ANNUAL REPORT

OF THE

MINISTER OF LANDS

OF THE PROVINCE OF

BRITISH COLUMBIA

FOR THE

YEAR ENDING 31ST DECEMBER

1921

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by WILLIAM H. CULLIN, Printer to the King's Most Excellent Majesty.
1922.

VICTORIA, B.C., March 22nd, 1922.

To His Honour WALTER CAMERON NICHOL,

Lieutenant-Governor of the Province of British Columbia.

MAY IT PLEASE YOUR HONOUR:

Herewith I beg respectfully to submit the Annual Report of my Department for the year ending December 31st, 1921.

T. D. PATTULLO,

Minister of Lands.

VICTORIA, B.C., March 22nd, 1922.

The Honourable T. D. Pattullo,
Minister of Lands, Victoria, B.C.

SIR,—I have the honour to submit the Annual Report of the Department of Lands for the twelve months ending December 31st, 1921.

I have the honour to be,
Sir,
Your obedient servant,

G. R. NADEN,
Deputy Minister of Lands.

PART I.

DEPARTMENT OF LANDS.

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DEPARTMENT OF LANDS.

REPORT OF OFFICE STATISTICS.

VICTORIA, B.C., March 2nd, 1922.

G. R. Naden, Esq.,
Deputy Minister of Lands, Victoria, B.C.

SIR,—I have the honour to submit the Annual Report of the Lands Branch of the Department of Lands, covering the administration of Crown lands in the Province during the year ending December 31st, 1921.

The attached statements contain a complete summary of the business done in the disposition of Crown lands and the various transactions connected therewith under the "Land Act" and sundry other Acts coming under the jurisdiction of this Branch—namely, pre-emptions, lands sales and leases, Crown Grants under the various methods of alienation, coal licences and leases.

The applications filed under the "Soldiers' Homestead Act," the "Soldiers Homestead Act Repeal Act," and the "Townsite Proportionate Allotment Act" have also been completed.

Final action was also taken with regard to the cancellation of outstanding agreements for sale of town lots and subdivided lands, and the cancellation of a large number of these delinquent agreements has taken place.

An auction of these resumed properties in the Point Grey Municipality and the City of Vancouver was held in September last and a considerable quantity of it sold. The balance is being disposed of by private sale according to the upset price established at said auction.

The administration of lands forfeited under the "Taxation Act" has proved a considerable addition to the responsibilities and duties of the staff of the Department.

I have, etc.,

H. CATHCART,
Superintendent of Lands.

PRE-EMPTION RECORDS, ETC., 1921.

Agency.	Pre-emption Records.	Certificates of Improvements.	Certificates of Purchase.
Alberni	16	2	12
Atlin	..	..	1
Cariboo	207	20	117
Cranbrook	31	12	13
Fernie	1	..	2
Fort Fraser	308	15	56
Fort George	322	12	71
Golden	3	3	14
Kamloops	30	9	13
Lillooet	146	45	162
Nanaimo	5	3	7
Nelson	13	2	11
New Westminster	3	1	2
Nicola	22	8	19
Omineca	96	9	74
Osoyoos	18	6	11
Peace River	54	5	1
Revelstoke	1	1	2
Similkameen	47	28	26
Skeena	50	2	29
Slocan	10	1	5
Stikine	..	..	..
Vancouver	97	33	49
Victoria	7	..	451
Yale	8	..	4
Totals	1,495	217	1,152

LAND-SALES, 1921.

	Acres
Surveyed (first class)	3,017.90
„ (second class)	25,456.08
	28,473.98
Unsurveyed	8,594.90
Total	37,068.88

CROWN GRANTS ISSUED, 1921.

Pre-emptions	461
"Pre-emptors' Free Grants Act"	184
Purchase	133
Mineral	265
"Soldiers' Homestead Act"	123
Town lots	112
Reverted lands (other than town lots)	227
Reverted town lots	65
Reverted mineral	64
"Townsite Proportionate Allotment Act"	22
"Dyking Assessments Act"	2
"Schools Act"	3
Soldier Settlement Board	16
Land settlement	7
Miscellaneous	15
Total	1,699
Applications for Crown grants	1,600
Certified copies	9

TOTAL ACREAGE DEEDED.

Pre-emptions	87,246.00
Mineral claims (other than reverted)	9,279.93
Reverted mineral claims	2,487.00
Purchase of surveyed Crown land (other than town lots)	17,078.24
Purchase of reverted land	6,635.15
Purchase of unsurveyed Crown land	35,463.44
Lands conveyed to Soldier Settlement Board	2,839.00
Lands Crown granted to Land Settlement Board	2,133.00
Total	163,161.76

REPORT ON COAL LICENCES, LEASES, ETC., 1921.

COAL-PROSPECTING LICENCES.

Number of licences issued, 160: area, 102,400 acres.

COAL LEASES.

Number of leases issued, 6; area, 3,840 acres.

SUNDRY LEASES.

Number of leases issued, 104; area, 17,577 acres.

PRE-EMPTIONS INSPECTED IN 1921.

Alberni	95
Atlin	...
Cariboo	58
Cranbrook	65
Fernie	8
Fort Fraser	340
Fort George	155
Golden	38
Kamloops	217
Lillooet	19
Nanaimo	1
Nelson	4
New Westminster	5
Nicola	4
Omineca	107
Osoyoos	27
Peace River	22
Revelstoke	1
Similkameen	31
Skeena	194
Slocan	4
Stikine	...
Vancouver	429
Victoria	7
Yale	12
Total	1,843

STATEMENT OF REVENUE (VICTORIA OFFICE ONLY).

Months.	Under "Land Act."								Under "Coal and Petroleum Act."					Sundry Receipts.		Total.
	Land-sales.	Rent of Land.	Survey Fees.	Crown-grant Fees.	Lease Fees.	Certificates of Improvements.	Pre-emption Records.	Royalty.	Licence Fees	Lease Rentals.	Lease Fees.	Penalty.	Lieu of Work.	Maps, Blue-prints, etc	Miscellaneous.	
1921.																
January.....	$ 8,570 87	$ 1,209 60	$ 39 25	$ 1,055 00	.....	....	$2 00	....	$ 1,200 00	$ 4,494 60	....	$ 25 00	$ 100 00	$ 235 85	$ 85 34	$ 17,017 51
February.....	6,303 99	2,043 55	64 00	895 00	$ 30 00	....	....	....	900 00	1,279 19	$ 5 00	....	200 00	254 90	28 80	12,004 43
March..	14,770 98	1,805 90	227 00	1,760 00	10 00	....	2 00	....	900 00	226 50	....	....	100 00	307 30	36 25	20,145 93
April.....	18,038 96	3,901 85	179 00	1,205 00	25 00	$2 00	....	....	2,874 83	3,152 18	5 00	....	600 00	1,531 54	25 01	31,540 37
May.....	10,182 78	2,625 30	259 00	1,505 00	15 00	....	....	...	3,800 00	689 15	25 00	....	.. ...	1,123 21	212 91	20,437 35
June.....	9,097 80	4,853 10	114 25	1,865 00	20 00	....	....	...	2,500 00	827 10	....	25 00	50 00	244 65	43 90	19,640 80
July.....	5,974 82	6,807 35	.....	855 00	10 00	....	2 00	....	500 00	13,451 78	10 00	50 00	200 00	257 55	544 38	28,642 88
August.....	12,274 26	2,109 95	.....	1,480 00	20 00	....	....	...	1,800 00	250 20	....	25 00	450 00	264 47	2,520 16	21,194 04
September ...	153,096 53	3,070 47	85 00	700 00	20 00	....	....	$ 15 40	900 00	4,683 31	....	75 00	300 00	148 25	5,966 15	169,060 11
October.....	2,574 64	2,223 25	54 75	1,190 00	15 00	....	....	181 95	900 00	2,421 46	5 00	25 00	50 00	391 76	1,593 04	11,625 85
November....	9,779 68	3,482 20	39 50	890 00	15 00	....	....	20 80	2,600 00	3,095 30	5 00	....	50 00	786 29	95 25	20,859 02
December....	3,643 92	1.502 43	422 55	1,205 00	5 00	....	....	15 47	1,100 00	945 02	....	....	50 00	699 06	103 86	9,692 31
Totals....	$254,309 23	$35,634 95	$1,484 30	$14,605 00	$185 00	$2 00	$6 00	$233 62	$19,974 83	$35,515 79	$55 00	$225 00	$2,150 00	$6,224 83	$11,255 05	$381,860 60

SUMMARY.

	1909.	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.
Pre-emption records.....	1,620	2,049	2,383	3,655	3,855	4,304	2,277	1,167	824	823	1,752	1,624	1,495
Certificates of Improve't.	289	439	624	715	962	1,002	665	465	541	379	326	328	217
Certificates of purchase..	4,363	9,031	7,141	5,065	3,640	1,805	990	729	778	592	747	1,067	1,152
Crown grants	1,714	1,572	2,566	2,737	2,110	1,376	718	847	1,167	1,512	1,806	1,827	1,699
Total acreage deeded....	326,229.54	300,587.79	524,325.99	253,143.60	390,036.32	245,244.78	75,225.00	98,452.00	187,111.64	260,321.40	512,844.87	215,364.50	163,161.76
Coal prospecting licences.	692	145	2,223	2,003	1,090	545	198	120	71	72	112	275	160
Sundry leases..	83	92	121	47	46	51	38	86	73	83	51	113	104
Coal leases.....	.. ..	....	.. ..	75	207	71	29	31	7	3	1	12	6
Cash received	$4,148,403.44	$3,190,416.21	$3,526,544.61	$2,525,497.29	$946,944.23	$589,687.36	$126,308.28	$159,213.65	$194,435.17	$369,392.51	$251,471.25	†$428,431.64	$381,860.60
Letters received.....	25,798	37,188	41,946	43,302	31,738	30,287	19,151	13,779	15,780	22,500	*53,835	32,180	28,951
Letters sent.....	.....	.....	23,568	21,612	17,305	14,790	10,104	8,432	12,632	12,500	18,063	19,912	22,372

*This includes total letters received by entire Department. †Cash received at Victoria only.

REPORT OF THE SUPERINTENDENT OF BRITISH COLUMBIA SOLDIER SETTLEMENT.

G. R. Naden, Esq.,
Deputy Minister of Lands, Victoria, B.C.

SIR,—I have the honour to submit herewith annual report for the year 1921 of operations under the "Soldiers' Land Act," chapter 80 of the Statutes of British Columbia, 1918, amended by chapter 76, 1919, and chapter 85, 1920.

SOUTHERN OKANAGAN IRRIGATION PROJECT.

Construction-work on the project has been continued during the year. The main canal excavation has been continued to within a mile of the head of Osoyoos Lake and canal lining completed to a point about 11¼ miles from the diversion-dam.

The cement-pipe plant has been run continuously since April last and approximately 12 miles of pipe in varying sizes of 6 to 16 inches manufactured. The laying of cement-pipe distribution has been carried on in the areas subdivided and has been largely completed, and concrete boxes for the measurement of water to the individual lots have been constructed.

An unfortunate occurrence in the way of a cloudburst in the mountains immediately north-east of the project occurred on the night of May 19th and did considerable damage, and delayed delivery of water for some time thereafter. Temporary connections were made, however, and the permanent repairs put in hand at the close of the irrigation season.

The Okanagan River also attained a height during high water 50 per cent. in excess of the highest previous recorded flow and for a time retarded progress on parts of the construction-work.

The sawmill was not operated until the beginning of October, when the sawing of some 350,000 feet B.M. that had already been cut in the woods was undertaken.

A waterworks system for the town of Oliver has been installed and will provide an ample supply and suitable pressure for both domestic use and fire-protection.

The area now subdivided, of which detail plans have been prepared, amounts to 3,387 acres. Seventy-eight parcels have been sold, amounting to 682.90 acres, for $180,075. Amount received as first payments on same is $21,905.66.

In the townsite of Oliver sixty-eight lots have been sold for $16,810. Amount received as first payments on same is $5,055.55.

The total expenditure on the project as at December 31st, 1921, is $2,332,632.11; total sales, $196,885; total deposits, $26,961.21.

The nursery has again had a very successful year, both in regard to the number of prospective purchasers who have received favourable impressions after visiting the place and from the results obtained from the propagation of nursery stock.

Orders have been taken from the settlers for 16,000 trees for this spring delivery, and after the forthcoming sale it is expected that the remaining available trees will be in demand or used to improve unsold lots. Arrangements have been made to ensure a minimum supply of 35,000 trees for the following spring.

Following the work of improving the neglected Myer's Flat orchard, the Department sold 769½ boxes of apples from approximately 100 trees through the British Columbia Growers, which returned $564 over and above packing-house charges. Good prices were obtained for Spitz and fair for Spys, but poor and unknown varieties, of course, reduced the average returns considerably.

SOUTH VANCOUVER HOUSING.

Eight houses in South Vancouver, built under chapter 80, Statutes of 1918, "Soldiers' Land Act," are all in good standing, with the exception of one purchaser being three months' payments in arrears as a result of sickness and another being one month in arrears.

AREAS OF LAND CONVEYED TO THE SOLDIER SETTLEMENT BOARD OF CANADA.

The following lands have been reserved and conveyed to the Soldier Settlement Board of Canada for soldiers who have applied for loans to the Board:—

Cariboo District.—Lot 658, 178 acres; S.W. ¼ Lot 4437, 160 acres; Lot 5081, 149 acres; N.W. ¼ Lot 6405, 160 acres; S.E. ¼ Lot 7179, 160 acres; W. ½ Lot 7255, 80 acres; N.E. ¼ Lot 8722, 160 acres; S.E. ¼ Lot 8625, 160 acres.

Coast District.—Block A, Lot 925, R. 2, 194 acres; S.W. ¼ Sec. 31, Tp. 6, R. 4, 163 acres; Lot 3189, R. 5, 160 acres; Bk. A, Lot 3718, R. 5, 160 acres; Lot 4087, R. 5, 160 acres; Bk. A, Lot 5684, R. 5, 155 acres; S.E. ¼ Lot 6440, R. 5, 160 acres; Lot 6660, R. 5, 160 acres.

Yale Division of Yale District.—Lot 779, 160 acres.

Lillooet District.—N.E. ¼ Lot 2959, 160 acres.

Total, 2,839 acres.

STATEMENT OF B.C. BETTER HOUSING FUNDS AS AT DECEMBER 31ST, 1921.

Municipality.	Amounts covered by Agreements within Time Limits.	Paymentsauthorized by Order in Council under "B.H.A."	Amounts expired by Time Limits.	Amounts returned unused.	Balance payable.	Houses erected.	Houses under Construction or to be erected.	Total Houses.
Burnaby	$ 45,500	$ 35,000	$ 10,500	.....	.....	8	3	11
Cumberland	6,000	6,000	.....	.....	.....	..	6	6
Courtenay	35,000	35,000	.....	.....	.....	11	..	11
Cranbrook	15,000	15,000	.....	.....	.....	..	5	5
Duncan	3,500	3,500	.....	.....	.....	1	..	1
Esquimalt	25,000	25,000	.....	.....	.....	9	..	9
Fernie	12,000	12,000	.....	$12,000	.....	..	..	..
Kamloops	75,850	75,850	.....	.....	.....	22	3	25
Kelowna	32,300	32,300	.....	.....	.....	10	..	10
Langley	10,500	10,500	.....	.....	.....	6	..	6
Matsqui	2,000	2,000	.....	.....	.....	1	.	1
Nanaimo	54,000	54,000	.....	.....	.....	9	8	17
Nelson	12,000	12,000	.....	.....	.....	..	4	4
New Westminster	85,000	85,000	.....	.....	.....	25	..	25
North Vancouver City	84,200	84,200	.....	.....	.....	30	..	30
North Vancouver District	86,500	86,500	.....	.....	.....	23	4	27
Oak Bay	37,000	30,950	6,050	2,500	.....	5	4	9
Penticton	23,000	23,000	.....	.....	.....	8	..	8
Point Grey	94,000	94,000	.....	.....	.....	23	..	23
Port Alberni	16,000	16,000	.....	.....	.....	3	2	5
Port Coquitlam	16,800	16,800	.....	.....	.....	6	..	6
Prince George	74,000	74,000	.....	.....	.....	25	10	35
Prince Rupert	125,000	125,000	.....	.....	.....	41	13	54
Saanich	59,000	59,000	.....	.....	.....	14	5	19
Salmon Arm City	3,500	3,500	.....	.....	.....	1	..	1
Salmon Arm District	4,200	.....	.....	.....	$4,200	..	1	1
South Vancouver	109,500	109,500	.....	.....	.....	34	7	41
Trail	27,000	27,000	.....	.....	.....	6	3	9
Vancouver	300,000	300,000	.....	.....	.....	92	..	92
Vernon	27,200	27,200	.....	.....	.....	8	3	11
Victoria	220,000	180,000	40,000	.....	.....	46	4	50
West Vancouver	37,500	37,500	.....	.....	.....	8	4	12
Totals	$1,758,050	$1,697,300	$56,550	$14,500	$4,200	475	89	564

I have, etc.,

J. W. CLARK,

Superintendent, B.C. Soldier Settlement.

PART II.

SURVEY BRANCH.

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REPORT OF THE SURVEYOR-GENERAL.

VICTORIA, B.C., January 3rd, 1922.

To the Hon. T. D. Pattullo,
Minister of Lands, Victoria, B.C.

SIR,—I have the honour to submit the following report on the operations of the Survey Branch of the Department of Lands for the year ending December 31st, 1921:—

The results of the field-work for the season may be considered as satisfactory, especially when compared with the past few seasons. Weather conditions were generally good and little time was lost in the field on account of wet weather, except on the coast between Vancouver Island and Prince Rupert, where the summer was wetter than the average. Costs of supplies and transportation were considerably below those for last year, and this also applies to labour, which, at the same time, proved more efficient than during any previous year since the war.

A total number of forty-one qualified surveyors were employed during the season, eleven of whom were assistants. Of these, thirty-one were men who served in His Majesty's Army during the war.

The responsibility of employing labourers and other assistants was, as usual, left with the surveyors in charge of parties. They were instructed, however, to co-operate with the Provincial Government Labour Bureau and to give preference to returned soldiers.

CROWN LAND SURVEYS.

The area of Crown land surveyed totals 155,374 acres. Of this, 65,132 acres was previously surveyed by private applicants into lots of 640 acres which reverted to the Crown under the "Soldiers' Land Act" and was resurveyed, or subdivided, into parcels suitable for pre-emption. During the year 1920 practically all outstanding unsurveyed pre-emptions in accessible localities were surveyed, with the result that very few of the parcels surveyed this year were alienated at the time of survey, and, consequently, practically all the lands surveyed are vacant Crown lands and will become available for new settlers when the surveys are gazetted.

The total number of parcels surveyed was 1,018, of which eighty-eight were alienated prior to survey.

Details as to the work done are given subsequently in this report, but in general it may be stated that surveys for settlement purposes were made in the majority of districts throughout the Province. Extending from the west coast of Vancouver Island to the Peace River District, the large majority of the acreage being tributary to the Pacific Great Eastern and Grand Trunk Pacific Railways.

The practice commenced in 1920 of obtaining detailed reports on special forms on all parcels surveyed was continued this year, and copies of these reports will be open for inspection at this office and at the office of the Land Commissioner in whose district the lands are situated as soon as the surveys are gazetted.

One of the principal functions of this office is to establish and maintain and control over the large number of land, timber, mineral, and other surveys, in order that there may be no conflict of surveys on the ground and that a proper clearance can be given on future applications for Crown lands and resources. This is done by the means of compilation of maps, using existing survey information and other available data. These maps are, necessarily, according to the nature and amount of information available, more or less imperfect or incomplete. As the country develops, however, there is an increasing demand for greater accuracy and detail in these maps, and in order to meet this demand this office utilizes each year a portion of the appropriation to control surveys. These surveys are of three distinct types: (1) Traverses between individual isolated lots or groups of lots; (2) base-lines; (3) triangulation.

During the season 461 miles of traverses were run. Surveys of this nature are usually run along a road, trail, or shore-line, or, if none of these exist, along the most direct or nearest route between the points to be connected. All survey parties engaged on surveys for settlement purposes are called upon to do more or less of this class of work, to keep their work connected with previous surveys, and to tie in previous surveys not already definitely located. As a general rule this office does not accept surveys of any nature unless tied in to some previous land survey

or control point, and it is satisfactory to note that the network of Provincial surveys is now so extended that there are now very few occasions when it is not possible to comply with this rule without running an excessive distance of traverse connection.

Base-line surveys are usually run along a parallel of latitude, a meridian of longitude, or some district boundary-line. Owing to the cost no work of this nature was undertaken during the past season.

Triangulation surveys constitute the most accurate and economical means of establishing control where conditions make this class of work possible. Two parties were employed on the triangulation of the Coast inlets as a continuation of the work done in previous years. A feature of this work is that each year we find geographic features greatly at variance with, or entirely omitted on, the charts of the Coast. This year a survey was made of an inlet or lagoon running north and south through Hunter Island, measuring 12 miles in length, which has not been shown on any Admiralty Chart, although this island is immediately adjacent to the main steamer-channel between Vancouver and Prince Rupert. In all, 480 miles of coast-line was triangulated by these two parties.

One party was engaged in establishing a tie between the head of Gardner Canal and the triangulation net established last year in the vicinity of Eutsuk Lake and the westerly end of the surveyed portion of the 53rd parallel of latitude.

Another party was engaged in establishing a triangulation tie between the loose ends of the surveyed portions of the 55th parallel at Babine Lake and Middle River. This party also made a survey of a portion of the shore-line of Babine Lake. A complete triangulation was made of the shore of Mahood Lake, in Kamloops District. The total mileage of lake-shore thus triangulated is estimated at 196 miles.

In carrying on this work the Branch endeavours to keep in close touch with the operations of the Dominion Hydrographic Survey and Geodetic Survey of Canada, with a view to avoiding duplication of work and obtaining proper control by means of connection to the primary geodetic triangulation of the Dominion. Close co-operation is also effected with the Geological Survey of Canada and the Chief Astronomer of the Dominion, who has from time to time, by arrangement, established latitude and longitude stations in various parts of the Province which have materially assisted in the control of Provincial surveys.

FIELD-WORK.

For convenience in reporting on the work done by the various parties, the Province is divided into three sections, viz.: Central and Northern Interior; Southern Interior; Mainland Coast and Vancouver Island.

The following paragraphs give the names of the surveyors in charge of the various parties and the locality and nature of the work done by them in the various sections:—

Central and Northern Interior.

That portion of the Province lying north of the Dominion Railway Belt and east of the Coast range of mountains is termed the "Central and Northern Interior." It is comprised chiefly of the areas served by the Grand Trunk Pacific branch of the Canadian National Railway and the Pacific Great Eastern Railway.

Nine parties were employed in this section, as follows:—

Surveyor.	Locality.
V. Schjelderup	Burns Lake and vicinity.
A. R. Barrow	Peace River.
J. D. Campbell	Vicinity of Fort George.
R. W. Haggen	Cariboo District.
W. C. Merston	Nazko and Chilcotin Valleys.
T. H. Taylor	Anahim Lake.
W. S. Drewry	Timothy Mountain and Mahood Lake.
R. C. Farrow	Eastern Lillooet District.
G. M. Downton	Southern Lilloet District.

Messrs. Campbell and Schjelderup were employed on surveying Crown lands adjacent to the line of the Grand Trunk Pacific Railway, including vacant unsurveyed areas and the subdivision of lands which reverted to the Crown under the "Soldiers' Homestead Act." The former worked chiefly in the vicinity of Ness and Bednesti Lakes, lying north and south of

the Nechako River respectively, about 20 miles west of Prince George, while Mr. Schjelderup's work extended over areas north and south of the railway in the vicinity of Burns Lake. Mr. Barrow was engaged on miscellaneous surveys for a short period only in the Peace River District. Mr. Haggen surveyed vacant Crown lands and subdivided Soldier Homestead lands in areas tributary to Quesnel. Mr. Merston surveyed a number of scattered meadows and a considerable mileage of traverse ties in the Chilcotin, Nazko, and Baker Creek Valleys. Mr. Taylor's work was in the vicinity of Anahim Lake, some 175 miles west of Williams Lake, which district seems to present excellent opportunities for development as a stock country. Mr. Drewry surveyed lands for settlement in the vicinity of Timothy Mountain, east of Lac la Hache, and also made a triangulation survey of Mahood Lake, carrying a connection through between the east boundary of Lillooet District to the surveys on Clearwater River, tributary of the North Thompson. Mr. Farrow worked in the Upper Bonaparte Valley, including in his surveys some land of excellent quality in the vicinity of Montana Lake. Miscellaneous scattered surveys were made by Mr. Downton in South-western Lillooet District.

Southern Interior.

In the Southern Interior, comprising all that portion of the Province lying south of the Dominion Government Railway Belt, the following surveyors were employed, viz.:—

Surveyor.	Locality.
W. J. H. Holmes	West Kootenay.
S. S. McDiarmid	Vicinity of Robson.
A. H. Holland	Kettle River Valley.
H. H. B. Abbott	Kettle River Bar.
O. B. N. Wilkie	Miscellaneous.

Mr. Holmes made miscellaneous surveys on Slocan and Kootenay Lakes, and also surveyed about 2,700 acres on Big Sheep Creek, being a portion of Lot 5816, one of the blocks repurchased from the Columbia & Western Railway. A similar area was surveyed by A. H. Holland in what is known as Christian Valley, being a portion of the valley of the main Kettle River in Lot 2714, also a repurchased railway block. Mr. Abbott resurveyed certain lands at Kettle River Bar which reverted to the Crown under the "Soldiers' Homestead Act," and made a traverse tie between these surveys and other surveys farther down the Kettle River, thus closing a circuit of considerable extent and furnishing topographical data over an area which has, up to date, been very imperfectly mapped. Mr. Wilkie was employed on scattered miscellaneous work, including the Nicola, North Thompson, and Similkameen Valleys and inspection surveys in East Kootenay District. Mr. McDiarmid laid out a small addition to the townsite of Castlegar and made other miscellaneous surveys in that vicinity.

Coast and Vancouver Island.

The following surveyors were engaged on work on the Coast and Vancouver Island:—

Surveyor.	Locality.
H. E. Whyte	Saturna Island.
John Davidson	Eastern Portion Sayward District.
M. W. Hewitt	Sayward and Coast, Range 1.
F. E. Leach and A. W. Harvey	West Coast, Vancouver Island.

Mr. Whyte made a resurvey of the greater portion of Saturna Island. This was necessitated by the fact that the old survey, made nearly fifty years ago, was practically obliterated and new settlers could not determine their boundaries. Messrs. Davidson and Hewitt were engaged on miscellaneous surveys, including the subdivision of expired timber licences and triangulation and traverse ties. Mr. Leach was employed for a portion of the season on miscellaneous surveys on the west coast of Vancouver Island. He received an appointment in the Dominion Government service during the season and A. W. Harvey was instructed to take charge of his party.

Control Surveys.

Surveyor.	Locality.
J. F. Underhill	Hunter Island and Ellerslie Channel.
A. E. Wright	Principe Channel.
F. C. Swannell	Kitlope River and Tahtsa Lake.
R. P. Bishop	Babine Lake.

Messrs. Wright and Underhill were engaged on the continuation of the Coast triangulation, about 360 miles of coast-line being covered. Mr. Swannell was employed on a reconnaissance and triangulation survey in the valley of the Kitlope and Kemano Rivers, at the head of Gardner Canal, and extending to the lake district to the east of the Coast Range. Another tie was established by him between the Coast triangulation of Gardner Canal and interior surveys. An interesting feature of this work was that Kitlope Lake was found to be almost 20 miles away from the position in which it has been shown heretofore on maps of the Province. Mr. Bishop's work consisted primarily in making a triangulation tie between the ends of the surveyed portions of the 55th parallel of latitude across the Babine Range. He also tied in various other existing surveys and made a triangulation of the northerly portion of Babine Lake. His work will serve as a control for the accurate mapping of a large area in the vicinity of Babine Lake.

PHOTO-TOPOGRAPHICAL SURVEYS.

The organization for photo-topographical work for the past season was the same as in 1920. Two parties, under R. D. McCaw and G. J. Jackson respectively, were engaged on this work. Mr. McCaw extended his previous season's work in the Upper Nicola Valley and Mr. Jackson covered an area immediately to the south and adjoining Mr. McCaw's area, including the valleys of Hayes (5 miles) and Summers Creeks. An area of approximately 865 square miles was covered. Maps of these areas are now in course of preparation and will be available in the spring. As in the past, these maps are being prepared on a scale of 1/40,000, or about two-thirds of a mile to the inch, with contour intervals of 100 feet. Maps are also prepared on the same scale showing the forest and grazing types. Blue-prints of the areas covered are available, including all of the Okanagan Lake and River watershed, the Ashnola River watershed, and portion of the Upper Nicola Valley. It is proposed to incorporate the information later on maps of the Degree Sheet Series (scale 2 miles to 1 inch). One of these, the "Vernon Sheet," will shortly be ready for distribution, and it is anticipated that this publication will demonstrate the value of this class of work in connection with the development of the Province to such an extent as to allay any criticism which might be made of the cost, which, under ordinary circumstances, runs about 2 cents per acre, including both field and office work.

During the past season an experiment was made in the use of aerial photography in connection with this work. The object of the experiment was to determine the feasibility of obtaining, by means of vertical photographs, information as to the outlines of lakes, streams, roads, etc., and to control this information for mapping purposes by means of locating control points on the ordinary ground photographs, or by instrumental measurements from camera stations. As the map of the area covered is not yet sufficiently far advanced to determine definitely the value of the results obtained, a detailed report on this experiment is being withheld until a later date.

There is no doubt, however, that the use of an aeroplane for a preliminary reconnaissance of an area to be covered by photographic methods would be of considerable value to the topographer in assisting him in locating in advance, in a general way, his triangulation and camera station sites, and thus enabling him to lay out his season's work to the best advantage.

Grateful acknowledgment is due to the officials of the British Columbia Station of the Canada Air Board for the use of their equipment and staff on this work.

ALBERTA–BRITISH COLUMBIA BOUNDARY.

The Interprovincial Boundary Commission, consisting of A. O. Wheeler, the British Columbia Commissioner, and R. W. Cautley, representing both the Dominion and Alberta Governments, continued work during the year. Mr. Wheeler's party completed the monumenting of the passes in the section lying between Yellowhead and Kicking Horse Passes. The Commission is now in position to complete the second part of their report, covering that portion of the boundary between the above-mentioned passes, and it is anticipated that this report will shortly be available.

In October last the writer attended a conference of representatives of the three Governments involved in consultation with the Commissioners, held at Edmonton. It was considered that the Commission should complete the survey of the mountain section of the boundary and produce the 120th meridian southerly to its intersection with the continental divide and northerly to about latitude 50° north. It is anticipated that this can be done in three field seasons.

SURVEYORS' REPORTS.

General reports prepared by the various surveyors employed during the season are appended to this report.

PRIVATE SURVEYS.

Surveys of Crown lands made at the instance of and paid for by private parties, such as surveys of pre-emptions, applications to purchase or lease, coal licences, timber licences, mineral claims, etc., are known departmentally as "private surveys."

As nearly all pre-emptions located before the amendment of the "Land Act" in 1918, prohibiting the pre-emption of unsurveyed land, have now been surveyed, there are very few surveys of this nature to be dealt with.

The cancellation of reserves against sale or lease in various portions of the Province is, however, responsible for an increasing number of surveys of lands so applied for.

There has been a considerable reduction in the area of mineral-claim surveys dealt with as compared with 1920.

The acreage of surveys dealt with under the "Coal and Petroleum Act" is also considerably below 1920. In view, however, of the cancellation of the reserve against stakings under this Act over the greater portion of the Province, it is reasonable to expect that surveys of this nature will increase in the near future.

The acreage of timber licences surveyed is considerably below that for the previous year, although 1921 was the last year provided by the "Forest Act" for the survey of timber held under licence. At the recent session of the Legislature provision was made to extend the time to December 31st, 1922, for survey to all licences which are in good standing as to fees. There are probably only a very few unsurveyed licences affected by this legislation and the year 1922 will therefore see the completion of this class of private surveys.

OFFICE-WORK.

The office staff is divided into two main divisions—viz., the Survey Division and the Geographic Division. Very few changes have taken place in the personnel of either division and the total number employed remains the same as at the end of 1921—viz., forty-two.

The reports of the Chief Draughtsman and the Chief Geographer are appended.

I have the honour to be,
Sir,
Your obedient servant,
J. E. UMBACH,
Surveyor-General.

REPORT OF THE CHIEF DRAUGHTSMAN.

December 31st, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report on the work of the Survey Division for the year ending December 31st, 1921:—

A general review of the work done during the past year shows that there has been a steady increase in the total volume of work carried out. The various members of the staff have shown great interest in their work and a high standard of efficiency has been maintained throughout.

The personnel at the end of the year numbers twenty-two, being the same as at the end of 1920. Two changes have been made, however, two members having resigned, while two other members of the service were promoted to their positions.

OFFICE-WORK.

The preparation of official plans from the field-notes of surveys received throughout the year, together with the compilation of new reference maps and the clearance of all land and timber applications, has formed the bulk of the work done. In addition, considerable time was taken up in dealing with correspondence and attending to the requests of surveyors and the general public for information as to field-notes, plans, etc., of the surveys throughout the Province.

There has been a large increase in the number of requests for descriptions and clearance of applications for reverted lands. The majority of such lands revert according to plans of subdivision on file in the local Land Registry Offices. As a result of this, it was decided to apply to the various Registrars for copies of such plans as they were required from time to time, and to date 544 copies of such plans have been received. These plans are being carefully indexed and tabulated by the Geographic Division.

The following records give (as well as it is possible to do so in figures) an outline of the work carried out.

FIELD-NOTES.

During the year 1,031 field-books were received, as against 1,117 received during 1920. The various surveys contained in these field-books consist of 1,383 land lots, 264 mineral claims, 100 timber licences, and 126 traverse connections or triangulations.

During the same period 1,923 lot surveys were plotted and found to be in order. Notice of their acceptance duly appeared in the Gazette. Tracings of these lots were prepared and forwarded to the respective Government Agents.

The following table gives an analysis of the acreage of the various kinds of surveys gazetted during the year:—

	Acres.
Pre-emption surveys	3,078
Purchase surveys	8,122
Mineral-claim surveys	6,290
Timber-licence surveys	247,766
Coal-licence surveys	4,423
Lease surveys	11,884
Government surveys	127,797
Total	409,360

A comparison of these figures with those of previous years, as far back as 1900, may be found by reference to Table A attached to this report.

The acreage of Government surveys gazetted during the year shows a large increase over that of the previous year, as is also the case in connection with lease surveys.

TIMBER SURVEYS.

Field-notes covering the survey of 100 licences were received during the year, as compared with 435 during 1920.

RIGHT-OF-WAY PLANS.

The recording and examination of the plans of railway rights-of-way, logging-railways, and pole-lines has been carried on as heretofore. During the year 297 miles of various railway right-of-way plans were examined and finally cleared for Crown-granting purposes.

CLEARANCES.

As in previous years, clearance reports have been furnished by this Branch on all applications for lands dealt with by the Lands Department. These include 1,495 applications for pre-emption, 360 applications to purchase, 160 coal licences, 104 miscellaneous leases, 1,699 Crown-grant applications, together with 755 timber-sales and 374 hand-logger licences.

DEPARTMENTAL REFERENCE MAPS.

Attached hereto, and shown as Table C, is a list of these maps, giving the price for which the blue-prints of same can be obtained. There are now 120 such maps in use, as against seventy-nine at the end of 1912. During the past year sixteen new maps were compiled and two retraced.

INFORMATION SUPPLIED TO SURVEYORS AND OTHERS.

A nominal charge is made for the preparation of copies of field-notes, blue-prints, etc., required by surveyors and others. The revenue derived for the copying of field-notes was $492.90, while the sum of $1,511.70 was paid in for blue-prints. It is calculated that over 10 miles of blue-print paper was used during the year.

The following is a statement of the number of blue-prints made:—

Mail and counter orders	1,363
Surveyor-General's Branch	3,196
Forest Branch	12,721
Other branches of Government service	12,007
Sundry	2,214
Total	31,501

There were also prepared 1,699 tracings (in duplicate) to be attached to Crown grants and 104 tracings (in duplicate) to accompany land leases.

CORRESPONDENCE AND ACCOUNTS.

During the year 6,500 letters were received and 6,629 sent out, which includes interdepartmental memoranda.

Table B attached to this report gives a summary of the office-work for the year 1921 and comparative figures for 1920.

I have, etc.,
F. O. MORRIS,
Chief Draughtsman.

APPENDIX TO REPORT OF CHIEF DRAUGHTSMAN.

TABLE A.—SHOWING ACREAGES OF EACH CLASS OF SURVEYS GAZETTED EACH YEAR SINCE 1900.

Year.	Pre-emptions.	Purchases.	Mineral Claims.	Timber Limits.	Coal Licences.	Leases.	B.C. Govt. Surveys.	Totals.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
1900	22,873	4,419	33,441	59	.....	664	10,057	71,513
1901	26,493	16,401	33,400	2,027	.....	593	.....	79,094
1902	35,297	29,652	31,057	1,040	626	1,026	.....	98,698
1903	37,615	26,787	18,115	127,992	.....	2,003	800	213,312
1904	48,124	36,468	20,549	155,279	48,670	3,009	179	312,278
1905	42,660	58,705	15,535	214,841	137,218	806	107	469,872
1906	33,573	66,668	9,894	77,829	41,312	9,566	.....	238,842
1907	50,460	162,218	10,017	83,016	20,367	4,387	113,968	444,433
1908	66,788	147,980	14,607	167,925	9,821	2,580	97,072	506,773
1909	71,316	145,325	10,744	426,121	8,310	15,239	512,373	1,189,428
1910	79,273	455,356	12,499	509,201	43,363	5,864	302,536	1,407,912
1911	89,485	1,352,809	21,325	686,909	120,938	6,500	948,644	3,226,610
1912	99,461	1,011,934	16,645	804,730	99,236	8,560	826,362	2,866,997
1913	55,202	508,062	18,043	1,181,355	72,719	4,740	1,014,366	2,854,487
1914	45,551	234,580	7,546	1,105,635	36,098	4,209	1,078,579	2,512,198
1915	22,746	41,551	8,339	512,628	29,245	841	705,170	1,320,520
1916	14,335	8,771	7,677	302,903	10,983	5,145	124,953	474,767
1917	12,632	802	8,386	275,538	2,843	2,960	111,256	414,417
1918	10,835	1,634	9,247	223,768	953	2,342	60,311	309,090
1919	8,514	153	10,264	165,289	160	1,495	77,121	262,996
1920	8,172	5,992	12,580	347,729	22,143	3,227	63,505	463,348
1921	3,078	8,122	6,290	247,766	4,423	11,884	127,797	409,360

TABLE B.—SUMMARY OF OFFICE-WORK FOR THE YEAR 1921 AND COMPARATIVE FIGURES FOR 1920.

	1920.	1921.
Number of field-books received	1,117	1,031
„ lots surveyed	1,231	1,383
„ lots gazetted and tracings forwarded to Government Agents	1,598	1,923
„ miles of right-of-way plans dealt with	220	297
„ applications for purchase cleared	351	360
„ applications for pre-emption cleared	1,624	1,495
„ reference maps compiled	13	16
„ Crown-grant applications cleared	2,014	1,699
Total number of letters received by Branch	6,261	6,500
„ „ Crown-grant and lease tracings made in duplicate	1,923	1,803
„ „ blue-prints made	30,381	31,501
Total revenue from sale of blue-prints	$2,037.70	$2,004.60

TABLE C.—DEPARTMENTAL REFERENCE MAPS.

Price-list of Blue-prints.

