

1878.
NEW ZEALAND.

THE
SURVEYS OF NEW ZEALAND

(REPORT BY THE ASSISTANT-SURVEYOR-GENERAL, ON)

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

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

SIR,—

General Survey Office, Wellington, 3rd September, 1878.

In the absence of the Surveyor-General, I have the honor to forward the Annual Report and out-turn of work of the Survey Department for the twelve months ended 30th June, 1878.

The main divisions of the work are Standard, Trigonometrical and Topographical, Sectional Surveys, Native Land Court, and Native Land Purchase Surveys.

The Standard Survey.

The selection and observation for true meridian of all the initial stations of Meredional Circuits had been made during the previous year, with the exception of the circuits of Collingwood and Amuri in Nelson Provincial District. These two meridians have been astronomically determined by Mr. Marchant. From Collingwood he extended bearings to the country around and on to Nelson. From Amuri he established and observed a line of Main and Reference Stations across the island to Ahaura, and another line north to St. Arnaud Station at the head of Buller Valley, also lines to junction and check with the Canterbury and Marlborough extension of standard bearings. The check on the Canterbury line showed a discrepancy of only 10" between the observed and computed convergence. These operations, and a few stations established in the early part of the season by Messrs. Thompson and Sinclair, complete the standard work for Nelson. Mr. Marchant also laid down chain standards at Collingwood and Amuri.

In Canterbury Mr. Adams extended standard bearings from Woolshed Hill up the Rakaia Valley to Lake Coleridge, then on through the Acheron Pass and along the West Coast Road to Bealey, and from Magog across the Waimakariri and back country to a close with one of Mr. Kitson's stations at Mairaki Downs. This circuit enclosed 853 square miles and closed to 4".

Similarly, another circuit of standard bearing, originating at the Meredional Station, Gawler Downs, was extended over the Upper Ashburton and across the back country to the Rakaia and down it to Double Hill and back to origin, enclosing 547 square miles, with an error in closing of 4". A line of coastal bearings was also run from Timaru to Mount Herbert, Banks' Peninsula. In reporting on this work Mr. Adams says:—"During the time I was at Timaru I obtained some excellent observations of Mount Cook, which, with others observed before and since, will enable me not only to calculate the position and height of Mount Cook, but to connect the East and West Coast surveys, and the observation will also afford a very reliable value of the longitudes of my West Coast Astronomical Stations."

Regarding the three West Coast Astronomical Stations established by Mr. Adams, it ought to be mentioned that, in computing the latitudes from his observations of stars N. and S. of zenith, there was an accordance within the limits of a few seconds of all the observations excepting those into which the star Alpha² Centauri entered. The discrepancy was so constant for all the deductions from that star, that the only solution of the difficulty was to assume that the declination, as given in the Nautical Almanac, was about 14" in error. It was rather bold for a surveyor with an eight inch Transit Theodolite to challenge the accuracy of the Nautical Almanac. But Mr. Adams did so by addressing the Greenwich and Melbourne Observatories on the subject, and he had the gratification of receiving letters both from Sir George Airey and Mr. Ellery confirmatory of his finding, that the declination of Alpha² Centauri was in error, as given in Nautical Almanac for 1877 and previous years.

The other extensions of standard bearings in Canterbury were conducted during the early part of the season by Mr. Kelleher, from Mount Horrible to Burke's Pass, and from Timaru to Waimate, and up the Waitaki, and to the head of the Hakateremea Valley.

Mr. A. D. Wilson, a very pushing and energetic officer, began and completed the whole of the extensions throughout the Marlborough circuit. During the season he established 49 main and 43 reference stations; the closes on his own work were never more than a few seconds out. His checks and closes on the Nelson and Amuri meridians we cannot pronounce upon, as the longitudes of the initial meredional stations of circuits have yet to be determined.

In Westland Mr. G. J. Roberts, under the very great difficulties of a bush country and a wet climate, which laid him up for a time, extended bearings on from Koiterangi, Geodesical Station to Geodesical Station, Ahaura. Simultaneously, under the direction of Mr. Mueller, he observed the triangles of a major-triangulation, which binds together with indisputable accuracy all the survey points north from Hokitika to Ahaura. The computation of convergence between the meridians of the two initial stations, determined astronomically respectively by Messrs. Adams and Browning last year, differs only 10" from the observed difference by Mr. Roberts.

In Taranaki Mr. Humphries and his assistants, Messrs. Bird and Skeet, jun., completed the selection and observation of a line of standard stations through the forest from Waitara, east of Mount Egmont to Hawera and on to Carlyle. They also extended the meridional line on to the Waingongoro River; but at this point had to desist on account of Native opposition.

This standard work is the most technical branch of the department, and a report of it cannot be of much interest, except to a few; but it is due to those gentlemen who have been engaged on it, and whose skill and enthusiasm in their profession have secured such excellent results so far, that their labours should not pass unnoticed or unrecorded.

The object of the work is to afford starting and closing points for the triangulation to follow, and to have the range or bearing of the lines of all surveys within a circuit referable to the same true meridian, and so secure, with the aid of triangulation, that the surveys of the colony, even in their most isolated and fragmentary parts, will be recordable as we proceed, and that ultimately as the interspaces are filled in, we shall have one harmonious whole, with neither overlaps nor gaps to perplex the settler or the Government. The standard bearings were observed with eight, nine, and ten inch theodolites and have been extended nearly as much as will be required for many years. Two parties at this class of work will suffice for the current year.

Trigonometrical and Topographical Surveys.

