

1881.  
NEW ZEALAND.

# SURVEYS OF NEW ZEALAND.

(REPORT FOR 1880-81).

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

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

General Survey Office,  
Wellington, 26th August, 1881.

SIR,—

I have the honor to report on the progress made in the surveys of Crown and Native lands for the twelve months ended the 30th June, 1881.

The detail of operations conducted within the several land districts are referred to at length in the reports of the Chief Surveyors in the Appendix, where they are arranged geographically, as in last year's report, beginning with Auckland and going south.

The maps show the areas in the colony which have been brought under the different classes of survey, and the progress made in the publication of maps up to the 30th June last.

The out-turn of field-work is detailed in the tables, but, before beginning to deal with the subjects of report, it may be here summarized in the following general statement:—

Nature of Work.	Area.	Rate per Acre.			Cost.		
		£	s.	d.	£	s.	d.
Major triangulation ... ..	1,087,086 acres	0	0	0·38	1,741	10	8
Minor triangulation, without topography ... ..	822,996 „	0	0	1·13	3,877	13	11
Minor triangulation, with topography ... ..	2,789,109 „	0	0	1·24	14,452	1	5
Rural and suburban section surveys ... ..	474,991 „	0	1	7·18	37,949	5	5
Town section surveys ... ..	2,658 allotments	0	15	10 (per allot.)	2,104	9	1
Native Land Court surveys ... ..	94,441 acres	0	0	5	1,973	12	9
Native Land Purchase ... ..	710,737 „	0	0	2·68	7,949	8	9
Gold-mining surveys ... ..	1,505 „	0	15	10	1,192	12	5
Road surveys ... ..	607½ miles	10	17	5 (per mile)	6,605	9	3

## TRIANGULATION.

This process of survey has for its objects the establishment of points over the face of the country, to which all settlement and Land Transfer surveys may be referred, their degree of accuracy tested, and their relative positions within narrow limits of error determined, so that, as the country gets occupied and further subdivided, all properties may be kept clear and distinct on the record plans, and, in case of obliteration or challenge of land-marks on the ground, their positions re-established. Triangulation also affords the only satisfactory ground-work for topographical maps. The delineation of the natural features of the country pro-

ceeds simultaneously with the minor triangulation. To accomplish these objects it is essential that all the lines of survey should have a definite relation in angular bearing to a known fixed line, and have the same unit measure of length.

The only known fixed line of any place is the true or astronomical meridian of that place. It is independent of any local reference-marks, for, should they get lost or displaced, the line can be redetermined by observation, as in the first instance. It is convenient in practice to refer all the surveys of a considerable area, east and west, to the meridian of some conspicuous natural point. New Zealand, from its lying so much north and south, and covering only twelve degrees of longitude, might conveniently have had all the sectional surveys referred to seven or eight meridians if trigonometrical survey could have in all cases preceded settlement; but this was impossible for many reasons. In 1876, when the surveys were brought under the control of one department, the colony was divided into twenty-eight meridional circuits. The meridians of twelve of these had already been observed under the Provincial Survey Departments. The astronomical observations to determine the remaining sixteen were entered on, and extensions of standard bearings made from each throughout their respective circuits where necessary.

All surveys are now conducted on the bearings of the circuit within which they are situate. The unit measure of length is the standard brass yard at the head office. From it a standard chain length has been laid down there at a temperature of 62° Fahr. At all the survey offices of the colony similar standards have been laid down, and compared with the one at the head office.

On the uniform basis of true meridian and standard length the trigonometrical survey proceeds in the districts where it is immediately required. As the different series of triangles close on each other from independent bases, they become a check and verification the one of the other. During the year an area of 4,699,191 acres has been triangulated, principally in the Land Districts of Auckland, Wellington, Marlborough, Nelson, Westland, Canterbury, and Otago. 8-inch and 6-inch theodolites have been used in the observation of the major triangles, and 5-inch in the minor.

The excellent results obtained by the surveyors engaged in triangulation and topography are convincing testimony of the skill and care exercised by them in its execution. In the various triangulations detailed in Chief Surveyors' reports it will be seen that only in a few cases does the error of closure on base of verification or on side of an adjacent triangulation exceed 2 links to the mile; generally the closure is well within that limit. Thus, Mr. C. Cussen, in a series of triangles extending over 282,000 acres of the Patetere country, began on a side of the Auckland major triangulation and closed on another side with the very satisfactory results of only  $\cdot 53$  of a link per mile of discrepancy in length of common side, of 8" in bearing, and of 4 feet in height of station.

From the base in Wairau Plain, Marlborough, Mr. A. D. Wilson extended major triangles across Cook Strait to a close on side Kaukau-Mana. Length of side by Wellington triangulation, 84,185.3 links; length of side by Marlborough triangulation, 84,183.2 links, a difference of 2.1 links, or  $\cdot 2$  of a link per mile. Without much further trouble it may be possible, with better-conditioned triangles than those already observed, to have observations from other points across the Strait, as the triangulation is extended down the coast of the Middle Island. Mr. Wilson, in the selection of stations, is to keep this in view; for it will be satisfactory to have a further verification of a work on which the relative geographical positions of the two Islands on the future maps of the colony will depend. In the Marlborough Sounds Mr. R. F. Goulter, a young surveyor, took up the survey and trigonometrical connection of the settlements in the numerous small bays. The closures of his minor triangulation, the first work of this class he has undertaken, are very creditable to him.

In Westland Mr. G. J. Roberts, who for the last three years has been engaged in a trigonometrical and topographical survey of that district, recently completed the observation of a Ray-trace, or chain of triangles, across the dividing range, connecting the triangulations of Westland and Canterbury. This was a very arduous work, conducted, as it necessarily was, for a considerable distance over glaciers and

snow-fields, with trigonometrical stations 5,000, 6,000, and 7,000 feet in height. It is only possible to work in this high region two or three months in autumn. In 1880 the triangles were advanced as far as practicable from the Westland side, and this year they were extended on to a connection with the triangulation of Canterbury Plains. The initial base was at Paringa, on the West Coast, and the base of verification in the valley of Upper Rakaia. Both were measured by Mr. Mueller by means of steel band and straining apparatus.\* Mr. Roberts's work, on being calculated, gave the computed length of base at Upper Rakaia only 1·1 link per mile different from the measured distance, a result eminently satisfactory under the great difficulties of the work. The close in heights was equally satisfactory. Thus, Mr. Roberts's heights of five trigonometrical stations in Upper Rakaia, referred to mean sea-level at Okarito, West Coast, differed only 5·5 to 6·6 feet from Mr. C. W. Adams's heights, referred to mean sea-level at Timaru, East Coast, as datum. The comparison of the heights of the five stations is as follows:—

	C. W. Adams.	G. R. Roberts.	Difference.
Prospect Hill ... ..	2,914·8	2,920·3	+ 5·5 feet.
Whale Back ... ..	2,196·1	2,201·7	+ 5·6 feet.
Totara Peak ... ..	6,442·8	6,449·3	+ 6·5 feet.
Manuka Peak ... ..	5,514·6	5,521·2	+ 6·6 feet.
Mount O'Connor ... ..	5,289·8	5,296·3	+ 6·5 feet.

By another independent series of triangles from East Coast the mean discrepancy in heights was only 2·2 feet; but the series giving the difference as above is deemed the more accurate. The difficulties of taking observations on these extreme altitudes, and the trouble of getting reliable observations for altitude on the Canterbury Plains, render the near agreement of the heights observed by Mr. Adams and Mr. Roberts at their common points a matter of gratification to all who delight in good work. Such results are not obtained by chance; they are the outcome of the devoted labours of two most able surveyors. Distance from Timaru to Prospect Hill in a direct line, 80 miles; 8-inch theodolite used for the greater portion of the distance, 5-inch for the remainder. Distance from Okarito to Prospect Hill in a direct line, 55 miles; 6-inch used in observations.

#### HEIGHT OF MOUNT COOK.

The Westland triangulation has extended down the coast past Mount Cook, and observations to the summit peak were taken by Mr. Roberts from twenty-four trigonometrical stations at distances varying from 20 to 70 miles. The observations from eighteen of these stations have been computed by Mr. Mueller, and the height of Mount Cook above mean sea-level is found to be 12,349 feet. This is the mean of all the computations, and no single observation differs more than 5 feet from the height given. The other observations have yet to be computed, but they are not likely to affect the result more than a foot, if so much. The height of Mount Cook hitherto accepted has been 13,200 feet, as given by the Admiralty surveyors, or 851 feet higher than the determination of trigonometrical survey. There can be no doubt that the Admiralty determination gives too great a height to the monarch peak of New Zealand mountains. For the future the height will have to be taken as nearly 1,000 feet less than what all the published maps now give it.

There have been other determinations of the height of Mount Cook, but, as none of the observers hereafter mentioned have had opportunities of taking observations of the mountain equal to those of Mr. Roberts, their results are not weighed against his, but are simply mentioned as contributory to an interesting subject.

	Feet.
Reconnaissance survey of Otago, 1857-58, J. T. Thomson. This determination was from observations taken from the Waitaki Valley by means of a 4-inch theodolite, distances from 60 to 110 miles between points of observation and Mount Cook. (Otago Provincial Gazette, 1859, No. 91, page 275, Appendix C.) ... ..	12,460

\* The band was supported on trestles and porters about 3 feet above the surface of the ground. The advantage of this method over the measurement on the surface is that the line does not require so much preparation, and those engaged in the measurement make the contacts with much greater ease than crouching to the ground.

	Feet.
Trigonometrical determination by G. R. Hackett. (Vol. vi., Transactions New Zealand Institute, page 298, foot-note) ...	12,264
In 1877-78 C. W. Adams, while extending the standard bearings in Canterbury, got observations by an 8-inch theodolite to Mount Cook from Herbert Peak near Lyttelton; from Patiti Point, Timaru; and from Mount Horrible, near same place. Distances: 135, 85, and 75 miles. Mr. Adams computed his observations, and reported in July, 1879, that, subject to a probable error of 25 feet, the height was ...	12,375
His observations with 8-inch theodolite at Hokitika and Abut Head, from stations of standard bearings, and computed with the distance of trigonometrical survey, are respectively 12,349·7 feet and 12,345·6 feet, or a mean of ...	12,348

#### GEODETIC LATITUDES AND LONGITUDES.

The differences of latitude between Mount Pleasant, Lyttelton, and Abut Head, Westland, computed through the triangulation, a distance of 170 miles, is only 1"·8 discrepant from that observed astronomically. But in the very same triangulation the discrepancy between the observed and computed difference of latitudes of geodesical stations of Gawler Downs and Koiterangi is 23"; the observed difference being 52' 9" and the computed 51' 46". The astronomical observations at these four stations were taken by Mr. Adams with an 8-inch transit theodolite of stars north and south of zenith. It is possible, but very unlikely, that his determination at each station may be uncertain to 5", in which case, if the errors at the two stations—Gawler Downs and Koiterangi—did not cancel each other, there would be an accumulated error of 10"; but, as there is an error of 23", the explanation of the greater part must be assigned to the deflection of the plummet, caused by the contiguity of mountain masses and the unequal densities of the earth's crust. Koiterangi and Gawler Downs lie nearly north and south of each other. The mass of the Southern Alps intervenes between the two stations, and both are situate close to the base of the mountain range. Since Maskelyne's observations, at Schiehallion, in 1774-76, demonstrated the influence of mountains in sensibly affecting the line of gravity, there have been many other proofs of the disturbing influence of mountain masses, and of similar effects on plains from the unequal density of the earth's crust. On this subject Colonel A. R. Clarke, in his work on geodesy, published in 1880, page 288, states, "It is not very uncommon to find, as in the vicinity of Edinburgh, a deflection of gravity to the extent of 5", while in the Counties of Banff and Elgin there are cases of still larger deflections, the maximum of 10" being found at the Village of Portsoy. At the base of the Himalayas, where we should naturally expect a large attraction, it amounts to about 30", diminishing somewhat rapidly as the distance from the mountain increases."

This is a very interesting subject, and one the department would gladly investigate further by taking observations with the zenith telescope at selected stations. But, without pursuing it specially, further opportunities of comparing the differences of astronomical and geodetic latitudes will arise as the triangulation connects the initial stations of meridional circuits.

The other comparisons, so far, do not show any such abnormal discrepancies as those reported of Koiterangi and Gawler Downs. Thus, the discrepancy between the initial stations of Marlborough and Wellington triangulations is 5". Similarly, the discrepancy between the initial stations of Amuri and Buller circuits, both observed by Mr. J. W. A. Marchant, is 2"·5.

The latter comparison was obtained from the reduction of the triangulation recently completed under Mr. Browning's direction, connecting Nelson with Amuri and with the West Coast *via* Buller Valley. The preliminary computations for longitude reveal a very large error in the recognized geographical positions of Flagstaff (Buller River), Cape Foulwind Lighthouse, and the Steeples, amounting in each case to nearly 6' longitude, or about 5 statute miles. The longitudes of these points given in "New Zealand Pilot, 1875," and in *New Zealand Gazette*, year 1875, page 701, are too far east. In other words, the coast-line at these points is further west than given in the Admiralty chart and Table of Maritime Positions, and, consequently, any ship making Westport would fall in with the land five miles sooner than she ought to do, according to chart. The positions of Perpendicular Point and entrance to Grey River, on the other hand, are given too

far west; so that, in reality, the coast-line is given distorted. As is well known, the Admiralty surveyors only made a running sketch survey of the West Coast north of Milford Sound; no great accuracy, therefore, can be expected. In furtherance of the Crown lands surveys, a triangulation, extending 200 miles along this coast, has been executed within the last three years. This has all been checked and connected into one series; and, by the two independent Ray-traces across the Middle Island from Canterbury and Nelson, with the connection across Cook Strait, the department has now got the information from which to deduce the latitudes and longitudes of many points in the Middle Island relative to the Survey Observatory, Mount Cook, Wellington. The longitude of it is in harmony with that of Pipitea Point, one of the most reliable positions of the Admiralty survey, and which has been verified by independent observations.\* In correcting the longitudes of maritime positions of a country, it is important to have them all referred to one recognized position. In this way no confusion can arise, as would inevitably be the case were longitudes referred to several points independently determined. The longitude of Pipitea Point is  $174^{\circ} 47' 53''$  E. of Greenwich, and from this, as origin, the longitude of Cape Egmont Lighthouse was recently computed for Marine Department as  $173^{\circ} 46' 10''$ . In a similar manner will other positions be given to that department as the computations are made.

#### SETTLEMENT SURVEY.

Under this head are classed rural, suburban and town surveys. During the year 4,932 sections of rural and suburban land, comprising 474,991 acres, have been surveyed, and 1,409 acres of town lands into 2,658 sections. Of the rural and suburban, 184,000 acres were arrear surveys of Crown lands which had been bought in years previous. The department has been labouring under the disadvantage of having to dispose of a large accumulation of back work. There still remained for disposal 254,000 acres on the 1st July last. Portions of this could be held over without much inconvenience to the purchasers, but in other cases the department is pressed to complete the surveys. The arrears have at length been brought within manageable limits, and should be much reduced during the current year. The great hindrance to the rapid execution of this work is the perplexing discrepancies of the old surveys and the meagreness of their records. Before the surveyor can survey the unoccupied intervening portions of land, he has to re-define boundaries of prior surveys, and reconcile as best he may the conflicting data which frequently presents itself. It will be a relief to the department when this back work is done, for it is very costly and troublesome.

The sectional surveys have been much improved in accuracy during late years by the steel tape superseding the chain in lineal measurements, and in bush traverse surveys the correction of bearings by observation of the greatest elongations of circumpolar stars. This means of correcting bearings has been much availed of by Mr. Humphries in his direction of the extensive bush surveys in the Taranaki District. The observation of an elongation is one of the simplest in practical astronomy. From the given latitude of the nearest trigonometrical station the latitude of point of observation is deduced. The computation is then easy, the resulting bearing, corrected for convergence, gives the true bearing of the meridian on which the survey is conducted. Under this system errors in bearing are localized and eliminated. The surveyor proceeds with confidence in miles of intricate bush traverse, feeling assured that his instrumental work will close within assigned limit of error when he completes connection with trigonometrical point or standard line. As will be seen from Mr. Humphries' report the errors in closing in no case exceeded 2 links per mile, nor  $1' 30''$  in bearing, a degree of accuracy very rarely attained in bush surveys, and which vouches for the skill and care exercised by the field surveyors in their work.

#### NATIVE SURVEYS.

Sixty-one blocks, comprising an area of 710,737 acres, were surveyed for the Native Land Purchase Department, and 213 blocks, covering a total area of 94,441 acres, to the order of the Native Land Court. The surveys of latter class are for

\* See Supplement to *New Zealand Gazette*, 1878, No. 46, page 635.

investigation of title, and are increasing very much on account of the facilities afforded the Natives in "The Native Land Court Act, 1880." Under section 40 any two or more Natives are entitled to apply for survey to the Governor. On the application being forwarded to the department through the office of the Chief Judge of Native Land Court, the survey usually proceeds at the expense of Government. After completion of survey and investigation of title, a lien for cost of survey is filed in the office of the Chief Judge at Auckland. Up to recent date these liens amount to a total of £14,617, of which £2,215 has been repaid by Natives on their dealing with the land.

There are 120 applications now on hand, comprising a total area of about 600,000 acres, and they keep coming in. The cost of survey has become a very heavy drain on the ordinary survey appropriation. This, of course, is a minor consideration as against the importance of inducing the Natives to aid in the settlement of the country, by bringing their land under title, thereby rendering it negotiable either by sale or lease. The outlay for survey will in time be recovered either in money or land. In cases where the area in allowance for survey would be sufficient for sale, it might be worth while, where there are no sufficient reasons to the contrary, to mark off the Government portion and offer it for settlement.

#### ROAD SURVEYS.

In the exercise of the right reserved in old Crown grants and in titles under the Native Land Acts, the department in the twelve months ended the 30th June last selected, surveyed, and recorded a total of 440 miles of road-lines. In this class of work the department has got a legacy of immense trouble and expense. Many of the former surveys were simply rectangles placed on the face of a rugged bush country, with no attempt at finding practicable road-lines to give access to them; the road question being disposed of by the simple expedient of reserving 5 per cent. of the area of each section, as an allowance for road-lines, to be selected at some future time. The Legislature, by subsequently limiting the time of selection to a period of five years from the issue of the grant for Crown lands, and to fifteen years from date of memorial of ownership or title under the Native Land Act, has aggravated the difficulty of dealing with this question, by implying the necessity of undertaking road surveys through lands which, since they were not done when the land was originally surveyed, could be very well left undone for some time longer without detriment to public or private interests. As but a small margin of the five or fifteen years is left in many cases, the department cannot hope to undertake all the work remaining to be done within the time available. Attention will therefore, in preference, be given to the survey of those lines which are deemed the most important.

#### ROAD CONSTRUCTION.

As the pioneer of settlement the department, in ordinary course, lines out the future roads of the country, and, under the regulations now in force, lays off a road to every section, howsoever small or remote the area may be. Where necessary the road-lines are graded. By circular 59 the limit of grade for main road-lines is fixed at 1 in 15, and for occupation-lines 1 in 10. Where, from the nature of the country, these grades are not attainable except by long detours, the surveyor reports for advice. Every care is taken to lay off the best lines, and there is no danger of the absurdities of the rectangular system being repeated over hilly country to the great trouble and vexation of settlers.

Under the vote, "Improvement of Crown Lands before Sale," the department is charged with the duty of the clearing and formation of road-lines and of drainage works sufficient to open out the lands for the occupation of settlers. In these works the valuable co-operation and assistance of the officers of the Public Works Department is acknowledged, as also of several County Councils and Road Boards; but where these agencies are not available, as in the more remote districts especially, the department undertakes this work entirely. Within the last two years 530 miles of road have been opened out, and 24 miles of outfall drains cut, at a total cost of £83,886 18s. 7d., up to the 30th June last. Reports on

these road-works will be found in the Appendix, also a very interesting report from Mr. Mueller on his exploration of a road-line from Upper Rakaia to Hokitika, over the main range *via* Mathias Pass.

#### LAND TRANSFER SURVEYS.

This class of work is executed entirely by private authorized surveyors. As all plans deposited at the Land Transfer Office are the basis of title guaranteed by the Government, the department is charged with the duty of seeing that no plans are passed into the office which are defective or inaccurate as survey records. Very considerable trouble was occasioned recently, in a few cases, where it was found that not only the plans were defective but also the surveys inaccurate and overlapping on the ground. Generally, however, the surveys for Land Transfer are executed with care and according to the regulations on the subject.

In one or two districts, where the earlier surveys were imperfectly executed, the department is deemed obstructive, because the Chief Surveyors cannot always accept the diagrams and descriptions on old Crown grants as sufficient for the certificate of title under the Land Transfer Act. The landowner, or his agent, cannot see why the description that served for the one title should not do for the other. If some flagrant inaccuracy is patent, then the demand is for the Government to rectify it. A good deal can be said on both sides of the question as to whether the landowner or the Government should be at the cost of perfecting defective descriptions. But, as the interviewing and correspondence in such cases is vexatious to both sides, it would be as well in future to prevent it by a regulation providing that, in cases where a resurvey is necessary, the landowner will have the option either of doing it through an authorized surveyor at his own expense solely, as at present, or the Government will undertake it on deposit of a survey-fee according to a moderate fixed scale of charges. The Government would not of course undertake any subdivisinal surveys of private property, but only the periphery survey and its connection with trigonometrical station or other standard point.

With the object of facilitating Land Transfer work, standard points have been laid down in the streets of most of the principal towns in the colony; and there are still other towns in which this is either now in hand or soon will be. To prevent any misconception in the public mind with regard to the object of standard survey of towns, it may be explained that the department, in making these surveys, does not attempt to settle any dispute as to boundaries between property—the keeping of the boundaries of a property is the function of its owner, not of the Government. But the dealing with the survey of a town at once, and in a comprehensive manner, sheds a flood of light on discrepancies which otherwise would not be revealed by any private survey, and prevents their further propagation. The points laid down, the distances and bearings between them, and their relation to the occupancy of the town, are mapped on a large scale, which map furnishes a sure guide and standard of reference for all surveys under the Land Transfer system. The utility of this work is so obvious, that the local authorities gladly share in the cost.

#### PUBLICATION OF MAPS.

The total number of plans, maps, &c., published during the year amounts to 429,028 copies; of these, 269,176 copies were for other departments, as detailed in Mr. Barron's report in Appendix. Before each land sale, from 250 to 1,000 plans of the block or township to be offered are lithographed on the 20- or 40-chain scale and distributed to the public. Maps of the trigonometrical surveys are issued to the surveyors. Geographical maps to the scale of 4 and 8 miles, and district maps to the scale of 1 mile to 1 inch, are being prepared and got out as rapidly as other current work will allow. It would be well to accelerate the issue of these maps by having more assistance. The maps on a scale of a mile to an inch are in an especial degree a great saving and convenience both to the public and Government. The scale is sufficiently large to show distinctly every section of land over 10 acres, and on this scale a very considerable area of country is shown on a small surface. A square of  $12\frac{1}{2}$  inches contains 100,000 acres, which is the standard size of the sheets

on this scale. Taken as a groundwork, and joined together as may be required, any of the numerous boundaries of Road Boards, property-tax, census, educational, electoral, or other administrative districts, can be shown on these sheets in a few minutes by a tint of colour. At first sight it might appear as though it would be better to print these boundaries—this is done in some instances—but, in the progress of a colony, boundaries are so subject to change that, as already stated, the important thing is to have an accurate groundwork on which to colour these changes as they arise. A beginning has been made in reducing the large amount of topographical information in possession of the department for the issue of a map of the colony brought up to date.

#### MISCELLANEOUS.

During the past year the expenditure on work for other Departments of the Service has amounted to £10,522, consisting chiefly of Land Purchase blocks, Native Land Court surveys, Education surveys of reserves, Land Transfer checks, maps and surveys for Road Boards and County Councils, West Coast Commission surveys, census maps, railway surveys and road surveys, and explorations to open land for sale, property-tax plans, and other requisitions in connection with the administration of Government departments.

#### FUTURE OPERATIONS—DEPARTMENTAL.

The season begins with 600,000 acres of settlement survey, of which 281,000 acres are arrear surveys, and 319,000 acres preparatory to being offered for selection and sale. The requisitions for survey from Native Land Court and Native Land Purchase aggregate a total area of 1,000,000 acres. Of trigonometrical and topographical survey there is on hand, or about to be, an aggregate area of 2,052,480 acres. This work should be pushed on if for no other reason than to supply topographical maps of the country on a scale of 2 inches to 1 mile. The average cost is 1½d. per acre. On these maps the main features of the country are delineated—the ridges, plains, river-systems, bush or clear lands, tracks in use, the best natural lines of future main roads, the altitudes of hills, valleys, passes, and other important points. The information thus brought together is invaluable in locating future settlements. Without it there really can be no intelligent administration of the Crown lands, for unsurveyed, unmapped territory is so much blank space. There are many millions of acres in the colony awaiting topographical survey. In the increased demand for Native surveys, there is the hope and the opportunity of adding largely to a correct knowledge of the topography of the North Island. In the Middle Island there is an extensive area in the south-west, between the Sounds and the Waiau River, a *terra incognita*, over which it has long been felt desirable to extend a reconnaissance survey. It may not be possible to do so this season, seeing that there will be unusual demands on the survey branches in Otago and Southland in the subdivision of Runs, but it should not be much longer delayed.