		Scale.	Price.
1.	West Coast, V.I. (Barkley Sound, Southerly)	1 inch to 1 mile	$1 00
1A.	West Coast, V.I. (Barkley Sound, Northerly)	„ „	1 00
2.	West Coast, V.I. (Nootka District)	„ „	1 00
3.	Belize and Seymour Inlets and Smith Sound	„ „	1 00
3A.	Quatsino Sound and West Portion of Rupert District	„ „	1 00
3B.	Gilford, Cracroft, and Broughton Islands	„ „	1 00
3C.	Nimpkish River Valley and Lake	„ „	1 00
3D.	Central Portion of Rupert District	„ „	1 00
4.	Knight, Bute, and Loughborough Inlets	„ „	1 00
4A.	Sayward District, Thurlow, Valdes, and Redonda Islands and Powell Lake and Toba Inlet	„ „	1 00
5.	Texada Island and West Portion, New Westminster District	„ „	1 00
5A.	Jervis and Seechelt Inlets	„ „	1 00
5B.	Howe Sound and Cheakamus River Valley	„ „	1 00
5C.	Harrison Lake and Lillooet River Valley	„ „	1 00
6A.	Nicola Valley	„ „	1 00
6B.	Princeton and vicinity	„ „	1 00
6C.	Ashnola and South Similkameen River Valleys	„ „	1 00
7.	North Okanagan and Mabel Lake	„ „	1 00
7A.	South Okanagan Lake and Kettle River Valley	„ „	1 00
7B.	Similkameen District (Keremeos, Fairview, and Greenwood)	„ „	1 00
11.	Clearwater and Murtle River Valleys	„ „	1 00
11A.	North Thompson River Valley	„ „	1 00
12.	Dean and Burke Channels and Bella Coola Valley	„ „	1 00
12A.	Dean (Salmon) River Valley	„ „	1 00
12B.	Kimsquit and West Side of Dean Channel	„ „	1 00
13.	Rivers Inlet and Fitzhugh Sound	„ „	1 00
14.	Banks and McCauley Islands	„ „	1 00
14A.	Graham Reach, Gardner Canal, and Kitimat Arm	„ „	1 00
14B.	Kitlobe River and West End of Eutsuk and Whitesail Lakes	„ „	1 00
14C.	Grenville, Squally, and Douglas Channels	„ „	1 00
15.	Moresby Island, Northern Portion	„ „	1 00
15A.	Moresby Island, Southern Portion	½ inch to 1 mile	1 00
16.	Graham Island, North-east Portion	1 inch to 1 mile	1 00
16A.	Graham Island, South-east Portion	„ „	1 00
16B.	Graham Island, West Portion	„ „	1 00
17.	Portland Canal and Observatory Inlet	„ „	1 00
17A.	Skeena River Valley (vicinity of Hazelton)	„ „	1 00
17B.	Nass and Kitwancool River Valleys	„ „	1 00
18.	Upper Fraser and Morkill River Valleys	„ „	1 00
18A.	Tete Jaune Cache and Upper Fraser River Valley	„ „	1 00
19.	Lower Skeena and Zymoetz River Valleys	„ „	1 00
19A.	Skeena and Kitsumgallum River Valleys	„ „	1 00
19B.	Prince Rupert, Mouth of Skeena and Nass Rivers	„ „	1 00
20.	Bulkley River Valley (Hazelton to Moricetown)	„ „	50
21.	Barkerville, Willow and Bowron River Headwaters	„ „	1 00
21A.	Fraser Lake, Endako River and South End of Stuart Lake	„ „	1 00
22.	Bowron and Upper Fraser River Valleys (vicinity of Hutton)	„ „	1 00

TABLE C.—DEPARTMENTAL REFERENCE MAPS—*Continued.*

Price-list of Blue-prints—Continued.

		Scale.	Price.
22A.	Fraser River, Fort George, South	1 inch to 1 mile	$1 00
22B.	Portion of Nechako, Stuart, and Salmon River Valleys	" "	1 00
22C.	Blackwater and Chilako River Valleys	" "	1 00
22D.	Fraser and Cottonwood River Valleys	" "	1 00
22E.	McBride, Goat and Upper Fraser River Valleys	" "	1 00
23.	Quesnel Lake (North and East Arm)	" "	1 00
23A.	Quesnel Forks and Swamp River	" "	1 00
23B.	Fraser River, Quesnel, South	" "	1 00
23C.	Nazko River Valley	" "	1 00
24.	150-Mile House and Harpers Camp	" "	1 00
24A.	Anderson and Seton Lakes, Lillooet District	" "	1 00
24B.	Lillooet Dist. (Clinton, Bridge Riv. & Taseko (Whitewater) Lakes)	" "	1 50
25.	Mainland Coast, Princess Royal and Adjacent Islands	" "	1 00
25A.	Bella Bella and Milbank Sound	" "	1 00
26.	Porcher and Adjacent Islands	" "	1 00
27.	Fraser River Valley (Williams Lake and Soda Creek)	" "	1 00
27A.	Fraser and Lower Chilcotin River Valleys and Lac la Hache	" "	1 00
27C.	Green Lake and Canoe Creek Valley	" "	1 00
28.	North Part of Babine and Takla Lakes	½ inch to 1 mile	1 00
28A.	Stuart and Babine Lakes	1 inch to 1 mile	1 00
29.	Chilcotin, West of 124th Meridian	" "	1 00
29A.	Anahim and Abuntlet Lakes	" "	1 00
29B.	Chilcotin River Valley, vicinity of Alexis Creek	" "	1 00
30.	Bonaparte River Valley and Canim Lake	" "	1 00
31.	Bulkley Valley	" "	1 00
31A.	Francois and Babine Lakes	" "	1 00
32A.	Tatlayoko Lake	" "	1 00
32B.	Homathko and Klinaklini River Valleys	" "	1 00
33.	Fraser River Valley, Fort George, North	" "	1 00
34.	Lot 4593, Kootenay District, West Portion, Flathead River	2 inches to 1 mile	50
34A.	Lot 4593, Kootenay District, East Portion, Flathead River	" "	50
35.	Saltspring, Gabriola, and Adjacent Islands	1 inch to 1 mile	1 00
36.	Upper Fraser River (vicinity of Hansard and McGregor River Valley)	" "	1 00
36A.	Headwaters of Wapiti and Herrick Rivers	" "	1 00
37.	Nechako River, Cluculz and Bednesti Lakes	" "	1 00
38A.	Groundhog Coal Area, East of Meridian	" "	1 00
38B.	Groundhog Coal Area, West of Meridian	" "	1 00
38C.	Upper Nass River Valley	" "	1 00
39.	West End of Ootsa Lake	" "	1 00
39A.	Eutsuk Lake	" "	1 00
40.	Euchiniko and Tetachuck Lakes	" "	1 00
41.	Upper Nechako River and East End of Ootsa Lake	" "	1 00
42.	Big Bend, Kootenay District	" "	1 00
42A.	Adams Lake and River	" "	1 00
42B.	Canoe River Valley	" "	1 00
42C.	Columbia River Valley (vicinity of Bush River)	" "	1 00
43.	Peace River, South of Dominion Government Block	" "	1 00
43A.	Peace River, North of Dominion Government Block	" "	1 00
44.	Kiskatinaw, Murray, and Sukunka Rivers	" "	1 00
44A.	Wapiti, Murray, and Head of Parsnip Rivers	" "	1 00
45.	Foreshore of Vancouver Island (E. & N. Railway Belt)	" "	1 00
46.	Saanich District and Islands	" "	1 00
47.	Peace River Valley, West of Dominion Government Block	" "	1 00
48.	Crooked and Parsnip River Valleys	" "	1 00
50.	Parsnip and Peace River Valleys	" "	1 00
51.	Finlay River Valley	" "	1 00
52.	Atlin Lake and vicinity	½ inch to 1 mile	1 00
53.	Telegraph Creek and Stikine River Valley	" "	1 00
54.	Upper Nass River Valley and Meziadin Lake	1 inch to 1 mile	1 00
15–0.	Upper Elk and White River Valleys	" "	1 00
15–9N.	Fernie and Crowsnest vicinity	" "	1 00
15–9S.	Elko and vicinity	" "	1 00
16–9N.	Kootenay River Valley and Cranbrook	" "	1 00
16–9S.	Moyie River Valley	" "	1 00
17–0S.	Duncan Lake and North End of Kootenay Lake	" "	1 00
17–9N.	Kootenay Lake, vicinity of Kaslo	" "	1 00

TABLE C.—DEPARTMENTAL REFERENCE MAPS—*Continued.*

Price-list of Blue-prints—Continued.

		Scale.	Price.
17–9s.	Nelson, Salmon River Valley, and South End of Kootenay Lake	1 inch to 1 mile	$1 00
18–9N.	Edgewood and Slocan River Valley	" "	1 00
18–9s.	Rossland and South End of Lower Arrow Lake	" "	1 00
18–20.	Nakusp and Upper Arrow Lake	" "	1 00
21–23.	Columbia and Windermere Lakes	" "	1 00
27–29.	Columbia River Valley, Wilmer, and Spillimacheen	" "	1 00
30–32.	Trout and Upper Arrow Lakes	" "	1 00

NOTE.—These reference maps show lands alienated and applied for, "Timber Limits," "Coal Licences," etc., surveyed and unsurveyed. They are compiled from all available data and are constantly being amended, and their accuracy is therefore not guaranteed. They were prepared originally for departmental use, and, having proved of value to the public, blue-prints of same are now on sale.

Victoria, February 1st, 1922.

REPORT OF THE GEOGRAPHIC DIVISION.

February 6th, 1922.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the report of the Geographic Division for the year ending December 31st, 1921.

The scheme of work outlined in the report of 1920 has been carried forward successfully. We satisfied the demands for republication of the pre-emptors' sheets, and at the same time made greater progress in the preparation of new publications. Only one change in the staff has occurred during the year—Mr. Wheatley being transferred to a vacancy in the Survey Division, while Mr. Tate was engaged to fill the junior assistant position so left vacant in the Geographic Branch.

The extension of the Standard Base Map staff as planned was postponed, so that it has been impossible to produce the full schedule of standard quadrilaterals on scale of 20 chains. The S.B.M. scheme has, however, completely proved its value in present and future economy. It has allowed us to accomplish survey compilations which before could not be considered. It has given, and will give, accuracy in the production of all our mapping which was not heretofore possible, and the lack of which has been a continual source of useless worry and waste of time. If this scheme be expanded to permanently maintain sufficient of the control points upon the ground, it can thus provide a skeleton of strength for survey-work in the field, which will be invaluable in years to come.

The work of the Division has been more definitely organized, and the high standard of quality has been upheld by the loyal and interested efforts of the staff, through whose co-operation the work has been efficient and enjoyable.

PRE-EMPTORS' MAPS.

Name.	No. of Copies.	Date of Issue.	No.	Scale.	Area in Sq. Miles.
Chilcotin. Compiled and drawn	4,100	Feb., 1921	3F	3 m. to 1 in.	9,000
Prince Rupert. Corrected and enlarged	5,750	April, "	3M	" "	10,000
North Thompson. Revised and compiled to projection	4,650	July, "	3J	" "	9,000
Nechako. Revised, expanded, and compiled to projection	7,250	Sept., "	3B	" "	9,000
Quesnel. Corrected, revised, and expanded	7,400	Nov., "	3G	" "	9,000
In Course of Preparation, 1922.					
Peace River. Corrected and partly redrawn. In hands of printer	4,000	March, 1921	3E	4 m. to 1 in.	12,000
Fort George. Compilation at present in hand	....	.....	3A	3 m. to 1 in.	9,000
Stuart Lake. Compilation at present in hand	....	.....	3C	" "	9,000

There are now four of our Pre-emptors' Series completed upon the polyconic projection in addition to the six noted in the report of last year, making ten in all.

Having the basis of the S.B.M. system, progress has been made in the new compilations of the Stuart Lake and Fort George areas. When these two sheets are produced—about the middle of 1922—all of the present Degree Sheet Series, with the exception of Graham Island, will be on polyconic projection, and will so have accurate relation one to the other and actual position on the earth's surface.

DEGREE SHEET SERIES.

Name.	No. of Copies.	Date of Issue.	No.	Scale.	Area in Sq. Miles.
Vernon. Sheet compiled to projection, comprising land surveys, contoured topography, etc., four colours, and drawn for reproduction	6,000	Dec., 1921	4J	2 m. to 1 in.	2,000
In Course of Preparation, 1922.					
Kelowna. Sheet compiled to projection, comprising land surveys, contoured topography, etc.	.....	July, 1922	4K	2 m. to 1 in.	3,100

The compilation of these two sheets has been completed during the year. The contoured area showing in the Vernon Sheet, other than photo-topographical survey made by R. D. McCaw, B.C.L.S., was interpolated and redrawn from surveys made by the Geological Survey of Canada. The roads and general informatory data were compiled and the drawing of the Vernon Sheet for photolithography was completed. The sheet is now in the course of printing and the issue will be available at the end of January, 1922.

The drawing of the "black" for the Kelowna Sheet for photolithography is almost completed.

With the production of these sheets a new and valuable departure in Provincial mapping will have been attained—the land surveys being shown in conjunction with the topographical relief contouring, besides the road classification, administrative boundaries, and general information. This system of mapping will furnish the basis for all classes of engineering in connection with irrigation, water-power, forestry, roads, mining, etc.

Our stock of the issues of the Rossland, Nelson, and Cranbrook Degree Sheets, which were produced in rough form in 1911–12, has been exhausted for some time, and we have therefore been unable to fill the considerable demand for these sheets. In the ensuing year effort will be made to commence compilation of these areas, and in this connection it is suggested that wherever topographical surveys which come within these areas have been made in former years by Dominion or other departments, it will be possible to incorporate such with our land surveys sufficiently to allow the production along the standard lines referred to in the Vernon and Kelowna Sheets, and so make such information of prime value to the engineering requirements of the districts.

There has been demand for the Arrowhead Degree Sheet, which was laid aside in 1915. Owing to preparation of more pressing mapping, opportunity to produce this work has not yet occurred, but effort will be made during 1922 to resume work upon it.

LAND SERIES MAPS.

Name.	No. of Copies.	Date of Issue.	No.	Scale.	Area in Sq. Miles.
Powell Lake. Compiled to projection, drawn for photo reproduction	.....	Sept., 1922.	2D	4 m. to 1 in.	15,000

The compilation of the Powell Lake Sheet was held up for months for reasons stated in our report of last year—viz., the control astronomic determinations. These were received, the compilation was proceeded with satisfactorily, and is almost finished.

One-third of the outline of the key colour—black—for photolithography has been completed. We anticipate producing this map about the middle of 1922.

DISTRICT AND DIVISION SERIES.

Name.	Date of Issue.	No.	Scale.	Remarks.
Map of B.C. Mining Divisions Revised to date. In hands of engraver. Wax-plate process	.....	....	50 m. to 1 in.	Prepared for Mines Department.
Map of B.C. Land Recording Divisions.	April, 1921	1cx	" "	4,200 copies.
Map of B.C. Land Registry Districts.....	July, "	....	30 m. to 1 in.	1,500 copies in additional colours to show boundaries.
In Course of Preparation, 1922.				
Map of B.C. Compilation finished; drawing for reproduction almost finished	Aug., 1922.	....	30 m. to 1. in.	This to replace former edition now exhausted. A complete series of administration districts and divisions will be prepared.

Substantial progress was made in the compilation and drawing of the new map of the Province and it is now practically finished. There remains the verification of detail and naming and the incorporation of this season's surveys. The drawing of our map of Northern Interior, published in 1917, is to be used in this map, thus providing a saving, and has yet to be checked over and altered to conform with our later data.

Repeated inquiry has been made for a map of the Province showing the relief. In this connection it was proposed to compile on the new map of British Columbia the topographical surveys in British Columbia which have been made by Dominion and Provincial Governments. The work of collecting and compiling has been taken up from time to time as opportunity presented throughout the year. What seemed at first to be a measurable work has proved a rather large undertaking, but has had a further result in indexing the large amount of topographic data procured in surveys of past years, but which had not until now been collected in one comprehensive scheme.

GEOGRAPHIC SERIES.

There has been much demand for a general map covering the south-west portion of the Province. The old map of the south-western portion was formerly one of the principal publications, and the old plate was brought up to date and reprinted numerous times. In 1912 there were two issues of this old sheet, and it was then decided that the condition of the plate was so poor that it would be too expensive at later time to bring it up to date. The old plate was therefore discarded. It was proposed that instead of making an entirely new compilation for the production of a new south-western map, the Land Series Sheets, which were greatly demanded, should be pushed forward as rapidly as possible, and when these were completed they would form an easy and cheap basis for the publication of the south-west portion of the Province. It was also pointed out that from the sale of this map a proportion of the cost of the production of the Land Series maps would be obtainable, the demand for a general geographic sheet of this area being large from commercial and tourist sources.

With the completion of the compilation of the Powell Lake Sheet, the drawing for photo-lithography of this map area will be commenced.

MISCELLANEOUS.

Name.	Scale.	For whom prepared, printed, etc.
Peace River Oil Report, E. M. Spieker, Map.....	3 m. to 1 in.	Water Rights Branch. Drawn for photo reproduction.
Powell Lake Subdivision Plans.....	300 ft. to 30 chains to 1 in.	Compiled and drawn for photo-zincography.
Special Map of B.C.....	30 m. to 1 in.	Liquor Control Board. Prepared drawing for reproduction.
Okanagan and Nicola Topographic Map (4 sheets)	1:40,000	Surveys. Design and lettering.
Oliver Townsite Maps—		
No. 1.....	200 ft. to 1 in.	
" 2.....	800 ft. to 1 in.	Water Rights Branch.
" 3.....	" "	
" 4.....	" "	Published only.
" 5.....	" "	

In addition to the above, numerous small works were undertaken for the various departments, the redefinition of the electoral, assessment, Land Registry counties, etc., causing numerous requests for special maps of same.

Geographical Naming and Gazeteer.

The naming in connection with geographical features of the Province has been referred to this office. Considerable addition has been made in permanently recording such naming in the records of the Geographic Board of Canada. This entails a large amount of searching of records and historical data and consumes a corresponding amount of time. The time, however, is minimized, and in most cases serves a double purpose in connection with the preparation of our new Geographical Gazeteer of the Province.

Although the assistant who is compiling the Gazetteer has been interrupted in his work for considerable periods in carrying on his other duties of checking, proof-reading, all naming, filing, and arrangement of geographical data, research in connection with the Geographic Board of Canada, the first operation in the compilation of the Gazetteer was completed in August, making a total of 16,622 cards filled in. These were then copied in ink to make a permanent record. The second operation of the Gazetteer, that of filling in detailed information covering the places recorded, is now well forward, approximately two-thirds of this work being completed. Besides the main operations in the preparation, a cross-index of old and other names of the geographical features has been completed, and is ready to be incorporated with the main Gazetteer when the Gazetteer cards shall be arranged in alphabetical order. This index is covered by approximately 1,700 cards.

The importance of showing in our maps educational facilities throughout the Province has been more and more apparent, and in order that such information should be reliable an indexed school-location system was instituted. Index cards were sent out to the Secretary of the Board of each school wherever necessary, and these, when properly filled in for location, have been included in our geographical index system.

Our indexes of post-office locations and other Provincial data have been kept up to date.

Cost-card System.

In past years the staff has been called upon to execute a large number of demands for special draughting by various departments of the Government; so much that these at times seriously interfered with the primary objects of the Division. To regulate this without inconvenience to the service, a cost-card system was introduced, so that all such work could be correctly charged to the department sending in the work. In this year forty-four demands for work of this nature were accommodated. These constituted many forms of draughting, from map-work to design and sketching, and were submitted by nearly all departments of the Government and the various branches of the Lands Department.

Map-mounting.

The volume of map-mounting this year has exceeded that of the preceding year. The work has been especially extended in the joining-up and mounting of the photostat prints and blue-prints, these having more than doubled in volume.

The rearrangement of accommodation referred to in our report of last year has proved particularly advantageous, and many fine examples of map-mounter's art have been turned out. One especially fine work was the preparation of a loose-leaf map-book containing a complete set of maps covering the cities and municipalities of the Province. This is the first time that such a record has been collected and bound together in permanent form.

A synopsis of the work accomplished during the year is as follows:—

Loose-leaf map-books prepared	6
Maps cut to fold and mounted	927
Blue-prints mounted	644
Photostat prints fitted, joined up, and mounted	513
Official maps repaired	5

In addition to carrying out the map-mounting requirement of the Survey Branch, the cash receipts and departmental credits for the period January 1st to December 31st amounted to $1,594.45.

Photostat.

The rearrangement for photostating accommodation has worked smoothly and efficiently during the present year. Although in the work done for the public the amount has decreased

about 20 per cent. from that of last year, the work completed for the departments has increased about the same percentage. In addition to the general demands for work, there has been an increasing requirement for reproduction to precise measurement. Such work has been greatly expedited by the use of the vertical copying-board, which allows of a 7:1 reduction, whereas the machine itself is built for a 2:1 reduction. In 1920 nineteen reproductions were completed by use of the vertical copying-board, whereas in 1921 this number increased to 109. A list of work completed is appended.

Requisitions for 1921—	Receipts and Credits.
Departmental, 568	$1,537 50
Public, 204	710 85

It is gratifying to note that, although the past year will be known as a period of depression, work in our photostat has shown a substantial level throughout. It is therefore anticipated that when conditions for engineering projects improve there will be correspondingly increased demand for the work of our photostat equipment.

MAP STOCK AND DISTRIBUTION.

The map-distribution direct to the public from the Geographic Division has proceeded satisfactorily. A saving has been effected by the organization which enables the work to be done in a portion of the time by a junior apprentice, whereas formerly it occupied considerable time of higher-priced clerks. The centralization in attending to map requests has proved a restraining influence upon duplication and wastage. At the same time the public receives speedy attention to requests.

Last year the time of the staff was principally engaged in preparation of our pre-emptors' maps to replace our depleted stocks. This year we have been able to devote greater attention to preparation of required new works.

The total number of maps issued to departments and public during 1921 was 16,375. Maps received into geographic stock, 24,492. A large proportion of the requests was for single maps. Certain special maps were printed for distribution by other departments, amounting in number to 12,800.

Letters received and answered during the year totalled 1,298, an increase of 30 per cent. over the preceding year.

Cash receipts for printed maps and draughting, January 1st to December 31st	$1,750 24
Credits (Lands Department) for printed maps and draughting, January 1st to December 31st	1,033 15
Total	$2,783 39

STANDARD BASE MAP.

Reviewing the work of the year in connection with our Standard Base Map system, and especially looking towards the practical application unfolded by the progress of the work, it is most gratifying to be able to report that the result has more than justified the hopes that were entertained for this scheme. Owing to present necessity for limiting expansion the staff as originally proposed has not been engaged. It has, however, been possible to steadily continue our policy of laying down the skeleton traverses and the compiling, computing, and fixing of the main control positions. This year 7,748.80 miles of skeleton traverse were laid down. This, in conjunction with the mileage laid down in 1920, totalling 17,090.90 miles, or 135 main routes, to date. Of these routes, thirty-four have been balanced and forty-seven computed.

The second operation of the scheme—that of plotting the skeleton routes on the scale of 1 mile to 1 inch—was begun; twenty-one sheets of 30-minute area, plotting all the skeleton routes contained in the area, have been completed.

The skeleton sheets on completion immediately proved their value, offering wherever available a solid constructive basis for the maps produced by the Geographic Division, minimizing the possibility of error, expediting the constructive work, and broadening the efficiency of the staff. This same effect has been realized by the Survey Division in their work in preparing new reference maps.

An initial effort was made on the third stage of the S.B.M. scheme—that of plotting of 10-minute quadrangle sheets on the scale of 20 chains to 1 inch (the Standard Base Map). Two

of these sheets were partially completed. The demand for the skeleton sheets of 1 mile to 1 inch has been so immediate that these proved the main object for this year.

The requirement for obtaining an advance plot of the triangulation of the coast-line of the Province, between the north end of Vancouver Island and Prince Rupert, necessitated special employment of one of the S.B.M. staff.

LAND REGISTRY PLANS.

Demand for copies of Land Registry plans in the administration of the Lands Department has been increasing. Heretofore as each demand arose delay was experienced until copies of these plans could be obtained. Arrangement was made by the Surveyor-General to obtain copies of these plans from the District Land Registry Offices, so that these would be available and avoid any delay within the Department. The Geographic Division was asked to devise and submit a system for filing this information, and subsequently requested to carry out the work of indexing and registering all such plans received, according to the system conforming with the principle of the Central Index. The importance of immediately putting this work into effect has necessitated giving it precedence over the work of the Central Index, as both these works are wholly in the hands of the S.B.M. Registrar.

The method of indexing requires the exact geographical location of the registered lots, and also entry under the district registered plan number; 544 plans have been received since this was instituted, making in all 1,088 entries.

CENTRAL INDEX.

The Central Index has proceeded in available time, so that 20 per cent. of the plans to be indexed were completely entered during the year. This amount, with the 15 per cent. accomplished in 1920, brings the total to 35 per cent. of the plans filed in the Lands Department.

At present date the Central Index is not sufficiently advanced to place it in general use, but it is clearly evident, from the work done so far, that this system is the one which will provide permanency in our filed records. In its construction a reference is made so quickly and definitely that it must also provide an appreciable economy in the time of the public and staff.

I have, etc.,
G. G. AITKEN,
Chief Geographer.

OOTSA AND BURNS LAKE, RANGES 4 AND 5, COAST DISTRICT.

BY V. SCHJELDERUP.

BURNS LAKE, B.C., November 21st, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—The work this season consisted of the survey of Crown lands in the vicinity of Tchesinkut Lake, Wistaria, and north of Burns Lake; the running of centre lines in previously surveyed lots in the district between Francois Lake and Ootsa Lake; the triangulation of Taltapin and Augier Lake, and various connection traverses; 7,790 acres of Crown lands were surveyed and 5,800 acres subdivided, lakes to the extent of 16 miles in length were triangulated, and 24 miles of connection lines and traverses were run.

TCHESINKUT LAKE.

This beautiful lake lies some 3 miles north of Francois Lake and parallel to same. It is about 10 miles long, with an average width of 1 mile, and has an elevation of 2,400 feet above sea-level. The main Government wagon-road from Burns Lake to Francois Lake meanders along the shore-line of the west end of the lake for about 1½ miles. The distance from Burns Lake is 9 miles.

Practically all the land surveyed by me in 1913 and 1914 has been taken up under pre-emption record, although the land is far from what one might call first-class agricultural land. A new school-house was built this spring and a post-office established this fall.

The lake affords very good fishing; especially grey and rainbow trout are plentiful and of exceedingly fine quality. Small game such as geese and rabbits are numerous everywhere. Deer, moose, and black bear are found in fair numbers, but here, as elsewhere in the district, not very plentiful.

The land, 3,854 acres surveyed this season, is situated on the north shore and at the east end of the lake. A detailed report on each parcel surveyed accompanies the field-notes of the surveys and therefore details will not be entered into in this report.

The proposed trunk road to connect the Bulkley and Nechako Valleys follows the north shore of Tchesinkut Lake, and, if ever built, I have no doubt that the larger percentage of the land surveyed will be taken up by incoming settlers. Some of the land has already been applied for and settlers are in occupation.

WISTARIA AND STREATHAM.

This part of the district may be reached by wagon-road either by way of Burns Lake or Houston. The distance from Burns Lake to Wistaria Post-office is some 50 miles and the distance from Houston practically the same. The Burns Lake route is the best and the one generally used by most of the settlers. Streatham Post-office is situated about half-way between Ootsa Lake and Wistaria Post-offices. There is a school at Wistaria.

In spite of the remoteness from the railroad, this district has shown more progress during the last few years than most parts of the Francois-Ootsa Lake District and the settlers seem quite satisfied with their prospects.

My work in this neighbourhood consisted partly of the running of centre lines in previously surveyed lots and partly of the survey of Crown lands. The new area surveyed, 1,700 acres, lies midway between Ootsa Lake and Francois Lake. A fair proportion of the land surveyed is good hay land and quite a number of acres could be cleared at a very reasonable cost. Wild hay has been cut on this land for several years by settlers in the vicinity.

NORTH OF BURNS LAKE.

On completion of the surveys in the Wistaria District the party moved back to Burns Lake, and after replenishing supplies, etc., headed north to carry out surveys between Burns Lake and Babine Lake; consisting of the triangulation of Taltapin and Augier Lakes, traversing of Augier and 15-Mile Creeks, the tying-in of previously surveyed lots in the locality, and the survey of Crown lands suitable for settlement.

TALTAPIN LAKE.

This lake was found to be 10 miles long, with an average width of about three-quarters of a mile. It lies in a north-west and south-easterly direction at an elevation of 2,700 feet above sea-level. Some 700 acres of land have been surveyed at the west end of the lake, but the land is of practically no value for agricultural or any other purpose.

Augier Creek flows in at the west end and another fair-sized stream comes in at the east end of the lake. The hills on both sides of the lake are rough and broken and not an acre of land worth while surveying for settlement was seen anywhere. On the south side the hills have a dense growth of spruce and pine timber of apparently good quality. From the west end and extending down the lake for 3 miles is a high ridge which drops very steeply to within a short distance of the shore. This steep and rocky slope is partly open and partly covered with a scrubby growth of poplar and willow. The balance of the north shore is mostly timbered with pine of no commercial value.

The lake has the reputation among the Indians of being one of the best fish-lakes in the district, but owing to the lack of boats and canoes on the lake we had little chance of ascertaining the truth of this assertion, as the two rafts which we built for moving down the lake were too slow for trolling and it was rather too late in the season for fly-fishing. No big game was seen, although, judging by the number of tracks, there must be quite a few moose ranging up and down the lake, also deer and bear.

15-MILE CREEK.

About 3 miles down from the west end of Taltapin Lake, 15-Mile or Anderson Creek, flowing in a north-westerly direction, drains Taltapin Lake into Babine Lake. This creek is some 8½

miles long. For the first 4 or 5 miles it has but very little fall and is more of a lake than stream. The lower 2 miles is nearly all rock canyon with a drop of some 350 feet. At the mouth of the creek the Dominion Hatchery has a cabin and salmon-traps, and a considerable amount of spawn is gathered here every season and taken to the main hatchery at the lower end of Babine Lake.

About 2½ miles up the creek, on the west bank, two lots of 160 acres each have been surveyed. These lots were tied in to the traverse, as were also the surveyed mineral claims farther up the creek. The Taltapin Mining Company's buildings are situated on the west bank of the creek some 3 miles up from the mouth. Mr. Anderson, who lives here in hopes of a rise in the price of silver and reopening of the mine, grows the most wonderful potatoes and other vegetables in his garden-patch, but from an agricultural point of view this part of the district has, in my opinion, no chance of development, and, as on Taltapin Lake, no additional land was surveyed by me.

The creek has an all-year flow of water sufficient to generate all the power necessary should the Taltapin Mining Company ever open up in earnest.

Augier Lake.

The north-west end of this lake is some 2 miles east and 4 miles south of the Babine Lake Landing. The length of it is a little over 6 miles and the width averages about half a mile. The lake lies at an elevation of 2,800 feet above sea-level in the usual north-west and south-easterly direction and drains in a south-easterly direction into Taltapin Lake. The distance between the lakes is 5 miles.

No land has been surveyed on the lake, and, with the exception of a very few acres on the north shore about 2 miles down, there is no land suitable for settlement. The hills on both sides of Augier Lake are high and rough from the head of the lake to about half-way down, from whence they taper off towards the outlet, where the country has a level appearance. The south side is densely timbered with pine and spruce, but very little of it appears to be of any value for commercial purposes. The hills on the north side for about 3 miles down are very rocky and but sparsely timbered with scrub poplar and willow; the remainder of the north shore is timbered with pine, with some scattered poplar and spruce here and there.

Pinkut Lake, which lies at an elevation of about 2,900 feet above sea-level and parallel to Augier Lake, drains into the latter. Pinkut Lake is a little less than 5 miles long and some 3 miles distant in a south-westerly direction from Augier Lake.

Crown Lands surveyed.

At Big Foot Lake, about 9 miles north of Burns Lake by road, one lot of 160 acres was surveyed, and between this and Burns Lake 2,080 acres were surveyed before I closed down field operations for the season. The land is not exceptionally good, but it is easily accessible by road either from Burns Lake or Decker Lake. Three of the quarters surveyed embrace land which would have been filed upon before this had it been surveyed and open for pre-emption. On some of the land there are patches of tie-timber which is now being cut by Mr. Hanson's camp, located just outside my surveys.

Roads.

A Government road leads from Burns Lake to Pinkut Lake Landing, a distance of 12 miles. From this landing there is a trail to the lower end of the lake, a distance of some 4 miles. From this latter point the Government road continues for about 6 miles to Babine Lake Landing. There is a great amount of traffic over this road both during the summer and winter months. In the summer-time wagons and loads have to be taken by boat from Pinkut Landing to the lower end of the lake and the horses driven down over the trail, which, of course, is a great drawback to any one freighting or travelling over the route. From about a quarter of a mile south of Pinkut Landing a winter road 12 miles long and built by the Taltapin Mining Company leads to the mine on 15-Mile Creek. A pack-trail was cut out by my party this fall from Augier Creek Crossing down to Taltapin Lake, a distance of 4 miles.

General.

So many reports have been written and published covering the district in general by various Government officials, as well as others, that but very little will be said by me this time.

The district, in my opinion, has a bright future ahead of it, and in spite of all the complaints and kicking one hears from would-be farmers it forges ahead, in support of which I may state that this year alone three new post-offices have been opened, two more promised, and four or five schools built. The real settlers, both old-timers and recent ones, realize the possibilities of the district for dairying and mixed farming, and feel quite confident that the day will soon come when activity and prosperity will be general throughout the district. The Government, through the Land Settlement Board, assists farmers in securing pure-bred dairy cattle on reasonable payments. Compared with other parts of the Central Interior, the Francois-Ootsa Lake District has been little advertised to the outside world, but, in spite of this, I believe the district has received more *bona-fide* settlers during the last three years than any other part.

Roads throughout the district are continually being improved by the Public Works Department, and a steam-shovel was brought in this spring which is doing wonderful work, and even the most pessimistic have to admit that now it is only a matter of a little more patience and good roads will be an accomplished fact. What is now needed is good settlers and lots of them. Good land can be bought at very reasonable prices and terms. The Land Settlement Board's prices vary from $3 to $15 per acre and comprises some of the best land in the district.

The Dominion Telegraph Line has this season extended their Francois Lake branch line through to Ootsa Lake with the intention of continuing it to Wistaria and the west end of Francois Lake, connecting up with the line built out from Houston some years ago. The cable across Francois Lake has as yet not been laid. However, it is expected that the cable will arrive in time to get it down before the lake freezes over.

A Prince Rupert firm has secured a tie contract on Francois Lake this winter. The ties will be hauled down to the lake-shore on the snow, and as soon as the ice goes out in the spring they will be towed down to the lower end of the lake, where they will be turned into the Stellako River to be picked up again near Fraser Lake, where this river flows under the Grand Trunk Pacific Railway. This contract will create quite a pay-roll among the people on the lake and may develop into an extensive industry, as almost unlimited quantities of tie-timber exist on both sides of this lake.

With the exception of Mr. Barker, who is successfully operating a fox-farm on an island in Ootsa Lake, the fur industry has as yet not been developed in this district. Mr. Anderson, on 15-Mile Creek, has succeeded in breeding marten in captivity, which, I am told, no one has done before. Whether he will make a success of it has yet to be seen. In the outlying portions of the district trappers are busy every season and some very good catches are brought in.

I have, etc.,

V. SCHJELDERUP, B.C.L.S.

SOUTH OF PEACE RIVER BLOCK, PEACE RIVER DISTRICT.

BY A. R. BARROW.

POUCE COUPE, B.C., August 29th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—The area allotted to my survey was that in the vicinity of the Interprovincial Boundary, south of the Dominion Peace River Block. My previous examination of the Peace River District had been only west of the area in question, with which I was not personally acquainted, and the little information concerning it, other than verbal, was contained in reports of the Minister of the Interior, much of it unpublished. In this connection I am much indebted to the officers of the Dominion Lands Survey, both at Ottawa and locally in the field, and particularly to Mr. Cautley, for their ready response to my inquiries.

The verbal information acquired I found to be unduly optimistic and the results of the season's work are distinctly disappointing. I think it probable that the information concerning the country was very slight when the 120th meridian was adopted as the Interprovincial Boundary, but that boundary proves to be, south of Swan Lake, also the boundary between large areas of land suitable for settlement, and small patches of land, adapted to the use of trappers and hermits, which may be cultivated, but which are surrounded by badly burnt country, windfalls, scrub timber, muskegs, and small lakes. The wagon-tracks to this boundary

land are all from settlements in Alberta, and I noted that uniformly the townships in Range 12 were desirable and in Range 13 less so, deteriorating as one travelled west, until at the boundary the land is nearly worthless. The settlement towards the boundary must be from the east and is likely to be slow, which circumstance condenms the country to isolation. Settlers west of the boundary, meanwhile, would have no claims for roads on the Alberta Government, which only could afford these necessities.

For the first time since 1902 I used wagons for transport and found that the greater distances travelled and time occupied were more than offset by saving the expense of a pack-train. Personally, I used the Boundary Trail and was able to get a good idea of the country to the west. This boundary, which is used as a pack-trail, traverses many bad mud-holes between the Wapiti River and Swan Lake, but north of that lake it is practically dry to the crossing of the trail from Pouce Coupe to Fish Lake in Township 77. The windfall south of Red Willow River is all that Mr. Cautley describes it.

At the Wapiti River no land could be found to attract the most hopeful settler, and in any case the elevation is probably about the limit of settlement in these latitudes.

At the Big Slough, Gunn's pre-emption (P.R. 3130), was found the best growth of slough-grass, the only product of the country, in view of the fact that it could be cut in most years, judging from appearances, but the pre-emption covers the available land. The country has afforded some large catches of fur in former years. The nearest base for supplies is Rio Grande, 18 miles.

The land reported by Mr. Cautley north of the Red Willow River was not surveyed. It is a small gravelly flat, backed by a strip of good land on the bank, 5 chains wide, beyond which is a dismal muskeg.

The land at Kelly Lake resembles the Big Slough, as also does Crooked Lake, which latter is, however, even in this dry season, too wet for mowing hay by machine. The settlers use Hythe as a base of supplies. At Crooked Lake I found only two men who were removing to some more favoured spot. They had squatted on a small lake 3 miles south-west, 2 miles beyond which is a tributary of the Cutbank River, in which grayling are plentiful and confiding. This is the first occasion on which I have found edible fish in the Cutbank watershed.

Lots 254, 255, and 256, north of Crooked Lake, are worthless for settlement and were surveyed only to complete Mr. Campbell's operations. It is significant that the surveyor of the adjoining Township 74 left the portion abutting on these lots unsurveyed.

On Lots 239 to 244, north of Swan Lake, it was pleasant to find dry ground. Generally speaking, the land is good for summer grazing, the value of which is increased by the adjoining Township 76 being a forest reserve. The land is unattractive for settlement owing to the want of water, with the exception of Lot 242, for which there is an application to purchase.

The topography of the country travelled over is outlined in the Dunvegan and Wapiti Sheets of the Dominion Sectional Map, 1917.

The outstanding feature of the exceptional weather, which occurs every season, is that it was exceptionally pleasant during the short time I was employed. The men of the party gave excellent service and the woman cook was an unqualified success.

I have, etc.,
A. R. Barrow, B.C.L.S.

NESS AND BEDNESTI LAKES, CARIBOO DISTRICT.

By J. F. Campbell.

Prince George, B.C., November 4th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—Surveys consisted of subdivisions of reverted lands in the vicinity of Ness Lake, surveys of vacant land near Bednesti Lake, and subdivisions of a few sections of reverted land on the Nechako River between Prince George and Isle Pierre.

Ness Lake.

Ness Lake lies 30 miles west by rail from Prince George and 6 miles north of Isle Pierre on the Nechako River. A road leaves the north bank of the Nechako River opposite Isle Pierre

Station, on the Grand Trunk Pacific Railway, and winding up a draw for three-quarters of a mile reaches the level of a plateau that extends north to the lake. The road runs northwards for 8 miles and ends near the western extremity of the lake.

The lake, beautifully situated between gently sloping banks, has a firm sandy gravel bottom and is 5 miles in length. The width varies from three-quarters of a mile to a few hundred feet where it winds through narrow passages. On first observation the size of the lake is deceptive, due to its many bays and narrow channels, and appears much smaller than is actually the case.

The area locally known as the Ness Lake District extends back from the lake a distance of from 3 to 4 miles, the general height of the land being 300 feet above the Nechako River. The elevation of the Nechako River at Isle Pierre, on the Grand Trunk Railway, is 2,082 feet above sea-level. The character of the country in this locality is distinctive from that usually encountered on the Nechako Plateau.

The first noticeable feature is the exceptionally heavy undergrowth of red willow, alder, and berries of different varieties. This undergrowth, which grows to a height of from 4 to 8 feet, is much entangled and matted and travel across country for this reason is at times extremely difficult. The heavy nature of the underbrush extends 3 miles to the south and 2 miles to the west, while to the north and east it is much lighter.

Another noticeable feature is the flatness of the country. This is usually a good feature, but in this case it is often difficult to obtain proper drainage, and in the spring the surface water lies in the depressions longer than is generally the case.

It was also noticed that there is no visible outlet to the lake, although the water-level at present is very little higher than it was some years ago, the higher water-level possibly being due to the heavy rains of the past summer. This tends to give the impression that there is an underground outlet to the east, where the ground is swampy for a considerable distance back from the lake.

