Lake Brunner, and in running the boundary between Nelson and Westland, the want of which work has repeatedly been felt in dealing with lands about the Crooked River. As for the rest of the surveyors, they will work up as far as possible and as found most pressing the arrears noted in my last abstract of surveyors' reports; and I am sure that the settlement surveys, at all events, unless a large amount of unforeseen work is thrown upon the department, will be brought up to date by the end of the current departmental year.

GERHARD MUELLER, Chief Surveyor.

CANTERBURY.

Minor Triangulation and Topography.—The accompanying return shows that 236,518 acres have been done, at a cost of £840 9s. 9d., or 0·85d. per acre, in country lying in the interior of the island, where it is only practicable to work in summer, and the surveys were necessary in order to fix the position of freeholds, to ascertain the nature and character of the country, and to enable the survey of the gold-mining leases to be made. Mr. Maitland, whose work in this class of survey has so often been favourably reported on, has, I regret to say, determined to leave the service.

Sectional Surveys.—On this work nine staff surveyors, one cadet, and one temporary assistant have been engaged, resulting (with the assistance which surrounding surveys afforded the offices at Christchurch and Timaru) in the completing, with very trifling field-work, of an aggregate of 41,967 acres, at a cost of £5,011 19s. 7d., or 2s. 4½d. per acre. This rate is no doubt high, but the work generally consists of sections of small area, much scattered and hampered by old surveys. The nearer the completion of the survey of sections bought under the free-selection system is approached the more expensive it becomes, if the rate is calculated at per acre; it may cost less to lay out a thousand-acre block on the plains than one acre surrounded by bad and doubtful work in the hills.

Inspection.—There has not been so much done as could be desired, so much of the Inspector's time having been occupied in other work, such as the correction of the property-tax estimate of the value of Crown lands, superintending the construction of roads, assessment of land to be offered for sale by public auction or by application, &c. Five inspection surveys have been made and duly reported to you.

Old Provincial Surveys.—Mr. W. C. Wright, of the Timaru office, has been fully occupied in compiling and, when necessary, revising these surveys in the field, calculating on the system now used surveys done under the old régime, and making the recent triangulation and sectional work the basis on which to embody the old. He reports having done nineteen sections, containing 430 acres, of the old work with sufficient accuracy to meet the requirements of the new, besides surveying twenty-two new sections, containing 784 acres, altogether at a cost of 11d. per acre. Similar work of combined old and new surveys has been completed under Mr. Shanks's supervision, in the Christchurch office, of eighty-six sections, containing 2,565 acres, at 12¾d. per acre (see heading "Sectional Surveys").

Gold-mining Leases—Have been surveyed in the Wilberforce by Mr. Pickett, under exceptionally difficult and trying circumstances, but at the cost of the lessees, who deposited with the Receiver of Land Revenue £15 for the survey of each lease, together £210, of which £153 18s. has been the actual outlay, which is to be passed to the credit of this department, and the balance is to be refunded to the lessees, the charges for each lease being based on the number of days occupied. The average height of these sections (leases) is 4,000ft. above sea-level, and they lie amongst mountains so precipitous that the higher pegs could not be driven, and indeed the marks have only been made and pegs put in at considerable peril to the surveyor and his men. Mr. Pickett, in his topographical plans and report, has furnished much valuable information concerning this almost unexplored region.

Land Transfer Surveys.—Mr. Munro, who has charge of the checking of plans sent to this branch of the Survey Office, reports that he has investigated the various titles, so far as the survey is concerned, of twenty-eight plans, containing 255 allotments, lodged under the Act; fifteen plans for public works and railways; twenty-three plans of road closures; and fifty-seven plans of applications for transfer. He remarks that, "by comparison with previous years, there has been a material decrease during 1883–84 in plans checked for deposit and documents referred to the office for checking of areas and descriptions, and a decrease of about one-fifth in number of ordinary certificates issued." In order to determine accurately the positions of holdings, standard surveys have been made by Messrs. Welch and Maitland in Akaroa and Timaru respectively, but, owing to the extreme accuracy aimed at, they have proved very costly; it is to be hoped that in the future the rate of expenditure for this class of work may not be so high.

Office Work.—Forty-two large and 127 small plans, with traverse sheets, have been received from the field surveyors, of which, and of those left last year, 37 large and 126 small have been passed as correct, and there remain unchecked, or held back on account of discrepancies, 45 large and 71 small plans; 10 block-sheets, 1 town and 3 district record-maps, have been constructed, and additional work placed upon a few of those formerly constructed in the Christchurch office; 13 block-sheets constructed and revised; and in 21 the adjacent work has been revised in the Timaru office.

Reduction Office.—One county map, that of Waimate, on a scale of 1 inch to the mile, has been made, and tracings of Geraldine and Akaroa completed for Wellington, besides one of Akaroa for the map-room. Of district maps, Akaroa and Pigeon Bay have been finished, and Okain's, Orari, Acland, Mount Peel, Kapunatiki, and Opihi are in preparation. Tracings for photo-lithography of the Hororata, Kowai, and Akaroa cannot be completed until the plots of some of the work are checked.

Crown Grants.—Forty-five grants of 52 sections, containing 1,969 acres, have been issued; 845 certificates of title of 1,437 sections, lots, or reserves, containing 175,388 acres, have been prepared; 1,718 certificates of area have been forwarded to the Chief Commissioners returning 177,185 acres. There remain to be done 154 Crown grants and 5,845 certificates of title.

PROPOSED OPERATIONS, 1884–85.

Arrears of surveys should apparently lessen very considerably year by year, when it is considered what few new purchases are made; but, owing to various causes, this lessening is not proportionate. By the subdivision of reserves into village allotments and the creation of new reserves, there are still 624 new sections, containing 24,705 acres, and 120 revisions, containing 11,468 acres, to be done, besides some large blocks of pastoral land to be vested in public bodies, which require to be surveyed before they can be Crown-granted.

Gold-mining Leases.—There is little doubt that in the summer some more of these leases will be taken up, and must be surveyed.

Triangulation and Topography.—It is to be hoped that the triangulation will be continued, and thoroughly good topographical maps made of the back country, similar to those admirable maps of the Amuri district prepared by the Nelson surveyors.

WALTER KITSON, Acting Chief Surveyor.

OTAGO.

I have had twelve staff surveyors and one private surveyor at work in the field, and four cadets. In the head office of this district eleven staff assistants and four cadets, and three temporary assistants; in the district offices, two assistants.

Minor Triangulation and Topography.—There were 347,489 acres of trigonometrical and topographical survey finished during the year, at an average cost of 0·96d. per acre. The surveyors engaged were Mr. Barron on Mount Buster District, Mr. Seaton on Hawkdun and Lindis Districts, Mr. Gibson on Crown, Cardrona, Tarras, and Cromwell Districts, and Mr. Cook on Upper Taieri and Hawkdun Districts. The country triangulated was high and rough, some of it nearly 7,000ft. above sea-level, and the weather experienced during the survey was unusually adverse, being wet and misty during the summer, while, as winter came on, the excessive amount of snow which fell compelled Messrs. Seaton and Cook to abandon further work for the season altogether. Mr. Seaton reports the wind so strong that the flags could not be kept on the trig. poles, and Mr. Cook that his theodolite, although securely planted, was on one occasion blown over and smashed. The field-work of 200,000 acres of Lorn and Rockyside Districts (not included in the before-mentioned area) was also done by Mr. Wilmot; as the maps, however, have not come in, the cost only of this work has been included in the year's return. The work unfinished by Messrs. Seaton and Cook has been handed over to District-Surveyor Barron to complete during the next summer in the usual course of his operations.

Rural and Suburban Section Survey.—An area of 81,310 acres has been surveyed into sections of a mean area of 160 acres each, at a cost of 1s. 1⅛d. per acre. Twelve staff surveyors and one private surveyor have carried out this work. The greater cost of this class of survey, as compared with that of last year, is due to the exceptionally wet summer and many of the surveys being in the bush, while others are small and scattered over the interior of Otago. The principal rural surveys have been made in the following districts: Kawarau, Dart, Poolburn, Leaning Rock, Tiger Hill, Blackstone, Maniototo, Swinburn, Budle, Nenthorn, Hummock, Hummockside, Waikouaiti, Wendon, Wendonside, Greenvale, Otara, and Waikawa, and they embrace the greater portion of the area kept out of Otago runs in 1882–83 for agricultural settlement. The sections and roads have been carefully pegged, and the grades tabulated regularly, so that the practicability of the latter may be readily ascertained at any time.

Town Section Surveys.—Under this class I include the resurvey of part of the Township of Sutton, surveyed by Mr. Cook, and the village settlements, being subdivisions of sections previously reserved at Hawea Flat, Glenkenich, and Tuapeka West, surveyed respectively by Messrs. Campbell, Mackenzie, and Seaton. An area of 431 acres has been laid off into 252 allotments, at an average cost of 19s. 10d. per allotment.

Standard Survey of Port Chalmers.—This work has been very well carried out to completion by Mr. Langmuir, to whom I intrusted it, the time occupied being about six months. The difficult nature of this work was not merely due to the hilly character of Port Chalmers, and the bustle of some of its streets during the day-time, but to the following causes: No original survey peg was found in any place within the town, and very few original positions of pegs could be satisfactorily ascertained from the evidence of settlers. This was found to be a very serious drawback in deciding on a basis of operations or starting-point, and was rendered more so on account of many very palpable errors and encroachments by fences on the street-lines, together with the absence of any connection of the original survey with a triangulation. In determining the position of blocks and street-lines, therefore, an approximation only has been aimed at, and which has been decided after long and careful consideration of the lengths of block frontages as occupied compared with the original Crown record-map distances for the same lines. Generally the blocks as occupied were found not to exceed in area or in frontages the blocks as shown on the Crown record-maps, and it is satisfactory that this close agreement holds good in George Street and other of the important business streets. Very solid standard stone blocks have been sunk, set in concrete, to mark the point where streets meet, and iron trig. tubes at less important points. The measurements were laid down with a steel band adjusted to the Dunedin standard, temperature being taken and everything done as carefully as for a base-line in triangulation. The closes average a difference of 0·0485 of a link, or about one-third of an inch in 10 chains. The vertical angles of all standard lines were observed by the theodolite with great accuracy, and the levels of all the principal points deduced therefrom. The altitudes, having their origin at the Geodesical Station, Observation Point, Port Chalmers, are consequently on the same datum as the altitudes of the Otago triangulation, viz., low-water mark of spring-tides. In regard to the town belt of Port Chalmers I have to add that its outer boundary was surveyed and pegged by Mr. Langmuir, an agreement having previously been signed by the mayor and the freeholders interested to accept the determination of this office as to its position. The maps, which are all beautifully and accurately drawn, comprise a general map of the town, showing the standard lines and points—four sheets, on a scale of 1 chain to an inch, showing the details of the standard survey, and three sheets of longitudinal sections of the street-lines. Copies of all the above-mentioned plans are being now made for the Corporation of Port Chalmers.

Gold-mining Surveys.—Four staff surveyors and one private surveyor have been engaged in the survey of the gold-mining claims during the past year in the Queenstown, Cromwell, Clyde, and Naseby office districts. The area so surveyed is 778 acres in fifty-nine sections, at a cost of 10s. 8d. per acre on an average. The surveys, and particularly in the Queenstown district, are unavoidably costly, as they

are scattered about, and often in very inaccessible localities, which cause the surveyor to make long journeys to overtake them at different times. They cannot be compared, as to cost, with any block surveys, and yet they are of very great importance to the gold-miner, as defining in a legal manner the ground which he can hold as his own in searching for the rich deposits of gold or gold-bearing quartz which he has previously prospected.

Road, Railway, and Water-race Surveys.—Of this class of work a total of 37⅞ miles has been surveyed, at a cost of £9 9s. 6d. per mile. This includes 3¼ miles of an engineering survey by Mr. Strauchon of the extension of the Tokanui Gorge road towards Waikawa Harbour, and five miles done by Mr. Wilmot to open up Crown lands for settlement at the head of Lake Wakatipu. There are also 21½ miles of water-races included in these totals.

Run-Improvement Valuations, &c.—The valuation of improvements on runs took three surveyors about a month each in the middle of summer, being the time when they could be least spared from triangulation on hand. This, together with reporting on pastoral deferred-payment sections and other Crown lands office work, was done at a cost of £230 7s. 8d.

Other Work.—This includes a survey for the Marine Department of a lighthouse site at Waipapa Point, a considerable amount of work for the Wardens in the district offices, and of work for the Colonial Secretary's Office, the Defence Department, Native Department, and Tuapeka County Council.

Survey Parties and Inspection.—As previously stated, twelve survey parties have been at work and one private party during the year. Sixteen inspections of parties and offices have been made by me, and four checks on field-work have been sent to the Head Office. The surveyors generally have been careful and efficient in their work, the pegging and the grading of roads being well attended to. Several surveyors have had to shift long distances to new work, and three of them have been transferred to other districts. As a rule, the maps sent in by the surveyors are neatly drawn, the best being those of Messrs. Strauchon and Langmuir. Mr. Cadet Calder continues to improve his drawing, and produces exceedingly creditable plans. Mr. McLean's office at Lawrence is distinguished by the very systematic and neat arrangement of its plans and records.

Dunedin Office Work.—The returns of work put through this office for the past year by Mr. Skey and the staff of assistants is not much short of that of the previous year, and all have made fair progress in the amount and style of work turned out. We have still some arrears to make up, including the drawing of new copies of such Crown record-maps as have been very much damaged by being handled for many years by the public. There will also be the making of Land Transfer index-maps this year. Mr. Skey, Chief Draughtsman, has prepared and passed 72 Crown grants, 266 certificates of title, 135 perpetual leases in triplicate, 189 pastoral licenses in duplicate, 130 deferred-payment licenses in duplicate, and 43 occupation licenses in duplicate. Mr. Thompson has checked and passed 128 plans sent in by the staff, 50 road and railway plans, 35 agricultural leases, and 54 gold-mining leases. Mr. Browne has prepared and recorded in duplicate 58 mining leases, 37 agricultural leases, 5 exchange leases, and 10 miscellaneous leases, in addition to the usual routine work of compiling, &c. Mr. Wadie has done all the work connected with the new run maps and preparation of plans for licenses, besides other duties. In the Road Office Mr. Fynmore has recorded 55 new roads and roads to be closed on working plans, on road district and county maps, reported on 41 road matters, taken out areas of new roads and railways, and prepared tracings and examined maps in connection with lithographs being prepared at Head Office. Mr. Runcie, the Accountant, has received and entered 310 plans, copied 884 vouchers, and recorded 4,556 letters and reports, besides attending to all the ordinary correspondence and keeping accounts, &c. A considerable part of my own time this year was devoted to valuations for the Property-Tax Department, along with the Commissioner of Crown Lands.

Land Transfer Work.—In this branch of office-work Mr. Thompson has checked and passed 45 plans, Messrs. Treseder and Mackay 92 applications, 1,393 transfers, 992 mortgages in duplicate, 1,194 draft certificates, 88 leases in duplicate, 907 plans put on certificates in duplicate. Besides these, Mr. Treseder has had a great part of his time engaged in searches, and work in connection with these, for the information and guidance of the District Land Registrar.

Lithographic Branch.—Mr. Percival has reduced and lithographed 51 block-maps and 2 photo-lithographs, from which 13,710 copies have been printed, besides numerous circulars or forms. Mr. Ross, Lithographic Printer, has printed from 53 block-maps transfers, 2 of which were photo-lithographs, 13,710 copies, also 3,000 forms. The photo-lithographs are produced by Mr. Ross at his private studio, and are very successful works of art; indeed they leave nothing more to be desired. Besides other duties, Mr. Bain has mounted 440 maps.

Proposed Operations for 1884–85.—A number of blocks still remain to be laid off in sections of the areas reserved out of runs lying in Kawarau, Lower Wanaka, Blackstone, Maniototo, Teviot, Benger, and Waikawa districts. These will be overtaken by the ordinary staff. Spotting surveys and mining claims also continue to accumulate from time to time, and there are a good many on hand at present. In the work of triangulation, Rockyside and Lorne maps have to come in, and in the Hawkdun district the unfinished work, which has been interrupted by winter, will be completed by Mr. Barron. As a preliminary to the future triangulation of the Tautuku Bush, I would suggest that an exploration be made this year round the mountain-tops on the north side of the bush, where trig. stations have been established, and continued by boat from Port Molyneux round to Waikawa Harbour. By this means a rough map may be got ready, which would be of great use, and much information could be got as to the quality of the bush, the soil, and open land (if any), as well as regards the possibility of opening up the country by roads or bush-tramways. I should also be glad to have more exploration sanctioned to the west of the Te Anau Lake, similar to Mr. Hay's mode further south during last year. I feel sure, from conversations I have had with explorers about the Te Anau, that a fairly good road can be found either to George, Caswell, or Bradshaw Sounds, while the distance does not exceed twelve miles.

W. Arthur, Chief Surveyor.

SOUTHLAND.

Field-work.—Under the heading of "Rural and Suburban Surveys" there have been executed during the year 396 sections, embracing 35,170 acres, at a cost of 1s. 7½d. per acre. In view of the acreage cost, due allowance must be made for the fact that upwards of 180 sections, covering more than five thousand acres, were in bush. Under the head of "Town Section Survey" there have been executed 184 sections, comprising 243 acres, some sixty of these sections being in bush. The work done under the head of "Minor Triangulation" has been merely nominal, and consisted simply of the extension of one or two triangles from the main Waiau triangulation to localities where sectional surveys were required. An analysis of the surveys shows that some eighty-two sections, embracing 19,173 acres, have been laid off within blocks that were expressly set apart on the maps for agricultural deferred-payment purposes. These blocks were situated chiefly in the Centre Hill and Takitimo districts, several of them lying on the eastern bank of the Waiau River, between Manipori Lake and the mouth of the Wairaki. This locality is somewhat remote at present, but, as means of communication improve, there can be little doubt that the sections will gradually be taken up. On the Waimea Plain, a short distance from Longridge Station, some fifteen sections, comprising 3,350 acres, were laid off for the Otago School Commissioners, being the subdivision of a large education reserve, the lease of which had previously expired. The sections were disposed of partly for cash and partly on deferred payments, very satisfactory prices being realized in every case. Under the head of "Rural and Suburban Survey," in addition to the sections mentioned, there were thirty-two purchased areas, comprising 6,091 acres, the survey fees of which, amounting to £421 4s. 4d., had been deposited by applicants under the system of "free selection before survey." These outstanding surveys have now been worked up to date, applications having been very few during the last year or two, owing, no doubt, partly to depressed times, and partly to the fact that, outside of deferred-payment blocks and freehold land, the choice is not now very extensive. During the year some eleven saw-mill areas have been surveyed, each covering 200 acres. This is a smaller return than was handed in last year, and would seem to indicate what is apparent in other ways, that the saw-milling industry in this district is less prosperous than it used to be—that the demand is smaller, and that prices are thus necessarily low. There can be little doubt, however, that the depression is merely temporary, the extensive forests possessed by Southland, and the extent of railway communication, being substantial guarantees of the permanence and future prosperity of the trade. A few mineral areas (coal and lignite) have been surveyed during the year, the remainder of the work chiefly consisting of the subdivision of bush and other reserves, the subdivisions as a rule being offered for sale partly on the cash and partly on the deferred-payment system. I might mention that some nineteen sections, comprising some 180 acres, were surveyed at Athol for the Southland High Schools Board, two or three sections being also laid off near Nightcaps for the same body. In addition to the sections in Waimea Plain, some suburban sections adjoining the Township of Edendale were also laid off for the Otago School Commissioners. The field-work, so far as I have been able to test it in the field and the office, has been very faithfully and efficiently done, the steel band securing closures in chainage that would hardly have been possible under the old linked and now superseded chain.

Office Work.—In addition to the usual routine work of the office, which could scarcely be shown in a tabular form, I have to report that there have been prepared during the year 353 certificates of title in lieu of Crown grants and 30 Crown grants proper. The Crown certificates being in triplicate, it will be seen that the preparation of these grants involved the making of 1,089 plans. The number of plans examined and passed for deposit in the Land Transfer Office was 29. These comprised 106 original sections, which were subdivided into 877 allotments, embracing an acreage of 44,102 acres. During the year there were 108 applications to bring land under the Land Transfer Act. These of course involved careful examination previous to their acceptance by the District Land Registrar. The number of certificates of title issued under the Land Transfer Act was 763. The plans of these being in duplicate, it will be seen that the number of same put upon titles was 1,526. To keep pace with the Crown and ordinary certificates issued it became necessary to prepare 101 record-maps. In regard to the preparation of lithographs, I have to report that thirteen drawings of townships, village settlements, deferred-payment blocks, &c., were made by us, and printed by a local lithographic printer, the number of prints turned out being 1,850. One of these was a large drawing of that portion of the County of Fiord which had previously been explored by Mr. District-Surveyor Hay. In addition to the above, ten drawings, four of which were tracings, were prepared of districts, townships, &c., and forwarded to Wellington for purposes of photo-lithography. Five of these embraced the survey districts of New River, Waiau, Lothian, Mataura, Mabel, and Lindhurst. One embraced an extensive subdivision of educational reserve land on the Waimea Plain, another showed the high schools endowment subdivision at Athol, the remainder being drawings of the Townships of Mataura, Gore, and Manipori. I may state that plans of a number of runs were prepared as a basis of lease during the year, and some 120 plans were inserted on deferred-payment licenses. Ere passing from the matter of district maps, I may state that in Southland only four districts remain to be lithographed, these being the sparsely-settled districts of Takitimo, Wairaki, Centre Hill, and Eyre, a considerable portion of each district being purely pastoral country. The utility of these district maps is very great indeed, and I hope ere the next annual report is required that all the survey districts in Southland will have been lithographed. We are now engaged with the preparation of a general topographical map of the Invercargill Land District, roughly embracing as it does the Counties of Southland and Wallace. As the Southland District proper is intimately connected geographically and commercially with many of the survey districts across the Mataura, a map of this description will meet a much-felt local want.

General.—By far the greater proportion of the deferred-payment blocks that stood upon the maps have now been surveyed. The work in prospect does not at present look very extensive, though there are one or two localities where surveys are fast becoming necessary to meet the wants of settlement. One of these is between Seaward Forest and the coast, and extending from Block V., Oteramika Hundred, to the Mataura River. Were a road to be constructed from Oteramika open

through the bush in a central position so as to tap the available land below I have no doubt that, with deferred-payment advantages, at least a considerable area would be taken up. The land in this locality has hitherto been shunned by settlers, and remains in a state of nature. That some of it at least has capabilities for something better will, I think, be shown were the country to be connected with the settled district of Oteramika by means of a passable road-line. Seaward Forest itself, and probably also Longwood Forest, when the respective railways are finished, and after the land has gone through the hands of the saw-miller, will no doubt be gradually coming up for subdivisional survey preparatory to settlement. While these are now the chief localities where Crown lands in bulk are left, there are of course a good many reserves scattered through the district that will sooner or later have to be cut up and offered for sale.

JOHN SPENCE, Chief Surveyor.

HEAD OFFICE.

I have the honour to furnish the annual report of the work of the Head Office of the Survey Department, for the year which ended on the 30th June last.

The correspondence has been of the average quantity, embracing about 8,958 letters, circulars, warrants, descriptions, and such-like, received and despatched, exclusive of minutes and memoranda upon papers.

The accounts passed for payment are, in number, about 8,385, and amount to £214,323 13s. 3d., viz., for Surveys, £136,031 9s. 1d., and for Road formation, to open up the land surveyed, for sale, £78,292 4s. 2d.

The drawings and maps published during the year were—25 district maps, scale 80 chains to an inch; 1 trigonometrical plan, scale 80 chains to an inch; 23 sale plans, chiefly on a scale of 40 chains to an inch; 12 other plans for reports, &c. The time of one draughtsman during the first half of the year was occupied in preparing descriptions and plans in connection with the Counties, Road Boards, and Licensing Acts, but latterly not much of this kind of work has been required.