Under this general designation an area of 5,422,735 acres has been surveyed, of which 1,249,440 acres is major triangulation extended partly over the mountainous bush country on the East Coast, Poverty Bay, by Mr. Barnard, and partly from Waikato triangulation, towards Taupo, by Mr. Cussen; the latter work had to be stopped, owing to the opposition of the Natives, who destroyed stations, and drove the survey parties off. These works will be resumed and completed on the next favourable opportunity. Their object is to afford a groundwork for the survey of large Native blocks, which, so far as the work done has allowed, have all been properly based on and connected to the trig. points.

The minor triangulation in Auckland has also been principally in the interests of Native surveys, and for the most part has been a breakdown from the major triangles covering the same ground.

The minor triangulation in the other parts of the Colony has proceeded independently from bases measured specially for the several surveys. A considerable proportion of this work in Canterbury and Otago has been done by contract, and with very satisfactory results. Triangulation, from the very nature of the work, is very difficult to check while the work is proceeding, and it can only be safely entrusted to surveyors of well known established skill and probity. The operation consists of the measurement on the ground of an initial base of two or three miles, and from it the extension over the country of a series of triangles, all the sides of which are computed successively the one from the other. It is manifest that, if in any portion of the angular work errors should arise, it will be propagated on through all the part that succeeds, and the computed distances will be erroneous. The most efficient field check on this is the measurement on the ground of a side of one of the triangles remote from the initial base. If the work has been correctly done, the computed length of this, the base of verification, should, theoretically speaking, agree with the distance as measured on the ground. In practice, however, there are errors which cannot be eliminated, and a limit of error has to be allowed. In the specification for the Canterbury work this was fixed at two links per mile. Each contractor, towards the completion of his work, had to declare the computed length of one of his lines; these, afterwards measured by the Inspector, Mr. Kitson, with a Chesterman's steel tape, standardised to the chain length laid down at the Christchurch office, the corrections for slope and temperature being made, the following results were reported:—

Contract Surveyor.	Declared Distance Links.	Measured Distance Links.	Diff. Links.	Accumulated Rate of Error Per Mile.	Area Triangulated Acres.
T. Maben ...	19785.26	19783.97	1.29	4 inches.	192,640
J. A. Connell ...	19982.2	19983.92	1.72	5.4 inches.	413,518
J. E. F. Coyle ...	22190.4	22190.05	0.35	1.0 inch.	306,000

Comparing the distances of the sides common in adjacent triangulations, there is from the Opihi to the Waimakariri a continuous line of minor triangulation, stretching over the Canterbury plains for 90 miles. This comprises the work of Messrs. Sealey, Coyle, Maitland, Kitson, and Maben, established on five independent bases. The errors reduced to any one of these bases as a common base vary from one-third of a link to two links per mile. Mr. Connell's work is detached from any of these triangulations, and cannot yet be compared with them.

Another contract trigonometrical survey is in course of execution by Mr. James Mitchell, over the Hakateremea and adjacent country, 170,000 acres have been completed in the field, but, as the maps are not all in yet, it does not count as completed work, and is not included in the year's returns. These surveys have been nearly all done with Troughton's five-inch theodolites, a small portion only having been done with a six-inch.

In Westland an area of 429,440 acres has been triangulated with a six-inch theodolite; the base of verification gave an error of only 6.1 inches per mile, an accuracy which would be commendable under any circumstances, but all the more so in this case, where there were many difficulties to be overcome. The other triangulations do not call for special remark. They have all the one object of establishing accurate points every two or three miles over the districts suitable for settlement. To one or more of these points every property is referred in distance and bearing, and the co-ordinates on the meridian and perpendicular of its connecting traverse tabulated, so that a clear record can be kept, and in the event of obliteration or challenge of original boundaries, they could be re-established with certainty within narrow limits of error.

The topographical survey, which is usually carried on simultaneously with the trigonometrical survey, furnishes maps of the country to a scale of two inches to the mile, on which the streams, forests, hills, and general configuration of the country is shown; the altitudes of ridges, saddles, and valleys given, and the best through lines for roads are also indicated. There are many parts of the Colony where the topography is both very vague and inaccurate, and which must be brought under trigonometrical and topographical survey at the earliest opportunity. These topographical surveys are invaluable as the groundwork of selection maps, and enable an intelligent selection of town sites and other public reserves to be made. There is much complaint made in various quarters as to the meagreness of information at land offices; the dissatisfaction is due very much to the want of these maps.

Settlement Survey (Rural and Suburban.)

This is the actual measurement and pegging on the ground of the areas which are to be occupied by the settlers. The other operations of survey already referred to are mainly useful only in so far as they are contributory to this end. 901,312 acres have been marked off into 5,692 sections of an average size of 158 acres each. The average cost per acre varies much in the several provincial districts, ranging from 11½d. in Canterbury to 2s. 9½d. in Westland. The main causes of difference are, as between grassy open districts and those covered with bush, and also as to whether the surveys are isolated or associated together in large blocks. The adverse circumstances are in full play in Westland and Nelson, and the most favourable natural conditions are in Canterbury, where, by grouping selections, it has been found practicable to let large contracts for sectional survey at prices ranging from 5d. to 11½d. per acre. The more isolated work, or the work abutting on old and doubtful boundaries, requiring time and investigation, has been reserved for the Staff Surveyors. The survey operations in Canterbury have, consequent on the extensive purchases of Crown lands there, become of much greater magnitude than in any other Provincial District, and will continue so for the next two years until the arrears are worked off. Mr. J. H. Baker, the Chief Surveyor in charge of this branch of the Department, has been most indefatigable and unwearied in his efforts to cope with the great demands of the position. He has, with the aid of his principal assistants, Messrs. Kitson, Williams, Shanks, Trudgeon and Wright, succeeded in getting this branch of the Department into good working order. In the Appendix will be found at greater length Mr. Baker's account of survey proceedings in Canterbury.