The demands on the department through the various classes of survey are more than the present field-staff can meet within the time that the surveys should be completed. It will therefore be necessary, as heretofore, to call in assistance from the private authorized surveyors. The departmental staff within the last twelve months has been reduced by eleven surveyors and twelve draughtsmen. In view of the large amount of work awaiting disposal, and of road and other surveys which must, in terms of Acts, be done within given times, it will not be wise to proceed further in reduction of an efficient staff of trained surveyors, who, if once dispersed, it would be a work of much time and expense to gather together the like again.

I have, &c.,

JAMES MCKERROW,

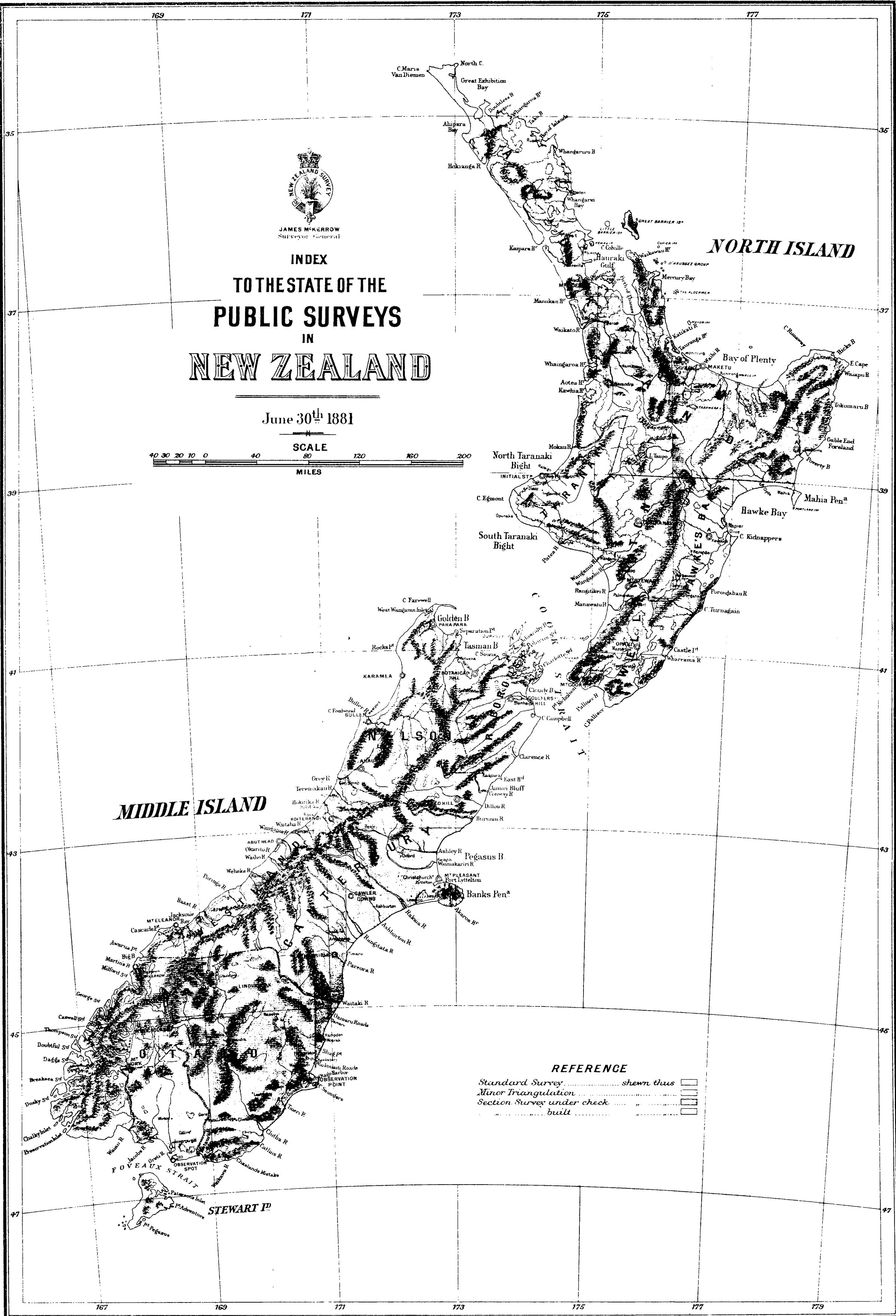
Surveyor-General.

The Hon. W. Rolleston, Minister of Lands.



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TO THE STATE OF THE  
PUBLIC SURVEYS  
IN  
NEW ZEALAND

June 30<sup>th</sup> 1881



REFERENCE  
Standard Survey ..... shewn thus [Symbol]  
Minor Triangulation ..... [Symbol]  
Section Survey under check ..... [Symbol]  
..... built [Symbol]



Districts.	Chief Surveyor.	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.		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 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.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
Head Office and General Photo-Litho. Branch	...	...	d.	...	d.	...	d.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

STATEMENT of the EXTENT and COST of TRIANGULATION executed in New Zealand up to 30th June, 1881.

District.	Standard Survey.				Minor Triangulation without Topography.	Cost per Acre.	Minor Triangulation with Topography.	Cost per Acre.
	Meridional Circuit.	Cost per Acre.	Major Triangulation.	Cost per Acre.				
	Acres.	d.	Acres.	d.	Acres.	d.	Acres.	d.
Auckland—prior to 1877 ...	...	...	8,060,287	32	125,000	25	134,400	14
"  since 1876 ...	...	...	1,838,696	3	1,943,413	11	2,477,918	89
Taranaki—prior to 1877 ...	...	...	...	...	20,000	5	...	...
"  since 1876 ...	590,000	11	...	...	211,500	153	58,000	18
Hawke's Bay—prior to 1877	...	...	1,971,120	4	37,000	1	...	...
"  since 1876...	...	...	...	...	151,848	175	600,690	97
Wellington—prior to 1877	...	...	3,958,000	75	1,970,000	15	...	...
"  since 1876 ...	211,000	19	251,040	76	52,536	137	1,580,778	143
Nelson—prior to 1877 ...	...	...	...	...	...	...	...	...
"  since 1876	4,997,120	125	...	...	231,601	105	1,240,570	205
Marlborough—prior to 1877	...	...	...	...	...	...	...	...
"  since 1876 ...	3,000,000	083	335,680	25	156,000	207	301,000	13
Westland—prior to 1877 ...	...	...	554,160	8	...	...	100,880	18
"  since 1876 ...	...	...	1,104,089	129	80,134	222	541,250	264
Canterbury—prior to 1877	...	...	...	...	2,818,800*	†	...	...
"  since 1876 ...	6,143,000	173	133,000	12	1,585,664	74	2,404,133	162
Otago—prior to 1877 ...	10,300,000	066	358,400	5	...	...	6,581,407	15
"  since 1876	...	...	...	...	20,150	19	1,353,065	12
Southland—prior to 1877 ...	2,940,000	066	...	...	...	...	1,520,000	15
"  since 1876 ...	...	...	...	...	...	...	357,660	142
Total areas	28,181,120	...	18,564,472	...	9,403,646	...	19,251,751	...

\* 1,843,700 acres of this either not reliable or stations lost.   † Not known.

ABSTRACT of the COST of the various CLASSES of WORK executed during 1880-81.

District.	Settlement Survey.	Road and other Surveys Not Classified.	Gold-Mining Surveys.	Crown Grants, Memorial of Ownership, &c.	Land Transfer Plans.	Native Land 'Purchase' Surveys and Native Land Court.
	£   s.   d.	£   s.   d.	£   s.   d.	£   s.   d.	£   s.   d.	£   s.   d.
Auckland ...	8,872 11 6	3,977 10 11	6 0 0	820 0 0	260 0 0	5,639 17 7
Taranaki ...	4,462 15 5	2,695 5 4	...	35 0 0	...	...
Hawke's Bay ...	1,588 17 2	1,072 2 1	...	120 15 0	46 0 0	...
Wellington ...	7,183 10 3	1,899 14 1	...	295 3 11	234 2 6	4,346 15 6
Nelson ...	8,298 10 2	1,062 18 6	808 12 7	32 8 0	133 4 0	...
Marlborough ...	1,992 13 9	67 4 0	...	23 10 0	27 15 0	...
Westland ...	2,284 14 4	1,810 11 8	77 12 6	15 0 6	62 0 0	...
Canterbury ...	14,616 15 2	882 6 9	...	755 19 0	832 18 4	...
Otago ...	5,885 2 7	836 18 7	239 9 4	450 0 0	320 0 0	245 0 0
Southland ...	3,283 10 4	121 19 8	60 18 0	40 0 0	335 0 0	...
Totals ...	58,469 0 8	14,426 11 7	1,192 12 5	2,587 16 5	2,250 19 10	10,231 13 1

ABSTRACT of the SURVEYORS Employed in each PROVINCIAL DISTRICT, and of the WORK ON HAND, on the 30th June, 1881.

Chief Surveyors.	Staff Surveyors.	Contract or other Surveyors.	District.	Triangulation	Settlement Survey.	Native Block and Land Purchase.	Railway, Road, and Water-races.
				Sq. Miles.	Acres.	Acres.	Miles.
S. P. Smith ...	19	2	Auckland ...	804	154,521	293,687	172 25
T. Humphries ...	9	1	Taranaki ...	94	12,600	100	...
H. Baker ...	4	7	Hawke's Bay ...	269	33,274	13,294	119
J. W. A. Marchant ...	11	2	Wellington ...	836	63,940	585	50
J. S. Browning ...	9	1	Nelson ...	...	102,027	...	...
H. G. Clark ...	2	...	Marlborough ...	300	3,060	...	...
G. Muller ...	5	...	Westland ...	160	52,788	1	19
J. H. Baker ...	12	2	Canterbury ...	204	169,058	...	...
W. Arthur ...	7	1	Otago ...	540	23,374	...	...
J. Spence ...	3	...	Southland ...	...	10,853	...	...
Totals ...	81	16	...	3,207	625,495	307,667	360 25

## APPENDIX.

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

#### AUCKLAND.

*Major Triangulation.*—An area of 412,000 acres has been covered, at the slight cost of about  $\frac{1}{4}$ d. per acre. This most useful extension was executed by Mr. L. Cussen and assistant, during last winter and early spring, over the Patetere country, by means of which another close has been obtained between the Mount Eden and Bay of Plenty circuits. The difference on the closing side being as follows:—

Mount Eden circuit side ...	...	39—31=81532·3		
Bay of Plenty circuit side...	...	39—31=81526·4	5·4	
			<u>5·4</u>	<u>10·2</u>
				= 0·53 link per mile.
Mount Eden circuit side ...	39—31=137°	24' 33"		
Bay of Plenty circuit side...	39—31=137°	24' 25"	+ convergence.	
		<u>8"</u>		

The distance between the two bases, as roughly measured through the triangles, is 240 miles. The closure therefore is another satisfactory proof of the dependence which may be placed in the major work. The heights at Station 39 differ by only 4 feet in a distance of 180 miles. This latter result is due, no doubt, to compensating errors; but a former closure between Bay of Plenty and Hawke's Bay major triangulation shows only a difference of 6 feet in a greater distance.

*Minor Triangulation.*—This work has been, in nearly all cases, derived from the major sides by the Ray trace-system. It covers an area of 496,696 acres, executed at a cost of 1·2d. per acre, being slightly less than the mean of last year, which is owing to the country covered being more open, though a large proportion has been in difficult bush country. A list of closures is furnished herewith, which will show that the work is well within the limits allowed, though in one case, from some unexplained cause, it approaches it very nearly.\*

*Topographical and Trigonometrical Survey.*—Under this head an area of 503,759 acres has been completed, at a cost of 6ld. per acre. It is found invariably to be the case in this district that this class of work is less costly than simple triangulation, the reason being that the topographical work can only be carried on (under ordinary circumstances) in the open country. The general return shows that the two last areas in this column have cost very much more than any of the others per acre, and this is due to the country being entirely forest-clad. The 282,000 acres completed by Mr. Cussen, at the slight cost of  $\frac{1}{4}$ d. per acre, is in very easy open country, and was done at the same time as the major work already referred to. In the extension of this work a closure was effected between the circuits of Bay of Plenty and Poverty Bay, with a result which, considering the circumstances, may be deemed fairly good; though probably a better will be obtained when the work is extended to eliminate a triangle in which an angle of 151° enters as a component of the closing triangle. The closure is as follows:—

Bay of Plenty circuit side ...	...	=45733·5		
Poverty Bay circuit side ...	...	=45748·4	14·9	
			<u>14·9</u>	<u>5·7 miles.</u>
Bay of Plenty circuit side ...	...	=113°	46' 30"	
Poverty Bay circuit side ...	...	=113°	44' 41"	+ convergence.
			<u>1' 49"</u>	

The distance between the bases is 130 miles. Great hardships were endured by the surveyor who did this work in the mountainous Urewera country, which is entirely forest-clad. The topographical plans of this work (excepting Mr. Cussen's) are hardly up to the standard I should like to see. This is the more to be regretted, as it is the class of work which, besides its practical use to the selector, is most likely to bring credit to the surveyor from the geographical world at large.

\* See page 23,

*Rural and Suburban.*—The return for this year shows a greatly-decreased area completed when compared with last year, viz., 30,320 acres, against 57,666 acres for 1880, and, what is of equal importance, a largely-increased cost per acre, viz., 2s. 9d., against 1s. 3d. for 1880. It is due to the gentlemen engaged on this class of work that an ample explanation should be furnished of the reason why so small an area has been made ready for settlement, and why, at the same time, the cost has been more than doubled. The reason is a very simple one, and easily understood by the profession: it is contained in the fact that nearly the whole area returned consists of small isolated sections surrounded by old surveys. Whenever this is the case the surveyor has not merely to survey the application covered by his instructions, but to go over, in addition, all the adjacent sections, to see that he does not encroach on granted land. The inefficient manner in which, as a rule, the old surveys have been marked on the ground, the inconsistencies and inaccuracies of the former system (or want of system), added to the incompleteness of the office record, all combine to produce a series of problems only soluble by the most earnest and careful application of the best professional acquirements. It is no exaggeration to say that, for every acre which the surveyor is allowed to return as surveyed, he has to survey two others to verify his position, and for which he gets no credit. It is due to the skill and care taken by the staff in these most perplexing questions that so few references have to be made to the office, or to the comparative absence of disputes as to boundaries. I cannot better illustrate the difficulties connected with these surveys than by pointing out that four of the most able and energetic officers in the district only produced something over 9,000 acres of section-surveys between them, notwithstanding that they work from twelve to fourteen hours a day, and did very little other work. It has been my unpleasant duty to refer to these old surveys, perhaps *ad nauseam*, in a strain the reverse of complimentary, but it is a duty I owe to the Government and the survey staff to do so; and I trust that I shall not thereby be thought to reflect on my predecessors as wanting in the necessary ability to carry out a more enlightened system. No one knows better than myself that they were hampered by want of means, the exigencies of an inflowing population, the Native difficulty, and physical intractability of the country; and that they, one and all, would have welcomed any change which substituted method for no method. The short-sightedness of former days (in addition to the above causes) now involves the colony in ever-increasing expense in rectifying former errors. I see no prospect of the cost of section-survey, when surrounded by old surveys, ever being less; on the contrary, it must increase. The set-off against this is, however, the fact that from time to time large blocks come in for subdivision, which reduces the mean cost on the whole considerably. This will be the case next year. This question of old surveys is a burning one in this branch of your department. The officers grumble at not being able to produce better results, whilst the outside public, utterly oblivious of the difficulties, blame the department for not attending to their individual wants as soon as they require them. The Waste Lands Board gets no small share of odium in the matter, for which they are not responsible. Whilst our best officers are engaged in works which produce so little result, it is no wonder that we are accused of retarding settlement. During the year an area of 4,772 acres has been surveyed, in order that grants might issue, at a cost of £825 17s. 2d. These have generally been old surveys, which, on examination, were found unfit for the purpose of the Land Transfer Act, or were deficient in linkages. The surveyors have generally taken them as they come up to them in the course of their work. A large amount of this work (how much is unknown) still remains to be done; but I am aware of 14,611 acres, in 122 separate sections, all of which must be resurveyed before grants can issue. Many of them will be most difficult to define, owing to the destruction by fire of the original maps. In one case a whole district of some 3,000 acres has to be granted, of which there are no plans whatever. The homestead surveys made during the year, at the cost of the applicants, amount to an area of 7,032 acres, in 37 sections. The survey of boundaries of lands sold many years ago has cost £361 11s. 7d.

*Town Section Surveys.*—A considerable area (457 acres) has been laid out in town sections, numbering 1,022, at a cost of 13s. per section. This includes part of Tauranga, part of Ngarua-wahia, part of Cambridge, Waihi Gold Field Town, Te Aroha Government and Gold Field Towns. The latter was surveyed at the request of the Warden during the Aroha rush; some sixty buildings were already erected on my last visit there. A Native town at Ohinemutu, at the Hot Lakes, has also been surveyed, and appears under this heading. Standard points (stone blocks) have been laid down in Cambridge, Ngarua-wahia, and Ohinemutu, whilst the usual iron pipes have been placed in the others.

*Native Land Court Surveys.*—The amount of work done by the staff under this heading is only 53,673 acres, whilst schedule surveyors have completed 30,276 acres, the cost of which has been advanced by Government under the Act of 1880. The two principal items which go to make up these areas are—20,850 acres, surveyed for the Tauranga District Land Court, at a cost of £565, and 3,417 acres of Native land at Ohinemutu, divided into 76 rural sections, which form part of the settlement scheme at the Hot Lakes.

The survey of the largest block, performed by one of the staff, has been paid for in land by the Native owners. The outstanding amounts due to the Government on Native blocks for survey is very large, and extend over a period of eight years. It will probably be advisable to make application to the Court to have certain defined portions of each block cut off and awarded to the Crown in lieu of payment, but on this subject I intend shortly to report to you at more length, giving full particulars. The Natives seem anxious to take advantage of the Act of 1880

to get the cost of survey advanced them, and a large number of applications are now with you for approval. The above areas do not by any means represent the total amount of land prepared for adjudication by the Court, for 319,343 acres, in 72 blocks, have been surveyed by private surveyors during the period, at the cost of the applicants. Operations under this heading will be very extensive during the next season, judging by the applications received, which cover a very large area; and it is by no means improbable that the ensuing season will see an advance into the King country, in the same manner as the last has witnessed the breaking-down of the barrier toward Rotorua, where for the first time a Native Land Court has held a successful sitting. In Poverty Bay, too, the area of large blocks for subdivision will be very considerable.

*Land Purchase Surveys.*—356,940 acres of blocks for purchase by the Crown, principally in Poverty Bay and Taupo, have been prepared for the Court, a part of the cost (£2,414) having been borne by Land Purchase votes. If to this area be added the Native Land Court surveys, made by Government and private surveyors, an area of 760,232 acres, in 226 blocks, will be found to have been prepared for the operations of the Court; whilst a considerable amount remains on hand, principally subdivisions of blocks, to excise the portions awarded to the Crown. More than half the area surveyed by the staff lies in the mountainous forest country of Urewera, involving very great hardship and privations on the surveyor so engaged, with great loss of time, owing to difficulty of getting provisions, and bad weather. The mean cost per acre, therefore, is very reasonable.

*Gold-Mining Surveys.*—Only one claim (the prospectors at Te Aroha) has been surveyed during the year.

*Roads, Railways, &c.*—Of the 185 miles of road surveyed, I am not aware of a single instance in which the limiting grade has been exceeded, which means that these lines are permanent, and will not require alteration as the country is settled. Nearly the whole quantity has been in exercise of the rights under the Native Land Court Acts. A separate report will inform you of the amount of work performed in the actual construction of roads to open up lands before settlement, the cost of which is not borne by Survey votes, though one officer of the survey staff has been engaged nearly all the season in constructing and laying down lines for immediate use, whose expenses are included in the general return. The amount of work to exercise the road-rights is enormous, and can never be overtaken by the present staff; whilst it is at the same time a matter of no small moment that the right should be so exercised at the earliest possible date.

*Detention owing to Native Opposition.*—This amounts to a sum of £155 18s. 11d., and arises through disputes as to boundaries, or the vexatious destruction of survey-marks.

*Other Work, &c.*—A detail statement under this heading is supplied. It covers miscellaneous work not returnable under the headings given, such as inspection, officers' leave, office-work, definition of old boundaries, road-inspection, reports, connections, &c.

*Inspection.*—During the year Mr. Hickson has not done much, owing to ill-health: he left the service on this account on the 30th June. Mr. Williams, who joined this branch on the 1st November, has made a number of inspections, copies of which have from time to time been forwarded to you. In four cases these resulted in the surveyors (private) having to revise their work. The amount of inspection is so great, and so very necessary, that Mr. Williams is quite unable to keep pace with it: only one of the staff officers' surveys has been inspected by him, though all of them would gladly welcome a visit, in order to prove the accuracy of their work. Mr. Barnard, at Poverty Bay, has shown his usual energy in carrying out this duty, a large number of his diagrams having been sent you. He has, in addition, supervised the construction of the road, Ormond-Opotiki, and laid out a considerable mileage of road besides. I have visited ten of the survey parties myself, but, owing to the multiplicity of duties I perform, I have no time to make a technical inspection. I have been absent from the office eighty-four days, travelling 2,800 miles on duty, exclusive of sixteen days occupied in journeying to Wellington and back. It will be apparent that the inspection duties are heavy in this district, when it is stated that there are, on an average, from twenty to thirty-five surveyors engaged on semi-official surveys, outside the members of the staff, all of whose work the Government are responsible for in one shape or another.

*Office-work.*—The returns show a considerable amount of work, which appears to be on the increase. To keep it up to anything like date has required the unremitted attention of Mr. Kensington and the indoor staff. Miscellaneous work has been performed for some eighteen other departments, exclusive of the plotting on the block sheets of a large number of roads taken under the Public Works Act, and also of conveyances to Road Boards and counties of deviations, &c. Some twenty-eight sittings of the Native Land Court have been held in various parts of the colony during the year, the plans for which have all passed through this office, orders of Court noted and communicated to other district offices; whilst not a day passes without numberless references from the Native Land Court and private individuals as to the tenure of lands, position of title, registration of liens, and other questions too numerous to mention, involving an amount of painstaking research of which it is difficult to give an adequate idea. Up to date, 660 block sheets have been got out showing more or less work on them; 148 triangulation sheets of districts complete, with all major and minor stations shown on them, of which 29 have been lithographed for the use of the surveyors; and, in addition, 113 record maps are prepared and in their places in the safe. As time and opportunity permitted, the

printing of lithographs has been continued to the number of 3,854 copies of 43 originals for the past year. We daily reap the benefit of the 80-chain lithographs, hurriedly got out last year. They have saved the Government the cost over and over again in reducing the number of tracings made, whilst they, at the same time, are largely used by the public. The proceeds of the sales of lithographs for the period amount to no less than £108 14s., which, together with fees received for search, &c., make a total of fees received by the Chief Draughtsman and the two branch officers of £124 14s. 6d. The number of plans placed on Crown grants, certificates of title direct from the Crown, and memorials and certificates of title under the Native Land Act, amount to a total of 2,914, at a cost of £820, computing the salaries at the reduced rate received by officers during the past year. The arrears under this heading are very large, and cause me a good deal of anxiety: they amount to—Crown grants and certificates, 174; titles under the Native Lands Act, 915—a number which I see no prospect of getting through during the ensuing season in addition to the current work. A commencement has been made, under instructions from yourself, to get out the four-mile sheets of the district for photo.-lithographing; only one has advanced as far as the outline, as I have had to take the draughtsman off to other and more pressing work, but I trust to continue it soon. The correspondence with surveyors, other departments, counties, Highway Boards, and the public is getting almost more than I can manage. The following figures show the number of letters and parcels received and sent for the last three months:—April: Letters received 484, sent 503; parcels received 42, sent 23. May: Letters received 546, sent 513; parcels received 70, sent 48. June: Letters received 556, sent 536; parcels received 39, sent 36. The accountant has passed through his hands during the season 1,384 vouchers, representing an expenditure of £52,762 6s. 6½d., which includes payments on roads both for opening lands before sale, and works on the Great North Road. A large amount of work has been performed by the Gisborne office staff, under Mr. Featon's charge, directed by Mr. Horace Baker, principally in checking and plotting on block-sheets the numerous Native Land Court and Land Purchase plans received. The want of a proper safe for this office is again brought under your notice; it causes both Mr. Baker and myself a good deal of anxiety, in view of the large number of original and valuable maps now in the wooden building used as a Government office.