One draughtsman is required to keep up the record of land sales, &c., on the county maps in this office. Five draughtsmen are now entirely engaged upon the preparation of maps for publication, chiefly 80-chain district plans and maps to illustrate parliamentary papers. One draughtsman is engaged on a geographical map of the northern part of the Middle Island, scale 4 miles equal 1 inch, and one draughtsman is engaged almost entirely in correcting and touching up lithographs and photo-lithographs.

I am glad to call your attention to the excellent drawing and writing of Messrs. Grant and Wilson; to the great improvement made by Messrs. McCardell and Taylor; and to the well-executed hill-work of Mr. Malings. Mr. Flanagan's writing is still the best, but some of his juniors are approaching very closely.

Mr. Hugh Boscawen during the year has drawn on stone and on transfer paper twenty-two pictures of New Zealand scenery, an edition of which, embracing 33 pages, is now in the press.

In the Photographic Gallery 435 plates, 15in. x 15in., have been taken during the year, 208 of which were for the Survey Department, 103 for the Public Works Department, and 124 for other departments.

There have been lithographed from the above plates, and from drawings on stone and on transfer paper, 846 separate plans or other papers, of which 530,478 impressions were printed, viz., 239,955 for the Survey Department, 61,563 for the Public Works and Railway Departments, 47,377 for the Geological Survey, 21,900 for the Mines Department, and 159,683 for other departments. This is equal to about 680 reams of demy paper, or a weight of 8 tons.

A map-mounter is now almost constantly employed in preparing plans for this and other departments, and during the year he mounted 1,345 plans, lithographs, and tracings. In the previous three years the numbers were 1,717, 1,792, and 1,370 respectively.

I submit for your notice the increasing tastefulness of the publications issued from the Survey lithographic press. Efforts are made not only to display on a map, a diagram of what is to be exhibited, but also to give pleasing and striking effects by colours and tints. It is now, indeed, unusual to have a map to illustrate a railway route, report, or statement printed in black only. I notice with pleasure the care and skill of the Master Printer, Mr. Earle, and also the excellent work done and the pains taken in proving by Mr. John Craig, Assistant Printer, whose press comes most directly under my notice. The maps issued with this report will, I think, testify the improvement and art of the publications of the lithographic press.

In the beginning of the present year I visited, by your instructions, the settlements at Martin's Bay and Jackson's Bay, and reported thereon.

In January last two officers assisted for a time with the heliotrope observations across Cook Strait, the calculations of the triangulation and the plan being executed by Mr. Grant.

A. BARRON,
Office Surveyor.

TABLES.

No. 1.—Abstract of the Surveyors employed and of the Work on Hand n each Provincial District on 30th June, 1884.

Chief Surveyors.	Surveyors employed.		Work on Hand.				
	Staff.	Temporary.	District.	Trig.	Settlement.	Native Block, &c.	Roads, Railways, &c.
				Sq. Miles.	Acres.	Acres.	Miles.
S. P. Smith, A.S.G. ..	23	13	Auckland	3,002	147,455	126,201	279
Thomas Humphries ..	6	6	Taranaki	156	17,000	30,000	3
H. Baker	5	5	Hawke's Bay ..	871	109,315	521,928	182
J. W. A. Marchant ..	9	5	Wellington	1,978	254,500	38,218	505
J. S. Browning ..	11	2	Nelson	328	112,795	..	25
H. G. Clark	2	..	Marlborough ..	625	335	..	..
G. Mueller	5	..	Westland	21,375	46,165	669	253
J. H. Baker (Walter Kitson, acting)	9	..	Canterbury	266	24,066	..	..
W. Arthur	7	1	Otago	375	24,535	..	4
J. Spence	2	2	Southland	..	12,673	..	..
Totals ..	79	34	..	9,976	748,839	717,016	1,251

No. 2.—Crown Grants and other Instruments of Title from the Crown prepared.

District.	Number.	Cost.	District.	Number.	Cost.
		£ s. d.			£ s. d.
Auckland	727	695 0 0	Westland	114	20 10 0
Taranaki	340	180 0 0	Canterbury	894	635 15 2
Hawke's Bay..	61	56 0 0	Otago	944	550 0 0
Wellington	500	85 13 10	Southland	383	120 0 0
Nelson	2	1 1 0			
Marlborough	20	7 10 0	Totals	3,985	2,351 10 0

No. 3.—Land Transfer Work.

District.	No. of Plans passed.	No. of Plans placed on Certificates of Title.	Cost.	District.	No. of Plans passed.	No. of Plans placed on Certificates of Title.	Cost.
			£ s. d.				£ s. d.
Auckland	231	852	993 0 0	Westland ..	279	229	32 11 10
Taranaki	27	1,216	200 0 0	Canterbury ..	189	1,670	649 16 8
Hawke's Bay ..	62	15	270 0 0	Otago	45	907	478 0 0
Wellington ..	44	703	85 16 4	Southland ..	29	1,526	350 0 0
Nelson	161	466	199 19 0				
Marlborough ..	25	98	49 10 0	Totals ..	992	7,682	3,308 13 10

No. 4.—Photographs.

Department.	Number of Plates taken during the Year.	Department.	Number of Plates taken during the Year.
Public Works	103	Insurance	4
Survey	208		
Museum	26	Total	435
Marine	8		
Education	1	Silver prints—	
Architect	50	Survey	33
Post and Telegraphs	13	Marine	17
Mines	6		
Premier	16	Total	50

JAMES McKERROW
Surveyor General.

MAP OF THE
NORTH ISLAND,
NEW ZEALAND.
SHEWING THE WORK ON HAND
JUNE 30TH 1884

Scale of Miles.

10 5 0 10 20 40 60 80

Reference.

Chief Towns	shewn thus WELLINGTON
Minor Towns and Post Offices	" HAMILTON
Roads	"
Railways	"
Boundaries of Provincial Districts	"
Major Triangulation	
Minor do	
do do with topography	
Rural and suburban section survey of land sold	
do do do do do for future settlement	
Town Survey	
Native Land Court	
do do Purchase	
Mining Surveys	
Road and Railway Surveys	

General Survey Office, Wellington, N. Z., July, 1884.

South Latitude

175° East Longitude

JAMES McKERROW
Surveyor General.

MAP OF THE
MIDDLE ISLAND,
NEW ZEALAND.
SHEWING THE WORK ON HAND
JUNE 30TH 1884

Scale of Miles.

10 5 0 20 40 60 80

Reference.

- Chief Towns ..... shewn thus ..... DUNEDIN
- Minor Towns and Post Offices ..... AKAROA
- Roads
- Railways
- Boundaries of Provincial Districts
- Major Triangulation
- Minor ..... do .....
- ..... do ..... do ..... with topography
- Rural and suburban section survey of land sold
- ..... do ..... do ..... do ..... do ..... do ..... for future settlement
- Town Survey
- Native Land Court
- ..... do ..... do ..... Purchase
- Mining Surveys
- Road and Railway Surveys

Canterbury Bight

Pegasus Bay

Banks Peninsula

Karamea Bight

Golden Bay

Tasman Bay

Cloudy Bay

TASMAN SEA

PACIFIC OCEAN

SOUTH PACIFIC OCEAN

FOVEAUX STRAIT

CHATHAM ISLANDS.
Scale 25 Miles to an Inch.

General Survey Office, Wellington, N. Z., November, 1882.

168° 169° 170° 171° 172° 173° 174° 175°

40° 41° 42° 43° 44° 45° 46° 47° 48°

166° 167° 168° 169° 170° East Longitude. 171° 172° 173° 174°

South Latitude

No. 5.—Lithographic Printing executed from the 1st July, 1883, to the 30th June, 1884.

Department.	No. of Separate Printings.	Number of Impressions		Department.	No. of Separate Printings.	Number of Impressions	
		By Machine.	By Hand.			By Machine.	By Hand.
Survey	429	215,694	24,261	Printing	2	2,500	..
Public Works	225	5,350	23,953	Native	13	1,000	765
Customs	25	..	1,630	Treasury	6	..	450
Geological	31	47,300	77	Architect	17	..	1,110
Justice	37	500	3,175	Prisons	18	..	985
Mines	16	21,900	5	Property-Tax	2	..	2,625
Railway Commission ..	4	5,800	..	Registrar-General ..	6	..	465
Insurance	2	..	12	Patent	10	..	509
Railway	46	27,000	4,150	Colonial Secretary ..	14	..	618
Post and Telegraph ..	16	8,750	1,020	Crown Lands	1	..	50
Marine	35	2,700	2,365	Premier	106	106,000	1,955
Postal	10	3,940	4,450				
Education	37	1,600	5,814	Totals	846	450,034	80,444

No. 6.—Abstract of Lithographs printed during the Year.

Head Office, Wellington	530,478
Auckland	5,250
Westland	3,047
Dunedin	16,763
Invercargill	1,850
Total	557,388

No. 7.—RETURN of Field-work executed by Staff and Contract Surveyors from 1st July, 1883, to 30th June, 1884.

PROVINCIAL DISTRICT OF AUCKLAND.

Surveyor and District.	Major Triangulation.			Minor Triangulation.			Topographical and Trigonometrical Survey.			Rural and Suburban.				Town Section Survey.				Native Land Court Survey.				Native Land Purchase Survey.				Gold-Mining Survey.				Roads, Railways, and Water-races.			Detention by Native Opposition or other Causes.	Other Work.	Total Cost of Surveyor and Party from 1st July, 1883, to 30th June, 1884.	Remarks.
	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Acres.	No. of Allotments.	Cost per Allotment.	Total Cost.	Acres.	No. of Secs. or Divis'ns.	Cost per Acre.	Total Cost.	Acres.	No. of Allotments.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Miles.	Cost per Mile.	Total Cost.	Cost.	Cost.		
		d.	£ s. d.		d.	£ s. d.		d.	£ s. d.			s.	£ s. d.			s.	£ s. d.			d.	£ s. d.			d.	£ s. d.			d.	£ s. d.		£	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
G. W. Williams, Rotorua ..	44,800	0·5	108 5 8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2·9	11·2	32 2 6	..	935 7 9	1,075 15 11	Inspector.
J. O. Barnard, Poverty Bay ..	..	..	..	85,244	0·5	175 10 0	..	..	..	3,878	90	5·1	987 17 9	46·2	16	20·4	47 3 0	..	..	..	..	..	..	..	..	..	..	..	..	8	4	32 0 0	..	446 3 6	725 0 1	Inspector in charge, Poverty Bay.
Sydney Weetman, Waitemata ..	..	..	..	13,511	0·7	40 8 6	..	..	..	2,798	23	3·25	446 13 5	1	1	100	5 0 0	4,457	8	1·1	242 2 0	..	..	..	..	..	..	..	..	2	13·1	26 12 6	..	..	1,096 14 4	All adjoining old work.
E. C. Goldsmith, Tauranga ..	..	..	..	4,400	0·75	13 18 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6·3	10	62 8 0	..	152 17 0	956 0 5	
L. Cussen and two assistants (part of time), King country	..	..	..	63,000	0·57	141 5 0	..	..	..	..	..	..	..	..	..	..	..	975	1	10	44 0 0	..	..	..	..	..	..	..	..	44	10·9	467 14 4	309 0 0	20 0 0	2,743 4 11	About 1¼ million acres major triangulation complete in field.
F. Simpson, Whangarei ..	..	..	..	..	..	..	6,220	1·5	38 17 6	349	9	3·25	56 15 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13·8	18·5	255 6 0	64 0 0	351 13 0	785 9 0	
J. Baber, Waipipi, &c.	..	..	..	..	..	..	..	..	..	5,651	73	3·0	855 0 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	30 0 0	848 5 9	Mostly adjoining old surveys.
F. H. Edgecumbe, Cambridge, &c.	..	..	..	..	..	..	..	..	..	6,201	137	1·3	403 8 2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	726 15 0	1,171 8 5	
R. Newmann, Hukerenui, &c. ..	..	..	..	24,700	1·7	181 10 5	..	..	..	6,780	53	2·9	988 1 3	..	..	..	..	6	1	..	5 15 0	..	..	..	..	..	..	..	..	..	..	..	..	..	897 16 10	Mostly "bush country."
B. Lambert, Opoiti, &c. ..	..	..	..	..	..	..	..	..	..	50	1	3·5	8 15 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	21·4	323 10 7	..	18 5 0	549 0 0	
P. E. Cheal, Thames	28,600	0·67	71 4 8	..	..	..	..	..	..	3,673	..	2·25	423 17 3	..	..	..	..	53	1	..	8 17 0	..	..	..	..	..	..	..	..	20·5	14·9	298 15 8	..	15 0 0	901 16 7	Roads; very difficult.
W. J. Parris, Opaheke, &c. ..	..	..	..	..	..	..	40,370	1·5	251 4 4	1,423	22	6·4	459 0 0	5	11	31	7 16 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	724 7 8	Mostly adjoining old work.
G. A. Martin, Kaipara, &c. ..	..	..	..	..	..	..	..	..	..	2,592	31	3·25	424 0 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	20·5	41 10 0	..	85 3 0	733 5 7	
W. C. Spencer, Taramarama ..	..	..	..	..	..	..	..	..	..	11,610	5	0·5	276 8 11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	330 5 0	797 2 11	
E. H. Hardy, Tokatoka, &c. ..	86,550	0·3	110 0 0	..	..	..	115,660	0·96	465 0 0	5,070	37	1·4	350 0 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7·6	8·9	68 0 0	30 0 0	19 0 0	597 9 7	
H. M. Smith, Pakiri	..	..	..	17,280	0·4	31 0 0	..	..	..	8,047	37	1·3	524 2 7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0·8	9	7 7 0	..	..	734 11 7	Mostly new work.
J. I. Philips, Opotiki	..	..	..	..	..	..	..	..	..	15,425	65	1·0	772 5 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	772 5 0	Good deal of old work.
C. Stevens, Maramarua	..	..	..	..	..	..	35,000	0·02	29 11 4	5,552	15	1·6	437 0 9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	647 18 9	Mostly adjoining old surveys.
J. Hannah, Waiapu, &c.	..	..	..	..	..	..	..	..	..	2,440	26	4·0	488 2 8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	696 6 8	All adjoining old surveys. 100 sq. m. trig. complete in field.
D. W. Gillies, Matakohe ..	..	..	..	..	..	..	..	..	..	1,214	17	5·3	321 18 5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	464 9 11	In the field since 26th November, 1883. All adjacent to old surveys.
C. W. McFarland, Waiheke ..	..	..	..	..	..	..	..	..	..	1,537	26	6·8	466 9 3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7 10 8	600 16 0	All adjacent to old surveys.
W. J. Wheeler, Mangamuka ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5·5	30·9	169 15 4	..	..	679 17 7	14 sections, 1,390 acres, and 5½ miles road complete in field.
H. D. Haszard, Karioi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	27 4 0	5 12 7	379 8 4	In field since 1st January. Two Land Purchase blocks, 12,000 acres, complete in field.
W. Armstrong, Waikohu ..	..	..	..	47,500	1·3	251 17 11	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	192 14 11	444 12 0	In field since 1st December, 1883.
H. G. Price, Waiau, &c. ..	..	..	..	36,000	1·0	151 13 4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	9·4	56 12 0	..	10 0 0	520 16 2	19,000 acres in sections complete in field.
H. J. Balneavis, Waimata ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,095	1	10	45 12 6	..	..	..	..	..	..	..	..	25	8	200 0 0	..	190 18 10	436 11 4	Left service 31st March, 1884.
H. A. Martin, Tauhoa	..	..	..	..	..	..	..	..	..	6,337	47	1·95	613 4 3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	689 17 4	All old surveys.
	159,950	0·43	289 10 4	291,635	0·81	987 3 2	197,250	0·95	784 13 2	90,627	714	2·06	9,302 15 8	52·2	28	..	59 19 0	6,586	12	12	346 6 6	..	..	..	..	159·4	12·7	2,041 14 11	430 4 0	..		21,657 13 3		
Authorized and contract surveyors	667,569	1·0	2,781 11 7	153,822	1·1	719 13 8	..	..	..	8,167	57	1·60	580 17 6	..	..	..	..	355,384	137	3·4	5,006 4 0	72,583	15	3·9	1,420 13 5	..	..	..	..	75	10·5	789 6 9	..	3,538 5 9	7,673 13 3	
Total	827,519	0·89	3,071 1 11	445,457	0·92	1,706 16 10	197,250	0·95	784 13 2	98,794	871	2	9,883 13 2	52·2	28	..	59 19 0	361,970	149	3·5	5,352 10 6	72,583	15	4·7	*1,420 13 5	..	..	..	..	234	12·1	2,831 1 10	430 4 0	3,538 5 9	29,331 1 11	

* Cost defrayed by Land Purchase Department.

PROVINCIAL DISTRICT OF TARANAKI.

	West Coast Commission.												Reserves Trustee.																					
	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Acres.	No. of Allotments.	Cost per Allotment.	Total Cost.	Acres.	No. of Secs. or Divis'ns.	Cost per Acre.	Total Cost.	Acres.	No. of Allotments.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Miles.	Cost per Mile.	Total Cost.	Cost.	Cost.	
		d.	£ s. d.		d.	£ s. d.		d.	£ s. d.			d.	£ s. d.			s.	£ s. d.			d.	£ s. d.			d.	£ s. d.			d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	
Staff Surveyors.																																			
E. S. Brookes, Mokau	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	37 4 5	186 2 0	..	..	664 4 0	Forest country.
H. W. Climie, Kaupokonui ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	25 14 7	128 13 0	..	443 17 0	661 18 0	
C. Finnerty, Kaupokonui ..	..	..	..	..	..	..	..	..	..	8,517	48	32·1	1,140 10 3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	226 1 8	858 1 6	
H. M. Skeet, Upper Waitara, Mimi, and Mokau	121,000	0·9	453 6 6	..	..	..	79,000	1·9	627 16 4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	72 0 0	70 10 0	1,223 12 10	
W. H. Skinner, Opunake and Mokau	..	..	..	..	..	..	..	..	..	5,208	32	30·1	654 7 10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	132 15 8	887 7 0	
A. O'Donahoo, Mimi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,000	3	51	212 9 3	..	..	..	..	24	21 1 7	505 19 8	26 1 8	356 4 10	888 6 2	
F. Duthie, Mokau	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	56 0 8	646 2 0	
A. C. Atkinson, Kaupokonui ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	243 6 2	243 6 2	
Temporary Surveyors.																																			
D. G. Fraser, Upper Waitara ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5,240	39	27	589 12 1	..	..	..	..	..	..	..	..	..	553 16 4	
A. Rawson, Waitara	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4,670	55	26·2	510 14 4	..	..	..	..	..	..	..	..	..	510 14 4	
C. A. Mountfort, Upper Waitara and Mimi	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7,650	15	22·7	723 1 6	..	..	..	..	..	..	..	..	..	504 4 6	
N. Macdonald, Waitara ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4,100	43	41·6	710 18 6	..	..	..	..	..	..	..	..	118 5 0	708 14 6	
R. H. Atkinson, Opunake, Cape, and Huiroa	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,000	1	39·8	165 17 10	4,722	44	17·4	345 1 2	..	..	..	..	52 18 5	539 18 11	Partly open.
J. Skinner, Opunake, Cape, and Huiroa	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	432	18	55·9	100 12 6	7,389	42	16	492 12 10	..	..	..	..	..	593 5 4	
F. Joseph, Opunake and Waitara	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,000	10	46·7	194 14 3	3,882	16	20·9	337 10 0	..	..	..	..	..	532 4 3	
F. Owen, Opunake	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1,416	8	19·9	117 13 0	..	..	..	..	..	117 13 0	
Contract Surveyors.																																			
Skinner and Sole, Waitara ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5½	27 5 6	150 0 0	..	..	150 0 0	Paid by Public Works Department.
F. Owen, Hawera	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	110 0 0	
C. E. O. Smith, Hawera ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	28 6 8	170 0 0	..	..	170 0 0	
Palmerston and Scott	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	275 0 0	Advances on survey of Native Land Court block to be refunded by owners.
Enclosed by other surveys ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3,000	..	..	..	..	..	..	..	..	..	..	..	..	..	
Total	121,000	0·9	453 6 6	..	..	..	79,000	1·9	627 16 4	13,725	80	31·4	1,794 18 1	..	..	..	..	..	..	..	..	28,092	184	27·4	3,208 0 3	17,409	110	17·8	1,292 17 0	45½	25 1 5	1,140 14 8	98 1 8	*1,699 19 5	10,838 8 10	
																																	Less amount chargeable to Public Works Department and Native Land Court block		858 0 0	
																																		£9,980 8 10	

* The £3,037 14s. 3d. for "other work" includes £802 for back-pegging on old surveys.

No. 7, *continued*.—RETURN of FIELD-WORK executed by STAFF and CONTRACT SURVEYORS, from 1st July, 1883, to 30th June, 1884.

PROVINCIAL DISTRICT OF HAWKE'S BAY.

Surveyor and District.	Minor Triangulation.			Topographical and Trigonometrical Survey.			Rural and Suburban.				Town Section Survey.				Native Land Court Survey.				Roads, Railways, and Water-races.			Detention by Native Opposition or other Causes.	Other Work.	Total Cost of Surveyor and Party from 1st July, 1883, to 30th June, 1884.	Remarks.
	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Acres.	No. of Allotments.	Cost per Allotment.	Total Cost.	Acres.	No. of Sections or Divisions.	Cost per Acre.	Total Cost.	Miles.	Cost per Mile.	Total Cost.	Cost.	Cost.		
		d.	£ s. d.		d.	£ s. d.			s.	£ s. d.			£ s. d.	£ s. d.			s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
Staff Surveyors.																									
W. Hallett, Clive, Te Mata, Oero, Waipukurau, Tahoraite, Mangatoro, Pourere, and Maraekakahu	37,900	0·75	118 8 9	70,600	1	294 3 4	574	25	3/6	100 9 0	22½	54	0 15 0	40 10 0	..	..	..	..	35	8 11 0	299 5 0	..	223 8 1	1,184 1 0	Generally open country in nine districts.
F. Rich, Matapiro, Wakarara, Ruataniwha, and Maraekahahu	27,000	0·58	65 4 4	..	..	..	1,921	3	2/5	232 0 8	..	..	..	..	..	..	..	..	8	8 11 3	68 10 0	..	..	737 0 0	Isolated surveys in expensive country.
J. L. D'Arcy Irvine, Nuhaka, Mahia, and Mocangiangi	5,125	0·5	16 4 7	..	..	..	6,658	11	1/	332 18 0	..	..	..	..	..	..	..	..	4	14 0 0	56 0 0	..	71 5 7	577 7 0	Principally bush country.
J. G. Wilson, Woodville and Tahoraite	..	..	..	..	..	..	705	20	10/	352 10 0	..	..	..	..	..	..	..	..	½	52 16 0	26 8 0	..	343 5 11	669 8 0	Detached surveys in expensive bush country.
H. G. Price, Mohaka and Waihua	27,200	1	113 6 8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	158 2 8	
Contract or Temporary Surveyors.																									
J. Rochfort, Napier and Takapau	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	208 17 0	Payments on account of Native Land Court surveys.
C. D. Kennedy, Waihua ..	14,575	1	60 14 7	..	..	..	10,000	9	0/4	166 13 4	..	..	..	..	..	..	..	..	..	..	..	..	..	60 14 7	Section survey, paid by Governors of Napier High School.
H. Ellison, Tahoraiti	14,570	0·5	30 5 10	..	..	..	4,265	48	2/	419 14 2	..	..	..	..	..	..	..	..	..	..	..	..	..	466 4 0	Bush country.
Palmerston and Scott, Norsewood and Takapau	..	..	..	..	..	..	3,945	78	1/5	273 16 8	..	..	..	..	..	..	..	..	..	..	..	..	..	273 16 8	"
Totals	126,370	0·77	404 4 9	70,600	1	294 3 4	28,068	194	1/4	1,878 1 10	22½	54	0 15 0	40 10 0	..	..	..	..	47½	9 9 7	450 3 0	..	637 19 7	4,335 10 11	

PROVINCIAL DISTRICT OF WELLINGTON.