The average cost per acre of this class of surveys for the twelve months has been considerably less than for the previous year, and it will still become less as system and organisation become more perfect.

Town Surveys.

1,273 acres have been marked off into 1,630 allotments, at an average cost of 15s. 1¾d. per allotment; these have principally been extensions of surveys in townships already established.

Native Land Court Surveys

Aggregate an area of 44,213 acres. The purpose of these surveys is to enable the Native owners to have their titles investigated before the Native Lands Court, and to secure a title enabling them to deal with their lands. The department leaves the execution of these surveys as much as possible to private authorised surveyors, who make their arrangements for pay direct with the Native owners or their agents. When Government undertakes the surveys a very long time often elapses before payment is made, at present a sum of about £3,440 is owing. This is not likely to be paid until the land is sold by the Natives. But the repayment is deemed sure some time, as Government has a lien on each block of land for the cost of its survey. During the year 148,826 acres were surveyed by private authorised surveyors. The plans and field work of all have to pass before the Deputy-Inspectors, so that the Natives run no risk of being imposed on by bad survey. There is also a scale of survey charges in force for the payment of such private surveys of Native lands. All these Native surveys have been done on true meridian, properly connected, and magnetic surveys with their uncertainties are of the past.

Native Land Purchase Surveys.

An area of 517,636 acres comes under this designation, and comprises Native Lands either purchased or under negotiation by Government. It is acquired in large blocks, and the survey usually consists of a circuit traverse of boundaries, connected and checked to triangulation carried on simultaneously. The latter secures that the blocks will be correctly located on the maps of their districts, and also that the sectional subdivision of the land may proceed immediately on its being handed over to the administration of the Land Boards.

Gold Mining Surveys.

These consist almost entirely of auriferous quartz lease applications—the maximum area allowed is 16½ acres. They are invariably situated in mountainous districts difficult of access. The cost of survey is necessarily high per acre. It is refunded to Government from the deposit made with the application. The other goldfields' surveys of extended claims and alluvial workings which are soon worked out, and not leased, and therefore not recorded, are not enumerated.

Road, Railway, and Water Race Surveys.

The road surveys during the year have been principally in exercise of the right reserved in certain Crown Grants, of taking a road within five years of the issue of the grant, or, in the case of Native lands, of ten years, provided the area so taken does not exceed the 5 per cent. of land reserved for the purpose. There are considerable difficulties in making the selection of roads after the country is occupied, as it frequently happens that the best line runs through cultivations and cuts off corners of fields, and otherwise upsets the plans of settlers. The system which is now in force is to survey the roads first, and then so far as the different land systems will permit, to design the sections so as to front on to them. In this way there is no after interference with settlers. The great main arterial road lines of the Colony may be said to have been nearly all selected, and also formed, more or less. What remains to be done, more especially by the sectional surveyor in laying off the country, is to see that the most practicable cross roads are selected. Where the country is hilly or undulating, and covered with bush, but still suitable for agricultural settlement, the roads are, if necessary, graded. In districts where the country is only fit for grazing, the best natural lines following the course of the valleys or ridges, or mountain spurs, are adopted. A prolific source of what may be relatively termed absurd roads arises from Land Boards requiring mountainous country to be cut up into small sized sections.

Detention by Native Opposition.

The direct loss attributable to this is stated at £736 11s. 8d. Indirectly the loss from destruction of trig. stations, disturbance of season's work, and the provoking annoyance of stations unflagged, and pegs pulled up, is very material, although it cannot be definitely stated. A good deal of this is done by stealth, but not always. In those cases where the perpetrators were known, it was deemed best by the Native Office rather to stop the surveys than force them against the opposition made by the Natives.

Miscellaneous Work

Comprises all work such as cannot be enumerated in the columns of regular survey work, and consists of services in connection with goldfields, Native Land Courts, reports, and selection of land for settlement, and all other incidental survey work of the Colony.

Land Transfer Surveys.

These are conducted entirely by private authorised surveyors, and come before the Survey Department for check and approval before final acceptance by the District Land Registrars. Their number is steadily increasing, and their regulation and control, so as to keep the Government free from granting titles on inaccurate data, is attended with considerable trouble. This arises mainly from the distances and areas of re-surveys disagreeing with the original Crown Grants. In such cases the questions arise as to whether the original or the re-survey is in error, and if the boundaries in existence really represent the ground as originally marked off. The original records being usually very meagre, and in many cases entirely lost, the investigation requires much skill and patience, and sometimes a reference to the ground by an officer of the survey staff. In town and suburban land, where there is a continual interchange and subdivision going on, it has been found absolutely necessary in some cases to have permanent marks laid down at intersections of main streets and roads to which all the adjacent surveys shall be referred. By this means, as the land is brought under the Act and new titles issued on the surveys so referred, the difficulties and uncertainties will gradually vanish. It is manifest that these land transfer surveys require on the part of the private practitioners great skill, care and integrity. The Chief Surveyors, on whom devolve the trouble arising from careless surveying, have in several instances suggested the propriety of exercising greater stringency in the authorisation of surveyors.

Office Work.