The soil to the south and west is a deep black loam, 2 to 4 feet in depth, with a clay subsoil, while to the north and east it is more of a chocolate-coloured loam of the same depth with a clay subsoil. On top of the soil the leaf-mould is 2 inches in depth.

The general timber is poplar and cottonwood 4 to 18 inches in diameter, an occasional lodge-pole pine and spruce in the swampy areas. When this land is cleared of the timber it is ideal for hay and oats, and from the indications of the growth of wild berries should produce a good berry yield. Wheat has been tried on the cleared land, but in all cases was sown too late in the summer to get a fair trial and was not a success.

There is considerable land that has the appearance of marshy muskeg, but when the mossy top is burnt off and the land drained and the soil allowed to dry, good crops of hay can be grown. Where the land is marshy a number of settlers are carrying out quite extensive drainage schemes, and areas of this drained land when put under crop have returned many times the value of the labour expended.

The majority of the settlers are recent arrivals from the Prairies, where lack of moisture in their particular district has made crop-failures for a number of years. They are well satisfied with the new location, although in some cases they were not familiar with clearing, and the progress made at first was slow; they have now got into the proper swing and expect to have small areas under cultivation next year.

The district is fairly well supplied with roads. Besides the road from Isle Pierre there is a new road building from Prince George to the east end of the lake, where it is now slashed, and from there will follow the southern shore west. This road will make the distance 18 miles to Prince George from the east end of the lake. There is another road branching from near the east end of the lake, and, going southerly, reaches the Nechako River at Miworth, on the Grand Trunk Pacific Railway. A Government ferry across the Nechako is in operation at this point and carries teams, wagons, etc., free of charge six days in the week, while on Sundays there is a charge of 25 cents per person and 50 cents per team.

ISLE PIERRE.

Isle Pierre is 30 miles west from Prince George on the Grand Trunk Pacific Railway. At this point the hills on either side of the Nechako River contract, and where the river cuts through a short canyon is formed, called Isle de Pierre Rapids. The name is taken from a small rocky island that lies near the right bank of the river, midway through the rapids.

On the north side the hills rise abruptly for 300 feet, while on the south there is a bench a quarter of a mile wide which the Grand Trunk Pacific Railway traverses. From this narrow bench the hills rise by a series of benches towards a rocky knoll 800 feet above the river and lying 3 miles to the south-west. This knoll is a prominent landmark and was used in the days before the railroad as a guiding mark.

Running back from the river on the south or right bank are draws that have been formed by the action of the water from the melting snows in the spring of the year. These draws or gullies are 10 to 15 chains wide at the bottom and gradually ascend from the river until the top of the bench is reached. The soil in the draws is very fertile and excellent crops of hay and oats are raised by the owners. One of these bottoms directly behind Isle Pierre Station is cultivated to the extent of 15 acres under oats, and the crop when seen in the latter part of July was 3 feet in height, with a good head. With the exception of the river-bottom bench, which is a quarter of a mile wide, and the narrow draws, there is no agricultural land until the top of the bench is reached, about 300 feet above the river. The bench on top is fairly level and the timber, principally lodge-pole pine and small poplar, is scattered. Some years ago a fire travelled the country and the second-growth poplar is very open and the clearing light.

The soil on the river-bench is a sandy silt, with a heavy growth of wild grasses and strawberries. On the upper levels the soil is more of a chocolate loam, with a mixture of sand where the recent fire has destroyed the top soil. In many places, especially towards the south-west, rock-outcrop is noticed, and the agricultural land in this vicinity, with the exception of the actual river-bench, is limited.

The few farms along the river have generally had a successful year and the crops have been up to standard. The heavy rainfall experienced in the late summer destroyed part of the hay-crop, but with this exception the farmers are well satisfied with crop conditions.

Bednesti Lake and Vicinity.

Bednesti Lake, one of the many pretty lakes in this district, is 30 miles west from Prince George, midway to Vanderhoof. The Grand Trunk Pacific Railway is 6 miles to the north, while the main trunk wagon-road between Prince George and Fort Fraser parallels the lake a mile to the north. Two short wagon-roads branch from the main road, one reaching the lake near the western end and the other about midway along the north shore.

The lake is 4 miles in length and has a hard sandy bottom. Berman Lake, half a mile to the east, is connected to Bednesti Lake by Moses Creek, a stream 100 feet wide. A heavily loaded boat can be rowed from one lake to the other.

Bednesti is on the old Stony Creek Trail, which in days before the building of the Grand Trunk Pacific Railway was the main artery of travel between Fort George and Fort Fraser. Along the shore of the lake are many open spaces that have been cleared by campers in past and recent years, for Bednesti is celebrated for the size and number of trout caught in its waters. The Indian name for the lake, Bednesti, means big trout, and it still justifies its name.

A series of sharply pitched rises or hog-backs, a quarter to half a mile wide, parallel the north shore of the lake. These at intervals branch into the lake, forming gravelly spits a few feet wide and a few hundred feet long. This ridge of hog-backs starts about midway on the north shore of the lake and ends 2 miles to the east. This narrow strip of rough country lies between the main wagon-road and the lake and is more or less gravelly. On either side the country is level and wooded with scattered lodge-pole pine, small poplar, and an occasional fir.

The land rises from the lake towards the north with a gentle slope and is fairly lightly timbered with pine and poplar, although there are patches where the timber is rather dense in growth but small in diameter. The soil is a chocolate-coloured loam, with gravelly knolls scattered throughout the area. The slope extends back for a mile, when the country levels out until the descent into the Nechako Valley is reached.

To the south of the lake the ground rises for 50 feet and then extends southwards with slight undulations until the base of Bobtail Mountain is reached. Along the lake-shore is a fringe of timber a few hundred feet in depth, while beyond this an old burn extends for many miles. This burn has cleared the country of its previous light growth of timber without injuring the soil to any great extent, although in any place that gravel lay beneath the top soil this is now exposed by the action of the fire. There are many meadows, both dry and marshy, throughout the burn, which sustain a heavy growth of wild hay.

Bednesti Lake drains to the east by Bednesti Creek, which empties into the Nechako River a few miles west of the Chilako River. This creek is remarkable for its tendency of disappearing underground for half a mile or more, and then reappearing, flowing stronger than ever. The old creek-bed is well defined, but no water has passed along it for many years and it has now grown up in willows.

The land bordering the creek and for a quarter of a mile on either side has a luxuriant growth of wild grasses and vetch. A mile from the lake the creek-valley widens and there are many small hay meadows 5 to 10 acres in size. Two miles east from the lake, and also to the south, hay meadows are encountered varying from 5 to 40 acres. On most of them hay is cut by the settlers in the immediate vicinity, and in winter, when the snowfall is light, they are used for winter pasture.

The country is rapidly being settled by farmers who are working hard and intend to make a success. Many of them have from 10 to 40 acres under crop and have a ready market at hand, either in Prince George or Vanderhoof. On the farm of A. J. Abery, 2 miles from Bednesti Lake, a tractor is used for ploughing and other farm-work. Although he has only been in occupation for eighteen months, half a dozen buildings are erected and 15 acres under cultivation. Two miles farther to the east H. B. Mason has 40 acres under crop, besides a dozen head of cattle in pasture. He has been in occupation for two years and is now shipping butter, beef, etc., to both Prince George and Vanderhoof.

There are many excellent pieces of land that would make good farms, but the land has to be carefully selected, as the country is patchy and the quality varies in a very short distance.

The road from Prince George that passes through this area is in first-class condition, both for heavy transportation and motor traffic. Two roads branch from the main road and run to the railroad, one to Nichol Station and the other to Bednesti Station, and with these the farmers have very little difficulty in getting their produce to market.

TRANSPORTATION.

The main trunk roads west from Prince George are in good condition during the summer. In the spring and late fall the melting snows and heavy rains soften the mud top and heavy vehicle traffic cuts the road into deep ruts. This makes travel in the spring and fall of the year rather difficult for heavy loads, but in the summer and early fall the roads are in first-class condition.

A road runs from Prince George west 70 miles to Vanderhoof and continues to Fort Fraser. This road parallels the Nechako River at an average distance of 6 miles to the south, and is used a great deal for motor traffic between towns and by the settlers when hauling their produce to market. During the construction of the Grand Trunk Pacific Railway this road was used for the transport of material for the railroad, and the bridges and embankments are built to withstand the heaviest loads.

The principal means of transportation is the Grand Trunk Pacific Railway. At most stations roads extend back to the main roads that parallel the river. At Miworth and Hulatt there are Government-operated ferries that transport teams and wagons free of charge across the Nechako River. At other points there are boats that carry passengers across the river.

TIMBER.

There is very little merchantable timber lying along the Nechako River. The only exception to this is tie-timber of lodge-pole pine. Most of the timber that could be used for ties is to the north of the river and some distance back, and to transport the ties for a few miles and then cross the river entails too much expense. There are a few isolated sections of good timber for milling purposes near Bednesti Station, on the Grand Trunk Pacific Railway, but not enough to pay for installing a mill.

GAME AND FISH.

Game throughout the district is very plentiful. The moose are increasing rapidly and were frequently seen, especially near the roads which they use for travel. It is within the past ten years that moose have come into the district in any numbers. Previously they inhabited the country farther to the north and east, but now that the Indians are few in numbers and do little hunting the game is rapidly coming south. The deer are plentiful, but are much more difficult to hunt than the moose, as they are wilder and more apt to take fright at the least noise.

In most of the lakes camped by fish were easy to catch. Ness Lake has no trout, but plenty of ling that grow to a fair size. Bednesti Lake is well supplied with rainbow trout that readily take the fly. Catches of over a hundred trout have been made in this lake over the week-end. The Nechako River can be fished successfully at certain stages of water and fair catches made. Occasionally sturgeon is caught, sometimes weighing as much as 300 lb., but this is more the exception than the rule.

I have, etc.,
J. F. CAMPBELL, B.C.L.S.

MISCELLANEOUS SURVEYS IN CARIBOO DISTRICT.

BY RUPERT W. HAGGEN.

QUESNEL, B.C., November 3rd, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—Surveys were made during the past season in the following localities in the Cariboo District: Blackwater, 10-Mile Lake, Quesnel, Big Lake, Beaver Lake, Horsefly Lake, and Moffat Creek. The work consisted largely of the subdivision of old surveyed lots into 160-acre parcels, involving the retracement of old lines, which are now overgrown in most cases.

BLACKWATER SECTION.

Eleven lots were subdivided near the mouth of the Blackwater River, which enters the Fraser some 45 miles above Quesnel. The northerly of these sections lie partly on very steep hills which border the Blackwater Valley and can hardly be considered as desirable for settlement, although one pre-emptor, who has been in the district a number of years, has located in Lot 3591, on a bench near the river, at the mouth of the Tako River, a tributary of the Blackwater.

The Blackwater itself is a large stream, draining from the Euchiniko and Nazko sections. The Yukon Telegraph Line and the road from Quesnel to Vanderhoof and Prince George cross the river about 15 miles from its mouth. From the crossing the stream is a series of cataracts, flowing in a deep, rocky gorge. The hillsides are wooded with a growth of gnarled fir, with occasional small benches covered with poplar or jack-pine.

Vandenberg's pre-emption lies on a trail which was constructed some years ago on the north side of the Blackwater. On either side it is so steep as to be almost impassable for horses, even though lightly packed, and it is very difficult to see how the great obstacle of transportation is to be solved; any road-construction would necessarily be expensive. My own opinion is that settlers would be very unwise to locate in this canyon.

The surveys south of the Blackwater lie on a rolling bench following the Deep Creek Valley. A trail was built, leaving the Quesnel–Blackwater Road at the Deep Creek Cabin, a shelter-cabin built for linemen on the telegraph-line. Along the westerly sections there is a good percentage of very fair land, in some places fairly open, in others wooded with a growth of poplar from 2 to 6 inches in diameter. The Deep Creek Cabin is about 33 miles from Quesnel, and these lots lie from 5 to 9 miles north of the cabin.

The soil here is generally a clay loam of considerable depth and appears to have good productive possibilities. It is unlikely that irrigation would be necessary for general crop production; water could be obtained from Deep Creek, but, as the benches lie between 200 and 300 feet above the valley, the conduit would be long and would probably cost more than it would be worth. Domestic water should be obtained easily; there are some springs and indications are that wells would strike water at shallow depth.

As is general in the country north of Quesnel, the country has been fire-swept some years ago and the present bush is all second growth. There is considerable brulé. Towards the break of the Fraser Valley the land becomes very rugged, with a tangle of brulé and standing snags. Here the soil is very poor.

As there are no residents in this section, no data were obtainable as to rainfall or summer frost. However, it is reasonable to say that depressions would be more or less subject to frost, while uplands and slopes would not be.

The Blackwater River is a favourite spot for trout-fishing and splendid catches are made. In Deep Creek there are brook-trout. Beaver are numerous on Deep Creek and springs. Bear and deer are quite plentiful.

In the future, although not immediately, it is quite possible that this section may be in demand for a mixed-farming settlement. At the present time settlers can obtain land of much better quality nearer to markets.

VICINITY OF QUESNEL.

Three lots on the west side of the Fraser River, opposite Quesnel, were subdivided. Most of these parcels have been pre-empted. Some of them lie in the valley of Baker Creek and contain small patches of fertile land in the creek-bottom. The soil is a sandy loam. The banks of the creek are high and precipitous and the adjacent land rough. The vegetation is cottonwood, with considerable brush.

There is insufficient land on these parcels to enable their being developed into self-supporting farms, but undoubtedly good garden produce can be grown. They lie within 1 to 3 miles of Quesnel and are consequently within reach of a market for their produce. Two of the parcels lying on poplar benches north of Baker Creek should be good pre-emptions. Irrigation is unnecessary and there is ample domestic water available.

TEN-MILE LAKE.

Five sections were subdivided at 10-Mile Lake, which lies on the Pacific Great Eastern Railway 10 miles northerly from Quesnel. The altitude of this land is from 2,400 to 2,800 feet. From 10-Mile Lake the land rises in a series of benches to the east. A forest fire years ago destroyed the original forest, which was heavy fir, and in most places burned the humus in the soil, leaving the subsoil, gravel or hard-pan, exposed. In the course of time a fairly dense second growth of poplar and pine has sprung up and a shallow humus developed on the surface. Several pre-emptions have been taken up in this locality, mostly on a big swamp lying along the railway, and efforts are now being made to reclaim this swamp.

On the benches the cost of clearing would be from $40 to $60 per acre. It would seem doubtful if the land is worth clearing at the present time, although it may prove productive. A rank growth of peavine and weeds indicates the surface humus to be quite rich, but one is diffident about declaring that the land is suited for farming until some pioneer settler proves or disproves it by actual test.

The ground should be free from frost, there is a good average precipitation, and it lies adjacent to the railway, three very favourable factors.

Two miles east of 10-Mile Lake the summit of the divide between 10-Mile and the Cottonwood River is reached, and the final descent into the Cottonwood is very steep. At the present time considerable prospecting is being done for placer and dredging ground on the Cottonwood, and good values have been found in the gravel benches above the river; whether the ground has been prospected sufficiently to determine its suitability I cannot say. However, it is quite within the realms of probability that gold-dredging will within the next few years be undertaken on a large scale in the Cottonwood Valley. All who have tested the ground seem optimistic. The installation of such a plant is, however, very expensive, and in these days of money tightness none but very wealthy syndicates can install it.

BIG LAKE, BEAVER LAKE, AND PEAVINE RIDGE.

This section contains a large area lying within the drainage-basin of the Beaver Valley, including the tributary valley of Beedey Creek, Big Lake Creek, and Peavine Ridge Creek. It lies within reach of the 150-Mile House–Quesnel Forks Road, 24 to 35 miles from the 150-Mile House, 10 miles farther from the Pacific Great Eastern Railway at Williams Lake. A fair road from Macalister Station, on the Pacific Great Eastern Railway, enters the area at Beedey Creek, 19 miles from Macalister; while another road, from Big Lake to Soda Creek, enters it at Marguerite Lake, 18 miles from Soda Creek.

The area comprises a rolling plateau, its elevation being between 2,500 and 2,800 feet. There is no merchantable timber within the area, although on many ridges there is fir of fair size. On about 30 per cent. of the whole area there is a growth of light poplar, which can be cleared at a cost of from $20 to $50 per acre, varying in the different spots. In parts there is jack-pine and spruce. Over the whole area there is a luxuriant growth of peavine, fireweed,

and vetches. This has been of great use to the settlers, and I have seen them cut enough of this for hay to winter their stock; furthermore, the stock do well on it and are turned out in good shape. Throughout this area there is a good proportion of deep loam soil. The ridges are gravelly. Timothy, clover, grain, and vegetables of the hardier varieties grow well, the growth being really prolific. Summer frosts are apt to do damage to susceptible crops in the depressions, but on the uplands or slopes they do not occur.

One settler, Mr. McCuaig, who located on the summit of the ridge in 1919, had this season 60 acres in crop. Most of the settlers are getting their places in shape for production.

While there is not a great deal of surface water in the area, wells yield water at shallow depth. There is ample rainfall and the soil is retentive, irrigation being quite unnecessary.

The whole section, of which the area under review is a portion, extending from Miocene, on the Horsefly Road, to Horsefly and Horsefly Valley, Beaver Lake and Peavine Ridge, is, I consider, the largest area of fairly contiguous farming land south of the Grand Trunk Pacific.

It has in the past been used to some extent as a stock country, but is not very suitable, the winter season being too long, involving great expense for winter feeding. Throughout the area there is magnificent summer range of soft leguminous feed, but this is usually badly perished in October, and the feeding of stock is usually necessary from the early part of November till the end of April.

A number of settlers have located within the area during the past two years and are well satisfied with it, but all agree that it is a mixed-farming, dairying country. It is hoped that in the near future a creamery may be established at Williams Lake or some fairly central point.

When dairying is established as a base for the mixed-farming industry there is no doubt that the country will develop very rapidly into one of the best mixed-farming areas within the Province.

A creamery has been established at Quesnel during the past season and has done well. To the small farmer it is a great boon, as the semi-monthly cheque enables him to keep his farm going. In the past these men have had to keep their farms; now their farms keep them. It is to be hoped that as a further development a bacon-curing industry may be established within the district during the next few years.

At Twin Lakes, near Big Lake, some placer-mining has been done in the past, but no rich strike made. This year some further investigation seeking an old channel has been made. Throughout the area there seems to be a strata of limestone and there are several limestone hills.

Roads of good standard will be required within a short time to facilitate the marketing of produce; the present roads have been, as a rule, built along the lines of least resistance for some temporary purpose; the Horsefly and Quesnel Forks Roads are not of high standard.

Within the area there are post-offices at Horsefly, Miocene, Ochiltree (Rose Lake), and Beaver Lake; public schools at Horsefly, Miocene, Rose Lake, Beaver Lake, and Big Lake. The post-offices are served by weekly stage from Williams Lake.

Many of the settlers have depended in the past on a grub-stake from trapping. Horsefly, formerly Harpers Camp, is the centre from which most of the trappers work, and in the past a great deal of fur has been brought there; the chief pelts being marten, beaver, and musk-rat. With the falling market of fur and close season on beaver, many are abandoning trapping, and this greatly reduces the revenue of the country. Beaver are now very plentiful and much annoyance to surveyors is caused by their handiwork.

Horsefly Bay, Quesnel Lake.

Two amendment surveys were made on lots near the mouth of the Horsefly River, 15 miles up Quesnel Lake from the outlet. A dam at the outlet has kept the lake-water raised over flats at the mouth of the Horsefly for some years. Last winter a portion of this dam was blown out, as it was becoming unsafe under high-water pressure, and the flats at the mouth of the Horsefly have become accessible. There is only a small area of good soil here, the balance of the flats being sodden with water.

A road from Horsefly follows Horsefly Valley to within 3 miles of Horsefly Bay, and a foot-trail, pretty well filled with logs, extends to the bay. This is the usual route of parties going up Quesnel Lake.

Apart from the flats at the mouth of the Horsefly, the country is hilly and densely wooded with hemlock, fir, spruce, and cedar.

Quesnel Lake is a good trapping-ground. Within the lake splendid catches of trout are made.

MOFFAT CREEK.

Four lots were surveyed for intending settlers in the Moffat Creek Valley, from 8 to 10 miles from Horsefly, on a road which extends from Horsefly to Lac la Hache. Originally this road was used for hauling supplies to Horsefly Mine and was extended as a sleigh-road to Bullion via Polley and Bootjack Lakes. Years ago the latter section fell into disuse and is now impassable even for a saddle-horse.

In Moffat Creek Valley there are numerous wild hay meadows and some willow bottoms and poplar-flats. Some settlers have been there for several years and seem well satisfied. The soil is not of good quality as a rule, and the range is much poorer than in other sections of the district; however, the range is within easy reach of the valley. Lac la Hache, 37 miles distant, is the nearest point on the Pacific Great Eastern for settlers along Moffat Creek.

Beaver and musk-rat are plentiful along this valley. Game of other varieties does not seem to be plentiful, and there are few fish in the creek.

MOUNTAIN HOUSE.

Some ties were made from unconnected lots on the main Cariboo Road and Quesnel Forks Road to the old surveys at the Mountain (158-Mile) House. All land of any value here has been surveyed and taken up years ago. The ties run through fir and jack-pine on high, gravelly land.

GENERAL.

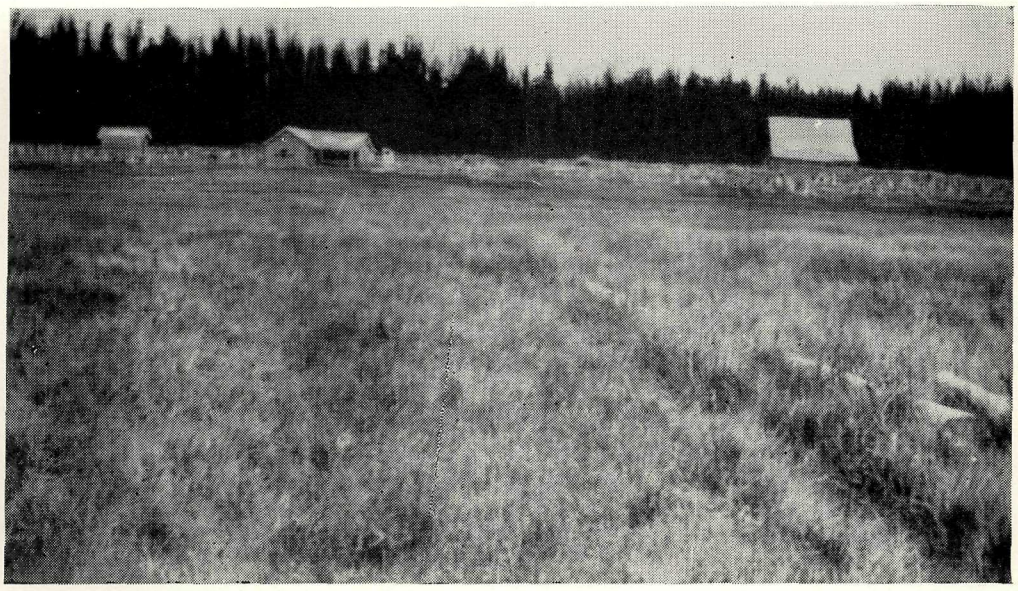
As was to be expected, the opening of the Pacific Great Eastern Railway has caused a considerable number of new settlers to come into the country. On the other hand, it has changed the conditions extant since the building of the Cariboo, when all mails, passengers, and supplies had to be hauled by horses over the long road from Ashcroft. During those years the ranchers did well raising horse-feed and the demand always equalled or exceeded the supply. Within very recent years hay has sold for as high as $80 per ton in Quesnel and oats at 6 cents per pound. Those farms which have not prepared for changing conditions are yielding little income to-day.

Of the new settlers who are coming into the section, a number have farmed on the Prairies and have come to the milder climate and more reliable conditions prevailing in this Province. These settlers, practical farmers, realize that the development of a farm involves labour; at the same time they know to what efforts it is best to turn their energies, and it is quite certain that most of them will make good. They have a definite object in view, know what steps it is necessary to take to reach their goal, and have some capital to tide them over the period of development, thereby having a great advantage over the settler who, lacking capital, must work out during a considerable portion of the year in order to exist. In the past a great many settlers pre-empted lands with the sole idea of doing the minimum amount of improvements, obtaining a Crown grant, and waiting for some one to buy them out. To-day the great majority of pre-emptors are taking up places because they want to develop farms.

Mining in the Cariboo has been continued on about the same scale as heretofore in the Barkerville section. On the Cottonwood River prospecting has been done. The Kitchener Mine at Keithley Creek has been hydraulicking and prospecting has been done in the vicinity of Cariboo Lake.

At Rose Gulch and Cedar Creek, near the outlet of Quesnel Lake, prospecting has been done on high benches and some very promising ground uncovered. One claim at Cedar Creek is yielding splendid returns at practically the grass-roots; up to the present, however, no data are available as to the probable extent of the auriferous gravel; it may be only a pocket or may turn out to be a big discovery.

The stockmen have had a very poor season. Beef to-day commands a price of about one-third of that prevailing two years ago, and is now selling at less than the cost of production on all but the most favourably situated ranches. Many of the newer ranchers, and especially the returned soldiers who bought places two years ago, can get no more for their 3-year-old



Making a farm in the Cariboo. Upper view shows first slashing and settler's cabin; lower, same land three years later.

stock to-day than they paid for them as yearlings. The unprecedented slump in live stock is bringing about a very serious situation for them. One year ago the cattle-raising industry was considered as the most stable in the country; to-day there is none more unprofitable.

In so far as the Cariboo District as a whole is concerned, while it will have its vicissitudes, there can be little doubt that the next decade will see splendid development in mining and farming; and probably a pulp industry will be started. At times we are all inclined to become a little pessimistic, but the more I see of the district the more firmly I am convinced that it will more than justify its development.

I have, etc.,

Rupert W. Haggen, B.C.L.S., D.L.S.

NAZKO AND CHILCOTIN VALLEYS, CARIBOO DISTRICT.

By W. C. Merston.

Victoria, B.C., December 23rd, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit the following report of my surveys in the Cariboo District during the season of 1921:—

I left Victoria early in June and travelled by the Pacific Great Eastern Railway to Williams Lake; then by a motor-truck to Alexis Creek, where I bought my first month's supplies. From this point I travelled by wagon and pack-horses up the Chilcotin Valley to Chezacut, and then to Nazko, where I picked up my second month's food-supply. My third and fourth months' food-supply met me on Upper Baker Creek, where I completed my season's work by following up Baker Creek to its headwaters, and thence continuing over the divide to the headwaters of Narcosli Creek, which I followed down to the Fraser River. During the season I ran 80 miles of tie-line, connecting 4,200 acres of open hay meadow.

Chilcotin Valley.

My first surveys were of three lots on the Chilcotin River, which completed the survey of vacant agricultural land in this vicinity. With the exception of a few scattered acres along the foot-hills, there is now no unsurveyed agricultural land in the Chilcotin Valley. I continued by way of the Chilcotin Valley to Chezacut, following a wagon-road up the Clinchintampan River, past Sucker Lake, and on to Aneko Creek.

The valley of the Clinchintampan contains the largest stretch of meadow country that was seen this summer. This valley is some 6 or 7 miles long, with an average width of about 1½ miles. In former years it was covered with brush, but this to a great extent has been cleared and now grows good hay. There is no vacant land in this vicinity.

Continuing from Sucker Lake, a wagon-road runs to Christie's meadow (Lot 3435). From here I ran a traverse-line to connect with my previous surveys in the Nazko Valley. Along this traverse I surveyed eight lots. The country is undulating and covered with second-growth jack-pine. Scattered among the jack-pine are depressions of various sizes covered with wild swamp-hay. The land between the swamp meadows is stony and of no use for agricultural purposes. A wagon-road connects Lot 3435 with the farthest of these meadows, which has been taken up by Mr. Christie. He has built a shack and barns and puts up hay here each year. Between Lot 3435 and the Nazko Valley there are approximately 850 acres of surveyed vacant land, all of which grows good wild hay and would be suitable for cattle-raising in a small way. This country lies at an elevation of 3,700 feet and is only suitable for cattle-raising. Good summer feed would be found near by in the Nazko Valley.

Nazko Valley.

On completing my surveys around Aneko Creek I moved to the Nazko Valley, where I surveyed seven lots.

With the advent of the Pacific Great Eastern Railway, giving easy and cheap transportation to Quesnel, many intending settlers are now coming in to the Nazko Valley. Whilst up to last June no new places had been actually taken up, five different parties were met who were seeking

homes in this part of the country. There is still much vacant land in this valley very suitable for cattle-raising in a small way.

The range along the valley is excellent and there is room for another 1,000 head of stock. The older settlers in this part of the country are prospering in spite of the slump in cattle prices.

Mr. Franklin, a local settler, has got out plans for the erection of a small sawmill to be operated by water-power from the Nazko River. The Harrington Bros., who are the largest land-holders in the valley, have just been joined by another brother, who has taken up a piece of land and has joined forces with his brothers in producing cattle.

I then traversed up Redwater Creek and surveyed two good quarter-sections on the way. These two quarter-sections are both mostly open and covered with good hay. At the present time cattle from the Nazko Valley graze here during the summer. The first of these two quarter-sections, Lot 9908, is locally known as Red Creek Basin. Its name is derived from its shape, which, with its gentle slopes, affords good early spring feed for cattle. At the head of this basin is a deposit of hæmatite, which I believe has been examined and reported upon by the Provincial Mineralogist.

While my party was completing the traverse to Redwater Lake, I was informed that "the largest meadow in the country" had just been discovered about 5 miles down the Baezaeko River from its junction with the Coglistico. I accompanied one of the settlers to this meadow and found it to be a long, narrow, S-shaped strip some 2 miles long, with an average width of not more than 10 chains. A tributary of the Baezaeko runs through it, cutting it up badly. Under the present system of surveys this piece could not be surveyed to advantage.

On completing the work in Redwater Creek Valley I moved by wagon to the Lower Baezaeko. A good wagon-road runs from the Nazko Valley, parallel to and some 2 miles south of the Blackwater River, to some hay meadows on the Baezaeko River. Two good parcels of bottom land were surveyed, which completed the survey of vacant agricultural land in this vicinity.

BAKER CREEK.

Leaving the Nazko, I travelled over the Nazko-Quesnel Wagon-road, which at this time (July) was in good condition and fit for a Ford car to travel over. On arriving at Puntataenkut Lake I turned south down a wagon-road which follows the western side of Baker Creek to some hay meadows about 5 miles from Tibble Creek. Two pieces were surveyed here, one of which has already been taken up by a settler in the neighbourhood.

From this point on I had to discard my wagon and use pack-horses. I procured these from the local settlers, who are mostly employed in raising horses and cattle. The settlement around Puntchesakut Lake, which is locally known as the Baker Creek Settlement, is going ahead rapidly. Three new families have settled in the locality during the last year and there are now sufficient children to start a school. With the aid of the Soldiers' Settlement Board, two families have bought herds of cattle and expect to make their fortunes in a few years' time.

On completing my first surveys on Baker Creek I crossed a low divide to Merston Creek and ran a traverse-line, connecting hay meadows up this creek to Tzenzaicut Lake. Three hay meadows were surveyed in this valley to the north of the lake and two parcels were surveyed at the east end of the lake.

The Merston Creek valley is narrow, widening out in a few places, leaving natural hay meadows in the bottom. Side-hills rise steeply from the valley to a height of 200 or 300 feet. These are thickly timbered with jack-pine growing up to 12 inches in diameter. In places a few spruce and poplar are found mingled with the jack-pine. Along the bottom of the valley a fringe of willows borders the creek on either side.

A large fire a few years back started on the west end of Tzenzaicut Lake and spread west to a distance of some 3 miles, completely cleared the country, and destroyed all the surface soil, leaving a bare and rocky country. A good trail follows Merston Creek to Tzenzaicut Lake; thence along the northern shore of the lake and continues on to Narcosli Creek, where it joins the Fraser River Wagon-road at McComb's place (Lot 9529). This trail was followed from the east end of the lake to Alexandria, and with the exception of land reserved for Indian lease, no unsurveyed agricultural land was seen.

Tzenzaicut Lake was triangulated and found to be 4 miles long, and not 9 miles as previously thought. It lies at an elevation of 3,675 feet and is much used by the Indians, who even come from as far as the Chilcotin to catch fish.

From Tzenzaicut Lake we retraced our steps down Merston Creek and found a trail leading through a low pass to Baker Creek, which we hit at the forks of Lot 9166. From here we had to cut a new trail for 3 miles up Baker Creek to join an old Indian trail from Quesnel to the Chilcotin. Along this trail I surveyed three good hay meadows on Baker Creek, and after crossing the Baker Creek-Narcosli Creek Divide, surveyed three more wild hay meadows on the headwaters of Narcosli Creek. The country along this trail is covered with second-growth jack-pine, among which, in the depressions, are a few small pot-hole meadows and a few larger ones growing good swamp-hay.

Upper Narcosli Creek Country.

While my party was surveying the meadows on the headwaters of Narcosli Creek, I explored down an old trail which follows down the North Fork of Narcosli. About 7 miles down the creek from Lot 9925 are two large swamps. These are evidently the two lakes shown on the old maps, the surfaces of which have been covered with decayed water-lily and other vegetation and has formed a muck surface. In years to come these swamps will grow grass and will eventually turn into wild hay meadows. At the present time there is no land considered worth surveying down the North Fork of this creek.

Another old trail runs from Lot 9925 over the Nazko watershed. This trail, on crossing the Nazko watershed, follows along a series of swamps and lakes, some 2 miles long, out of the end of which a creek runs in an easterly direction into Tautri Creek and thence to the Nazko.

There is considerable summer feed along this small valley, which widens out at the eastern end into a series of hay meadows; one of these, containing about 100 acres of open meadow and lying about 3 miles south-east of Lot 352, has been cut during the past years by the Chilcotin Indians, who have done some fencing and have built a wagon-road into the meadow.

In this vicinity I saw about five parcels with a total of about 400 acres of swamp-hay meadow that I consider worth surveying. On the completion of my surveys on the North Fork of Narcosli Creek I traversed along another trail which took me south to the South Fork of Narcosli Creek and brought me out on the old Palmer Trail between Lots 9697 and 9696.

The country along the trail followed is undulating and rocky and some difficulty was encountered in finding sufficient feed for our horses. The country is covered with small jack-pine, and what few swamps there are amongst the timber were too soft for horses to graze upon. I surveyed two pieces on Narcosli Creek adjoining Lot 9697, around both of which I found innumerable staking-posts.

The Palmer Trail.

Through these lots runs the old Palmer Trail, which now is little used except by Indians. It is blocked in many places by windfall, which would have to be cut out before pack-horses could use it.

Whilst my party was surveying here, I followed the old Palmer Trail to the west to what is marked on the maps as Taharti Lake. From Lot 9696 the trail follows up Narcosli Creek, passing through a stony, burned-over, jack-pine-covered country for some 3 miles, when it leaves Narcosli Creek Valley on the south and, heading slightly north of west, follows above the lake, which I believe to be Taharti Lake. This lake is about 2¾ miles long and half a mile wide; steep jack-pine-covered hills rise from its banks. At the east end of the lake is an open patch of approximately 100 acres, which in places grows a good crop of swamp-grass, and with drainage the whole piece could be made to yield a good crop of hay.

A creek runs in a westerly direction through this meadow and flows into Taharti Lake. At the west end of this lake is another large open flat, much used by the Indians for their camping-grounds while fishing. About 80 acres of this piece would grow good hay. A creek runs out of the west end of Taharti Lake and, flowing through a series of long, narrow lakes, runs into Tautri Creek. On all the old maps the water is incorrectly shown flowing in the opposite direction. I saw in this neighbourhood about 300 acres of wild hay land worth surveying.

On completing my work on Narcosli Creek I ran a tie-line to connect the Narcosli Creek surveys with the surveys already made in the Fraser River Valley. In this connection I was obliged to cut about 8 miles of new trail from a point on the old Palmer Trail some 3 miles north-east of Lot 9697 to Lot 9491. This pack-trail will be of great benefit to the few settlers

who have taken up land on Upper Narcosli Creek, saving them half a day's travel from the settlements in the Fraser Valley. Along this trail no new land fit for agriculture or hay was seen.

The Upper Narcosli Creek country, lying as it does at an elevation of approximately 3,550 feet above sea-level, is of no use for agriculture, but is a very good country for hay. Some of the larger meadows have been taken up, but there are still many small meadows worth cutting.

GAME.

During the first two months of the season very little game of any sort was seen, but on arriving in the Upper Baker Creek country fresh tracks of many kinds were seen. The moose are very plentiful and give the settlers in the country fresh beef for the whole winter. On Merston Creek my pack-train was held up by two moose who refused to move off the trail, and the packers having no guns with them that day, the animals escaped scot free. Beyond Upper Baker Creek and over the Baker Creek-Narcosli Divide the moose are not so plentiful, but many deer were seen.

Of the smaller animals, grouse and rabbits were very plentiful this season. Fish in both Baker Creek and Merston Creek were not very plentiful this year, but excellent sport was had in the Nazko River, where both the settlers and the Indians could, if they wished, support themselves on fish during the whole year. The fish in the Nazko are chiefly trout, ranging up to 2 lb. At the end of July a few salmon were running up the river, but at this distance from the Coast they were much knocked about and were only eaten by the Indians.

CLIMATE.

The country operated in this season all lay at an altitude of from 2,700 to 3,500 feet, at which height summer frosts occur during the whole summer.

I have, etc.,
W. MERSTON, B.C.L.S.

ANAHIM LAKE, RANGE 3, COAST DISTRICT.

BY T. H. TAYLOR.

VANCOUVER, B.C., November 21st, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—The work allotted to me was chiefly the subdivision of lots located in the vicinity of Anahim Lake, Range 3, Coast District, which have reverted to the Crown under the "Soldiers' Homestead Act," and the survey of Crown lands suitable for settlement in the same district.

There are two main routes into the district—one from Bella Coola via wagon-road and trail to Anahim Lake, a distance of 110 miles, and the other from Williams Lake Townsite, on the Pacific Great Eastern Railway, via the Chilcotin Wagon-road, which is now open for traffic, through to Anahim Lake. The latter route was taken. It is longer than the Bella Coola one, but has the advantage that the greater portion of it can be travelled by train and automobile and a considerable time is thereby saved.

I left Vancouver at 9 a.m. on June 17th, travelling over the Pacific Great Eastern Railway, arriving at Williams Lake Townsite about 3 o'clock in the afternoon of the following day. This townsite, established since the advent of the railway, is at the westerly end of Williams Lake, from which it derives its name. It is already a busy and thriving little town, and being on the Chilcotin Road is the outlet for that vast territory lying to the west of the Fraser River, as well as the surrounding neighbourhood.

At this point I organized my party and proceeded by auto along the Chilcotin Road to the scene of operations, passing through the settlements of Chilcotin, Hanceville, and Alexis Creek. At the old Nigard Ranch, locally known as the Chilanko Forks, and about 8 miles westerly of the Redstone Indian Reserve, I purchased part of my supplies and outfit from Robert Pyper's store. A four-horse team, wagon, and five pack-horses from Tatlayoko Lake, as arranged beforehand, met me here. The four-horse team was also used for packing when

roads were not available. From Chilanko Forks our party proceeded as far as Frank Render's ranch, a distance of some 50 miles, where we left the automobile. In passing, I may mention that I was shown some hull-less oats 6½ feet high which had been grown by a near-by rancher, Sam Caldwell, from seed obtained from the Government Experimental Farm. From here we had to proceed by wagon and pack-horses as the road beyond was not in fit shape for auto traffic. It has only been constructed from near Mr. Render's place to Anahim Lake this year, and is still rough, but can eventually be made a good road. The grades are fair and a very good bridge has been constructed over the McClinchy River, and the country through which it passes is not difficult for road-construction.