*Work of the ensuing Season, 1881–82.*—The monthly abstract shows that the surveyors have on hand (instructions issued and work in progress)—Triangulation, 804 square miles; section-surveys, 60,521 acres; Native blocks, 53,637 acres; roads, &c., 90 miles. In addition, there is the work which will come in during the year, but for which instructions have not been issued to the surveyors: Triangulation, 1,200 square miles; section-survey, 94,000 acres; Native blocks, 24,000 acres; roads, 82 miles. If all goes well, the major triangulation will be carried down the east side of Taupo, and possibly connected there with the Wellington surveys, as the Native applications cover nearly the whole of this area. Of the section-surveys about 20,000 acres are of the same kind as the work executed last season—*id est*, surrounded by old work—but the remainder is new work, which the Land Board has requested us to prepare for sale. A large portion of this is in Poverty Bay, and both Mr. Baker and myself think it will be best, with your sanction, to let it by contract. We shall continue to resurvey lands for the issue of grants as they adjoin other surveys; and I hope some progress towards reducing the considerable area on hand may be thus worked off. The defining of boundaries of land sold many years ago I propose still to leave in abeyance, unless my instructions to that effect are cancelled. The Native block surveys will have to be done generally by schedule surveyors, as the staff cannot be spared for the purpose; whilst the roads will be continued in exercise of the rights, as opportunity occurs. There is a very large amount of this work to be done, especially in Poverty Bay. It is sincerely to be hoped that an officer can be spared part of the year to continue the city standard survey. I have made arrangements towards this end, but much fear the pressure to survey Crown lands may neutralize them. During the year three of the surveyors have resigned—two through ill health, and their places have been taken by young men educated in the department, who are doing their work well and economically.

S. PERCY SMITH,  
Chief Surveyor.

#### TARANAKI.

*Standard Surveys.*—The bringing under settlement survey of the level tract of forest country inland of Waimate necessitated the running of a standard line due west from the meridian line, to form a basis for the sectional work, as the very level nature of the country precludes the possibility of any triangulation. This has been run a distance of 19 miles, with sights varying from 40 to 60 chains, and checked at intervals by astronomical observations. It now requires only 3 miles more to reach the open land at Opunake, where a close will be made with the standard bearings brought up from Hawera. I have carried the true bearings down to Cape Egmont, which completes all the necessary standard operations in this district, west of an imaginary line from Pukearuhe to Patea.

*Triangulation.*—During the year operations of this nature have not been extensive; that completed embracing only 20,000 acres, and extending along the coast from Okato to Moutoti. There remains a gap of about 16 miles from Moutoti to Oeo, through Native land, which, as yet,



we have been prevented operating on; but I am hoping that the objection to it will soon be removed, when we shall connect the New Plymouth and Patea series, and have it continuous from Pukearuhe to south end of the district. Another portion is being triangulated in the interior, from the Kaharoa Block, on the Patea River, through the forest in a northerly direction to Ngatimaru, and will ultimately make a junction with the New Plymouth series, on the coast north of Waitara. The stations are selected and cleared over about 60,000 acres.

*Rural and Suburban Surveys.*—The area of rural and suburban completed during the year (without any arrears from last) is 58,188 acres, at a cost of 1s. 3½d. per acre, with average size sections of 76 acres. This low rate for this district is greatly due to the very favourable nature of the country; 35,000 have been in open country, costing at the rate of 1s. 3½d. per acre. This would have been considerably less had it not been for the greatly-increased work in the 16,000 acres near Parihaka consequent on necessary survey of all the numerous cultivations and reserves which had to be done in conjunction with the sectional work. The resurvey of the Waimate Plains, comprising 15,200 acres, cost £600 7s. 3d. This was a work of absolute necessity, and entailed a great deal of labour. Through the rapid growth of fern, flax, and toitoi none of these lines was discernible, and the pegs had been destroyed in great numbers by the Natives, who, I may say, were ably assisted by the pigs. In one block of 5,000 acres two-thirds of the section—the same proportion of those on the roads; and on a road of 2 miles in length every trace of pegs were gone, and the survey was obliterated. On account of the wide-spread destruction of marks, including all the trig. stations, with two exceptions the whole survey had to be reproduced.

*West Coast Commission.*—Services to the extent of £1,747 10s. have been rendered by the department. Messrs. H. M. Skeet and W. H. Skinner, staff surveyors, and Mr. H. L. Skeet, authorized surveyor, temporarily engaged, were employed on this particular work up to February, at which time the conduct of the surveys was taken over by the Commission itself; the amount expended by the department at that period being £1,536 10s. The work performed by them was principally the boundaries of the 25,000-acre continuous reserve, other reserves within and roads through it, besides numerous small reserves in the open land. A further charge of £211 is for subsequent service in the Parihaka Block. The department having performed all the required surveys in connection with the Native cultivations and reserves in that locality, which, as I have before stated, has considerably increased the rate per acre of the sectional work there.

*Inspection.*—During the year nineteen inspections have been made by myself, and two by Mr. Bird. The field checks forwarded to you testify to the very superior manner in which the work has been done by the field staff: the closes in no instance exceed 2 links per mile, the majority far below, nor the instrumental work more than 1½ minutes at the close of circuit in the forest. Common points on adjoining surveys, executed by different members of the staff, which are numerous, show equally good results, which is, no doubt, the best of tests, and show uniformity in the measurements. In attaining this accuracy the progress of the work has not been hindered, for, as will be seen by the returns, there have been executed during the year larger areas, and at lower rates, than any previous one; favourable circumstances, such as a large portion of the area being in open, and the remainder in level forest country, having had much to do with it.

*Office.*—With our comparatively small office staff, in the early part of the year the arrears of work were increasing rapidly, but, by the addition of Messrs. Caldwell and Rogers, we have been able to keep pace with the current work, although, as yet, we have not succeeded in reducing the arrears. Thirty-nine copies of working sheets have been made and sent to the District Office at Patea, and there is yet a large number to be done before the set is complete of the lands south of Stratford; 129 Crown grants, comprising 1,064 acres, have been prepared, including a number for the West Coast Native Commission; 66 Land Transfer maps have been examined and passed; and 529 plans placed on certificates. The work for the ensuing year will be the completion of the triangulation now being undertaken by Mr. H. M. Skeet, previously referred to, and the sectional survey of the remainder of the forest country inland of the Waimate Plains.

THOS. HUMPHRIES,  
Chief Surveyor.

#### HAWKE'S BAY.

*Minor Triangulation.*—The calls upon the staff for road- and section-surveys have not allowed of the extension of trigonometrical surveys, the operations for the year having been confined to small triangulations, to meet the immediate requirements in various districts where the surveyors were engaged. The area completed is 137,479 acres, at an average cost for triangulation, including topographical survey, of 1d. per acre; and for triangulation alone of 0·6d. per acre.

*Section-surveys.*—Thirty-eight applications, and two education reserves, containing 33,458 acres, have been surveyed, at a cost of 8d. per acre. The area of arrear surveys has been reduced to 9,341 acres, the surveys of which have been finished in the field but are not yet mapped.

*Native Land Court Surveys.*—The surveys under this head have come to a standstill for the reason that the different claimants often cannot agree about the surveys; either one side or the other is not ready to survey, or is jealous of its opponent. An illustration of the difficulty attendant on the survey of Native lands occurs within 10 miles of Napier. The claimants to several blocks covering an area of at least 12,000 acres have applied to the Court to investigate their claims; they ask and are ready to employ their own surveyor—so far all is plain; but now comes the stoppage: another set of claimants to the same land are not ready to survey, and threaten violence to any surveyor who may go on the ground. It would seem contrary to the intention of the Act that one party should be able to prevent their opponents from bringing the cases on for hearing by the Court. There appears but one way to settle the matter, and that is for the department to step in and make a sketch survey of the land in dispute. A topographical sketch plan showing the various claims and boundaries would be quite sufficient for the purposes of the Native Land Court. The survey of the blocks could then be proceeded with after the Court has investigated the titles to the different claims.

*Roads.*—During the year 123 miles have been laid out in exercise of the rights of road through Crown-granted and Native blocks. Out of the mileage surveyed, over 90 miles have been inspected by me on the ground, and I can safely say that practicable lines have been secured.

*Land Transfer Surveys.*—Under Mr. Dennan, the examining draughtsman, 58 plans, representing an area of 30,971 acres, in 736 allotments, have been checked, recorded, and passed on to the District Land Registrar.

*Proposed Operations, 1881–82.*—Minor triangulation: Mr Hallett will proceed with the extension of the triangulation over an area of 240 square miles in the Districts of Te Mata, Maraekakahu, Waipukurau, and Oero; at the same time bench-marks for the use of Land Transfer surveyors will be laid down in the rural Townships of Hastings, Havelock, Clive, Waipawa, and other inland settlements. Section surveys: The area on hand for survey is 23,659 acres, of which 9,150 acres are in a forward state, leaving 14,509 acres to be provided for. There is a probability that, on the completion of the Government purchases in the Seventy-Mile Bush, the Waste Lands Board may decide to cut up for settlement from 5,000 to 8,000 acres, which will bring the estimate of work required up to 20,000 acres. Roads: The immediate requirements under this heading are 120 miles: two Assistant-Surveyors will be engaged on these surveys during the year. Before concluding the annual report, I desire to call your attention to the satisfactory manner, both as regards quantity and price, in which Assistant-Surveyor, Mr. W. Hallett, has executed the triangulation section- and road-surveys intrusted to him during the past three years.

HORACE BAKER,  
Chief Surveyor.

#### WELLINGTON.

The following is a summary of the work executed:—Major triangulation: Area, 60,000 acres; cost, £125; character of country, mostly under forest. Minor triangulation: Area, 9,536 acres; cost, £31 18s.; character of country, nearly all under forest. Minor triangulation and topographical: Area, 478,038; cost, £3,022 8s.; character of country, mostly under forest. Sectional surveys: Area, 60,178 acres; cost, £4,115 15s.; character of country, mostly under forest. Town surveys: Area, 2 acres; cost, £13 9s. Native Land Court: Area, 10,109 acres; cost, £346 2s.; character of country, mostly under forest. Native Land Court for Land Purchase Department: Area, 353,797 acres; cost, £3,848 1s.; character of country, mostly under forest. Road surveys: Area, 110 $\frac{1}{4}$  miles; cost, £1,089 15s.; character of country, about half through forest. In addition there are miscellaneous surveys, besides the works carried out under the Public Works, Land Transfer, and Native Lands Acts, the cost of which was not defrayed out of the Survey vote. The area defined under the latter Act in this way was 61,440 acres, and is represented by twenty-two plans.

*Triangulation.*—The officers, Messrs. Dundas, Llewellyn Smith, Northcroft, and John Annabell, who completed the greater part of the triangulation, did so in an able, energetic, and economical manner.

*Sectional Surveys.*—In reference to the sectional surveys, I have to state their definition involved the location of road-lines in difficult forest country, and, with two exceptions, I have the satisfaction of knowing that the duty was intelligently attended to. Messrs. Dundas and Tone appear to me to have bestowed most foresight and care in the selection of routes. The arrears of survey under this head have been considerably reduced, and I hope in a few month's time to be in a position to report that there are no cases where the Crown grants cannot issue owing to incomplete surveys of areas purchased many years ago.

*Township and Standard Surveys.*—No new townships were laid off in this district, but standard points of reference, both for bearings and distances, were or are in course of being established in the Towns of Wellington, Wanganui, Masterton, Marton, and Bull's.

*Native Land Court and Land Purchase Surveys.*—The surveys for the Native Land Court and Land Purchase Department have been executed in a reliable and permanent manner. The progress of the triangulation under Messrs. Llewellyn Smith and J. D. Climie has enabled this

office to furnish to the Native Land Court maps of several blocks in which the Government are interested, and of which the titles were incomplete. The cost of survey in these cases could not be ascertained, as the work of many surveyors in former years had to be utilized, so the amount of the lien is given instead in the general return.

*Roads.*—Notwithstanding that three of the field officers were detached from my staff for duty in the Taranaki District during several months, every attention has been given to the laying-off and legalizing of roads through Crown-granted property. Warrants have been procured for various surveyors in conformity with powers conferred by “The Crown Grants Act, 1866,” and the Native Lands Acts, and they are acting in conjunction with the County Councils, in some localities, in carrying on the surveys before the grants mature. There are few more important questions than this, and I would urge that increased effort be made to assist the counties and Highway Boards to remedy, as far as is possible, the effects of neglect in the past to lay off roads through lands alienated by the Crown. County Councils and local Boards evidently cannot afford to compensate owners of property through whose lands roads have to be forced after the Crown grants have matured; and it must be borne in mind that the warrants only operate in cases where landholders purchased under the original regulations, and obtained from 3 to 5 per cent. by way of provision for future roads. Prompt action is the more necessary at the present time as the arrears of Crown grants have, the Commissioner of Crown Lands informs me, been materially reduced, and in all parts of the country the time is lapsing from day to day, precluding the right of laying-off roads without compensation. Delay is also objectionable to the landholders, who are precluded from fencing and planting, in some cases, owing to uncertainty as to the direction and location of proposed roads.

*Topographical Surveys.*—Forest conservation, which is being dealt with by the Survey Department, and which I have already made the subject of a special report, appeared to necessitate the co-operation of the field officers; hence advantage is being taken of their thorough knowledge of the climate and country in this part of the colony to obtain their views and suggestions on this interesting question, so as to effect a rough preliminary classification of the forests; and this will also lead to the preparation of a good topographical map of this provincial district.

*Office-work.*—Mr. James Mackenzie, the Chief Draughtsman, has carried on the office-work in a careful and methodical manner, under such necessary safeguards as tend to reduce chances of error to a minimum. The Crown grant and Land Transfer record maps have been brought forward, and the remainder of the arrears of Crown grants, so far as this office is concerned, have been almost overtaken, and generally the business is conducted without difficulty now that the New Zealand system of surveys has been effectually introduced and acted up to in all respects; indeed, it is found that, though the press of work has been incessant, the majority of the staff and authorized surveyors are now so well acquainted with the rules and requirements of the Survey Department, and are so ready to comply with our requisitions, that the examination of plans, &c., becomes easier and more expeditious. In connection with this subject, I have to record my appreciation of the uniform courtesy and attention which I have experienced from all quarters. Now that the field inspection has devolved upon me, it has the advantage of bringing me in contact with almost every member of the profession employed in the district, and, of course, facilitates the settlement and clearing-up of difficulties which constantly arise in connection with defective prior surveys.

J. W. A. MARCHANT,  
Chief Surveyor.

## NELSON.

*Minor Triangulation.*—During the year it has been found necessary to extend the triangulation over some of the roughest part of the district, in order to command scattered mining and sectional surveys.

The area triangulated covers 1,211 square miles, at an average cost of 1·27d. per acre. Of this, 89,082 acres were revision, at a cost of 0·33d. per acre, by Mr. F. Smith, who also executed 140,270 acres in the Grey District, connecting with Westland and the Buller circuit. This work has been carried over exceedingly rough country on the Paparoa Ranges of the western seaboard. Mr. J. Snodgrass has done 142,500 acres, extending from Westport to Mount Newton Geodesical Station on the Upper Buller, for the purpose of connecting the scattered surveys in that part. Both these officers deserve credit for the perseverance they have shown in carrying their work, under great disadvantages, over some of the roughest portions of the Nelson District, the stations being often in bush or lying at altitudes of from 3,000 to 5,000 feet, and the work continually delayed by thick weather. Mr. Montgomerie has triangulated 65,657 acres in the Inangahua District, connecting the Grey and Buller circuits by way of the Grey Valley. Mr. H. Ellison has completed his contract, amounting to 179,794 acres, connecting the Nelson and Amuri circuits through the Wairau Gorge, over a very rough country, but free from bush. The position of boundary-line between Nelson and Marlborough, from Tophouse to Barefells Pass, has been determined by this work. Mr. T. Sadd has done 11,480 acres in the Maungatapu District, connecting Nelson and Marlborough triangulation; also 115,368 acres from St. Arnaud to Mount Newton, in the Upper Buller Valley, thus effecting a connection between the east and west coasts of the Nelson District. One of the results of this last work has been to show that

discrepancies exist in some of the geographical values hitherto assigned to important maritime positions on the West Coast, on which I have previously reported. Mr. C. Lewis has done 13,350 acres in the Collingwood District in connection with sectional surveys. The following tabulation shows the closing errors:—

Survey District.	Lines.	Survey by	Survey by	Difference.	Error per Mile.
Cobden ... ..	B-SP	F. Smith— 52,722·8	Westland Trig.— 52,717·0	5·8	0·9
Mawheranui ... ..	B-F	44,207·7	44,203·6	4·1	0·7
Brighton ... ..	Q-Y	34,888·5	H. Hiller— 34,883·0	5·5	1·26
Mawheraiti ... ..	GL-I	65,356·5	J. Montgomerie— 65,355·6	0·9	0·1
	ST-J	55,789·9	55,784·3	4·4	0·6
Tutaki ... ..	N-LL	J. Snodgrass— 63,811·2	T. Sadd— 63,815·3	4·1	0·5
Inangahua ... ..	R-H	45,438·0	J. Montgomerie— 45,441·0	3·0	0·5
Ngakawau ... ..	D-E	36,397·6	H. Hiller— 36,392·7	4·9	1·07
Kawatiri ... ..	I-D	22,980·8	22,977·6	3·2	1·11
	C-D	36,221·7	36,217·3	4·4	1·0
Alma ... ..	A-B	H. Ellison— 19,463·6	Measured— 19,469·5	5·9	2·4
	T-D	33,981·7	33,990·5	8·8	2·4
Howard ... ..	...	T. Sadd— 15,987·4	Measured— 15,985·6	1·8	0·9
Mangatapu ... ..	KH-P	27,313·2	Marlborough— 27,302·2	11·0	3·1

Mean error per mile of the above = 0·36 links.

*Sectional Surveys.*—Of these, 395 sections have been surveyed, amounting to 31,349 acres, at a cost of 2s. 8½d. per acre. The average size of the sections is 79 acres, the smallness of which, with the scattered positions in bush and adjoining old magnetic surveys requiring revision, have tended to increase the cost. Four officers have been chiefly engaged in extending necessary triangulation and keeping up current mining-work also, so that less sectional work is returned by them during the year. During last year surveys made in the Amuri District, where the cost was small, tended to reduce the average cost of work in the district to a much lower figure. This year I have not been able to place an officer in that part.

*Mining Surveys.*—Under this head 1,017 acres have been laid off, consisting of 87 sections, at a cost of 15s. 10d. per acre. Fees have been paid on these to the amount of £670 14s. 6d. These surveys are always very expensive, being without exception in the roughest parts of the district, in scattered localities, and much loss of time is involved in travelling distances from 40 to 60 miles, many localities being only accessible by foot- or pack-tracks through heavy bush.

*Arrears of Survey.*—The arrears on the 1st July, 1880, amounted to 114,024 acres, and on the 30th June, 1881, to 102,353, in 611 applications: 395 sections have been surveyed during the year, and, if the new applications alone had to be dealt with, the arrears could soon be overtaken and kept in hand. In most cases they adjoin the old defective surveys, which must be revised in order to prevent encroaching with the new, thus necessitating constantly three or four times an amount of work other than the application to be laid off. The sections held under lease are on the old magnetic survey, and are constantly being made freehold by purchase: these must be revised before a certificate of title can be issued, so that the most economical plan of working has been found to be that of revising all the old leasehold sections that are in the locality of new applications when the surveyor is once on the ground; and it will take some years of patient work to get these surveys into order. I propose placing Mr. F. Smith and another surveyor, if obtainable, in the Amuri District, to work off arrears amounting to 48,000 acres, which should be completed next season, the high altitude of the country not admitting work during the winter. More assistance is much required in the Nelson District to take in hand the surveys required in the bays and inlets of the sea-coast, which are only accessible by water. Assistance is also required for the surveys in the valley of the Upper Buller and on the tributaries of that river. During the year two visits have been made to the West Coast districts, including inspection of four offices, two check bases of triangulation measured, and various surveys of staff and contract surveyors inspected and checked.

*Office-work.*—During the year we have lost the services by death of Mr. W. G. Sealey, draughtsman, and several of the surveyors have been ill owing to continuous work in the wet bush of the West Coast districts. Mr. F. Bryne was engaged temporarily as assistant-draughtsman, but his services terminated on the 31st May. During the year 68 Crown grants and 263 leases and licenses have been prepared; 14 new Crown-grant record maps have been compiled or constructed; 14 district and 42 block plans have been prepared, and sectional work laid down on the latter. A large amount of extra work has been done by the draughtsmen for the Crown Lands and other departments in supplying necessary information and tracings.

*Land Transfer Work.*—During the year 107 plans have been examined and passed, 298 plans placed on certificates of title. Standard surveys are required in the Townships of West-

port and Reefton to control the Land Transfer surveys, which I hope to be able to put in hand this year.

Survey fees, &c., received during the year, £933 18s.

JOHN S. BROWNING,  
Chief Surveyor.

### MARLBOROUGH.

*Triangulation.*—My report for last year shows Mr. Wilson engaged on major and minor triangulation over the lower part of the Wairau Plain, the Waitohi Valley, Queen Charlotte Sound, and Port Underwood: the completion of that work I am now pleased to report. The above triangulations, commenced on the 8th October, 1879, and finished on the 31st March, 1881, comprise 335,680 acres of major, including 111,445 acres embraced by the connecting triangles over Cook Strait with Mana Lighthouse and Trig. Kaukau, in the Wellington District, and 224,000 acres of minor triangulation, with topography, and covering the greater part of Arapawa and parts of Cloudy Bay, Linkwater, and Gore Survey Districts, and were completed at a cost of  $\frac{1}{4}$ d. per acre for the major and  $1\frac{1}{4}$ d. per acre for the minor. About two-thirds of the work was carried over mountainous forest country, the remainder being partly open and partly covered with scrub. Mr. Goulter's triangulation of the Pelorus Sound, in progress at that date, has also been completed during the year. This triangulation, commenced the 1st January, 1880, and completed the 30th November, 1880, at a cost of  $1\frac{1}{2}$ d. per acre, comprises 77,000 acres of minor triangulation, with topography, carried over portions of the Orieri, Arapawa, Linkwater, and Tennyson Survey Districts. The country covered by this triangulation is heavily timbered over the greater part, and, with the object of making the stations easy of access to the section surveyor (most of the section surveys required being on the coast-line), they have been kept as close to the coast as possible: the triangles are therefore of necessity small, averaging 1- to 2-mile sides. The side of a triangle in the Wakamarina District was used as a base, and to suit the peculiar configuration of the Sounds a chain of triangles was carried from the mouth of Kenepuru Sound down the Main Sound to Tawero Point, and back again through Crail Bay, closing as follows:—

Kauauroa	..	..	Ref. Geo. =	20,050·8
				20,050·6

Difference  $\cdot 2 = \cdot 08$  per mile.

A branch series was carried up Kenepuru Sound, closing on Mr. Wilson's Queen Charlotte Sound triangulation to a mean of 2·3 per mile. The meridional distances, however, of Onahau, Takorika, as determined by major triangulation, show—

				North.	West.
Major triangulation	..	..	..	33,012·8	80,756·0
				33,013·2	80,755·4
				·4	·6

The greatest difference in closing of the chain of triangles being 1·1, the least 0·8, or an average of ·38 link per mile.

*Section-survey.*—There is under this heading 3,890 acres of rural-section-survey, in 38 sections, executed during the year, 15 sections (1,655 acres) of which may be classed as revision surveys. Twelve of the above sections (1,122 acres) were surveyed on application, either to go to auction sale or for selection under the deferred-payment system; and the balance, 11 sections (1,113 acres), were, at your desire, surveyed for the Nelson office: these latter, situate in Port Ligar and adjacent bays, were, I understand, applications of very long standing. Field-plots of the Nelson surveys, diagrams of subsidiary triangles, and part of the Orieri Survey District triangulation, together with co-ordinates of Kaituamauma and Kauauroa Ref., and other data sufficient for the Nelson office to utilize the triangulations in this district in calculating the position of the respective survey districts and block-lines to which these surveys belong, were furnished to Mr. Browning in May last. The above surveys are scattered about in various bays of the Sounds, and the revision surveys were done at the same time; advantage being taken to revise and connect with the trig. points the old surveys in the vicinity of the work. By adopting this course I shall gradually, as the work proceeds, re-establish and revise all the isolated and erratic surveys in the districts now under control of triangulation, plot them on their respective working block-sheets, and prepare Crown-grant and Land Transfer record maps thereof. In this class of survey many obstacles present themselves. In the Sounds much time is lost through detention of boats by adverse winds and bad weather, days sometimes being lost from this cause alone; chaining in some cases can only be accomplished at low water; shifting camp for nearly every block requiring survey; in others the bush has been worked for saw-mill purposes, involving extra time and labour in opening up lines through fallen tree-tops and entangled undergrowth encumbering the ground. These, and searching for and re-establishing the boundaries of adjoining surveys, and the limited extent of the land to be laid off, greatly add to the cost of this descrip-

tion of survey, and the comparative results of the season's work appear unfavourable to the surveyor compared with other work on a large scale and under more advantageous conditions. To reduce therefore the expense of cutting side lines and back angle-pegs of sections on steep hill-sides fronting the sea and no available land at the back, the side lines have only been partly cut with direction-pegs; the back pegs in those cases may not be required for many years.

*Crown Grant and Land Transfer Work.*—Under this head 8 deposited survey plans, containing 91 subdivisions, have been examined and passed; plans placed on certificates of title, 79 (in duplicate); Crown grants, 4 (4 copies of each); certificates of title in lieu of Crown grants, 56 (in triplicate), representing 342 marginal plans. This completes the grants of alienated lands in the district to August, 1879. The above surveys were made by authorized surveyors duly licensed, and the same degree of accuracy in the field and neatness in draughting is insisted on as is the practice in work executed by the staff. The defective state and paucity of information in the few existing field-books compel the department to ask for resurvey, in many cases, of lands applied for to be brought under the Act: the Government being responsible for the correctness of the title, this cannot be dispensed with. When once, however, a correct survey has been made, the resurvey of subsequent subdivisions is, I am of opinion, not required, provided sufficient information is afforded by the resurvey to accurately compute the interior subdivisions in area, in angular, and in linear measurements.