The usual routine of office work is the check of the plans as they come in from the surveyors, their reduction and entry into the working plans and Record Maps of the Survey Office, and into the Selection and Index Maps of the Land Offices, the preparation of Crown Grants, Agricultural and Mining Leases, Memorials of Ownership, and other instruments of title. Some of the Land Offices were, and still are, very deficient in maps showing clearly the areas selected and those still open for selection.

It is the duty of the Survey Department to supply these maps, and much has been done during the year to bring up the heavy arrears of this work. In the Auckland Provincial District, which is under the able direction of Mr. Percy Smith, selection maps have been prepared for the Land Board, old provincial and confiscated land plans, numbering 3,000, have been registered and compiled on Index Maps, the preparation of the plans for the memorials of ownership for the whole Colony, and issued by the Native Department, and the ordinary work of the office. Also, a set of maps on a scale of an inch to the mile has been prepared of all the counties in the Provincial District.

In the Nelson Provincial District Mr. Browning has had the survey information gathered together as much as possible from the meagre materials at his command, and it is a good beginning of what is yet requiring to be done to bring the maps up to date. This district, from its being cut into three main divisions by natural barriers, requires sets of maps at local offices, such as Reefton. The dissatisfaction which has been expressed on the Nelson South West Goldfields, with regard to the Nelson Land Board, is due in a very considerable measure to the want of good district maps and delays in surveys. This is in course of rectification.

In the Christchurch office there are still very great arrears of work—regular dead work, which has been accumulating for years and cannot be hurried through, but must be taken patiently and methodically. The triangulations approved, revised, and recently executed, are a sound basis on which to plot, record, and check this arrear work. It will be seen, from Mr. Baker's report that, notwithstanding the difficulties he enumerates, very good progress has been made with the plots of old work. The system, or rather no system, of allowing surveyors to go on for long periods without plotting up their work is simply an encouragement to slovenliness and a premium on bad survey.

Maps of the Counties of Mongonui, Hokianga, Bay of Islands, Whangarei, Hobson, Rodney, Waitemata, Eden, Manukau, Coromandel, Thames, Piako, Waikato, Waipa, Raglan, Taranaki, Tauranga, Whakatane, Cook, Wanganui, Kaikoura, Westland, Waitaki, Waikouaiti, Maniototo, Vincent, Lake, Peninsula, Taieri, Bruce, Clutha, Tuapeka, Southland, Wallace, have been prepared at the District Survey Offices, and are now on exhibition at the head office. They show the lands sold, leased, reserved, and open for sale, also boundaries of ridings, positions of towns, roads, railways, and generally give such information as would be of service to a stranger in ascertaining where land is for sale. The County Maps of the Provincial Districts of Canterbury and Nelson will be gone on with also. A copy of the map of each county enumerated has been given to its Council. The copies of County Maps at Head and District Survey Offices will be posted up periodically, so that they will always afford a very good idea of the tenure of the public estate.

Publication of Maps.

A General Land Tenure Map of the North Island was issued early in the year, and a fresh printing, corrected to date, is about to issue. A land tenure map of the Middle Island is also on the stone and will issue in a few days hence.

A very great want in the Colony, and one that will be more and more felt, is the need of published maps of its settled districts. A beginning has been made, and it will be continued, of bringing out maps of surveyed districts to a scale of one inch to the mile.

Photo-lithographic Department.

In the return of office work appended, it will be seen that 195 independent plans, or subjects, have been disposed of, and 59,118 copies struck off. The greater number of these are sale maps of townships and of blocks of rural land. There are also included the maps provided for the census, for some of the Parliamentary Blue Books and other miscellaneous purposes. This branch of the Survey Department, in pursuance of arrangements made by the Honorable the Minister of Public Works, will be shortly generalised and extended, so as to undertake all the photo-lithographic work of the Government.

The Work of the Current Year.

This will mainly consist of working off the arrears of sectional surveys, which aggregate 1,610,000 acres, part of this is not arrears in the sense of land purchased and remaining unsurveyed, but is land that the Land Boards have recommended to be got ready for disposal. The arrears in all the districts, with the exception of Canterbury, are well in hand. There, an arrear of 765,934 acres begins the season. But of this 349,051 acres are let in survey contracts. Contracts yet to be let, 200,000, and the staff will dispose of 120,000, so that a total of 669,051 acres ought to be completed by 30th June, 1879.

Triangulation and Topographical Survey

Will also be gone on with in those districts, where settlement is soon to follow. That in hand amounts to 1,804,000 acres.

The Surveyor-General has arranged to return to the Colony early in November. In London he ordered, from Troughton and Simms, the necessary instruments required for the determination of latitude and differences of longitude. Should they arrive in time, the work of determining the position of the principal survey points of the Colony, more especially those cut off from trigonometrical connection by high mountain ranges, will be gone on with and probably completed within the season.

Mr. Thomson also availed himself of the opportunity of getting from the Astronomer Royal a copy of the actual observations taken at Greenwich of the moon's right ascension, of even date with his own observations at Rockside, Dunedin, September, 1869, to June, 1871. The detail of this will be found in *New Zealand Gazette*, No. 46, 20th May last.

During the year several valuable officers left the service to engage in private business as surveyors and estateagents. The great increase in the value of land has induced so much subdivision of property as to cause much demand for the services of surveyors and draughtsmen. It must also be mentioned that several officers were allowed to leave, whose services were not deemed profitable to the Government. The department is getting rapidly recruited by lads, born, bred, and educated entirely in the Colony, and not a few of them are already well forward in the department, and have become mainstays in it.