A. Dundas, Ongo, Apiti, Pohangina, and Tiriraukawa	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	21	13 12 0	275 6 4	..	105 7 8	1,056 3 3	
L. Smith, Tararua, Mangaone, and Kopuaranga	..	..	..	107,000	1·22	547 6 2	847	18	1/7½	68 12 11	..	..	..	..	3,353	2	0 6¾	94 3 1	9	4 6 2	38 16 0	..	203 9 5	1,162 12 0	Mountainous and hilly bush country.
G. A. Northcroft, Kopuaranga ..	..	..	..	27,000	1·5	168 15 0	765	9	2/3	86 1 0	..	..	..	..	..	..	..	..	12¾	12 10 0	159 7 6	..	62 16 0	912 6 2	Hilly bush country.
" ..	..	..	..	..	..	..	7,500	39	2/6½	956 15 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
J. D. Climie, Onoke, Wairarapa, Waiohine, and Belmont	..	..	..	207,000	0·87	750 3 8	143	3	7/2	51 2 0	..	..	..	..	..	..	..	..	5½	30 10 0	167 14 6	..	88 15 0	998 7 2	Mountainous and hilly bush country.
John Annabell, Momahaki, Kapara, Mangawhero	..	..	..	83,540	1·35	471 1 4	..	..	..	..	..	..	..	..	1,887	..	0 2¾	20 18 2	29	9 3 0	266 5 1	..	285 4 5	1,145 18 9	Triangulation rough bush country difficult of access. Other surveys partly open country.
J. F. Sicely, Rangitoto, Ongo, Wangaehu, &c.	6,200	0·45	11 14 6	..	..	..	..	..	..	..	..	..	..	..	500	..	1 3	31 10 7	32½	8 19 7	292 6 8	9 7 6	331 15 2	636 16 0	
N. J. Tone, Huangarua, Tiffin, and Otahoua	4,779	0·63	12 10 4	59,000	1·18	296 4 8	347	3	3/2¾	55 11 7	3	2	7 5 5	14 10 10	272	4	3 0½	41 10 0	54½	6 14 10	367 8 6	7 16 7	98 12 10	700 5 11	Triangulation rough bush hills. Other surveys mostly in open country.
G. Struthers, Haurangi, Waipawa, &c.	..	..	..	67,000	0·2	579 13 4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	17 12 0	127 15 0	
C. W. H. Thompson, Wangaehu, Ongo, &c.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	461 7 10	418 4 2	Inserting back pegs Paraekaretu section.
A. E. Ashcroft, Wangachu and Waipakura	..	..	..	..	..	..	6,703	17	0/11½	314 2 10	..	..	..	..	1,867	1	1 4	131 5 3	14	11 1 6	155 3 7	..	20 10 0	583 8 9	Hilly forest country.
R. P. Greville, Mangaone ..	..	..	..	..	..	..	..	..	..	..	4	2	5 0 0	10 0 0	..	..	..	..	4	16 12 6	66 10 0	..	278 12 11	509 14 0	Surveys mostly situated in hilly bush country.
Kopuaranga ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3½	25 1 4	85 9 4	..	..	..	
C. A. M. Crombie, Wainuioru and Kaiwhata	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	446 18 8	
Temporary.																									
J. R. Annabell, Momahaki and Kapara	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	125 10 10	434 12 0	Mr. Joseph Annabell executed about one-third of the triangulation returned by Mr. John Annabell. Employed in very inaccessible and rough bush country.
Office computations	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2,108	2	0 11¾	103 19 0	..	..	..	..	..	..	
Totals	10,979	0·53	24 4 10	550,540	1·23	2,813 4 2	16,305	89	1/10½	1,532 5 4	7	4	6 2 8	24 10 10	9,982	9	0 10	423 6 1	185¾	10 2 0	1,874 7 6	17 4 1	2,079 14 1	9,133 1 10	
Authorized Surveyors	..	..	..	..	..	..	..	..	..	..	7¼	3	5 1 8	15 5 0	46,941	12	0 3¼	648 7 0	92	5 0 0	465 15 7	..	..	..	
Totals	10,979	0·53	24 4 10	550,540	1·23	2,813 4 2	16,305	89	1/10½	1,532 5 4	14¼	7	5 13 8	39 15 10	56,923	21	0 4½	1,071 13 1	277¾	8 8 0	2,340 3 1	17 4 1	2,079 14 1	9,133 1 10	
Private Surveyors	..	..	..	..	..	..	..	..	..	..	..	..	..	..	49,385	..	..	..	..	..	..	..	..	..	

No. 7, *continued*.—RETURN of FIELD-WORK executed by STAFF and CONTRACT SURVEYORS from 1st July, 1883, to 30th June, 1884.

PROVINCIAL DISTRICT OF NELSON.

Surveyor and District.	Major Triangulation.			Minor Triangulation.			Topographical and Trigonometrical Survey.			Rural and Suburban.				Town Section Survey.				Gold-Mining Survey.				Roads, Railways, and Water-races.			Other Work.	Total Cost of Surveyor and Party from 1st July, 1883, to 30th June, 1884.	Remarks.
	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Acres.	No. of Allotments.	Cost per Allotment.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Miles.	Cost per Mile.	Total Cost.	Cost.		
		d.	£ s. d.		d.	£ s. d.		d.	£ s. d.			d.	£ s. d.			s.	£ s. d.			s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	
A. P. Rawson, Wai-iti and Motueka	..	..	..	..	..	..	..	..	..	1,000	10	32½	136 0 0	..	..	..	..	..	..	..	..	6	11 12 3	69 16 1	..	807 16 1	Cadet two months. Broken, timbered country. One month's absence.
										Revision: 2,432	21	39½	401 0 0													
J. H. Jennings, Inangahua and Reefton	..	..	..	..	..	..	..	..	..	1,041	25	58	251 15 0	..	..	..	..	..	..	..	..	7½	6 18 0	51 10 0	168 8 7	811 13 7½	Mountainous; bush on gold fields.
										Revision: 1,242	23	65¾	340 0 0													
J. Snodgrass, Mokihinui, Kawatiri, and Waitakere	..	..	..	..	..	..	13,850	2·8	162 7 0	2,989	64	40	498 10 0	0¾	6	25	7 10 0	208	17	18 0	187 4 0	9½	10 0 0	92 10 0	..	948 1 0	Ditto. Cadet assisting.
J. A. Montgomerie, Reefton	..	..	..	..	..	..	..	..	..	1,056	18	63	276 11 2	..	..	..	..	91	4	11 7	52 14 4	1½	7 5 0	9 12 0	783 15 0	1,113 3 11	Standard survey, Reefton.
R. T. Sadd, Motueka, Tadmor, and Hope	..	..	..	..	..	..	57,217	0·58	138 4 10	6,086	69	24⅕	618 1 7	..	..	..	..	..	..	..	..	..	..	..	..	716 11 2	Rough bush country. Six weeks' leave. Cadet four months.
C. Galwey, Ahaura, Mawheraiti, Mawheranui	..	..	..	..	..	..	..	..	..	3,506	79	41·2	602 8 8	..	..	..	..	43	13	15 0	32 5 0	..	..	..	101 7 2	770 0 10	Scattered surveys in bush. One month absent.
G. H. Bullard, Waitahu	..	..	..	..	..	..	..	..	..	261	4	81	88 4 11	..	..	..	..	..	..	..	..	3¼	5 10 0	18 13 4	122 12 2	770 8 9	Rough, mountainous country, heavily timbered.
										Revision: 30,796	2	9	1,154 17 0													
F. S. Smith* and F. A. Thompson,† Maling, Dillon, Boyle, Stewart, Haupiri, &c.	..	..	..	30,000	0½	62 10 0	149,000	1½	930 8 4	1,393	6	12	69 13 0	..	..	..	..	..	..	..	..	..	..	..	76 10 3	2,222 17 2	* Two months' leave. 70,000 acres trig. field-work, not plotted. † One month's leave. Cadet assisting.
C. Lewis, Aorere and Waitapu	..	..	..	..	..	..	..	..	..	3,312	37	43·6	602 8 0	..	..	..	..	60	4	19 0	57 0 0	3¼	33 6 9	108 7 0	..	770 15 0	Broken country, timbered.
W. D. B. Murray, Waimea and French Pass	..	..	..	12,000	1½	78 8 7	..	..	..	550	5	48	109 18 11	..	..	..	..	..	..	..	..	17½	30 15 0	521 2 1	..	743 14 7	Rough, through bush.
	..	..	..	42,000	0¾	140 18 7	220,067	1·4	1,231 0 2	55,664	363	22·2	5,149 8 3	0¾	6	25	7 10 0	402	38	16 4·5	329 3 4	48	18 3 1	871 10 6	1,252 13 2	9,675 2 2	
Contractors.																										
J. B. Saxon, Wai-iti, Motupiko, Gordon	..	..	..	..	..	..	..	..	..	10,357	107	18·4	802 5 0	..	..	..	..	..	..	..	..	..	..	..	..	954 3 0	
C. E. Watkins, H. Little — Reefton and Waitahu	..	..	..	..	..	..	..	..	..	1,769	4	21	151 18 0	..	..	..	..	258	13	13 0·5	168 5 6	..	..	..	..	168 5 6	
A. W. Carkeek, Pakawau	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	453	16	8 10·1	200 5 6	..	..	..	..	200 5 6	
H. G. Houston, Cobden	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	1	25 3	12 12 6	..	..	..	..	12 12 6	
R. A. Young, Marina	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	1	14 0	7 0 0	..	..	..	..	7 0 0	
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	69	5	20 5	70 7 6	..	..	..	..	70 7 6	
Total	..	..	..	42,000	0¾	140 18 7	220,067	1·4	1,231 0 2	67,790	474	21·6	6,103 11 3	0¾	6	25	7 10 0	1,202	74	13 1	787 14 4	48	18 3 1	871 10 6	1,252 13 2	11,087 16 2	
																					Less fees deposited for survey				2,540 15 0	Native Land Court survey. Mr. A. W. Carkeek surveyed 88,350 acres at West Wanganui, at the expense of the Natives.
																									8,547 1 2	
																					Office expenditure				2,612 3 6	
																									£11,159 4 8	

PROVINCIAL DISTRICT OF MARLBOROUGH.

																		A. R. P.								
A. D. Wilson (standard), parts of Whernside, Buibui, Kaitarau, Mount Fyffe, Greenburn, Hundalee, Acheron; and also parts of Terako, Percival, Waiau, and Hawkswood, Nelson Provincial District	363,905	0·25	387 18 11	..	..	..	363,905	·64	979 18 9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	849 17 0	Country generally rough and high, with bush in a few places.
R. F. Goulter (staff), Wairau and Pelorus Mining District	..	..	..	..	..	..	..	..	..	1,134	11	21	100 0 10	..	..	..	..	18 0 0	2	17 0	15 6 0	..	..	..	..		Covered with heavy bush.
" " " " "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28	19 17 2	556 0 2	..		Land plan survey. Also covered with heavy bush.
" " " " "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2¼	38 0 0	85 10 0	..		Engineering road survey.
" " " " "	..	..	..	..	..	..	..	..	Revised	336	7	21	29 8 0	..	..	..	..	..	..	..	..	..	..	..	..	565 18 2	Sections in Pelorus Sound. Cost per acre includes connection with trig. stations. Heavy bush.
" " " " "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	61 8 6		Sub-triangulation. Forest country; heavy cutting in breaking down from high hills.
	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1 10 0		Business areas, Deep Creek.
A. J. C. Ward (schedule), Wairau and Pelorus Mining District	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13 3 30	1	20 1	14 0 0	..	..	..	..	..	Partly open, partly bush and scrub.
Total	363,905	0·25	387 18 11	..	..	..	363,905	·64	979 18 9	1,470	18	21	129 8 10	..	..	..	..	31 3 30	3	18 4	29 6 0	30¼	21 4 1	641 10 2	62 18 6	1,415 15 2	

No. 7, *continued*.—RETURN of FIELD-WORK executed by STAFF and CONTRACT SURVEYORS, from 1st July, 1883, to 30th June, 1884.

PROVINCIAL DISTRICT OF WESTLAND.

Surveyor and District.	Major Triangulation.			Topographical and Trigonometrical Survey.			Rural and Suburban.				Town Section Survey.				Gold-mining Survey.				Roads, Railways, and Water-races.			Other Work.	Total Cost of Surveyor and Party from 1st July, 1883, to 30th June, 1884.	Remarks.
	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Acres.	No. of Allotments.	Cost per Allotment.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Miles.	Cost per Mile.	Total Cost.	Cost.		
		d.	£ s. d.		d.	£ s. d.			s.	£ s. d.			s. d.	£ s. d.			s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	
W. G. Murray, Totara, Mahinapua, Kanieri, Waimea	..	..	..	14,080	3·2	190 1 3	660	93	3/6·4	116 15 9	32	126	11 8	73 11 0	475	48	14 11·7	355 16 2	0·2	28 0 0	5 12 0	162 8 0	904 4 2	Bush cutting within the gold fields; cadet assisting.
E. I. Lord, Arnold, Greymouth, Hohonu, Waimea	..	..	..	..	..	..	1,553	25	2/0·8	411 18 2	..	..	..	..	35·5	6	11 8	20 14 6	10·3	17 1 6	175 19 4	330 3 10	938 15 10	Broken bush country within a gold field. No cadet.
J. N. Smyth, Kanieri, Toaroha	..	..	..	13,440	2	115 9 2	2,435	40																
				Revision			2,873	54	3/10·8	560 15 0	..	..	..	..	..	..	..	..	31	6 1 6	188 7 8	54 17 6	919 9 4	Densely-bushed country; cadet assisting for two months.
G. J. Roberts, Okuru, Matakitaki, Governor's Pass, Turnbull, Arawata	169,276	0·45	317 3 0	140,956	1·8	1,053 5 0	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	171 16 1	1,542 4 1	Rough, mountainous country, densely timbered.
R. Wither, Abbey Rocks, Paringa, Cascade, Otumotu	..	..	..	17,280	1	65 2 10	1,779	7	1/11·9	174 2 0	..	..	..	..	..	..	..	..	18	22 10 6	405 8 4	104 2 6	748 15 8	Heavily timbered, and expensive district.
Totals	169,276	0·45	317 3 0	185,756	1·84	1,423 18 3	9,300	219	2/8·61	1,263 10 11	32	126	11 8	73 11 0	510·5	54	14 9	376 10 8	59·5	13 0 6	775 7 4	823 7 11	5,053 9 1	

PROVINCIAL DISTRICT OF CANTERBURY.

J. S. Welch, Akaroa	..	..	..	..	..	..	3,155	35	2/6¾	486 15 1	..	..	..	..	..	..	..	..	m. 1·67	30 11 8	51 4 8	307 8 7	845 8 4	Contour survey, Ripa Island, £76 17s. 2d.; 2 miles 50 chains, standard, £230 11s. 5d.; survey at £87 16s. 8d. per mile; balance bush work.
" "	..	..	..	..	..	..	*r*640	27																
James Hay "	..	..	..	..	..	..	2,428	61	4/8½	794 19 0	..	..	..	..	..	..	..	..	..	..	..	..	794 19 0	Bush and scattered hill work.
" "	..	..	..	..	..	..	*r*949	35																
H. Maitland, Geraldine	..	..	..	..	..	..	519	7	2/7¼	67 15 5	..	..	..	..	..	..	..	..	..	..	..	..	745 9 6	High mountainous country.
" "	..	..	..	104,530	1·54	677 14 1	..	..	..	..														
T. N. Brodrick, Ashley and Selwyn ..	..	..	..	..	..	..	4,560	61	2/5	569 13 6	..	..	..	..	..	..	..	..	2·0	81 7 8	162 15 4	..	813 16 6	Hill country; mountainous. Cadet twelve months.
" "	..	..	..	..	..	..	*r*364	3																
" Selwyn	..	..	..	28,328	0·69	81 7 8	..	..	..	..														
J. E. Pickett, Selwyn and Ashburton ..	..	..	..	..	..	..	2,404	41	2/5¼	481 2 3	..	..	..	..	*231	14	13 4	153 18 0	..	..	..	..	716 8 3	Less £153 18s. to be passed to credit of Survey Department by Receiver of Land Revenue, with whom the lessees deposited the amount.
" "	..	..	..	..	..	..	*r*1,535	36																
" Ashburton	..	..	..	103,660	0·19	81 8 0	..	..	..	..														
H. C. White, Waimate	..	..	..	..	..	..	3,923	110	2/7¾	805 3 2	..	..	..	..	..	..	..	..	..	..	..	..	805 3 2	Old surveys in hills.
" "	..	..	..	..	..	..	*r*2,171	24																
L. O. Mathias, Selwyn	..	..	..	..	..	..	1,748	68	3/10	588 11 9	..	..	..	..	..	..	..	..	..	..	..	..	588 11 9	Very scattered work in the mountains.
" "	..	..	..	..	..	..	*r*1,312	30																
G. H. M. McClure, Ashburton and Geraldine	..	..	..	..	..	..	6,654	190	1/9	674 1 2	..	..	..	..	..	..	..	..	..	..	..	..	674 1 2	Mostly bush in hills.
" "	..	..	..	..	..	..	*r*1,077	20																
F. Watkins, Selwyn and Geraldine ..	..	..	..	..	..	..	1,163	9	/11	52 14 8	..	..	..	..	..	..	..	..	..	..	..	..	316 7 5	Seven months in field.
" Geraldine	..	..	..	..	..	..	*pdp*3,306	2	1/7	263 12 9														
James Adam, Ashley	..	..	..	..	..	..	190	8	8/2	112 8 10	..	..	..	..	..	..	..	..	..	..	..	..	112 8 10	Subdivision of reserves.
" "	..	..	..	..	..	..	*r*90	2																
Christchurch Office (various counties) ..	..	..	..	..	..	..	2,565	86	/1¾	15 9 2	..	..	..	..	..	..	..	..	..	..	..	..	15 9 2	
Timaru Office, Geraldine	..	..	..	..	..	..	760	26																
" "	..	..	..	..	..	..	*r*430	19	/11	99 12 10	..	..	..	..	..	..	..	..	..	..	..	..	99 12 10	
" Waimate	..	..	..	..	..	..	24	1																
Totals	..	..	..	236,518	0·85	840 9 9	41,967	901	2/4½	5,011 19 7	..	..	..	..	231	14	13 4	153 18 0	3·67	58 3 4	214 0 0	307 8 7	6,527 15 11	

NOTE.—*r*, resurveys; *pdp*, pastoral deferred payments. * At cost of lessees.

No. 7, *continued*.—RETURN of FIELD-WORK executed by STAFF and CONTRACT SURVEYORS, from 1st July, 1883, to 30th June, 1884.

PROVINCIAL DISTRICT OF OTAGO.

Surveyor and District.	Minor Triangulation.			Topographical and Trigonometrical Survey.			Rural and Suburban.				Town Section Survey.				Gold-Mining Survey.				Roads, Railways, and Water-races.			Other Work.	Total Cost of Surveyor and Party from 1st July, 1880, to 30th June, 1884.	Remarks.
	Acres.	Cost per Acre.	Total Cost.	Acres.	Cost per Acre.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Acres.	No. of Allotments.	Cost per Allotment.	Total Cost.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Miles.	Cost per Mile.	Total Cost.	Cost.		
		d.	£ s. d.		d.	£ s. d.			s. d.	£ s. d.			£ s. d.	£ s. d.			s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	
John Strauchon, Waikawa, Mokoreta, Otara, Waipahi..	..	..	..	..	..	..	13,577	92	1 $4\frac{3}{8}$	926 10 0	..	..	..	..	..	..	..	..	$3\frac{1}{4}$	15 6 2	49 15 0	31 9 0	1,007 14 0	A considerable portion bush, ordinarily expensive. Wet and stormy weather was prevalent during the year—worse than ever experienced. Cadet assisting nearly two years.
D. Barron, Blackstone, Naseby, St. Bathans, Gimmerburn, Maniototo, Upper Taieri, Mount Buster, Kyeburn, Rock and Pillar	..	..	..	80,000	1·22	408 2 4	2,173	27	1 $7\frac{1}{2}$	176 15 6	..	..	..	..	222	22	4 $9\frac{3}{4}$	164 9 0	..	..	..	204 16 8	954 3 6	Open country within a gold field. Surveys scattered over an extensive district. Considerable time taken up laying off forest reserves, &c. Cadet one year assisting.
A. R. Mackay, Tiger Hill, Tarras, Leaning Rock, Nevis, Lander, Wakefield, Cromwell, Fraser, Cairnhill, Wanaka	..	..	..	..	..	..	122	13	4 $5\frac{3}{8}$	27 2 8	..	..	..	..	8	1	5 $1\frac{1}{2}$	2 1 0	$2\frac{1}{2}$	3 4 8	8 1 8	658 6 3	695 11 7	Within a gold field, and a very expensive district. Country all open excepting near Hawea and Wanaka Lakes. Very mountainous. Absent on leave for four months. No assistance excepting cadet draughtsman for eight months.
George Mackenzie, Glenomaru, Catlin's, Hummock, Hummockside, Dunedin and East Taieri, Waikouaiti, Table Hill, Greenvale, Hawkesbury, Glenkenich	..	..	..	..	..	..	6,568	80	2 $3\frac{3}{8}$	748 9 9	275	91	1 7 6	125 2 6	..	..	..	..	$5\frac{3}{8}$	6 18 0	35 6 9	27 15 8	936 14 8	13,000 acres were bush. Land rough, and sections small and very much scattered.
W. D. B. Murray, Greenvale, Wendon	..	..	..	..	..	..	3,306	14	0 $9\frac{1}{2}$	131 14 5	..	..	..	..	..	..	..	..	..	..	..	..	131 14 5	Open country within a gold field. Transferred to Nelson in August last.
J. Langmuir, Beaumont, Tuapeka West, Port Chalmers	..	..	..	..	..	..	1,179	3	2 0	117 18 0	..	..	..	..	..	..	..	..	1	6 0 0	6 0 0	548 18 0	672 16 0	Bush, and rough scrubby country.
E. H. Wilmot, Kawarau, Shotover, Skipper's Creek, Upper Wakatipu, Cardrona	..	..	..	*	..	143 10 2	832	17	3 $2\frac{1}{4}$	132 14 5	..	..	..	..	114	11	19 $2\frac{1}{4}$	109 8 6	5	26 0 0	130 4 10	249 9 8	765 7 7	District within a gold field; very rugged and expensive to work. Spotting surveys. Field-work done of 200,000 acres triangulation, but plans not finished. Cadet ten months assisting.
M. McNicol, Wakaia	..	..	..	..	..	..	10,317	74	1 4	674 7 2	..	..	..	..	..	..	..	..	12	9 10 0	114 0 0	18 3 0	806 10 2	Nearly all hilly country and terraces, partly covered with flax and scrub, and cut up by large creeks—which had to be traversed. Cadet ten months assisting. Transferred last May to Napier.
A. Seaton, Strath-Taieri, Nenthorn, Tuapeka West, Lindis, Hawkdun	..	..	..	60,000	1·36	339 0 0	12,115	12	0 $7\frac{5}{8}$	387 6 6	123	27	2 11 5	69 9 0	16	1	3 11	3 3 0	9	2 0 0	18 0 0	..	816 18 6	Village allotments of from three-quarters of an acre to ten acres. Very wet when doing this work—scarcely a dry day during the month. Covered with manuka scrub. Triangulation work retarded by wind and snow.
William Armstrong, Swinburn, Waihemo	..	..	..	..	..	..	5,949	8	1 2	348 1 1	..	..	..	..	..	..	..	..	..	..	..	..	348 1 1	Open country, and very rough. Transferred to Gisborne in November last.
D. W. Gibson, Poolburn, Lake Wanaka, Tiger Hill, Crown, Cromwell, Cardrona, Kawarau	..	..	..	123,553	0·76	393 16 0	9,038	57	0 $8\frac{3}{4}$	330 12 8	..	..	..	..	..	..	..	..	..	..	..	..	724 8 8	Open country within a gold field. Greatly hindered by wet weather and snow.
John Cook, Blackstone, Lauder, Sutton, Strath-Taieri, Nenthorn, Hummock, Budle, Upper Taieri, Loganburn, Hawkdun, Lindis, Ahuriri	..	..	..	83,936	0·84	293 10 0	15,096	91	0 $7\frac{1}{8}$	449 10 11	21	53	0 3 $11\frac{1}{2}$	10 11 0	..	..	..	..	..	..	..	..	753 11 11	Open country. Resurvey of part of Sutton Township. 31,000 acres topography done (not included), when accident occurred to theodolite.
Contract.																								
J. Campbell	..	..	..	..	..	..	1,038	19	1 $5\frac{3}{4}$	76 13 9	12	81	0 11 $1\frac{1}{4}$	45 0 0	..	..	..	..	..	..	..	..	121 13 9	Open country. Village allotments, Hawea. Within a gold field.
Fees.																								
J. Campbell	..	..	..	..	..	..	..	..	..	..	..	..	..	..	418	24	6 $6\frac{3}{8}$	136 11 0	..	..	..	..	136 11 0	
Totals	..	..	..	347,489	1·09	1,577 18 6	81,310	507	1 $1\frac{3}{8}$	4,527 16 10	431	252	0 19 10	250 2 6	778	59	10 8	415 12 6	$37\frac{7}{8}$	9 10 10	361 8 3	1,738 18 3	8,871 16 10	

* Maps not quite finishe.