Arriving at Cariboo Flats, we left the wagon-road, branching off to the west to survey the first block of land in my work. Commencing operations at the north-west corner of Lot 575, I surveyed seven lots containing some 4,500 acres, running westerly to Charlotte Lake, or, as the Indians call it, Kapan Lake, meaning "Little Moccasin." On the southerly shore of the lake four lots containing some 2,100 acres were surveyed, the southerly boundaries being at the foot-hills about a mile away. Charlotte Lake is a beautiful sheet of water about 15 or 20 miles in length and 5 or 6 miles in width, with numerous bays, the shores of which are covered with fine sand, making excellent bathing-beaches. The scenery of the lake, combined with the boating, fishing, bathing, and hunting facilities, make it an excellent site for a summer resort, as these facilities are unsurpassed. The elevation of the lake is approximately 3,500 feet above sea-level. The country lying between Lot 575 and the lake is generally covered with jack-pine averaging about 8 inches in diameter, and the soil is mostly rocky, but there are numerous small hay meadows scattered throughout where the soil is good. The land along the south side of Charlotte Lake for approximately a mile back is level, with dry hay meadows in places and in others covered with willow-brush, jack-pine, and spruce, which will not be difficult to clear. The soil is black alluvial deposit, with a few scattered rocks. There are several creeks running through the area to the lake which could be utilized for irrigation purposes if this was found necessary. While stationed here I took the opportunity of exploring the country south of Charlotte Lake, and found it to be all open mountainous country lying at an average elevation of 4,000 feet above sea-level, covered with good grass affording fine summer grazing. Numerous small lakes abound, and I discovered two lakes at the head of the North Fork of the Klinaklini River. These lakes bear approximately north and south and are at an elevation of 2,000 feet. The northerly one is about 10 miles long by 2 miles wide and is connected to the southerly lake by a river about a quarter of a mile long. The southerly lake is approximately 5 miles long by 2 miles wide and its outlet is into the Klinaklini River. This open country referred to stretches southerly from Charlotte Lake for about 15 or 20 miles and westerly to the lakes at the head of the Klinaklini River, and can be ridden throughout on horseback.

On finishing my work in the vicinity of Charlotte Lake I moved northerly along the wagon-road and subdivided Lots 1000, 1001, 1002, and 1003, lying between Towdystan Lake and Nimpo Lake. These lots are generally grazing lands and contain some fairly good hay meadows. While in the vicinity I took the opportunity of exploring the country to the north of Nimpo Lake and east of Dean River, and found a large tract of good grazing land with several fair hay meadows, lying at an average elevation of 3,500 feet above sea-level. I would suggest that the land lying between Dean River and Lily Lake, extending northerly as far as Lot 415 and southerly to Lot 546, be surveyed at some future date. From reliable reports I learned that there is a considerable amount of good meadow land lying to the north-east of Lily Lake and towards the Itcha Mountains, but time would not permit me to explore same.

I also explored the country to the north-east of Lot 553 for a distance of about 20 miles. It is mostly covered with jack-pine, burnt timber, and windfalls, with a few scattered meadows, and is not, in my opinion, worth surveying. There are, however, three or four sections of good meadow land lying around two fair-sized lakes on the Chilcotin Trail, about 4 miles easterly of Lot 553, which should be surveyed. Along the main road to Anahim Lake there are also three sections of land lying between Lots 554 and 555 which I consider should be surveyed, as they contain fair hay meadows and good grazing land.

From Nimpo Lake vicinity I moved northerly and subdivided Lots 519 to 529, inclusive, and Lot 538, and surveyed the remaining portion of Crown land lying between this block and Lots 420, 421, 432, and 433, surveyed by me twelve years ago. This area is generally rolling,

with good grazing land, several meadows, and tracts of jack-pine which have been burnt over in places. Several creeks containing good water traverse the area. I would suggest that the tract of Crown land lying northerly of this block, some 4,500 acres, be surveyed at some future date. It is similar to that described above. Leaving this section, we ran a tie-line 3¼ miles long from Lot 404, at the south-east end of Anahim Lake, along the telegraph-line and Bella Coola Trail, and surveyed six 160-acre lots. Some of these are being applied for as pre-emptions and leases by Messrs. Schilling, Christensen, *et al.* The land lies a few miles westerly of Anahim Lake and adjoins a small lake which I named Pelican Lake. It is mostly composed of wild hay meadows, much of which is mossy but which can be burned, and some muskeg. Between the meadows are ridges covered with poplar, willow, and jack-pine. To afford better drainage to the land, Mr. Schilling has lowered the lake about a foot, and it could be easily lowered a further 2 feet at small expense, as there is a good fall through a creek running into Anahim Lake. This completed my work for the season and I returned to Vancouver on the same route that I went in on.

GENERAL.

The weather during the spring and early fall to the middle of October is delightful. The summer is very hot, with liability to night frosts and with very little rainfall. Many of the creeks dry up by the middle of August. The mosquitoes are very bad during July and August. From all accounts the winters are not very severe.

Few deer were seen. Moose-tracks were encountered and it would seem that they are multiplying, especially to the south of Charlotte Lake and to the east of Lily Lake. It is a paradise for duck and geese (which largely breed locally), with quite a number of grouse. Trout of all kinds are plentiful in Dean River, Charlotte Lake, and in the small lakes in the mountains to the south of Charlotte Lake.

Magnesite and soda have been found in the vicinity of some lakes about 15 miles from the west end of Tatla Lake and several oil claims have been staked in the district. Iron-deposits have been staked near the Render Ranch.

The area is essentially a stock-raising country. Large areas of summer range are available, but the number of cattle that can be supported is, of course, governed by the amount of hay that can be grown for winter feed.

SETTLEMENT.

A few settlers have come in to Anahim Lake this summer, being brought in by Mr. Gray under a colonizing scheme, and there is the prospect of quite a few more coming in next year through the same agency. A store has been established by A. C. Christensen & Son on Lot 411, about 8 miles south-east of Anahim Lake, as a branch of their Bella Coola store. A few supplies were purchased here. Mr. Christensen has quite a number of head of cattle and was busily engaged in cutting hay while I was in the vicinity. The mail is delivered as far as the post-office at Tatla Lake, about 60 miles distant from Christensen's, the delivery being made once a month on the third Sunday in the month. Occasionally mail is brought in from Bella Coola.

I have, etc.,
T. H. TAYLOR, B.C.L.S.

HEADWATERS OF BONAPARTE RIVER, LILLOOET DISTRICT.

By R. C. Farrow.

Vancouver, B.C., November 11th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to submit the following report on the work done by me near the headwaters of the Bonaparte River, East Lillooet District:—

This area lies roughly between the Cariboo Road in the vicinity of the 70-Mile House to the west and the Kamloops-Lillooet District boundary to the east. Extending eastwards from west of the Cariboo Road there is a plateau with an elevation varying from 3,800 to 4,000 feet. It is uniformly timbered with jack-pine and the soil is a light glacial drift. The only lands of any value in this area are occasional wild hay meadows, resulting from old beaver-workings. These meadows vary in area from a few acres to 100 and more. This plateau is cut by the Bonaparte River, which splits into two forks about 6 miles west of Young Lake. These streams cut through the plateau in deep valleys. A certain amount of good land lies along the valley-bottoms.

The plateau extends for about 25 to 30 miles east of the Cariboo Road, when the land begins to drop to the east and north-east to an area dotted with numerous lakes of all sizes, of which the larger and better known are Bridge Lake and Bear Lake. The watershed of this area is peculiar. Bridge Lake and numerous small ones near it drain out through Bridge Creek to the Thompson River, while other lakes, in some cases very close to Bridge Lake and its feeders, drain out to the North and South Bonaparte Rivers. There are few creeks of any size and the drainage of many of the lakes one to another is hardly discernible.

This lake area is about 3,500 feet elevation and considerable areas of good land—poplar and willow bottom—are scattered about. The soil is mostly a loam with a clay subsoil.

Farther east again a range of mountains with summits to 5,200 feet cuts off the area from the North Thompson River.

Roads.

The district is well supplied with roads of a sort, though the majority of them are passable only for wagons, and a number, I believe, have never been taken over by the Works Department. The main road for this district leaves the Cariboo Road at the 70-Mile House and runs east and a little north to Bridge Lake. It is passable for cars but could not be classed as a good road. From this road various feeders run out to the north and south, tapping the ranches and settlements.

Ranching.

The ranchers in the district are all small cattlemen, the plateau being unsuitable for anything else owing to the elevation. The Bridge Lake area holds out other possibilities, which I will deal with later on.

Game.

There is a fair amount of game in the district. Willow-grouse, spruce-hen, and some blue grouse and prairie-chicken. Ducks and geese are plentiful in the fall. Deer are fairly plentiful in places, particularly along the South Bonaparte River, and there are a few bear and moose.

As far as fur-bearing animals are concerned, it appears to be a fairly good trapping country. Beaver, musk-rat, otter, marten, mink, weasel, and coyote are plentiful.

There are trout in the Bonaparte River and most of the larger lakes, several varieties and salmon-trout being in evidence. There are three notable "runs" of fish in the district each year—a run of a small specie of salmon-trout known by the Indians as Kokenees, which occurs in August and September in the South Bonaparte River above Young Lake; a run of a larger specie of salmon-trout in Bridge Lake in October; and a run of a white variety of fish in Bear Lake during the winter. I was unable to find out definitely what these were.

Climate.

The winters are fairly severe, though they apparently vary considerably. The thermometer has registered 60° below zero in the district, but that is extreme and rare. The snowfall is not excessive, varying from 6 inches to 2 feet.

The plateau area is fairly dry in the summer, but farther east in the lake area there is a good rainfall, which in normal years renders irrigation unnecessary. The heat is not excessive.

WORK PERFORMED.

The total acreage surveyed by me this season was 9,150 acres. This was scattered over a considerable area.

I worked eastward from the 70-Mile House across the plateau and down to Bridge Lake; thence south to Montana and Bear Lakes; thence west again to the 70-Mile House. On the plateau I subdivided Lots 1625 to 1628 and surveyed five Government lots and two leases, Nos. 4964 to 4968 and 4970 and 5212. All these lots are very similar, consisting of a wild hay meadow surrounded by jack-pine. The ranchers on the plateau depend entirely on these meadows for their hay, which is good cattle-feed. They figure on 2 tons per head for wintering stock. I saw no vegetables or grain grown on the high lands, and old-timers claim that such crops are failures owing to the altitude and summer frosts.

I then moved to the South Bonaparte, in the vicinity of Sharpe Lake, and subdivided Lot 1807. This is good range, but hardly suitable for cultivation. Returning through here on my way out I surveyed a Government lot, No. 5213, 3 miles south-east of Sharpe Lake, containing a large meadow.

Moving on to the Bridge Lake area the country undergoes a marked change; some fir and a heavy growth of poplar and willow takes the place of the jack-pine. The growth of herbage is heavy, consisting of fireweed, peavine, vetch, lupine, and grasses. In this area I subdivided Lot 1895, situated on the south side of Bridge Lake, also a school-site about half a mile farther east, Lot 4971. While on the north side of Bridge Lake I surveyed a Government lot, No. 4977, and on my way out later in the season surveyed an island at the west end of the lake as Lot 5211.

South of Crooked Lake, which lies parallel to Bridge Lake, about half a mile to the south and draining into it, I surveyed eight Government lots, Nos. 4969, 4972 to 4980. All these lots in the vicinity of Bridge Lake contain considerable areas of poplar and willow lands on a good loam soil and should yield crops when cleared. Timothy, clover, and oats are grown in this area without irrigation. This was a very dry year and I should imagine that in normal years the crop would be good. Potatoes and other vegetables are grown with success. Summer frosts are somewhat of a menace, but do not appear to be severe enough to do much harm. At one ranch I saw growing potatoes, carrots, beets, turnips, mangels, parsnips, peas, beans, onions, radishes, lettuce, and rhubarb. Late seeding, however, is necessary for such things as peas and beans.

I next moved south and surveyed eighteen Government lots in the vicinity of Montana Lake—Lots Nos. 5191 to 5208. These again are mostly poplar and willow lands, sloping towards Montana Lake. Lots 5192 and 5195, however, contain wild hay meadows.

Moving farther south to Bear Lake, I surveyed three Government lots—No. 5210, Lillooet District, and Nos. 2112 and 2113, Kamloops District. These are willow and poplar bottoms, lying between the lake and the mountains behind. The soil is good and irrigation unnecessary.

The natural outlet for the Bridge and Bear Lake area appears to be eastwards to the Canadian National Railway along the Thompson River. There are several good passes, and a pack-trail exists now and is much used from Lac des Roches to Mount Olie Station, on the Canadian National Railway, a distance of about 20 miles. I was informed that a good road-grade could be obtained. Given better roads and therefore easier transportation—preferably a good road to the Canadian National Railway—the Bridge-Montana-Bear Lake District should develop into a dairying country.

Summer feed is plentiful and excellent, but for winter feed clearing would be necessary, which limits the size of the rancher's herd. Green feed could be successfully grown, I believe, and put up in silos.

Returning eastward, I completed my season's work by surveying four Government lots about 6 miles south-east of the 70-Mile House, all containing wild hay meadows.

I have, etc.,

R. C. FARROW, B.C.L.S.

SOUTHERN LILLOOET DISTRICT.

BY G. M. DOWNTON.

LILLOOET, B.C., November 4th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report on work done by me in the Southern Lillooet District this season:—

The work consisted of the survey of a small number of pre-emptions held by returned soldiers and other persons which were staked prior to the amendment of the "Land Act" prohibiting the staking of unsurveyed land, and which still remained unsurveyed. Also a number of ties were made connecting up surveys for mapping purposes, and a few pieces of Crown land suitable for settlement surveyed for local residents who were anxious to increase their holdings.

This work was necessarily of a very scattered nature and entailed considerable travelling. The different localities in which my work lay were as follows: The valley of the Fraser River in the vicinity of the town of Lillooet, Big Bar, Seton Lake, Anderson Lake, Pemberton Portage, Lillooet Lake, and Pemberton Meadows.

Along the valley of the Fraser River seven pre-emptions and two Government lots were surveyed, also one group of lots was resurveyed and one tie was made for mapping purposes. Big Bar, one pre-emption and eleven Government lots; Seton Lake, one pre-emption; Anderson Lake, one Government lot; Pemberton Portage, one Government lot; Lillooet Lake, two pre-emptions and several ties; Pemberton Meadows, one pre-emption. The total acreage surveyed during the season was 3,359 acres, and the average mileage per day, neglecting travelling-time, was 1 mile.

Practically all the areas mentioned above have considerable differences in climate owing to their situation and altitude. The first three—viz., valley of the Fraser River, Big Bar, and Seton Lake—are in what is known as the "Dry Belt." The last two—viz., Lillooet Lake and Pemberton Meadows—experience a climate rather similar to that met with on the Coast; while Anderson Lake and Pemberton Portage may be classed as intermediate, being located in the midst of the Cascade Range.

Describing the general characteristics of the areas in the order mentioned:—

FRASER VALLEY BENCHES.

The Fraser River Valley from the town of Lytton (47 miles south-south-east of the town of Lillooet) to at least 80 miles north of Lillooet may be described as running, generally speaking, due north and south. The mountains on each side of the valley are not very rugged except at isolated points, and are uniformly clothed to their summits with a stunted growth of Douglas fir. There is also a considerable growth of yellow pine in the southern part of this area, this being replaced by black pine farther north. The average width of the valley proper is not more than 2 miles from mountain-foot to mountain-foot on each side, and it is much narrower in some places. In prehistoric times vast quantities of silt and gravel have been deposited by glacial action in this valley, and possibly at the close of the glacial period the aspect of the valley was similar to many others in the Province; that is to say, fairly flat, with a river meandering from side to side, and possibly with periodic floods. In the course of subsequent ages, however, the river has cut down through the gravel and silt, swinging from side to side of the valley as it found a softer material, until at the present time it seems to have reached bed-rock, 500 or 600 feet below the glacial deposits, leaving in successive ages flat water-worn benches at various heights and of varying widths and shapes. In places perfectly flat, more generally tilted at a slight slope towards the river, and in most cases bare of trees, these benches form a distinctive feature of the landscape, and wherever water has been obtainable from neighbouring mountain streams they have proved most extraordinarily productive.

The subsoil composing these benches is boulder-clay and gravel; the top soil is mostly a very fine pulverized river-silt with varying percentages of sand and clay. Light sandy loam best describes the general soil, which is of a light texture, and although locally there are considerable outcroppings of gumbo, the soil is porous and does not readily retain a large amount

of moisture. The average elevation of these benches above sea-level varies from about 500 feet (the lowest level at Lytton) to about 1,600 feet, the highest in the vicinity of Canoe Creek. The average annual rainfall does not exceed 15 inches, practically all of which falls between September 30th and April 15th.

Over this area then, rightly described as a region of almost perpetual sunshine, cultivation can only be carried on by means of irrigation, and up to the present time only those benches on to which water can be easily got by gravity from creeks flowing from the adjacent mountains can be cultivated. The remainder lie idle and unproductive, covered by a growth of sage-brush. There is a wide field in this locality for the irrigation engineer, but lack of transportation and markets have hitherto checked development. Shortage of water is undoubtedly acute, but there are great storage possibilities on many of the streams. Added to this there is a great reluctance on the part of property-owners to subdivide and sell for reasonable prices the areas now under cultivation, and there has been in the past a most regrettable practice of renting them *en bloc* for a period of years to Chinamen, whose unfailing practice seems to be to work them until the soil is thoroughly impoverished and then turn them back to their owners. The possibilities of this area have been amply demonstrated. Lillooet potatoes command the highest price in the Coast markets to-day and cannot be beaten. Three crops of alfalfa can be raised and harvested in the year. The apple-orchards of Lillooet are equal to any sections of the Okanagan, and only lack of organization on the part of the fruit-growers has hitherto prevented the quality of the fruit from being appreciated. With the completion of the Pacific Great Eastern Railway to Fort George and the connection with the Prairie via the Grand Trunk Pacific thus assured, the present very restricted market will change to conditions where the demand will greatly exceed the supply, and the area described is practically the last point north at which fruit can be successfully raised.

The state of development at which this area has now arrived is that at which practically no Crown land suitable for settlement remains. No subdivision of original Crown grants has yet taken place and there is apparently no move at present in this direction. The area will undoubtedly support a large population, and I believe eventually that fruit will become the staple product. The climate is almost unrivalled in this Province, the winters being comparatively mild and the summers hot and dry. The lowest temperature last winter in Lillooet was 10° above zero; this was exceptionally mild, but the lowest temperatures experienced usually are about 15° below zero. The highest summer temperature is about 98° to 100° in the shade and lasts about two weeks at the end of July.

The Pacific Great Eastern Railway serves this area, with stations at Lillooet, Mackinnon, Glenfraser, and Pavilion. There is much need of a wagon-road on the west side of the Fraser River, opposite Glenfraser and Pavilion, connecting with the east side, with a bridge somewhere in the neighbourhood of Pavilion. An inadequate ferry at Pavilion now serves a large area on the west side, and the only direct connection with Lillooet is by a mountainous pack-trail, dangerous in winter and most laborious in summer.

The town of Lillooet, reached either by the Pacific Great Eastern Railway from Squamish or by 47 miles of auto-road from Lytton, on the Canadian Pacific Railway, is a small town of about 200 inhabitants, pleasantly situated near the point where the outflow of Seton Lake and Cayoosh Creek enter the Fraser River from the west at an elevation of 840 feet above sea-level. There are three churches, two hotels, hospital, school, telegraph-office, and several well-equipped general stores, and railway-station on the Pacific Great Eastern Railway.

BIG BAR.

Finishing up my operations on the Fraser River, I proceeded to the vicinity of Big Bar Creek, which flows into the Fraser River from the east 40 miles above the town of Lillooet. This creek rises in Big Bar Lake, situated on the high green timber plateau at the northern end of the Marble Mountains, at about 3,700 feet above sea-level, and is supplemented by several creeks which have their source on the western slopes of the Marble Mountains. The largest of these creeks is 7-Mile or Stable Creek, and at the point where this creek emerges from the foothills of the Marble Mountains is a considerable plateau at an elevation of about 4,000 feet above sea-level. The elevation here renders this area unsuitable for anything but cattle-raising and dairying, and only a limited area can be brought under cultivation for raising hay for winter feeding owing to the lack of water and the depth of the creeks below the general level of the

plateau. The plateau is covered with a uniform growth of jack-pine, a good deal of which has been burnt off, leaving patches where the small pines are coming up very strongly. In places where there had been recent burns I noticed quite a strong growth of wild grasses. Any area that can be irrigated will grow good crops of timothy and clover. I surveyed three new lots along 7-Mile Creek and two along 11-Mile Creek, on to all of which water could easily be brought, and there still remains a little land on 11-Mile Creek which might be surveyed to advantage when it has been demonstrated what can be done on the land surveyed this year. I did not feel justified in surveying any more here, as the season was getting short and my programme did not admit of any delay.

Seton Lake.

Seton Lake, about 13 miles long and three-quarters of a mile wide, lies just to the west of the town of Lillooet, at an elevation of 777 feet above sea-level. There is a very limited amount of agricultural land along the lake, and practically all the land that can be brought under cultivation lies either on Indian reserve or has already been alienated from the Crown. The climate is very mild in winter and hot in summer, and except from the point of view of scenery and location for summer homes, it may be almost discounted from an agricultural point of view. The Pacific Great Eastern Railway runs along the north shore, and at a point near Shalalth Station on the north shore the Bridge River Power Company, of Vancouver, is investigating with a view to developing water-power by tunnelling through the mountain between Bridge River and Seton Lake, a distance of 2 miles, and turning the water of Bridge River through the mountain to Seton Lake. The difference of elevation between Bridge River and the lake is about 1,200 feet and would necessitate a penstock about half a mile long down the mountain-side. The maximum horse-power that could eventually be developed here is estimated to be over 400,000.

At Shalalth Station the Government road to Bridge River starts up Mission Mountain and reaches the top by a series of switchbacks in a distance of 5 miles. This is the shortest route to the valley of the Whitewater, where a remarkable gold strike was made this spring. This route follows the Bridge River Road for 33 miles and then branches off up the Gun Creek Trail, which rises steadily for about 35 miles after leaving the road and passes over a summit about 6,500 feet above sea-level before descending into the Whitewater Valley. This route, however, is not open on account of snow until about June 1st. The other route is via Big Creek, where a wagon-road connecting with the Fraser River Bridge at Churn Creek reaches to a point to within 25 miles of the workings, and from which point an easy trail passable in April has been built.

Anderson Lake.

Anderson Lake, also about 13 miles long and three-quarters of a mile wide, lies to the south-west of Seton Lake and is separated therefrom by a portage 1½ miles long. This lake is about 60 feet higher than Seton Lake and discharges into it by a creek which flows across the portage. The Pacific Great Eastern Railway follows along the west shore of the lake, which is uniformly mountainous and rugged. Small points here and there jutting out into the lake might form a vantage-ground for some summer cottage or tourist resort, but there is practically no agricultural land of any value from one end to the other of the lake.

The portage between the two lakes has a limited amount of agricultural land on it and it has an ideal climate for fruit-raising.

At the south end of Anderson Lake, at D'Arcy Station, on the Pacific Great Eastern Railway, there is a pleasant summer hotel. The scenery along these lakes is magnificent and it is probable that this locality will become a popular tourist resort. My operations here this year were confined to the survey of a small point of land about 4 miles up Anderson Lake on the east side.

Pemberton Portage.

The Pacific Great Eastern Railway on leaving the south end of Anderson Lake climbs from an elevation of 850 to 1,625 feet in about 11 miles, and at this elevation about a mile south of Summit Lake crosses the divide. Summit Lake is a small sheet of water about a mile long and half a mile wide and is situated at the point where the portage passes through the summits of the Cascade range of mountains. The whole valley of the Pemberton Portage is not more than a mile wide from side to side, and in some places narrower. There is a limited amount

of agricultural land north of Summit Lake, but practically none south of it, as most of the land south of this is heavily timbered; in fact, it may be said that the Dry Belt ends at Summit Lake and the Wet Belt commences. Pemberton Portage is one of two main passes through the Cascade Range in British Columbia, the other being the point just below the town of Hope, where the Fraser River cuts through the range.

There has been considerable activity in agriculture along the northern part of the Pemberton Portage within the last three years, and in several places new settlers are clearing the bottom land and bringing it under cultivation. Noticeably is this the case with a Mr. Jonkis, a French-Canadian, who has recently settled here, and whose large family of sons has satisfactorily solved the problem of the hired man. I only made one survey in this area just south of Summit Lake.

LILLOOET LAKE.

As above stated, the railway crosses the divide about a mile south of Summit Lake and descends along the Birkenhead River to the valley of the Upper Lillooet River, which it enters 6 miles above the upper (north-western) end of Lillooet Lake.

This lake is about 16½ miles long and has an average width of three-quarters of a mile. It is practically devoid of any agricultural land on either side throughout its whole length, and with very few exceptions the mountains rise fairly steeply from the lake. These mountain-sides for about half a mile back from the lake are heavily timbered with Douglas fir interspersed with a small amount of hemlock and red cedar. The bulk of this timber is held under timber licence, but there are small patches here and there lying outside these limits.

The Upper Lillooet River flows into the lake at the north-western end, and there is no doubt that in earlier times the lake was much longer than it is at present. Evidence points to the fact that all the area from a point about 2 miles above the point where the railway crosses the Upper Lillooet River to the present north-west end of the lake, 9 miles below the railway crossing, was part of the lake within comparatively recent times, but the enormous quantities of silt which are brought down by the Lillooet River have gradually filled up the lake, and each succeeding year at flood-time more silt is laid over the whole area, until at the present time it is only flooded at highest water. The fall in the Lillooet River through this area is so slight and the material of which the soil is composed so light that new channels may be formed in a single flood, with the result that the point where the Lillooet River now enters the lake is a network of channels, some of which are dry except at high water. The slow process of accretion is still proceeding and pushing sand-bars farther and farther into the lake. As these become higher each year above the water from the deposit of silt at flood-time, willow-seeds blown from the vegetation farther up or deposited with the silt, germinate and cover the sand-bars, bind the soil together, and assist the work of natural reclamation. I gave an estimate in 1913 that the rate of accretion was proceeding at the rate of 1 mile in 100 years, but I am now inclined to believe that it is proceeding considerably faster than this.

The outlet at the lower or southern end of the lake is not large enough in cross-section to carry off the flood-water in summer, with the result that the level of the lake rises rapidly and backs the water up the lower stretches of the Lillooet River.

Three-quarters of a mile below the southern end of Lillooet Lake is another lake known as Little Lillooet or Tenas Lake; it is 5 miles long and not more than a quarter of a mile wide in the widest part, narrowing in the middle to about 100 yards. The level of this lake is about 15 feet lower than that of Lillooet Lake, and the waters of the latter shoot down into the lower lake with considerable velocity.

In 1860 a wagon-road was built by the Royal Engineers from Douglas, on Harrison Lake, to the lower end of Little Lillooet Lake to accommodate the traffic to the Cariboo, and a little later a steamboat was built on Lillooet Lake for the same traffic. A dam was built across the outlet at the lower end of Little Lillooet Lake to raise the water sufficiently to enable this steamboat to more easily negotiate the rapids between the two lakes, and it is said by Indians, with what truth I cannot say, that the building of the dam was coincident with the commencement of bad floods in the low land at the upper end of Lillooet Lake. The fact remains that there is an extensive gravel-bar now existing just above the site of the dam, the position of which can still be discerned by the broken piles and old crib-work just at the outlet of the lake, although the dam has long since rotted away and been washed down by floods. It is in the removal of this gravel-bar, as well as in the widening and deepening of the rapids between the two lakes, that the solution of the problem of relieving the floods may be found.

LILLOOET VALLEY.

In my report on the Pemberton section, published in the Annual Report of the Minister of Lands for the year ending December 31st, 1919, I reviewed at some length the question of reclamation by lowering the lake-level and straightening the Upper Lillooet River. A repetition of my remarks is hardly necessary here, except to emphasize the financial advantages of a well-considered policy of drainage and protection to the property-owners in the valley of the Upper Lillooet River. A very large area in this valley is owned by corporations who are at present deriving no income from their land, the taxes on which are a constant drain. Considerable tracts are swampy and there is the constant danger of summer flooding and consequent damage to crops, as well as the ever-present sense of insecurity should this land be cleared and put under cultivation. Projects have been started, proposing that in return for the land being drained the company reclaiming the land should become entitled to some percentage of the area thus reclaimed and protected. It appears reasonable that a project which converts land of no value into land of considerable agricultural value should attract the notice and consideration of the property-owners, but only those owners who are in residence can appreciate the situation, and the larger number of absentee owners either cannot be easily approached or appear indifferent, and the projects have been abandoned.

This valley is the natural home of the black currant and raspberry and can support a very large population, and it might easily become one of the most thriving agricultural communities in the Province. The climate is such that silos are the solution of the winter feeding of dairy cattle and stock. The growing season is long and the winters are mild, the snow falling and lying before the frost has a chance to freeze the ground. There is an area of approximately 40,000 acres of cultivable land in the valley.

This valley can at present be reached by the Pacific Great Eastern Railway, leaving Vancouver at 9 a.m. and arriving at Pemberton Station about 5 p.m.

YALAKOM RIVER.

On the completion of my work in this area I made a hurried trip to Yalakom River, formerly known as the North Fork of Bridge River. Considerable work has been done on five of the ranches since my last visit in 1913, and a school is now being built. The Yalakom River joins the Bridge River 15 miles above the point where the Bridge River flows into the Fraser River, and the available agricultural land along it is situated on fairly level benches about 300 feet above the river-level.

The benches on the north-east of the valley are covered with a stunted growth of yellow pine easily cleared, while Douglas fir predominates on the south-western side of the valley. The climate is such that apples can be grown, and alfalfa does well; there is also good summer range on the adjacent mountains. There is a good water-supply for irrigation on the south-western side, but the north-western side is badly in need of an irrigation system. About 600 acres of bench land could be brought under cultivation on this side by means of a ditch, and water could be obtained either by an inverted siphon across the valley from La Rochelle Creek, or by going 5 or 6 miles farther up the river and taking water out of the river itself. Both these schemes will entail considerable labour, and at present the three ranches mostly concerned cannot command the required capital. When water is got on to these benches they will be very valuable.

There does not appear to be any land suitable for settlement farther up the river beyond 4-Mile Creek, and with the completion of Lot 5150, which I surveyed here this year, I consider that all the surveying in this locality is finished so far as vacant Crown land is concerned.

I have, etc.,

G. M. DOWNTON, B.C.L.S.

BIG SHEEP CREEK AND SLOCAN LAKE, KOOTENAY DISTRICT.

By W. J. H. Holmes.

Victoria, B.C., December 7th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—My work this year was located at or near the headwaters of Big Sheep Creek, about 14 miles due north-west of Rossland as the crow flies, and in the valley of Slocan Lake, Kootenay District, and consisted of the survey of vacant Crown lands suitable for settlement, also the survey of two small blocks of land in the valley of Goose Creek, near Crescent Valley, Slocan River.

I organized a survey party in Nelson on May 20th and first proceeded to Beasley, on the Kootenay River, to make a connection between Lot 12804 and a mineral claim, Lot 2082; then on May 24th I took my party to Crescent Valley and pitched camp about 3 miles up Goose Creek. This valley, while maintaining as settlers a few others, is largely occupied by Doukhobors, who have cleared up and placed under cultivation some 500 or 600 acres. These people appear to be very successful and are growing large crops of potatoes, wheat, and oats, besides garden-truck of all kinds and small fruits, also flax, which they themselves weave and manufacture into cloth. They have this year completed the installation of a large pump on Goose Creek for irrigation purposes.

The soil in the valley is a light sandy loam and wherever water can be got on the land is highly productive. The lack of water is without doubt the cause of many hundreds of acres of excellent land that are owned by our own people now lying idle and unproductive. Many blocks have been cleared, or partly so, and are now apparently abandoned.

The village of Crescent Valley, near the mouth of Goose Creek, is on the Slocan River and on the line of the Slocan Branch of the Canadian Pacific Railway, and has a general store, post-office, church, school, etc. It is on the main highway between Rossland, Trail, and Nelson, which road crosses the Columbia River by ferry at Castlegar; thence follows up Pass Creek for about 6 miles, and swinging to the east follows down Goose Creek and crosses the Slocan River at Crescent Valley; thence along the north side of the Kootenay River, past Bonnington Falls to Nelson.

On June 4th I left Crescent Valley with a view to commencing operations in the valley of Big Sheep Creek, and the same evening arrived at Paulson, on the line of the Kettle River branch of the Canadian Pacific Railway, and the next day proceeded to get the party and outfit out to Michener's ranch, which is at the end of an old logging-road, a distance of about 5½ miles by rough road from Paulson. At Paulson there is only an hotel, with general store and post-office on the ground floor. There is a fairly good wagon-road between Cascade and Paulson, and this road continues up Hamlin Creek to the Inland Empire Mine, now lying idle.

I camped at Michener's ranch for ten days and constructed a good horse-trail from there eastward for a distance of 2½ miles, giving access to the valley of Big Sheep Creek and connecting with the old Government trail running through this valley to Rossland.

Headwaters of Big Sheep Creek.

This is an attractive valley varying in width to over half a mile and almost level for over 5 miles. There are numerous grass meadows throughout this part of the valley, between which are stretches of open pine and spruce 6 to 10 inches in size. The mountains on either side slope more or less gently away, and, while many fires have run over the hills, are in places still covered with pine and spruce up to 12 inches in diameter and some cedar. Before the fires the timber was in places as large as 3 and 4 feet in diameter on the hillsides. In the centre of the stretch under review lies what I have named Meadow Lake; this is a pond of about 4 acres lying in the centre of an open grass meadow of about 100 acres and empties westward into Big Sheep Creek.

At the eastern end of the stretch I surveyed lies Sheep Lake, a body of water of about 80 acres, which is the source of Blueberry Creek, flowing eastward and emptying into the Columbia River about 3 miles south of Castlegar. The lake is supplied by a small stream flowing through the meadows and flat lands on the west.

When I arrived in the valley in June it was particularly beautiful with its profusion of wild flowers and other spring vegetation. I found the valley literally covered with blue violets, while not only the flat lands, but also the hillsides were covered thickly with wild strawberry blossoms, and the fruit a little later provided us with a welcome addition to our bacon and beans.

The altitude of Sheep Lake is 4,120 feet and of Meadow Lake 4,250 feet, and owing to the possibility of summer frosts the land is probably best suitable for stock. Snow arrives towards the end of October, but I am informed it is often a month later, and the ground is bare again in the spring towards the end of April or early in May.

The soil on the hillsides is a light sandy loam on a gravel subsoil. The flat lands are a variety of alluvial soils, varying from light sandy loam or gravel to deep light loam rich in humus, while in the meadows the soil is distinctly peaty, with a depth varying up to 4 feet, and perhaps more.

Game is plentiful in the valley; that is to say, deer are numerous and there are some caribou. Black bear are numerous also, and grizzly and silver-tip are to be found farther back from the valley on the higher mountains. Grouse are plentiful and also rabbits, and there are some mink and marten. I saw many old beaver signs, but none fresh.

I here surveyed a total of 2,700 acres. Any one desiring to look at these lands should go in from Paulson, and may arrange ahead with H. D. Griswold, the postmaster, for riding-horses to be brought from Cascade. A hurried trip in and out might be made in one day, but for a careful examination one or more pack-horses should be taken with camp outfit. Arrangements with Mr. Griswold could be made for a guide.

Early in August I withdrew my party from Big Sheep Creek and proceeded to Rosebery, on Slocan Lake, for the purpose of surveying some lands on Wilson Creek which had been reported as being suitable for settlement, and on August 15th completed the establishment of camp about 9 miles up this creek from Slocan Creek.

Wilson Creek.

As described in my report of 1920, this is the largest stream flowing into Slocan Lake, and is about 100 feet wide and 8 feet deep at the mouth, with a current 8 to 10 miles per hour when in flood, and which at the time of low water falls to 1 to 2 feet deep. The creek takes its rise in several tributaries in the range of mountains along the southern border of the watershed of Lardeau Lake and River, and flows almost south, entering Slocan Lake, near its north end at the town of Rosebery, or about 3½ miles north of the town of New Denver. It is a typical mountain stream, the mountains for the most part sloping steeply down to the water's edge; for the first 8 or 10 miles or so from the mouth there is little or no width to the valley-bottom. The valley at one time was heavily timbered with cedar and fir ranging up to 4 feet in diameter, and even more, interspersed with hemlock. As you ascend the mountain-sides the timber is lighter, and you also find tamarack, spruce, and pine to 2 feet in diameter. Periodical fires have destroyed much of this valuable timber, but much still remains.

About 8 miles up the creek, on a bench on the west side, is some of the best land I have seen in the district. This bench is about 2 miles long and three-quarters of a mile wide in its widest part. It is almost all covered by pre-emptions, but I surveyed two blocks at the north end which are available for settlement.

On this bench the soil is alluvial and varies from 6 to 18 inches of light sandy loam to the same of clay loam; the subsoil is in places gravel and in other places a blue clay.

After completing my work on Wilson Creek I moved my party to the south end of Slocan Lake and ran a tie traverse between the existing surveys about Slocan City and other surveyed lots situated on the east side of the lake, and at the same time, by triangulation, connected up certain isolated surveys on the west side of the lake. I also surveyed three pieces of unoccupied Crown land situated on the east side of the lake.

I have, etc.,

W. J. H. Holmes, B.C.L.S.

CASTLEGAR TOWNSITE AND MISCELLANEOUS SURVEYS, KOOTENAY DISTRICT.

BY S. S. MCDIARMID.

ROBSON, B.C., October 13th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—Under your instructions, a number of small surveys have been made by me in the vicinity of Castlegar, in the Kootenay District. This district is so well known and so well served by transportation systems that there is little to be supplied as information by a surveyor. Much is hoped for in the establishment of industries and railway development at Castlegar. For some time the construction of a pulp and paper mill has been mooted, and it may be that with more settled conditions in the financial and commercial markets this will be realized, making Castlegar something more than a railway junction as it is to-day. The Arrow Lakes and Upper Columbia River could be used for driving and towing pulp-wood, and this great territory would feed a mill sited at Castlegar, where the manufactured product would be shipped by rail.

There has been more or less talk of Castlegar becoming a Canadian Pacific Railway divisional point, with repair-shops and other necessary works. Should this materialize or should a pulp industry be established, the subdivision which was made this summer for your Department will be rapidly taken up. The sole industry at present is the mill of the Edgewood Lumber Co., situated on the north side of the Columbia River, over which a foot-bridge is built against the railway-bridge. All vehicular traffic must use the Government-operated ferry, which is a gas-engined and cable ferry running about half a mile west of the railway-bridge. The ferry is of great importance to road traffic between Rossland and Nelson, and in the summer is used a great deal by automobile tourists, for it forms a link in the Trans-Provincial Highway.

The Arrow Lakes are dependent upon the Canadian Pacific Railway steamer service, which has of late been only tri-weekly in each direction. The lower terminus of the steamer run is West Robson, a mile west of Castlegar. At this point passengers and goods are transferred to the Kettle Valley Railway. The shores of Lower Arrow Lake are quite steep and wooded. The timber is small and is chiefly composed of fir, cedar, pine, and tamarack, some of which is desirable for lumber. Wherever a tributary stream forms a valley, or wherever the ground is of easy slope, orchards have been planted by settlers. The fruit is of excellent quality, and it is claimed that this is the finest district for growing Bing and Lambert cherries.

The climate is not severe in winter, as excellent peach-orchards at Renata and Deer Park prove. In summer there are periods of hot stretches with a notable absence of rainfall. This latter condition makes irrigation a necessity and much may be done towards increasing production by getting water on the land. The snowfall is light and streams soon go dry in the summer, except in the case of those which rise far back in the higher mountains.

Owing to the sparse settlement and the prevailing natural conditions the shores of the lakes are an excellent refuge for game. It is not a district to attract the professional sportsman, but for the man who looks for a few days' hunting in the autumn it will furnish good sport for grouse, deer, and black bear. The coyote is somewhat of a pest to the rancher, but is not easily caught.

The mining industry seems to have suffered through adverse conditions. Practically all the ore for the Trail Smelter is drawn from other places.

I have, etc.,
S. S. MCDIARMID, B.C.L.S.

SIMILKAMEEN DIVISION OF YALE DISTRICT.

By A. H. Holland.

Vancouver, B.C., December 5th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I beg to submit the following report in connection with surveys made by me during the past season, which consist chiefly of the surveys of land in the Heinze Belt, previously held under reserve but now thrown open for pre-emption, and open Crown lands in Christian Valley:—

Following your instructions of June 11th, a party was organized and we proceeded to Grand Forks, where I made my headquarters for the season.

Sutherland Creek.

On June 18th we left Grand Forks by motor-truck for the headwaters of Sutherland Creek, a distance of 12 miles. Passing through Cascade, we noticed the new road from Cascade to Rossland was under construction, which when completed will be the Inter-Provincial Highway. We then climbed the steep wagon-road to Fife, where the railway siding was piled high with poles and ties, showing the work done by the ranchers and tie camps up Sutherland Creek during the past winter, and proceeding up the road noticed the prosperous-looking ranches and many acres of logged-off land that are now being stumped and ploughed.

During the season of 1920 a severe forest fire swept through this valley, having originated on Italy Creek, a tributary of Sutherland Creek, and though all the merchantable timber was fire-killed, it left the logged-off land in better shape for settlement, and it was in this area that we surveyed two small lots.

Deer Creek.