I have, &c.,

JAMES MCKERROW,

Assistant-Surveyor General.

APPENDIX A.

RETURN of FIELD WORK EXECUTED by STAFF and CONTRACT SURVEYORS in the COLONY of NEW ZEALAND, from 1st July, 1877, to 30th June, 1878.

Provincial District.	Chief Surveyor.	Major Triangulation.		Minor Triangulation without Topography.		Topographical and Trigonometrical Survey.		Rural and Suburban Section Survey.			[Town Section Survey.			Native Land Court Surveys.			Native Land Purchase Surveys.			Gold Mining Surveys.		Road, Railway, and Water-race Surveys.		Detention by Native Opposition or other cause.	Miscellaneous Work.	Total Expenditure on Field Work for period.	Total cost of Office Work and Inspection for period, including Land Transfer Work.	Remarks.
		Acres.	Cost per Acre.	Acres.	Cost per Acre.	Acres.	Cost per Acre.	Acres.	Average size.	Cost per Acre.	Acres.	No. of Allotments.	Cost per Allotment.	Acres.	Average size blocks.	Cost per Acre.	Acres.	Average size blocks.	Cost per Acre.	Acres.	Cost per Acre.	Miles.	Cost per Mile.	Cost.	Cost.	£ s. d.	£ s. d.	
Auckland	S. P. Smith	1,249,440	$\frac{1}{4}$ d.	378,204	$1\frac{5}{100}$ d.	979,726	$\frac{84}{100}$ d.	124,067	148	$1\frac{1}{2}$	281.2	505	$15\frac{1}{6}$	25,295	575	$6\frac{1}{2}$	237,942	9914	$2\frac{1}{2}$	17.5		88	$10\frac{1}{8}$	$533\ 1\ 0$	$2,113\ 11\ 11$	$20,795\ 12\ 1$	$5,903\ 7\ 9$	106,000 acres reconnaissance survey also executed. 113,258 acres Native Land Court surveys paid for by claimants not included.
Taranaki	T. Humphries			68,200	$1\frac{4}{10}$			36,534	100	$2\frac{1}{4}$	31	52	$13\frac{1}{3}$	2,660	886	$2\frac{1}{11}$	42,083	3,507	$7\frac{1}{2}$			$20\ \frac{5}{10}$	$10\ 6\ 0$	$25\ 0\ 0$	$216\ 14\ 0$	$7,749\ 15\ 9$	$1,681\ 5\ 10$	Includes 13,300 acres old rural and suburban survey, which had to be revised—cost $1\frac{1}{10}$ per acre.
Hawke's Bay	H. Baker			81,257	$2\frac{6}{10}$	96,400	1	14,903	131	$2\frac{1}{4}$	$2\frac{1}{2}$	1	$\pounds 6$									$25\ \frac{4}{10}$	$6\ 13\ 0$		$367\ 7\ 1$	$3,193\ 18\ 3$	$1,685\ 4\ 9$	35,568 acres Native Land Court surveys done by private surveyors at cost of Native claimants, besides the area shown in this return.
Wellington (Crown lands)	H. Jackson							151,112	275	$1\frac{1}{4}$	$517\frac{1}{2}$	191										$41\frac{1}{2}$	$12\ 5\ 9$	$33\ 0\ 0$	$41\ 13\ 4$	$9,429\ 4\ 10$	$3,245\ 15\ 1$	Three-fourths rough forest country
„ (Native lands)	G. W. Williams					164,070	$1\frac{1}{2}$	33,365	161	$1\frac{1}{9}$				15,103	244	$1\frac{1}{4}$	233,531	116,765	$1\frac{1}{2}$					$145\ 10\ 8$	$355\ 0\ 0$	$5,643\ 5\ 4$	$1,142\ 12\ 0$	Mostly forest country.
Marlborough	H. Clarke							618	38	$2\frac{1}{8}$										56	$23\frac{1}{10}$	$4\ \frac{1}{10}$	$11\ 0$			$1,087\ 17\ 7$	$848\ 15\ 1$	Also 5,000 acres Topographical, at $\frac{3}{4}$ d. per acre; and standard survey over the whole district.
Nelson	J. S. Browning			16,509	$3\frac{1}{2}$	166,411	$3\frac{1}{2}$	16,303	100	$2\frac{1}{5}$	75	217	$15\frac{1}{12}$							1018	$10\frac{1}{9}$	$66\ \frac{5}{10}$	$8\ 3\ 0$		$2,106\ 17\ 1$	$11,964\ 8\ 4$	$2,453\ 11\ 9$	Forest mostly.
Westland	G. Mueller			459,227	2	64,721	2	6,728	58	$2\frac{1}{9}$										319	$22\frac{1}{6}$	$33\ \frac{5}{10}$	$8\ 9\ 3$		$256\ 18\ 5$	$6,007\ 18\ 0$	$3,068\ 8\ 3$	All forest.
Canterbury	J. H. Baker			500,706	$\frac{3}{4}$	800,824	$1\ \frac{9}{10}$	350,483	144	$0\frac{1}{11}$																$28,655\ 14\ 6$	$9,200\ 3\ 10$	Includes revision of 343,000 acres triangulation at $\frac{3}{4}$ d.; 2,289 acres rural sections at $2\frac{1}{4}$ per acre.
Otago	W. Arthur					314,000	$\frac{9}{10}$	85,556	172	$1\frac{1}{7}\ \frac{3}{7}$	110	291	$22\frac{1}{12}$							337	$13\frac{1}{3}$	$35\ \frac{1}{2}$	$1\ 19\ 1$	$50\ 0\ 0$	$1,553\ 11\ 7$	$8,518\ 11\ 11$	$4,662\ 17\ 6$	
Southland	John Spence			60,000	$\frac{2}{8}$	23,040	$4\frac{1}{2}$	81,643	164	$1\frac{1}{4}\ \frac{4}{6}$	256	373	$12\frac{1}{11}$							135	$37\frac{1}{2}$				$395\ 12\ 0$	$5,294\ 11\ 0$	$2,648\ 12\ 2$	One party was engaged on Stewart's Island, where the work was very intricate and expensive, being mostly in bush.
TOTALS AND AVERAGES		1,249,440	$\frac{1}{4}$ d.	1,564,103	$1\frac{1}{2}$ d.	2,609,192	$1\frac{1}{2}$ d.	901,312	158	$1s.\ 3d.$	1,273	1,630	$15\frac{1}{12}$	43,058	395	$11\frac{1}{2}$ d.	513,556	13,167	$2\frac{1}{2}$ d.	1,761	$15\frac{1}{5}$	$314\frac{1}{5}$	$\pounds\ 8\ 17\ 4$	$\pounds 786\ 11\ 8$	$\pounds 7,407\ 5\ 5$	$\pounds 108,345\ 17\ 7$	$\pounds 36,545\ 14\ 0$	