*Office-work.*—Exhibition maps of the provincial district have been completed and placed in show-cases in the public Survey Office. These maps, three in number, drawn to a scale of 1 mile to 1 inch, show all surveyed, leased, and licensed lands, reserves, and lands open for selection throughout the district. The four remaining survey districts were prepared, and tracings made and forwarded to be lithographed, and 17 proof lithos. revised. There are now (including those received last year) 8,940 lithos. on sale at this office: these, with the exception of the District of Gore, complete this district. Proof lithos. of Mr. A. D. Wilson's Wairau, Pelorus, and Kaituna major and minor triangulation sheets (traced last year) have been revised and printed; copies of the major triangulations, and of Wakamarina and Heringa Districts, have been supplied to, and are on sale at, this office. Tracings of Mr. A. D. Wilson's Wairau and Queen Charlotte Sound and Mr. R. F. Goulter's Pelorus Sound triangulation maps are now being proceeded with, to be forwarded to head office for photo-lithography when completed. Major, minor, and topographical maps: Maps partly drawn by Mr. A. D. Wilson of major triangulations, and parts of the Districts of Arapawa, Cloudy Bay, Linkwater, and Gore, have been completed by the office, together with working plans of surveys done for Nelson office. Block plans: Nine of these have been constructed, and the various surveys plotted thereon to a scale of 10 chains to 1 inch. These being complete working plans in themselves will almost entirely do away with the necessity for using the original plots, which can thus be kept in a state of preservation. Surveyors' plans: Sixteen of these have been received during the past year, and have been duly examined and recorded. In addition to the above, the office staff has been employed in the preparation of maps and plans for census, property-tax, postal, and marine purposes, certificates of title, examining deposited plans and diagrams on applications for the Land Transfer Department, pastoral leases and licenses, deferred-payment and mineral licenses, tracings for field surveyors, and attending to the requirements of the Crown Lands Office and the general public.

*Summary, and Proposed Operations.*—Reviewing the work of the year, it will be seen that 335,680 acres of major, at  $\frac{1}{4}$ d. per acre, and 301,000 acres of minor triangulation, principally over rough forest country, together with trigonometrical and topographical maps, at an average of 1.3d. per acre, and 3,890 acres of section-survey, at an average cost of 1s. 7 $\frac{1}{4}$ d. per acre, have been completed; these surveys, owing to the rough and wooded nature of country, involving much laborious bush-cutting. During the current year triangulation will be pushed forward by Mr. Wilson over the lower portion of the Wairau Plain, and the open country extending along the East Coast to the Ure River, and the lower part of the Awatere Valley. It will be necessary to extend this work southwards to the settled districts at the Kaikoura Peninsula. Trigonometrically-fixed points for Land Transfer and other purposes are much required in that district, and a suitable base of verification for the whole series of triangles from Wairau to this point could be selected and measured. Of the arrears of survey, amounting to 3,060 acres, part is now in progress, and the balance will be in hand shortly. When not hindered by more pressing work, I contemplate preparing the Crown-grant record maps of townships in the district, with copies of same for Land Transfer Office record. The compilation of the rural and pastoral lands must be delayed until triangulation is more advanced; the building-up of some 700 detached surveys to a scale of 20 chains to 1 inch, based in most cases on independent magnetic meridian, and no fixed points to control them, becomes almost impossible. The errors of position in one survey has its influence on succeeding ones, increasing with the number of plans to be dealt with, and, although tolerably accurate individually, become unmanageable when attempted to be compiled in large areas. The preparation of these maps must, for the present, be confined to those districts already triangulated, and sufficient ties made thereto, either in progress of section and Land Transfer surveys, or specially made for that purpose.

HENRY G. CLARK,  
Chief Surveyor,

## CANTERBURY.

Notwithstanding the material reduction in the number of the field officers, of whom six have either resigned or left the service in consequence of the recent retrenchment, a very satisfactory amount of work is shown to have been done.

*Minor Triangulation.*—Mr. C. W. Adams has completed 101,254 acres between the Fighting Hill Survey District and the head-waters of the southern branch of the Rakaia River, thus connecting with the base of verification in the Rakaia Valley, selected and chained by the Chief Surveyor of Westland, in order to check the triangulation extended across the main snowy range by his District Surveyor, Mr. Roberts, and, consequently, making a complete network from the West to the East Coast. Mr. Adams also extended his triangulation to connect with that of Mr. Connell, at Lake Heron, thus completing the circuit of the standard-bearings he had previously observed in the Gawler District.

Mr. Brodrick has done 44,062 acres with topography, and 61,038 acres without, in the Mount Thomas and Grey Survey Districts, and 37,440 with topography in the Makarora Valley, from the head of Lake Wanaka to Haast Pass. The work last mentioned was exceptionally arduous, all the stations but three being about 5,000 feet above sea-level.

Mr. Maitland completed the topography of 87,200 acres which he had previously triangulated; and it is a matter for sincere regret that this energetic young officer had, owing to illness, to obtain a lengthened leave of absence.

Mr. Welch has finished 45,741 acres, thus finishing the Peninsula triangulation, a work for which he deserves great credit, owing to the systematic manner in which it was done, carried, as it was, over a very rough and difficult piece of country, necessitating extensive clearings on many of the hills. In future, therefore, it will be an easy matter for surveyors, both staff and public, to get reliable starting-points in a country in which it had been deemed impracticable to make correct surveys under the previous system.

The total triangulation completed for the year is, therefore, nearly 300,000 acres, and the closures obtained, although not quite so satisfactory as those of the preceding twelve months, are yet considerably within the limit of allowed error, viz.:—

Survey District.	Lines.	Surveyor.	Surveyor.	Difference, in links.	Error per Mile, in links.	Mean.
Grey ... .. {	D-O	J. A. Connell—	T. N. Brodrick—	5·3	1·50	} 1·06
	O-N	28,328·7	28,334·0	2·8	1·01	
	N-B	22,091·7	22,094·5	2·4	0·66	
Mount Thomas ... .. {		T. Maben—	C. W. Adams—			} 1·10
	A-B	21,068·7	21,064·4	4·3	1·63	
	B-C	28,390·4	28,388·4	2·0	0·56	
Fighting Hill ... .. {		J. A. Connell—	C. W. Adams—			} 2·05
Heron ... .. {	N-M	24,326·5	24,320·3	6·2	2·05	

Mean error of above six chainages, 1·235 links per mile.

*Sectional Surveys.*—Considerable progress has been made, not only in putting applicants in possession of their boundaries, but also in revising the old Canterbury surveys, which, as they could not be plotted, delayed the issue of the Crown grants; and it may be noted that, owing to the trouble of re-establishing the original survey-marks, these revisions absorb as much or more time than the new work. I trust, however, that by the end of next year I shall have finished all the old work requiring this process, with the exception of the Peninsula, which will take a considerable time to complete.

During the year have been sent in—

	1,498 sections	=	114,345 acres of new work.
	496 „	=	47,808 „ revisions.
Total ..	1,994 „	=	162,153 „
of which	1,455 „	=	109,327 „ were done by the staff.
	539 „	=	58,286 „ „ contract.
Total ..	1,994 „	=	162,153 „

Of the staff surveys, 36,555 acres were on the Peninsula, entailing heavy bush-cutting, and the remainder—with the exception of 20,107 acres of Mr. White's revision of the Messrs. Sealey Brothers' Provincial Government contract, and 4,950 acres of Mr. Pickett's revision of Contract 23—was very scattered, necessitating continued shiftings of camp, and, as a sequence, considerable loss of time and increased cost per acre. The average size of the sections was but 80 acres.

*Inspection.*—Both the staff and contractor's work have been inspected by Mr. Kitson, whose reports and diagrams have been duly forwarded to you.



*Mapping.*—Within the twelve months the staff and contract surveyors have sent in 126 large and 161 small plans, some of which are already checked and ready for the issue of the certificates of title; 43 block-sheets have been made in the Christchurch office, and 23 in the Timaru office, and additional work has been shown on those previously reported as constructed. The plans checked by Mr. Shanks are entered on the Crown-grant record maps from time to time. Two new district maps and one town record map have been compiled, and the bulk of the work recorded on the sixty Crown-grant record maps already constructed. The current work is well in hand, and the arrears are being steadily overtaken. In the reduction office 10 new district maps have been compiled, 8 traced for lithographing, and 20 traced on linen, coloured, mounted, and sent into the public room for the guidance of selectors and for general reference. Two county maps have been made and traced for the head office, and two county maps were also traced and mounted for the public room in Christchurch. By the end of the current year I trust to have all the county maps so far completed that a new general map of the whole provincial district can be issued, showing all surveys to date.

Of the triangulation, 8 new district plans have been compiled and tracings made for the lithographer, and of this item of the work I hope to have by the end of the year all arrears completed, and the whole issued for the use of public and private surveyors, so that all surveys may be readily fixed to reliable starting-points.

Nine hundred and fourteen Crown grants were prepared under the old system and 213 certificates of title under the new, giving an aggregate of 1,605 sections, containing 188,949 acres. Some little trouble has been experienced in inaugurating the new method of issuing certificates of title in lieu of grants, owing to the delay in passing schedules through the various offices concerned before they reach this department; but after a little time has elapsed the system, which has many advantages over the one it replaces, will be found to work more smoothly, and I anticipate little difficulty in getting the plans placed on the certificates. I think that in two years the greater part of the arrears that have been accumulating for the last ten years can be worked off.

*Land Transfer Surveys.*—In the Christchurch District Mr. C. W. Adams has sent in plans showing 14 miles 19 chains of standard traverse survey and 39 stone points fixed, but, of this, some 3 miles had been done during the season of 1879-80, though it was not credited to that year, as the completed plans had not been sent in. Mr. Adams was engaged for the first three months of the year in this survey, and he has evidently devoted a great deal of time to the preliminary ranging of the lines. The work is done with his usual commendable accuracy; he has also put in 17 survey stones and has ranged 14 miles of roads. Mr. Maitland was engaged three and a half months also on standard traverse, during which time he completed 27 miles and fixed 78 stone points between Papanui and Rangiora, including the Borough of Kaiapoi, which has stones placed at the corners of the principal streets. Both Mr. Adams's and Mr. Maitland's work show most excellent results, the different circuits closing with an average error of 1 link in  $4\frac{3}{4}$  miles, the greatest error being but 1 link in  $2\frac{1}{2}$  miles.

These permanent stone blocks, where the triangulation cannot now be used, will greatly facilitate the checking of Land Transfer surveys, enable the licensed surveyors to base their work on the true meridian of the district in which the surveys are situate, and give reliable points from which these surveys can be re-established in the event of the original marks being destroyed or lost.

Mr. Monro, the officer in charge of this branch of the Survey Office in Christchurch, reports that the following work has been done during the year:—

Plans received and checked, 103, containing 2,833 allotments; Public Works plans received and checked, 13; transfers, 2,870, of which 1,503 required to be checked; number of applications received and checked, 248; number of mortgages received, 2,223, of which 65 required checking; number of leases received, 133, of which 38 required checking; certificates of title issued, 1,716.

The above shows that the general depression in business has but slightly affected the number of transactions recorded in this office compared with the previous year, and with a return of prosperity may be expected a large increase in the work to be done under this heading.

Mr. Monro, in his report, states that "most of the surveys made in Christchurch and its suburbs, in Lyttelton, and in Kaiapoi (since extension northwards of standard survey), have been made to meridian of standard survey, and connected to permanent marks of that survey: this will enable the position of boundaries of properties to be re-established in a conclusive manner in the event of boundary marks becoming obliterated or destroyed. In the case of Timaru a standard survey of the borough and suburbs is much required to produce uniformity in frontage lines and in meridian of surveys. From the absence of uniformity in these particulars, and from the position of section-corners being differently assumed by different surveyors, dimensions on survey plans frequently appear to conflict when there is no actual overlap in boundaries claimed. Surveys of country land have been made for the most part to circuit meridian, and connected with triangulation; but it has been occasionally necessary to refer back plans owing to non-compliance in this respect with the survey regulations."

*Arrears and Proposed Operations, 1881-82.*—I am glad to report that, notwithstanding the reduction of the staff, the arrears of work are now brought within manageable limits, and during the ensuing season I hope to get a great portion of these done.

The arrears proper on the 30th June last consisted of 2,429 sections, containing 169,058



acres, that have to be pegged on the ground to enable purchasers to get their boundaries for fencing purposes; but, in addition to these, there are 531 sections, equal to 34,627 acres, surveyed under the auspices of the late Provincial Government, and which from various causes have still to be plotted, and probably a great portion revised in the field; and there are in the Timaru District 30 sections, containing 4,155 acres, that have been returned by Mr. Wright as requiring revision. The preceding work must be done before certificates of title can be issued.

I also estimate that there are on the Peninsula about 75,000 acres of old surveys that, sooner or later, will require revision to make the holdings agree with the titles; and, of the new work remaining to be done there, I hope to get a great portion completed this year, and I shall then be better able to report on the extent and nature of the revisions that I foresee will have to be undertaken. In the rest of the Canterbury District I think the old surveys will not require revision, except such as will take place from time to time as new surveys are put in hand, *i.e.*, the subdivision of land under the Land Transfer Act.

During the current year I purpose extending the minor triangulation into the back Waimakariri country, where there is some sectional work to be done, which, in the absence of the triangulation, cannot yet be undertaken. I also purpose surveying the sections purchased in the Mackenzie country, over which the triangulation was carried last season, and to survey other sectional work in various parts of the provincial district. The unsurveyed portion of Waimate Township will be subdivided into sections, and several reserves which it is in contemplation to subdivide into small allotments under the Village Settlement Act will also be surveyed.

*Retrospective.*—The following is a summary of the work done during the four and a half years I have been in charge of the Canterbury branch:—

				Acres.	Acres.
Area over which standard-bearings have been established				..	4,967,000
Minor triangulation, with topography	..	..	..	2,404,135	
„ without „	..	..	..	1,585,742	
				—————	3,989,877
		Sections.	Acres	Sections.	Acres.
New sectional surveys	..	11,568	..	1,378,497	
Incorrect „ revised		873	..	79,205	
		—————		—————	
				= 12,441	— 1,457,702

Old Canterbury surveys replotted from field notes, 3,153 sections, 324,457 acres; town allotments, 3,192; standard survey under the Land Transfer Act, 110 miles.

As you must be aware, such large areas of survey necessitated a great deal of office-work and supervision to thoroughly check and record so many sections, prepare duplicate plans, and reduce to the various district and county maps. In preparing these under the present system, I have also had to reduce anew, from the large 10-chain roll-plans that were in the office when I took charge, about 1,572,000 acres plotted during the previous twenty years.

The following is a *résumé* of the office-work for the period under review:—

Plans received from staff and contract surveyors,	755 large, 668 small	1,423
New block plans prepared in the Christchurch office	.. ..	384
„ „ „ Timaru office	.. ..	91
Crown-grant record plans constructed in Christchurch office	.. ..	63
New county maps prepared	.. ..	3
Ditto, 3 duplicates traced for Wellington and 2 for Christchurch.	.. ..	
New district plans compiled	.. ..	38
Ditto, 11 traced for publication, and 39 for public office, Christchurch.	.. ..	
District triangulation plans compiled	.. ..	67
„ „ lithographed	.. ..	48
Crown grants or certificates of title issued	.. ..	6,469

#### *Land Transfer Work.*

Plans received from licensed surveyors and checked, 446 = 15,242 allotments.  
Certificates of title issued, 8,437; plans, 16,874.

JOHN H. BAKER,  
Chief Surveyor.

## WESTLAND.

*Major Triangulation.*—Total area completed 146,406 acres, at a cost of 1.16d. per acre. It extends from the head-waters of the Weheka (or Cook's) River to the Paringa Valley. The base-line in Paringa Valley was measured in October, 1880, and declared to be 24,843.33 links. In June, 1881, the triangulation had extended to Paringa base, and the calculated length was found to be 24,842.89 links, equal to an error of 0.14 link per mile. The direct distance between Wataroa base (the one previously measured in connection with the Westland triangulation) and the Paringa base is 59 miles; the number of triangles observed is 113, and the average closing error in these only 5.5 seconds. The calculation of altitudes are not completed yet, but, judging from results already obtained, they promise to be equal to Mr. Roberts's work in preceding year between Hokitika and Okarito, where the difference between the mean sea-level, carried by calculation from the former to the latter—a direct distance of 55 miles, and by stations varying up to 3,600 feet in height—and the mean sea-level marked at Okarito Wharf, and determined by a period of tidal observations taken by Harbourmaster there, was found to be only 4 feet 7 inches. The question of the heights of Mount Cook, Mount Tasman, Mount Hardinger, and nine more of the principal peaks of the dividing range can now be finally set at rest. Altitude observations to Mount Cook alone have been taken from twenty-four of the main stations, situated between Mount Graham, 70 miles north-east, and Mount Argentine, 39 to the south-west of Mount Cook. In connection with the major triangulation Mr. Roberts has completed the topographical survey of 96,000 acres outside the triangulated area, and has supplemented to a great extent the topographical features given on maps of former surveys.

*Minor Triangulation, Topographical and Trigonometrical Surveys.*—101,074 acres completed, at an average cost of 2.8d. per acre. It comprises traverse circuit survey of 25,760 acres in Grey and Hokitika Districts, executed by Messrs. Murray and Lord, and 75,314 acres of minor triangulation and topography, completed by Mr. Roberts. Of the latter, 19,424 acres are situated within Westland, and 55,890 acres within Canterbury District. The connection with Canterbury triangulation *vid* dividing range by head-waters Wanganui River into Rakaia Valley has been tested by the measurement of base in January last: its length was then declared to be 27,881.038. In March the observations were completed, and the calculated length of Rakaia base found to be 27,877.113, equal to an error of 1.1 links per mile, which, considering that the altitudes of ten of the stations range from 5,296 to 7,065 feet, and that the difficulties which had to be contended with in carrying out this work have been exceptionally great, is a most satisfactory result. The average error (taken from 155 triangles) involved in minor triangulation observations within Westland is 5.7 seconds, and within Canterbury (mean of 31 triangles) is 6.9 seconds. The calculations of the differences of latitude, longitude, and convergency between the Westland and Canterbury circuit initial stations are now in hand, and will shortly be reported upon.

*Rural and Suburban Section-surveys.*—Area, 9,827 acres; cost, 2s. 2½d. per acre. These surveys have been very scattered, and involved a large amount of bush-cutting in almost every instance, which accounts for the comparatively high cost per acre. Simultaneous with the section-surveys have the circuit traverses and road surveys been carried on, the closures of which I find to be as follow: W. G. Murray—7 traverses; total length, 44 miles; average error per mile, 1.5 links. E. J. Lord—8 traverses, total length, 38 miles; average error per mile, 4 links. H. G. Price—9 traverses; total length, 30½ miles; average error per mile, 4.6 links. Total length of proved traverses, 112½ miles; average error per mile, 3.2 links. Mr. Murray's traverses covered favourable ground throughout as compared with the rough portions of the survey districts within which the other surveyors were employed, and hence the better closures in his work. In addition to the above, the surveyors had to connect old section-surveys wherever any of the traverses passed within easy reach of them; and this part of their work, which is not returned separately, inasmuch as it cannot be classed as either "new" or "revised" surveys, helped much towards swelling the cost of the work returned.

*Roads and Water-race Surveys.*—88½ miles, at £13 8s. 7d. per mile. Mr. Smyth's surveys under this heading only require special mention, and, amongst these, more particularly the road from Mahitahi to Haast, traversing some very difficult country: it necessitated the cutting of many miles of trial lines before the best route for main road could be finally fixed upon. The work has been well executed; the grade of road does nowhere exceed 1 foot in 15 feet, and longitudinal and cross sections are prepared throughout its entire length.

*Office-work.*—Land Transfer, Crown grant, certificate of titles, &c., as per return. Of triangulation maps, 12; topographical maps, 3; block maps, 37; application maps, 9; Crown-grant record maps, 6; Land Transfer and road record maps, 6—have been plotted during the year. Besides these, maps for various departments, such as Crown Lands, Land-tax, Education, counties &c., have taken up a deal of the draughtsmen's time.

*Proposed Operations, 1881–1882.*—Extend minor triangulation from Weheka (Cook's) River to Paringa River, and major triangulation to Matakitaki Range, with view of connecting with Jackson's Bay circuit initial station. Arrears of section surveys, 55,935 acres, and of office-work consisting of about thirty-four maps (triangulation, topographical, block, Crown grant, &c.), to be overtaken as far as possible.

GERHARD MULLER,  
Chief Surveyor.

## OTAGO.

No contract surveys have been done this year within this district. The areas of the different classes of survey-work done during the past year, the average cost per acre or allotment, and the total cost, together with the cost of this office and the branch offices, I find to be as follow :—

Description.	Area, Acres.	Rate. £ s. d.	Total Cost. £ s. d.
Minor triangulation and topographical survey	463,200	0 0 0·97 per acre	1,861 10 4
Rural and suburban sections ..	40,841	0 1 6·75 „	3,219 5 4
Town sections (720 lots)	512	1 2 4 per lot	804 6 11
Gold-mining surveys ..	275	0 17 4 per acre	239 9 4
Native Land Court sur- veys ..	383	0 12 10 „	245 0 0
Roads, railways, and water-races ..	Miles. 26	7 17 6 per mile	234 10 6
Other work ..	..	.. ..	602 8 1
			<hr/>
			£7,206 10 6
Less amount paid during last year			270 14 4
			<hr/>
Total cost of field-work for the year ..			£6,935 16 2
„ Dunedin and branch offices			3,023 5 9
			<hr/>
			£9,959 1 11

The particulars of the trigonometrical and rural section-surveys, and of the other work as tabulated above, are in the following pages and in the tabulated statements which accompany this: but I would here remark, as regards the cost of the town sections, a considerable number of these were laid off in the bush at Tapanui; and also, as to the cost of road surveys, 9½ miles of these are included in an engineering survey in the Wyndham Valley, which is necessarily expensive. The above total cost of £9,959 ls. 11d. includes about £1,000 due by other departments to this office.

*Minor Triangulation and Topography.*—The trigonometrical survey this year has been carried on solely by the staff, and chiefly with the view of completing the topography of the Otago runs, which fall in in 1882–83, and which work will be resumed so soon as winter has passed. At the same time the connection between Lake Wakatipu and Martin's Bay has been advanced a stage. Messrs Barron, Mackay, Murray, and Langmuir have been more or less engaged during the year on the run surveys. The acreage done by each is 60,000, 85,551, 93,600, and 191,049 acres respectively. The cost of this work averages 0·97d. per acre, or a little under 1d. per acre. This work is very necessary and useful, as no survey of the country they have overtaken has ever been made since the reconnaissance survey of 1856, by Mr. J. T. Thomson, C.E., the late Surveyor-General. Topographical maps on a scale of 40 chains to 1 inch have already come in of the most of this work, and those of the balance will soon be finished also. All the existing run fences and other features are carefully marked, together with homesteads, the altitude of trig. stations, and so on. The boundaries of new runs can thus be laid down with considerable accuracy on these maps. This triangulation has been carried on by means of plain theodolites of 5-inch diameter for measuring the horizontal and vertical angles, and the steel band where necessary for base line, lineal measurements. The difference of bearing in the close of Mr. Barron's triangulation, Turnagain District, with Mr. G. M. Barr's, is 45", and the linkages close with an average difference of 0·64 link per mile. Considering the rough and mountainous nature of the country, this is very fair work. Mr. Murray's Warthill triangulation, carried over very rough high country, shows a mean difference in the closing of its triangles of 10", with a maximum of 33", and a minimum of 0". The linkages agree to within an average of 1·9 links per mile. At its junction with Mr. Connell's triangulation in Benger District the bearings agree to within an average of 10", and the linkages to 1·58 links per mile. Mr. Langmuir's triangulation of parts of Teviot, Benger, Beaumont, Lammerlaw, Longvalley, and Hedgehope Districts agrees in the closing of triangles to within an average of 12", and in linkages to an average of 1·06 links per mile. At the junction of this work with the Serpentine District the bearings close to within 34", and the linkages to 3·54 links per mile. The bases used are about 50 miles apart, and Mr. Langmuir reports that the atmosphere during the work on the highest ranges, towards the Serpentine, was unfavourable, being very warm, unsteady, and very often dulled by smoke from grass fires. Mr. Murray and Mr. Langmuir have taken much pains in making very good topographical maps, which are now in this office. As regards the connection from Wakatipu to Martin's Bay, carried on by Mr. Wilmot this summer, it has been under difficulties. Last year the work was all laid out by the selection of suitable trig. stations up the Routeburn and down the Hollyford Valley. This season the men of the party refused to go again, seeing wages had been reduced; so Mr. Wilmot had to get such new men as were obtainable. With these new men double work became necessary, in the surveyor having to go to each trig. point it out. The weather also was bad,

and difficulty experienced in victualling the party. Travelling too was dangerous in many places where the mountain sides were just a mass of moving stones: on one occasion a huge rock came away several tons weight, and struck the cadet who had the instrument box on his back; but for the box receiving the first of the shock he would probably have been killed. So that the triangulation is only completed over the saddle towards the Hollyford, but Mr. Wilmot expects to be able to finish it next season. The men have refused to go again; so I apprehend some inducement must be offered so as to secure good hands when the time comes. The area triangulated is 33,000 acres.