Our next move was to the headwaters of Deer Creek, which rises on the same height of land as one branch of Fourth of July Creek, but flows into the North Fork of the Kettle River, whereas Fourth of July Creek empties into the main Kettle River. We travelled by motor-truck, again passing through Grand Forks, where the packing-houses were all busy shipping cherries and small fruits.

At the headwaters of Fourth of July Creek we left the truck on the main road and proceeded by wagon over an old logging-road, which is in good condition for 2 miles, or as far as a squatter's clearing. Here we surveyed 1,800 acres of more or less heavily timbered land, where ties have been cut for several years past, leaving the balance chiefly suited for cordwood. The soil is clay loam with some rock, and though this area would be fairly heavy clearing, it has several small spring creeks through it, and there is open range both on the north and south. This land is between 2,500 and 3,200 feet in elevation, and one squatter has a small clearing where small fruits as well as grain do well.

Adjoining this land on the north and lying at the head of Fisherman Creek is what is known as "Summit Camp," where in the past considerable mining development was carried on, but which is now deserted, and the hillsides, which were at one time full of mining prospects, would serve as good summer range for a number of cattle.

Loon Lake.

From here we moved by wagon over the main highway (Grand Forks to Greenwood) to Loon Lake, passing through Denoro, where at that time the Canadian Consolidated Mining Company was operating the Emma Mine. This lake is on the summit of Eholt Mountain at an elevation of 3,200 feet and about 1½ miles from Eholt Station on the Canadian Pacific Railway. Here we surveyed two lots, one of which has been held under mineral licence for some years and has had improvements to the value of several thousand dollars made, consisting of small cabin, barns, and 25 acres seeded to timothy and clover.

The greater part of the surrounding country is held under mineral licences, and though active mining has ceased, it is still not available for settlement, though there are some small areas which no doubt will later come under cultivation.

BROWN CREEK.

Our next move was to the mouth of Brown Creek, and this necessitated our going over the divide and down into the valley of the North Fork of the Kettle River, but rather than go back through Grand Forks and up the main road of the North Fork we went to Eholt, and from there followed a road little used on account of its steep grades and which was originally built in construction days to supply contractors' camps.

The land surveyed lies between the Canadian Pacific Railway right-of-way and Brown Creek and is on a rolling side-hill covered with willow, poplar, and pine, which would not be heavy clearing and would raise good hay-crops, the ground being sub-irrigated from the surrounding hills and having several springs coming to the surface on the lots. There is a small clearing of about 5 acres on one of the lots and the owner cuts timothy and clover thereon, holding the land under mineral licence.

Most of this area is covered by reverted mineral claims and there are some hundreds of acres lying to the south which are suitable for cultivation, but are still tied up under mineral licences, though there has been no mining in the vicinity for a number of years. The land to the north is more broken and rocky and is now almost bare of timber, having been fire-swept many times, and would afford good pasturage for a few hundred head of cattle.

SAND CREEK.

This work completed, we moved by wagon to the mouth of Sand Creek and before leaving the main valley surveyed a reverted mineral claim near Snowball Creek; then, having obtained pack-horses, moved 3 miles into the hills to the basin of Sand Creek.

About ten years ago there was a considerable area of Crown lands staked and surveyed in this locality and some thousands of dollars were spent in building a wagon-road from Grand Forks up Averil Creek and into this land; no settlers, however, remained on the surveyed lots, which have now reverted to the Crown, and the road fell into disuse and successive fires have blocked it with windfall and burnt out some small bridges, but it was laid out with a good grade and the expenditure of very little money would again make it passable for wagons as far as the surveys which were made by me this year.

At an elevation from 3,200 to 3,500 feet, 1,300 acres were surveyed here; all of it suitable for settlement. There is little or no standing timber remaining, as it has been fire-swept several times and is now grown up in willow, poplar, and small jack-pine, the clearing of which would be fairly heavy, but the soil is a sandy or clay loam, with some gravel and boulders, and there is a sufficiency of water to make it good hay land.

The most northerly of these lots is in the drainage-basin of Snowball Creek, and there are between 1,500 and 2,000 acres of good land in this basin still unsurveyed, but the growth is very thick pine and tamarack scrub which has been fire-killed, and the windfalls are now in such a tangle that we found it impossible to get a trail in without at least a week's hard work, and as there was a forest fire in the neighbourhood, I did not consider it advisable to attempt the work till the land already surveyed had been taken up.

Throughout all this land there is a growth of feed-grass and there are about 200 head of cattle ranging through it. There is only one settler and he has about 2 acres in timothy in a clearing around his cabin and only uses his place to pasture his cattle, which he drives in during the summer months.

HARDY MOUNTAIN.

Our next work was on Hardy Mountain, 3,800 feet above sea-level and 2,000 feet above the valley, lying between Fourth of July Creek and the North Fork of the Kettle River, so we moved back to the mouth of Sand Creek by pack-horses; then by wagon up a steep but good wagon-road almost to the top of Hardy Mountain. Climbing the hillside one gets a most wonderful view of Grand Forks and the valley of the main Kettle River for miles, with its orchards, gardens, and grain-fields, and one can also see the towns and ranches across the International Boundary; it also affords a view up the North Fork of the Kettle River for some miles.

The land surveyed lies in a basin at the head of Hardy Creek, where we found a small lake of about 2 acres, which is the source of the creek and is used as a reservoir for irrigation purpose in the main valley. There is a growth of fir and tamarack from 6 to 20 inches, but

there is little or no merchantable timber, though some ties could be cut and the balance would be good firewood, which has a market in Grand Forks, only 5 miles distant. The soil is silt or clay loam with some small gravel throughout, and as evidence of its fertility the adjoining lot has been cultivated for ten years and raises good grain, vegetables, and all small fruits, and we saw both tomatoes and melons ripening while there in August.

Lying to the north-west there are 300 to 400 acres of open range land, which, though steep and rocky, affords good pasturage for a number of cattle.

Boundary Creek.

Our next work was on Boundary Creek, 25 miles away, so we moved by wagon to the foot of the hill, where a motor-truck was waiting, and rather than go down into the valley over the main road we followed a wagon-road through a Doukhobor settlement, joining the main road on Fourth of July Creek near Spencer.

We drove for 3 miles through the Doukhobor farms, where one marvels at the work done by these settlers; the orchards all laden with fruit, the small fruits, the vegetable-gardens, and even the houses a picture of neatness surrounded by a mass of flowers. We stopped at one house for water, and men, women, and children gathered tomatoes, cucumbers, apples, and even presented us with a watermelon, all freshly picked.

We camped at the junction of Eholt and Boundary Creeks, the land surveyed lying north and west along this latter for 4 miles. The country is broken and is chiefly suited for pasturage, as the timber has been logged or burnt and now grown up in poplar and jack-pine. The basins on two creeks have good clay loam and no doubt will be shortly taken up, as they are both adjoining a first-class waogn-road leading to the Jewel Mine, 3 miles away.

It is reported that there is a further area of agricultural land 10 miles beyond the wagon-road, but as there is no trail it was considered to be too far to be inspected.

Lind Creek.

From here we moved up Lind Creek Road to an elevation of 4,000 feet, where two lots covering reverted mineral claims were surveyed. This ground has been logged for ties and cordwood and would be fairly heavy clearing, and though the soil is clay to a depth of from 4 to 6 feet and all sub-irrigated, it would be only suitable for hay-raising, as it lies on the north slope of the hill and the growing season is short.

The adjoining land is being used for dairy purposes, and as the feed through the timber is good they seem to be making it pay, but the area open for settlement is very limited, as practically this whole hillside, extending from Greenwood at the bottom to the old townsite of Phoenix at the top, is covered by mineral claims, which, though not working, still prevent the surface being taken up for agricultural purposes.

Nicholson Creek.

Our next move was up Nicholson Creek, which flows into the Kettle River from the north about 7 miles west of Midway. There are some good ranches along the creek on the lower levels, but the pieces surveyed are at an elevation of 3,300 to 3,700 feet, and being without running water are best suited for pasturage.

The timber in this valley, chiefly yellow pine and tamarack, is open and park-like and there is good feed-grass throughout. There is a good wagon-road extending back about 10 miles into the hills, where there are several settlers, chiefly raising cattle, and there is also a small sawmill operating.

Rock Creek.

This work completed and having a number of small pieces to do around Rock Creek and Bridesville, we moved to Rock Creek and camped near the traffic-bridge over the Kettle River. In the sixties Rock Creek was the centre of considerable excitement and the creek-bottom and the bench claims were washed for many years, the Chinese having worked until a few years ago. It is again, this season, being prospected and an attempt is being made to sink a shaft to bed-rock near its junction with the Kettle River, but the difficulty in handling the water had forced a temporary lay-off before getting to any great depth.

JOLLY JACK CREEK.

From this camp we surveyed a lot on Jolly Jack Creek, reached by the old stage-road to Camp McKinney. This piece was taken up for a wild hay meadow that is on it and for pasture on the surrounding hills. The adjoining country, being high and timbered, is not fitted for settlement at the present time.

WESTBRIDGE.

We also surveyed a small piece of bottom land about 5 miles north-west of Westbridge, on the West Fork of the Kettle River. This part of the valley is very narrow and the mountains rise steeply on either side and are covered with fir and jack-pine of no commercial value, but there is a fair range throughout.

CHRISTIAN VALLEY.

Having completed the work in this vicinity, we moved by a 2-ton motor-truck up the main Kettle River, through Westbridge into Christian Valley, a distance of 45 miles. The road is only a fair one and at times the heavy truck failed to take the soft sandy grades without help from the party, and it was almost dark when the end of the wagon-road was reached at Copper Creek.

It is only seven years since the original settler, after whom this portion of the valley is named, took up his holdings here, and four years since the pack-trail above Canyon City was converted into a wagon-trail, but now the settlement consists of seven families, who have their own school and can reach Rock Creek by motor in three hours. Judging from the numerous inquiries received as to conditions, both as to soil and climate, there is no doubt there will be many additions to the settlement before next season.

For the first 17 miles above Westbridge, or as far as the old mining camp of Canyon City, logging operations have been carried on for the last ten years; many million feet of pine, tamarack, and fir have been driven down stream to the mills at Grand Forks and Cascade, and the cutting of this amount of timber has employed a large number of men each winter; many of these have taken up land of their own and there are some fine ranches extending through the valley.

There are some thousands of acres of logged-off land still held under timber licence, but when these revert to the Crown they will be readily taken up by settlers.

For 12 miles above Canyon City the valley is narrow and timbered and the land is chiefly held for its timber value. Thirty miles above Westbridge, the river having passed through a narrow canyon, the valley widens and a different growth is found, the timber having all been fire-swept and the new growth is chiefly black pine. The mountains on either side are steep and afford little or no pasturage till Copper Creek is reached, where there seems to be a break in the mountains to the west, and there is said to be good range extending through 4 miles to some small lakes on the headwaters of the Beaverdell.

My surveys commenced at the end of the wagon-road and continued north up the valley, which at this point is 1¼ miles wide, with the main Kettle River flowing at the foot of the mountain range on the east boundary. About half a mile north of here the river forks, the East Branch flowing from the north along the foot of the mountains, while the main river at this point comes in from the west, making a bend of three-quarters of a mile after flowing south for some miles parallel with the East Fork.

Between the two rivers there is a low divide of from 400 to 500 feet in height, whose slopes are more or less heavily timbered with black pine, with scattered tamarack on the foot-hills and fir on the ridge.

The bottom land, extending south from this ridge, lies in a series of low benches varying from 10 to 40 feet above the river-level and are of a light sandy soil, with thick outcropping of wash-boulders on the higher levels. There are many depressions where there is a deposit of from 6 to 12 inches of silt or clay above the gravel, and throughout all the flats there is a growth of vetch and pine-grass which affords pasture for the stock in the valley. The timber-growth on the bottom land is black pine varying in size from 3 to 6 inches and from an open park-like growth to that of a thicket. Parts of this have been fire-swept and there are hundreds of acres where there would be little or no clearing required, while none of it could be called heavy clearing.

The elevation of the valley at the end of the wagon-road is 2,900 feet, there being a 700-foot rise in the 45 miles from Rock Creek, and there is no appreciable increase in the next 8 miles.

The bottom land on the main river as far as Damfino Creek, or about 4 miles above my surveys, is about three-quarters of a mile wide and is of the same character as that already described; the mountains on the west, rising steep and rocky from the river-bottom and having been fire-swept, are bare, or in places covered with scrub, while on the east the slopes are not so steep and have small benches of green timber, chiefly black pine and fir.

The bottom land on the East Fork is of the same width but of a different nature; the sandy soil gives place to a silt or clay and the timber-growth becomes spruce and alder, with the river winding through the bottom from side to side for the next 4 miles above my surveys. Here the valley narrows and the river becomes a swift-running stream, with a steep mountain range on either side; the bottoms and foot-hills covered by a heavy growth of cedar, which will have a commercial value for poles and shingles.

There is an old trail running up the main river to its headwaters, and this season it was partly cut out and reblazed for some 20 miles and was connected with the mining camp on Lightning Peak in the hope that some day this would become a wagon-road, and the rich ores which are being discovered there would be carried through to the railway through the valley. There is seemingly a more direct route by way of the East Fork and Lightning Creek, and this season we converted about 5 miles of old survey-line into a first-class pack-trail, and I believe this could be continued on a good grade following an old trap-trail up the west side of the East Fork 8 miles to Lightning Creek, and thence due north up the creek to the summit.

The present settlers in the valley are growing hay, oats, and vegetables and running a few head of cattle, and as far as climatic conditions are concerned seem to have less extremes and more precipitation than in the lower valley.

Though there was still no snow or cold weather in the valley on November 1st, we discontinued work and moved out by wagon, making a new camp two days later in the Kettle Valley 5 miles west of Midway.

Ingram Mountain.

Here we surveyed 500 acres of high rolling bench land which has been held under pre-emption for twenty-five years. There were only 75 acres under cultivation, but the remainder is mostly open bunch-grass range, which is fenced and pastured. There are also some hundreds of acres to the south held under mineral licence on which no mining has been done for ten years, and this is also splendid range land.

Kerr Creek.

We also surveyed one lot on Kerr Creek, 3 miles north from the Kettle River and reached by a good wagon-road, over which many thousands of ties have been hauled to the railway. The valley of this creek is narrow and timbered and a few ranches are being cleared as the timber is cut off. The lot surveyed is near the headwaters of the creek and is rolling and timbered, and has been held under timber-sale and there are still some ties to be cut.

Roads.

The district covered this season, being one of the oldest settled and also the centre of the mining industry, is well supplied with good roads, for, besides the trunk roads in the main valleys, there are others, over which a car can be driven, running back to all the higher benches and valleys, and a prospector for either mineral or land can take a saddle-horse almost anywhere through the mountains.

Game.

The valley of the main Kettle River above Westbridge is a sportsman's paradise and is recognized as such throughout the district, so that it is no unusual sight during the fishing season to see cars parked any place along the road, and trout varying from 1 to 5 lb. are the catch for which people come miles.

Mule-deer are very numerous and the white-tail (which are protected in this district) are often seen. Black bear are numerous, and as one proceeds up the valley one hears of occasional

silver-tips, but it is not until one gets 10 miles above the wagon-road that one really reaches the haunts of the latter.

Beaver are quite plentiful in the valley, especially on the upper river, and as they are protected they are becoming more numerous. Nearly all the settlers have trap-lines and in the winter much other fur comes from the headwaters of the river.

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ARTHUR H. HOLLAND, B.C.L.S.

HEADWATERS OF KETTLE RIVER, OSOYOOS DIVISION OF YALE DISTRICT.

BY H. H. B. ABBOTT.

KELOWNA, B.C., November 30th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report on my survey operations this season for your Branch on the upper waters of the Kettle River:—

To avoid trouble from high water which would have greatly hampered, if not prohibited, work during the early summer, a start was not made until July 12th, when we left Kelowna with equipment and supplies on a 2-ton motor-truck and travelled via Vernon, Lumby, and Cherry Creek to the head of the Monashee Pass. We arrived here on July 13th, and were joined by our pack-train from Lumby. From here we proceeded by pack-train down McIntyre Creek to the Kettle River and made our first camp at Fish Creek, some 2 miles below the Kettle River Bar, the mouth of McIntyre Creek.

The balance of the month of July and most of August was spent in subdividing surveyed lands lapsed under the "Soldiers' Homestead Act" into 80- and 160-acre tracts. The bulk of these lands are of no great value from an agricultural standard, but in view of the prevailing tendency in this part of the Province to pre-empt anything whatever that is vacant, I don't anticipate it will be long till these are taken up. The two main drawbacks are elevation and lack of transportation, and the latter will to a considerable extent be alleviated by the completion of the Vernon–Edgewood Road. The other is rather more serious, as this country is at an elevation of upwards of 3,500 feet above sea-level, and I was surprised to find that we had frost every fine night throughout July and August.

September and the first three weeks of October were spent in making a traverse connecting these surveys with the surveys on the lower part of the Kettle River through a tie to the west boundary of the C.P.R. Lot 2714, a total distance of 23 miles. This traverse has been referred to Mr. Coryell's corner of Sections 11, 12, 13, and 14, Township 64, being the north-east corner of Lot 4785 and the north-west corner of Lot 4788 of my surveys. The general course of the valley has been followed with this traverse and the main topographical features have been tied in. Each mile of southing along the traverse from the point of reference has been marked by a legal post and bearing trees and the number of miles of southing marked on the post. A system of double-chainage in feet and chains was adopted and frequent observations taken on polaris to verify azimuth.

This portion of the Kettle River Valley is practically worthless, being neither agricultural land nor carrying timber of any merchantable value. The previous growth of timber had been largely cedar, but was almost entirely burnt out evidently over fifty years ago, and 80 per cent. of the present stand is black pine, the remainder being tamarack, spruce, poplar, and some fir.

Tamarack (western larch) grows thicker in this locality than anywhere I have seen, and towards the lower end of our work reaches a large size—trees up to 5 feet in diameter having been seen—but it will not pay to log. Above Brewer Creek the Kettle follows a canyon for about 2 miles and again enters a series of canyons about the 16-Mile post, and these continue with small breaks down to Damfino Creek. For the rest the valley averages about half a mile in width and is flanked by mountains rising to about 2,000 feet above the river. The valley consists mainly of jack-pine benches, and where a few open meadows occur these are very little above high water and the gravel is only a few inches below the surface.

A side-trip was made up into the Lightning Peak country in the latter part of September for the purpose of locating the headwaters of the East Fork of the Kettle River. To get there we followed a very third-rate trail leaving the main Kettle River Trail near the 14-Mile post; this route is not recommended except in circumstances such as ours, of finding ourselves in the locality at the time; there is a first-class trail into this country from the Fire Valley side. The various waterways on this divide were traced out and tied in by traverse to an existing road traverse made by A. H. Green, B.C.L.S., in 1920, and enough information secured thereby to correct existing maps of this area.

Time did not permit of my completing the rest of the work mapped out in my instructions—the resurvey of lands reverted under the "Soldiers' Homestead Act" on the Kettle River above the bar and in Fire Valley around Wauchope. Also, our horses suffered considerably from lack of feed at the lower end of the work and we were compelled to cease work and pull out in a hurry. We struck camp on November 2nd, and returning by the same route arrived in Kelowna on November 5th.

Accessibility.

The country can be reached by either of three routes: (1) Vernon, the Monashee Pass, and McIntyre Creek; (2) Edgewood, Fire Valley, and Kettle River Bar; (3) by trail from Westbridge, on the Kettle Valley Railway. With regard to the first two routes, there is a road at present under completion between Vernon and Edgewood which will at the least make a valuable branch to the Trans-Provincial Highway. From Vernon to the head of the Monashee Pass, a distance of 48 miles, this is old road-bed and under favourable conditions is passable for any loads, though the last 9 miles should, and easily can, be put on a much easier grade. From the Monashee this road was carried on by the use of interned enemy alien labour in 1916 to within a mile of the Kettle River, but owing to sluffing of rock from the Monashee Mountain this portion is not at present passable for wheeled traffic. From the Edgewood end the existing road some 9 miles up Fire Valley is being carried forward to close the gap, and I believe this year and last about 6 miles of new grade has been built, leaving some 15-odd miles to complete; this is at present served by the old pack-trail. This road will cross the Kettle River about 4 miles above the bar; diversions by good trail from the Monashee or Wauchope can be made to reach the bar and so to link up with the trail down the main Kettle, which ends in a wagon-road about 15 miles above Westbridge.

As concerns the main Kettle River Trail from Westbridge, it is a good pack-trail as far up as Damfino Creek, after which it becomes increasingly rough till Fish Creek is reached, where it again becomes a good trail. Much of it we found grown over and extremely hard to follow and we had to clear it out for about 20 miles. Also, from out 15-Mile post to Brewer Creek, a distance of about 14 miles, the trail crosses the river fourteen times. Though some of these crossings could be done away with, at least four of them are unavoidable, and as the river floods considerably in high water this trail becomes absolutely impassable for a month to six weeks at that time of year.

Mining.

The Lightning Peak country, which is about 35 miles from Edgewood, is best reached by pack-trail leaving the Fire Valley Road about 14 miles from Edgewood. There are many promising silver-lead properties, with also showings of gold and copper, on the Lightning Peak, but difficulty of transportation has greatly retarded development. Apparently financial reasons account for the fact that properties here are rarely, if ever, worked two years in succession, but there are two or three of these being worked nearly every year. This year Mr. Williams and his sons are working on the Lightning Peak Group, and I believe on the Rampalo there is also considerable development going on.

There are the beginnings of renewed activity around the Monashee this fall. Mr. Munson is working the old McIntyre Mine at the head of the pass and expects to keep a big camp here all winter. The Morgan Mine on the South Fork of Cherry Creek has been working all fall, and Mr. Rear is working an hydraulic proposition still lower down.

Game.

In view of its extent and remoteness, this is rather a disappointing game country throughout. Deer, some goat, the three species of bear and grouse are native to the district, but not very plentiful.

Fish Lake is very thickly stocked with rainbow trout running as high as 5 to 6 lb., and Keefer Lake, at the head of the Kettle River, gives even better fishing for the ordinary mountain-trout. Small trout are also fairly plentiful in the Kettle River itself.

CLIMATE.

The climate partakes more of the nature of the Kootenay than of the Okanagan climate, and while the snowfall is less than the average in the Kootenay, the rainfall is slightly greater.

I have, etc.,

H. H. B. ABBOTT, B.C.L.S.

PORTIONS OF KAMLOOPS, YALE, SIMILKAMEEN, AND KOOTENAY DISTRICTS.

BY O. B. N. WILKIE.

VICTORIA, December 20th, 1921.

J. E. Umbach, Esq.,.
Surveyor-General, Victoria, B.C.

SIR,—My instructions for the season of 1921 were to carry on certain miscellaneous and inspection surveys. These surveys included parcels in Kamloops, Yale, Similkameen, and Kootenay Districts; the territory covered extending over a widely diversified area. In the different localities almost all of the important industries of British Columbia are represented.

Our party was organized at Merritt, which is the largest town and principal trading-point in the Nicola Valley and serves a considerable outlying agricultural and stock-raising district.

All business is well represented at this point, and in addition to the regular business carried on here it is the centre of some important industries. The Nicola Pine Mills, a large lumbering company, is located here and employs a large force of men. The McGorran Mill also turns out lumber and runs retail yards in Merritt.

To supply these mills logging camps are operating throughout the timbered areas, furnishing employment for many men. Settlers engage in logging during the winter season to a considerable extent, the returns enabling them to improve their ranches. During the past year camps up the Coldwater River were engaged in getting out tie-timber, for which there was a great demand. Mining-timbers are also supplied for the coal-mines at Merritt.

There are two coal companies operating at the present time, getting out a first-class quality of coal and employing quite a number of miners. Two or three other coal companies, which are at present closed down, are located here.

In the district tributary to Merritt considerable interest is shown in the development of mining for gold, silver, iron, copper, gypsum, etc. Bentonite has been found in quantity, and a deposit of calcium carbide has been opened up during the past year and a local company formed to carry on operations.

One of the most noteworthy of the various industries of this locality is silver-fox farming, there being several companies and individuals engaged in the fascinating occupation of breeding foxes for sale. It is claimed that fox-farmers in Merritt and vicinity own in the neighbourhood of $100,000 worth of foxes. It is the largest station in this line in British Columbia.

Merritt is the centre of an agricultural district, where general farming and cattle-raising are the principal sources of income. It is particularly suitable for cattle, as the mountains surrounding the valleys furnish excellent pasture for stock. Peavine and bunch-grass grows profusely. Many settlers are making good ranches on upland pre-emptions; numerous small streams and lakes furnishing water for irrigation and domestic purposes. The Nicola Valley is irrigated for the most part from the Nicola River.

Wheat, oats, barley, etc., make good crops on the lower levels, while hay is successfully grown on the mountain ranches. Grain, potatoes, and the hardier vegetables mature up to an altitude of about 2,500 feet. Sheep seem to do well and hogs especially well.

It is not a fruit-growing section, but the small fruits do well and some of the hardier varieties of tree-fruits.

More dairying is done each year and in the summer of 1921 considerable cream was being shipped to outside points.

Timothy and clover hay grows remarkably well and alfalfa makes a good crop, but is a little harder to get a stand.

A branch line of the Kettle Valley Railway connects Merritt with the main line of the Canadian Pacific Railway at Spences Bridge, 42 miles distant, and Brookmere, on the main line of the Kettle Valley Railway running from Vancouver to Nelson.

From this point some pre-emptions, applications to pre-empt, and British Columbia Government lots were surveyed and isolated lots tied in at Lower Nicola, Coyote Valley, Douglas Lake, Clapperton Creek, and Aspen Grove.

Upon completing this work we proceeded by way of the main Merritt–Princeton Automobile-road through Aspen Grove, the Otter and Tulameen Valleys to Coalmont; the latter being a small station on the Kettle Valley and Great Northern Railways, where coal-mines are in operation. There is also a general store, post-office, and hotel.

Granite Creek.

We made camp at Granite Creek, about a mile east of Coalmont, on the Tulameen River. Granite Creek is remembered by the old-timers as the scene of one of the gold-rushes of the early days. In 1885 gold was discovered and almost overnight it became a booming mining camp of 4,000 or 5,000 inhabitants. It is now practically abandoned as a mining camp, although individual prospectors still pan gold in small quantities from their placer claims.

We surveyed the old camp as a Government reserve and the occupied portions were laid out as a townsite; the old cemetery being laid out as a Government lot. Some applications to pre-empt were surveyed near this point. The general character of the country is rough and mountainous, with an elevation in the valley of around 2,000 feet.

Similkameen Valley.

Our work being finished in this locality, we broke camp and moved by way of Princeton to a point in the Similkameen Valley, which is a wide and fertile valley, well watered, and many successful ranches are found there.

Princeton, lying at the junction of the Tulameen and Similkameen Rivers, is a flourishing town where all lines of businesses are fairly well represented. It also has coal-mines in operation and a few miles out is the British Columbia Copper Company, one of the largest copper-mines in British Columbia. This plant is now closed down on account of the low price of copper.

The main line of the Kettle Valley Railway passes through Princeton and railway connections can be had via the Great Northern Railway to points south across the International Boundary by way of Oroville and Spokane, Washington.

Around Princeton some miles out, in the upland country, some Government land suitable for cattle ranching and farming may be found.

Our next camp was located at Soukup Creek, which lies about midway between Princeton and Hedley, in the Similkameen Valley. Here two recorded pre-emptions were surveyed.

At Hedley, on the Great Northern Railway, about 20 miles south-east of Princeton, is located one of the largest gold-mining companies in the Province.

Keremeos, farther south in the same valley, is the centre of a very fine fruit- and vegetable-growing district and has several packing and canning plants. The climate is favourable for the growing of tender vegetables such as tomatoes, and a good income is made from growing them for the canning companies.

The Kootenay Power and Light Company, with plant located at Bonnington Falls, near Nelson, supplies power and light for the towns in the Similkameen Valley, extending the service as far as Princeton and the British Columbia Copper Company.

Our next surveys were to be made in the Kootenay District, near Goatfell and Kingsgate. To reach this point we went by train over the Kettle Valley Railway's main line to Nelson, passing through Penticton en route.

Penticton and South Okanagan.

Penticton is situated at the lower end of Okanagan Lake and is the principal town in the Southern Okanagan fruit-growing district, and a popular summer resort as well. Thousands of boxes of apples and other fruits were shipped from the Okanagan Valley the past season, which compares favourably in quality with the best imported fruits.

About 30 miles below Penticton the British Columbia Government has taken over a large area of land and is constructing a concrete irrigation system to irrigate it for settlement. The new town of Oliver is located near the centre of this tract. Good roads traverse the entire district.

NELSON AND VICINITY.

Nelson, the end of the Kettle Valley line, is the largest town in the Interior of the Province and a distributing-point for many smaller towns and country districts. It is beautifully situated on the Kootenay River near the point where it flows out of Kootenay Lake. Canadian Pacific boats furnish connections with the Crowsnest branch, joining the main line at Medicine Hat. The Great Northern Railway furnishes transportation to points across the boundary and connecting with Spokane.

Some fruit is grown in the territory surrounding Nelson and general farming, dairying, and cattle-raising is carried on. The principal industry, however, has been mining, some good mining properties being located in this vicinity.

NEAR GOATFELL AND KINGSGATE.

From Nelson we went by boat and train to Goatfell and Kingsgate, where several old surveys were inspected and amendments made. In general this section of the country differs greatly from that of the Kamloops or Similkameen Districts. Little irrigation, if any, is required for the production of crops. The timber is heavier, with more underbrush, and consists principally of fir, cedar, tamarack, and hemlock. It is not so good a range country for cattle, the vegetation being less plentiful.

Logging is one of the principal industries, numerous large mills being located in this section.

The Crowsnest branch of the Canadian Pacific Railway serves the district and the Trans-Provincial Highway is completed from Kootenay Lake to the Alberta boundary.

In the immediate vicinity of Goatfell and Kingsgate the settlers are engaged in general farming, but at Creston and Yahk, only a few miles distant, fruit is successfully grown, Creston, more particularly, making large shipments of fruit during the season.

Nelson, Cranbrook, and Fernie are the principal towns and distributing centres for the South Kootenay District. Trail, about 20 miles from the International Boundary, is a town of some importance, the Consolidated Mining and Smelting Company being located there. This is the largest smelter in the Province.

NORTH THOMPSON VALLEY.

Upon finishing the work assigned to me in the Kootenay District, we proceeded by way of Kamloops to a point about 70 miles up the North Thompson River to Blackpool, where we surveyed several recorded pre-emptions and new applications.

The North Thompson Valley is a wide, fertile valley, narrowing in places to the river, and traversed by the Canadian National Railway. Fair roads extend along the river on either side for about 100 miles, several ferries at various points giving access to the railway.

The soil in the valley is a rich sandy clay, and, as the elevation is only about 1,200 feet, the climate is favourable for the production of fruits, vegetables, and all farm products. There are numerous prosperous ranches and in the lower part some good cattle-ranches. Dairying is successfully carried on, creameries being located at Heffley Creek and at Kamloops.

At Barriere and Chu Chua, on the Canadian National Railway, there are large general stores which appear to do a thriving business, as well as smaller stores at other points. A coal-mine is in operation at Chu Chua, and near Blackpool a large concentrator for the reduction of ores has been built, but it is not in operation at the present time. Considerable mining is done in the adjacent territory.

Kamloops, the second largest town of the British Columbia Interior, is located at the junction of the North and South Forks of the Thompson River. It has two railways, the Canadian Pacific and the Canadian National, and is a division-point on both. It has grain-elevators, large hardware and implement houses and creamery, and is the principal supply-point and market for a prosperous agricultural community. General business is well represented in all lines and the Land Registry Office and Government office is located here.

Telephone systems are in operation over all the territory covered by my season's work.

Throughout the wooded, mountainous regions considerable trapping and hunting is done in the season. Fur-bearing animals are plentiful and consist principally of coyote, lynx, marten, fisher, beaver, bear, mink, and ermine. Deer, ducks, and geese furnish good shooting.

In all these districts the raising of poultry, turkeys, and geese in connection with general farming or as a separate business is successful and a good source of income. There is a good demand for all such products.

I carried on surveys up the North Thompson until stopped by extraordinary snowfalls the last of November, and I then returned to Merritt, where my party was disbanded.

I have, etc.,

O. B. N. WILKIE, B.C.L.S.

RESURVEY, SATURNA ISLAND.

BY H. E. WHYTE.

VICTORIA, B.C., September 29th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report regarding the survey carried out on Saturna Island to re-establish and define the boundaries of lands which had not been Crown-granted, and to resubdivide such land so that each quarter-section should have all posts planted and at least three boundaries run:—

After digging for three days I located the broken glass that had been placed under the original post at the south-east corner of Section 11 at the head of Narvaez Bay. The original survey made in 1874 was commenced at this point; hence I began my work at the same place and was able to locate the original position of all posts thereafter, even though some of the country had been badly burnt and the original survey had been made forty-seven years ago.

Saturna Island is very rugged, consisting of two ranges of hills, rising to approximately 1,100 feet, separated by a narrow valley running from Lyall Harbour to Narvaez Bay, the highest point in this valley being about 300 feet above sea-level. The hills are steep, rocky, and broken on the south side, while on the north, though steep, the surface is not so rocky and broken.

Communication with the island is maintained by the C.P.R. boat "Island Princess," sailing from Victoria in the summer and Deep Cove in the winter. Calls are made bi-weekly.

There is a post-office and store on the west end of the island and a wagon-road about 4 miles in length runs easterly through the centre; the last half-mile, near Narvaez Bay, has yet to be graded. The town of Sidney, on Saanich Peninsula, is about 16 miles distant.

A great portion of the island is rock, the balance being sandy loam, with a small area of bottom land. There is only a small portion fit for cultivation.

The area is as a whole heavily timbered, chiefly with cedar, fir, and balsam. Logging has been done in the valley running easterly from the head of Lyall Harbour. The south-west quarter of Section 11 was being logged at the time of survey. Clearing would cost in the neighbourhood of $300 per acre.

The climate is mild, being very similar to that of Victoria. Deer and grouse are plentiful.

I have, etc.,

H. E. WHYTE, B.C.L.S.

SAYWARD DISTRICT.

BY JOHN DAVIDSON.

VANCOUVER, B.C., January 20th, 1922.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to report on the past season's surveys undertaken in the Sayward District, and in adjacent portions of Range 1, Coast, and New Westminster Districts.

The work was divided into two portions—the subdividing into blocks of from 40 to 80 acres of those portions of logged-off lands found suitable for settlement, and a triangulation survey between unconnected land and timber surveys on the Coast, which at the same time formed the basis of an accurate map of the shore-line.

OWEN BAY.

The most extensive subdivision survey was made at the head of Owen Bay, on Sonora Island. Here, out of an area of 2,100 acres of an expired and logged-off timber licence, 790 acres were surveyed as suitable for settlement and cut up into fourteen blocks, each containing between 30 and 40 acres of agricultural land.

Owen Bay is situated on the north shore of Okisollo Channel, at the west end of the Hole in the Wall, and is an indentation 1 mile in depth and half a mile in width. Its waters are well sheltered by a group of small islands at the entrance, which, while protecting it from the south, do not impede navigation by the ordinary coastal steamship.

It is about 130 miles north-westerly from Vancouver, from which there is a weekly service by the Union Steamship Company's steamers to Wyatt Bay and to Churchhouse. Owen Bay is about 3 miles from Wyatt Bay and 9 miles from Churchhouse. At each place there is a post-office and good general store, and Wyatt Bay has the added advantage of a telephone service communicating with the Dominion Government Telegraph.

The rapids of Okisollo Channel and of the Hole in the Wall, which later are only navigable for a short period around slack water, detract from the accessibility of Owen Bay, but as navigation in the whole district is similarly governed by the tides, there is less inconvenience than would be anticipated.

The shore-line of Owen Bay is bounded by steep bare rocks, with small shingle beaches in the narrow indentations, and a long stretch of muddy sand at the head, bared for about 20 chains at low tide. On the east shore for the first 40 chains surveyed the rock bluffs of the shore rise steeply into a rugged hillside, broken up by shallow ravines and old watercourses, and the enclosed area of land between the shore and the mountain is unfit for any agricultural purpose. The remainder of the shore-line surveyed, including the head, is low; the rocks, rising 10 to 20 feet above sea-level, immediately give place to a deep deposit of sandy loam or loam.

The vegetation along the shore-line is a luxuriant growth of the usual berry-brush, salmon-berry and thimble-berry predominating. The merchantable timber has been logged off and only a few hemlocks and cedars are left.

On the west shore there is no land suitable for cultivation. A steep, high rocky ridge rises from the shore, the crest being about 20 chains back from the beach, and running parallel to the shore it continues north-easterly, separating the block surveyed from St. Aubyn Lake.

Along the foot of the easterly slope of this main ridge flows the main drainage creek of the land to the east. This creek rises in the swamp meadows towards the north-east corner of the block and drains two-thirds of the area surveyed. In summer it is about 15 feet wide and 1 foot deep and nowhere is it swift. The land drained by it, rising gradually and evenly, is fairly flat, but is broken up by a few small ridges which run at right angles to the main ridge. There are a few swamp meadows throughout the area, but sufficient fall can be obtained to efficiently drain them.

Throughout there is an exceptional depth (for the Coast) of good soil with a clay subsoil. A detailed description of each parcel is part of the field-notes.

On the east shore of Owen Bay, through Lots 1174 and 1175, the land rises steeply to a low ridge and then drops quickly to Hyacinth Lake. The soil here is a sandy loam with a clay subsoil, and except where the granite rock outcrops is from 3 to 6 feet in depth, with the usual

tangled growth of salmon-berry brush amongst the old logging-slash and young alder. Hyacinth Lake is a shallow body of water half a mile square, covered with water-lilies and bordered with beds of white hyacinths. Its average depth is about 8 feet and the bed is covered with 2 or 3 feet of soft mud, deposited by the main feeder from the north-east. The outlet is at the north-west corner of the lake. It is about 15 feet wide and 2 to 3 feet deep and falls rapidly to the sea, dropping about 40 feet in the first 200 yards of its course. Sufficient power could be developed from it to furnish light to a small settlement.

The main feeder of the lake flows in through Dorr's pre-emption at the north-east corner and is a gently flowing stream 6 feet wide and 18 inches deep. It rises amongst the ridges about half a mile east of the lake, and as it drains a good watershed it rapidly increases in size before it reaches the string of swamp meadows through which it flows to the lake.

These meadows can be readily drained by clearing and deepening the creek-bed and ditching towards it. The soil is a deep deposit of black muck over clay loam with a clay subsoil. Wild hay has been cut on a few of these small meadows for some years by Dorr, who has cleared about 8 acres on his pre-emption and grows excellent vegetables, including tomatoes. Another feeder of Hyacinth Lake rises amongst the ridges south-west of the lake, and after a short, swift descent through a deep, well-timbered draw flows quietly over a gravel-bed through a small flat of good soil, shaded by hemlock and spruce to 18 inches, where it enters the lake at the south-west corner.

St. Aubyn Lake is about a mile due north of the head of Owen Bay. At the east end of the lake there is an area of about 10 acres of easily cleared swamp land of a muskeggy nature. The creek, which enters the lake here, flows through a narrow valley with steep side-hills and has cut a deep channel in a gravelly soil.

The outlet is a wide, shallow stream flowing gently for the first half-mile of its course, and then more swiftly as it enters a narrow valley at the foot of the main ridge on the west side of Owen Bay, and down which it continues till it reaches the sea in Okisollo Channel, about half a mile west from Owen Bay.

The only land with agricultural possibilities bordering on the lake was found on the banks of this creek, the remainder of the lake-shore being bounded by steep, well-timbered slopes, with low rock bluffs at the water's edge. A trail was cut all the way up this creek in 1919 by the Fisheries Department when making the stream passable for salmon. A shorter route to the lake is obtained over a low pass in the main ridge from near the head of Owen Bay to this trail.

Timber.

Except for about 80 acres north-east of Hyacinth Lake covered by a timber-sale, the merchantable timber has been logged off. The new growth is of young hemlock, except along the old skid-roads, where it is entirely of alder. There are scattered patches of hemlock to 20 inches and occasionally larger cedar. The old slashing is now a tangle of down-timber, limbs, and dense berry-brush, with clumps of young hemlock. A detailed report of the timber in the area was made by Mr. McVickar, of the Forestry Service, in April, 1920.

Clearing.

To clear an area large enough to make a producing farm within a reasonably short period of time the use of machinery is advisable, and as few individual settlers have sufficient capital to warrant the purchase of a donkey-engine for stumping and piling, co-operative settlement is essential. The cost of clearing would be about $400 per acre. Again, in marketing the produce in the local market—that is, in the logging camps—a certain steady supply of produce is necessary to meet the needs of the camps. To ensure this some kind of co-operation is needed amongst the settlers.