APPENDIX B. DISTRICT OFFICE WORK.

DISTRICT.	CROWN GRANTS.		LAND TRANSFER PLANS.		NATIVE MEMORIALS, &c.		LITHO. MAPS PUBLISHED.	
	No.	Area, acres.	No. Passed.	No. placed on Cert. Title, &c.	No.	Area, Acres.	No. of Plans.	No. of Copies.
Auckland	333	82,752	21	379	222	682,811	...	...
Hawkes Bay	99	38,514	9	390	...	...	...	...
Taranaki	301	2,930	19	not enumerated	...	...	...	...
Wellington	423	97,423½	39	874	...	...	...	...
Nelson	308	not enumerated.	46	63	...	...	...	...
Marlborough	66	4,901	55	57	...	...	...	...
Westland	381	13,025	49	161	..	...	2	700
Canterbury	1284	not enumerated.	58	1,734	...	...	...	...
Otago	952	...	24	not enumerated	...	...	48	12,000
Southland	425	...	not enumerated.	320	...	...	...	...
Totals	3572	...	...	...	222	682,811	50	12,700

HEAD OFFICE—PRINTING DEPARTMENT.

	Number.	Copies Printed.
Maps, Photo-lithographed (1 plate)	56	23,738
" " (2 plates)	17	4,400
" " (6 plates)	1	300
" " (9 plates)	1	300
Maps printed from Drawings on Stone	8	2,208
" " " Paper	17	8,024
Circulars and Forms, various sizes	45	7,448
Totals	145	46,418

Maps mounted on Paper or Cloth, 2,500.

APPENDIX C.

Extracts from the Report of Mr. BAKER, Chief Surveyor, Canterbury, to the Surveyor-General.

Sectional Surveys.

"Although I have given due prominence to the necessity of putting applicants in possession of their boundaries at the earliest possible dates, I regret that I could not get as much progress made as I could have desired, owing, (1st) to the want of the necessary reliable triangulation; (2nd), to the accumulation of unplotted work from previous years, which prevented, and, in some districts, still hinders me from going on with these Surveys, having no plots of the work already done, and (3rd), to the changes which, with your concurrence, I have found it necessary to make in the staff.

Considering these drawbacks, I may venture to hope that the progress made will be deemed satisfactory.

In all 2444 sections, containing 350,483 acres have been surveyed, and the plans properly drawn, with tabulated meridian distances, are in the office and, when checked and recorded, the Crown Grants can be at once issued.

Of the area completed, 1,100 sections, equal to 230,986 acres, have been surveyed by contract, at an average cost of 8d per acre; 1,344 sections, containing 119,497 acres, being done by the staff officers at a cost of 1s. 6½d. per acre; of course, between the relative cost of the staff and contract work no comparison can fairly be instituted; the sections done by the staff officers being often isolated, and involving much more loss of time in doing them and making the necessary trig. connections; for instance, the work on the peninsula surveyed by the staff costs from 1s. 1d. to 9s. 4½d. per acre, owing to the heavy bush cutting and intricate road traverses. One group of 10 sections, containing only 2,140 acres, done by Mr. Brodrick, necessitating, owing to the road traverses, no less than 730 pegs being driven, the position of each being duly recorded and shown on the plan, averaging 73 pegs to each section.

On the other hand, the surveys done by the contractors are of considerable areas, nearly all in open country, and generally contiguous. The former contract price for this latter work was 1s. 3d. per acre; the plans to be completed by the office."

Arrears of Unplotted Surveys.

"Shortly after I took charge of this department I reported to you the enormous arrears of sections returned as surveyed, but not plotted, or only partially so, and for which it was impracticable to issue Crown Grants. Since then I have had proper sectional record books prepared, and returns made of all sections surveyed, but unplotted; and I regret to state that these arrears are much greater than I at first supposed, as I have found sections surveyed in March, 1872, not yet plotted.

On the 1st January, 1877 there were, so far as I can judge, not less than 4,725 sections, containing 437,674 acres, returned as surveyed, but which were unplotted. It is necessary to call your attention to this matter, as the plotting of these arrears causes an immense amount of work, both in the Christchurch and Timaru offices. There is no clear index in the field books by which these sections can be traced, and the field notes are so imperfect that it often takes an officer days to elucidate and plot a survey which should be done in a few hours. Several of the surveyors who did the work had left the staff and the country before I joined the department, so that no reference could be made to them.