*Rural Section-surveys.*—Ten survey parties were at work on the 1st July, 1880, that being the whole field-staff on this class of work. Mr. Edie resigned a month later, and Mr. Campbell's engagement ceased three months afterwards, while Mr. Armstrong came into the office in May. Altogether 40,841 acres have been laid out for settlement, including many small sections. The area of sections ranges from 5 acres to 320 acres, the average size being 130 acres. The average cost per acre is 1s. 1½d. for most of the above, but a suburban section-survey in the Bengier District by Mr. Langmuir, in 5-acre sections, and Mr. Armstrong's work, which was all or mostly bush, are exceptions, having averaged 3s. 3½d. per acre. Mr. Campbell's work was very much scattered and altogether exceptional. The most important of the blocks surveyed are two at Otara, amounting to over 5,000 acres, and consisting in great part of very good land. Then there is a block on the Waiarikiki Stream, Tutarau District, of 4,750 acres, the Gimmerburn Block of 4,645 acres, and a block of 4,410 acres in the Kurow District. The land in all of these is good land, although some of it may be a little hilly. A village-settlement block of about 500 acres in Mount Hyde District, near Hindon, has been laid off by Mr. Edie, in sections ranging from 7 acres to 22 acres in area. This is very good land and is situated within 2 miles of the Otago Central Railway. A number of old reserves have, by order of the Waste Lands Board, been subdivided into small sections for sale.

*Town Section-surveys.*—Of these, 720 sections have been laid off, at an average cost of £1 2s. 4d. per allotment. This work is comprised in 9 sections surveyed in Naseby; the Kurow, Waihemo, and Wayne's Townships, 240 sections; extension of Tapanui Township, 31 sections; resurvey of sections in Weatherstone Township, 44 sections; and extension of Township of Pembroke, 396 sections or allotments. There are 682 ¼-acre lots, and 38 larger, from 1 to 8 acres, have been surveyed.

*Gold-Mining Surveys.*—Of gold-mining surveys, 275 acres, in 39 sections, have been surveyed, at an average cost of 17s. 4d. per acre. These mining surveys are situated in the Naseby, Kyeburn, Mount Buster, Serpentine, and Manorside Districts of Mr. Barron's district in the Bannockburn; Fraser and Lauder Districts of Mr. Mackay's district; in the mining localities of Bluespur, Weatherstone, and Waitahuna of Mr. Langmuir's district; and in the Shotover, Skipper's Creek, and Earnslaw Districts of Mr. Wilmot's district. Generally these surveys have caused long journeys, and are detached; hence the greater cost per acre over ordinary rural section-work.

*Native Land Surveys.*—Mr. Mackenzie has been occupied part of the year in laying off a reserve in Block I., Hawkesbury District, and Block I., Moeraki District, for the half-caste claims. The soil of these blocks generally is of superior quality; the sections vary from 8 to 10 acres in area.

*Roads, Railways, and Water-races.*—Under these heading no railway surveys have been made during the past year, but 16½ miles of road surveys, at a cost of £12 4s. per mile, and 9½ miles of water-races, at a cost of £3 10s. per mile, have been executed. Of these, the only works calling for special reference by me are the new road from Outram to Hindon, and the road from Clinton to Wyndham *via* the valley of the Wyndham River. The former—the road from Outram to Hindon—was surveyed by Mr. Edie in July last, while it was being constructed under contract, the length actually surveyed being 3½ miles. As to the road itself I have to report that the £3,000 expended by Government on it, through the Taieri County Council, has resulted in a very excellent dray-road across the gorge of the Lee Stream being made, which has shortened the road for wheeled traffic from 30 to 13 miles: it is much used by the settlers on Boyd's Run, by the storekeepers at Hindon, and by the gold-miners, and has been found of great advantage to the district generally. The Wyndham Valley Road has been laid off for a distance of 10 miles from Dr. Menzies' pre-emptive right section on Block I., Mokoreta District, up the valley towards the Cairn Station, by Mr. Strauchon, and 10 or 12 miles more are now under survey. I examined this line of road in company with Mr. Strauchon, and found that an excellent route existed, which could be made practicable for wheeled traffic by the expenditure of a few thousand pounds. By means of this road, when formed, the valuable lands belonging to the Otago High School will be easily accessible both from Clinton and from Wyndham. I shall be able, so soon as I get the plans and sections from the District Surveyor, to inform the Board of Governors of the approximate cost of this road.

*Survey Parties and Inspection.*—There has been no contract-work this year in connection with the Dunedin office. Ten survey parties began work in July, 1880, whereof eight only were engaged during the year, as Messrs. Edie and Campbell ceased working for this office, as explained above, after a month or two of work. I have personally made all the inspections of blocks or other work being carried on in the field, also of all the country survey offices. Seven field-checks have been sent by me to the head office and fifteen inspections made. In my inspections of the survey offices, at the Lawrence Survey Office I found the plans and other

documents all kept by Mr. McLean in a manner specially commendable. Mr. Adair, of the Queenstown office, reports plotting surveys on five district maps, and on other general maps; compiling surveys on 18 working maps and record maps, making copies of spotting surveys, attending Warden's Court, and making several bush-license surveys. Besides my ordinary inspections, I visited the new road to Hindon on its completion, with Mr. Hay, the County Engineer; I went over the whole of the road for opening up the Wyndham Valley, selecting the best lines along with Mr. Strauchon, and I visited the Wanaka District with the two Commissioners of the Waste Lands Board on their inspection of the runs in that locality.

*Proposed Field-work.*—For the year just entered on I propose to overtake all the trigonometrical and topographical work more especially required to delineate accurately those Otago runs whose leases expire in 1882 and 1883. This I expect to be able to accomplish with the present staff of surveyors. Then I would suggest the survey, for immediate settlement, of 6,600 acres in the Wanaka, Lower Hawea and Tarras Districts; of 4,200 acres in the Lauder and Blackstone Districts; and of 5,000 acres along the Taieri River, in the Maniototo and Gimmerburn Districts; being altogether an area of about 16,000 acres of good agricultural land. Should this be approved, these blocks can be ready for settlement on the expiry of existing pastoral leases.

*Dunedin Office-work.*—Mr. Douglas, Chief Draughtsman, and the staff in this office, have been busily engaged all the year checking, copying, and recording on Survey Office and on Land Office maps all the block surveys and detached surveys of applications; also recording all leases for minerals and for gold, as the surveys come in, has gone on as usual. Many road surveys under the Public Works Act, and surveys of railway severances or land plans, have come for checking and record or deposit, besides preparing plans for the various Census Enumerators in this district, which the assistants in this office have done. Plans of the Otago runs have been getting ready, and considerable progress has been made, besides beginning special county maps of the same for the use of a Committee of the House of Representatives.

*Land Transfer Branch.*—Mr. Thompson and Mr. Treseder have checked and passed through a great amount of work under this branch during the year. It appears also to be work which will increase. Still, I find it requires constant watchfulness and care to keep the surveys sent in up to the regulations, entailing frequently a large amount of explanation or writing on me. I have passed and certified 54 of these surveys this year, including 14 townships or extensions of townships. The other details are—examining and checking applications, 191; examining and checking transfers, 1,562; examining and checking mortgages, 1,124; examining and checking draft certificates, 1,323; placing plans in duplicate on 1,323 certificates of title (2,646 plans); engrossing "Pursuant" on same, 2,646.

*Crown Grants.*—The number of these prepared, recorded, and issued during the year is 369, representing an acreage of 22,177 acres; prepared and ready for issue, 541; partly finished or ready for recording, 100; deferred-payment licenses prepared, 128; agricultural leases prepared, 164; gold-mining leases prepared, 112; exchange agricultural leases prepared, 74; and coal-mining leases prepared, 16 (the leases all in duplicate).

*Lithographic Office.*—Mr. Ross and Mr. Bain have done a good year's work in lithographing, printing, and mounting maps—viz., blocks drawn, 40; blocks printed, 12,000 copies; traverse forms, 1,000; protractor forms, 1,000; circulars, &c., 3,000; and maps mounted, 500.

The alterations to this office, so long felt to be needed, to give the fullest and most efficient use of the floor-space within the walls, have been effected; and I am glad to report the result to be greater accommodation to the public, concentrating those officers together near the public room who require to be accessible to the public, and securing the privacy of the draughtsmen from all intrusion during office hours.

W. ARTHUR,  
Chief Surveyor.

## SOUTHLAND.

*Work done.*—It will be seen, from the tabulated return attached, that the amount of trigonometrical work done (including topography) has been 32,960 acres, at a cost of 1.6d. per acre. The amount of rural and suburban sectional survey executed has been 421 sections, embracing 38,787 acres, at a cost of 1s. 6½d. per acre. The town section-survey comprises 79 sections, covering 134½ acres, executed at a cost of 17s. 9½d. per section, while the gold-mining lease areas, all of which were in bush, embrace 103 acres, executed at a cost of 11s. 10d. per acre. In judging of the cost of these surveys there are several important circumstances that must be taken into account. The triangulation consisted of unusually small triangles, the country covered being irregular in shape, and having narrow bights running into the surrounding bush. It will also be apparent from the return that the sectional survey this year has been dispersed in comparatively small areas over a wide extent of surface, the connectional work being heavy, and considerable time and expense being lost in travelling. Neither must it be overlooked that, including all classes of sections, there were some 200 of them, embracing over 4,600 acres, laid off in bush. An analysis of the sectional work shows that 57 sections, embracing nearly 13,000 acres, were laid off for rural deferred-payment settlement; 38 sections, covering 13,850 acres, were laid off under the free-selection system, survey-fees having been deposited; 7 sections, covering

1,310 acres, were laid off as saw-mill areas; 8 sections, covering 6,453 acres, were laid off as education reserves; 7 sections, covering 103 acres, were laid off as gold-mining lease (quartz) areas; while the remainder for the most part consists of township and village reserves, cut up into suburban size, portions of which are meant to be opened for absolute sale, and portions disposed of on the suburban deferred-payment system. The land lately surveyed for rural deferred-payment purposes has, as a rule, been taken up the moment it was thrown open, and settlement and surface improvements are now rapidly taking place in localities that were formerly covered only by the native tussock. The deferred-payment blocks in the vicinity of the railway-line and in accessible localities have now for the most part been laid off, and, indeed, the deferred-payment blocks now unsurveyed are neither numerous nor large. The chief work that will probably fall upon this branch of the department for some time to come will be the subdivision of bush and village reserves (for small settlement), many of which are dispersed over the district. There is a large amount of Crown land only a short remove from the present centres of settlement, comprising the whole of Seaward and the southern fringes of Longwood Forests, which must doubtless be subdivided at an earlier or later date. The district has now come to such a stage that settlement will not so much broaden out as it will fill up and become more dense. In my last annual report I alluded to the great advantages attending the use of the steel band in preference to the old chain, and the work during the year will thus, I am sure, bear a very favourable comparison with any that has been done before. The days of the old linked chain have evidently gone by, and, if improvements are sought after, these should, I think, be in the direction of perfecting the steel band.

*Land Transfer Work and Crown Certificates.*—A considerable amount of work has been done during the year, particularly during the early part of it, in connection with the Land Transfer branch. During the year 50 plans for deposit have been examined and passed. These I find cover 219 of the original Government sections, embrace 3,458 subdivisional allotments, and deal with an acreage of 61,468. The number of Crown grants prepared prior to the coming in vogue of the new system (which I may include under this head) is 350. The number of Crown-title certificates prepared during the period has been 77, while the number of ordinary title certificates has been 628. The plans of the former being in triplicate, and of the latter being in duplicate, the number of diagrams thus drawn for the Land Transfer Office, apart from those required for the Crown grants above mentioned, was 1,487. The number of applications made under the Act during the year, a good proportion of which required examining and checking with the Government maps, was 312.

*Lithographs.*—During the year 14 drawings have been prepared for purposes of lithography, a number considerably smaller than that of last year. Of these, two (*i.e.*, one of Longwood Reefs and one of Wairio District) have been general maps, embracing a large number of sections and a considerable breadth of country. With two exceptions the drawings were printed locally, the cost of printing and preparation being about £60, and the number of prints issued being 2,700. The total publishing price of the lithographs is £171 5s. We have still two or three districts to draw and lithograph, and have presently in hand a general map of the Southland District on a scale of 2 miles to 1 inch. No map of the kind has been prepared in this office since 1865, and of course the progress which the district has made in the interval, as indexed by the construction of fresh roads and railways, the creation of fresh townships, &c., renders a new general map desirable, apart from the fact that the old issue is now all but out of print.

*General.*—There have been very few purchases indeed during the past year, and this has enabled the department to thoroughly work up the outstanding arrears. The staff both in the field and office now stands at a minimum, below which it would scarcely be possible to cope with the current work. As it is, there are many absolutely necessary branches of work, such as the construction of block and Land Transfer record maps, which must meanwhile be left for the most part in abeyance, with the hope of having more time in future to overtake them. During the year the office has sustained a severe loss through the death of Mr John Innes, Office Surveyor. He was noted for his conscientious discharge of duty, and will be much missed. I might state that the large wall maps lately prepared for the use of the public have been highly appreciated, the advantages of seeing the whole district at a glance, in its topographical and sectional features, being very apparent.

JOHN SPENCE,  
Chief Surveyor.

#### HEAD OFFICE.

THE work of the head office has consisted chiefly as follows: A map of the portion of the North Island, lying south of the parallel of 39°, has been drawn and photo-lithographed, and will be published during the year. The projection used is Mr. Thomson's rectangular tangential, and the central meridian is that of 176° E. The reductions from the mile scale were made and the outline drawn by Mr. Grant, the writing and hill-work by Mr. Flanagan, very creditably. It has been photo-lithographed on the scale of 8 miles to 1 inch, and will, I believe, be very useful, as no topographical map of the Wellington District has yet been printed.

Mr. Spreat has drawn on stone the map of the North Island, showing the map publication of the department (which accompanies this report), and he has in hand the map of the Middle Island on the same scale—25 miles to 1 inch. It will be seen that what has been finished is an

excellent specimen of lithography. The projection is the polyconic—the middle line being the meridian of 172° 30' E, and the two maps will be of the same size. The scale and form have been adapted to the size of the steam litho. machine, in order that great numbers may be printed quickly.

Messrs. Kemp and McCardell have been engaged chiefly on 1-mile district maps of Marlborough, Nelson, and Canterbury. Nelson and Marlborough have been completed, and the maps are capable of being joined into a complete map of that part of the Middle Island.

When engaged on the compilation of the map of the Middle Island now being drawn on stone, it was found that the existing maps, compiled from Admiralty charts, showed the position of the West Coast about the Steeples to be drawn about 6' of longitude too far east.

The maps of land advertised for sale during the past year have been printed in colours, denoting the various modes of disposal, and they seem to have answered the purpose of bringing each class of land clearly before the public very well.

The work done in the Photographic Gallery and in the Litho. Printing Office has not been so great as last year, and consequently two printers have been dispensed with.

In the Record Office the work done is partially represented by the statement that 7,341 letters were received and despatched during the year. This office and that of the Accountant's have had their duties increased by the correspondence and accounts of the expenditure undertaken to open up lands for sale by means of the construction of roads, &c. Payments on this account to the amount of £32,580 3s. 10d. have been passed during the year.

In January last, in accordance with your instructions, I visited the Chatham Islands, and reported on certain disputes as to roads, and generally as to the state of the country. The islands contain about 192,000 acres, and of this probably 45,000 acres are in the hands of Europeans, but the Crown does not possess in freehold a single acre there. Wool is the principal production; the extent of agricultural land does not, I believe, exceed 20,000 acres. The action now being taken by Parliament will stimulate the progress of the community; and if the Natives can be induced to sell their lands for settlement, or even give fixed leases, the prosperity of the islands would be greatly increased. At present, being followers of Te Whiti, the Maoris do not deal with their possessions in any form.

A. BARRON,  
Office Surveyor.

#### LITHOGRAPHIC PRINTING executed from July, 1880, to June, 1881.

Department.	No. of Separate Printings.	No. of Impressions		Department.	No. of Separate Printings.	No. of Impressions	
		By Hand.	By Machine.			By Hand.	By Machine.
Public Works ...	227	33,914	136,780	Patent ...	11	1,450	3,600
Survey ...	374	33,523	102,775	Treasury ...	13	1,495	...
Telegraph ...	39	10,000	9,900	Printing ...	3	435	...
Geological ...	24	7,100	35,335	Architect ...	4	260	...
Native ...	26	2,255	...	Inspector of Prisons ...	1	30	...
Customs ...	48	2,960	...	Defence ...	1	250	...
Railway ...	15	2,725	...	Exhibition Commissioners ...	1	300	...
Registrar-General ...	18	1,105	...	Legislative Council ...	1	50	...
Property-tax ...	3	1,530	...	Colonial Secretary ...	17	1,002	...
Marine ...	10	940	1,150	Crown Lands ...	4	205	...
Annuities ...	8	2,400	2,200				
Education ...	63	5,870	...				
Justice ...	56	3,935	...	Totals ...	967	113,734	291,740

MAPS MOUNTED, various sizes, from 18 in. x 18 in. to 6 ft. x 6 ft., 1,370.

WORK ON HAND 30th June, 1881, 21 plans, in 38 colours, giving 17,370 impressions and 29,920 pulls.

#### PHOTOGRAPHS.

				No. of Plates Taken during the Year.					No. of Plates Taken during the Year.
Survey ...	...	...	...	121	Railway ...	...	...	...	1
Public Works ...	...	...	...	80	Customs ...	...	...	...	13
Patent ...	...	...	...	8					
Telegraph ...	...	...	...	19	Total ...	...	...	...	257
Marine ...	...	...	...	2					
Government Printer ...	...	...	...	1	Ferrocyanide prints ...	...	...	...	41
Museum ...	...	...	...	12	Silver ...	...	...	...	1,083

WORK ON HAND 30th June, 1881, 7 plans, 9 plates 16 in. x 16 in

ABSTRACT OF LITHOGRAPHS PRINTED.

								No.	Average No. of Copies of each Lithograph.	No. of Impressions.
Head Office	...	...	...	...	...	...	...	967	420	405,474
Auckland	...	...	...	...	...	...	...	42	91	3,854
Otago	...	...	...	...	...	...	...	72	236	17,000
Southland	...	...	...	...	...	...	...	14	190	2,700
Totals	...	...	...	...	...	...	...	1,095	392	429,028

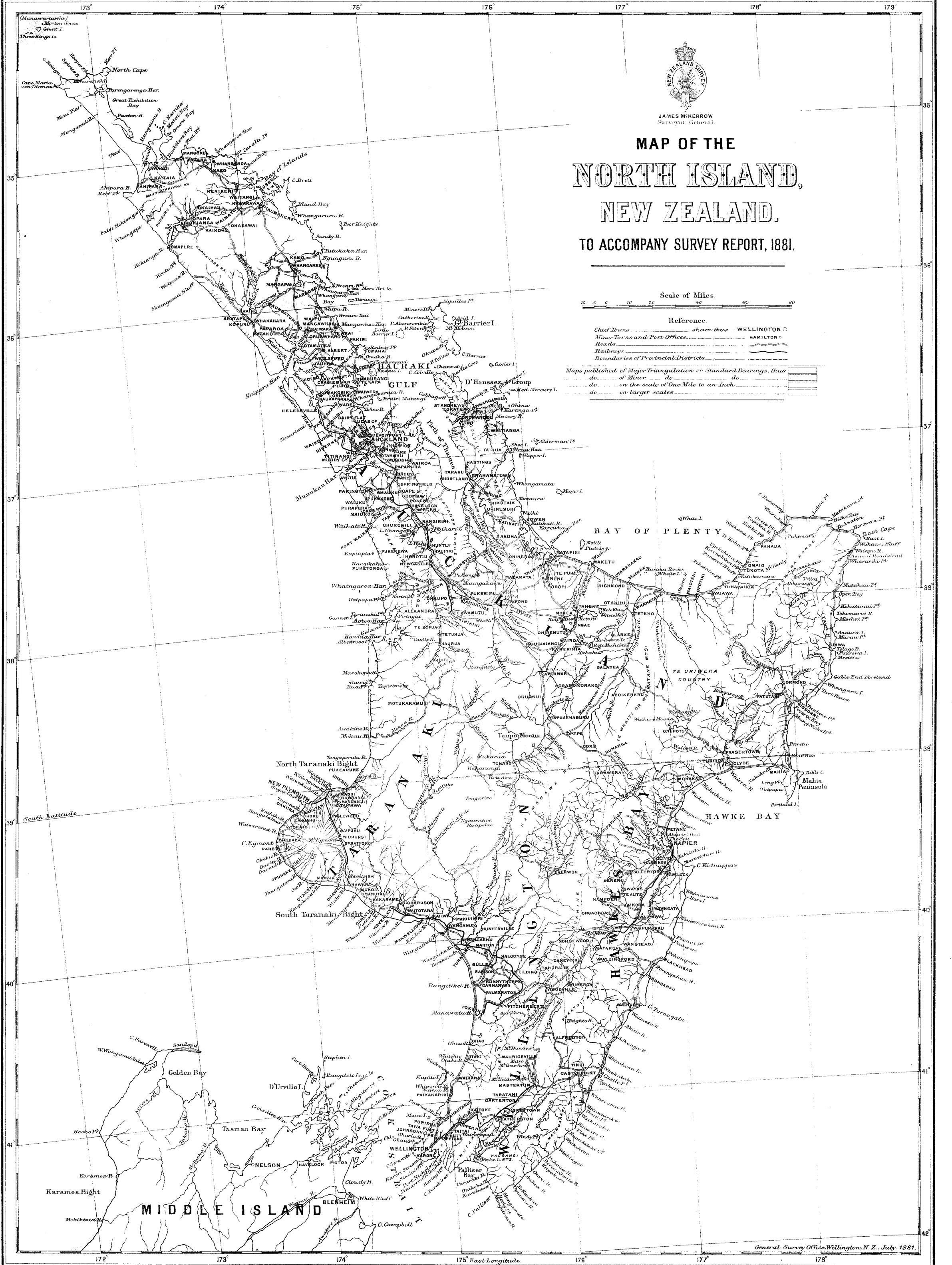
CROWN GRANTS and CERTIFICATES of TITLE from the Crown Prepared.

District.				Number.	Cost.	District.				Number.	Cost.
					£ s. d.						£ s. d.
Auckland	...	...	...	2,914	820 0 0	Westland	...	...	...	62	15 0 0
Taranaki	...	...	...	129	35 0 0	Canterbury	...	...	...	1,127	755 19 0
Hawke's Bay	...	...	...	265	120 15 0	Otago	...	...	...	1,504	450 0 0
Wellington	...	...	...	615	293 5 11	Southland	...	...	...	350	40 0 0
Nelson	...	...	...	68	32 8 0	Totals	...	...	...	5,694	2,585 17 11
Marlborough	...	...	...	60	23 10 0						

LAND TRANSFER WORK.

District.				No. of Plans Passed.	No. of Plans Placed on Certifi- cates of Title.	District.				No. of Plans Passed.	No. of Plans Placed on Certifi- cates of Title.
Auckland	...	...	...	71	824	Westland	...	...	...	241	175
Taranaki	...	...	...	66	529	Canterbury	...	...	...	103	3,432
Hawke's Bay	...	...	...	58	92	Otago	...	...	...	54	2,646
Wellington	...	...	...	123	766	Southland	...	...	...	50	1,487
Nelson	...	...	...	107	298	Totals	...	...	...	881	10,328
Marlborough	...	...	...	8	79						





JAMES MEKERRON  
Surveyor General.