Climate.

Weather conditions are very similar to Vancouver. There are no summer frosts. The rainfall averages between 70 and 80 inches. The land is suitable for mixed farming, and small fruits and apples grow well in the neighbourhood.

Game.

Deer are more plentiful here than in any other part of the island, and the same might be said of the cougar. There is a fair showing of young grouse and several small flocks of wild

pigeons were seen, apparently nesting here. Ducks are numerous in the fall. Good fishing can be had at any time in the rapids, as well as salmon-fishing in the season.

Many inquiries were made regarding this area by intending settlers and I anticipate that all of this land will be applied for within a year.

CAHNISH BAY, QUADRA ISLAND.

Five lots were surveyed for settlement on the south shore of Cahnish Bay. They are from 40 to 80 acres in extent and are more readily cleared than the average. The logged-off areas have been well burnt and not as yet reseeded to any extent, while the original forest-growth on the remainder seldom exceeds 20 inches in diameter.

The land rises fairly steeply from the shore, but none of it is high. The whole area surveyed lies between two main creeks, both about 20 feet wide, and which, entering the south boundary about 60 chains apart, flows parallel for almost a mile, when the most westerly creek turns a right angle and joins the other just before reaching the sea.

The land is broken up by many ridges, on all of which the soil is light and shallow, with rock-outcrops in places, but in the flats good soil is found. The area is suitable for grazing land and good skid-roads make any part of it readily accessible.

Granite Bay lies 2 miles to the east. Here there is a school, post-office, and general store. A good road follows the old railway logging-road up the valley towards Village Bay, on the east shore of Quadra Island. When the logged-off lands adjacent to this old logging-road are opened up for settlement, judging by the productivity of the land at present cultivated, Granite Bay should be the port of a thriving farming community. Several prospects in this valley have had a considerable amount of development-work done and trial shipments have been made of a gold-bearing copper ore.

THURSTON BAY FOREST RANGER STATION.

Surveys were made at Thurston Bay of a reserve for the Forestry Branch of the Lands Department. This included the survey of foreshore, of two small islands, and of the various improvements made.

An extensive plant has been assembled here for the building and the repair of patrol-boats for the Forest Service. Power to run the plant and to light the buildings is obtained from Florence Creek, a turbulent stream rising in Florence Lake, and which, like all small Coast streams not glacier-fed, fails for about two weeks in the hottest part of the summer.

The station is fitted with a wireless telephone, which is successfully used in communicating with the patrol-boats and with Vancouver. Under favourable circumstances I was able to hear a gramaphone being played in a wireless station south of Los Angeles.

The land surveyed here has no agricultural possibilities, being steep, rough side-hills with rock-outcrops, but covered with a heavy growth of poor timber. From the north boundary near the north-west corner photographs were taken looking north and south along Nodales Channel, a typical passage in this district.

Near Thurston Bay, in Cameleon Harbour, several families have settled on the land subdivided in 1919 and a start made to clear and cultivate the land. Good vegetables were grown there this season, the soil proving to be very productive.

ESTERO BASIN.

At the head of Frederick Arm booming-grounds were surveyed for the benefit of those logging in Estero Basin. This was done in conjunction with the Forest Service.

TRIANGULATION SURVEYS.

The triangulation stations were marked by permanent monuments, the main quadrilaterals being defined by iron pins set in holes drilled in rock and marked with the station number. Secondary stations were defined by drilling a hole in the rock and inserting a wooden plug; in this a copper tack was set.

Each station was witnessed by a triangular wooden post, with the number of the station inscribed on it, set in a rock mound, and wherever possible bearing trees were also used.

For sighting, a tripod was made of peeled poles 18 to 24 feet long and from 4 to 6 inches in diameter. This was erected over the station and plumbed carefully by the aid of a cord hung

from the true intersection of the poles. The ends of the poles were set in rock mounds or wedged in cracks in the rocks, and where necessary were further strengthened by braces nailed across the base. In some cases platforms were of necessity built to stand on when reading the angles.

Nodales Channel.

This work was commenced on the west shore of Sonora Island about 3 miles north of the entrance of Okisollo Channel. Here a base-line was carefully traversed and ties made to Chatham Point Light. The triangulation system was then carried up Nodales Channel to join the last season's work at Johns Point and Owen Point. Existing surveys were tied to and Howe, Hardinge, and the Lee Islands surveyed. The unsurveyed portions of the shore-line were defined by intermediate stations.

Blind Channel (Mayne Passage).

Ties were made from Bickley Bay, on Thurlow Island, to Lot 1437 on the Mainland, and a connecting traverse run along the shore between Lot 1433 and S.T.L. 10603P; this to define Timber-sale 2627.

Cardero Channel.

The triangulation carried out in 1920 covered Cardero Channel from Johns Point to Henry Point, and this season it was carried southerly to Gillard Island Beacon from a new base-line traversed on the shore opposite Henry Point. All of this season's work here was in the Euculta Rapids, which are only navigable for a short period of time around slack water, and rarely for more than an hour at any one time, unless travelling with the current. The average tug-boat with a boom of logs takes two favourable tides to make the journey through, tying up on the south shore of Dent Island for the first night. With rowboats and an overboard engine the navigation of the rapids between survey stations was found to be very interesting and at times exciting. The whole party were glad when this part of the work was completed. Little Dent Island, Gillard Island, and several smaller islands were surveyed, as well as the unsurveyed channels. Ties were made to existing surveys and doubtful locations cleared up.

Calm Channel, North Passage, and Pryce Channel.

A base-line was run on the south end of Stuart Island, and from here a system of triangles was carried south to Rendezvous Island, east through North Passage to Ramsay Arm; thence along Pryce Channel to Elizabeth Island on the north shore, and to the lime-quarry on Redonda Island. An extension was also carried north to tie to Gillard Island Beacon, so that there is a triangulation tie from Chatham Point up Nodales and down Cardero, through Calm Channel, and along Pryce Channel.

Stations were so placed that at some future date the system can be extended through the Arran Rapids to Bute Inlet, southerly down Calm Channel to connect with last season's work on Cortes Island, up Ramsay Arm, and along Pryce Channel to Toba Inlet. As in the other systems, ties were made to existing land and timber surveys and the unsurveyed coast-line carefully mapped.

A tie was also made to the old Indian reserve on Sonora Island north of the east end of the Hole in the Wall, the north boundary of which was re-established. From this reserve a low divide forms another route into the land surveyed at Owen Bay. This reserve was abandoned by the Indians in favour of the newer reserve at Churchhouse, where there is a large church, school, and quite a number of pretentious houses. Here most of the Indians spend the winter, their fishing-fleet finding sheltered anchorage in front of the village.

The reserve at Orford Bay, the south boundary of which was redefined this season, is becoming popular with these Indians in the summer and several new houses are being erected.

General.

Lumbering is the chief industry of the district covered by this season's work, and during 1921 1,200 men were employed in logging in the various camps. Over 100,000,000 feet of fir, cedar, and hemlock, valued at about $1,000,000, were cut and about 1,300 acres were logged off. In addition to the logging, several small lumber and shingle mills gave employment to about 100 men.

FISHING.

The salmon-fishing was very poor here this season and the pack was light. Cod-fishing amongst the several rapids keeps a few boat crews busy the year round, and two dogfish-oil factories engage a few fishermen in the winter months.

MINING.

There was practically no development-work done this year. Much money has been spent on the various properties in previous years and trial shipments have been made from time to time. Prospecting was carried out as in former years and good reports were heard of some new and some old locations.

A lime-quarry is being operated on the north shore of Redonda Island for the Whalen Pulp and Paper Mills Company, Limited, and regular shipments made to Mill Creek of an almost pure limestone.

I have, etc.,
JOHN DAVIDSON, B.C.L.S.

SAYWARD AND RUPERT DISTRICTS, AND RANGE 1, COAST DISTRICT.

BY M. W. HEWITT.

VANCOUVER, B.C., November 2nd, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report of the surveys made by me during the past summer in Sayward and Rupert Districts, and Range 1, Coast District:—

Leaving Vancouver on June 13th, I took steamer to Quathiaski Cove, proceeding from there by wagon to Lot 113, immediately adjoining the Cape Mudge Indian Reserve.

This lot has been thoroughly logged and was very completely burnt in the dry fall of 1919. Within its boundaries I laid out Lot 126, covering Pre-emption Record 353, using, as far as could be determined, the old corners established thirty years ago; the balance, including some vacant Crown land to the north-east, I cut up into lots running from 33 to 65 acres.

The surface is very uniformly level, rolling slightly, the ridges running approximately north and south; these are composed of gravel, for the most part clear of boulders, and will furnish an inexhaustible supply of excellent road material. The sides of the slopes are composed of a dark-red sandy loam, mostly free from stone, which seems capable of raising good crops of fruit and vegetables, judging from gardens on similar soil seen around Quathiaski. The bottoms are mostly swampy, but have sufficient fall to be easily drained, the soil varying from sandy to clay loam. The subsoil, as far as could be determined, is a mixture of clay and gravel, the clay in some places having a marly appearance. There are two considerable open swamps of wild hay on the lot, besides numerous smaller ones.

The vegetation is, for the most part, that usually found on logged and burnt fir land—bracken, fireweed, and blackberry-vines on the ridges, with wild grass, red blind-nettle, wild mimulus, and sorrel in the bottoms. On the south end wild columbine is prevalent and since logging the big Scotch or bull thistle has come in very universally. I was also very sorry to find in one place on the grade of the old railway a very flourishing patch of the noxious Canada thistle. There are no well-defined creeks on the lot; adjoining farms find an apparently plentiful supply of water in shallow wells.

Being surrounded by occupied and improved lands, the lot is well served by a good gravel road, which crosses it diagonally, with a fork at the south end, one branch crossing the south boundary at about its centre and the other crossing the east boundary, giving a connection to Quathiaska and Heriot Bay, distant respectively about 4 and 8 miles. Besides this, there is the grade of the old logging-railway, which can very easily be made to give access to all lots not otherwise served. The general elevation is about 200 feet above sea-level.

On completion of this I proceeded to Gowlland Harbour, where I resurveyed the very rough and extremely rocky North-west Quarter of Section 215, covered by Pre-emption Record No. 261, and on completion of this proceeded to a camp on the shore of Lot 165, making a survey of Lot

230, covering the vacant Crown land immediately to the east of Lot 166. This piece of ground is also very rough and rocky. This completed the work in Sayward District.

From here I moved camp to Beaver Creek, on the west side of Loughborough Inlet, where I subdivided portions of Lot 29, Range 1, Coast District, the portions subdivided being the easterly point included between Sydney Bay and Beaver Creek, and the extreme westerly portion of the lot.

The greater part of the easterly portion was logged a considerable time ago and is now grown up with a dense second growth of fir, cedar, hemlock, and alder. The ground rises sharply from either shore, the top being on an easy incline both ways from the central ridge. The soil is mostly clay and clay loam, with occasional outcrops of rock.

At the time of the survey in the latter end of July a number of small streams were found along the shore-line, and Mr. Green, on Lot 1467, had good water in a shallow well, which, however, dried up just before we left; the elevation is from 100 to 200 feet above sea-level. The portion of the western end subdivided has been partially logged recently, but there is still a considerable amount of hemlock standing, and there are also a number of fir logs and cedar shingle-bolts cut and left lying in the woods.

The surface is mostly flat and slightly rolling, with a general elevation of about 300 feet above sea-level. The soil varies from gravelly loam to clay loam. There is a creek of considerable volume on Lot 1470 and a smaller one on Lot 1468.

I also tied in by triangulation the land surveys on the east side of Loughborough Inlet to the surveys on either side of Beaver Creek. In this triangulation, as in all others made by me, a careful traverse of the shore was made for a base-line, selected so that the two extremities were visible from one another, thus securing a check by a comparison between the bearing as read and the bearing as figured.

From here I proceeded to Jackson Bay, Topaz Harbour, where I investigated a reported overlap between Lots 569 and 36. Leaving here, a day and a half by gasolene-launch brought us to Fort Rupert, where I tied the two ends of the Geodetic Surveys base-line to the adjoining land surveys. I then crossed Queen Charlotte Sound and tied in by triangulation the Geodetic Surveys station on Numas Island to the land surveys on the Mainland, following this by a triangulation of Wells Passage and Canoe Pass to tie the surveys on Broughton Island to those on the Mainland. On completion of this I made camp on Hayle Point, on the east end of Broughton Island, and tied in by triangulation the Burdwood group of islands and the land surveys on Gilford, Baker, and Broughton Islands to those on the Mainland, making also a stadia traverse with transit angles to locate and tie in the various islands of the Burdwood Group.

Leaving here, I made camps in Port Harvey and Chatham Channel, tying in by triangulation the surveys on Cracroft and Hull Islands to the surveys on the east side of Havannah Channel, and also the surveys on Cracroft Island to those on the north side of Chatham Channel. I also from these camps subdivided portions of two expired timber leases—Lot 70 on Cracroft Island and Lot 31 on the Mainland. Of Lot 70, the lowest and best portion is covered by Lot 105. Of the remainder, a good deal was found to be unfit for subdivision, being mostly mountain and rock bluff; five lots, however, were laid out, one fronting on Port Harvey, one inland, and three fronting on Chatham Channel. The first two are mostly low-lying, the soil being a sandy loam on a subsoil of clay; the other three rise steeply from Chatham Channel to an elevation of from 100 to 200 feet, followed by a short gradual northern slope, breaking into a long, even, southern slope towards Port Harvey, the soil of these being gravelly. All have been very thoroughly logged, the only timber of any commercial value left being a fair sprinkling of cedar poles. On Lot 31 I laid out five lots fronting on Chatham Channel and on the bay behind Low Island.

The front of Lot 31 is low and flat, the back rocky hills, unfit for subdivision, carrying a considerable stand of hemlock timber and some fir and cedar. The low ground only has been logged. The land subdivided is of excellent quality, the soil being a brown clay loam, very wet at the time of survey owing to the heavy rains in September and October, but with plenty of fall for drainage and carrying a considerable growth of swamp-grass. In addition to the lots surveyed, a good 80-acre lot could be got behind Lots 1877 and 1878 and a lot to the east of Lot 1878, fronting on the water. I was anxious to survey these, but the weather was so bad during the last week of my stay that I was forced to abandon the idea of this.

I surveyed Low Island as Lot 1476. It is composed principally of boulders and has been, I think, the medial moraine of the Call Creek Glacier. It has a maximum elevation of 10 feet above sea-level and carries down the centre a belt of scrubby fir and a considerable growth of wild grass round the edges, which should afford good summer grazing. It has no water.

I have, etc.,

M. W. HEWITT, B.C.L.S.

WEST COAST, VANCOUVER ISLAND.

BY A. W. HARVEY.

VICTORIA, B.C., November 30th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—In accordance with instructions received, I have made certain surveys on the west coast of Vancouver Island during the season of 1921.

My first work was making a connection from Drinkwater Creek, which runs into the head of Great Central Lake, to the head of Bear River, which empties into Bedwell Sound. I found on reaching Della Lake that I could not get through the Bear River Pass owing to heavy snow, so I triangulated to a sharp mountain-top and completed the work by continuing Colonel Leach's traverse up Bear River and triangulating to the same peak. I then made several connections from the Bear River traverse to old surveys, surveyed Warn Island and connected it by triangulation to Lot 506, and connected Indian Reserve No. 8, Kennedy River, to Lot 612. I then surveyed a pre-emption in Cypress Bay, which completed the work in the neighbourhood of Clayoquot. I left Clayoquot on the steamer on September 3rd intending to go into Hesquiat, but the weather was very rough and we were unable to land there, so I had to proceed to Centre Island, Esperanza Inlet, where I partially surveyed seventeen lots, being recalled early in October by yourself. A further two weeks' work would have completed this survey if the weather was fine. These lots all lie in one block on the south side of the entrance to Esperanza Inlet. The country is rough and broken, with small patches of good land in places, but the clearing is very heavy and it would take years or the expenditure of a great deal of money for a settler to bring even 10 acres under cultivation. I completed my season's work by a triangulation connecting old surveys on Alberni Canal which were found to be very incorrect.

I have, etc.,

A. W. HARVEY, B.C.L.S.

COAST TRIANGULATION, FITZHUGH SOUND TO ELLERSLIE CHANNEL, RANGES 2 AND 3, COAST DISTRICT.

BY J. T. UNDERHILL.

VANCOUVER, B.C., November 30th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report upon my season's work in Ranges 2 and 3, Coast District:—

Work was conducted in a similar manner to previous years, but owing to the narrowness of many of the smaller channels the actual distance of triangulation carried out was less, although eighty stations more were occupied this season than last. The immense amount of detail covering innumerable small islands, rocks, lagoons, etc., naturally kept down the length of the triangulation chain.

FITZHUGH SOUND.

This body of water is probably so well known as to require few remarks from me. Its west shore, bounded by Calvert, Hecate, Nalau, and Hunter Islands, differs considerably from the mainland shore to the east. All of the above islands are poorly timbered with hemlock, cedar, spruce, and pine, and many comparatively open patches of muskeg with scattered timber are

seen from the water. What timber there is gets gradually better and better as you proceed northerly from Queen Charlotte Sound.

The east shore is generally better timbered and slopes back more gently from the shore-line. Room for a few pre-emptions may be found along this shore. The tidal effect in the channel is very noticeable from the entrance of Hakai Pass to the mouth of Burke Channel, particularly on the ebb. Practically all of the Burke Channel tide sweeps out through Hakai Pass, thus creating quite a set in that direction.

Owing to Nalau Pass closing down to a few chains in width there is little tidal set in that direction. A curious wind effect is noticed with the prevailing west winds of summer. It enters by way of Hakai Pass and then divides, blowing up-channel to the north and down-channel to the south. This creates a nasty sea in the area off Koeye River, particularly when the tide is ebbing and when big swells are coming in from Hakai. With a south-east or south-west blow, quite heavy weather is common in the lower part of Fitzhugh from Addenbroke Island south.

South-west Coast, Calvert Island.

This shore-line, which was traversed from the vicinity of Cape Calvert to Lot 911, is exceedingly rough and broken. Being fully exposed to the open Pacific and pounded by surf for centuries, the shore-line has been broken into a mass of small, deep, and narrow bays, islands, rocks, and reefs, the intervening softer material having been washed away. Reefs and rocks extend out some little distance to sea, and on a rough day broken water is visible in almost any direction. The land immediately adjoining this traverse is totally unsuited for agricultural purposes, being rocky, with only a scattering of surface soil. Scrub, cedar, hemlock, and spruce, with pine, badly wind-swept, covers the shore for some little distance back from the water.

Lot 715.

This pre-emption on the north shore of Safety Cove lies on a steep mountain-side, moderately well timbered with red and yellow cedar, hemlock, and occasional spruce. Owing to Safety Cove being the nearest suitable shelter for boats about to cross Queen Charlotte Sound, this property may be of some little value, but its agricultural possibilities are negligible. It has little soil and rock-outcroppings occur throughout the Lot.

Hakai and Nalau Channels.

These channels, with adjoining bodies of water, bear little resemblance to the same as shown upon charts, particularly Nalau Channel or Pass. Nalau and Hakai Channels are connected by smaller channels which I named Edward and Ward. The latter splits what is shown as Nalau Island into two parts. Besides these there are a number of small inlets and lagoons, and also a great number of small islands, islets, rocks, and reefs, not shown on the chart. Hakai is exposed to the open Pacific and is rarely free from large rollers, which break even as far in as its junction with Fitzhugh Sound. While tying in the islands in this vicinity all reefs noticed were also tied in, this practice being carried out generally during the season, the information thereby gained being invaluable for navigation purposes. Nalau Pass, except at its immediate junction with the Pacific, is always calm, being well sheltered. This channel is far different from same as shown on the chart. After leaving Fitzhugh Sound it narrows down to some 7 chains in width, and then opens up very slightly to its junction with the Pacific. At this point there are a considerable number of reefs, and unless one is acquainted with the locality he should exercise great caution in taking a boat through same.

Owing to surf a great deal of trouble and delay was caused in getting at some of the more exposed stations. Fog was also a cause of delay. The Japan Current undoubtedly touches the Coast in this area, and due to its warming influence and the excessive moisture this summer we were seldom free from heavy fog in the late evening and early morning.

As regards the islands in this vicinity and also the shores of Hunter and Hecate Islands, they are very much broken wherever reached by surf. The timber is of no commercial value, being small and stunted, bearing abundant evidence of its exposure to Pacific storms. Owing to the lack of fresh water in this vicinity it is doubtful if the adjoining land can be used for commercial purposes. The tides in Hakai Channel are strong, as through this pass practically all the tidal waters of Burke Channel must pass. The tide is also strong in Nalau Narrows, but has small volume.

KILDIDT SOUND AND WEST COAST, HUNTER ISLAND, TO SUPERSTITION POINT.

Kildidt Sound bears a strong resemblance to the latest blue-prints showing same, but no semblance to the chart. Its lower end, being exposed to the open Pacific, has a very rough and broken shore-line. In this area are a great number of small islands, rock, reefs, inlets, and lagoons, all of which were investigated and tied in. At the north end of Kildidt Sound is a large lagoon connected with the sound by a narrow body of water. This lagoon extends northerly well into the interior of Hunter Island. The lagoon itself consists of two fairly large bodies of water connected by a narrows. In the lower lagoon are several islands close to the entrance to the inner lagoon and also at its western extremity. The narrows connecting this body of water to Kildidt Sound can only be used at slack water owing to the swift current and reef in the vicinity of its entrance.

The area lying around the south-west corner of Hunter Island is nothing like the same as shown upon the chart. Spider Island and adjoining islands as shown thereon are in reality a great number of small islands, besides which there are a great many more not shown on existing charts. These islands are separated generally by narrow channels, affording excellent shelter in stormy weather. One good channel, fairly free from reefs, permits a sheltered course for boats through this area, except for approximately 2 miles in rounding Superstition Point. Caution should be exercised in navigating any of these waters owing to the number of sunken rocks and reefs, and, although it may seem absurd, the danger of losing one's way.

With the exception of Kildidt Lagoon, the timber in this area is of little use commercially, being stunted and badly wind-swept. In Kildidt Lagoon, however, a few small stands of good cedar and spruce were seen, particularly on the flat land at its head. It is doubtful if this country will ever be used for agricultural purposes, the smallness of suitable areas, inaccessibility, and probable lack of water in dry years being very much against it. Owing to the number of interesting channels, lagoons, bays, sheltered nooks, etc., its great possibilities for an ideal summer resort at a future date, providing water and weather are suitable, are most promising. By weather I mean rainfall; there are any number of excellent shelters for small craft in stormy weather.

SUPERSTITION POINT TO BELLA BELLA VIA CHOKED PASSAGE, PLUMPER CHANNEL, AND LAMA PASSAGE.

This stretch of water for purposes of description might better be divided into two parts—namely, Choked Passage and vicinity, and Plumper Channel and Lama Passage. The first, as well named, is a continuation of Plumper Channel choked with a great number of small islands, islets, rocks, and reefs. Despite this, Choked Passage affords an excellent inside channel for travelling down the west side of Hunter Island, and not till within a mile of Superstition Point are open waters encountered. By taking the most easterly channel between the islands, water practically free from reefs can be used. The islands and the shore of Hunter Island in this area are generally poorly timbered with stunted, wind-swept cedar, hemlock, and spruce of no commercial value. The tides in Choked Passage are strong wherever the channel is narrow, and a bad tide-rip is frequently seen in the vicinity of Superstition Point. None of the land in this area, other than small parcels, is really suitable for agricultural purposes.

Plumper Channel, being unexposed to the Pacific, presents a more regular shore-line. It is used by fishing-craft heading out to the open Pacific, being the most convenient channel connecting the main inner steamboat course with outside waters. Except where it enters the Pacific, there are few reefs to be avoided. Quite a strong tide runs in this channel, as portions of the waters of Dean and Fisher Channels find access through it to the sea. As in Fitzhugh Sound, a noticeable improvement in the timber may be seen as one gets farther from the ocean, but at best the timber on its shores is of poor grade. A few pre-emptions have been taken up, more particularly on the Campbell Island side, but as their development has not been pushed to any extent, it is difficult to form an estimate of their possible agricultural value.

Lama Passage, a portion of the main navigation channel of the Coast, is so well known as to require no remarks from me.

Bella Bella, one of the largest Indian settlements on the Coast, is situated near its northern extremity and is dependent almost entirely on the fishing industry for its existence.

Just north of this point Lama Passage joins Gunboat Passage, and here a tie was made to T. H. Taylor's triangulation of the previous summer.

ELLERSLIE CHANNEL AND BAY.

This channel was surveyed for its upper 22 miles, the lower part having been previously done. It is bounded by high, rocky mountain-sides, generally well timbered with hemlock, cedar, and spruce. About 12 miles from its head it narrows down very considerably, and at this point on its east shore Ellerslie Bay breaks off to the east. Several large creeks enter the channel in its upper reaches, most of which are capable of developing considerable electrical power. The tides in this channel have a fair flow, being more noticeable in its upper 12 miles. Several parties of hand-loggers were operating along its shores, the logs being taken to Ocean Falls for pulp or lumber purposes. No land of any consequence suitable for agricultural purposes was noticed.

CLIMATE.

The area of the Coast covered by me this year is well known for its damp climate. This season was exceptionally wet, no less than sixteen days' rain in June, ten in July, and thirteen in August. Local residents and others who have spent their summer there for some years state that it was one of the wettest they have ever experienced.

Quite a difference in temperature is apparent between the inside channels and the open Pacific. The Japan Current washes the westerly shores of the islands in this area, and the warmer waters of same are the cause of heavy fogs, from which in fine weather we were seldom entirely free. Fog on an average about 200 to 300 feet in height would commence to settle at dusk and sometimes not rise till after noon the day following.

The prevailing winds of summer are strong westerly blows, getting up between 8 and 9 a.m. and dying down with sunset. This summer, being extremely wet, we had an exceptional amount of south-east and south-west winds.

MINERALS.

With the exception of Ellerslie Channel and the south-west coast of Calvert Island, the absence of visible mineral indications was most remarkable. In no other stretch of British Columbia Coast have I seen such an entire absence of same. Even the wash and float in the creeks by which we camped were lacking in this respect.

Staking-posts of a few claims were seen on the south-west coast of Calvert Island, and in Ellerslie Channel iron-cappings, with here and there copper leachings, were noticed. Insufficient time to investigate further precludes giving more information on this subject.

GAME.

On no part of the Coast have I seen Coast deer in such numbers. Calvert Island in particular abounds with them. Does with yearling bucks and fawns were seen on almost every island of any size. Owing to this area being away from the hunter's general haunts and hard to get at, it should remain well stocked for years to come.

Plover and snipe in abundance were breeding on almost every rock on the western or exposed sides of the islands, sharing these rocks with the sea-gulls. A few geese breed at the upper end of Kildidt Lagoon and in some of the smaller lagoons. Ducks, while not lacking in numbers, do not appear to be breeding in this area. Trout were found in all streams fished.

Of fur-bearing animals seen, mink were the only ones in numbers. Beaver are present in the swampy area in the interior of Calvert Island.

MARINE LIFE.

The marine life in Fitzhugh Sound, Ellerslie Channel, and Plumper Channel is similar in all respects to the inner channels of our Coast. In the waters lying out to the west of the islands, however, a very great increase in the amount and size of marine life is noticed. This is probably due to a large extent to the Japan Current. Shell-fish, such as barnacles, mussels, etc., grow to several times the size of those on the inside waters. Mussels over 12 inches long were found. The shallow water close inshore teemed with numerous sea animals of great variety of shape and colour, and many forms of sea vegetation not seen on the inside Coast were noticed. A fair number of whales, blackfish, sea-lions, seals, and fish common to British Columbia were seen.

I have, etc.,

JAMES T. UNDERHILL, B.C.L.S.

COAST TRIANGULATION, SURF INLET TO CHATHAM SOUND, RANGES 3, 4, AND 5, COAST DISTRICT.

BY A. E. WRIGHT.

PRINCE RUPERT, December 5th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report on my survey operations during the past summer, consisting of the triangulation of the outlying channels from the head of Grenville Channel to the vicinity of Surf Inlet, the survey of the Lawyer and Kinnahan group of islands in Chatham Sound, and the survey of certain pre-emptions and purchases on McCauley Island:—

Where possible permanent marks were left at all stations. These marks consist of iron pins driven into drill-holes in the solid rock, wooden posts, or drill-holes themselves from 3 to 5 inches deep. All were referenced by bearing trees where available. Ties were made to certain Dominion Hydrographic Stations on Telegraph Pass, Ogden Channel, and at the entrance to Surf Inlet, as well as to the stations on the summit of End Hill and Dolphin Island.

The first shores to be triangulated were those between the foot of Telegraph Pass and the head of Ogden Channel. A very satisfactory base-line was measured on the east shore of Kennedy Island opposite Claxton, and the triangles brought down Telegraph Pass, tying on to monuments at the head of Grenville Channel.

Kennedy Island is a prominent granite-mass, with steep sides heavily timbered with cedar, spruce, and hemlock. It lies between Arthur and Telegraph Passes in the immediate delta of the Skeena River.

The waters on the north and east are very shallow, with many drying mud-banks. South of Kennedy Island a chain of low islands extends southerly to within 1½ miles of the north end of Pitt Island. They are named in order Marrack, Bedford, Lambert, Gibson, and Bloxam Islands. The steamboat-channel passes south of Gibson and Bloxam Islands and swings north for Arthur Passage, passing west of Kennedy Island. There are unwatched lighthouses on Watson Rock, a quarter of a mile south-west of Gibson Island, and on a rock in the centre of Arthur Passage.

Lewis Island lies a mile west of Kennedy Island, being separated from it by Arthur Passage. To the west of Lewis Island is a narrow gas-boat passage named Kelp Pass, separating it from Porcher Island. Lawson Harbour is a protected bay at the north-east end of Lewis Island, where a small settlement and a miniature shipyard for fishing-boats and gasolene-launches has been established.

At Oona River, on Porcher Island, about 3 miles south of Lewis Island, there is a larger settlement of prosperous fishermen and loggers, principally of Scandinavian origin.

OGDEN CHANNEL.

This is a deep channel about a mile wide and 7 miles long, which separates Porcher Island from Pitt Island. The steep and rocky shores are covered with a fair growth of cedar, spruce, and hemlock. Several bodies of water come together at the south end of Ogden Channel.

Kitkatla Inlet bears away in a north-westerly direction towards the centre of Porcher Island, one arm terminating in Dries Bay and the Serpentine, a mile south of Welcome Harbour, on the north coast, and the North Arm terminating in a large salt lake which extends to within three-quarters of a mile of Jap Inlet, also on the north coast. The south end of Kitkatla Inlet is a mass of islands and rocks, some of which are large and well timbered.

The main entrance to Ogden Channel is through Beaver Pass, which separates McCauley Island from Spicer Island. There is a lighthouse about half-way along the pass. Opposite Beaver Light, on McCauley Island, three families have settled.

Two pre-emptions and a purchase of 80 acres were surveyed here. The soil is the usual muskeg of the Northern Coast, with subsoil consisting of gravel or clay, although a large portion of the muskeg lies directly on the solid rock. The settlers all have very good gardens, but the soil requires a great deal of preparation. Their main source of income is fishing and hand-logging.

Two and a half miles south-west of Beaver Light, at Murder Cove, a small sawmill has been established. It is operated by water-power, the water being conveyed around the hill in an open flume and conducted to a Pelton wheel through a home-made square wooden pipe. In clear weather there is not enough water to operate successfully. The logs are supplied by hand-loggers and the lumber is mostly used in boat-building. Two gas-boats were in course of construction when Murder Cove was visited in November.

Another entrance to Ogden Channel is through Schooner Pass. This pass separates Spicer from Dolphin Island. It is half a mile wide and 2 miles long and with Beaver Pass opens out into Browning Entrance.

On Dolphin Island, Kitkatla, one of the largest Indian villages of the Northern Coast is situated.

Both Spicer and Dolphin Islands are rather rough, attaining an elevation of about 800 feet, and are covered with muskeg and a scrubby growth of hemlock, red and yellow cedar, and jack-pine.

North of Dolphin Island lies Goschen Island, with a high rocky summit about 1,000 feet in height. It is separated from Porcher Peninsula by Freeman Pass. The tide runs very strongly in all these passes, attaining a strength of 6 knots in Freeman Pass.

PETREL CHANNEL.

Petrel Channel separates McCauley from Pitt Island. It is about 25 miles long and varies from 30 chains to 2 miles in width. The shores are steep and rocky and covered with scrubby hemlock, red and yellow cedar, and jack-pine. Captain Cove and Newcombe Harbour are two good ships' anchorages on the Pitt Island shore. Captain Cove is used by tug-boats as a harbour for the storage of Davis rafts. The rafts are brought over singly from Queen Charlotte Islands, the same tug being able to handle two rafts from there to the sawmills at Prince Rupert, Swanson Bay, and Ocean Falls.

There is good hemlock, spruce, and cedar on the banks of most of the creeks flowing into Petrel Channel from Pitt Island. The best of it is pretty far back, but it will no doubt be logged off some day.

Hevenor Inlet is a long narrow inlet running south-easterly into the centre of Pitt Island from a point on the shores of Petrel Channel 3 miles north of its southern end. It is from 20 to 60 chains wide and 13 miles long, with a narrows 8 miles in that can only be navigated at slack water. The shores are fairly well timbered, but a rather large percentage of the timber is balsam. At the foot of Petrel Channel is a maze of unnamed inlets and channels which extend into Pitt Island for a considerable distance, although only the principal ones were traversed. The timber on these inlets is very fair for the most part, consisting of hemlock, spruce, balsam, and cedar.

Anger Island is low and rough. It lies 2 miles south of the end of Petrel Channel and is badly cut up by inlets and lakes.

Principe Channel separates Banks from Pitt and McCauley Islands and extends the full length of Banks Island. It varies from 1 to 5 miles in width.

BANKS ISLAND.

Banks Island is 46 miles long and 11 miles wide and presents a much less rough appearance than does Pitt Island. At the north end a considerable area has been surveyed as pre-emptions and purchases and a few pre-emptors were living there this summer. Lettuce to the value of $700 is said to have been shipped to Prince Rupert from a clearing of considerably less than half an acre. The centre of Banks Island is fairly mountainous, but the intervening valleys do not seem to contain any timber of commercial value. The south end of the island is also flat and probably contains several lakes and inlets entering from the outside. The only indentation on the Principe Island side is Colby Bay, about a mile deep and 10 chains wide at the entrance.

The McCauley Island shores of Principe Channel are low, but very rough, and cut into by deep bays which were not surveyed. Port Canaveral is a surveyed ships' anchorage near the south end of McCauley Island on Principe Channel.

South of Anger Island is a deep, wide bay named Mink Trap Bay, with several inlets running in from the head. The passage behind Anger Island is rather shallow in places, with several

rocks. Three inlets extend for 3 miles into Pitt Island from this channel. South of Mink Trap Bay Principe Channel widens, gradually merging into Nepean Sound.

Port Stevens is a surveyed ships' anchorage on the Pitt Island side about 8 miles south of Mink Trap Bay. An inlet of the same name extends 6 miles easterly into Pitt Island from half a mile south of Port Stevens.

Nepean Sound, with a width of 7 miles, is the southern continuation of Principe Channel. Its western and eastern extremities are named Otter Pass and Otter Channel respectively. Otter Pass, separating Banks and Estevan Islands, is a dangerous channel 1½ miles wide, partly choked with islands and rocks. The tide attains a strength of 6 knots at springs, forming dangerous tide-rips.

Otter Channel separates Pitt and Campania Islands. It is 4 miles long and 1 mile wide at the narrowest place and is free from dangers, though the tide runs strongly. Both the ebb and flood tide appear to flow westerly from Squally Channel into Nepean Sound.

Squally Channel lies to the east of Campania Island and extends northerly along the east shores of Pitt Island for 6 miles north of Otter Channel. Here it narrows down and, as Union Pass, connects with Grenville Channel. Union Pass is narrow and twisted and is used by gas and tug boats only. The east shores of Squally Channel are formed by Farrant, Fin, and Gil Islands.

Farrant Island is the most northerly and is fairly well timbered with cedar, hemlock, and jack-pine. Between Farrant and Fin Islands lies Cridge Pass, which was triangulated in 1920. Lewis Pass lies to the south and east of Fin Island, which it separates from Gil Island.

Gil Island is 7 miles wide and 17 miles long and is fairly well timbered with hemlock, red and yellow cedar, and spruce.

Whale Channel separates Gil Island from Princess Royal Island. It has two entrances north and south of Passage Island. Ties were made to stations left at the entrance of Whale Channel and Cridge and Lewis Passes in 1920.

Campania Sound is the southern continuation of Squally Channel and is bounded by Campania, Princess Royal, and Aristazable Islands, and is open to Hecate Strait between Campania and Aristazable Islands, where it is 8 miles wide. A portion of Campania Sound has been surveyed by the Hydrographic Survey and ties were made to two of their stations at the entrance to Surf Inlet.

SURF INLET.

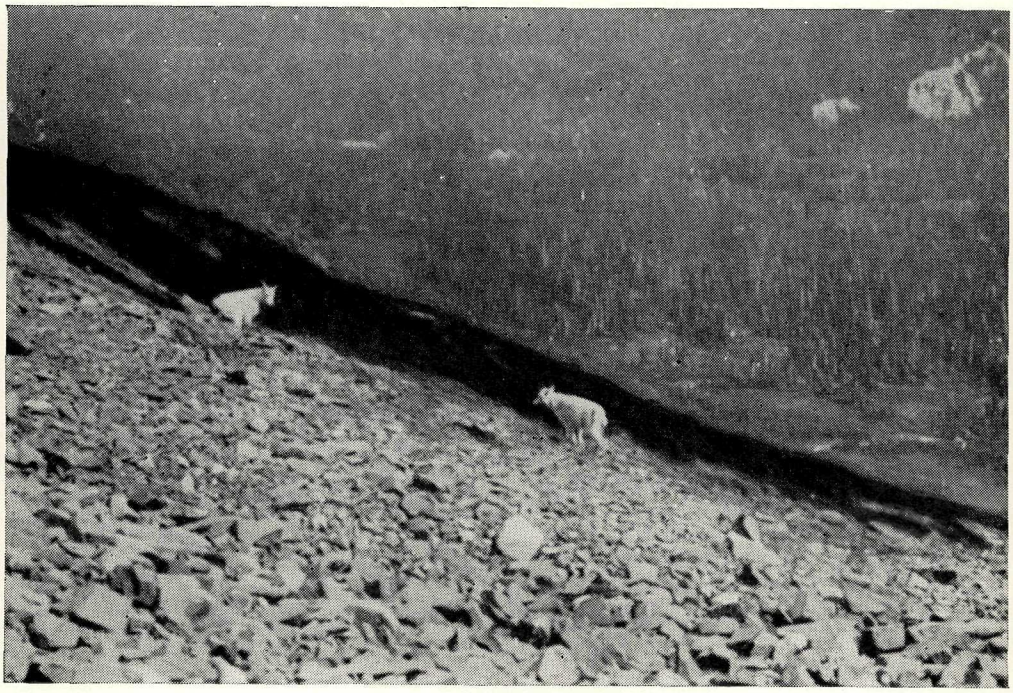
Surf Inlet is an indentation half a mile wide and 14 miles long. At the head are the wharf, bunkers, and power plant of the Belmont-Surf Inlet Mines, Limited. The power is developed from a large creek flowing into the head of Surf Inlet. The dam, which is practically at tide-water, has formed one large lake out of the Cougar, Bear, and Deer Lakes.