Two of my most experienced officers have been engaged nearly continuously on this work, 2,072 sections, containing 193,317 acres, having been plotted and the areas calculated; in addition, Mr. Wright at Timaru has also 954 sections, equal to 70,268 acres, plotted, but the area not yet determined.

Of these arrears there remain to be plotted, therefore, 1,699 sections, embracing 194,089 acres, of which I estimate that at least 50,000 acres will require revision in the field.

Referring to the old contracts, 1,013 sections, containing 154,721 acres, of the Messrs. Sealey, in South Canterbury, have been plotted by Mr. Wright, who states that "the work plots very fairly, but the compilation on the block sheets shows that, as a rule, the measurements are somewhat long, when applied to the trig. survey." The balance of this contract amounting only to about 13,000 acres has also been plotted, but, although many of the sections close in themselves, their position is doubtful, and they have, therefore, been returned to Mr. H. Sealey for revision. The Messrs. Sealey have given every assistance, and if any line was at all doubtful have at once gone into the field to revise their work.

Of Mr. Bain's contract I cannot report favorably, although only about 68,000 acres in extent, but costing £6,919; it has been in progress for more than 5 years, not one third of the work being yet plotted. The field books in many places are nearly unintelligible, and some of the surveys having been done by incompetent assistants. A large proportion is quite unreliable.

I regret to have to make such unfavorable comments, but it is only fair to myself to state that the time unavoidably absorbed in the endeavour to clear up this old work is very great; in fact, in some instances, having no plots to guide me to what has been done on the ground, I am quite unable to go on with new surveys.

The urgent necessity of keeping the staff officers engaged in placing new purchasers in possession of their boundaries has prevented me having this work—and some done by staff officers, which is equally unreliable—revised, or rather re-surveyed; the latter method will, I am compelled to state, be the cheaper and most effective in the majority of the cases in question.

I do not enter into the matter of these unplotted arrears with any intention of implying censure on the officers who formerly had charge of the plotting in the Christchurch and Timaru offices. In my opinion they had infinitely more work than they could be expected to overtake; the consequence being that, whenever any difficulty arose in the plotting of a survey, owing to some error on the part of the surveyor or other cause, the plots were put aside to be cleared up at some future time, when the surveyor

might happen to be in the same locality, no record was kept of these imperfect surveys; and thus the mistakes made, and which will continue to be made under any system short of absolute perfection had been left to accumulate *for years*, with no guide or clue to their number or extent, except when they were brought to light by some owner of a section requiring his grant, which we find cannot be issued.

You will, I am sure, perceive that the difficulty of unravelling and correcting these mistakes is no small matter, and I cannot, while the rush of work lasts, pretend to do it in a more thorough manner than by revising urgent cases as they may arise. Mr. Wright, at Timaru, is, however, an able assistant, and during the past year has worked most energetically in clearing up the arrears of plotting in the the Southern district.

Surveys Requiring Revision.

During the past year the closures obtained between the old and the new surveys, both in the minor triangulation and the sectional work, have enabled me to form a better estimate of the extent of revision which will probably be necessary.

As previously reported to you, I found that upon attempting to re-calculate the triangulation north of Waipara, and between the Rakaia and Rangitata, west of the railway, discrepancies existed so serious, and suggesting the necessity of such extensive revisions, that I considered it better to do the whole again. This course, meeting with your approval, has therefore been adopted, the country north of the Waipara being completed under a contract to Mr. Connell, and the triangulation now being re-observed by Mr. Maitland is almost completed.

The re-observations of the former contract disclose errors ranging from 2 to 17 links per mile in the length of the sides of triangles, and in the latter contract the base line from which the work was calculated, and which, of course, was supposed to have been carefully chained, shows a discrepancy of 13 links per mile. Elsewhere the errors are from 7 to 21 links per mile, whilst the angles differ from 1 to 5½ minutes.

In another place angles supposed to have been observed could not be seen, a high hill intervening; in fact, the errors disclosed in every part of the work suggesting that the survey was not honestly done. As a triangulation it is useless.

The remainder of the Canterbury triangulation is, I believe, fairly accurate, the re-calculation and closures not showing any great discrepancies, with the exception of a few triangles in the southern portion, which, I think, can be re-observed without revising the whole work.

In the course of the present year I hope to clear up all differences of such of the old triangulation as is available for use. Anent sectional surveys on the Canterbury plains—in the Ashburton district for example—I find that a comparison of three surveyors' work under the present system, with that of the old *regime* surveys, shows that differences exist in the chained distances given on the old plans, ranging from two to 30 links per mile, in nearly every instance the old chainage being too short, showing that the surveys were done with a chain longer than the standard, the effect being—and I think it will be found a general rule on the plains—that the Crown Grantees really occupy a larger area than is shown in their titles.

In the Waitaki district the same rule obtains; the distances given on the plans being short of the true distance on the ground, from eight to 16 links per mile. The chains here used having also evidently been too long.

In the cases just quoted the angular work appears to have been well done, the largest discrepancy found being seven minutes.

In the Waipara district, so far as I have been able to compare the old with the new work, larger differences arise, but, as yet, I have insufficient check to warrant my drawing definite conclusions, further than that in rough country the effect is the reverse of that on the plains. In the district under notice the distances given on the old plans are too long, and this result might be expected to occur on hilly ground, unless the surveyor was very careful to make sufficient allowance for the difference of hypotenuse and base caused by the inclination of the ground; if this is not done the distances given on the map are greater than they really are on the ground.