PROVINCIAL DISTRICT OF SOUTHLAND.

Staff.																								
John Hay, Longwood, Jacob's River	..	..	..	..	..	..	1,725	74	7 3	640 0 0	44	174	1 0 0	174 0 0	..	..	..	..	$1\frac{1}{2}$	14 0 0	21 0 0	19 0 0	909 11 0	Weather exceptionally wet for several months. Surveys nearly all in bush, long traverses required. Officer on leave for a month, and laid up for three weeks owing to an accident. In progress: 15 sections (600 acres in bush); cost to date, £55 11s.
James Blaikie, Eyre, Mararoa, Takitimo, Waiau, Wairaki, Oteramika, Mataura	7,000	0·34	10 0 0	..	..	..	14,000	102	0 11·3	658 12 4	140	69	0 13 8	47 5 0	..	..	..	..	$5\frac{1}{2}$	12 0 0	66 0 0	..	781 17 4	Seven township allotments and $2\frac{3}{4}$ miles of road traverse were in bush.
George Watson, Winton, Oreti, Hokonui, Eyre, Centre Hill	..	..	..	..	..	..	10,826	97	1 3·8	713 0 4	..	..	..	..	..	..	..	..	..	..	..	3 3 0	766 3 4	Fifty sections, comprising 791 acres, were in bush. Some of the surveys were in rough broken country. In progress: 21 sections, embracing 4,900 acres; cost to date, £70, £20 carried from previous year.
William Hay, Invercargill	..	..	..	..	..	..	327	58	11 $10\frac{1}{4}$	193 17 2	..	..	..	..	..	..	..	..	..	..	..	..	193 17 2	Nearly all the sections were in heavy bush. Surveyor resigned at end of September, 1883.
A. K. Robertson (temporary), Invercargill, Lindhurst, Wairio	..	..	..	..	..	..	2,968	25	1 0·9	159 15 0	..	..	..	..	..	..	..	..	..	..	..	..	159 15 0	Many of the sections were in bush, two being saw-mill areas. Party was at work from October, 1883, to February, 1884.
Fee System.																								
George Hately, Longwood, New River, Forest Hill ..	..	..	..	..	..	..	1,140	6	2 4	133 3 3	..	..	..	..	..	..	..	..	..	..	..	..	133 3 3	Five saw-mill areas and one purchase.
T. B. McNeil, Invercargill, New River, Forest Hill, Hokonui, Eyre, Mabel, Lindhurst	..	..	..	..	..	..	2,827	18	1 6·4	217 0 9	..	..	..	..	..	..	..	..	..	..	..	..	217 0 9	Comprising 16 purchases and 2 saw-mill areas.
T. S. Miller, Wairaki, Oreti, Waiau, Wairio, Mataura ..	..	..	..	..	..	..	851	12	2 0·1	85 11 9	..	..	..	..	..	..	..	..	..	..	..	..	85 11 9	Purchases, mineral areas, &c.
William Hay, Invercargill, Mabel, Oteramika ..	..	..	..	..	..	..	506	4	2 $8\frac{1}{2}$	68 12 6	..	..	..	..	..	..	..	..	..	..	..	..	68 12 6	Comprising 2 purchases and 2 saw-mill areas.
Totals	7,000	0·34	10 0 0	..	..	..	35,170	396	1 7·5	2,869 13 1	184	243	0 18 $2\frac{1}{2}$	221 5 0	..	..	..	..	7	12 8 7	87 0 0	22 3 0	3,315 12 1	

JAMES McKERROW
Surveyor General.

MAP OF THE
NORTH ISLAND,
NEW ZEALAND.

SHEWING THE
ROADS TO OPEN CROWN LANDS FOR SALE
SURVEYED & CONSTRUCTED DURING 1881-2, 1882-3, 1883-4

Scale of Miles.

10 5 0 10 20 40 60 80

Reference.

- Chief Towns ____ shewn thus ____ WELLINGTON ○
- Minor Towns and Post Offices ____ " ____ HAMILTON ○
- Roads ____ " ____
- Railways ____ " ____
- Boundaries of Provincial Districts ____ " ____
- Roads cleared ____
- do do and formed ____
- do surveyed and graded ____

NORTH ISLAND

SOUTH ISLAND

MIDDLE ISLAND

Tasman Sea

Cook Strait

BAY OF PLENTY

HAWKE BAY

TE URIWERA COUNTRY

Bay of Islands

HAURAKI GULF

D'Haussez Group

Firth of Thames

Manukau Har.

North Taranaki Bight

South Taranaki Bight

Karamea Bight

Golden Bay

Tasman Bay

D'Urville I.

Palliser Bay

General Survey Office, Wellington, N. Z., July, 1881.

South Latitude

East Longitude

JAMES McKERROW
Surveyor General.

MAP OF THE
MIDDLE ISLAND,
NEW ZEALAND.

SHEWING THE
ROADS TO OPEN CROWN LANDS FOR SALE
SURVEYED & CONSTRUCTED DURING 1881-2, 1882-3, 1883-4

Scale of Miles.

10 5 0 20 40 60 80

Reference.

- Chief Towns ..... shewn thus ... DUNEDIN ○
- Minor Towns and Post Offices ..... " ... AKAROA ○
- Roads ..... "
- Railways ..... "
- Boundaries of Provincial Districts ..... "
- Roads cleared
- do do and formed
- do surveyed and graded

TASMAN SEA
Golden Bay
Tasman Bay
Karamea Bight
Cloudy Bay
Pegasus Bay
Canterbury Bight
Banks Peninsula
Otago Harbour
Foveaux Strait
Solander I.
South Latitude
PACIFIC OCEAN
NORTH ISLAND
SOUTH ISLAND
STEWART ISLAND
COOK STRAIT
NELSON
WELLINGTON
BLENHEIM
CHRISTCHURCH
DUNEDIN
INVERCARGILL
GREYMOUTH
HOKITIKA
WESTPORT
TIMARU
OAMARU
GISBORNE
NAPIER
NEW PLYMOUTH
WANGANUI
PALMERSTON
HASTINGS
MASTERTON
GREYTOWN
LYTTELTON
AKAROA
KAIKOURA
BLUFF
QUEENSTOWN
ARROWTOWN
CROMWELL
ALEXANDRA
OAMARU
TIMARU
ASHBURTON
TIMARU
GORE
INVERCARGILL
RIVERTON
OTAUTAU
WYNDHAM
LUMSDEN
MOSSBURN
TE ANAU
MANAPOURI
MILFORD SOUND
DUSKY SD.
DOUBTFUL SD.
BREAKSEA SD.
RESOLUTION ISLAND
CHATHAM ISLANDS.
Scale 2.5 Miles to an Inch.

General Survey Office, Wellington, N.Z., November, 1882.

166° 167° 168° 169° 170° East Longitude. 171° 172° 173° 174°
40° 41° 42° 43° 44° 45° 46° 47° 48°

APPENDIX No. 3.

ROADS TO OPEN CROWN LANDS FOR SALE.

Extracts from Reports and Statements by Supervising Officers and Local Authorities, on the Work done from 1st July, 1883, to 30th June, 1884.

AUCKLAND.

Kaihu to Kaikohe.—No work has been done on this road, for the reason stated in last year's report, viz., that the lands it immediately affects are withheld from sale pending the making of the Kaihu Valley Railway.

Homestead Blocks, Mangonui.—Prior to last year's report a grade survey had been made of 4½ miles. This is now under contract, and 2¼ miles of 4ft. in the solid road have so far been completed, under Mr. Garsed's inspection. The vote will not be exceeded.

Pakiri Block.—Bridge built by Rodney County Council. See last year's report.

Wairua to Sandy Bay.—Works on this line were in hand at date of last report, and were completed shortly afterwards to 8¾ miles as a bridle-road of 12ft. and 8ft. width, and 3 miles further have been graded; but works are delayed owing to want of funds, and to the difficulty of getting a title through a block of Native land where it runs. Mr. E. J. Fairburn has been in charge. The vote is expended.

Wairua to Helena Bay.—At the date of last report Mr. E. J. Fairburn had completed five miles of 8ft. and 5ft. road. Since then he has added 4½ miles of road of the same character, which brings it out to Mimiwhangata, a convenient landing-place on the coast. The vote is all but expended. Two groups of sections are now being laid out on this line for sale.

Whangarei through Taheke.—Mr. J. C. Blythe was sent up to explore for this road about four months ago, and found a good road into and through the Crown lands, but, on account of the compensation asked by persons whose lands were affected, we had to abandon the first-proposed line and seek for another, which Mr. Blythe succeeded in finding. He has 11½ miles graded and about 3 miles under contract as a bridle-road. The vote taken for this line will not carry it through, but it will open a good deal of country described as being of very good quality.

Purua and Mangakahia.—On this line a bridge of 169ft. in length and 65 chains of cart-road have been completed, opening a through communication to a large district. The works have been well and cheaply done, the bridge plans having been prepared by Mr. E. Fairburn, who has also inspected the works occasionally. This is a very useful work to the public generally, as well as opening up some good land. The vote is not quite expended.

Tangihua No. 3.—Nothing further than the purchase of a piece of road through private property has been done on this line; but I propose getting Mr. Blythe to improve an old road, to render access to our former works easier.

Maunganui Bluff to Kaihu.—The remaining gap of 2½ miles on this line was in hand at date of last report, and Mr. J. C. Blythe completed it in October last, thus making a continuous line from the Wairoa River to the beach north of Maunganui Bluff. Heavy timber and the number of swamps and culverts has made this an expensive work, and, as the Crown lands it was to open are all tied up for the Kaihu Railway, the Government do not derive the advantage from the works they otherwise would have done.

Takahue to Manganui-o-wae.—Completed last year.

Okaihau to Victoria Valley.—At the date of last year's report we had five contracts in operation. Up to the present time 10 miles have been completed, out of which 3½ miles have been finished this year. It is a cart-road of from 16ft. to 22ft. in width, and has cost about £280 per mile, including inspection, surveys, &c., the bridging being a large item. The end of the work is at the Waihou River, about the bridge for which you will lately have received reports, &c. Beyond the Waihou a grade survey has been carried for 11½ miles, and plans prepared for works; then comes a gap of 3 miles of unsurveyed line before a junction is effected with Mr. Garsed's survey from the northern end, which has been graded for 16 miles, but no works have been done on it. Everything is in abeyance at present owing to difficulties with the Natives. There is a balance of £2,195 to credit of vote. Mr. Fairburn has had the general inspection of these works, Mr. Blundell being the local Inspector.

Helensville to Kaipatiki.—Mr. J. C. Blyth was just commencing the extension of this work at the date of last report. He cleared, drained, and bridged an additional 3 miles as a cart road, but did not complete the road to the deferred-payment settlers' land on account of the money running short.

Waiuku Road District.—Mr. Mellsop, Inspector of Works, reports: "The road from the end of the Hermitage Road to the Akaaka Creek, a distance of 60 chains, was drained by making two drains 24ft. apart, 7ft. wide on top, 3ft. 6in. deep, and 4ft. wide at the bottom, the earth being thrown into the centre of the road. After the swamp had sunk, the drains were deepened 1ft. 6in. and widened 1ft. The Akaaka Creek was cleared of all logs and other obstructions for a width of 12ft. and a distance of about 2 miles, and a narrow temporary bridge thrown across it. The drains have dried the swamp to a distance of about 10 chains on each side since the Akaaka has been sufficiently lowered to let the drains act to their full depth."

Waikato River to Block XVI., Awaroa.—Beyond building one 30ft. bridge, three 15ft. bridges, and a 5ft. culvert, no work has been done. The vote is expended. In view of the large amount of good though broken land this line opens up it would be advantageous to improve some parts of it. Some sections for sale will be surveyed along the road during the ensuing season. The road is open for 23½ miles.

Waikato River to Block VII., Awaroa.—No further works have been done on this road, 18 miles having been completed just prior to last report.

Tauranga to Te Puke and Matata.—At the date of last report Mr. Goldsmith had completed 19¼ miles, and since then the road has been carried on a further distance of 3 miles, making 22¼ altogether, the total cost of which is £3,810 9s., or at the rate of £171 per mile, a very reasonable price considering that the road runs across country and has twenty-seven bridges and culverts, with many heavy cuttings and embankments. It opens a line for through traffic by wheels from Tauranga to Otamarakau on the beach, beyond which place the Public Works Department have improved the line as far as Matata.

Opotiki to Waiotahi.—2½ miles of road and one 12ft. bridge through Mr. Thomson's property were finished during the year, under Mr. Crapp's supervision, by the Opotiki Road Board.

Opotiki to Ormond.—The eastern end of this road is in charge of the Survey Department, the western in that of the Public Works Department. The efforts of the Survey Department were confined to clearing away some slips and making necessary repairs consequent on the heavy rains of the past season. Some further burning-off for grass-sowing was done, but not very successfully. Mr. O'Ryan's special report gives full details as to state of road. Mr. Crapp, of the Public Works Department, reports that during the past year 13 miles 52½ chains were laid off for construction through difficult forest country, thus completing the connection of the survey between the Bay of Plenty and Poverty Bay. Of the road formed during the season of 1882–83, 21 miles have been maintained and repaired, and 1,158 cubic yards of rock excavated in widening the track from 4ft. to 8ft. 11 miles 60 chains have been formed during the season, the bush being felled 1 chain wide and the track formed 4ft. and 5ft. wide. The remainder of the road—about two miles of which is contracted for—is in progress, and when completed the track will be open for horse traffic from Gisborne to Opotiki.

Te Aroha–Katikati.—Mr. Goldsmith kept two men employed on this line until the 18th January last, when it was handed over to the Tauranga County in good condition. The cost of men and occasional supervision was £141 17s. 6d., which was money well spent in keeping it clear of slips and putting in additional culverts.

Huihuitaha to Patetere.—Completed at date of last report. Nothing done this year.

Ormond to Waiapu.—At the date of last report 24½ miles were completed as a bridle-road, the work at the northern end having at that time been brought to a standstill by the opposition of the Natives; but, proceedings having been taken against them in the Resident Magistrate's Court, and fines inflicted, this had the good effect of preventing further trouble. Up to the time when works were stopped owing to the expenditure of the vote, a distance of 30 miles had been added to the work of the previous year, much of which is wide enough for dray traffic.

Waipiro Branch of the above road, which had been formed for 8½ miles at the time of last report, has had the necessary culverts put in to complete it as a dray-road.

Tuparoa Branch of Waiapu Road has been completed as a dray-road a distance of 3½ miles, making, with last year's work, 6 miles altogether. Both these latter works, and the northern end of Waiapu Road, have been under Mr. Haig's direction.

Gisborne–Waimata Road has had some repairs and culverts added to it, but no further mileage of road has been opened.

Gisborne to Wairoa.—The works on the northern portion, 28 miles, of this road during the past season have been undertaken by the Cook County Council, inspected and certified to by Mr. Barnard. They consist of widening out and draining. The southern end of this road is being constructed by the department under Mr. Horace Baker's direction, Mr. Lambert being in charge. During the season 4 miles have been added, making 7¾ miles completed to date, on which are some bridges of considerable size. There now remain the 8 miles between Waihau and Te Reinga to complete the formation between Gisborne and Wairoa.

Taupo viâ Rotoaira to West Coast.—The past season has added 34½ miles to the 2 miles finished at the 30th June, 1883, though some of the heavy rock-blasting is not yet finished. Mr. Wright has had charge of this work, the blasting being done by the Constabulary detached for that purpose by Major Scannell. It is a cart-road of from 14ft. to 18ft. width, and the cost per mile to date, including two bridges of a total length of 128ft., is £78 9s. It has not been considered advisable to bridge the Tauranga–Taupo and Waikato Rivers, which this road crosses, for the cost of so doing would be considerable. Both are dangerous rivers, and will obstruct the traffic when in flood. Some difficulty has been experienced from Native obstruction, but, thanks to Major Scannell's kind assistance, it has been overcome.

Ruakituri Block.—In addition to some repairs made on the lines mentioned in last year's report, Mr. Lambert has constructed rather more than 3 miles from Te Tuhi to Ruakituri River as a bridle-road, thus most effectually opening up this block. A ferry has also been established at Te Reinga.

Kohukohu to Rakautapu.—On this branch of the Herd's Point–Takahue Road Mr. Wheeler has surveyed 5½ miles, the contracts for which are now ready, and tenders will be invited directly.

Maungakaramea to Tangiteroria.—This portion of the main road from Whangarei to the Wairoa River has been graded where necessary for some 4 miles, and two contracts for its formation as a cart-road have been let, 2¼ miles being completed to date, under Mr. D. C. Wilson's supervision.

Kenana–Rangiuru.—This is a branch road from the Tauranga–Opotiki Road, to open up the Rangiuru Crown lands. Mr. Goldsmith reports that he has finished 4½ miles of 12ft. road, at the small cost of £40 16s. per mile, and hopes to finish the remaining 2¼ miles in two months' time.

Aotea–Kawhia.—Arrangements having been made that the Survey Department should take over the direction of this road, Mr. C. W. Hursthouse started in January last, with parties of Maoris, Constabulary, and several small contractors, to continue on from where the Public Works Department had finished, near Te Mata. Up to date he has completed 6¾ miles of from 12ft. to 18ft. in width, excepting two bridges, 3¼ miles of which are at the Kawhia end, leading from the township northwards. There remain about two miles more to complete this road to Aotea Harbour at both ends. No works are contemplated along the shores of this harbour, as the sands form a good road.

Kawhia-Waipa.—At 2¼ miles along the above road northwards from the Kawhia Township this line branches off to the eastward to head the arms of the harbour. Mr. Hursthouse reports that up to date (since March) he has completed 4 miles of 15ft. road, with the aid of Constabulary and Maoris, and has graded in addition some 9 miles ready for construction. Near Hikurangi, on the Waipa side, another party of Constabulary is at work making a long grade of 1 in 16, to avoid that terrible hill leading from the open country into the forest on the old Maori track. In consequence of instructions received, the width of formation will be reduced in future to 6ft. in the solid. The road will pass over some high country, Tirohanga-Kawhia being about 1,350ft. above the sea, but excellent grades have been found everywhere.

The following roads under the Hon. the Minister of Lands' votes have not been touched this year: Tolago to Arakihi, Wairoa to Otau, Te Maire to Kahuru, Whaingaroa to Kahuru, Waerenga through Whangamarino, Whangape to Victoria Valley; but it would be advantageous to commence some of them during the ensuing season, in order to open lands for settlement.

The above is a brief statement of the works carried out by the department in this province during the past year, epitomized from the very full reports furnished by the officers in charge, whose remarks on the cost per mile of construction, survey, and supervision by the various systems of contracts, piece-work, or day-labour in force are very instructive and will prove of permanent value.

Appended hereto is a table showing these work, in a form similar to that supplied last year, from which it will be seen that we have completed 112 miles of roads in all.

S. Percy Smith, Assistant Surveyor-General.

Schedule of Road-works to open Crown Lands before Sale completed within the Provincial District of Auckland during the Period from 1st July, 1883, to 30th June, 1884.

Name of Road.	Bridle-road.	Cart-road.	Graded in Addition.	Bridges not included in Roads.	Remarks.
	Miles.	Miles.	Miles.	Feet.	
Homestead blocks, Mangonui ...	2·25	...	...	...	Works still in progress.
Wairua to Helena Bay	4·5	...	...	...	Completed.
Whangarei-Taheke	0·25	...	11·25	...	Works still progressing.
Purua-Mangakahia	...	0·75	0·50	169	Completed.
Maunganui Bluff-Kaihu	2·50	...	4·0	...	"
Victoria-Okaihau	...	3·50	17·25	...	Delayed.
Helensville-Kaipatiki	...	3·	...	...	Completed.
Tauranga-Matata	...	3·	...	...	"
Ormond-Waiapu	30·	...	4·5	...	Delayed.
Tuparoa Branch	...	3·25	...	...	Completed.
Gisborne-Wairoa	...	4·	...	...	Works still in progress.
Ormond-Opotiki	11·8	...	13·7	...	" "
Taupo-Murimotu	...	34·5	...	...	Delayed.
Ruakituri Block	3·	...	...	...	Completed.
Kohukohu-Rakautapu	...	...	5·5	...	
Maungakaramea-Tangiteroria ...	...	2·25	1·25	...	Work still progressing.
Kenana-Rangiuru	...	4·5	2·	...	" "
Aotea-Kawhia	...	6·75	2·	...	" "
Kawhia-Waipa	...	4·	9·	...	" "
Totals	54·3	69·5	70·95	169	

TARANAKI.

I have the honour to forward a report on roads to open up Crown lands north of Waitara.

The expenditure on the twenty miles of new road, which is an extension of the main road from Pukearuhe to Mokau, has been £859 6s. 6d. Of this, £222 10s. has been paid to natives on piece-work, £472 10s. to contractors for bush-felling, and £164 6s. 6d. to Constabulary working parties.

Before these works were commenced the travelling to Mokau was attended with great danger to life, as the track lay principally along the sea-beach, with precipitous cliffs, at high water the sea dashing up against them. Points run out to sea, around which, even at lowest spring-tides, the traveller had to swim his horse, excepting in very rare instances. The first thing done to remedy the evil was to cut a zigzag horse-track up the face of the cliffs at the place known as the "Rope Ladder," which is here 160ft. in height; the streaks are from 2 to 3 chains, and the grade 1 in 5; the width varies from 2ft. 6in. to 4ft. This has proved a great service, as horses not loaded can be got up, and the most dangerous points avoided. From the top of the cliff to Kawau, a distance of eight miles, the road has been cleared a chain wide, and a good 6ft. horse-track made the whole distance. From this place at about half-tide there is a good beach to Mokau. Besides this, some ten miles of road has been felled by Constabulary working parties and contractors.

From Pukearuhe to Tamurenui, near the zigzag, a road-line has been taken inland, to avoid the beach, which, below the cliffs, is generally a mass of large boulders. This goes through a saddle in

the range about 600ft. above sea-level. The range is very broken, and the road will be an expensive one to make. It has already been felled 1½ chains wide, and the Constabulary are now making a 6ft. horse-track along the line, about a mile of which is done.