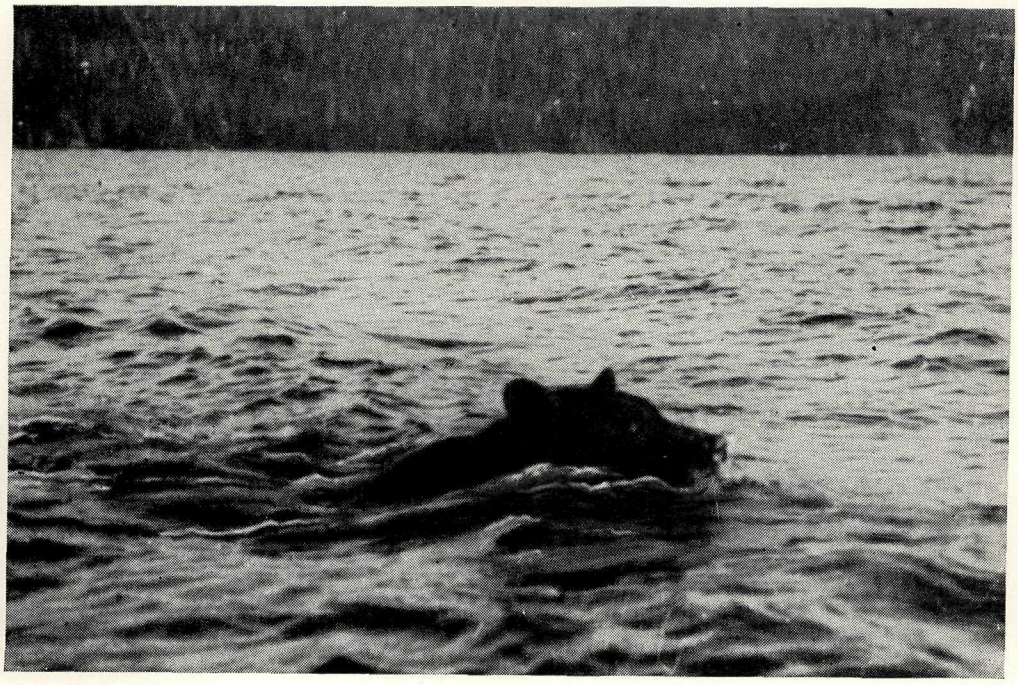
The ore is crushed and concentrated at the mine and brought a short distance by a narrow-gauge railway to what was Bear Lake. The loaded cars are then run on a scow, brought down Bear and Cougar Lakes to the dam, and thence down a short incline to the bunkers.

After triangulating to the entrance of Surf Inlet we moved to River Bight, on Whale Channel. It flows into Whale Channel about 5 miles from the north end of Princess Royal Island, and its appearance when the tide is running out certainly resembles a large river. The entrance, 3 chains wide, can only be navigated by gas-boats, and by these only at slack water and a short time before and after. Inside it widens out to from 20 to 40 chains and extends for 7 miles into the island, dividing into two arms when 3 miles in. The timber is very good as a whole and several good patches of spruce and hemlock were seen. An old trail exists connecting the head of the South Arm of River Bight with Deer Lake, and one can reach the Surf Inlet mines by this route.

After completing the triangulations of River Bight the party left for Prince Rupert, and on arrival there commenced the survey of the Lawyer and Kinnahan groups of islands in Chatham Sound. The Lawyer Group consists of several small islands 2 miles north-east of Porcher Island. A lighthouse is on the largest island.

The Kinnahan Islands lie about 2 miles south-west of the entrance to Prince Rupert Harbour. They consist of two large and two small islands. They are rough and rocky and have no safe harbour. The timber is scrubby hemlock, cedar, and jack-pine. A small light is situated on the north-east shore.





Two typical game animals of the Coast Mountains. Upper picture shows mountain-goat; lower, grizzly bear swimming.

Industries.

Logging, fishing, and mining are the industries that are likely to be developed in the area triangulated. In time it is possible that certain portions will be farmed, but the cost of preparation and the isolated condition of the arable portions will prevent farming on a large scale. There are, however, many small areas which in time will be taken up by fishermen.

All the logging, with the exception of some in the vicinity of Surf Inlet lakes, has been carried on by hand-loggers. The great number of lakes and inlets on the west portion of Pitt and Princess Royal Islands makes it a convenient district to log by that method. Owing to the closing of Swanson Bay only one hand-logger was working in the vicinity surveyed, though two booms of logs were seen anchored in sheltered coves, the owners being unable to sell them at that time.

On the lakes at Surf Inlet J. R. Morgan, of Prince Rupert, has been logging for some time, the logs being rafted down the lakes and shot over the dam into salt water at Surf Inlet Wharf. There seems to be some difficulty in selling the cedar and there is some possibility of a shingle-mill being established here to take care of that part of the cut.

Estevan and Campania Islands have practically no timber that can be handled profitably by present methods.

Fishing.

There are no canneries established in the area triangulated, as all the salmon caught are taken to Lowe Inlet or Prince Rupert. There are several good salmon-streams on Pitt, Banks, and McCauley Islands. Gill-nets are never used and all fish are caught by purse or drag seines.

During bad weather in Hecate Strait many of the smaller halibut-boats fish in the sounds and wider channels where shelter can be reached quickly.

Great quantities of herring are caught in the spring and a large herring-pound was established at Captain Cove in the early part of this year.

Mining.

The rock formation consists of masses of granite of the Coast batholith and the highly metamorphosed schists and sedimentaries of its western contact. The largest operating mine is that of the Belmont-Surf Inlet Mines on Princess Royal Island. This mine is at the present time the largest gold-producer in the Province and there are several good prospects in the same vicinity.

On the east coast of Porcher Island, on Pitt Island and other points along Grenville Channel, a very good grade of moquetite is found, but so far no development has been undertaken other than that required for assessment purposes. Surface showings of copper are found on Porcher and Gibson Islands.

Many leases have been granted from time to time for the purpose of quarrying limestone and marble, but no development has been undertaken except on the north-east shore of Banks Island, 4 miles south-east of End Hill. Here several 4-inch drill-holes were put down several years ago to test the size and quality of the deposit. Within a quarter of a mile of these workings a prospect showing chalcopyrite in a lime formation is seen.

Other places where lime or marble can be found are on Gurd Island in Kitkatla inlet, on Banks Island opposite Mink Trap Bay, on some islands in Mink Trap Bay, and on certain of the Surf Islands in Campania Sound.

Climate.

The climate throughout the area triangulated is typical of the Northern Coast, being mild, with varying degrees of rainfall. At the heads of inlets which separate the higher mountains the rainfall is much heavier than at the outer and more open coast-line. A difference can be seen and felt when entering even a short inlet, and the nature of the timber alone is sufficient to show this difference. While places such as Surf Inlet, Swanson Bay, Lowe Inlet, and the interior of Pitt and Princess Royal Islands have a precipitation which in certain years amounts to 280 inches, it is doubtful whether the outer islands will exceed 100 inches on the average. The snowfall is heavy in the inlets and channels between the higher mountains, but the outer islands, such as Porcher, McCauley, Banks, and Aristazable, have practically none.

GAME.

The small Coast deer is very plentiful on the seaward islands and there are considerable on the larger islands and Mainland Coast. They swim freely from island to island. Black bear are found on the higher islands, but there do not seem to be any on the outer islands, such as Banks and Porcher Islands. A species of white bear (Kermode's) is found on Princess Royal Island and Gribble Island and they have been seen as far north as the Skeena River near Terrace.

Goats are found on the Mainland and on Pitt Island, but there are none on Princess Royal Island nor on any of the outer islands. There are a large number of wolves on all islands with the exception of Porcher Island. An odd one is seen at times there also, but the settlers have practically exterminated them.

A few geese nest on the muskegs and bays of the outer islands, but the large flocks, which spend the winter on the bays and tide-flats, for the most part nest in the Far North. Most of the edible varieties of ducks do not arrive until the end of September, having also nested in the marshes of the North. Blue and willow grouse are found on all the islands, but they seem to have been scarce this year.

In all creeks which are not actual cataracts several varieties of trout can be caught, and several species of cod and flatfish may be taken with hook and line in salt water. Many whales were seen in Whale and Squally Channels, and the entrances to Beaver and Schooner Passes are a favourite sporting-ground for dolphins. Hair-seals are seen everywhere, but sea-lions are not nearly so numerous. Clams are found on all flat beaches except those near the mouths of large creeks. They are not exploited at present, but ruins of clam-canneries can be seen at Welham Creek, on Spicer Island, and on the east shore of Fin Island.

All the area triangulated can be reached by launch from Prince Rupert. There are post-offices at Claxton, at the mouth of the Skeena River, and at Surf Inlet. Steamers call weekly at Surf Inlet, Lowe Inlet, and Claxton, but for any one contemplating a visit to these waters the best point of departure is Prince Rupert.

I have, etc.,
A. E. WRIGHT, B.C.L.S.

TRIANGULATION AND RECONNAISSANCE SURVEY, KITLOPE VALLEY AND TAHTSA LAKE, RANGE 4, COAST DISTRICT.

BY F. C. SWANNELL.

VICTORIA, B.C., January 17th, 1922.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to send in herewith report on the season's operations.

Six weeks at the commencement of the season were spent in endeavouring to get a tie across from Gardner Inlet to the headwaters of the Kimsquit River, in order to obtain a check on the triangulation between the 53rd parallel as run and the Coast triangulation. Owing to the exceedingly inclement weather and the abnormal depth of snow in the mountains intervening, a direct tie by a rigid triangulation was impossible in the time at my disposal. I, however, mapped the Lower Kitlope River and lake and carried a traverse and triangulation 30 miles inland from tide-water, from which point I succeeded in tying into some of my previously fixed peaks on the eastern fringe of the Coast Mountains. The area mapped on the western side of the Coast Mountains is about 1,500 square miles.

While I was endeavouring to reach Kimsquit Lake, Mr. Blane, of the Water Branch, made the attempt by the main Kitlope River, and succeeded after a very arduous and adventurous trip in reaching the Chatsquot Branch of the Kimsquit River.

Returning to Gardner Inlet the beginning of July, I went around to Ootsa Lake via Prince Rupert, ascended the Tahtsa River, and spent the remainder of the season mapping Tahtsa Lake and the passes leading over to Kemano Bay and Gardner Inlet. All this region is now tied by triangulation to Ootsa, Whitesail, and Eutsuk Lakes, and the end of the survey of the 53rd parallel by R. P. Bishop, B.C.L.S.

KITLOPE RIVER.

At the head of Gardner Inlet is a mile of tide-flats into which Kitlope River swings sharply around a long rocky spur. The river is 500 feet wide, turbid with glacial silt, and the current only rapid at low tide. Tidal water backs some 5 miles up-stream. This stretch of the river is through bottom land, of which several hundred acres are open meadow, only flooded at times of extreme high water or when the river is in flood. The Kitlope is joined half a mile from its mouth by a smaller river, the Tsaytis, which heads to the north and is not navigable. The Kitlope as far as the Indian shacks at the head of tide-water is cut into numerous channels and back sloughs, some of which are dry at low water. Above this is 3 miles of fairly swift water with numerous bars and sloughs.

At Mile 8 Kitlope Lake discharges almost directly into the river by a short reach, whose current, striking the main river at right angles around a rock bluff, forms strong eddies and small whirlpools. Above the junction with Kitlope Lake the river-valley swings east by south-east, the river becomes swifter, is more cut up by bars and side-channels, is full of riffles and drift-piles, and its navigation is very dangerous. Skilled canoe-men can, however, navigate it up to the forks at Mile 24.

Mr. Blane informs me he reached a small lake at the head of the North Fork or Kapella, 36 miles from salt water. Crossing a short divide at an elevation of 1,390 feet, he reached Ear Lake, the head of the Chatsquot Branch of Kimsquit River.

KITLOPE LAKE AND TEZWA RIVER.

Kitlope Lake is 8 miles long, three-quarters of a mile wide, lies 30 feet above sea-level, and is entirely mountain-walled except at its upper end. Anciently it formed part of Gardner Inlet, which then extended south to the forks of the Tezwa; the 8 miles between the present head of the inlet and the lake having been filled up by deposits from the Kitlope River, while the two branches of the Tezwa have silted up the upper 8 miles of the ancient inlet. The mountains rise sheer, in many cases precipitously, from Kitlope Lake for 3,000 feet, then round off into glacier-capped summits. The scenery is of the grandest description, the glacial torrents falling directly into the lake in wild cataracts. Apart from fan of detritus at the torrent-mouths, there is no beach nor flat land except at the head.

TEZWA RIVER AND PASS TO THE KIMSQUIT.

The Indian name of the river entering from the south is, as nearly as I can represent the sound, "Hwuis-u-Tezwa." My Indian informant gave me to understand it was a place-name only, without meaning in his language. I have called the river by the last two syllables, or "Tezwa."

We ascended this river by boat for 6 miles, the first 4 miles being very easy water. A mile and a half from the lake a large rapid stream 60 feet wide enters from the north-west. This smaller river soon becomes a torrent and heads in 10 miles in the wild jumble of peaks west of Kitlope Lake.

The main Tezwa at 6 miles up is 100 yards wide, 3 feet deep, and running swiftly over a gravel-bed. For 5 miles its right bank has hugged the base of the Kitlope Mountains. A mile wide strip of flat land, the silted-up bed of the ancient extension of Gardner Inlet, lies to the west for 6 miles. This is mostly open swampy meadow with numerous beaver-ponds. A narrow strip of timber and bushes separates this from the river.

CROSS-VALLEY LAKE TO THE KIMSQUIT.

Seven miles from Kitlope Lake the river forks, the main water coming in from the west after a tortuous 3-mile course through a wide gravel flood-bed. These forks split up into glacial torrents fed by an amphitheatre of huge glaciers ringing the valley-head. The East Fork for a mile or so loops and twists in the Old Gardner Inlet depression. Into this it cuts its way in canyon down a narrow valley, whose sides, almost precipitous, are glacier-capped. This valley, or it might be more aptly termed cleft, we could trace for 12 miles. The cross-valley occupied by the West Fork extends eastward, but is only occupied by an inconsiderable stream.

Six miles east of the forks there is a low trough section divide (about 1,500 feet altitude), with open swampy meadows and scattered scrub timber. The exploration was not carried beyond this point. The valley eastward could be seen to widen out and deepen, and Kimsquit Lake

almost certainly lies in it. This is reported to have been an old Indian route from Gardner Inlet to Dean Channel. Four several mountain ascents were made. In every case nothing but an appalling welter of glacier, snow-field, and jagged peaks were visible as far as the eye could carry the whole ring of the horizon. All the mountains of this region are of one type and there are no definite ranges. From the deep narrow valleys the mountains rise almost precipitously to about 3,000 feet altitude. For miles there will be absolutely no chance of making an ascent. Above this altitude they break into ridges or round out into huge snow-fields. Everywhere are glaciers, some several square miles in area.

LAKE REGION SOUTH AND WEST OF OOTSA LAKE.

Ootsa Lake lies entirely out of the Coast Mountains. The western third only of Eutsuk Lake lies in the mountains, and rather over half of Whitesail Lake is hemmed in by mountains. Troitsa, Tahtsa, and Nanika Lakes are, however, typically mountain lakes. The whole lake system occupies deep depressions running south-westerly directly into and cutting the main Coast Range at right angles. These depressions continue westward to the deep coastal inlets, the divides between the Coast rivers and these large lakes being close to the latter and only averaging 1,500 feet above their level.

The lakes themselves, including the most north-westerly one, Morice Lake, lie at much the same altitude—2,700 to 2,800 feet above sea-level. Of all these lake depressions, that occupied by Ootsa Lake and Tahtsa River and Lake is the straightest, and Tahtsa Lake itself most deeply penetrates into the range, its western end being only 22 miles from Kemano Bay, Gardner Inlet.

TAHTSA RIVER.

Entering the west end of Ootsa Lake as a wide sluggish stream, flowing through swampy meadow land and dense willow bottom, Tahtsa River comes from the westward in the deep depression above referred to. At 4 miles up, to the left of a low brushy point, the widening called Sinclair Lake, fed by Whitesail River, opens out to view, Tahtsa River itself opening out inconspicuously to the right through low willow bottom. The river is sluggish for nearly 20 miles above Ootsa Lake, although the low flats along the lower reaches change into broken bench country largely burnt over.

At 17 miles from the mouth the steep grassy spur of a high hill-range runs directly to the river. From Mile 20 to Mile 22 the river is very tortuous, riffles are frequent, and there are two rather nasty turns. We then enter almost 12 miles of dead water with low banks and large areas of meadow and brushy bottom on either hand, the benches and low hill-spurs only extending occasionally to the river. The country back of the river-flats is worthless, both as regards timber and soil.

Between the river-valley and Whitesail Lake lies a broken hill and bench country with numerous small meadow-ringed lakes. The soil is gravelly or rocky and the timber burnt or fallen. At Mile 34 the Tahtsa runs swift and shallow over a gravel bottom. Thirty-six miles up-stream a burnt rocky hill, a spur of Huckleberry Mountain, juts into the river. After 3 miles of badly cut-up river running swiftly with many sharp turns, a second long reach of dead water occurs which might almost be termed a shallow mud-bottomed lake. Spruce bottoms and willow-swamps extend half a mile back to the south.

At 42 miles up the river becomes a perfect maze of channels, is very swift, and choked with dangerous drift-piles.

There is only one route by which a canoe can be taken. We had to chop through drift-piles and portage several times, and one particularly swift chute we barely made aided by an Evinrude engine, a pole in the bow, and three men ahead with a line. There are 10 miles of this bad water; then 2 miles of swift but good water to Tahtsa Lake. The surrounding country is very broken and 6 miles below the lake the river cuts through a rock ridge forming the so-called "Little Canyon."

The channel is clear and there is no danger here, however. I estimate the total length of river as 52 miles, although the distance between lakes, disregarding the crookedness of the river, is only 32 miles.

TAHTSA LAKE.

Tahtsa Lake is 19 miles long and 1¾ miles wide at the widest place. It is entirely glacier-fed, its waters emerald-green in colour and very cold, the temperature of the surface water being

Both above photographs were taken from same place—summit of Penteuch Pass, 4,025 feet—upper looking east to Tahtsa Lake; lower, west to Kemano Bay, Gardner Canal.

only 45° F. in August. The scenery surrounding it is magnificent, especially at the western end, where the craggy peaks of Mount Tahtsa rise above the snow-fields and green ice of the glacier-cap. Rhine Ridge (5,000 to 6,000 feet) lies a mile back from the north shore and continues 7 miles up the lake, terminating opposite the outlet in a huge castellated crag (6,300 feet) capping steep rock-slides. This crag is a conspicuous landmark from far down the Tahtsa River. The little flat land along the lake occurs as deltas built out into the lake by entering torrents, some of which obtain the size of small rivers.

Twelve miles up the lake a low pass leads north-west to Nanika Lake, the distance between lakes being 8 miles. A trap-line blaze from a cabin on the north shore crosses from lake to lake. The mountains south of the lake rise abruptly from a rocky shore, broken through at 8 miles up by a small river heading in glaciers behind Laventie Mountain, a smaller branch of this river rising in a low divide in a through valley crossing to Troitsa (Blue) Lake—a sheet of water 9 miles long—which drains into Tahtsa River 12 miles down the latter.

Laventie Creek, really a small river, comes into Tahtsa Lake from the south, 12 miles down. Forking 8 miles up, its valley is wide and travelling is easy through large alpine meadows. The two forks head some 15 miles back in the range in large receding glaciers, which anciently scooped out the valley.

PASSES TO GARDNER INLET.

We had reason to believe Tahtsa Lake was the "First Lake" referred to in the Canadian Pacific Railway exploration of 1874 from Kemano Bay. Search for the pass over which they ran their line was naturally made at the head of Tahtsa Lake. One route we explored led up the large creek at the lake-head directly up to and across the moraine of a hanging glacier on the north slope of Mount Tahtsa. We reached a summit at 4,260 feet close to a small moraine lake, whose waters, rapidly augmenting in volume, ran south-west in a deep valley. At 7 miles down the creek entered a box canyon, turned abruptly north-west, and joined the Horetzky Branch of the Kemano River. Satisfied this was not the Canadian Pacific Railway Pass, we worked back around Mount Tahtsa to the other creek entering Tahtsa Lake at its south-west corner. Three and a half miles of very rough going brought us to Sandifer Lake, 3 miles long, and at an altitude of 3,250 feet.

At its south end we found a pass (5,000 feet) at the head of an alpine valley which soon turned sharp south and narrowed in, the creek entering a box canyon at an altitude of 3,500 feet. This creek I believe to be a fork of Tsaytis River, which joins Kitlope River near the mouth of the latter.

South of Sandifer Lake, and 3 miles up a glacier-scored trough valley, is a huge glacier which drains three several ways. Facing Sandifer Lake it is a tongue of ice half a mile wide, the face being a rampart of ice cliffs. An accident to one of the party prevented further exploration in this direction.

PENTEUCH PASS.

Later we found an old, very faint trail leading inland from a creek entering Tahtsa Lake on the north side, a mile from the lake-head. The going is easy through alpine meadows. At 1 mile from Tahtsa and at an altitude of 3,100 feet a steep ascent brought us into a basin with a tarn lying against rock slides and cliffs. An easy ascent to an altitude of 3,700 feet, followed by a short scramble up a cataract-bed, led to a small grassy basin and a rough boulder-strewn gap. This is the summit of the pass (4,025 feet) and is 3 miles from Tahtsa Lake.

Two hundred and fifty feet below, to the west, lay Siffleur Lake of the Canadian Pacific Railway report, draining due west. Half a mile beyond we looked down the deep straight valley of the Horetzky (or Penteuchltenay) Creek and could plainly see the flats of Kemano Bay, Gardner Inlet, 18 miles away.

The valley of Horetzky Creek I did not explore in detail; the following excerpt from the report of Chas. Horetzky, who explored it in 1874, will prove of interest. At the junction of the Kemano River with the creek I have named after him he cached his canoes. The altitude here was 190 feet. He writes:—

"The ascent was sharp and, numerous obstacles obstructing our way, we advanced slowly. Three miles above the canoe encampment we came to a heavy snowslide originating from the heights on our left. This avalanche had cleared a passage through heavy green timber, snapping stout spruce-trees off close to the ground, and now not only filled the bed of the stream, but had

actually reached a considerable way up the opposite side of the ravine. As we advanced similar avalanches were passed. . . . Towards the head of the ravine glaciers began to appear. Eleven miles beyond the canoe camp the ground rose very abruptly indeed, and 3 miles farther on the Summit (Siffleur) Lake, situated at an altitude of 3,769 feet, was reached. It will thus be seen that in a distance of 14 miles we had ascended 3,580 feet, an extremely steep rise and quite unavoidable. . . . From this point (the summit) we beheld a scene of surpassing grandeur. Southward, a perfect sea of glaciers obstructed the horizon. . . . Bald rugged mountains, terminating in peaks 3,000 to 4,000 feet above the eye, towered above huge glittering masses of ice held in their vast chasms. A terrible silence, broken only now and again by the dreadful crash of some falling avalanche, reigned over this scene of desolation."

MEANS OF ACCESS AND AGRICULTURAL POSSIBILITIES.

At present Swanson Bay and Butedale Cannery are the nearest points to Kitlope River on the main steamer route. There are no settlements on Gardner Inlet except a cannery and the small Indian village of Kemano.

There is good land on Lower Kitlope River, especially on the Indian reserve, but it would not amount to over a section altogether outside the reserve. The 5-mile strip of bottom along Tezwa River is good land, but would require draining, and it is too inaccessible and far from a market to have a present value.

Along Tahtsa River probably six sections of land fit for agriculture could be obtained, largely willow bottom and meadow. Much of the latter is, however, too rough for cutting, and all would require draining. The timbered areas, both along Tahtsa Lake and the Kitlope Valley, are being reported upon separately for the Forest Branch.

CLIMATE.

The Kitlope Valley has an exceedingly wet climate and the snow in winter lies very deep. The average mean temperatures for June were: Maximum, 55°; minimum, 43°. We experienced also a very cold, wet summer on Tahtsa Lake, the mean maximum temperature in July and August being 67° and the mean minimum 45°. Between July 11th and August 31st rain fell on twelve days. We only experienced two or three really hot days the whole summer, and one blazing-hot day, July 24th, when the temperature at noon was 91° F. The snow is reported to be 12 feet deep on Tahtsa during the winter.

MINING DEVELOPMENT.

There has been no mining development in the region mapped this year, much of it being previously unexplored, and only a little desultory prospecting having been done in the lake area. The prospects on Sibola Mountain, close to the outlet of Tahtsa Lake, were not worked this year.

GAME.

Game was not plentiful. Goat are fairly numerous. Cariboo we saw only back of Kitlope Lake. Beaver were plentiful up Tahtsa River and north of Tahtsa Lake. We saw three bears only up Kitlope River, one on Tahtsa Lake, and were able to get several excellent close-range snapshots of a grizzly swimming Whitesail Lake. Grouse are exceedingly scarce along Tahtsa Lake, although becoming quite plentiful as we neared Ootsa Lake.

All the information obtained is being embodied in a topographical map on a scale of 1 inch to the mile, which will shortly be filed.

I have, etc.,

F. C. SWANNELL, B.C.L.S.

TRIANGULATION CONTROL, BABINE LAKE.

By R. P. Bishop.

Victoria, B.C., January 25th, 1922.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

Sir,—I have the honour to report on the triangulation connecting sections of the base already surveyed along the 55th parallel of latitude and extending to cover part of Babine Lake and the adjoining territory.

Before reporting on the technical aspect of the work I will describe the country from a general point of view.

The Lie of the Land.

The country under report may be roughly described as forming the north-western corner of the great Northern Interior Plateau. Hills there are here in abundance and a few mountains, but the latter are lower and not so frequent as in the country immediately to the north and west.

The governing features of this part of the world are the three depressions which contain the Bulkley Valley, Babine Lake, and the Takla-Stuart Lake system. Lying between these are the Babine and Middle River ranges, features which are very pronounced at the northern end of the area, but which break up and die away towards the south. These valleys parallel each other at a bearing of approximately N. 30° W., which is the general direction of so many of the main physical features of the Province. Transverse valleys occur in several places, the more important of these being the portage traversed by the present road between Babine and Stuart Lakes and the valley to the west of Trembleur Lake, through which a road was made in the days of the Manson Creek gold-rush. The latter valley contains the largest block of agricultural land in the country and will be referred to later.

The Sakeniche Valley.

The main longitudinal valleys referred to appear clearly on the map and give an indication of the general lie of the land, but I must admit that I was not prepared to find a similar valley some 70 miles long lying between the Babine and the Takla systems. This valley extends from the Manson Creek Trail to the North Arm of Stuart Lake, and is for the greater part of its length, drained by the two forks of a river called the Sakeniche, which empties into Takla Lake near the Narrows. The two forks unite at Natowite Lake, which is a few miles up-stream from the mouth of the river.

The Sakeniche resembles in a minor sort of way the Peace River, in that its two forks, flowing together from opposite points of the compass, unite and turn at right angles to the general direction, to force a passage through the main axis of the country, the Middle River Range; in the same way that the Peace breaks through the Rocky Mountains immediately below the junction of its branches, the Finlay and the Parsnip.

The North Fork of the Sakeniche, which I have not explored, is said to cross the Manson Creek Trail at "Long Bridge" and to extend through a series of minor lakes to Natowite. I understand that the name of the branch is Hautete, and the largest lake through which it flows is known as Nakinilerak. This apparently lies a little to the east of and parallel to Morrison Lake. I was told by a Babine Indian that he owned canoes on Nakinilerak and could reach them by pack-train from Babine. I had a distant view of Natowite Lake from three triangulation stations, Tsitsutl, Deescius, and Blanchet, and "cut in" an island there by rays from these points. With this exception the lake remains unmapped. There are canoes on Natowite owned by Old Fort Louis, who traps the surrounding country. The lake is reached by a trail from Babine Lake which is said to start not far from the mouth of the Morrison River; there is also a trail up the Sakeniche Valley from Takla Lake which was used a great deal in the past, but I am not certain whether it is of much use now. I was told by the Indians that Natowite Lake, with the trails on either side, formed the chief route between Babine and Takla Lakes before the construction of the Wright Bay Wagon-road.

The Southern Fork of the Sakeniche drains Tochcha (Blue Grouse) Lake, which lies a few miles up-stream from Natowite. Tochcha, which was until this year entirely unmapped, is 12 miles long, straight and narrow, its general direction being that of the main valley. About

6 miles farther down this valley lies Klaytahnkut Lake, which is separated from Tochcha by an almost imperceptible divide and drains in the opposite direction by way of Tyldesley Creek, a considerable body of water almost meriting the title of river. This creek turns to the left a few miles farther on, to flow into Trembleur Lake, but the cleavage continues in the general direction as far as the North Arm of Stuart Lake, which forms part of it. Between Tochcha and Klaytahnkut Lakes there are some very fine meadows, which probably amount to 300 or 400 acres. They are too inaccessible for present use, but may come in handy when the country between Wright Bay and Trembleur Lake is settled up, as they are best reached from that direction.

Having passed from a general description of the country to a more detailed account of this valley, it will be convenient to report next on the surrounding district, working from Tochcha as a centre.

There seems to be a fairly extensive pine-covered flat between Tochcha and Natowite Lakes, but its soil is gravelly and not any good at the southern end, where I made an examination. The northern part of the east shore of Tochcha was burnt over many years ago and has no growth of timber of any size, but there is a certain amount of spruce around other parts of the lake.

East of Tochcha and rising some 2,300 feet above it is Deescius, a bare-topped rocky ridge lying parallel to the lake and commanding an uninterrupted view of its western shore. I was told that the name "Deescius" arose from the number of caribou-horns which were once to be found there, the word "Dee" meaning horn and the suffix "ius" a hill.

East of this ridge is a valley drained by the Gloyazikut (Meadow Creek), which flows in a south-easterly direction until it reaches the end of Deescius, where it makes a sharp bend to the right, passing through the meadows already described to enter the east end of Tochcha Lake by way of the main valley. At the bend it approaches within about a mile of a similar kink in Tyldesley Creek. There are also some meadows in the valley east of Deescius, on the headwaters of the Gloyazikut, but these appear rather too swampy to be of much use. I had not, however, time to examine them thoroughly.

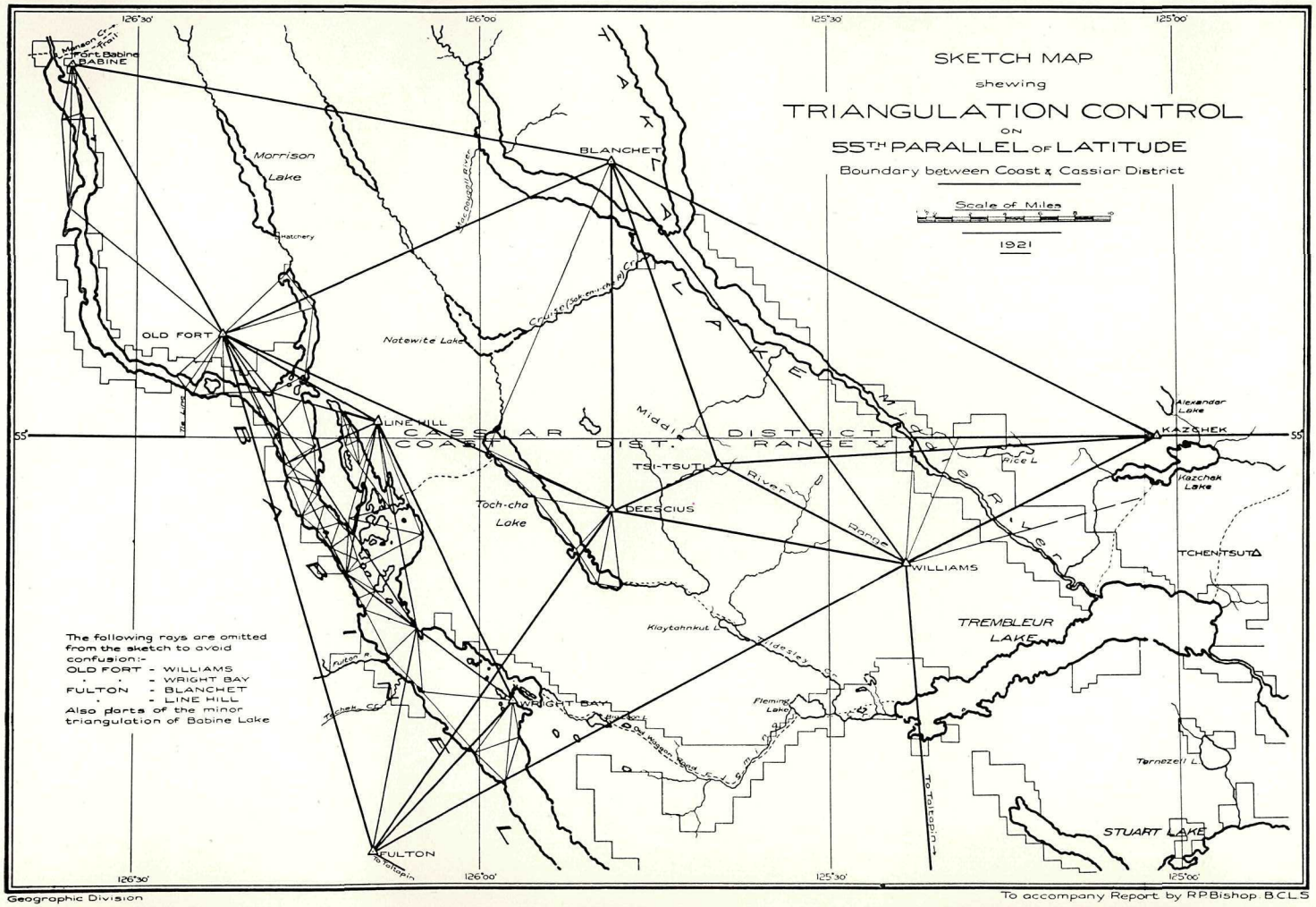
THE MIDDLE RIVER RANGE.

East of this valley lie the foot-hills of the Middle River Range, which are very broken and rugged, and, generally speaking, consist of "hog-backs" running out at right angles to the main system. They seem to be of recent volcanic origin. The main range closely parallels Middle River and is cut in two by a valley just to the south of Pyramid Peak. The northern part is known as Tsitsutl (Stony Mountain) and the southern part as Mount Williams. The latter has an Indian name which I made several attempts to pronounce, without, however, getting quite the right inflection. My instructor in the language warned me that what I really said was something altogether different, and not quite polite, and suggested that if I ever happened to discuss geographical matters in the neighbourhood of his village it would be as well for me to refer to the mountain by its English name. To the lay eye it would appear that the southern (and highest) peak of Mount Williams is a volcano of comparatively recent extinction, as a barren razor-backed ridge of volcanic boulders forms a semicircle about what looks like the remains of a crater. The compass showed 120° of local attraction here. A little to the north we found a quantity of asbestos in a contact between a slaty-looking sort of formation and the volcanic rock. Further traces of asbestos occurred in several other localities. The northern part of the range appears to be mainly of serpentine formation.

Mount Williams commands a wonderful view of nearly all the lakes of the Stuart River system, which are many and various, the largest ones in sight being Takla, Trembleur, Stuart, Inzana, Alexander, Kazchek, Tezzeron, Pinchi, and Tochcha; parts of Babine represent the Skeena watershed and the Nation Lakes, the waters of which flow into the Arctic.

GRAZING AREAS.

The north-eastern slopes of the range are thickly covered with windfall and difficult to get through, while the southern slopes are more or less open and in many parts covered with luxuriant alpine vegetation. This usually attains its greatest growth in the neighbourhood of the timber-line, where the grass gets a certain amount of shade and where the soil does not wash away so freely. There are parts of the hill, however, where the bare and unproductive soil comes right down to meet the dense bush.



Geographic Division

To accompany Report by R.P. Bishop B.C.L.S.

As regards the commercial development of this pasture, I think the land on the northern part of Tsitsutl is too remote and not of sufficiently high quality to be of much practical use. It might perhaps be used some day in conjunction with the lower level meadows between Tochcha and Klaytahnkut Lakes if an easy route for a trail can be found through the broken foot-hill country. As the larder was getting low, we had to travel somewhat hurriedly through this district and devote our time to stalking ground-hog rather than to sizing up the area of grazing land.

To the south on Mount Williams and the adjoining peaks there is a somewhat larger pasture which will probably be grazed some day by cattle from the large block of land which lies to the west of Trembleur Lake. The mountain pasture seems to have an area of between 1 and 2 square miles, which should justify the construction of a trail some day. I had not the opportunity to go into the grazing question thoroughly, so merely indicate regions which it might pay to examine in the future. Other areas worth looking at are Fulton Mountain and a district near the 55th parallel, east of Moricetown, where a large area is referred to by A. Holland, B.C.L.S., in his notes of survey of that line.

A Swede who was working on the 55th parallel in 1920 was of opinion that pastures of this sort would eventually support a cheese-making industry. In his part of the world the families used to camp out for the summer months, following the cows up the mountain-side as the snow melted. On Mount Williams, however, there are a few grizzly which might be disposed to give cattle too hearty a welcome.

TRAIL TO TOCHCHA.

West of Tochcha Lake is a thickly wooded range of hills which attain their highest point near Wright Bay. North of these is a low pass connecting Babine Lake with the north end of Tochcha. This pass is traversed by a trail cut by the "Charlie Pius" family of Indians, who live at the mouth of Fulton River, but claim the Tochcha country as their trapping-ground. As there are two smoke-houses on the lake and several miles of trail around it kept in a very passable state of repair, it must be conceded that they have certain hereditary and vested interests here, although, like most Indians when talking of the size of their "hunt country," they are inclined to lay claim to illimitable country.

At the Babine end of the trail there is a certain amount of good land, bearing a fairly heavy growth of spruce. Close to the lake is a fairly recent burn, now a tangled windfall. The heavy growth of peavine which occurs here shows that the soil has good agricultural possibilities. Bob Charlie has a cabin here and lays claim to some sort of an Indian reserve, although he is not often in residence. The Babine end of Tochcha Trail is very hard to find, and to follow when found, as the first mile or so is through a bad windfall.

OLD FORT.

There is a good deal of land of an excellent quality along the southern shore of the peninsula which lies about 3 miles to the north of the 55th parallel. In the centre of this peninsula lies Old Fort Mountain, a heaven-sent triangulation point, visible from far and near, and with an amazing view of the lake. From Donald's Landing, some 60 miles away, it forms a distinctive landmark, appearing as a perfectly symmetrical cone when viewed from that direction. Nearer approach, without detracting from its beauties, discloses features somewhat unusual in this part of the country, great open patches appearing on the southern slopes and extending almost as far as the top of the hill.

Old Fort village is situated at the tip of the peninsula and from this point Indian farms extend for several miles to the west. The farms are chiefly for hay-cutting and there is not very much done in the way of cultivation. We were, however, able to obtain excellent potatoes, turnips, and carrots here, and also some very good beef on one occasion. The lesser vegetation along the southern slopes of the mountain is amazingly rank in places, fireweed and hemlock growing 7 feet high and making it rather a wet business to climb the hill after a shower. The trees are generally scattered poplar and easily cleared. Higher up the mountain the vegetation grows lower, the soil being not so rich. The upper slopes were apparently once covered with spruce and balsam which were burnt out some fifty years ago.

The country to the south of the lake, especially a little way inland in the neighbourhood of the parallel, forms a marked contrast to all this, being covered with dense brush and littered

with a tangle of windfall which makes progress slow and dangerous. This is presumably chiefly due to the northern slope.

The hills to the east side of the lake, however, as far as Wright Bay, are covered with "Christmas trees" and present quite a different aspect to Old Fort Mountain. Whether the remarkable difference in the vegetation of the latter is entirely due to the quality of the soil, or is partly due to successive burning and grazing, I am unable to say. The matter is extremely interesting from the stock-farming point of view and is well worth investigation by some sort of an expert.

Apparently very little cultivation has been done in the country, with the exception of the few crops raised by the Indians. Mr. McAvoy, who has a pre-emption near Fort Babine, is a firm believer in the agricultural possibilities of his part of the world and has raised some crops on his place, but nothing yet to any great extent. This part of the world is apparently very little affected by summer frost. Towards the other end of the lake, in the Taltapin direction, I believe that Mr. Bowling has an excellent garden.

GAME.

We saw plenty of grouse and fool-hen throughout the year, but not much big game. Deer are scarce, especially near Babine Lake, where the Indian dogs keep them well on the run. Moose are reported plentiful at Wright Bay and in the neighbouring country; we did not go inland here, but saw a few tracks near Klaytahnkut Lake. Caribou are said to have been plentiful on Mount Fulton (Caribou Mountain) up to the time of the construction of the Grand Trunk Pacific and horns are still to be found on the mountain in large numbers. The Indians say that these beasts formed part of a larger herd, which is now confined to the south of the railway. I should think they extend for some distance along the foot-hills of the Coast Range, as we found a good many while running out the 53rd parallel in 1912 and 1913. Caribou were once to be found on Deescius and on the Middle River Range, but have been extinct there for many years. There are, however, said to be a few on the Frypan Mountain, to the north of the Manson Creek Trail. We saw no signs of mountain-goat during the whole season; there are apparently none in the country, but the Indians say that they occur in the hills to the north and west. Above timber-line on the grassy southern slopes we saw plenty of ground-hog (hoary marmot) and more frequently heard the shrill whistle which they emit by way of warning their friends of the approach of an invader. These little beasts are exceedingly good to eat, but by no means easy to hit. The skins make excellent robes. There are some black bear and a few grizzly here; we saw tracks of the latter in August on the Middle River Range, especially near the runs of the ground-hog, whose flesh they much appreciate.

FUR-BEARING ANIMALS.