# MAP OF THE NORTH ISLAND, NEW ZEALAND. TO ACCOMPANY SURVEY REPORT, 1881.

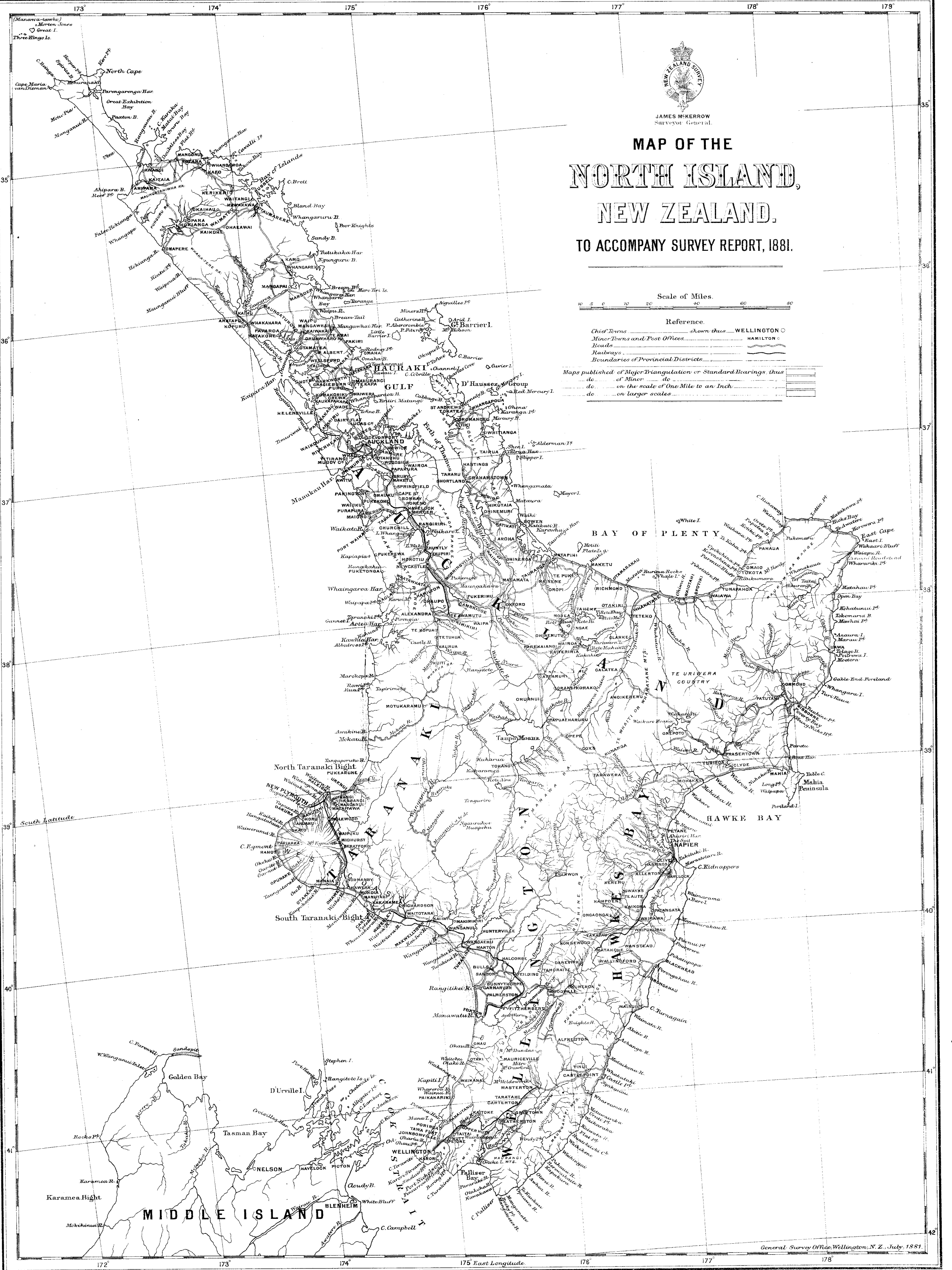
Scale of Miles.  
0 5 10 20 30 40 50 60 70 80

Reference.

Chief Towns ..... Shown thus ..... WELLINGTON ○  
Minor Towns and Post Offices ..... HAMILTON ○  
Roads .....  
Railways .....  
Boundaries of Provincial Districts .....

Maps published of Major Triangulation or Standard Bearings, thus  
do ..... of Minor ..... do .....  
do ..... on the scale of One Mile to an Inch .....  
do ..... on larger scales .....

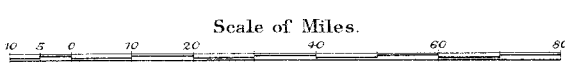




JAMES McKERRROW  
Surveyor General

# MAP OF THE NORTH ISLAND, NEW ZEALAND.

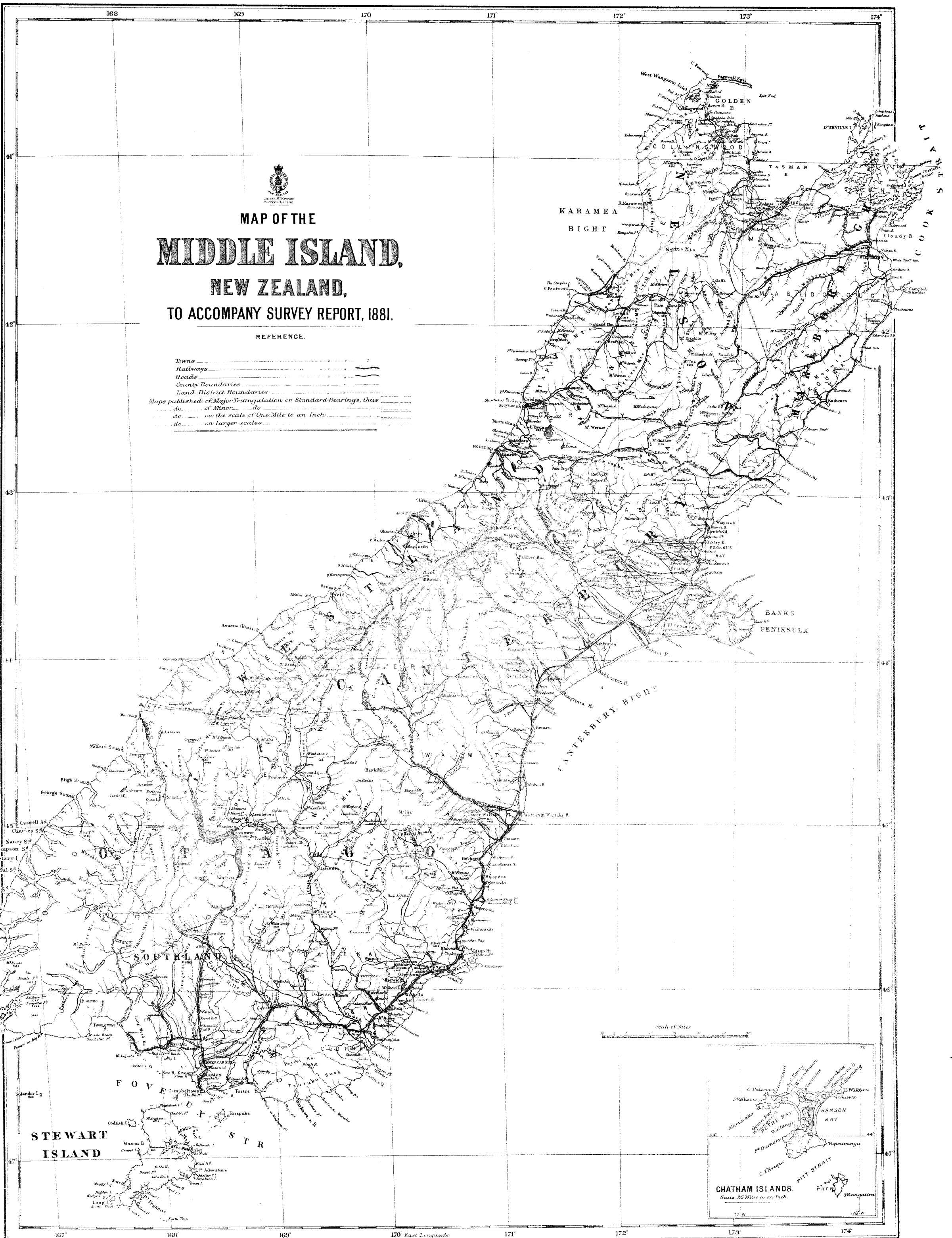
TO ACCOMPANY SURVEY REPORT, 1881.



### Reference.

- Chief Towns shown thus WELLINGTON ○
  - Minor Towns and Post Offices HAMILTON ○
  - Roads
  - Railways
  - Boundaries of Provincial Districts
- Maps published of Major Triangulation or Standard Bearings thus
- |    |                                     |    |
|----|-------------------------------------|----|
| do | of Minor                            | do |
| do | on the scale of One Mile to an Inch |    |
| do | on larger scales                    |    |





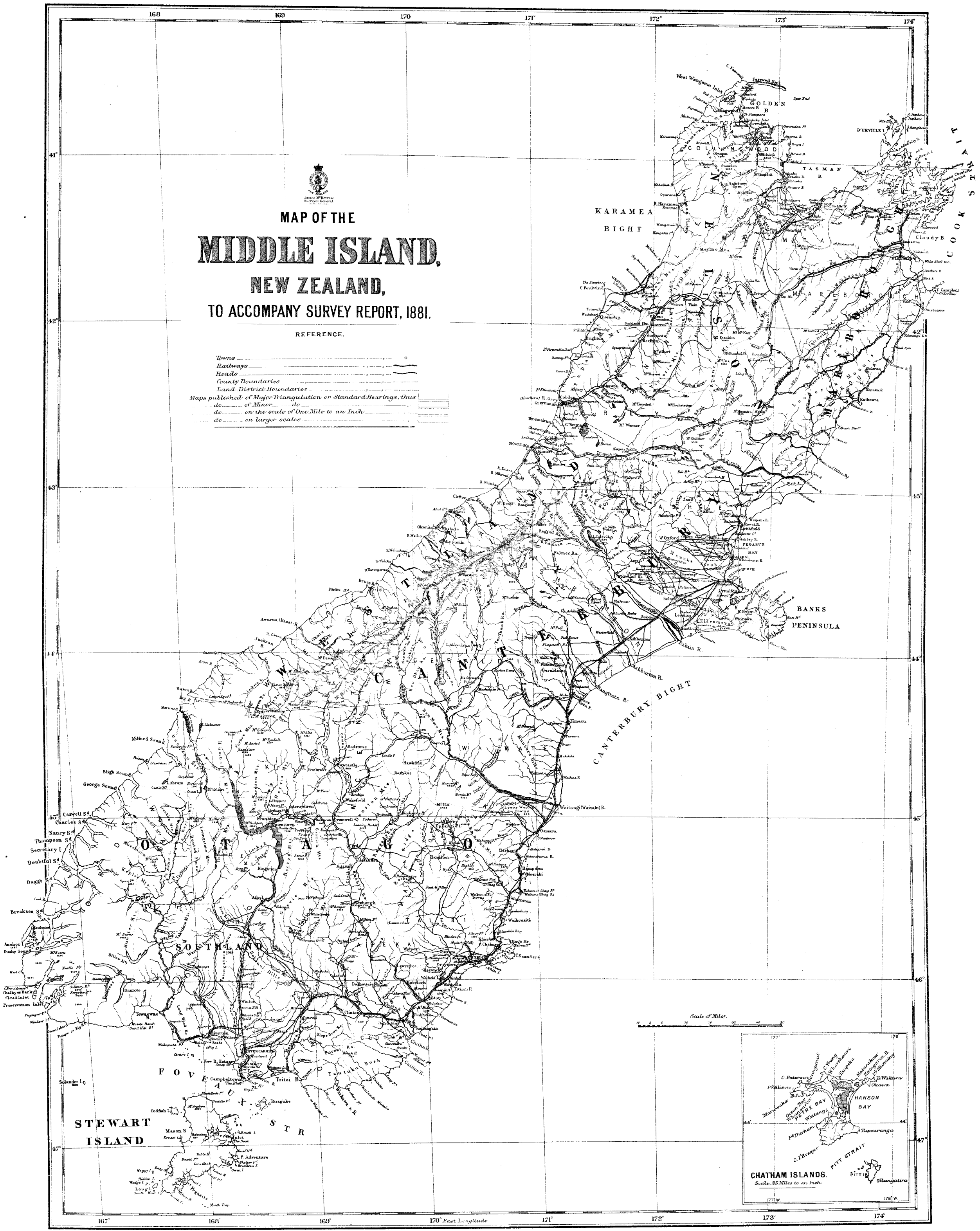




MAP OF THE  
**MIDDLE ISLAND,**  
NEW ZEALAND,  
TO ACCOMPANY SURVEY REPORT, 1881.

REFERENCE.

Towns .....  
Railways .....  
Roads .....  
County Boundaries .....  
Land District Boundaries .....  
Maps published of Major Triangulation or Standard Bearings, thus  
do ..... of Minor .....  
do ..... on the scale of One Mile to an Inch .....  
do ..... on larger scales .....







MINOR TRIANGULATION.					TRAVERSE.					
Surveyor and Survey District.	Side.	Bearings.	Distances.	Error Ratio per Mile.	Survey District.	Survey Pegs.	Chainages.	Closing Errors.		Distance in Miles.
								M.	P.	
Martin, G. A., Waiheke...	15-981	° ' " lks. 100 33 8 33 9	lks. 26,160·0 152·2	lks. ...	Opotiki ...	10-731A	9	lks. 3·1	lks. 11·3	2·5
		diff. 1	diff. 7·8	2·4	" ...	130-130	8	8·4	2·3	1·8
Clayton, C., Waiwera ...	XII-864	Polygon ...	30,543·0 52·1	...	Waitemata	52-37	15	5·5	3·0	1·0
			diff. 9·1	2·4						
Clayton, C., Waiwera	861-864	349 55 28	27,184·4							
Weetman, S., Waiwera		55 15	179·2							
		diff. 13	diff. 5·2	1·5						
Weetman, S., Waiwera ...	923-864	109 35 15 35 43	28,658·4 45·3	...	Kaipara ...	1-1	12	2·1	5·4	2·0
		diff. 28	diff. 13·1	3·6	" ...	A1-A	10	1·1	1·4	0·8
Weetman, S., Kaipara ...	23-921	Polygon ...	12,567·1 12,564·6							
			diff. 2·5	1·6						
Neumann, R., Kaeo ...	10-10A	305 43 30 43 39	14,750·5 53·7	...	Kawakawa	R peg-R peg	19	1·0	1·0	0·9
		diff. 9	diff. 3·2	1·7	Russell ...	7A-7A	27	4·9	0·3	1·5
Edgecumbe, —, Newcastle	928-930	293 51 58 51 47	28,818·2 20·0	...	Alexandra	1-1	9	2·5	1·4	2·5
		diff. 11	diff. 1·8	0·5	Newcastle	1-1	5	0·5	0·2	1·5
Edgecumbe, —, Newcastle	M-1	204 9 23 9 30	16,039·2 40·9							
		diff. 7	diff. 1·7	0·9						
Edgecumbe, —, Newcastle	47-E	282 29 50	25,382·3 81·1							
			diff. 1·2	0·4						
Baber, J., jun., Maioro ...	K-35A	106 5 15 5 27	25,516·6 19·7	...	Onewhero	IV-IV	46	0·9	2·5	5·75
		diff. 12	diff. 3·1	1·0	Drury ...	A-A	16	2·0	4·0	2·3
Baber, J., jun., Maioro ...	G-36	42 42 39 42 36	27,800·0 2·5							
		diff. 3	diff. 2·5	0·7						
Cussen, L., Patetere North	820-804	Polygon ...	37,704·0 9·0	...	Patetere ...	T-814	23	16·0	19·7	4·3
			diff. 5·0	1·1						
Cussen, L., Patetere South	802-808	Polygon ...	34,034·0 35·1							
			diff. 1·1	0·3						
Cussen, L., Ngautuku ...	807-826	Polygon ...	43,162·2 1·2							
			diff. 1·0	0·2						
Simpson, F., Opuawhanga	G-F	41 25 19 17	23,208·4 10·7	...	Hukerenui	5-5	10	2·2	1·0	1·5
		diff. 2	diff. 2·3	0·8						
Philips, J. I., Maketu ...	C-974	283 33 49 33 37	20,497·5 502·4							
		diff. 12	diff. 4·9	1·7						
Williams, G. W., Otahuhu	Remuera-Orakei	Polygon ...	13,259·8 9·9	...	Rangitoto	Peg-peg	6	0·7	0·3	0·5
			diff. 0·1	Nil						
Smith, H., Patetere North	804-824	188 46 5 6	21,193·5 90·7	...	Whangarei	5-19	15	1·8	2·7	3·3
		diff. 1	diff. 2·8	1·1						



## PROVINCIAL DISTRICT OF AUCKLAND.

Less paid by Land Purchase Department

## PROVINCIAL DISTRICT OF TARANAKI.

\* Waimate resurvey work.

† This sum includes the cost to date of incomplete work, £916 5s., and the cost of standard survey of 10½ miles bush-line.

PROVINCIAL DISTRICT OF WELLINGTON.

\* Represents amount of lien.

RETURN of FIELD-WORK executed by STAFF and CONTRACT SURVEYORS from 1st July, 1880, to 30th June, 1881.  
PROVINCIAL DISTRICT OF NELSON.

Surveyor.	District.	Major Triangulation.			Minor Triangulation.			Topographical and Trigonometrical Survey.			Rural and Suburban.			Town Section 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, 1880, to 30th June, 1881.	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.	Cost.	
G. B. Sinclair	Wai-iti	...	d.	£ s. d.	...	d.	£ s. d.	...	d.	£ s. d.	1,159	11	5/7 <sup>3</sup>	327 9 2	...	...	...	£ s. d.	...	...	s. d.	£ s. d.	...	£ s. d.	£ s. d.	£ s. d.	£ s. d.	438 8 4	765 17 6	Work not completed.
A. P. Rawson	"	...	...	...	...	...	...	...	...	...	3,270	22	1/11 <sup>1</sup>	320 12 4	...	...	...	...	...	...	...	...	...	...	...	...	...	673 9 0	673 9 0	Sections adjoining old surveys in bush.
C. Lewis	Waitapu and Mount Arthur	...	...	...	13,350	2'8	155 15 0	...	...	...	3,599	21	1/11 <sup>3</sup>	352 16 8	...	...	...	...	...	...	...	...	...	...	...	...	...	642 15 10	642 15 10	{ Sections adjoining old surveys in bush ; heavily-timbered and broken country.
R. T. Sadd	Howard, &c.	...	...	...	11,840	1'19	51 17 8	115,368	0'81	393 12 11	1,502	12	2/4	175 4 8	...	...	...	...	113	8	15/0	84 15 0	6 <sup>1</sup> / <sub>4</sub>	11 4 0	70 0 0	...	56 11 0	642 15 10	642 15 10	{ Sections adjoining old surveys in bush ; heavily-timbered and broken country.
J. Snodgrass	Lyell, &c.	...	...	...	...	...	...	142,500	1'57	932 5 0	2,202	15	2/2	238 7 2	...	...	...	...	...	...	...	...	7	3 12 2	25 12 6	...	20 0 0	770 11 10	770 11 10	Heavily-timbered and broken country. Cadet, 8 months.
J. H. Jennings	Cobden	...	...	...	...	...	...	...	...	...	627	10	2/	82 14 0	...	...	...	...	176	11	9/2	80 19 6	6	7 0 0	42 0 0	...	...	883 9 2	883 9 2	Heavily-timbered and broken country. Cadet, 8 months.
F. S. Smith	"	...	...	Revision	89,082	0'33	122 8 0	140,270	1'12	654 15 10	2,118	34	2/5	260 18 3	...	...	...	...	...	...	...	...	...	...	...	...	133 0 0	739 18 6	739 18 6	2,000 acres in progress. Heavy bush and broken country.
C. Galwey	Ahaura	...	...	...	17,512	1'6	118 0 0	...	...	...	1,160	...	2/4	136 10 6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
J. A. Montgomerie	Reefton	...	...	...	...	...	...	65,657	1'7	468 8 9	1,687	22	3/11 <sup>3</sup>	335 19 6	...	...	...	...	...	...	...	...	...	...	...	...	100 0 3	868 4 4	868 4 4	1,600 acres in progress.
Contractors, &c.—		...	...	...	...	...	...	...	...	...	5,340	104	2/8 <sup>1</sup> / <sub>4</sub>	730 10 0	...	...	...	...	39	6	16/0	31 4 0	7	6 0 0	42 0 0	...	68 0 3	1,117 6 8	1,117 6 8	Heavily timbered. Cadet, 12 months. Adjoining old surveys.
R. A. Young	Waitakere, &c.	...	...	...	...	...	...	...	...	...	3,254	70	2/10 <sup>1</sup> / <sub>4</sub>	466 2 6	...	...	...	...	2	27	14/5	19 10 0	536	33	15/3	409 4 7	...	...	...	...
J. Rochfort	Mount Arthur	...	...	...	...	...	...	...	...	...	4,200	42	2/3	472 10 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H. E. Ellison	Gordon, &c.	...	...	...	...	...	...	179,794	1'5	1,123 14 3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Means and totals	...	...	...	...	131,874	0'9	448 0 0	643,589	1'36	3,572 16 9	31,349	395	2/8 <sup>1</sup> / <sub>4</sub>	4230 2 9	10	62	15/4	47 10 0	1,017	87	15/10	808 12 7	26 <sup>1</sup> / <sub>4</sub>	6 16 10	179 12 6	...	883 6 0	9,167 19 4	9,167 19 4	£52 17s. paid by fees ; 4,000 acres field-work completed. Alpine ranges.

PROVINCIAL DISTRICT OF MARLBOROUGH.

A. D. Wilson (standard)	Part of Cloudy Bay, Linkwater, Gore, and Arapawa	335,680	0'25	349 12 6	...	...	...	224,000	1'25	1,177 19 8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	800 2 10	Two-thirds of this triangulation carried over mountainous forest country; remainder partly open, partly scrub. One month's leave of absence. No cadet assisting. Most of the stations in this triangulation required heavy bush-cut- ting. One month's leave of absence on account of ill-health. No cadet assisting. Of this amount, £63 15s. paid for survey by applicants has been placed to credit of Public Account. 1,113 acres situated in Nelson Land District. Partly open, partly wet swamp, partly manuka. Paid for by applicants. Partly resurveyed, and connections made with adjacent surveys and trig. stations.	
R. F. Goulter (staff)	Part of Tennyson, Arapawa, Linkwater, and Oriari	...	...	...	...	...	...	77,000	1'5	501 0 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7 12 0	...		59 12 0
"	Arapawa, Gore, Oriari, and in Nelson District	...	...	...	...	...	...	...	...	1,933	22 2	1 1/4	204 16 9	...	...	...	...	...	...	...	...	...	...	...	...	...	528 18 1		
"	Pelorus and Queen Charlotte Sound	...	...	...	...	...	...	...	...	Revised	1,017	14 1	6 1/4	77 17 4	...	...	...	...	...	...	...	...	...	...	...	...	...		...
J. O. Western (schedule)	Cloudy Bay	...	...	...	...	...	...	...	...	...	302	11 1	0 1/2	16 0 0	...	...	...	...	...	...	...	...	...	...	...	...	...		...
	Linkwater	...	...	...	...	...	...	...	...	Revised	638	10 1	5 1/2	15 0 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	31 0 0
Means and totals	...	335,680	0'25	349 12 6	...	...	...	301,000	1'3	1,678 19 8	3,890	38 1	7 1/4	313 14 1	...	...	...	...	...	...	...	...	...	...	...	7 12 0	...	59 12 0	1,360 0 11

Mr. Wilson.—Major and minor triangulation in progress, 270,000 acres; cost to date, £220 10s. 8d.; commenced 1st May, 1881.

PROVINCIAL DISTRICT OF WESTLAND.

W. G. Murray	Waimea, Totara, Kanieri, Toaroa, Turiwhate, and Mahinapua	...	...	...	...	...	8,320	2'5	92 1 6	2,985	24	2 8½	406 2 6	...	...	...	...	86	17	11 3¼	48 9 0	10½	6 4 0	65 12 6	...	144 14 6	757 0 0	Bush country in centre of gold field. Unassisted by cadets.	
E. J. Lord	Tekinga, Arnold, Greymouth and Hohonu	...	...	...	...	...	17,440	4'5	328 8 10	2,649	10	3 0½	403 1 6	16½	4	18 8	15 8 0	16	5	28 8	22 19 0	4¾	11 9 5½	54 10 0	...	73 16 4	898 3 8	District all dense forest; very rough and broken; expensive gold-field. Unassisted by cadet.	
J. N. Smyth	Paringa, Haast, Arnott, Cascade, Smoothwater, and Abbey Rocks	...	...	41 10 0	}	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	48	19 10 9	937 18 10	...	128 0 0	1,107 8 10	£41 10s. major triangulation, covering the cutting and measurement of Paringa base-line. The road surveys were situated in heavily-timbered mountainous country, with dense undergrowth. One cadet (his first year in field) assisting.	
G. J. Roberts	Okarito and Mount Gawlor Circuits...	146,406	1½	660 1 7		...	...	...	75,314	2'5	764 10 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	200 0 0	1,624 11 7	Including cost of triangulation of 55,900 acres within Canterbury, and topographical survey of 96,000 acres outside the triangulated area.	
H. G. Price	Waitaha, Totara, Toaroa, and Kanieri	...	...	12 0 0		...	...	...	...	...	4,193	44	1 3¾	275 2 0	...	...	...	...	5	2	24 10¾	6 4 6	25¾	6 18 7	175 1 6	...	30 18 0	499 6 0	Bush country; within gold field. Unassisted by cadet.
Means and totals	...	146,406	1½	713 11 7	...	...	...	101,074	2'8	1,185 0 4	9,827	78	2 2½	1,084 6 0	16½	4	18 8	15 8 0	107	24	14 6	77 12 6	88½	13 18 7	1,233 2 10	...	577 8 10	4,886 10 1	£1,183 2s. 4d. of this sum is chargeable to cost of works done for other departments, &c.

RETURN of FIELD-WORK executed by STAFF and CONTRACT SURVEYORS from 1st July, 1880, to 30th June, 1881.  
PROVINCIAL DISTRICT OF CANTERBURY.