I take the opportunity of expressing my satisfaction at the manner in which the Constabulary road parties have worked, and the assistance that I have received from Captain Messenger in supervising and inspecting contracts. These men get 1s. a day extra, and I think that the following will show that a great advantage is gained by their employment. The amount paid for these working parties is £164 6s. 6d., including cost of tools, &c. My estimate of the value of the various works done by them is £509, showing a saving of nearly £345.

Several more small contracts are let to natives north of Kawau, but they appear to be getting tired of the work, and I anticipate yet having to finish the work nearly if not entirely independent of them.

THOS. HUMPHRIES, Chief Surveyor.

TARANAKI-WEST COAST.

DURING the past year over seventy-six miles of roads have been felled 1 chain wide, and cart-way cleared 16ft. wide in the centre of the road, at a cost of £4,697. On these and on some of the roads felled last year the sum of £2,430 has been spent in bridging, culverting, and draining, and generally in making the roads passable for dray traffic. Over a hundred miles of roads have also been sown with grass seed, to prevent the growth of underwood. The total expenditure for the year, including supervision, has been £7,565 6s. 6d., the supervision, including a part of the Inspector's (Ranger's) salary, amounting to only a small fraction over 4 per cent. of the whole. The work has been let in seventy-six contracts, and carried out chiefly by settlers holding lands in the vicinity of the roads felled, thus enabling many to clear the bush and build upon their farms who would without this assistance have probably been unable otherwise to have done so. The roads opened up include those running through the Native lands recently leased by the Public Trustee and lying between the Waingongoro Stream and Opunake; also those opening up Crown land at the back of Waimate, in the Ngaire, Kaupokonui, Oeo, and Opunake Survey Districts; also, the Tariki Road in the Huiroa Survey District, Taranaki Land District, and the Motoroa Road, in the Wairoa and Omahini Survey Districts, near Waverley. A schedule is attached to this report, showing details of cost of the above works. The works now in hand will all be completed within two months' from the present date, and I have as yet received no authority for entering upon any new works. I desire here to draw your attention to the great advantage of felling roads during the early spring, they being thus ready for burning and grassing in the following autumn, thus preventing the growth of underwood and saving future expense to the Road Boards.

The works I beg to recommend for the coming year are—

1. The felling of a small part (a deviation) of the Tariki Road, Huiroa district, and the culverting, bridging, grading, and forming of about five and a half miles of it, from its junction with the Ratapeko Road to the Waitara River. The estimated cost of this work is £1,200. This would complete a fair dray-road from the railway-line at Tariki Road station to the Waitara River, a distance of about twelve miles, suitable for traffic during about eight months in the year.

2. The opening of a road from the Bristol Road, Moa district, crossing the Manganui Stream below its junction with the Maketawa Stream, and joining the Tariki Road at the Mangaone clearing. The estimated cost of felling, clearing, culverting, and bridging the road to this point is about £1,600. These two roads will be required to open up the Crown lands lying between the Inglewood district and the Waitara River in the Ngatimaru district, and would also lead to the Crown lands to the eastward of the Waitara River, in the Ngatimaru country. I beg here to remind you of the great gain which would result not only to the district through which the road would pass, but also to the Government, by not merely opening the above road—from Inglewood to Waitara—in the usual way by felling, culverting, &c., but by also forming and metalling it, previous to offering the Crown lands for sale. The lands in the Waitara, Taramouku, and other valleys which would be opened up by this road are of excellent quality, the soil being a rich, loamy clay. The growth is light bush, scrub, and fern, a large extent being only scrub and fern. This land, if opened up by a metalled road, would probably realize prices approaching the values given in the Waimate district; but with an ordinary bush road the best of the land would in all likelihood be purchased by speculators, to hold until the country was properly opened up by roads, and the balance would be unsaleable, excepting at very low prices. The distance from Inglewood to the Waitara River by the above road would scarcely exceed ten miles, and with a metalled road stock could be driven to New Plymouth and shipped to market cheaper than from Waimate. I would therefore strongly recommend that none of the land in the Ngatimaru district be offered for sale until a metalled road is made to it. The cost of metalling would be more than recouped by the increased selling value of the land.

3. I would recommend that provision be made for opening roads through lands in the Ngatimaru District the surveys of which will, I believe, be commenced in spring. Probably the sum of £1,000 would suffice for the present year.

4. The opening-up by roads of a block of about 7,000 acres of bush land near Inglewood, part of which was known as the Titanic Ironsand Reserve. The front of this land is within two and a half miles of a metalled road—the Junction Road and Mountain Road—and part of it the same distance from the railway-line. The cost of felling, clearing, and culverting the required roads would be about £1,200.

5. The culverting the roads recently felled through Crown lands in the Kaupokonui and Opunake districts. The estimated cost of this work is £2,100.

6. The culverting the roads through Native lands recently leased by the Public Trustee in the Waimate and Opunake districts; estimated cost, £960.

7. The opening of roads by felling, culverting, &c., through Native lands recently leased by the Public Trustee, and lying between Opunake and Moutoti, and between the Waiweranui and Hangatahua (Stony River) Streams. The estimated cost of these works is £1,650.

I also beg to draw your attention to the hardships experienced by settlers who have purchased land on or near the East Road, in Block III., Ngaere district, by no bridge being as yet erected over the Kahouri Stream. Some years since a sum of £800 was placed upon the estimates for this work, but the vote was allowed to lapse. In consequence of the present low cost of timber and other materials, and also of skilled labour, I am of opinion that a bridge and approaches could now be constructed for about £500, and it is probable that a portion of this cost would be borne by the Road Board, the School Commissioners, and by the owners of blocks of land east of the confiscation boundary-line purchased from the Natives. Were this bridge erected I believe the settlers would be able to do the minor works themselves.

I have been well supported in the road-work by the overseer, Mr. R. Stanners. I cannot speak too highly of his conduct, or of the manner in which he has worked—in many cases during the summer months over seventy hours a week, and in the winter attending to his duties regardless of weather.

G. F. Robinson, Crown Lands Ranger.

Annual Return of Cost of opening up Roads through Crown Lands in the Taranaki and West Coast Land Districts for the Year ending 30th June, 1884.

Name of Road.	District.	Cost of Felling.			Cost of Culverting.			Totals.		
		£	s.	d.	£	s.	d.	£	s.	d.
Tariki[1]	Huiroa	202	16	3		...		202	16	3
Opunake[2]	Kaupokonui	325	0	0	190	16	7	515	16	7
Skeet[3]	"	93	17	0	44	0	6	137	17	6
Manaia[4]	"	84	13	11	23	9	7	108	3	6
Duthie[5]	"	121	3	0	50	5	4	171	8	4
Hastings[5]	"	344	9	3	27	2	8	371	11	11
Oeo[6]	"	200	18	11	58	12	4	259	11	3
Palmer[7]	"	213	10	4	112	16	0	326	6	4
Finnerty[8]	"	45	5	3	13	1	2	58	6	5
Rowan[9]	"	347	8	1		...		347	8	1
Mangawhero[10]	"	185	6	5		...		185	6	5
Ronald[11]	"	183	9	11		...		183	9	11
Wiremu[12]	"	117	9	0		...		117	9	0
Eltham[13]	Kaupokonui and Opunake	34	16	5	858	2	2	892	18	7
Patiki[14]	Oeo and Opunake ...	55	13	3	247	19	0	303	12	3
Rama[15]	Waimate	28	19	11		...		28	19	11
Omuturangi[16]	"		...		112	8	5	112	8	5
Taikatu[17]	"	201	17	2		...		201	17	2
Tempsky[18]	"	67	19	7	97	11	0	165	10	7
Katetauru[19]	"		...		68	18	0	68	18	0
Kokiri[20]	"	168	5	2	201	16	3	370	1	5
Glenn[21]	"	193	6	0	49	18	5	243	4	5
Fraser[22]	Hawera		...		75	14	1	75	14	1
Nopera[23]	Oeo	59	13	7		...		59	13	7
Kiri[24]	Opunake	155	7	8		...		155	7	8
Watino[25]	"	284	17	0		...		284	17	0
Ihaia[26]	"	237	15	7		...		237	15	7
Kaweora[26]	"	277	9	4		...		277	9	4
Waiteika[27]	"	465	14	4		...		465	14	4
Motoroa[28]	Wairoa		...		198	0	0	198	0	0
Miscellaneous[29]			...			...		437	12	8
Totals ...	... ...	4,697	2	4	2,430	11	6	7,565	6	6

Remarks.—[1] Felling road from Block-line II. and VI., Huiroa, to Waitara River. [2] Felling road from Punehu Village Settlement to Rowan Road, and culverting from Manaia Road towards Rowan Road. [3] Felling road from Oeo Stream to Patiki Road, also culverting the same. [4] Felling road from Opunake Road to Forest Reserve, also culverting. [5] Felling and culverting road in Block VIII., Kaupokonui. [6] Felling road in Block IX., Kaupokonui, and culverting in Block XIII. [7] Felling and culverting road in Block VII., Kaupokonui. [8] Ditto, Block VIII. [9] Felling road in Blocks VII. and XI., Kaupokonui. [10] Ditto, Block X., Kaupokonui. [11] Ditto, Block V., Ngaire and VIII., Kaupokonui. [12] Ditto, Block IX., Kaupokonui. [13] Culverting between Auroa Road and Opunake, also draining and forming near Opunake. [14] Felling road in Block XI., Opunake, and draining and forming between Skeet Road and Railway Reserve. [15] Balance of road-felling, Main Road to Skeet Road. [16] Culverting Main South Road to Oeo Road. [17] Felling road from Main South Road to Skeet Road. [18] Balance of felling and culverting road from Hastings Road to Palmer Road. [19] Formation from Normanby Road towards Skeet Road. [20] Felling and culverting road from Normanby Road to Skeet Road. [21] Felling and part culverting road from Main South Road to Skeet Road. [22] Felling road in Blocks II., Hawera, and XIV., Ngaere. [23] Felling road, Main South Road to Skeet Road. [24] Felling road through Block IX., Opunake. [25] Felling road from Main South Road to Eltham Road. [26] Ditto in Block X., Opunake. [27] Ditto, and XII., Opunake. [28] Formation in Block III., Wairoa, and Block IV., Omahini. [29] Grassing roads, £158 7s. 5d.; sundries, £7 15s. 6d.; supervision, £271 9s. 9d.

HAWKE'S BAY.

THE votes to open out the following blocks have been expended: Ngamoko Block, Norsewood District; Ahuaturanga Block, Woodville District; Tukituki to Waipawa, Ruataniwha District; and Blocks IX. and XIII., Tahoraiti District. Reports on these works have been furnished with the returns for previous years.

Maharahara Block, Woodville District.—Three contracts, covering 7 miles 28 chains of road-line, have been cleared 66ft., logs rolled off, and stumped 16ft. in the centre, and sown with grass seed, at a cost, including supervision and exploration surveys, of £1,496 1s. 1d. The balance available for expenditure is £40 18s. 11d. A further sum of £1,900 is required to clear the remaining roads, for formation in wet ground, and for side-cuttings. The area to be opened out is from seven to ten thousand acres of good level agricultural and pastoral bush land.

Tahoraiti to Tautane.—Six miles of road-line have been cleared through the bush, 66ft. in width, at a cost of £559 18s. 6d. The road surveyor employed on this block was engaged during the first six months of the year in laying off for the Hawke's Bay Rabbit Prevention Committee the first section of the proposed line of fence. He has completed twenty miles of traverse, following the watersheds. The Committee have let contracts for clearing and fencing several miles. The line of road from Tautane to Tahoraiti has been definitely decided upon and graded, in readiness for clearing and formation, a distance of thirty-seven miles between the points that are at present open for dray traffic. In previous reports I have entered fully into particulars concerning the road-line and the country to be opened out by it. The expenditure to date is £1,612 11s. 9d., leaving the balance of the vote, amounting to £3,903, available for works; but, as I have before stated, a much larger sum will be required to complete the road.

Rotokakarangu Block.—With regard to this road nothing has been done beyond taking the initiatory steps towards acquiring the land for a deviation of the road, at the starting-point in the Ohinepaka Valley. Here, again, the vote is much too small to do anything further than making a start with the road.

Mohaka to Waitara.—Mr. Kennedy has made the necessary surveys, and has prepared specifications for calling for tenders for twenty-two miles of bridle-track. Cost of surveys, £151 6s. 4d.

Block XIV., Tahoraiti District.—Roads cleared through forest, 66ft. in width, 4 miles 33 chains; formed for dray and bridle traffic, 2 miles 65 chains; culverts and bridges erected, 10; cost, including supervision and the taking of levels, £1,690 6s. 1d. These works have been let in nine small contracts to settlers living in the locality. It is very desirable that a further distance of two miles should be made passable for horse traffic. This block, containing 4,016 acres, was advertised for sale on the deferred-payment system in April last; since then every section except one has been taken up. The sum to be paid by selectors for the land amounts to £5,456 18s. 10d., of which a third—or £1,818 19s. 7d.—will from time to time be handed to the Kumeroa Road Board for expenditure on the roads. From the sale of Blocks IX., XIII., and XIV., Tahoraiti District, and Block IX., Woodville District, the above-named Road Board will receive the sum of £4,817 10s. 8d. to carry on the roads that have been commenced in their district, extending over an area of about 13,096 acres.

Block IX., Woodville District.—Road-line cleared 66ft. in width, and stumped on level ground 1 mile 29 chains; cost, £163 2s. 6d. The lands, 614 acres, in this block have also all been taken up, and will yield to the Road Board during the next few years a revenue of £528.

Raikaiatai Block, Takapau and Norsewood Districts.—Roads cleared 66ft. and stumped 16ft. in centre, 3 miles 14 chains; cost, £518 18s. 6d. The area opened out is 3,760 acres, of which 1,219 acres have been sold for cash for £4,480 18s. 9d., and on deferred payments, 2,551 acres, for £3,963 6s. 10d. The revenue coming to the Road Boards from the sale of deferred-payment sections is £1,321 2s. 3d.

HORACE BAKER, Chief Surveyor.

WELLINGTON.

THE Chief Surveyor reports that the only road-works carried out under the supervision of this office were upon the Martin–Murimotu line, between the Paraekaretu northern boundary and the open country in the interior. The work consisted of opening the whole line for traffic over a distance of about twenty-five miles by removing slips and repairing bridges and culverts; this had to be repeated twice for the greater part of the distance. Three and a quarter miles of road were cleared of bush three-quarters of a chain wide; four and a quarter miles were formed from 8ft. to 25ft. in width; eight bridges were constructed of available durable spars, and twenty-seven well-built permanent culverts were placed in position on the Pokiori Flats. The removal of slips kept the working-party fully employed for weeks at a time; and there is every probability that constant attention will be required to keep the road open. Mr. Charles Field and a gang of labourers carried out the whole of the works under Mr. John Annabell's supervision. I am well satisfied with the energetic and practical manner in which Mr. Field conducted the works. The total cost amounted to £560.

In anticipation of road-works the staff surveyors have been employed in exploring for and locating roads on Crown lands, with the following results: West Tokomaru, 4 miles graded; Otairi, 3 miles graded; Waitapu and East Pohangina, 16½ miles graded, and 21 miles engineering plans and specifications prepared; Makuri–Puketoi, 40 miles explored; Kaiwhata, 4 miles graded; Paratieke, 6 miles graded; Kaiewarewa, 6 miles graded.

A sum of £50 was expended on a road in Fitzherbert Block leading to Crown lands in the Mangatainoko Block.

Mr. King, the Engineer for the Wairarapa East County, furnishes the following statement showing work done towards opening up Crown land in the County of Wairarapa East :—

Name of Road and Contract.	Length of Formation.	Bridges.	Remarks.
Hawera—	Ch. lks.		
1. Road Contract No. 2	112 00	1 40-ft.-span truss bridge	Completed.
2. " No. 3	83 00	...	"
3. " No. 4	80 00	1 26-ft.-span bridge ...	"
4. " No. 5	14 00	...	"
5. " No. 6	57 00	...	"
6. Dreyer's Rock Road Contract No. 1 ...	74 00	...	"
7. " " No. 2 ...	54 00	...	"
8. Makakahi " No. 1 ...	56 61	1 30-ft.-span truss bridge	"
9. Central Mangaone " No. 1 ...	80 00	...	"
			"
Totals	610 61	3 bridges	"

Contracts Nos. 1 to 3, 6, 8, 9, were returned last year as "in progress," but nearly the whole of the payments were made during the year ended 30th June, 1884. The country through which these roads lie is all dense forest, and very broken in nature, necessitating heavy cuttings and deep embankments, the subsoil in many instances being of a rocky nature. The bush has been felled one chain in width, cleared 33ft., and the formation varies from 13ft. to 15ft. The extent of Crown land opened is not very materially increased beyond that mentioned in last return. The cost of the work done has been £ , and the county has £583 11s. cash in hand for other projected works.

Mr. H. C. Field, the Engineer to Wanganui County, reports "that the sum of £1,000 was placed at the Council's disposal by the Government for the purpose of improving the portion of the Wanganui–Taupo Road north of Mr. Mason's land. The work done consisted of widening the narrow formations along steep faces, further clearing of timber where wanted, the erection of two rough bridges over streams previously crossed by fords, the renewing of two other bridges erected some years ago, and the construction of drains and culverts. The approaches to several fords were also improved, and the line throughout kept clear of slips and fallen trees. The road in question intersects the Paratieke Block, and debouches on the Karioi Plain close to the Rangatana and Tawhitoariki Blocks, all belonging to the Crown. It also affords direct access to the Murimotu Block, in which the Government is interested, and will ultimately do so to the Kirikau and Retaruke Blocks by a branch line through the level country lying to the westward of Ruapehu and Tongariro."

Mr. F. P. Fookes, Clerk to the Wairoa Highway Board, reports that "the road commencing from the boundary of Sections 1 and 2, Block VIII., and 378 and 387, Block IX., Wairoa Survey District, has been felled a chain wide as far as about the centre of Section 2, Block IV., Wairoa Survey District, and a bridle-track formed passable for horsemen, but not available for carts, there not being sufficient funds available for the completion of the road for cart traffic. A bridge has been also erected over the Motuwhero Stream. The total expenditure on the bridge and road as above has been £393 14s. 10d., or £93 14s. 10d. in excess of amount agreed to be expended by the Board on the road, which was made up as follows: Government grant, £200; subscription from settlers on the block, £35; deferred-payment moneys, £37 7s. 8d.; general rates, £121 7s. 2d.: total, £393 14s. 10d. Several sections on Block IV. were taken up through the opening of this road."

MARLBOROUGH.

Awatere Valley Road (6 miles 57 chains).—On reference to my report for last year, ending the 30th June, 1883, it will be seen that four contracts for the construction of a further section of the road 9¼ miles in length had been accepted, 6 miles 32 chains of which had been completed to date. This year three contracts for 3 miles 69 chains, the last section of the road required to complete the communication up the Awatere Valley, have been let, for the sum of £1,785, at an average cost of £460 3s. per mile. The road-works covered by these contracts and the uncompleted portions of last year's contracts above referred to, amounting to 6 miles 57 chains, from 18ft. to 20ft. in width, have been completed during this year, with the exception of about 30 chains at the Hodder River still in the hands of the contractors and requiring repairs owing to some heavy slips having taken place before the final passing of the work. The contracts let during the year extend from the Hodder to the Grey River, and connect with the road already made to Saxton's Pass. The physical features of the country traversed are much of the same character as that of other sections previously reported upon. The road has for some time been used for carriage traffic, and opens up for settlement some seven thousand acres of Crown lands, well suited for grazing purposes, and contributing to the successful working of about 142,000 acres of Crown lands at present held under pastoral leases. All the works in connection with this line of road have been carried out by the Awatere Road Board, on surveys and specifications approved of, and under the general supervision of the Survey Department.

Wakamarina Road (2 miles 23 chains).—In accordance with instructions, an engineering survey of a continuation of the present line of road up the Wakamarina Valley has been made. The estimates and specifications are in hand, and its construction can be gone on with when required. Good grades have been obtained, the steepest grade being 1 in 15, and he mean 1 in 80.

This line of road starts at Deep Creek Bridge and terminates at the junction of the track leading to the quartz reefs up Dead-horse Creek with the track from the Forks. It follows generally the contour of the spurs on the eastern side of the river, with ascending grades all the way. The first quarter of a mile is through open and comparatively level country, and the remainder through hilly and heavily-timbered country. This section will be more expensive to make than the Canvas Town–Deep Creek section, owing to the length of side-cutting, about 1¾ miles, and the rock being close to the surface. One bridge of 30ft. span will be required on this section, and one large culvert of from 8ft to 10ft.

HENRY G. CLARK, Chief Surveyor.

NELSON.

Hampden to Maruia.—The two final contracts for this horse-track, Nos. 12 and 13, 5 miles in length, were completed in the early part of the year, the cost of which was £684 15s. 5d. The total length of horse-track, constructed with dray-road gradients, is 26¾ miles, on which the total expenditure is £7,200 7s. This road opens out a block of land of ten thousand acres in the Maruia Valley, which it is proposed to sectionize during the next year. The road has been handed over to the Inangahua County Council, who are now maintaining it.

Tadmor and Sherry to Buller Road—Dray-road.—This line of road is being constructed for the purpose of opening out a block of about ten thousand acres in the Tadmor Valley, which would not otherwise be available. Very good gradients have been obtained, and, when the construction is continued so as to connect with the main West Coast Road in the Hope Valley, a great deal of traffic will probably pass to the West Coast from Nelson by this road, instead of going by the present road over the Hope Saddle, which is higher in altitude and of steeper grades. During the year contracts Nos. 14 to 19 inclusive have been completed a distance of 12 miles. The expenditure during the year is £3,110 14s. 4d., and the total cost to date is £3,527 12s. 6d. The bush has been felled 66ft. wide, clearing 14ft., and formation 12ft., with partial metalling on fillings, bridge-approaches, and soft ground. The survey has been completed, and plans and specifications are ready for the remainder, a distance of 5½ miles, yet required for completion of the work. A line for a dray-road has been surveyed up Slippery Creek and Sherry Valley for a length of 4¾ miles, which would probably open up a block of about two thousand acres of land similar to that in the Tadmor Block.

Orinoco and Rosedale Dray-road.—This work, which consists in opening out the old horse-track into a dray-road, has been undertaken by the Pangatotara Road Board. Survey plans and specifications have been prepared by the department, and the contracts let by the Board, subject to supervision. Two contracts 4 miles in length have been completed during the year, and the remainder, necessary to connect the new and old portions of the road, is nearly completed. The expenditure on this work has been £985.

Takaka to Karamea Horse-track.—Mr. H. Tarrant has been employed on this line, which passes through an exceedingly rough country, heavily timbered. The grades are very steep, and construction would be very costly. A distance of 10 miles has been graded, plans and specifications prepared, and the line has been surveyed for a further distance of 4 miles, making a total of 16 miles, at a cost of £300, when Mr. Tarrant left for the Maruia.

Maruia and Amuri: Horse-track on Stock Road, Canterbury, Amuri, and Westland.—Mr. H. Tarrant has graded this road from Cannibal Gorge, Maruia, over the Lewis Saddle, to the junction of the Lewis and Boyle Rivers, a distance of 15¾ miles. Plans and specifications are being completed. The expenditure to date is £326 9s. 9d., and the estimated cost of construction, £3,000.

Aniseed Valley Road.—This road has been surveyed and graded for a dray-road for a distance of 9¾ miles, for which specifications have been prepared. A contract, No. 23, for 2¼ miles is in progress at the lower end of the valley. Branch roads from the main valley line have been graded up the Serpentine, Miner River, and Toi Gully. The branch of the Miner was reported upon by Mr. H. Gordon, Mining Inspector. The length of these is 4¾ miles, on which no work has been undertaken.