I think that on the plains—except such districts as Rangiora and Ellesmere, where great discrepancies are known to exist, which, up to this time, I have had no opportunity of examining—the sectional surveys are sufficiently reliable not to need revision, save such revision naturally arising as the land is brought under the provisions of the "Land Transfer Act."

On the Peninsula much graver errors occur, errors which a comparison of the old and new surveys shows can but be the product of gross carelessness in execution. In some instances I find errors of 187 links in 25 chains; 188 links in 46 chains; 130 links in 21 chains; and to take the last case brought under my notice, in which two sections are Crown Granted as one, in a rectangular block, 2,440 by 1,850 links, the following differences occur on the ground:—One side of the section is right, measuring 1,850 links, and one angle is as it should be, a right angle; the other sides measuring respectively 2,407 and 2,466, instead of 2,440, and 1,811 in lieu of 1,850, the angles being 1 deg. 51 min., 2 deg. 34 min. and 8 min. wrong; two of the boundary lines instead of being straight, have bends in them.

Land Transfer Surveys.

The work under this branch of the department is so rapidly increasing that the work of supervision required to be undertaken by this office is already largely augmented.

If the Land Transfer Surveys are to be, as they should be, systematically checked and properly recorded, more precautions than have hitherto been taken will have to be observed, in order to guard against the receipt of incorrect work from the licensed surveyors.

Plans on a large scale—to show clearly the subdivisions in each original section or sections held under one title or certificate—must be prepared from the Land Transfer Surveys.

During the past year 58 subdivisional plans have been checked and passed through the office, embodying 1,703 separate allotments; the number of certificates of title prepared in duplicate being 1,734, and the plans drawn thereon 3,468.

Mr. Davis, the officer at present responsible for the proper check of the plans sent in by the licensed surveyors under the Act, has, in compliance with his instructions, submitted such plans to mathematical reduction. He reports that—

“The character of the work done for the Land Transfer Office by licensed surveyors has steadily improved since the institution of mathematical tests in January, 1876, and this improvement has been very evident during the past year. Some of the incompetent surveyors have ceased to practice, and others who still send in work find great difficulty in getting it passed. A continuance of the same system will soon weed out the few surveyors who still send in indifferent or negligent work, and so correct the grave error committed in former years of licensing men not properly qualified.”

That such a check was really a necessity cannot fairly be denied. Plans have been sent in by licensed surveyors which, if the titles had been issued upon the plans as submitted, would have probably involved the Government in serious losses.

A plot sent in by a licensed surveyor showed errors at the rate of 30 links per mile in the chainage of the street lines of an important borough. Other surveys have been forwarded from Timaru and elsewhere disclosing mistakes of from 11 to 37 links in the mile.

A grant from the Crown (of 170 acres) bearing, on the face of it, evidences of incorrectness, the ground in occupation was re-measured and found to contain 178 acres; eight acres more than granted.

A plan of a subdivision of an estate, into allotments not exceeding half-an-acre, although showing no serious discrepancies, was proved, by inspection on the ground, to have errors of from two to 30 links in the sides of separate allotments. A certificate of title under the Act conveys 30 links of a property belonging to an adjoining holder, which 30 links happens to include the best part of the latter's house, as well as the ground.

It is well known that some of the surveys of suburban properties, subdivided into allotments for auction purposes, are made by unqualified surveyor's assistants in the most careless manner. The land not being under the Act, no kind of supervision or check takes place, the solicitors preparing the conveyances from the sale plan. In time, portions of these estates are sought to be brought under the Act, and, knowing the kind of surveys which have been made, we are obliged—before complying with applicant's request—to demand re-surveys; this course, although a necessity, often deterring owners from proceeding further.

In cases where, under similar conditions, re-surveys were formerly not insisted on, or rather were not demanded, we find that the certificates of title will not agree with the land as occupied; as, in the example I have last quoted, the certificate of title, when the measurements were reproduced on the ground, gave the holder 30 links of his neighbour's land, on which was the greater portion of his house. This is, perhaps, the worst instance that has come under my notice, but the correction of less serious overlaps may prove very costly to the Government, especially in this district, where land is becoming so valuable.

Another source of fruitful errors in the boundaries of Land Transfer Surveys is the slight and totally insufficient way in which the subdivisional surveys are pegged on the ground. Often the pegs are 3 in. by 1 in. battens, driven only a few inches; these soon get knocked out, and are frequently put in again at random; the buyer of the subdivisional allotments fencing his land by them is afterwards much disappointed to find that his fences and his title do not agree.

In such circumstances I can but repeat my recommendation, that more stringent rules respecting surveys under the Act, and a rigid examination of the qualifications of surveyors, or assistants working under it, should be adopted, and also that licensed surveyors certifying to surveys which may be afterwards proved incorrect shall be removed from the list.

Although, in rejecting surveys and insisting upon absolute proof of capability before forwarding surveyor's certificates for your approval, I have been accused of private motives and personal animosity. I trust that the somewhat delicate position in which the discharge of this duty necessarily places me, and the apparent impossibility of carrying out any needed reform without incurring such imputations, will be properly estimated, and that the result will show that I am actuated purely by a desire to improve the quality of the work, and, as a sequence, to prevent the serious losses in which the Government will inevitably be involved by guaranteeing titles under the Land Transfer Act, without an insistance of the correctness of the surveys, upon which such titles are based.