Surveyor.	District.	Major Triangulation.			Minor Triangulation.			Topographical and Trigonometrical Survey.			Rural and Suburban.				Town Section Survey.				Roads, Railways, and Water-races.			Other Works.	Total Cost of Surveyor and Party from 1st July, 1880, to 30th June, 1881.	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.	Miles.	Cost per Mile.	Total Cost.	Cost.		
Staff.			d.	£ s. d.		d.	£ s. d.		d.	£ s. d.		s. d.	£ s. d.		s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		
C. W. Adams	...	...	...	...	...	...	...	101,254	1'49	629 8 6	...	...	...	...	...	...	...	...	...	...	264 12 9	894 1 3	Also 14½ miles standard traverse survey, of which 3 miles were chained in 1879-80, but were not credited, as plans were not in; 39 stones put in.	
T. N. Brodrick	Ashley	...	...	...	61,038	0'53	136 5 6	44,062	0'63	115 16 6	2,038	17	10½	89 2 6	...	...	...	...	...	...	...	...	...	
"	Vincent	...	...	...	...	...	...	37,440	1'60	250 2 9	3,544	33	1 1½	250 3 5	...	...	...	...	...	...	...	...	...	
"	Oxford	...	...	...	...	...	142 15 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	984 5 8	£142 15s. for minor triangulation in the Oxford District not yet completed. Cadet assisting.	
W. A. Nalder	Ashley	...	...	...	...	...	...	...	...	...	3,086	60	1 9½	531 13 1	11	44	4 6	10 0 0	...	...	...	...	638 1 7	Partly bush survey. Left department 31st March.
"	"	...	...	...	...	...	...	...	...	...	2,838	28	8 3½	96 8 6	...	...	...	...	...	...	...	...	...	...
J. E. Pickett	"	...	...	...	...	...	...	...	...	...	232	44	8 3½	96 8 6	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	635	24	10½	327 15 4	...	...	...	...	...	...	...	...	...	...
"	Selwyn	...	...	...	...	...	...	5,365	...	...	6,856	84	10½	327 15 4	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	3,441	72	1 7	382 13 4	...	...	...	...	...	...	...	...	...	...
David Watt	Ashley	...	...	...	...	...	...	...	...	...	1,354	24	1 7	382 13 4	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	7,858	42	1 6½	722 5 1	...	...	...	...	...	...	...	...	...	...
H. Maitland	Selwyn	...	...	...	...	...	...	...	...	...	1,509	31	1 6½	722 5 1	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	261	9	7 1	116 1 2	...	...	...	...	...	...	...	...	...	...
"	Geraldine	...	...	...	...	...	...	...	...	...	67	4	...	...	...	...	...	...	...	...	309 12 10	620 0 8	Also 27 miles standard traverse; 78 stones put in; 87,200 acres topographical sketching; sectional work intricate, entailing re-establishment of old survey marks.	
J. W. O'Brien	Ashburton	...	...	...	...	...	...	...	...	...	1,830	14	...	...	...	...	...	...	...	...	194 6 8	393 0 3	Open grass country. Resigned.	
"	Selwyn	...	...	...	...	...	...	...	...	...	3,906	19	11	393 0 3	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	2,722	17	...	...	...	...	...	...	...	...	...	...	...	...
G. H. M. McClure	"	...	...	...	...	...	...	...	...	...	4,212	23	1 5	375 2 9	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	1,078	29	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	69	25	2 11	10 0 0	...	...	...	...	...	...	...	...	...	...
J. S. Welch	Akaroa	...	...	133,000 0'12	67 17 7	45,741	2'13	407 5 8	...	...	...	1,511	21	3 10	339 8 0	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	261	9	...	...	...	...	...	...	...	...	...	...	...
James Hay	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
M. McNicol	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. Seaton	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. Houghton	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
E. S. Donald	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W. H. Grano	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. O'N. O'Donahoe	Ashburton	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
G. S. Anderson	Geraldine	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
C. E. O. Smith	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W. C. Wright	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
H. C. White	Waimate	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Contractors.																								
W. Darby	Akaroa	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	" (resurveys)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W. A. Harper (42)	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	" (resurveys)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
D. McGill	Ashburton	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
J. H. R. King	Geraldine	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	" (resurveys)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
G. L. Wilkins	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	" (resurveys)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
"	" (suburban)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
G. Duncan	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
J. Cumine	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
W. A. Harper (33)	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Dennison and Grant	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
A. J. Lewis	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
J. E. F. Coyle	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
F. Howden	"	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Means and totals	...	133,000	0'12	67 17 7	106,779	1'54	686 6 2	188,121	1'27	995 7 9	168,153	1994	1 6½	12,813 17 3	86	233	10 3	119 4 0	4½	26 15 0	113 14 6	768 12 3	16,128 6 8	

RETURN of FIELD-WORK executed by STAFF and CONTRACT SURVEYORS from the 1st July, 1880, to 30th June, 1881.  
PROVINCIAL DISTRICT OF OTAGO.

Surveyor.	District.	Topographical and Trigonometrical Survey.			Rural and Suburban.				Town Section Survey.				Native Land Court Survey.				Gold-Mining Survey.				Roads, Railways, and Water-races.			Other Work.	Total Cost of Surveyor and Party from 1st July, 1880, to 30th June, 1881.	Remarks.				
		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.	Acres.	No. of Sections.	Cost per Acre.	Total Cost.	Miles.	Cost per Mile.	Total Cost.	Cost.						
John Strauchon	Toetoes, Otara, Tuturau, Wyndham, Waikaka	...	d.	£ s. d.	15,607	129	1 0	777 19 1	...	...	...	£ s. d.	...	...	...	£ s. d.	...	...	...	£ s. d.	...	...	...	£ s. d.	950 1 7	3,752 acres, in 48 sections, wholly bush, involving large amount of bush-cutting; not in gold field. Cadet over one year, assisting eight months.				
"	Fortrose	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	9 1/2	17 5 5	168 8 6	...						
"	Mokoreta	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	3 14 0	...						
David Barron	Naseby, Gimmerburn, Kyeburn, Serpentine, Manorside, Long Valley, Mt. Buster, Upper Taieri, St. Bathans	...	...	...	4,800	37	1 4	320 0 0	...	...	...	...	...	...	...	...	120	13	20 0	120 0 0	...	...	...	...	932 18 11	Open country, within gold field; surveys much scattered, involving a great amount of travelling. Cadet over one year, assisting for six months.				
"	St. Bathans, Turnagain	60,000	1 2	300 0 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	183 18 11						
"	Naseby	...	...	...	...	...	...	...	2 1/2	9	20 0	9 0 0	...	...	...	...	...	...	...	...	...	...	...	...						
A. R. Mackay	Leaning Rock, Cromwell, and Bannockburn	...	...	...	940	15	2 6	117 10 0	...	...	...	...	...	...	...	...	45	3	8 0	18 0 0	9 1/2	3 10 0	33 5 0	...	823 6 5	Open country, in gold field; large and scattered district; surveys detached; over 800 miles in travelling were gone over during the year. No cadet.				
"	Nevis	9,551	2 0	79 10 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	258 8 1						
"	Poolburn, Blackstone, and Tiger Hill	76,000	1 0	316 13 4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...						
George Mackenzie	Hawkesbury, Moeraki, Kurow, Dunedin and East Taieri, Otago Peninsula, Waikouaiti, Mount Hyde, North Harbour and Blueskin	...	...	...	5,294	71	1 8	440 13 2	...	...	...	...	383	39	12 10	245 0 0	...	...	...	...	...	...	...	...	910 13 2	790 acres, very rough bush land, cut up into small areas; surveys scattered. No cadet. Not in gold field.				
"	Moeraki, Reidston, and Kurow	...	...	...	...	...	...	...	233	240	18 9	225 0 0	...	...	...	...	...	...	...	...	...	...	...	...						
W. D. B. Murray	Glenkenich	...	...	...	3,960	25	1 2 1/2	239 7 5	...	...	...	...	...	...	...	...	...	...	...	...	1 1/2	...	12 8 6	...						
"	Greenvale	...	...	...					...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...			
"	Chatton	...	...	...					...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...			
"	Wart Hill	93,600	0 7 5	285 17 0	...	...	...	...	...	...	...	...	121	31	40 0	242 9 5	...	...	...	...	...	...	...	...	894 11 11	Partly bush, partly in gold field. Cadet assisting.				
"	Tapanui	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...						
John Edie	Mount Hyde	...	...	...	443	34	5 0	110 15 0	...	...	...	...	...	...	...	...	...	...	...	...	3 1/2	...	10 0 0	...						
John Langmuir	Tuapeka East, Benger, Teviot, Weatherstone	...	...	...	497	39	4 4 1/2	109 12 10	...	...	...	...	3 1/2	44	22 9	50 1 6	...	...	...	...	40	12	14 4 1/2	28 15 0	1 1/2	...	6 14 6	...	79 7 8	In gold field. No cadet, left the service.
"	Hedgehope, Teviot, Lammerlaw, Beaumont, and Long Valley	191,049	0 6 7	537 12 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	732 15 10	Within gold field, open country; mining surveys at Bluespur, &c., very intricate. Cadet under one year's service assisting.				
"	Upper Wakatipu, Shotover, Coneburn, Skipper's Creek, Kawarau	...	...	...	3,738	20	2 2 1/2	416 11 6	...	...	...	...	...	...	...	...	50	9	21 1	52 14 4	...	...	...	7 4 6						
E. H. Wilmot	Martin's Bay	33,000	2 5	341 18 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	760 15 4		Open country, within gold field; surveys much scattered, and district very expensive to work. Cadet under one year's service assisting.			
William Armstrong	Glenomaru, Catlin's, and Warepa	...	...	...	5,121	39	2 2 1/2	572 16 4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	25 18 6	598 14 10	1,400 acres dense bush, balance open. In office seven weeks. No cadet.				
"	Pembroke	...	...	...	...	...	...	...	152	396	14 0	277 16 0	...	...	...	...	...	...	...	...	...	...	...	...						
John Campbell	Cromwell, Cardrona, Tarras, Wakefield, Lauder, and Lower Wanaka	...	...	...	441	18	5 2	114 0 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...			252 10 6	Open country, within gold field. No cadet, left the service.		
"	Leaning Rock	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20	2	20 0	20 0 0	...	...	...	...	...					
Means and totals	...	463,200	0 9 7	1,861 10 4	40,841	427	1 6 1/2	3,219 5 4	512	720	22 4	804 6 11	383	39	12 10	245 0 0	275	39	17 4	239 9 4	26	7 17 6	234 10 6	602 8 1	6,935 16 2					

PROVINCIAL DISTRICT OF SOUTHLAND.

Staff.	John Hay ...	Waiau, Lillburn, Takitimo, Alton, Monowai, Mararoa, and Jacob's River	32,960	1 6	216 14 0	6,443	57	2 0	651 0 4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	40 0 0	907 14 4	Triangles small; country irregular; bounded by bush. Rural surveys greatly dispersed. Some 45 sections, embracing 615 acres in bush, involving long traverses, &c. Cadet assisting.	
	William Hay	Hokonui, Mabel, Winton, Taringatura, and Invercargill	...	...	...	7,714	196	1 11 3/4	766 10 4	4 5	12	19 0	11 8 0	...	...	...	...	...	...	...	...	...	...	...	17 10 0	825 8 4		120 sections, embracing 1,470 acres, were in bush. In progress subdivision of 2,000 acres (bush); cost to date, £30. Cadet assisting.
	N. Prentice	Taringatura ...	...	...	...	1,885	54	1 6 3/4	148 6 1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	148 6 1	Party was broken up on 20th August, 1880.	
Temporary.	James Blaikie	Wairio, Wairaki, Mabel, and New River	...	...	...	10,962	78	1 3 3/4	700 6 10	...	...	...	...	...	...	...	...	...	...	...	2	3 10 0	7 0 0	57 9 8	764 16 6	Work scattered, and some 600 acres in bush.		
	H. E. Moors	Wairio, Jacob's River...	...	...	...	2,910	3	0 9	109 2 6	130 0	67	17 7	58 18 6	...	...	...	...	...	...	...	...	...	...	...	...	108 5 0	£59 16s. carried from last year. Party broken up middle of August, 1880.	
Schedule.	D. W. McArthur	Hokonui and Invercargill	...	...	...	1,428	5	1 7	113 10 1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	113 10 1	Comprising three saw-mill areas, and two purchases.	
	W. J. Hall	Winton	...	...	...	200	1	3 8	36 12 0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	36 12 0	Saw-mill area.	
	J. A. Robertson	Eyre, Centre Hill, Forest Hill, Hokonui, Invercargill, Jacob's River	...	...	...	3,327	17	1 5 1/2	242 4 6	...	...	...	...	...	...	...	...	...	...	...	12	1	14 6	8 14 0	...	250 18 6	Of these, eight sections, embracing some 460 acres, were in bush.	
	H. E. Moors	Jacob's River	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	91	6	11 5 3/4	52 4 0	...	...	52 4 0	All these areas in heavy bush (Longwood Reefs).
	F. A. Nutter	Hokonui	...	...	...	3,174	5	0 10 3/4	140 18 6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	140 10 6	Comprising four purchases and a 200-acre saw-mill area.	
	T. B. McNeill	Waimumu, Lindhurst...	...	...	...	385	2	1 3	23 19 2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	23 19 2	Purchases.	
	R. C. Taylor	Jacob's River, Longwood	...	...	...	359	3	3 7	64 7 6	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	64 7 6	Comprising two mineral and one saw-mill area (all in bush).	
Means and totals	...	...	32,960	1 6	216 14 0	38,787	421	1 6 1/2	2,996 9 10	134 5	79	17 9 1/2	70 6 6	...	...	...	...	103	7	11 10	60 18 0	2	3 10 0	7 0 0	114 19 8	3,436 12 0		





## ROADS TO OPEN UP LANDS FOR SALE.

EXTRACTS FROM THE REPORTS OF CHIEF SURVEYORS HAVING THEIR GENERAL OVERSIGHT,  
DURING THE YEAR ENDING 30TH JUNE, 1881.

## AUCKLAND.

*Takahue or Victoria Valley to Herd's Point, Hokianga.*—This line, although mentioned in the appropriations as two, is continuous between the above places. It has been completed during the year, and is now open for horse-traffic from end to end. It runs for the greater part of its whole length through Crown lands of very fair quality, and some of them of very superior quality, though nearly all forest. It has supplied a much-needed want, by giving a good line of communication between two settled districts hitherto only in connection by long round-about roads. The works are pretty heavy in places, owing to the fact of our having had to cross a range the saddle on which is 1,160 feet above the sea, but the grade of 1 in 10 has everywhere been maintained. The total length is 28 miles, costing, with inspection and part survey, £4,938, out of which  $21\frac{3}{4}$  miles have been made this year. A few slips have occurred, which it is only natural to expect, but these have now been cleared away.

*Kaihu to Maunganui Bluff.*—Owing to difficulties with the Natives, only  $8\frac{3}{4}$  miles, at a cost of £872 Os. 10d., have been constructed on this line, but that covers the most difficult portion, thus avoiding the fearful road over the bluff. The usual grade has been maintained right through; there is, therefore, now a good cantering road, where, formerly, the traveller had to drag his horse through mud knee-deep in winter, and nearly as bad in summer. The Native difficulty, which has hitherto prevented the completion of this line to the navigable waters of the Waioa River, consists in the demand for payment for the land taken by the road. Parore, the resident chief, is the cause of this, though all the other Natives will raise no objection to the road, and, indeed, would gladly assist in making it. It would be wrong in principle to pay for this road, which has been taken under the rights secured by the Native Land Act; whilst it is, at the same time, an important matter to get it opened, for, as soon as the surveys of Crown lands now going on are completed, a number of settlers will be ready to locate themselves there.

*Kaihu to Kaikohe (or Hokianga).*—This line is a branch from the above, and is intended to run through the Waoku plateau to Hokianga; the line has been explored, and about  $5\frac{1}{2}$  miles made. Here we adopted a different system, by actually making the road by paid labour, under the supervision of Mr. Palmer, or by letting it in piece-work. At present we are clearing a 12-feet track through the forest, making side-cuttings or bridges where necessary, so that it will be available for horse-traffic; but, as the sun is not let into it, of course the road will be very bad in winter. The line runs through very good lands, all of which will be soon taken up after the surveys have been completed. The cost of making this  $5\frac{1}{2}$  miles is about £240.

*Waikato River to Block VII., Awaroa.*—This road starts from Churchill, on the Waikato River, and is intended to open a large extent of Government land, which has hitherto had no outlet at all. In all 10 miles have been constructed, at a cost of £1,272 8s. 2d., most of which was absorbed by some heavy swamp-works near the river. The works have now very nearly reached the deferred-payment block, and should be continued to the West Coast, through the Government lands in that locality, all of which are suitable for settlement.

*Waikato River to Block XVI., Awaroa.*—On this line  $11\frac{3}{4}$  miles, at a cost of £1,793 10s. 7d., have been opened, whilst a grade survey is completed to an existing road running along the West Coast to Raglan. The works on this line and on the last mentioned have been done by day labour, under direction of Mr. Blythe, and the result proves that, when properly managed, an excellent bridle-road on permanent grades can be made at a cost of about £75 per mile. I trust that funds will be forthcoming to continue this road right through. It passes through some excellent lands, though a good deal broken; indeed, I do not know anywhere in the district where the quality of the soil is better. Work done during the season,  $6\frac{3}{4}$  miles, cost £1,016 18s.

*Te Puke Road.*—The portion made by the Survey Department runs from Waiari Stream to Atuaroa Village-site, a distance of 2.1 miles; cost, £819 10s. 5d. This has been constructed as a cart-road to afford access from the landing for the special settlers, whilst it is at the same time part of the main road from Tauranga to Opatiki. The work is much more expensive than any of the other lines which we have to do with, partly because of the deep swamps crossed, and partly because the people tendering seem to think that their profits ought to be much larger than elsewhere. As is usual in swamp-works, the embankments will require attending to to keep them up. The county and Constabulary have nearly completed this road into Tauranga, whilst during this next season I hope to see it continued in the opposite direction through Te Pukeroa Block, now under survey for sale.

*Ormond-Opatiki Road.*—This is the main road from Gisborne to the Bay of Plenty, and runs through the roughest part of the province. Under the energetic supervision of Mr. Barnard, 32 miles have been made, part being repairs to the old line, at a cost of £2,500. It was made in nine sections, two of which were let by contract, the others either by piece-work or day-labour under overseer. The last two sections of  $6\frac{1}{2}$  miles have only been cleared 21 feet wide, instead of the usual chain; this was done so as to make the money reach the Motu Bridge. The portion properly formed and cleared cost just a trifle under £100 per mile, which I consider very reasonable, considering the amount of cutting, number of culverts, and difficulty of the country. The

road as constructed will give access to the lands under survey in the Motu Valley. To continue it to Opotiki, or rather to Omarumutu, where it strikes the coast, will cost at least £3,000 more, and further will involve considerable deviations from the partly-formed line already existing.

*Te Komata Road.*—This line, although not strictly one of those undertaken to open up lands before sale, is under the supervision of this office. I have reported at length on the success attending the carrying through of this road, which, through the determined opposition of Tukumino (which had become historical), had been delayed for years. About  $2\frac{1}{2}$  miles are nearly completed as a dray-road. Where finished from the end of the county road at Hikutaia to Ohinemuri, there will be a coach road (summer) from the Thames, through Te Aroha, Hamilton, and Whatawhata, to Raglan. It is by no means therefore an unimportant link in one of the main lines of communication of the country. During the progress of the works on this line, Tukumino has often come down to protest against it, but, as he confined himself to doing so verbally, the work has not been interrupted.

The total mileage of roads made during the season is 63·85, at a cost of £9,287, or at £142 per mile for open and forest (excluding Te Komata). The bush-roads have cost about £167 per mile, the open £80 per mile. This includes bridges, all of which are suitable for carts, though the roads themselves, exclusive of Te Puke, are bridle-roads, of a formed width of about 8 feet.

The average cost is higher than last year, but it is also a fairer criterion as to what roads can be made for of the class we are constructing. We have no contracts on hand at present, but three different road-parties are at work on different lines. I believe this to be the cheapest plan, as contractors' profits are saved.

S. P. SMITH,  
Chief Surveyor.

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#### TARANAKI.

*East of the Waingongoro.*—1. At a cost of £5,390 15s. the whole of the roads,  $93\frac{1}{2}$  miles, in an area of about 50,000 acres, have been felled 1 chain wide, with a cleared track in most cases 16 feet, the remainder 12 feet wide; the rate per acre of this work is 2s.  $1\frac{1}{2}$ d. A very large proportion of the area is subdivided into sections varying from 50 to 100 acres, which has necessitated a very great mileage of roads, and, consequently, increased outlay. 2. In 40,000 acres west of the Waingongoro, and inland of the plains, 44 miles of road have been felled, and track cleared 16 feet wide, at a cost of £3,327 6s. 3d., equal to 1s. 8d. per acre. To complete the felling of the remaining roads in this locality a further expenditure of £1,650 would be required, making the rate per acre 2s. 6d.; this comparatively high rate is due partly to the fact of  $3\frac{3}{4}$  miles of road, at a cost of £186—which is entirely through Native land, but was necessary to get access to the Crown lands—being included, and also through the whole of the Eltham and Manaia Roads being felled 2 chains wide. I should state that the above refers to contracts completed during the twelve months; the actual amount paid during the year being £7,310 1s. 6d., the remaining £1,408 having been paid as progress-payments previous to 30th June, 1880. Mr. Robinson and myself have gone carefully into the question, and find that, where country is cut up into sections varying from 100 to 320 acres, similar to what is being done inland of Waimate at the present time, to fell the roads 1 chain wide, and clear a cartway 16 feet wide, the rate per acre would be about 1s. 8d.; for culverts and earthwork, taking a general average, 6d. more: making a total of 2s. 2d. to open them up for cart-traffic, and a further expenditure of 1s. 10d. per acre would bridge every stream. The cost of inspection for the year, taking overseer's salary, Mr. Robinson's travelling expenses and £50 of his salary, has only been  $3\frac{1}{2}$  per cent. on the actual amount paid during the year, which testifies to the economical manner in which work can be supervised under the present system.

THOS. HUMPHRIES,  
Chief Surveyor.

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#### HAWKE'S BAY.

I preface my remarks on the different blocks opened out by roads with a statement of the objects that have been held in view when deciding the character and extent of the works to be undertaken. The first aim has been to render accessible the greatest possible area that could be got at with the means at command. By the term "accessible" is meant the providing of a road for the settler through the forest, not the construction of a metalled dray-road. There can be no doubt that the formation of metalled roads through the forest affords the greatest facilities for settlement, and that such roads will pay for themselves; but the object when the construction of road-lines through the bush was first taken up was to render accessible each block as it was placed in the market. Three kinds of roads have been formed: 1. Dray-roads, which are cleared 66 or 40 feet in width, and formed 14 or 12 feet in the centre. All the work put on these roads is of a permanent character, and so far as it goes will last for several years. 2. Bridle- or pack-roads through hilly country. These tracks have been cleared 66 feet in width, and are cut along the sidings on the permanent grades. 3. The clearing of roads 1 chain in width. The advantages to be derived from first opening out the forest by means of passable roads before forming metalled roads are, that all additional work can be done by the settlers living on the ground, which will afford many of them employment; and that the average cost of the work will be reduced by one-third.

Puketoi Block, Tahoraiti District, 9,080 acres	£	s.	d.
open for sale on deferred payments. Roads			
felled, 1 chain, formed 12 feet .. .. 3½ miles, cost	1,127	2	0
Bridle-roads, felled 1 chain, formed for horse-traffic .. .. 3½ ..	747	16	0
Roads felled, 1 chain in width .. .. 7 ..	750	18	11
	<hr/>		
	14		8
		£2,625	16 8

—or about 5s. 9d. per acre. This block before being opened up was quite inaccessible and little known. The land has now been in the market twelve months, during which time 24 sections, containing 2,460 acres, have been taken up on deferred payments, and 22 sections, containing 94 acres, in the Village Settlement of Kumeroa, have been sold for cash. The value of the land disposed of is £3,500. In addition to the work already done towards opening up the land, the Road Boards at the expiration of every six months will be given one-third of each deferred payment, which, from the land already taken up will within ten years produce over £1,000. The Puketoi Block having been thrown open for selection on deferred payments, if the whole block is taken up at the upset price, no less a sum than £3,000 will accrue, to be spent on road-works. The bush-felling and formation were let out in 32 contracts.

Ahuaturanga Block, Woodville District, 8,700 acres, forest land.—Roads, felled 40 feet, and formed 14 feet .. .. 3 miles, cost	898	13	0
„ „ .. .. 2¼ ..	250	0	0
	<hr/>		
	5¼		8
		£1,148	13 0

—or about 2s. 8d. per acre.

This block has not yet been offered for sale. An additional sum of £700 has been asked for to complete the main road, and to fall the bush on the cross roads.

Ngamoko Block, Norsewood District, 3,992 acres, forest land. Roads, felled 40 feet, and formed 12 feet .. .. 2½ miles, cost	566	6	0
„ 66 „ .. .. 5½ ..	579	14	9
	<hr/>		
	8		9
		£1,146	0 9

—or, say, 5s. 9d. per acre.

Since the completion of the road-works these lands have been offered for sale, and the following transactions have taken place: Cash sales—15 sections, containing 978 acres; on deferred payments, 20 sections, containing 1,354 acres. From the land already taken up on deferred payments, there will be available within the next ten years for road-works over £500.

Makaretu Reserve, Ruataniwha District, 3,000 acres forest land, not yet surveyed. Bridle-road, felled 33 feet, 4½ miles, cost £478 1s. 8d. An additional sum of £250 to complete this line is required, which will amount to, say, 4s. 10d. per acre. The land is situated close to an extensive settlement, and will if offered on deferred payments be readily taken up.