Baton to Karamea.—Improvement of road: This work has been in the hands of the Upper Motueka Road Board under vote to Waimea County of £200. Work has been done in two sections, consisting of rock-blasting of some bad points and construction, to avoid two dangerous river-crossings. This has amounted to £154 18s. 6d. The balance of £45 1s. 6d. has been expended in removing bad points, necessary culverts, and construction of short lengths of road. The whole work was completed in March.

These works, being undertaken by the department, have, in connection with surveys, necessitated a great deal of travelling on visits of inspection during the year.

JOHN S. BROWNING, Chief Surveyor.

WESTLAND.

Mapourika to Gillespie's Road.—A contract for sections 7 to 12, length 6 miles, clearing 33ft., formation 9ft., and metal 5ft., was in progress at the beginning of the year. Three miles of this contract were then finished, and the remaining three were completed in November last. The contract price for sections 7 to 12 was £3,073 14s.; extras, £51 10s.: total, £3,125 4s. To reach the large extent of good land in Cook's River Valley, and to give through inland communication from Gillespie's to Okarito, an extension of 6 miles to across Clearwater Stream is required. The survey of the road to Gillespie's has been completed, and specifications, plans, and sections for the above 6 miles are prepared, ready for calling for tenders.

Mahitahi to Haast Road.—The last five miles of this road—sections 25 to 29—were also in course of construction at the beginning of the year, and the work was completed in March, 1884. There remained then only the erection of the Moeraki suspension foot-bridge, and the general

repairs and cleaning up of the whole of the thirty-four miles of road constructed. This work, with your approval, was done by day-labour, at a cost of £117 9s. 3d. for Moeraki Bridge, and £319 8s. 6d. for repairs; and the road was then handed over for maintenance to the county authorities. The last contract (sections 25 to 29) amounted to £2,143 10s., and extras, for additional culverts and drains, £55. Owing to non-completion within specified time, however, a fine of £50 was deducted from the above. The nature of the work is: Clearing, 33ft.; formation, 9ft.; and metal, 5ft. The construction of the whole of the thirty-four miles of road extended over four years. By the construction of this road through communication from Hokitika to Jackson's Bay and *viâ* Haast Past to Wanaka Lake, Otago, has now been established.

Kumara to Beach.—Construction of two miles of dray-road, to give access to the timbered land between the Borough of Kumara and sea-coast. It consists of 33ft. clearing, 14ft. formation, and 10ft. metal. Above a mile had been completed during the previous year, and the rest was finished in October last. The cost of construction of this road was subsidized by Government, the County Council having to defray part of it. The total cost of the work was £1,192 16s., towards which Government contributed £625 during the past year. The County Engineer states that "this piece of road has opened up about four square miles of heavily-timbered flat land, but when the road is constructed through to the sea-beach there will be at least ten square miles of the same class of land opened up."

Moeraki Crossing to Otumotu.—Nothing by way of construction has been done. The survey, specifications, plans, &c., of this road, nine miles in length, were completed in January last, and ready for inviting tenders. It is the only one of the roads for the construction of which appropriation was made and which has not yet been contracted for. The work is much wanted. Besides giving access to a quantity of good land in the Moeraki and Wakapohai River Valleys, it will also give access to the large belt of auriferous country between Abbey Rocks and Arnott Point. The want of this road is very much felt, and makes profitable mining within that part of Westland almost impossible. Five or six men are employed on ground there now which should carry as many hundred.

Smoothwater to Cascade.—£300 are authorized to be expended in benching and otherwise improving the surveyed road-line. The work is in hand, but no progress-payments have been made on it. The length of the road is nearly twelve miles.

Main South Road, Okarito.—Erection of bridge, culverts, and sundry improvements and repairs. Works carried out by the County Council, under my supervision, and subsidized by Government to the extent of £500 during the past year.

Duffer's Creek, Bowen Road to Sea-beach.—Length of track about four and a half miles, clearing 12ft., formation 4ft., metalling 3ft.; subsidized to the extent of £222 12s. In addition to those above enumerated, the construction of two more horse-tracks—"Duffer's Creek, Greenstone Road, to 15-mile-post, Christchurch Road," and "Extension of Back Creek Track to Eel Creek"—is now in progress. These tracks are subsidized by Government under the Gold Fields Act, but no progress-payment has as yet been made. The County Council is carrying out the work under my supervision.

GERHARD MUELLER, Chief Surveyor.

CANTERBURY.

Teviotdale Road (to Deferred-payment Lands, Teviotdale).—A subsidy of £150 was granted to the Waipara Road Board to improve a cutting-out of the Omihi Creek, thereby making easier the access to the road completed last year. But, though that Board let a contract for it, it was not finished, and nothing has been done for some time. An additional £200 has been granted, to be expended on the surveyed road beyond the part finished last year, and tenders are now invited for part of this work.

Kuku Pass Road (to Upper Ashley, over Kuku Pass).—5 miles and 79 chains of easy grade have been formed through bush, and 3 miles 18 chains more have been let by contract. The Clerk to the Ashley Road Board reports: "With reference to No. 2 grant for this road, the work was commenced in June, 1883, at a distance of 3 miles 37 chains from the foot of the pass at the Kuku Creek Bridge, north of White Rock Quarries. The above distance was constructed out of No. 1 grant, the width of road to this point, as per agreement, 20ft. wide in the solid; No. 2 grant, starting from 3 miles 37 chains, with a road 12ft. wide in the solid, as ordered. There has been formed and now open for dray traffic a further distance of 5 miles 79 chains, making a total distance of 9 miles 36 chains from the foot of the pass at the Kuku Creek Bridge near White Rock Quarries. There is also a contract let for a further extension of 3 miles 18 chains. This contract has just been commenced. It has been considered advisable to make some deviations from the line laid out by Mr. Dobson, C.E., so as to avoid expensive bridges; but the grades are very little altered. Log culverts, stone fords, and cuttings have been constructed instead. This has been done with the approval of the Chief Surveyor. With reference to amount expended up to the 30th June, the Board have received, up to the above date, £1,450; amount expended up to the 30th June, including the June pay-sheet, £1,377 8s. 11d.; balance, £72 11s. 1d., due end of July on work completed."

Oxford Bush Road (Oxford Bush to Upper Ashley).—6 miles 40 chains have been made, and £1,488 10s. 9d. has been granted to the Road Board; but the surveyor to the Board reports that, besides this sum, £183 19s. 3d. has been expended out of the Board's funds. Neither the Oxford Bush Road nor the Kuku Pass Road has been surveyed, and the measurements given come from the Board's surveyors.

Waimate County.—Mr. N. Hillary, County Engineer, reports "That the Crown lands which have been opened for sale by roads are Reserve 143, situate within Waimate Survey District. The work done was formation and culverts on the road-line passing through a portion of said reserve. The total amount expended during the year ending on the 30th June, 1884, is £61 10s.; amount received from Government as part payment of the above sum, £30; leaving a balance of £31 10s., which has been spent out of the Council's ordinary revenue."

Mackenzie County.—Mr. F. W. Marchant, Engineer to the county, reports as follows: "The only work on which Government moneys have been expended in opening up Crown lands is the Mount Cook track, extending from Glentanner Homestead, at the head of Lake Pukaki, towards Mount Cook on the west side of the Tasman River. The total amount expended thereon has been £774 18s. 4d., of which £649 18s. 10d. was provided by the Government, the balance being contributed by the Mackenzie County. The total length of road which has been constructed and repaired for this expenditure is about seven and a half miles. The road passes through very broken ground occasionally, consisting of ancient glacial deposits, and crossed by numerous watercourses; no more work has been executed than would suffice to make the road safe and convenient for traffic. The total distance from the head of Lake Pukaki to the Governor's Camp by the Mueller Glacier is about twenty-five miles, a considerable distance of which consists of stony flats. Swampy ground, and a short piece of old moraine near Birch Hill Station, cause great inconvenience to the traffic on this road: they do not, however, stop traffic, unless the Tasman River happen to be in high flood, as the swamps are not deep, and the moraine can be avoided by travelling along the shingle-bed of the Tasman River. However, to make a permanent road through these obstructions will become a necessity in time, if the Government desire to make this part of the alpine scenery of New Zealand attractive and easily accessible to tourists. The cost of carrying a road through them will amount to about £1,200, in addition to the money already expended. As stated in my report to the Hon. the Minister of Lands on the 15th May last, the work that has been executed has enabled vehicles to be driven from the head of the Pukaki Lake to the Governor's camp, which was previously utterly impossible on account of the broken ground existing, which has now been opened by means of the seven and a half miles of road constructed."

WALTER KITSON, Acting Chief Surveyor.

OTAGO.

WAIKOUAITI COUNTY.

Road across Waikouaiti River.—The most of the contracts on this road were finished during the year, absorbing vote, £1,516 15s. 3d. The work done covers all the most difficult and rugged portions, and forms a very fair road 14 feet wide between Orbell's Station and Scratchback Hill, a distance of 5¼ miles, costing an average of £289 per mile. There is still a long piece of wet road to get to the perpetual leases, the ditching of which will cost £250.

Mount Watkins Road.—This line is to give access to the north end of the same block that is benefited by above road. It has a vote of £600, of which only £157 has been spent.

TAIERI COUNTY.

Road, Billie's Ridge to Nenthorn Flat.—This road has been finished, at a total cost of £689 14s. 1d., the amount spent during the year being £189 14s. 1d.

Strath-Taieri Suspension Bridge.—This handsome bridge, 150ft. span, was finished during the year, at a total cost of £1,983 12s. 3d.

VINCENT COUNTY.

Road, Cromwell to Perriam's, East Bank of Clutha River.—This work has been finished, including a bridge over Firewood Creek. The bridge is a substantial timber trussed structure, resting on solid masonry abutments, the span being 80ft., with extensions at either end, bringing up the total length to 115ft., costing £808 10s. The vote was £2,600, and during the year the amount expended was £477.

MANIOTOTO COUNTY.

Deepdell Road, Run 210.—The amount expended during the past twelve months has been £1,156 17s. 6d.; vote, £1,500. The County Engineer reports that £300 additional will be necessary to make the road practicable for wheeled traffic throughout.

Block XI., Naseby, Whitesow Valley.—Two contracts are now proceeding on this block, and will probably be completed in a few weeks. The amount authorized is £300, of which the contracts absorb £288.

Block XV., Maniototo.—A sum of £200 is to be expended early in the spring to form roads in this block.

TUAPEKA COUNTY.

Road Beaumont to Miller's Flat.—During the year the sum of £645 has been spent on the formation of 140 chains of this road, to the width of 15ft., between the Horseshoe Bend and Minzion Creek, making a total of £3,500 for its formation. A very fair road has been made all the way, excepting about two miles from the Talla Burn to the Horseshoe Bend on the Clutha River.

Road to Run 140a.—A connecting road 63 chains in length, through Mr. Dickison's paddock, has been formed during the year, subsidized to the extent of £500 by Government. This money has been well spent, as the work has been well done and must have cost the county considerably more than the above sum.

Dunkeld to Remarkable Bush.—32 chains of this road have been widened, at a cost of £300, of which the county contributed £100.

SOUTHLAND COUNTY.

Tokanui–Gorge Road.—The contract on this road has been finished, at a total cost of £1,148 16s. 8d., whereof £815 6s. 6d. was spent this year. A very necessary extension of this road, just surveyed by Mr. Strauchon, to open up lands surveyed but not yet sold (about five thousand acres), will cost £600, including a small bridge, or if metalled about £1,300.

Wakaia Roads.—These roads, which are all within an education endowment, have been finished, at a cost of £3,297 19s., of which, however, only £2,832 7s. 6d. has passed this office as yet.

Mr. Howorth, County Engineer, reports the work done by Southland County Council to be: "Formation, 253½ chains; ditching, 104 chains; gravelling, 352 chains; timber in culverts and bridges, 39,800 superficial feet; cuttings, 9,100 cubic yards; embankments, 22,300 cubic yards; stone culverts, 16; glazed tile drains, 68 lineal yards; and stream diversions and outfall drains, 10 chains."

"*Branch Road to Forest Hill.*—Formation, 170 chains; ditching, 276 chains; gravelling and fascining, 40 chains; timber in culverts and bridge, 11,000 superficial feet; and 29½ chains of clearing. Road in Bush Land east of Makarewa: Formation, 130 chains; bush-felling and clearing, 130 chains; ditching, 130 chains; timber in culverts, 3,000 superficial feet."

LAKE COUNTY.

The County Inspector of Works reports that "the sum of £1,112 8s. 11d. has been expended in forming a road between the Crown Range Saddle and the Cardrona Valley, thereby opening up communication by wheeled traffic been the Wakatipu, Wanaka, and Hawea Districts, and affording the settlers in the last-mentioned places an outlet for their surplus supplies of grain, &c. in the direction of Invercargill and Dunedin by aid of the Government railway-line to those places. The Lake County Council has accepted tenders for carrying the completion of five miles and sixteen chains of road, as follows: No. 2 contract, Romans and Brodie, two miles, £1,194 7s. 5d.; No. 3 contract, Welsh and Co., three miles sixteen chains, £898: total, £2,092 7s. 5d., of which the Council has paid in progress-payments,—No. 2 contract, to Romans and Brodie, first payment £388 17s. 8d., second payment £368 11s. 7d.; No. 3 contract, to Welsh and Co., first payment £354 19s. 8d.: total, £1,112 8s. 11d. The road through No. 3 Section is not yet finished: frost has set in, and operations have been entirely suspended for the past six weeks. A buggy was driven over the Crown Range lately by one of the candidates for legislative honours, but, owing to heavy falls of snow within the last few days, wheeled traffic is now impossible."

The details of mileage and areas of land benefited by above lines as given in last year's return I need not repeat here.

W. ARTHUR, Chief Surveyor.

SOUTHLAND.

Seaward Forest to Coast.—This road extends from Woodend, on the Invercargill–Bluff line, and runs south-east for some three miles, thereafter trending in a due southerly direction, and terminating at Awarua Bay, the total length of the road-line being six and a half miles. Of this, at the northern end, nearly four and a quarter miles have been ditched on either side, and formed and gravelled, the remaining two and a quarter miles having, as yet, been only ditched and formed. It is satisfactory to state that nearly all the sections have been taken up as far as the gravelling extends. The road, when finished, apart from tapping the country through which it runs, will give convenient access to the Crown land abutting on the north side of Awarua Bay, the road for many miles along the beach being a natural one, and requiring only here and there a culvert or open-creek crossing to make it passable for dray traffic. A small jetty at the road terminus at the beach, to provide for water communication with Bluff, will probably prove a convenience if not a necessity of the future.

Orepuki to Waiau.—This road extends from Waimeamea River, near Orepuki, by a line running north-westward, roughly parallel to the Ocean Beach, for a distance of some four miles. For one and a half miles from the Waimeamea the road is formed, gravelled, and culverted in places. Beyond this the road has been cut through the bush, and formed and gravelled for a distance of over one and three-quarter miles. At the end of this section the road has been bush-cleared and formed only for a further distance of some seven-eighths of a mile. The present terminus is situated only some three miles from the mouth of the Waiau River.

Branch Road to Forest Hill.—This road extends from the north-east corner of Block III., New River Hundred, by a line running due east for a distance of three and a quarter miles, and thereafter by lines running north-easterly for a distance of some three and three-quarters of a mile further, terminating near the south boundary of deferred-payment block at Shark's Tooth. It has been ditched and formed for nearly the whole of the way, fascining having been done and bridges and culverts put in in places. From Wilson's Crossing, on the Invercargill–Kingston railway-line, to deferred-payment block at Shark's Tooth, the road is now fit for traffic, though it is to be feared that heavy drays and the sloughing effects of winter may prevent its being used at all seasons of the year. The road, apart from giving admission to the deferred-payment block above mentioned, has opened up an old settled and hitherto almost inaccessible part of this district, and is a boon to settlers which has been highly appreciated. A branch of this road, I may say, starts from the eastern boundary of New River Hundred, and runs for nearly a mile towards the Makarewa—same having been ditched and formed in the same manner as the main road already described.

Tomogalak Creek to Deferred-payment Block.—This road extends, from a point some one and a half miles above Ardlussa Station, in a northerly direction along the Mataura River for a distance of some two and a half miles up the river. It has been ditched, formed, and gravelled in places, several stone culverts having also been constructed. Though the formation, &c., have not been continuous, the road has been rendered fit for traffic, the result at the time being that nearly all the sections were taken up in the deferred-payment block which the road was designed to tap, and this at very satisfactory prices.

Bay Road to Otatara Bush.—This road extends from opposite Section 1, Block XXI., Invercargill Hundred, southerly to the south boundary of said block, thereafter due east for some half a mile, the whole length of road being some two miles. It has been ditched, formed, and gravelled the whole way. The gravel is probably too light for heavy traffic, but it was the best material available. The upper part of the Crown block has thus been tapped, but it would be well if next season a further vote were expended in continuing the road for some distance down the heart of the

block. As in the case of the branch road to Forest Hill, the construction of this road has been an incalculable boon to settlers alongside, many of whose holdings were previously almost inaccessible.

Bush Land East of Makarewa.—This road extends from the Main North Road, where it passes through the Makarewa Township, running due eastward through the Bush Reserve, now included within the boundaries of the surveyed township, for a distance of over one and a half miles. The work done on this road consists of ditching, bushfelling, clearing, and formation, including also the construction of seven culverts. The completion of the work so as to absorb the full Government vote has been delayed till the winter is over. I think there can be little doubt, from the population of the present township and the demand for land in this locality, that, after the difficult parts of the road have been made fit for traffic, the suburban township sections will be gradually taken up and settled upon.

Port William to Half-moon Bay, &c. (Stewart Island).—Some two miles of bush-clearing, forming, and metalling in places have been executed, partly along Half-moon Bay and partly between Half-moon and Horse-shoe Bays. In addition to this, tracks have been cut through the bush to the extent of eight miles, one track extending from Half-moon Bay to Port William, another extending from Half-moon Bay to Kaipipi Bay, two other smaller tracks having been cut from Half-moon Bay southward to the shores of Paterson's Inlet at Deep Bay and Ringaringa Point respectively.

The roads constructed during the last year to open up Crown lands (including Branch Road to Forest Hill, Tomogalak Creek to Deferred-payment Block, Bay Road to Otatara Bush, and Bush land east of Makarewa) were under the supervision of the engineer to the Southland County Council, and in all cases the work was very efficiently executed. The other works were mostly executed during the previous year, and were referred to in last year's report.

Forest Hill Tramway.—The constructed portion of this tramway extends from the Town of Winton, where it branches from the Invercargill–Kingston line and runs in a generally easterly direction for a distance of five and a quarter miles, meanwhile terminating at the Gap, on the eastern boundary of Winton Hundred. This portion of the tramway has been finished for the last year and a half. It has been constructed of light timbers and iron rails, suited for horse traffic, the gauge, however, being similar to that on the railway-line from which it branches. The extension of the tramway for a further distance of some five miles was begun six or seven months ago. At the present time five-eighths of the formation has been finished, all the iron and about one-fifth of the timber for permanent way being on the ground. The work is expected to be completed about the end of May next year. The constructed part of the tramway I understand was handed over to the County Council some considerable time ago, but, pending the extension of the line, I presume the Council thought it desirable to lease the same to the extension contractor. The public, however, seem to have the full use of the line when required.

J. Spence, Chief Surveyor.

STATEMENT of EXPENDITURE in the FORMATION of ROADS to OPEN up LANDS for SALE, from the 1st April, 1881, to the 30th June, 1884, and of the LIABILITIES and AVAILABLE BALANCES out of the £3,000,000 LOAN at the 30th June, 1884.

Name of Road.	Liabilities of the £150,000 Vote in 1882.	Estimate for Three Years (viz., £62,915 from Cash in Hand = Liabilities of £150,000 Vote, and £205,500 from £3,000,000 Loan).	Expenditure out of the Vote of £150,000.	Total Expenditure to 30th June, 1884, out of Appropriation of £267,415.	Expenditure for Twelve Months ended 30th June, 1884.	Total Expenditure from the Two Appropriations of £150,000 and £205,500.	Balances on Items, 30th June, 1884.
AUCKLAND.							
	£	£	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Kaihu to Kaikohe	..	1,666	334 2 0	..	..	334 2 0	1,666 0 0
Takahue to Herd's Point ..	..	..	52 10 1	50 19 0	..	103 9 1	..
Homestead blocks, Manganui	..	500	..	3 2 0	3 2 0	3 2 0	496 18 0
Pakiri Block	..	300	..	282 7 6	160 0 0	282 7 6	17 12 6
Wairua to Sandy Bay ..	..	1,500	..	1,529 19 6	225 19 6	1,529 19 6	..
Wairua to Helena Bay ..	..	800	..	950 4 8	465 3 3	950 4 8	..
Whangarei through Taheke ..	..	800	..	124 6 0	124 6 0	124 6 0	675 14 0
Purua and Mangakahia ..	..	430	..	711 3 6	709 4 0	711 3 6	..
Tangihua No. 3	..	260	..	219 11 7	219 11 7	219 11 7	40 8 5
Manganui Bluff to Kaihu ..	1,892	1,892	207 19 7	2,923 5 7	681 6 1	3,131 5 2	..
Takahue to Mangonuiowae ..	..	360	1,371 4 0	..	..	1,371 4 0	360 0 0
Okaihu to Victoria Valley ..	..	6,000	..	3,762 16 3	2,838 17 3	3,762 16 3	2,237 3 9
Helensville to Kaipatiki ..	1,460	1,460	39 17 6	2,360 2 2	731 4 5	2,399 19 8	..
Waikato to Block XVI., Awaroa	195	545	604 13 0	1,584 19 3	223 14 6	2,189 12 3	..
Lake Whangape to Block VII., Awaroa	714	1,364	635 10 3	1,571 4 7	..	2,206 14 10	..
Hikutaia to Ohinemuri ..	400	400	3,228 6 6	794 1 1	..	4,022 7 7	..
Tauranga to Te Puke and Matata	1,752	7,002	2,547 17 8	6,853 3 1	1,690 2 1	9,401 0 9	148 16 11
Opotiki to Waiotahi ..	500	500	..	500 0 0	500 0 0	500 0 0	..
Opotiki to Ormond	2,294	7,294	2,206 1 14	6,335 11 7	2,305 14 2	8,541 12 11	858 8 5
Te Aroha Block	4	1,404	1,135 18 7	2,275 16 7	550 18 3	3,411 15 2	..
Huihuitaha to Patetere ..	530	530	177 10 6	530 0 0	..	707 10 6	..
Ruakituri Block	1,080	1,880	120 0 0	1,906 8 2	372 5 0	2,026 8 2	..
Ormond to Waiapu	2,574	6,000	..	7,225 5 1	4,201 18 9	7,225 5 1	..
Gisborne to Waimata ..	1,500	1,500	534 9 0	1,741 0 6	227 1 9	2,275 9 6	..
Gisborne to Wairoa	2,400	9,700	300 0 0	5,700 2 0	1,758 16 1	6,000 2 0	3,999 18 0
Taupo, *viâ* Rotoaira and Murimotu, to West Coast	..	4,000	..	3,194 10 7	2,467 17 4	3,194 10 7	805 9 5
Tolago Bay to Arakihi ..	..	2,000	..	53 1 0	..	53 1 0	1,947 19 0
Kohukohu to Rahutapu ..	..	500	..	65 14 6	65 14 6	65 14 6	434 5 6
Wairoa River to Otau ..	..	720	..	..	..	..	720 0 0
Te Maire to Kahuru ..	..	1,000	..	..	..	..	1,000 0 0
Whangaroa to Kahuru ..	..	1,000	..	..	..	..	1,000 0 0
Ohuka to Waikaremoana ..	..	1,500	..	100 0 0	..	100 0 0	1,400 0 0
Waerenga through Whangamarino	..	250	..	..	..	..	250 0 0
Whangape to Victoria Valley	..	500	..	..	..	..	500 0 0
Miscellaneous	..	2,000	..	234 15 8	648 7 8	234 15 8	1,765 4 4
Totals	17,295	67,557	13,496 0 0	53,583 11 5	21,171 4 2	67,079 11 5	20,323 18 3
TARANAKI.							
Road through bush, Waimate Plains	642	3,642	3,357 15 8	9,955 18 1	5,206 16 0	13,313 13 9	..
Roads east of Stratford ..	210	1,884	116 5 0	231 10 5	..	347 15 5	1,652 9 7
Bush land inland of Patea ..	136	1,376	123 17 0	1,216 17 11	50 0 0	1,340 14 11	159 2 1
Bush land north of New Plymouth	..	500	..	..	..	..	500 0 0
Continuous Reserve (to be refunded)	..	3,000	..	5,632 5 10	3,653 18 2	5,632 5 10	..
Miscellaneous	..	676	3 13 6	..	..	3 13 6	676 0 0
Totals	988	11,078	3,601 11 2	17,036 12 3	8,910 14 2	20,638 3 5	2,987 11 8
						Exceeded	5,958 12 3
HAWKE'S BAY.							
Puketitiri Block	..	400	520 0 0	..	..	520 0 0	400 0 0
Puketoi and Tahoraite ..	331	1,331	43 16 2	970 19 8	682 13 8	1,014 15 10	360 0 4
Norsewood District, Ngamoko, and Maharahara	..	1,537	109 5 6	1,227 11 4	1,210 8 4	1,336 16 10	309 8 8
Ahuturanga Block	502	502	347 11 3	522 0 9	0 10 6	869 12 0	..
Tautane	300	3,515	..	1,743 14 1	1,091 16 1	1,743 14 1	1,771 5 11
Tukituki to Waipawa ..	..	344	357 14 7	466 13 9	12 0 0	824 8 4	..
Rotokakainga Block ..	..	500	..	..	..	..	500 0 0
Mohaka and Waitara ..	..	1,500	..	151 6 4	151 6 4	151 6 4	1,348 13 8
Tahoraite to Tautane ..	..	2,000	..	162 12 3	162 12 3	162 12 3	1,837 7 9
Miscellaneous	..	500	..	224 7 3	224 7 3	224 7 3	275 12 9
Totals	1,133	12,129	1,378 7 6	5,469 5 5	3,535 14 5	6,847 12 11	6,802 9 1