Waitara Block, Maungaharuru District, 34,000 acres, open pastoral land. A bridle-road varying from 5 to 7 feet on the solid, and formed on the permanent grades, has been formed for 12 miles through the centre of the block, at a cost of £793 0s. 6d., or 5¾d. per acre. The expenditure on the Waitara Block has not been reproductive: there is a reason for this. The average market or selling value of the land is from 5s. to 10s. an acre. By the Land Act the Crown lands in Hawke's Bay cannot be sold for less than £1 an acre, whilst Crown lands of a similar character to the Waitara Block are sold at 5s. and 10s. an acre in Auckland District, and 10s. in Wellington. When the Waitara Block was prepared for settlement, pastoral lands in this district commanded a higher price than they do now. The works in the Ahuaturanga, Ngamoko, and Makaretu Blocks have all been let out in 63 small contracts, worth from £20 to £80 each. The cost of the construction of the roads mentioned above include all incidental expenses, such as exploration, supervision, and engineering work.

HORACE BAKER,  
Chief Surveyor.

#### WELLINGTON.

The following blocks were opened up by roads: Pahiatua, Kiwitea, and Akatarawa, near Hayward's Railway-station. The practical carrying out of the works was put in the hands of the County Councils.

In the Kairanga Block the road and drain works were executed under the control and direction of the District Engineer, Public Works Department, on lines set out and levelled by this department. In the Fitzherbert Block I directed the bush felling and stumping of 220 chains of road-line, to widths of a chain and half a chain respectively.

The road-line from the saddle at head of Akatarawa Stream to the Waikanae Flat was ex-

plored and graded by the department, and a bridle-track is now in course of formation by the County Council. The completion of this work will open out a direct line of communication between Upper Hutt and Waikanae on the projected main lines of road and railway from Wellington to Manawatu.

J. W. A. MARCHANT,  
Chief Surveyor.

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#### MARLBOROUGH.

During the year no roads for opening up Crown or other lands have been laid out by the staff. The Awatere Road Board, however, as you are aware, has surveyed and graded a portion of the main line of road up the Awatere Valley, about 7 miles in length, through the Awatere Shearing Reserve. Subject to my approval, specifications and plans have been prepared, and thirteen contracts for forming this portion of the road accepted by the Board. The supervision and final passing of these contracts will be carried out by myself, and the work will probably be completed in about five months.

H. G. CLARK,  
Chief Surveyor.

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#### WESTLAND.

1. *Wataroa to Waitangi Road*.—Length,  $5\frac{1}{2}$  miles. This work was placed into the hands of the Westland County Council in 1879, but was not completed until beginning of present year. It was let in two contracts: the first for felling and clearing, 33 feet and 20 feet wide respectively; and the second for forming, 9 feet wide, inclusive of construction of culverts, crossings, &c.

2. *Stoney Creek to Totara River* (being part of road named "Mapourika to Waiho" in the last estimates).—Length,  $1\frac{1}{4}$  miles. This also was a work carried out by the Westland County Council—authorized in 1879, but only completed during the past year; it, like the preceding one, comprises—felling, 33 feet; clearing, 20 feet; forming, 9 feet; with culverts, &c.

3. *Road round Mapourika Lake*.—Length, about  $4\frac{1}{2}$  miles. The felling, 33 feet, and clearing, 20 feet, of about  $3\frac{1}{2}$  miles of this road were done and paid for last year by the County Council of Westland out of county revenue, and a sum of £400 (*vide* your telegram of 23rd May, 1881) has been granted by General Government for forming, 9 feet wide, and metalling, 5 feet wide, where necessary, to make the road available for horse-traffic. A deviation, to avoid some bad ground and steep grades, I found, on inspection, to be absolutely necessary; and, owing to this, some delay in the carrying-out of the work has taken place; plans and specifications, however, will be ready for calling for tenders in a week or two.

4. *Mahitahi to Haast Road*.—Total length, 29 miles. The construction of this road Government kept in their own hands. Sections Nos. 4 to 12 inclusive—length, 9 miles—were finished last year; section No. 13—length, 1 mile—will be completed before the end of the present month, and the remaining 19 miles have still to be constructed. The work comprises—felling, 33 feet; clearing, 20 feet; forming, 9 feet; and metalling, 5 feet wide; with bridges, culverts, pitched crossings, &c., where necessary. At the mouth of the Waita River, two little contracts of  $\frac{1}{2}$ -mile each for rough bush-clearing, &c., to enable horses to pack up that river, were also completed during the year; but if my recommendations contained in my report upon main road through Westland, dated 8th June, 1881, are acted upon, this last mile of Mahitahi to Haast Road, at mouth of the Waita River, requires to be properly constructed. The survey of the whole of this road-line has been completed, and tenders for any part of it can be called for at a week's notice.

6. *Smoothwater Valley to Cascade River*.—Length, 12 miles. This road has been surveyed, graded, &c., ready for preparation of specifications.

GERHARD MUELLER,  
Chief Surveyor.

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#### SOUTHLAND.

*Seaward Moss Road*.—For about  $1\frac{3}{4}$  miles from the Invercargill—Bluff main road the newly-formed road has been in the hands of the Invercargill Road Board, under the supervision of whose engineer it has been formed. The work of gravelling it is only at present in progress. Owing to a portion of the road passing over heavy swamp it will be absolutely necessary to gravel it. The work of gravelling has lately been temporarily suspended, owing to the wet weather, &c. The portion of the road at the end of this section has been constructed for a distance of  $2\frac{1}{2}$  miles into the heart of the Seaward Moss. It was ditched on either side, and formed under the supervision of the Public Works Department a year or so ago. A good portion of this section will, I fear, require regular gravelling ere it will stand traffic. Meanwhile the completion of the section which is in the hands of the Road Board is most urgently required. I might state that all the sections belonging to the deferred-payment block, some time ago laid off on the margin of Seaward Moss, have been taken up, and settlement and drainage improvements, &c.,

are meanwhile taking place. The road will shortly be surveyed onwards towards Awarua Bay, and additional sections laid off alongside. At present the road, as a whole, may be regarded as formed but unmetalled.

JOHN SPENCE,  
Chief Surveyor.

## PROPOSED TRACK FROM CANTERBURY TO WESTLAND VIA MATHIAS PASS.

The CHIEF SURVEYOR to the SURVEYOR-GENERAL.

SIR,—

Chief Surveyor's Office, Hokitika, 10th February, 1881.

Referring to your memorandum, numbered and dated S.G. 3838-3, 22nd December, 1880, I have the honor to inform you that I have, during my stay in Canterbury, embraced the opportunity of calling upon Mr. Phillips, of Rockwood Station, and upon Messrs. Richards and Collins, then in the employ of Mr. Gerard, at Snowdon Station, for the purpose of getting information regarding Mathias Pass. Mr. Phillips never crossed the dividing range, and Messrs. Richards and Collins, after crossing the pass, followed the Hokitika River into Westland, which is probably the worst route by which an attempt of the descent into the low country could be made.

After collecting all the information I could, and getting a general description of the difficulties to be encountered along the route the above-named gentlemen travelled, (it took them five days to work their way down the Hokitika River,) I started for Hokitika *via* Mathias Pass. I left Mr. Roberts's camp on the morning of Monday, 24th January, camped near point marked P (see plan attached to report) on night of 24th, in north branch of Frew's Creek on 25th, one mile north of point F on 26th, at junction of Hokitika and Pass Rivers on 27th, a mile and a half south of point A on the 28th, and reached Hokitika on the evening of the 29th January. The weather was good, but the rivers were high, as they generally are, owing to the melting of snow during the hot summer months, and the fording consequently was difficult. The "working around," and over some of the precipitous bluffs also, which involved ascents of from 300 to 500 feet, gave us much trouble. Apart from these drawbacks, however, and the special treat of having had to live on a small piece of scone for nearly three days, while carrying heavy swags and traversing ground so difficult and steep that on several occasions first the swags and then the men had to be lifted up or let down from ledge to ledge, the whole passed off well. Our involuntary fasting was brought about by the stupidity of a man, who, in accordance with my instructions, was despatched from Hokitika to deposit the necessary supply of provisions at the east side of Pass River, near junction of Frew's Creek. On arrival at Pass River it appears he found the river too high, and, therefore, as we learned after arrival at Hokitika, contented himself with leaving the provisions on the west side of Pass River. When, on our descent to mouth of Frew's Creek, we found no provisions (our last bite of meat had been consumed that morning), nor any indication of the relief-supplies having been left on the opposite side, we did not attempt crossing the Pass River, but worked our way down on east side as best we could under the hungry circumstances.

Enclosed herewith please receive report on the practicability of constructing Mathias Pass Road; plan and section are attached to report.

I have, &c.,

GERARD MUELLER,  
Chief Surveyor.

J. McKerrow, Esq., Surveyor-General,  
Wellington.

### Enclosure.

REPORT by Mr. G. MUELLER, Chief Surveyor, on proposed Stock-road connecting Westland with Canterbury *via* Mathias Pass.

#### *General Description.*

THE road will commence at the south end of Koiterangi Road, will follow the banks of Hokitika and Pass Rivers; thence north of Frew's Creek along the southern slopes of Mount Meta Range to Mathias Pass; thence down the eastern slopes of Agassiz Range into Mathias River, and across the downs on east side of that river to the west end of the main Rakaia Valley Road.

On the Westland side of the Mathias Pass the road will traverse forest lands, and on the Canterbury side scattered light scrub for a few miles, and the rest grass country.

The total length of this connection (Koiterangi Road with Rakaia Valley Road) is 39½ miles; but 7½ of these require no construction whatever, while half of the remainder—namely, 16 miles—require to be formed only, while the other 16 (possibly 12 miles only) must be metalled in the usual way.

The road-construction along this line will vary with the nature of the ground to be traversed. Particulars are, as far as this is possible, given under next heading, and the estimates attached to the report are framed on these bases, *i.e.*, that the road proposed to be constructed is to be a stock-road, and that no expenditure beyond that required for making it a fair stock-road is to be incurred.

*Particulars of Ground to be traversed (vide Plan and Section attached).*

A to B—Length,  $3\frac{1}{2}$  miles.—The road will traverse river-flats and islands covered with light scorb or grass. No construction is necessary, but across one or two of these islands 20 chains of scrub-cutting may be required.

B to C—Length,  $1\frac{1}{4}$  miles.—Over or around a rocky gorge covered with a few feet of loamy soil, and involving clearing 33 feet wide, formation 9 feet, and metalling 6 feet wide.

C to D—Length,  $2\frac{1}{4}$  miles.—Over river-flats, &c., requiring neither forming nor metalling. As at A to B, a few chains of scrub- or bush-cutting may be required to keep clear of flood-water in back channels. Long Ford is a permanent and good ford, available, excepting during floods, all the year round.

D to E—Length, 6 miles.—Bush-clearing 33 feet wide, and forming 9 feet wide throughout. Metalling will be required here and there; total length of metalling probably not exceeding 3 miles.

E to F—Length, 2 miles.—Clearing and forming throughout, metalling of parts of it only. This section will also involve a little blasting where passing the gorge.

The upper ford of Pass River (at E) is one of the best fords of that river, practicable when most of the other fords are absolutely dangerous.

At F also is a ford, called Lower Ford on plan, which, however, is dangerous during the summer months, and hence the necessity of extending the road up to the Upper Ford. The road should of course be connected with the Lower Ford, so as to enable drovers, &c., to cross there whenever the state of the river allows of its being done. Travelling over an additional 4 miles of road will thereby be saved.

F to G—Length, 6 miles.—Requiring clearing and forming throughout, and metalling for the greater part of the distance. I am also prepared to meet with a few rocky points along the sidelings, where blasting will have to be done. The grade of this section will be steeper than that of any of the others; 1 in 10, I am sure, can be obtained; but I have hopes to be able to increase the distance, and so ease the grade proportionally.

G to H—Length, 2 miles.—Involving neither clearing nor metalling, but formation only. At a few points also a little rock-blasting will be found necessary.

H to I—Length, 3 miles.—These 3 miles comprise the most difficult and expensive work of the whole road, and involve rock-cutting to a more or less extent along their entire length. The whole of that portion of Agassiz Range is rock—the north side of Cannon Creek as well as the south side, and the former is far more steep and unfavourable to road-construction than the latter. Moreover the chances of taking the road down Cannon Creek are absolutely *nil*. This creek is for nearly two miles bounded by the perpendicular wall of a solid rock gorge, ranging from 300 to 1,000 feet in height. It is true we ascended in Cannon Creek, but would not have dared to do so if we had not been favoured with so long a continuance of fine weather. As it was we had to cross and recross this mountain torrent fifteen to twenty times, and with three solitary exceptions this could only be done by joining hands and getting what assistance and support were available to prevent being swept off one's feet and being carried amongst the seething waters. When examining Agassiz Range from below, where we camped in Mathias River, I had hoped to be able to descend from the saddle into the Mathias River in an almost southerly direction, so avoiding the rocky spur of Cannon Creek altogether, but, when I reached the saddle, and got a full view of the height of this rocky spur, which is running from it to the mouth of Cannon Creek on its south side, I at once abandoned that idea; nor do I now think it would be advisable to adopt that course, even if the formation of Agassiz Range was favourable to it. Mathias Saddle I found higher than has been reported; I make it 4,280 feet (aneroid observation), or about 680 feet above the snow-line on that side of the dividing range. To get below this line (below 3,600 feet) as soon as possible is of paramount importance, and that object could not be gained by following Agassiz Range in a southerly direction, as at first contemplated, while it will be gained most expeditiously by grading along the above-described rocky spur, at 1 in 17, or even less, if the ledges, of which there are many running around said spur, prove favourable. Both Mathias Saddle and Frew's Creek Saddle are sharp razor-back saddles, and the facilities to descend rapidly from these to below the snow-line are as good as they could be. The rock-cutting provided for on this section only covers a fairway of 7 feet, and stonewalling, wherever the precipitous nature of the sidelings calls for precautions being taken against accidents.

I to K—Length, 3 miles.—In my estimate for this section I have provided for rock-cutting for the greater part of its length, but I believe that more than half will prove to be ordinary sideling-cutting only.

K to L—Length, 2 miles.—Involving ordinary sideling-cutting only.

L to M—Length,  $1\frac{1}{2}$  miles.—Across Mathias River and over ordinary river shingle. The fords thereabout are numerous and easy, and no road-construction whatever will be required.

M to N—Length, 1 mile.—Around a rough and rocky limestone knoll, with holes (as they always occur in limestone districts) in abundance. Will require thorough good forming and, probably, metalling throughout.

N to O—Length, 6 miles.—Traversing well grass downs, with ground firm and solid. The ascents and descents at terraces and creek-crossings need be formed, and the road-line throughout should be pared, and tussocks, spaniards, and wild irishmen removed therefrom for width of, say, 10 feet.

*Alternative Lines affecting a Reduction in Cost of Construction. (Marked in green on plan.)*

F to G—Length,  $3\frac{1}{2}$  miles.—Ascending from mouth of Frew's Creek to Frew's Creek Saddle can be accomplished by a road with grade of 1 in 6 in  $3\frac{1}{2}$  miles, thus affecting a saving in construction of that section of £1,000. A grade of 1 in 6 cannot be called too steep for a stock-road, more especially when, as in this case, it is, to the stock driven over it, a descent and not an ascent. However, it appears to me that if this road is to be constructed at all it should be constructed with the view of its becoming ultimately something more than a stock-road, seeing it will be the direct route from Hokitika to the centre of Canterbury. If constructed with a grade of 1 in 6 now, the whole of the expenses incurred in connection therewith will be lost to the country, if hereafter it is necessary to provide for a better line of communication. On these grounds I cannot recommend that the line as proposed on page 3 (F to G) should be deviated from.

H to P—Length,  $4\frac{1}{2}$  miles.—Here again a saving of £2,150 might be effected by descending from Mathias Saddle into Mathias River by a grade of 1 in 15, terminating somewhere near point marked P, the nearest point to mouth of Cannon Creek, where a descent could be effected. From P to L and M the shingle river-bed might be utilized, thus doing away with the construction of about  $3\frac{1}{2}$  miles of road. In regard to this I desire to point out that the river-bed travelling between P and L is exceedingly rough, not over small shingle as south of L, but over big boulders, and up and down high and steep banks cut by Mathias River, which is running between P and L at a very rapid rate, and changing its bed with almost every flood. I am sure that if the experiment was made there would be an outcry raised before long to have the road from P to L constructed, and then it would traverse less favourable ground than if it had been carried along that sideling with easy grades, as shown on plan from H *via* I and K to L.

*Alternative Line insuring better Communication.*

D to Q—Length, 14 miles, namely, D to Long Ford,  $1\frac{1}{2}$ , and Long Ford to Q,  $12\frac{1}{2}$  miles.—The construction of this line would do away with the crossings of two formidable rivers—the Hokitika and Kokatahi—by leading into Town of Hokitika along Ross Road and across Kanieri Bridge. On the other hand, however, the cost of construction of stock-road *via* Mathias Pass would be increased by £1,860. I draw attention to this matter, not with the view of having the route adopted in preference to the one treated as on page 2 (A to B to C to D), but simply for the purpose of pointing out that the question of bridges over Hokitika River at or near Long Ford, and over Kokatahi River abreast of Koiterangi Road, need not enter into calculation; but that there is the far cheaper way of meeting the case, namely, by extending the Mathias Road from point D to point Q at Ross Road.

*Re Plan and Section attached hereto.*

The altitudes are deduced from my own aneroid observations, and, although I had no check readings taken at Hokitika, the weather throughout my journey had been so very even that they may be relied upon as correct within a trifle. They are marked in blue on plan and section, and those few altitudes which have not been actually observed, but roughly deduced from observation taken in the neighbourhood, have the word "estimated" noted below them.

The grades given on plan and section are the possible general grades of various sections treated of in my report. They do not represent the minimum grade in each section, seeing that is a matter which can be determined only by actual road survey; but they simply denote the grade obtainable between the respective altitudes recorded on plan and section.

*General Remarks re Proposed Road.*

A stock-road *via* Mathias Pass is practicable, and can be constructed for the sum noted in my estimate, and is desirable for many reasons, whether looked at from a Westland or Canterbury point of view, into the particulars of which I need not enter now.

However, I am anxious to guard against disappointment, and on that account beg to draw your attention to the fact that, owing to the high altitude of Mathias Pass, there is a probability of the road not being always available during the winter months—namely, from the end of May to the beginning of October—when, as a rule, the snow lies fast bound on the ranges.

As I have already stated in the report, Mathias Pass and Frew's Creek Saddle are exceedingly narrow, and consequently favourable ridges for crossing expeditiously. Mathias Pass is about 4 chains wide on the top, falling rapidly on both sides, and Frew's Creek Saddle only 2 chains wide, falling more rapidly still, and consequently, if a "block" by snow should occur, the shovelling aside of, to the utmost, 3 miles of snow (no more than has to be done at Arthur's Pass, Christchurch Road, many times almost every winter, owing to its being comparatively flat for a distance of 4 miles at an altitude of about 3,100 feet) from centre of road might be required, or else for that distance the stock may travel through or over the snow, and in that case the outside edge of the road may be staked out with guiding poles at suitable distances.

Mathias Pass, in regard to altitude, ranges after Arthur's Pass, but I have no hesitation in saying that, in spite of the difference in altitude, Mathias Pass would be selected in preference to Arthur's Pass, if the question of coach-road between Westland and Canterbury had still to be settled. The whole difficulty on Mathias Pass route is the pass itself, and that difficulty is

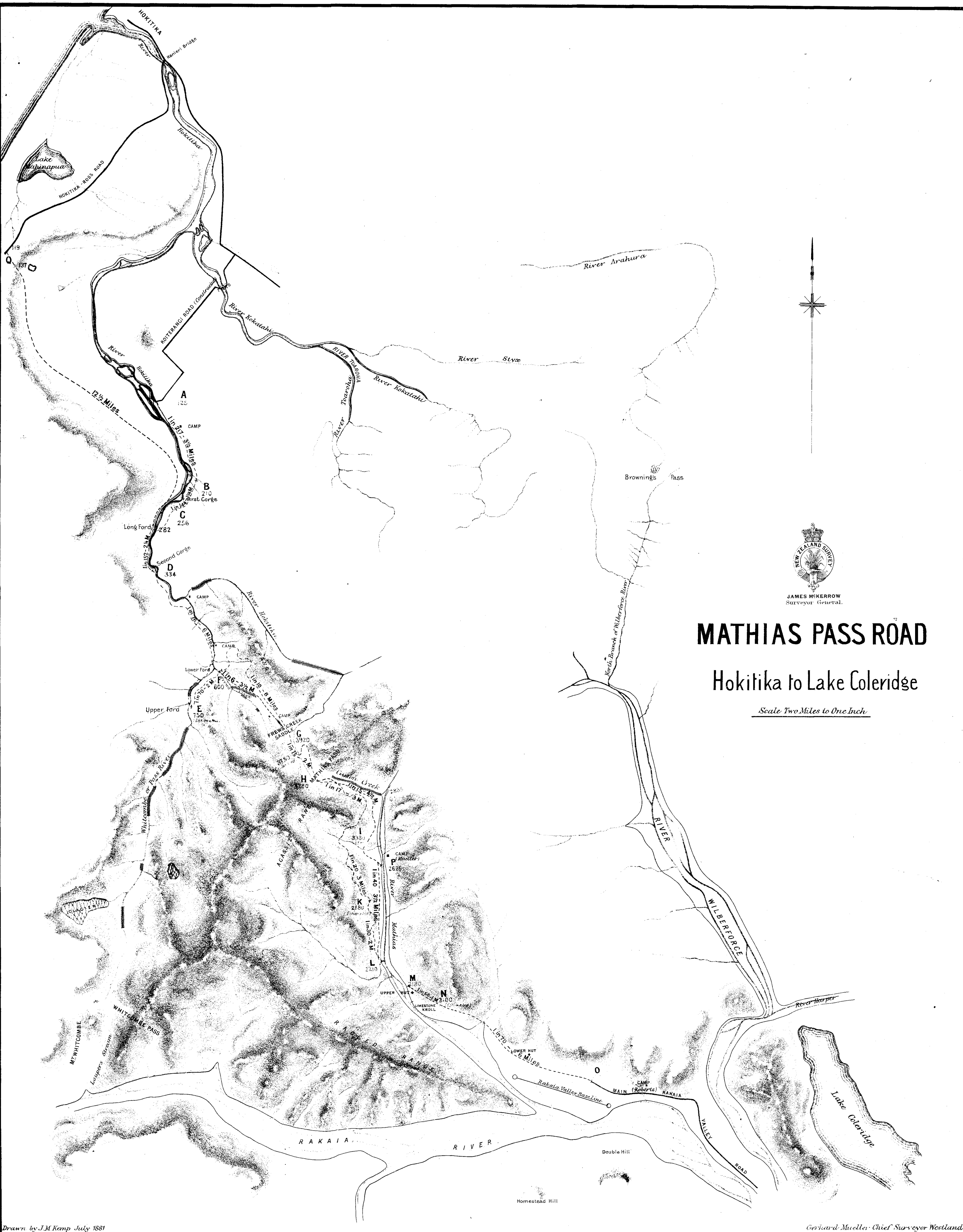
restricted to two or three miles, and from either side of this pass it is an almost steady incline to the terminal points Hokitika and Christchurch, quite unlike the ups and downs on the present Christchurch Road,—*vide* Hoho and Blue Spur Terraces, Arahura to Teremakau watershed, Waimakiriri cuttings, Cragie Burn, Porter's Pass, &c.

One more point, and that in reference to railway communication between Westland and Canterbury, I desire to draw your attention to. I have had an opportunity of glancing at the report and examining the plans of line *vid* Mathias Pass. The principal difficulty on that route was the descent from Mathias Pass Tunnel to the mouth of Cannon Creek. To effect this, a stationary engine was declared to be absolutely necessary. Now that I have travelled over the ground, I do not hesitate in affirming that a stationary engine is not necessary; that the railway can be taken down from mouth of tunnel to Mathias River-bed in a similar way to that in which I propose to take the stock-road down. I, of course, do not pretend to grasp the whole question of the merits or demerits of this route in all its bearings. I had neither opportunity nor leisure to consider it fully, and there may be very powerful reasons, apart from this question of stationary engine at mouth of Mathias Pass Tunnel, which may make it desirable that the idea of constructing a line along that route should be abandoned; but I do say that if the fact of a stationary engine being required has been given as the reason for condemning the Mathias Pass line (and this I am given to understand is the case), then the decision arrived at is wrong. Grading it at 1 in 50 will bring the line from Mathias Pass Tunnel to Mathias River-flat, in 16 miles, to almost abreast the limestone knoll at point M, by following around the large creek south of L.

I do not think the Government, for some time to come, will be in a position financially to undertake a work of that sort, but I considered it my duty, in case this matter should be taken into consideration with the view of giving it immediate practical effect, to draw your attention to the fallacy of the assumption that the Mathias Pass route could not be worked without a stationary engine.

G. MUELLER,  
Chief Surveyor.





JAMES MCKERROW  
Surveyor General.

# MATHIAS PASS ROAD

## Hokitika to Lake Coleridge

Scale Two Miles to One Inch





JAMES McKERROW  
Surveyor General

## Section

### SCALE

Horizontal 2 Mile }  
Vertical 1600 Feet } to One Inch

## MATHIAS PASS ROAD

Hokitika to Lake Coleridge