STATEMENT of EXPENDITURE in the FORMATION of ROADS, &c.—*continued.*

Name of Road.	Liabilities of the £150,000 Vote in 1882.	Estimate for Three Years (viz., £62,915 from Cash in Hand = Liabilities of £150,000 Vote and £205,500 from £3,000,000 Loan).	Expenditure out of the Vote of £150,000.	Total Expenditure to 30th June, 1884, out of Appropriation of £267,415.	Expenditure for Twelve Months ended 30th June, 1884.	Total Expenditure from the Two Appropriations of £150,000 and £205,500.	Balances on Items, 30th June, 1884.
WELLINGTON.							
	£	£	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Pahiatua, Mangaone, &c. ..	5,673	10,338	661 16 7	8,327 17 4	1,392 14 10	8,989 13 11	2,010 2 8
Kairanga Blocks	..	..	1,524 7 2	..	..	1,524 7 2	..
Repairs, Fitzherbert Bridge ..	500	500	..	500 0 0	..	500 0 0	..
Roads, Fitzherbert Block ..	250	400	..	400 0 0	50 0 0	400 0 0	..
Otamakapua	366	5,000	..	261 17 0	11 0 0	261 17 0	4,738 3 0
East side of Pohangina River	..	1,850	..	30 13 6	30 13 6	30 13 6	1,819 6 6
Momahaki Block	..	2,616	384 6 5	1,966 4 0	134 18 0	2,350 10 5	649 16 0
Tokomaru Block	700	1,200	..	883 3 6	..	883 3 6	316 16 6
Wanganui to Murimotu ..	..	2,000	..	2,000 0 0	..	2,000 0 0	..
Marton to Murimotu ..	..	2,000	..	1,144 12 3	450 14 7	1,144 12 3	855 7 9
Rangitumau Block	..	500	..	500 0 0	..	500 0 0	..
Sandon Township	..	30	60 0 0	..	..	60 0 0	30 0 0
Wairarapa East	..	1,500	..	1,500 0 0	612 11 7	1,500 0 0	..
Crown land, Mangahao ..	..	1,750	..	..	..	..	1,750 0 0
Mungaroa–Waikanae ..	459	459	1,659 17 0	..	..	1,659 17 0	459 0 0
Miscellaneous	..	1,000	..	221 16 0	107 0 0	221 16 0	778 4 0
Totals	7,948	31,143	4,290 7 2	17,736 3 7	2,789 12 6	22,026 10 9	13,406 16 5
NELSON.							
Cobden to Seventeen-Mile Diggings	1,210	1,210	290 1 6	1,388 9 6	105 15 0	1,678 11 0	..
Hampden to Maruia ..	362	4,948	51 19 9	6,955 6 0	991 7 3	7,007 5 9	..
Grey Valley to Teremakau ..	470	3,970	30 7 6	2,657 14 7	14 4 6	2,688 2 1	1,281 17 5
Wakefield to Stanley Brook ..	200	200	..	200 0 0	..	200 0 0	..
Aorere Valley to Karamea ..	54	1,254	244 14 3	..	..	244 14 3	1,254 0 0
Tadmor and Sherry to Buller	..	2,500	..	3,696 15 4	3,498 14 2	3,696 15 4	..
Baton to Karamea	..	200	..	200 0 0	200 0 0	200 0 0	..
Maruia to Amuri	..	2,000	..	245 7 11	245 7 11	245 7 11	1,754 12 1
Takaka to Anatoki and Collingwood	..	3,000	..	19 4 2	19 4 2	19 4 2	2,880 15 10
Ahaura to Kopara and Amuri	..	2,000	..	..	..	..	2,000 0 0
Takaka to Karamea ..	..	500	..	289 3 4	289 3 4	289 3 4	210 16 8
Oronoko to Rosedale ..	..	600	..	864 10 3	744 10 3	864 10 3	..
Miscellaneous	..	1,000	..	24 11 0	3 6 0	24 11 0	975 9 0
Totals	2,296	23,382	617 3 0	16,541 2 1	6,111 12 7	17,158 5 1	10,357 11 0
MARLBOROUGH.							
Awatere Valley Road ..	1,243	5,243	2,756 14 1	5,348 19 6	3,593 12 10	8,105 13 7 *Exceeded*	.. - 105 19 6
WESTLAND.							
Mapourika to Gillespie's ..	2,183	6,124	476 2 0	6,166 13 0	3,146 4 0	6,642 15 0	..
Mahitahi to Haast	4,764	9,534	2,636 7 10	9,718 5 4	3,478 17 3	12,354 13 2	..
Mathias Pass Road	1,384	2,384	116 0 0	228 18 0	..	344 18 0	2,155 2 0
In the County of Westland ..	..	760	1,220 0 0	760 0 0	..	1,980 0 0	..
Kumara to beach	..	1,000	..	1,000 0 0	1,000 0 0	1,000 0 0	..
Moeraki Crossing to Otumotu	..	1,500	..	..	..	..	1,500 0 0
Miscellaneous	..	1,000	..	..	..	..	1,000 0 0
Totals	8,331	22,302	4,448 9 10	17,873 16 4	7,625 1 3	22,322 6 2	4,655 2 0
CANTERBURY.							
Mathias Pass Road	1,436	2,436	63 16 10	1,982 19 0	180 7 1	2,046 15 10	453 1 0
To Upper Ashley over Kuku Pass	..	3,000	..	1,443 3 5	1,440 11 5	1,443 3 5	1,556 16 7
Irrigation works, Eyre and Waimakariri	..	3,000	..	624 0 0	400 0 0	624 0 0	2,376 0 0
Oxford Bush to Upper Ashley	..	4,000	..	1,496 2 3	1,395 12 3	1,496 2 3	2,503 17 9
Burke's Pass through Mackenzie country to Ahuriri	..	3,000	..	249 18 10	249 18 10	249 18 10	2,750 1 2
To deferred-payment lands, Teviotdale	..	2,000	..	1,336 16 8	732 16 6	1,336 16 8	663 3 4
To deferred-payment lands, Waikari	..	2,000	..	784 19 1	126 11 6	784 19 1	1,215 0 11
To deferred-payment lands, Malvern	..	500	..	..	..	..	500 0 0
To village and deferred-payment blocks	..	1,360	..	1,166 15 10	17 2 0	1,166 15 10	193 4 2
Miscellaneous	..	4,000	..	870 3 0	790 3 0	870 3 0	3,129 17 0
Totals	1,436	25,296	63 16 10	9,954 18 1	5,333 2 7	10,018 14 11	15,341 1 11

STATEMENT of EXPENDITURE in the FORMATION of ROADS, &c.—*continued.*

Name of Road.	Liabilities of the £150,000 Vote in 1883.	Estimate for Three Years (viz., £62,915 from Cash in Hand = Liabilities of £150,000 Vote and £205,500 from £3,000,000 Loan).	Expenditure out of the Vote of £150,000.	Total Expenditure to 30th June, 1884, out of Appropriation of £267,415.	Expenditure for Twelve Months ended 30th June, 1884.	Total Expenditure from the Two Appropriations of £150,000 and £205,500.	Balances on Items, 30th June, 1884.
OTAGO.							
	£	£	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Beaumont to Miller's Flat ..	3,000	3,500	..	3,500 0 0	744 18 9	3,500 0 0	..
Through Blocks VIII. and X., Benger	500	500	..	500 0 0	..	500 0 0	..
Run 106	1,000	1,000	..	1,000 0 0	..	1,000 0 0	..
Kelso to Greenvale	500	500	..	500 0 0	..	500 0 0	..
Tapanui Railway to Run 140	1,000	1,500	..	1,145 2 3	145 2 3	1,145 2 3	354 17 9
To open up Otago and Southland runs	1,500	11,809	..	12,898 13 1	4,414 16 1	12,898 13 1	..
Hindon to Otago Central Railway at Christmas Creek	..	2,000	..	..	..	..	2,000 0 0
Through Runs 177 and 257 ..	..	3,000	..	..	..	..	3,000 0 0
Waiau to Hauroto	..	500	..	..	..	..	500 0 0
Through Runs 171 and 171A ..	..	1,500	..	1,500 0 0	1,500 0 0	1,500 0 0	..
Cottesbrook through Run 250	..	1,000	..	..	..	..	1,000 0 0
Glenorchy up Rees and Dart	..	1,500	..	..	..	..	1,500 0 0
Lauder Block	..	1,000	..	..	..	..	1,000 0 0
Upper Clutha Blocks ..	..	1,500	..	..	..	..	1,500 0 0
Run 137	..	1,500	..	..	..	..	1,500 0 0
Pembroke to Matukituki ..	..	1,000	..	..	..	..	1,000 0 0
Education reserves (to be recouped)	..	3,000	..	2,811 0 6	2,811 0 6	2,811 0 6	188 19 6
Waikaia Bush to Clutha Valley	..	2,000	..	..	..	..	2,000 0 0
Miscellaneous	..	6,000	..	2,112 8 11	1,712 8 11	2,112 8 11	3,887 11 1
Totals	7,500	44,309	..	25,967 4 9	11,328 6 6	25,967 4 9	19,431 8 4
SOUTHLAND.							
Seaward Forest to coast ..	2,043	3,443	382 1 7	2,026 18 4	..	2,408 19 11	1,416 1 8
Forest Hill Tramway ..	1,319	5,819	2,400 4 10	4,767 17 8	2,998 1 7	7,168 2 6	1,052 2 4
Waikawa to Catlin's ..	..	1,281	..	2 14 0	2 14 0	2 14 0	1,278 6 0
Orepuki to Waiau	..	800	..	800 0 0	..	800 0 0	..
Branch road to Forest Hill ..	1,000	1,500	..	1,494 19 5	500 0 0	1,494 19 5	5 0 7
Scott's Gap to deferred-payment land	..	500	..	..	..	..	500 0 0
Tomogalak Creek to deferred-payment land	..	500	..	499 5 6	499 5 6	499 5 6	0 14 6
Bay Road to Otara Bush ..	..	1,000	..	1,179 18 3	320 0 0	1,179 18 3	..
Bush land east of Makarewa	..	500	..	324 6 8	324 6 8	324 6 8	175 13 4
Port William to Half-Moon Bay	..	250	..	250 0 0	250 0 0	250 0 0	..
Totals	4,362	15,593	2,782 6 5	11,345 19 10	4,894 7 9	14,128 6 3	4,427 18 5
SUNDRY ROADS.							
Mimi to Mokau	..	..	..	1,174 9 3	1,174 9 3	1,174 9 3	..
Kawhia to Aotea	..	..	..	1,416 3 8	1,416 3 8	1,416 3 8	..
Opotiki to Whakatane ..	..	..	..	100 0 0	100 0 0	100 0 0	..
Hedgehope Flat Road ..	..	..	..	240 0 0	240 0 0	240 0 0	..
Totals	10,383	10,383	..	2,930 12 11	2,930 12 11	2,930 12 11	7,452 7 1
Total liabilities ..	62,915	..	..	..	..	..	..

SUMMARY of EXPENDITURE for the TWELVE MONTHS ended 30th June, 1884.

Auckland	£21,171 4 2
Taranaki	8,910 14 2
Hawke's Bay	3,535 14 5
Wellington	2,789 12 6
Nelson	6,111 12 7
Marlborough	3,593 12 10
Westland	7,625 1 3
Canterbury	5,333 2 7
Otago	11,328 6 6
Southland	4,894 7 9
Sundry roads	2,930 12 11
	78,224 1 8
Less amounts to credit	645 0 0
	£77,579 1 8
Roads through lands recently purchased	£785 11 1

SUMMARY.

	Liabilities of the Vote of £150,000 taken 1881–82.	Estimate for Three Years, viz., from Balance of Old Loan, £62,915, and £205,500, from Three-Million Loan.	Expenditure out of Vote for £150,000, 1881–82.	Total Expenditure to 30th June, 1884, out of Appropriation of £268,415.	Expenditure for Twelve Months ended 30th June, 1884.	Total Expenditure from the Two Appropriations of £150,000 and £200,000.	Balances on Items not exceeded, 30th June, 1884.	Expenditure in Excess of Items, 30th June, 1884.	Balances, 30th June, 1884.	Liabilities, 30th June, 1884.
	£	£	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£
Auckland	17,295	67,557	13,496 0 0	53,583 11 5	21,171 4 2	67,079 11 5	20,323 18 3	6,350 9 8	13,973 8 7	3,662
Taranaki	988	11,078	3,601 11 2	17,036 12 3	8,910 14 2	20,638 3 5	2,987 11 8	8,946 3 11	..	478
Hawke's Bay	1,133	12,129	1,378 7 6	5,469 5 5	3,535 14 5	6,847 12 11	6,802 9 1	142 14 6	6,659 14 7	1,281
Wellington	7,948	31,143	4,290 7 2	17,736 3 7	2,789 12 6	22,026 10 9	13,406 16 5	..	13,406 16 5	2,638
Nelson	2,296	23,382	617 3 0	16,541 2 1	6,111 12 7	17,158 5 1	10,357 11 0	3,516 13 1	6,840 17 11	1,624
Marlborough	1,243	5,243	2,756 14 1	5,348 19 6	3,593 12 10	8,105 13 7	..	105 19 6	..	..
Westland	8,331	22,302	4,448 9 10	17,873 16 4	7,625 1 3	22,322 6 2	4,655 2 0	226 18 4	4,428 3 8	16
Canterbury	1,436	25,296	63 16 10	9,954 18 1	5,333 2 7	10,018 14 11	15,341 1 11	..	15,341 1 11	7,390
Otago	7,500	44,309	..	25,967 4 9	11,328 6 6	25,967 4 9	19,431 8 4	1,089 13 1	18,341 15 3	2,274
Southland	4,362	15,593	2,782 6 5	11,345 19 10	4,894 7 9	14,128 6 3	4,427 18 5	180 18 3	4,247 0 2	5,645
Sundry Roads	10,383	10,383	..	2,930 12 11	2,930 12 11	2,930 12 11	7,452 7 1	..	7,452 7 1	21
	62,915	268,415	33,434 16 0	183,788 6 2	78,224 1 8	217,223 2 2	105,186 4 2	20,559 10 4	90,691 5 7	25,029
Less Votes exceeded—Taranaki, £5,958 12s. 3d.; Marlborough, £105 19s. 6d...									6,064 11 9	..
									84,626 13 10	..
Liabilities, 30th June, 1884									25,029 0 0	..
Net available balance, 30th June, 1884									58,597 13 10	..
Roads through lands recently purchased									195 8 11	

168° 15′ 30′ 45′

44° South Latitude

ARAWATA
JACKSON'S BAY
Arawata R
Cascade Pt
Cascade R
Half-way Bluff
BOULDER BANK
Big Cascade
Lit Cascade
Cascade Bay
Sandrock Bluff
Bluff G
Callery's G
Big Reef
LIMESTONE CLIFF
Gorge R
Longridge Pt
Mt Malcolm
Awarua Pt
AWARUA
or
BIG BAY
Long Reef
Hollyford R
MARTIN'S BAY
JAMESTOWN
MAY HILLS
L WILMOT
Pyke R
Proposed Main Road
Red Hills
The Knob
CASCADE PLATEAU
STAFFORD R
TWIN ROCKS
L ELLERY
Jacksons R
Arawata R
Mt Collyer
Mt Riddle
Mt Richards
GORGE RIVER PLATEAU
WILLIAMS RANGE
RED HILL RANGES
BARRIER RANGE
ALABASTER
Mitre Pk
Tutoko Pk 3042
MILFORD SOUND
DARRAN MOUNTAINS
HUMBOLDT MTS
L ADELAIDE
L HARRIS
L WILSON
Conical Hill
Eagle Burn
SYLVAN L
DIAMOND I
Dart R
Rees R
Mt Christina 8675
I HOWDEN
McKELLAR'S L
KINLOCH
GLENORCHY
L WAKATIPU
Caples R
Rich Burn
Greenstone R
Hen Burn
Pigeon Id
Rigid Id

A
B

JAMES McKERROR
Surveyor General.

Topographical Plan
OF COUNTRY BETWEEN
JACKSON'S RIVER AND HOLLYFORD VALLEY

Scale. 4 Miles to an Inch.

4 3 2 1 0 4 8

REFERENCE.

Proposed main road Jackson's Bay to L. Wakatipu.
Minor Roads and tracks.
Aneroid heights thus. 120, trig. heights thus. 120.
Westland Survey Camps. ⚠ S.C.
Cascade, Hope & Gorge Rivers are roughly traversed, viz: distances estimated, bearings by Prismatic Compass.
Line A-B divides Otago and Westland Surveys.
Position of point M abreast of Lake Alabaster, determined by observations to Coast line and Red Hill Relative to Mitre Pk and Tutoko Pk (Otago Surveys) point M is situated about a mile West of where shewn on plan.

T.M. Grant, delt.

East Longitude

Photolithographed at the General Survey Office, Wellington N.Z. August 1894.

APPENDIX No. 4.

REPORT upon RECONNAISSANCE SURVEY of PART of WEST COAST between CASCADE PLATEAU and JACKSON'S RIVER on the North, and LAKE MCKERROW and HOLLYFORD VALLEY on the South.

Procedure.—The survey north and east of line AB in blue, as shown on tracing marked (A) in red, attached hereto, is the result of two explorations in the southern district, the first undertaken in February, 1883, and the second in February and March, 1884. The principal object in view—apart from the desire to get a good topographical map of the district—was to ascertain whether it was possible to get a practicable line for extension of main road to Martin's Bay Settlement and so a connection with Lake Wakatipu District, Otago. The surveys south and west of line AB in blue, and shown on said tracing, are the work of Otago surveyors. Avoiding all details, the main features of the two explorations referred to were as follow: In February, 1883, I left Jackson's Bay, travelling inland across Stafford River, &c., to the Twin Rocks on Cascade Plateau, thence into Cascade Valley and up Cascade River. From Mount Richards Range the north head of Big Bay, as I thought, with the sea beyond it, was plainly visible: a low saddle—altitude between 1,500ft. and 1,600ft.—with high ranges on both sides, leading into the Awarua River, the course of the river into Big Bay almost a straight run west (magnetic), which coincided exactly with the old Canterbury map. I descended the Olivine Range, forded the Cascade River, and crossed the saddle and travelled down the Awarua. Three days' journey brought me to the sea, and I then discovered that the river I had been following to its mouth was the Gorge River, and not the Awarua, and that Mount Richards was nearly five miles out of position on our old maps. Unable then to spend the time necessary in completing the survey, I travelled along the coast to Barn Bay, and from thence in an open boat (22ft. long) back to Jackson's Bay. On the 16th February, 1884, the measurement of the Cascade Plateau base-line being then completed, I descended into Cascade Valley and started on my second journey south, travelling along the sea-coast to Gorge River, up that river and Jerry River. From point marked (D), above S.C. 2290 (survey camp, altitude 2290ft.), the course of the Awarua, as I thought, with the old map again before me, could be clearly seen for about five miles. To the south side of "The Knoll" the main branch as shown on said map appeared to join it, and both, turning sharp round into the low gap between the Knoll and the foot of Skipper's Range, evidently continued in a westerly direction straight for Big Bay. I descended this supposed Awarua River and travelled down to the Knoll, when I found that, instead of running westerly, the course of it was south-south-east. The mystery had to be cleared up, but, having only a day's provisions left, I could not follow the river, but retraced my steps to camp marked S.C. 180, and the day following worked along the foot of McKenzie Range to Big Bay. On that day's journey I at last found the mysterious Awarua River, a stream less than half the size given on the map, and its source, instead of three or four miles to the east of Red-hill, as many miles to the west of it. From Big Bay I travelled along the coast line to Martin's Bay, thence across Lake McKerrow up Hollyford and Pyke's Creek (I suppose called a creek in irony, for it carries a large body of water, and is unfordable for either man or beast between the Lake and the Hollyford) to Lake Alabaster and to ranges east of it. I returned *via* Martin's Bay along the sea-coast to mouth of Cascade, thence up that river and Martyr's River across a low saddle into Jackson's River, and down that river and Arawata River to Jackson's Bay.

Topographical Work.—The rivers have been rough-traversed, and the ranges—Olivine Range, Gorge River Plateau, Red-hill Range, and part of Humboldt Range—have been explored, and the others adjoining fixed from them. The only basis obtainable for determining positions inland was the coast-line, with its many bluffs and headlands, and on the correctness of this coast traverse, which, as far as I am aware, was a piece of contract work carried out under the Provincial Government (Canterbury), some years before the gold discovery on the West Coast was made, depends the correctness of the whole work. The principal points made use of are: Cascade Point, mouth of Cascade River, mouth of Hope River, Sand-rock Point, Long-ridge Point, and the north and south heads of Big Bay. The way in which the bearings fell in when plotting the work, with the coast-line as a basis, shows plainly that there is an error of about a mile and a half in the coast traverse between Big Bay and Cascade Head. Where it is, and whether cumulative or confined to one or more spots, I could not say. Going into particulars would unduly extend this report; suffice it to say that at questionable points I meaned the results derived from different observations to coast-line features, and so carried the work down to point M, abreast Lake Alabaster. I had hoped to be able to "tie on" to some trig. stations on the Otago ranges, but found that impossible, as none of them have been planted on the tops of the ranges. They are all fixed on the slopes either in the bush or just at the beginning of the open land. This was done, I presume, for the purpose of enabling the surveyor to fix points commanding the settlement surveys in the valley of the Hollyford and about Lake McKerrow. I should have asked Mr. Arthur to direct that a station or two be planted and trigonometrically fixed on the top of both Skipper's Range and Humboldt Range, while the survey was in hand. It would have greatly facilitated the connection of Westland and Otago triangulation, but this did not occur to me at the time. Returning to point M, the bearing from it to the junction of the Pyke and Hollyford and to Trig. Y—the position of which, however, I could only guess at from description received at Martin's Bay from one of Mr. Wilmott's survey labourers—falls in fairly well; but the intersections of the bearings to the principal mountains, notably the Tutoko and Mitre Peaks and Mount Christina (I am not quite sure that the one I took to be Mount Christina is really Christina), throw that point a mile to the north-west of where shown on tracing. The topography of the inland features is altogether wrong on the old maps; indeed, it is little better than a guess at what the inland country might be when simply looking at it from the sea-coast. Almost every one of them a few miles from the sea-coast is not only not approximately right, but radically

wrong. Hope River is running five miles across Gorge River and right through Gorge River Plateau; Awarua River running miles across Pyke River, and so on. On comparing the coast-line of our old map, which I say must be about a mile and a half too long between Cascade and Big Bay, with the coast-line on the latest Admiralty chart, the following is the result: Jackson's Head to Cascade River, difference about three miles; Cascade River to Big Bay, difference about five miles; Big Bay to Milford Sound (River Cleddau, as given on Otago maps), difference about six miles. There are evidently serious discrepancies in the positions of the headlands of the coast which require rectifying as soon as possible.

Main Roads.—In regard to this point, the result of the explorations has been very satisfactory. A splendid inland line of road, from the Cascade Plateau to the junction of the Pyke and Hollyford can be had, and, what is more, there is only this one line of inland road possible, namely, across Cascade and Gorge Saddle and across Jerry and Pyke Saddle, as marked on tracing. The whole of the road-line has been explored, excepting that portion between Lake Alabaster and the Knoll, but it could be plainly seen from the ranges I was on. It presents no difficulty whatever. It is just a level run along the foot of the range from the Lake to the Knoll. The ascents and descents on this line need be nowhere steeper than 1 in 15, and along these, as far as I could see, there will be nothing but ordinary sideling cutting. I have been particular to watch for rock outcrops, and of these a few only are found along the west bank of Cascade River and on the east side of Lake Alabaster, neither of these, however, more than a couple of chains long. Of the three proposed connecting roads I have explored two, namely, the one into Barn Bay and the one into Big Bay. Neither of these presents any difficulties. The third one, into Martin's Bay across Jamestown Saddle, I did not follow, but from what I saw, looking at it from both sides, I feel satisfied that it also will be found easy of construction. But, whether or not, it is the only practicable communication with Main Road, as constructing a road along either side of Lake McKerrow means a couple of miles of rock-work, and that is prohibitive on account of its great cost.

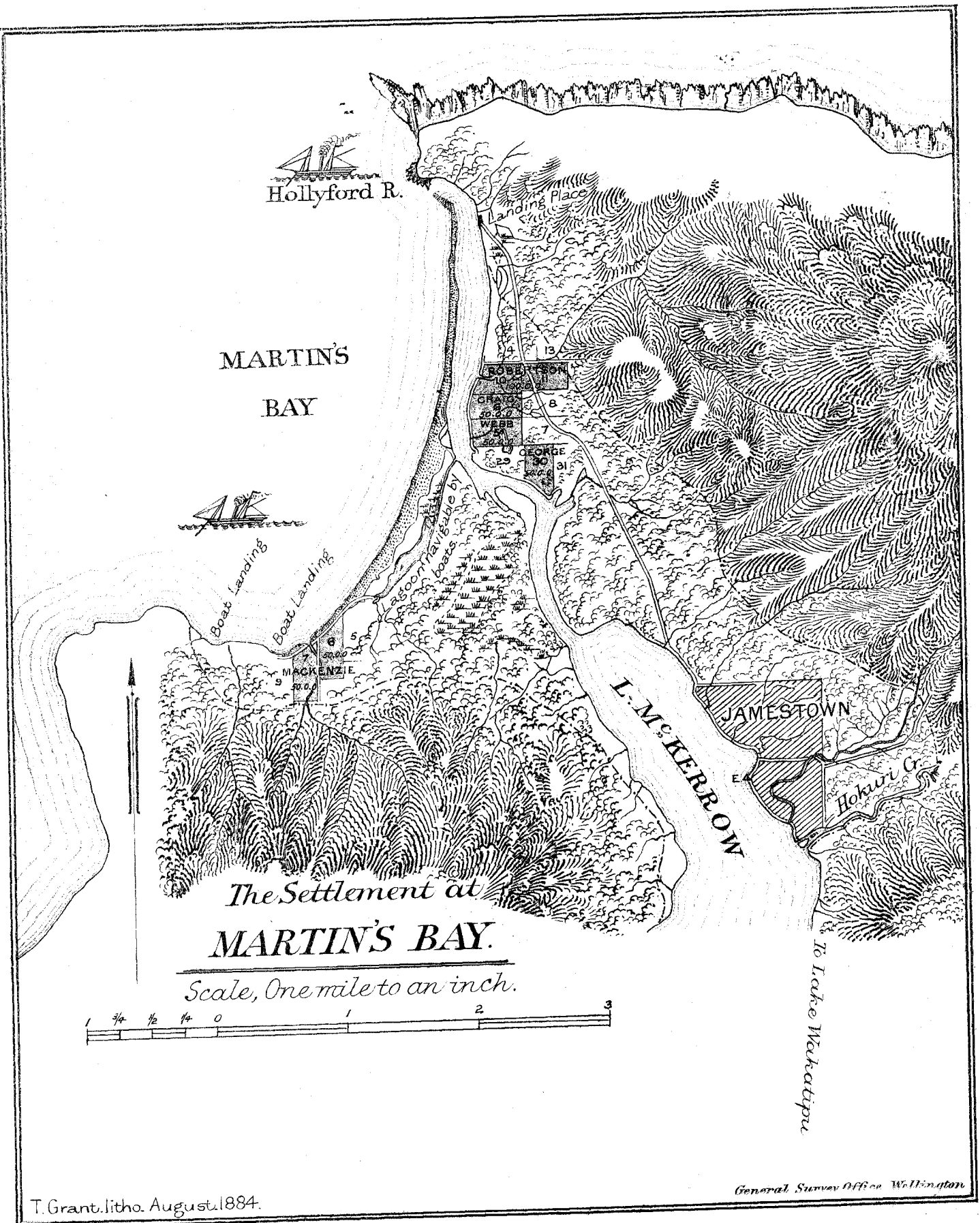
GENERAL.

Land for Settlement.—There is a large quantity of very good land in the Cascade Valley, and patches of from five hundred to a thousand acres of fair agricultural lands in the Hope and Gorge River Valleys. The Big Bay Flat is worthless—sour and swampy—but both along the foot of the McKenzie Range and Skipper's Range, more especially along the foot of the latter, the land is very good. In the Pyke Valley there is scarcely any land suitable for settlement on the western side of river, while on the east there is a narrow belt of good land extending from north boundary, Otago, to near Lake Alabaster.

Land for Pasturage.—Every one of the river valleys, but particularly the Cascade River and the Pyke River Valleys, are good pasturage ground for cattle. Not a beast ever having been on these, the bush is full of karaka and broad-leaf. Of the open-top ranges Olivine Range, Hope Range, and Barrier Range are absolutely worthless for grazing purposes. Red-hill Range and Skipper's Range are partially grassed, while Gorge River Plateau is very good, grassed from end to end.

Geological Formations.—The most remarkable feature about the southern district appears to me to be that of Olivine Range, to the east of Cascade River: it is a red-and-violet-looking mass, and, from about 1,000ft. above the river, devoid of almost every vestige of vegetation. It is the same formation the Cascade Plateau and a great part of the Gorge and Jerry Valleys country consist of. The "Red-hill" itself is olivine, while the spurs running therefrom are a sort of greyish slate with grey granite belts here and there through them. An extraordinary red granite belt is crossing the Jerry River a little above the proposed road crossing. The olivine formation is traceable as far as the Humboldt Mountains; the last indications of it I saw on the low saddle the Barrier and Olivine branches and Hidden Falls Creek rise from: the extent of it there does not exceed a couple of acres, but it is very marked and distinct. A great part of the Hope Range is auriferous, and along the whole length of Gorge River the "colour" is found on washing a dish of stuff. I believe that when once made accessible the Gorge country will prove a great field for hydraulic sluicing—the getting the necessary water supply there will not be difficult. Almost all along the coast-line from Barn Bay to Martin's Bay the beaches and coast terraces carry gold. Some of these beaches proved very rich in the early days of the coast, and are still being worked. Coarse gold in considerable quantity was found at the mouth of the Gorge River—a party of two men, both known to me, lifted forty-three ounces in less than a week from a patch 10ft. square. The colour of gold is also got in several of the tributaries at the headwaters of the Pyke River. There are a number of other interesting geological features about that district, as, for instance, the various outcrops of limestone, &c., all of which are marked on map at this office, and about which a geologist might write pages of foolscap; but, extensive acquaintance with this branch of science not being an acquisition I can boast of, I shall desist philosophizing upon the way how all or either of the formations originally got there, where they came from, and why they are not somewhere else.

GERHARD MUELLER, Chief Surveyor.


Hollyford R.
Landing Place
MARTIN'S
BAY
ROBERTSON
CRAIG
WEBB
GEORGE
Boat Landing
Boat Landing
Lagoon navigable by boats
MACKENZIE
L. McKERROW
JAMESTOWN
Hokuri Cr.
To Lake Wakatipu
The Settlement at
MARTIN'S BAY.
Scale, One mile to an inch.
1 3/4 1/2 1/4 0 1 2 3
T. Grant. litho. August. 1884.
General Survey Office Wellington

APPENDIX No. 5.

REPORTS on the SETTLEMENTS at MARTIN'S BAY and JACKSON'S BAY, West Coast, Middle Island.

MARTIN'S BAY.

SIR,— Wellington, 30th January, 1884.

In accordance with your instructions I visited Martin's Bay on the 21st and 22nd instant. The "Stella's" boat landed her cargo and passengers about a mile up the River Hollyford. Several of the settlers were on the beach waiting the arrival of the mail and their goods, the steamer having fired a gun and blown her whistle to apprise them of her arrival.

After some conversation with the people I engaged a boat, and went up the river and across Lake McKerrow as far as Jamestown, and, on landing there, traversed the bush to the foot of the hills and up to the Hokuri Stream.

The Hollyford is a river broader than the Clutha at Balclutha, but neither so rapid nor so deep throughout, although in many places it is much deeper; its current is more like that of the Avon in Christchurch, but it is certainly six times its width, and very much deeper. The banks are low, and the flat is mostly on the right bank or northern side. The tide flows up to Lake McKerrow; and the Hollyford, Lake McKerrow, Pyke's Creek, and Awarua in Big Bay were no doubt at one time connected, as Dusky Sound and Breaksea now are.

I was informed by Mr. Craig and others who had explored the country that the rise from Big Bay to Lake Alabaster did not appear to exceed 15 feet, and that thence down Pyke's River the fall to Lake McKerrow is very little. Gold has been found in this country, but its difficulty of access renders working unpayable.

The settlers at Martin's Bay are,—

Mrs. Robertson, a widow, with two sons and two daughters. She has 100 acres in occupation, of which twelve are cleared and in grass. About thirty cattle graze on this and in the bush. The elder son has a mining claim in an adjoining creek, and could, he says, make £2 to £3 a week if he worked continuously. Mrs. Robertson also collects birdskins for disposal in Dunedin.

Mr. Craig and his wife occupy a house and have a very fair garden, but he does not own any land yet. He has also a creek claim on the northern side of the flat, but has only recently begun to work it.

Mr. Webb's holding comes next, going up the river. His household consists of six persons, and he occupies fifty acres, of which twelve acres are cleared and under grass, with about half an acre of garden. He has thirty-two cattle, and has a claim from which he earns about £1 a week, working half his time in it.

Mr. John George is the next settler, with fifty acres, of which he has cleared twenty acres, and has patches of wheat, oats, potatoes, grass for seed, and a small garden. They look very well, but he says that the sparrows will probably eat up all his wheat before it is ripe.

Mr. D. Mackenzie is the other settler. He is located on the beach, and holds about 100 acres, of which he has cleared five acres, and planted potatoes and sown some grass. He has twelve cows milking, and exports the butter by the "Stella."

With the exception of Mr. Webb, all the people expressed themselves as able to make a living, and seemed to think they were as well off in Martin's Bay as they would be in some other part of New Zealand.

The river settlers have a grievance—that the "Stella" does not land their goods, as they say might oftener be done, in the river, instead of at the boat-landing on the south side of the bay.

The river entrance is a difficult one, except with a flowing tide and near high water, unless in calm weather. With a southerly wind it is unsafe. The boat-landing is best in a southerly breeze, the river in a northerly wind.

As the master of the "Stella" is the best judge which place is the safest to land his cargo at, and as he is moreover in a measure responsible for the lives of his men and the care of his boats, there is no reason to doubt but he will select the most fitting landing-place in all circumstances. He could, of course, wait at Milford Sound for a wind and tide favourable for the river, but, as the steamer's working expenses are £20 a day, this is scarcely to be thought of.

As the majority of the settlers would be pleased to have their goods landed in the river, this no doubt will be done when practicable, but in any case the greatest distance they would have to be carried on land is not over a mile; and, if the river settlers would build a futtah at the boat-landing, their goods would not be injured at all by exposure. They, however, prefer to take round a tent-fly when it is wanted, rather than "encourage the landing of their stuff on the beach."

The want of a passable track up the east side of Lake McKerrow was brought under notice. The route is just practicable by foot, but quite impassable for cattle or horses. The only horse in the settlement had to swim round the bluffs after a boat. From the upper end of the lake the Greenstone track to Lake Wakatipu is fairly fit for driving stock, or could easily be made so, and, if the track along Lake McKerrow were formed, cattle could be driven to and from the Lake District, and further settlement made more practicable. The cost, they say, would be about £500; and I believe, if a good long time were given, the settlers themselves would do the work at a low rate.

The want of more frequent postal communication is also much felt. The "Stella" comes every three months, but rarely gives time for replies to letters received by her. Occasionally Queenstown is visited by some of the settlers, but, as the journey to and from takes nine days, it is not often done. Could a mail be arranged midway between the trips of the steamer, the isolation of the place, and this objection to further settlement, would be much remedied. There is in the bay about 4,000 acres of level land yet unoccupied and fit for settlement, and I believe, with better means of communication, much of it would be taken up and occupied. The climate is said to be pleasant; there is a fine river, with good land on its banks; gold is found in the neighbourhood, north and south; cattle thrive in the bush; birds and fish are plentiful. To men with growing families there

is the great objection that no school exists at which they could be educated: the few children now in the settlement learn to read and write from their parents, and this must continue until the place is better peopled. A. Barron.

The Surveyor-General, Wellington.

JACKSON'S BAY.

Sir,— Wellington, 30th January, 1884.

In accordance with your instructions I visited Jackson's Bay on the 23rd instant.

Starting on horseback from Arawata Township in company with Mr. Macfarlane, I rode up the valley of the Arawata as far as occupied, and conversed with every settler who was at home.

Returning along the river-bank, we went by the beach to Waiatoto and Okuru, where there are a few settlers, whom I saw. I had not time to visit Smoothwater, but ascended Mount Eleanor, from which the level land, at one time occupied, but now entirely deserted, could be clearly seen.

The people all expressed themselves as able to make a living, and thought they were doing as well there as in any other place.

The level land in the Arawata, Waiatoto, and Okuru is of very considerable extent, and seemed to be of better quality, and more easily cleared, than that in Martin's Bay. It is all covered with forest; the roads are good; the settlers appear to be getting on fairly. None of the rivers are bridged, of course, but ferries are established, horses having to swim after the boats. The rivers are very dangerous from their constant shifting, and from the quicksands which form and change so often.

In the Arawata, Mr. Jackson had cleared ten acres out of the seventy held by him; had ten cows milking, and about seventy more in the bush and on a run up the river jointly held with Messrs. Collins and Callery. His garden was very good; in it were the largest cabbages I have seen for a long time.

Messrs. Thomson and McArthur hold forty acres, of which fourteen were cleared, and they had seventeen cattle and a good field of potatoes.

Mr. Callery holds thirty acres, of which about seven were cleared; he had ten cows milking, and forty head on his run up the river. He makes and has ready for export 75lb. of good butter every fortnight.

Mr. Clark occupies fifty acres, has ten acres cleared, and runs twenty cattle. He also works on the roads.

In the upper valley there is the run of 30,000 acres of Messrs. Jackson, Collins, and Callery, on which they have about 140 cattle.

The soil in the settlement is not deep, and the subsoil is gravel; but when cultivated it produced very good crops.

In the Waiatoto Valley, which I did not visit, are eight families, who occupy forty to fifty acres each, and who have cleared about forty acres in all. They have a few cattle, and most of them dig for gold, or work on the roads.

Between the Turnbull and the Okuru, where formerly the Italians were settled, are now located Messrs. Cuttance, Collyer, Lindsay, Nerger, and Macpherson. Mr. Cuttance has a run of 30,000 acres up the Okuru River, and 160 acres at the settlement, of which about twenty acres are cleared; and he owns about 100 cattle.

Mr. Lindsay has 100 acres, of which twenty acres are cleared, and he has a small paddock of good oats, another of potatoes, and one of hay. He runs six cattle, and works at his trade as a blacksmith when there is work to do.

Mr. Macpherson has forty acres in the Okuru and ten acres on the Arawata; he runs eight cattle, and has about five acres cleared. When not employed at home or in the neighbourhood he works on the road.

Mr. Collyer is the ferryman at Okuru, and owns 250 acres; he has fifteen cattle, and has cleared about fifteen acres, including a quarter of an acre in potatoes.

Mr. Nerger occupies fifty acres, and has a few cattle in the bush.

There are altogether settled on the Okuru nine families; on the Waiatoto eight families; and on the Arawata five families. In the town there are two families.

The "Stella" and the "Waipara" are supposed to visit Jackson's Bay and the adjacent settlements at equal intervals of six weeks; but they generally arrive at Jackson's Bay within a few days of each other. The "Stella" is usually within a week of her time, and, if it could be arranged that the "Waipara" would be as regular, the settlement would be benefited. At present they can depend on getting stores only once every three months, and at the time of my visit the people at Okuru were very nearly out of bread for want of materials.

Several settlers urged the advisability of opening tracks into the auriferous country between Cascade and Barn Bay. At present, although gold is known to exist there, the toil of getting to it through the forest, and of bringing provisions to it, entirely prevent its development.

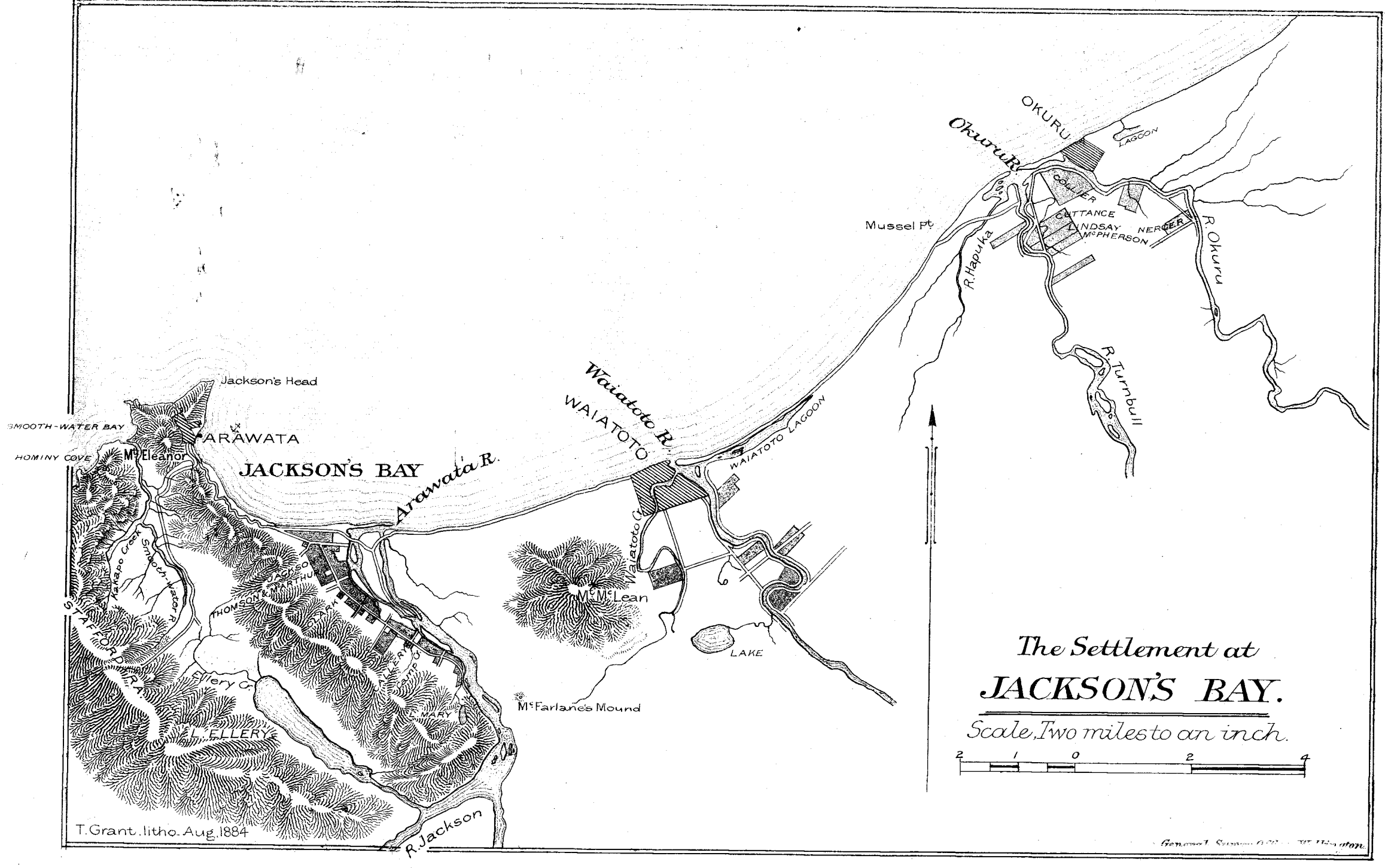
A road has been laid out as far as the Cascades, and Mr. Mueller estimates that a foot-track, with gradient not steeper than 1 in 15, could be made on the permanent line for 5s. per chain. This would be simply a bench along which one man could walk. Assuming the distance to be twelve miles, this would cost £240, a sum which, I think, is worth expending in developing this gold-bearing country.

The Cascade Run would also probably be worth stocking if a mining population could find profitable occupation near it.

I was requested to bring under notice the need for a jetty at Jackson's Bay. Some years ago a steamer's jetty was commenced, but it only extends a little beyond low water. What is now wanted, failing the completion of the larger wharf, is a boat-landing jetty in the middle of the bay to the east of the one commenced. Its cost is estimated at £100. This would save landing stores on men's backs through the water, and prevent their getting wet sometimes. The beach is a good one, however, and goods can, with due care, be landed at the present time without damage.

The Surveyor-General, Wellington. A. Barron.

By Authority: George Didsbury, Government Printer, Wellington.—1884.


Jackson's Head
SMOOTH-WATER BAY
HOMINY COVE
Mc Eleanor
ARAWATA
JACKSON'S BAY
Arawata R.
Waiatoto R.
WAIATOTO
WAIATOTO LAGOON
Waiatoto C.
Mc McLean
LAKE
Mc Farlane's Mound
Mussel Pt
OKURU
Okuru R.
LAGOON
COLLIER
CUTTANCE
LINDSAY
McPHERSON
NERCER
R. Hapuka
R. Okuru
R. Turnbull
Kakapo Creek
Smooth-water R.
THOMSON
CLARK
CAMP
Ellery C.
L. ELLERY
L. MARY
R. Jackson
T. Grant. litho. Aug. 1884
The Settlement at
JACKSON'S BAY.
Scale, Two miles to an inch.
2 1 0 2 4