Marten, mink, fisher, ermine, fox, beaver, musk-rat, and bear are the chief of these. Trapping is an extensive business here and affords a good living to many hundreds of Indians and a few white men. A detailed account might be out of place in this report. In the spring Mr. Anderson had a few mink and some marten which he intended to breed for fur. I believe that some of these have been taken over by J. Wiggins, who has a place on the north shore of the lake, a few miles from the eastern end.

FISH.

Babine Lake is on the Skeena watershed, where the salmon have not been exterminated as is practically the case on Stuart Lake. Salmon still form the staple diet of the Babine Indians, who put up large numbers of dried fish for the winter. They originally had a weir where the Babine River flows out of the lake, but now have to use nets, as the weir has been destroyed in order to allow fish to come up for spawning. There is a Dominion Government hatchery on Morrison Lake, which latter drains into the Fraser River. Other fish are trout, char, land-locked salmon, and whitefish; the trout and char readily take a spoon, but the others have to be netted. Some of the char we caught measured 36 inches. I think there are no sturgeon here, although these are caught over the divide in Stuart Lake.

INDIANS.

There is a large Indian population around Babine Lake, semi-migratory and, one might almost add, amphibious, as movement is generally up and down the main lake or one of the

lesser waterways. Babine, the largest village, is at the north end of the lake, where the Babine River flows out of it. The Indian part of the village boasts of two churches, one new and the other falling into decay, and two stores, which are, however, closed when the Indian population is away from town. The white population there is represented by the Hudson's Bay Company officials and their families, the schoolmaster, and at times, the various fishery officials.

Another village is at "Old Fort," on the tip of the peninsula just to the north of the 55th parallel. A good many houses are scattered along the lake in this vicinity, mainly for the first 6 miles to the west of the village, on the southern slopes of Old Fort Mountain. There are also some houses at Tachek, at the mouth of Fulton River, and at Donald's Landing, the end of the Burns Lake Road.

Reference to "The History of the Northern Interior of British Columbia," by the Rev. A. G. Morice, O.M.I., shows that Babine Lake was first visited by the North-west Company in 1812, and the first post, Fort Kilmars, established at "Old Fort" in 1822, the year after the amalgamation of the company with that of the Hudson's Bay. This post was supplied from Fort St. James, the headquarters of the district. After a few years it was found that trade on the lake was badly affected by competition from the Coast Indians, who bought goods from ships on the Pacific and brought them up the Skeena to trade at Hazelton. The fort was accordingly moved to the north end of the lake in 1836 to offset this new competition.

The habit of independent trading and of quickly taking advantage of new and advantageous trade routes is still very noticeable among the Babines, some of whom are very successful storekeepers. Communication with the Coast has had its effect on the taste of the inhabitants, as various products of the "saltchuk," such as oolachan-grease, dried seaweed, and fish-roe, find a ready market at Babine. The Stuart Lake Indians, on the contrary, have no taste for oolachan-grease and could not be induced to buy any when the Hudson's Bay Company at Fort St. James imported a consignment of it. I suppose the prehistoric grease trade did not extend in this direction, and, as the liking for this delicacy is what epicures call an "acquired taste," perhaps the Stuart Lake people have not yet had time to pick it up; personally, I never got beyond the smell. The seaweed I saw at Babine looked something like the laver eaten in Devonshire with hot roast mutton.

About July 1st the world, his wife and his dogs, from all parts of the lake, go to Babine to get away from the mosquitoes and have a good time generally. There may be some other reason for this meeting of the clans, but I was not able to discover it.

I cannot say that the dogs always have much cause for rejoicing at this time of the year; their time comes later when the salmon run is on. They were, however, doing very well when we arrived, as a horse had very thoughtfully died close to the landing-place a few hours beforehand. The next morning only a few bones remained. The Stuart Lake Indians had told me the year before of the great numbers of dogs to be found here, and I found that the picture was by no means overdrawn. Those beasts have a poor time of it in the winter, to judge by their condition and appetite in the spring, and for this reason one cannot leave one's tent for a moment when camped near the village. They are easily scared away in the spring, but an Indian told me that later on, when well fed after a good salmon run, they get "too high-toned" and, I suppose, a bit abrupt in their manner.

It is easy enough to go to Babine about July 1st, but a very different matter to get away from the village for the next week or two if one is at all dependent on Indians for transport, as nobody wants to miss the festivities by taking a job which might lead out of town. The census official was particularly unfortunate in his efforts to obtain a motor-boat this year, and eventually had to make his trip down the lake and back (about 200 miles) in a rowboat. The more experienced prophets foretold for us a stay of at least a week, so we considered ourselves lucky in being able to outfit, hire a pack-train, and leave for Takla Lake within a couple of days. When we got back about the end of the month everybody was leaving to cut hay, and in a few days the village was practically deserted. After the hay season the salmon run has to be attended to, when the year's supply of fish has to be caught, cleaned, and smoked.

Preparations for trapping commence about the end of September, and I understand that the next break is at Christmas, when everybody lays off for a week or two in order that the season may be kept with appropriate observances. On special occasions, however, everybody will flock back to town. We were camped opposite "Old Fort" in October when a funeral took place; mourners came from far and near and the village was once more inhabited for a few

days. It was a fortunate occurrence for us, as an ox had to be killed to provide for this influx, and we were, in consequence, able to purchase some beef.

A number of the Bear Lake Indians usually turn up at Babine for the July celebrations or whenever the priest is expected. These Indians are partly of Sicanni descent, and, like the Sicanni, lead a very nomadic life, hunting north as far as Thutade Lake and the headwaters of the Stikine, and sometimes staying away for over a year at a time. The Babines, on the contrary, though always on the move, seldom go very far afield for trapping or hunting.

This year the Bear Lakes were late in turning up at Babine. I had a Bear Lake Indian with me for some weeks and found him extremely useful in triangulation-work, as he could invariably describe to me beforehand the views to be obtained from any hill which I proposed to use as a station, thus saving me from making several abortive trips.

The Babines are extremely adaptable and quickly pick up any new idea. Many of them are masters of the art of Evinruding and seldom get stuck with a motor. They are wonderfully conversant with its working principles and also with the various dodges for dealing with a sulky engine. As fitters they are perhaps inclined to be a little too hearty with the use of the file; one non-mechanical gentleman put this fairly well when he said: "Jimmy's engine not much good now; too much fix 'em all the time." Many of them own engines but are always out of gasolene, which they have no hesitation in trying to borrow. The Babines clearly feel conscious of an Indian national spirit, but at the same time are loyal subjects as far as their ideas go. I am told that only men of a certain standing are allowed to fly a Union Jack at the bow of their boats, in the same way that only an Admiral of the Fleet is allowed to fly this flag at the fore; but I cannot vouch for this. Two of them who were on a side-trip with me were deeply interested in the system of government of the Empire; not so much in the elective part of the business as in the relationship of the King to the Governors-General and the Lieutenant-Governors. After I had explained this to the best of my ability he wanted to know the names of our Kings for some time back. My reply seemed to puzzle him, for he then said: "I think more than one King stop some place; one time So-and-so tell me he go Ottawa see King Laurier"!

All the Carrier Indians are very nervous about meeting any kind of strangers when travelling in the woods and often conjure up the spectacle of a "bad man" lurking behind a tree. The bogy is generally supposed to be a Cree, who is looked upon in very much the same sort of way as a "Stik" or fresh-water Indian is regarded by his cousins of the Coast. Any sort of stranger is "bad" to the Carrier, but the Cree is especially to be feared for his indiscriminate use of love philtres, of which he is said to possess some terribly powerful brands.

RESOURCES, COMMUNICATIONS, AND DEVELOPMENT.

These subjects should be discussed at the same time, as the successful development of the resources of any country depends entirely on the existence of a cheap and reliable system of transportation.

In the past this country has mainly depended on the fur trade or on the placer-mining carried on in the neighbouring territory of Manson Creek, so that lines of communication have been planned with a view to the development of one or other of these industries.

The present stage is plainly transitional, following on the completion of the Grand Trunk Pacific Railway and the construction of a partly completed road connecting Babine Lake with the steel at Burns Lake.

This road was designed, presumably with a view to agricultural development, by a land company hailing from Spokane, which was interested in certain lands along the shore of Babine Lake. The development did not follow, and the company was unable to complete the payment of wages for road-work, which were consequently settled up by the Government.

The road was well worth the money expended, as a good deal of traffic has gone over it, but the Public Works Department is in no way responsible for the construction of the road, which is badly located in places and not built around Pinkut Lake.

Before dealing with the question of the future development of the country, I will describe what has taken place up to the present, as certain natural features made use of in the past will play an important part in the lines of communication of the future.

I have referred to the establishment of the Hudson's Bay Company's post at "Old Fort," and later on at Babine, as offshoots to the headquarters at Fort St. James. Later on, when supplies came up the Skeena and over the trail to Babine, this state of affairs was reversed and

Fort St. James supplied from the west by way of Babine and Stuart Lakes, large scows being used on these waterways, which were connected by a wagon-road at "The Portage." This route supplied the greater part of the Northern Interior prior to the construction of the Grand Trunk Pacific Railway.

I remember while working in the Nechako Valley in 1907 we found supplies especially hard to procure when one of the Hudson's Bay Company's steamers sank on the Skeena, thereby causing a shortage at the Fraser Lake post, which was then largely supplied by way of Stuart Lake. With the completion of the Grand Trunk Pacific, Fort St. James drew its supplies from Vanderhoof and the scows on the lakes went out of business. The wagon-road at the Portage is still, I believe, in good condition.

The rush to the Manson Creek diggings in 1869 and the following years brought an influx of miners up the Skeena to Hazelton and on to Fort Babine, whence supplies were ferried up the lake to Wright Bay and hauled by wagon to Trembleur Lake over a road built for the purpose.

The connection with the Manson Creek Trail at the Old Landing on Takla Lake was made by the steamer "Venture," whose remains are still visible on the west shore of Trembleur Lake. The valley through which the old road passed contains a belt of land which is generally reported to be of exceptional value, so it is likely that a portion of the old road will be used again at some future date.

The Wright Bay route was eventually superseded by a trail cut direct from Babine to Takla Lake by way of Frypan Creek. The easterly part of this is now disused and the present trail goes south of the Frypan Mountain to Takla Landing, where passage over the lake can be made by a scow. The Manson Creek diggings are practically a thing of the past, and what little traffic there is usually goes by way of Fort St. James, so that the trail beyond Takla Lake is not very much used. The western part is travelled over more frequently, especially by the Bear Lake Indians on their periodical trips to Babine.

The Hudson's Bay Company continues to draw supplies from Hazelton by pack-train to this day, and we were fortunate enough to see the good old-fashioned spectacle of eighty horses unloading at Babine on the day of our arrival there.

The Hazelton Trail is, however, being supplied by the Burns Lake Road already referred to, although the latter is incomplete and suffers from the disadvantage of being cut in two by Pinkut Lake. Rates from the Grand Trunk Pacific to Babine Lake are 5 cents per pound by way of the pack-trail and 2 cents by way of the road, so that the Burns Lake route is cheaper even when supplies have to be shipped right up to Fort Babine, at the north end of the lake, despite the intervening 74 miles of water.

Transport up the main lake is by sleigh in winter or by small flat-bottomed bateaux propelled by outboard motors during the summer. The extremely strong winds which blow here at times make the trip a somewhat uncertain sort of business with these boats, but should not hinder the craft of larger size which will undoubtedly be used here at some time.

I believe that freighting on the ice generally takes place during the latter part of the winter, as at first the ice tends to get flooded in places when pressed down by the weight of fallen snow.

As active competition for the Indian trade has developed at Burns Lake, traffic by this road has greatly increased. It would undoubtedly be the only freight route to Babine were it not for the fact that the road has not yet been built around Pinkut Lake. This break in continuity, and the consequent confusion arising from ferrying freight down the lake and reloading into a fresh wagon at the other end, makes things very awkward during the summer months for people who live at a distance. Further complications ensue when Pinkut commences to freeze and becomes impassable for a few days until the ice is strong enough for a team. The Burns Lake way is, however, the favourite route to Babine Lake, despite all these difficulties, and will be still more so when they are overcome.

Travellers who may be going into the Babine country in the near future will be interested to learn that teamsters may be hired at Burns Lake who will see them safely through to Babine, and that the date at which the road is passable and the lake navigable varies with the seasons, but is rarely later than May 15th. At the fork of the road just before Pinkut Lake there is a cabin containing a store and other accessories, which the Taltapin Mining Company has kindly placed at the disposal of the public. Although the road is not built along the side of Pinkut Lake, there is a pack-trail for horses on the western shore.

There are a couple of boats on the lake, and on one of these Mr. Aslin, of Burns Lake, had a motor during the summer. This year there was on the far section of the road a wagon which was, I believe, in full commission for a few weeks; at other times horses have to be walked by trail around the lake. If the teamster forgets the swingle-trees there is a certain amount of delay at the far end. It is as well to have a man with the team who knows the ropes; this year Brunel, McPhail & McDonnell were specializing on this route. At Donald's Landing, the end of the road, are the boat-houses of the Provincial Forestry Department and Dominion Fisheries Department, which can be distinguished by the signboards "P.F. Department" and "Canadian Naval Service" respectively.

Jimmy Donald, an Indian who does a good deal of freighting on the lake, has several boats here and is often available for hire. The boat question is, however, rather an uncertain one at this point.

Emile Williams, a Babine Indian, has just started a store here; he does freighting and has several horses and one or two boats. He is generally supposed to have a pretty good head for business and has certainly shown good judgment in choosing this location.

FUTURE DEVELOPMENT.

In considering the question of future development, we must remember that the simple means of communication which have in the past sufficed for the prosecution of the fur trade and for the needs of a population which has up to the present consisted almost entirely of Indians will not adequately provide for the future. A more elaborate and carefully thought-out means of transportation will be required if the mineral, land, and forestry resources are to be fully developed on an economically sound basis. Such a basis can only be obtained by avoiding the waste of effort which inevitably occurs when the various resources of the country, their development, and the several links in the chain of communication which supports such development are considered as separate problems and not as different aspects of the same problem. In other words, we must, before opening up a country, take into consideration the value of its natural resources in order to forecast the direction and extent of the lines of communication which their development should ultimately justify. Under the heading of "The Lie of the Land" I have referred to the three main longitudinal valleys, the main physical characteristics here. Along the westernmost of these is the Grand Trunk Pacific Railway, the datum to which we must refer the whole question of transport throughout this district. Each of the other valleys contains great waterways, Babine Lake and the Takla-Stuart system, navigable during the summer and used as sleigh routes in the winter. Through both the transverse valleys connecting these lakes have at one time run wagon-roads, each of which has formed part of a main transportation route in conjunction with Babine Lake and the system to its east. If the railway is connected with Babine Lake it is consequently connected with the whole system, and such connection would therefore open up a large tract of territory with comparatively little expense.

We have now to consider the question of the most suitable route along which such connection should be made. The Hazelton route is suitable for a pack-trail only. There are other locations between this and the existing road, one being between Fulton River and Topley or Perow. The Burns Lake route is probably the shortest, and although the present road is purely a makeshift, it seems likely that the same general location can be followed later on by a better road, or possibly a light railway. Furthermore, Burns Lake is a distributing centre to the Ootsa Lake and Francois Lake countries and is already a rapidly growing little town. It seems, therefore, to be the logical point of departure for the Babine territory.

The next step is then to determine the value of the Babine resources in order that we may see what kind of transportation along this route their development will justify.

Sufficient information has not yet been acquired to enable a final decision to be reached at present. I will, however, indicate lines on which inquiry should be made before any further work is done on this route beyond keeping the present road in repair.

The chief resources as yet undeveloped are mineral, land, and timber. The chief mineral-deposits are Mr. Newman's claims on the 55th parallel (1913), Mr. MacDonald's on Copper Island (1913), Mr. Hagan's on Silver Island (1913), and Mr. Anderson's near Taltapin Lake (1920). These properties have been examined by mining engineers who have allowed their reports to be printed in the Department of Mines Report for the years noted. I believe that the properties have not been examined in detail by officials of the Department.

There are also other deposits, away from the lake, on the east side of the Babine Range, which affects the general situation. J. D. Galloway, Assistant Mineralogist, deals with the question of access to these in very clear language in his general report on the district printed in the Mines Department Report for 1914.

He says: "In order to open up the Babine Lake country there will probably be a road put in from the railway, starting either at Fraser or Burns Lake. When this is done the properties on the Babine Range, which lie on the slope towards Babine Lake, will find that their best method of transporting ore."

A good deal of development-work has been done on the Babine Lake claims in recent years, so that their value can be now more clearly determined.

It is clear that in order to gauge the type of transport which the traffic will ultimately justify a complete report will be necessary on the combined value of these deposits, both on the Babine Range and on the lake.

There is not much large timber on Babine, but a certain amount of spruce of fair size occurs in scattered patches. I saw no fir on the northern end of the lake, although on Takla Lake a few specimens occur as far north as 55° 16′. Taken as a whole, the country around Babine Lake has been remarkably little burnt over in comparison with the Middle River District, so that balsam, spruce, pine, and poplar of moderate size are common.

In view of the success of recent experiments as to the value of jack-pine for pulp-making, the rapid growth of this industry, and the great length of the shore-line of Babine Lake, which is navigable everywhere, it seems possible that the industry, if it continues to develop at its present rate, might be established here eventually, but not, of course, for some time. I understand that the falls on Fulton River are capable of developing a considerable amount of power which should be useful for this purpose.

I have referred to the open country near "Old Fort." This is largely occupied by Indian reserves, but to what extent I cannot say as I have not been over the lines. Some good and also some indifferent land has also been surveyed at different times along the lake-shore by private individuals, and there are still some places where a few more lots might be run out. Altogether, the surveyed land around the northern shores is too scattered for present use, but will probably settle up by degrees as transportation develops along the lake.

West of Trembleur Lake, however, we have a large block of agricultural land through which the wagon-road ran in the early days of the gold-rush. The surveys here are extensive and some of the land is excellent, but whether the whole block is of high quality cannot be said until a careful cruise of it has been made. The centre of the block is about 12 miles to the north of Donald's Landing, and from this centre a valley, which suggests from the lake a good route for a road, runs in a southerly direction to a point on the shore which might be suitable for a crossing, as the lake is fairly narrow there. Hitherto the lake has been considered as a help to transportation; here it becomes an obstacle between this tract of land and the railway. The road from the south should accordingly be planned so as to reach the shore at a point where there will be good ice for crossing during the winter, as well as harbour facilities during the summer.

The question of transportation may be affected by a further matter of which I have, however, no first-hand knowledge. Mr. Newman has located some licences on Fulton River, where he says that there is a very considerable body of coal. Judging from the appearance of the country, this should be easily accessible from the lake as from the railway near Topley. If the quantity is large enough it might justify the building of a spur, which could perhaps be carried on to reach Babine Lake near the mouth of Fulton River. This part of the lake, however, is very broad and liable to violent squalls, so that it would not be a suitable crossing for people living on the block of land I have already referred to.

SURVEY.

The chainage of the portion of the parallel between Kazchek Mountain and Middle River (Miles 42 to 55) was used as a base and the position of a station on Mount Williams cut in from several points on this line. An approximate check on the value of the line Kazchek-Williams was obtained by triangulation from another point on line north of Inzana Lake. Expansion to Mount Blanchet was obtained by means of "Tsitsutl," a point on the Middle River Range near the parallel, and connection with Babine Lake followed by the quadrilateral Blanchet-Williams-Fulton-Old Fort.

The diagonals of this quadrilateral were observed, but, as they were about 42 miles in length, were too long to make sure of observation during the hazy weather. Accordingly, a central point, Deescius, was selected to map Tochcha Lake, the entire southern shore of which was visible from the triangulation station. Outlying points were fixed at Fort Babine and Taltapin Mountain, the latter being tied to by V. Schjelderup during his triangulation of Taltapin Lake. The point on Fulton was connected with the Bulkley Valley surveys by means of a subsidiary base measured on a tangent of the railway between Topley and Perow.

The greater portion of the Babine Lake triangulation was controlled by the side Fulton-Old Fort of the figure referred to above, this line being broken down by a series of minor quadrilaterals. The detail work on the lake was somewhat intricate and took a certain amount of scheming. Virgil's "Insula est in arcessu longo" describes this part of the world very well, for wherever a deep retiring bay occurs on Babine its mouth is sure to be blocked by an island so thickly clothed in bush as to frustrate the surveyor's efforts. Fortunately a few high bare-topped hills were close enough to the lake to control the lesser work and at the same time break down the main figures.

The angles were observed with 5-inch Berger transit theodolites reading to 30 seconds. The verniers were read by means of a double lens which permitted interpolation to 10 seconds. Minor stations were cut in by rounds of angles taken with both faces, the results being very satisfactory and justifying the maker's claim that no discrepancy can be detected between A and B verniers of the instruments.

In observing at main stations I used the method of repetition in preference to that of direction, although the latter is generally employed in modern practice. In the former method each angle is multiplied four, eight, or twelve times, according to the degree of accuracy required, and the resulting angle read from the instrument divided and by the number of repetitions. When possible the horizon is "closed" by summing the angles and apportioning among them excess or defects over 300°.

In the direction system a complete round of angles on all stations is taken with the theodolite set in a certain position. The instrument is then set on a fresh zero and a fresh round taken, the process being repeated a number of times and a mean of the results taken.

This latter system is generally employed in modern practice and is very satisfactory where one has micrometer instruments which read to a second or two, and where uninterrupted observation may be had of the distant points. In geodetic work this latter condition is usually obtained by lights at night wherever the rays are too long for easy observation by daylight. Night observation is, however, out of the question on work of this sort. Furthermore, by day the haziness produced during the hot weather and the continually changing character of the light at all times seldom allows clear views of all the objects at the same time, so that the direction method is not convenient as far as observation conditions are concerned.

Again, micrometer instruments, although giving very close readings, are extremely delicate and too heavy for work in the Northern Interior, where help is expensive and dense bush makes travelling a slow business.

This year when travelling to remote points we left behind the tripod and mahogany box and carried the instrument in a gasolene-tin, well wadded up with spare clothes, beans, Quaker oats, and other suitable articles. The tin was wrapped in blankets and carried by means of a pack-saddle, pack-straps, or a pair of old overalls. The other man carried the cook-pots, fly, and some more food and blankets, so that two of us could easily last out for three or four weeks, given decent weather. This mobility would have been impossible with micrometer instruments.

When observations were being taken without the tripod the theodolite was mounted on the board, which is designed to secure it in place in its box. On the hill-tops we were able to get on very well, as a suitable lump of rock could usually be found to take the place of the tripod. Given a solid enough rock, the horizon closures were as satisfactory as those obtained when the instrument was set up in the orthodox manner.

It is evident that weather conditions and the difficulties of transporting instruments suitable for the direction system combined to make the repetition method of observing angles more suited to local conditions.

As the results obtained by these two systems require to be adjusted by different methods, I am balancing the larger figures by the method of angles in accordance with the principles laid down in "Adjustment of Observations," by Wright & Hayford. The method which is usually

described in more recent text-books is better suited to angles observed by the "direction" system. These adjustments do not apply to simple triangles, but only to figures where certain geometrical conditions have to be satisfied. In the work under report I avoided a complicated network as far as possible and endeavoured to secure either quadrilaterals with open diagonals or closed polygons with an internal point. Good examples of the adjustment of these figures by the method of least squares are given on page 233 *et seq.* of "Adjustment of Observations." These figures afford excellent checks on the work, especially where any angles have been missed, and give far better results than simple triangles, with very little extra labour.

On lake-shore work, however, the tripod was very necessary to raise the instrument to a height sufficient to clear the curvature of the earth's surface. On Babine Lake, where some of the stations were several miles apart, the effect of curvature was especially marked, so that a white flag had to be placed above beacons built on the water-level whenever they were separated by a distance great enough to make our standard-pattern whitewashed beacons disappear hull down beneath the horizon.

A number of the stations on the lake-shore were marked by the standard-pattern iron post provided by the Department. Where suitable work occurred a hole was drilled and the post driven into it. The shore-line was sketched between stations, occasionally with the help of intermediate points, and a certain amount of stadia-work done. The coast-lining was rather hurried, as we were anxious to obtain enough information to make a map of the northern part of the lake, on the scale of 1 mile to the inch, before the freeze-up. This object was attained, together with the connection between the sections of the base and ties to all surveys in the neighbourhood.

In conclusion, I wish to express my thanks to H. MacDonald and Mr. and Mrs. Pendleton for the use of their cabins on the lake which we used as headquarters for the summer, and to acknowledge the assistance given by the officials of the Forestry and Fishery Departments and the Hudson's Bay Company.

I have, etc.,
R. P. BISHOP, B.C.L.S.

TIMOTHY MOUNTAIN LAKE, LILLOOET DISTRICT, AND MAHOOD LAKE, KAMLOOPS DISTRICT.

BY W. S. DREWRY.

VICTORIA, B.C., February 8th, 1922.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—Under your instructions, I left Lac la Hache to place a party in the field to subdivide lands east of that point adjoining Timothy Mountain Lake. A camp was established at Greeny Lake, about 7 miles from Lac la Hache, on the road to Timothy Mountain Lake, which will hereafter be referred to as Timothy Lake.

The field-work was put under charge of Major D. M. Mackay, O.B.E., and commenced by connecting the surveys in Township 30 with isolated surveys near the west end of Timothy Lake; following which traverses of Greeny Lake and the north shore of Timothy Lake were made, so that the subdivisions of lands could be planned to the best advantage.

CHARACTER OF LANDS.

The lands in that vicinity are for the greater part open poplar-flats or slightly rolling country, with black loam soil having a clay subsoil. Some stony, fir-clad ridges lie about Greeny Lake; but these are narrow, falling off to the north into flats along Timothy Mountain Creek, and descending south slightly to a plateau extending east on the southerly side of a ridge along the south shore of Timothy Lake. This plateau falls to the south into the valley of 111-Mile Creek, draining eventually into Lac la Hache.

North of Timothy Lake the slopes of Little Timothy Mountain come to the water very gradually, the lower portion being clad with quite open poplar and pine forest, throughout which is found luxuriant vegetation, embracing various grasses, peavine, lupine, and other nutritious fodder-plants.

On the south side of the lake the northerly slopes are quite steep in places, but considerable of the area might be brought under cultivation. The forest-cover is mostly small poplar, with black loam soil carrying a rank growth of grasses and other plants, caused probably by sub-irrigation, breaking out as springs near the shore.

It is probable that this land, if cleared, would make excellent hay land; but it was not subdivided, as it was considered advisable to use available funds for the survey of level lands which would probably be brought into use first.

All this portion of the country, including Lac la Hache Valley, may be classified as primarily a grazing and dairying country, but grains of various kinds are grown, as well as good garden produce.

TIMOTHY MOUNTAIN LAKE.

Throughout the whole area mentioned above the securing of winter fodder is of prime importance, and the natural meadows are not of sufficient extent to permit full development of the country. The existence of this lake-basin, which could be utilized for storage, lying some 250 to 300 feet above the valleys in question, would therefore appear to be of paramount importance, since water stored there could be brought on the benches above the bottom lands, thereby greatly increasing the area on which fodder for winter use might be grown, as well as improving much of the open range.

The outline of Timothy Mountain Lake was determined by chain traverse along the north shore and triangulation to points on the south shore. The easterly end of the lake was also triangulated and the shore-line sketched in down to the narrow neck leading to what is shown on the map as Dempsey Lake, but which is really a portion of Timothy Lake, the division being a low beaver-dam across the neck. The outlet is a creek flowing through a meadow for about half a mile and then falling rapidly into 111-Mile Creek at Chub Lake.

ACCESSIBILITY.

The area surveyed in that section is 6,234 acres and may be reached from Lac la Hache by the road to Timothy Lake, whence a rough road has been cut southerly some 2 miles to a meadow lying east of Lot 3650. From this point a road was cut easterly some 3 miles to Lot 4989, connecting with a road from that point to the Spring Lake Road in 111-Mile Valley. The survey camp was moved over this route by wagon, eventually reaching 111-Mile House by the Cariboo Road, within about 2 miles of which the Horsefly Road was crossed. This latter road, commencing at 108-Mile House, extends northerly to Harpers Camp and the Horsefly country, but between 108- and 111-Mile Houses is not passable for wagons owing to some of the bridges having been burned. In addition to the road, several trails traverse the area, the main trail from Canim Lake to Lac la Hache passing south of the lake, while a branch goes around the west and northerly sides of the lake, being utilized by Indians both from Canim Lake and Chilcotin, who visit this section to gather blueberries and hunt. The branch trail was extended around the east end of the lake for survey purposes, so that a complete circuit of the lake may now be made with horses.

GAME.

Deer and moose appeared to be fairly numerous on the slopes of Little Timothy Mountain and the rough country east of the lake.

Black bear appear to be plentiful throughout the area, probably being attracted by the luxuriant crops of blueberries and saskatoon-berries, for which the region is noted.

Timothy Lake is famed locally as a fishing-place and affords fine sport with a fly-rod, the fish being rainbow trout from 1 to 2 lb. in weight.

CANIM AND MAHOOD LAKE SURVEYS.

Having initiated the survey of lands at Timothy Lake, a small second party in charge of J. H. Drewry, B.Sc., was placed in the field at Canim and Mahood Lakes to survey lands under application, and a tie from the Lillooet-Kamloops boundary, surveyed in 1913, to surveys in the Clearwater Valley whose position on the map was somewhat doubtful.

A tie-line about 1½ miles long, also run in 1913, from the district boundary mentioned above to Mahood Lake was utilized. It having been decided to survey Mahood Lake by triangu-

lation, the use of a boat was secured from B. H. McNeil, of Canim Lake, and a light raft of cedar constructed which it was found could be rowed about 3 miles per hour on smooth water.

The lake survey was commenced by measuring a short base some 22 chains in length along the shore at the westerly end of the lake, eight measurements of the base being made and the mean taken as true length. From this base a triangulation was expanded easterly, using a quadrilateral system with diagonals observed as control in adjusting angular measurements made with a 6-inch "Berger" transit cut to 20 inches. Each angle of the triangulation was read eight times, so that very small corrections were necessary at any station to conform with the quadrilateral adjustment. Side equations were not taken into account, as it was considered that the instrument used did not warrant expenditure of time which would be required to make such adjustment.

A cedar post referenced by bearing trees was placed at each station, being sometimes planted firmly in the ground, but frequently placed in a substantial cairn used as an instrument-platform when observing. These posts are 4 or more inches square and marked L.T.A., with the station number following, even numbers being on the south shore and odd numbers on the north side.

A short signal-mast, generally a small cedar or poplar peeled, was stepped in a 1-inch hole bored in the top of the post, and was held in a vertical position by three braces nailed to the mast. When observing at any station the masted was lifted out of the post and replaced when observations were completed. Small flags fastened to the masts were found to identify them sufficiently.

The triangulation net covering Mahood Lake extends some 12¼ miles in an easterly direction and has an extreme breadth of about 1½ miles, most of the stations being slightly above high-water mark, but station 20 on the south side of the lake is 280 feet above the water on a rock bluff rising sheer from the water.

The final side, some 33 chains long, at the easterly end of the lake, was measured carefully with the tape, and the difference between measured and computed lengths was found to be about half a link. The initial base was measured in July, while the final side or check-base was measured in September, the difference in temperature of the periods being probably at least 20° F. Using the expansion coefficient 0.0000065 for steel tapes, this temperature difference would account for the one-half link discrepancy in computed and measured lengths of the check-base. This very close agreement is no doubt due to an accidental balancing of the small errors of survey, but serves to show that the work was carefully done.

Connection to Clearwater Valley Surveys.

From the last triangulation station a traverse was run north-easterly to the north-west corner of Lot 3475 on the east bank of the Clearwater, about 1¼ miles below the mouth of Murtle River, and northerly along the west bank of the Clearwater to the south-east corner of Lot 2692. The Clearwater at this point flows through a canyon some 300 or more feet in depth.

Where crossed the stream was some 5 chains wide, apparently about 30 feet in depth, with a flow of about 5 miles per hour. The volume of water from Murtle River seemed greater than that in the Clearwater above their junction. The timber seen in this neighbourhood seemed to have more possible value as pulp-wood than saw-timber. The lands observed are unsuitable to agriculture, being rough and stony.

General Description.

Canim Lake is a fine body of water some 20 miles long, with an extreme breadth of about 3 miles, lying 27 miles north-easterly from 100-Mile House on the Cariboo Road, from which point it is accessible by motor-road. This lake is bounded in part by high wooded mountains, but about the mouths of creeks and the easterly end there is considerable agricultural land; B. H. McNeil's fine farm at Jim Creek, with considerably over 200 acres under cultivation, proving the possibilities in this direction.

The outlet is Bridge Creek, which at about 1½ miles from the lake drops perpendicularly some 85 feet, and then falls in a succession of cascades, pools, and swift riffles about 300 feet in about 2½ miles, whence it flows with rapid current about a mile into Mahood Lake near its west end. Incidentally it may be mentioned that this stretch of broken water affords probably some of the best stream-fishing to be found, the trout being of large size and extremely lively.

The valley is from 1 to 2 miles wide, some of the land being suited to agriculture, while part of it is stony.

There is no agricultural land about Mahood Lake, excepting a few hundred acres at its west end.

Evidently the mountain-slopes have at one period been covered with a forest of large fir, cedar, and spruce, which was destroyed by fire. This forest is now being reproduced, but the timber is as yet too small for the saw, most of it being fit only for pulp purposes.

The rock-exposures are mica-schist until Candle Creek is reached, flowing in from the north about 8 miles down the lake. Here an escarpment of lava some 300 feet high shows for about half a mile. This lava escarpment again shows about the easterly end of the lake-basin, which has some resemblance to a shallow crater-bowl.

Bridge Creek flows out of the lake at its extreme easterly limit, falling about 6 feet in the first 100 feet of its course. The stream is extremely rough, dropping some 300 feet in about 2½ miles to the Clearwater River. A very considerable water-power might be developed here, with Mahood, Canim, Horse, and Bridge Lakes as storage-reservoirs.

Mahood Lake is a particularly beautiful sheet of water, the mountains on either side rising abruptly from the shores, showing cliffs and rock-slides in places. The mountain-slopes are clad in a soft mantle of green, broken here and there by rock bluffs, while the tops show rugged and bare some 3,000 to 4,000 feet above, with an occasional patch of snow until late summer. The vistas and colouring are lovely, especially toward the eastern end, where snow-capped mountains beyond the North Thompson River are visible above the lava-rim of that portion of the lake.

POSSIBLE DEVELOPMENT.

Canim and Mahood Lakes seem to possess the elements for development of a great resort, having beautiful natural surroundings about 2,000 feet above sea, magnificent fishing and boating, bathing-beaches, mountain-climbing possibilities, and good fall hunting-ground.

Having fished at Bonnington Falls on the Kootenay River before it became a world-famous resort, the writer has no hesitation in saying that Mahood Lake greatly excels it both as to quantity and size of fish, which are rainbow trout of about 2 lb. weight and take the fly readily.

Much larger fish may be taken by trolling, but, as our catch was limited to what could be used, a few minutes with a fly-rod generally sufficed to procure all the party could consume.

ACCESSIBILITY.

As before stated, Canim Lake may be reached by motor from 100-Mile House on the Cariboo Road. A motor-boat and small barge could take traffic and freight down Canim Lake. Many years ago a road was cut from Canim to Mahood Lake, about 5 miles, over which a donkey-engine was taken on its way to the Clearwater River. It is thought this old road could be converted into a fair motor-road for about $5,000. At present there is a motor-boat on Canim Lake owned by B. H. McNeil, and pack-horses were used to transport camp outfit and supplies from Canim to Mahood Lake, where there is an ideal camping-ground through which a small spring creek flows. A visit to this region would richly repay any lover of nature.

I have, etc.,

W. S. DREWRY, B.C.L.S.

PHOTO-TOPOGRAPHICAL SURVEY, UPPER NICOLA VALLEY, KAMLOOPS DIVISION OF YALE DISTRICT.

BY R. D. MCCAW.

VICTORIA, B.C., December 14th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I beg to submit report on field operations carried on by me during the past season, being a continuation of the photo-topographical surveys in the Nicola Valley commenced in that area last year:—

Previous reports of mine have dealt with the technical details involved in the photo-topographical method, so I will not go into these now. A large portion of the area done this year was plateau country and prominences for photographic stations were difficult to obtain. Again, when these were found, the creek-valleys were so obscure that we were compelled to use an auxiliary system for locating valleys, creeks, lakes, and roads. For this purpose stadia

and paced traverses were run where necessary. The latter depended upon compass bearings, and the extremities are located either by triangulation or photographic intersection. Intermediate points were also located where convenient. This same system is employed in many topographical surveys where the contour interval is not less than 100 feet. Elevations in this method are derived by aneroids, using a camp instrument for comparison.

The triangulation is dependent on positions of the Geological Survey of Canada, which, although preliminary, are quite accurate enough for our purposes. This is also a continuation of practice in former years in this locality. The Geological Survey net is based on North American datum. At some future time all our positions can be reduced to data which will be supplied by the Geodetic Survey of Canada. During the past season the preliminary work was done for the extension of the primary net from the existing triangulation at the Coast eastward to about longitude 119° 30′. Two stations selected fall within the watershed of the Nicola River—namely Pennask and Tahaetkun Mountains. Some experimentary work was tried by aerial photography this summer, but the results are not assembled yet, so this will be dealt with later in a supplementary report. This was done by a sea-plane of the Dominion Air Board.

SEASON'S OPERATIONS.

The season's operations were started from Merritt on June 22nd, and before organizing the whole party, Iron Mountain, south of Merritt, was visited and new cotton placed upon the Geological Survey signal still standing. A new signal was also placed on top of the high rock bluff north of Nicola Lake. This was intended as a station for connecting with the astronomical station at Merritt, erected by the Dominion Observatory. The new signal was also found to be of considerable use during the summer. On June 24th and 25th, with full party, we moved to a camp on Spahomin Creek, and on the 27th started active field-work. Mount Hamilton (Geological Survey Station) was visited shortly after and the signal rebuilt and new cotton tacked on. For the ensuing few weeks our energies were directed upon the area lying south of the 1920 Sheet and in the vicinity of the Spahomin Creek and Wasley Creek watersheds. The locality consists mainly of low, rolling, hilly country, with south slopes open in part and north slopes and summits timbered. Lakes and meadows are very numerous and the nature of the country required much compass traverse, operated in conjunction with the camera. A beginning was made in the Pennask Lake-Hatheume Lake area, but owing to a local bush fire I thought it better to change my outlined plans, as the outlook for smoke was bad, and leave this area until later. Before leaving the vicinity Gottfriedsen Mountain (Geological Survey Station) was revisited and occupied as a camera station. The signal was still standing and some fresh cotton was put on it.

On July 25th we moved down to Lower Spahomin Creek, and from that date until August 6th photographic work was carried on between Douglas Lake and Minnie Lake, several camera stations being occupied on the Mount Hamilton Ridge. The country is nearly all open, rolling hills, with large areas of flat land in the bottom, and is used as range by the Douglas Lake Cattle Company.

From Minnie Lake we continued up Quilchena Creek and established stations as needed, no definite system being adopted. In this locality stations were occupied on the Siwash-Quilchena watershed overlooking that flat area in the upper reaches of those creeks. Generally the low rolling or flat nature of the surface made photographic stations difficult and on account of thick timber were hard to obtain. Paced traverses were again used and with the other information a fair control was established. One main triangulation station was occupied about 4 miles west of Paradise Lake (a lake on Upper Quilchena Creek).

The Pennask Lake area is practically the same altitude as Upper Quilchena Creek country and similar in type; the divide between Pennask and Quilchena Creeks lies so low in one part as to be difficult of definition. From August 31st to September 3rd we occupied a series of stations on the Pennask Mountain Ridge. These stations average some 1,800 feet above Pennask Lake and give good views over the whole Quilchena-Pennask Plateau, showing the myriads of lakes and meadows scattered over this area. Our base camp was located at Brenda Lake during this period. It was here that my assistant, L. A. Austen-Leigh, B.C.L.S., was taken ill and had to be removed to the Merritt Hospital. Several days were occupied in going to Merritt and getting back again, and while away my party moved camp to Lot 4140 on the Upper Nicola River.

The Gottfriedsen Mountain Station was again occupied for triangulation readings on September 8th and a camera station located on the north end of the ridge a few days later. On September 12th, 13th, and 14th we were moving back to Minnie Lake, finishing some traverse, land-survey connections, etc., on the way down. At Minnie Lake several additional stations were done and on the 21st the camp was moved to Quilchena. Upon this date A. S. Thomson arrived to take Mr. Leigh's place as assistant for the balance of the season, Mr. Leigh having been sent to the Jubilee Hospital in Victoria.

During the balance of the season our energies were directed against the open range country adjacent to Lower Quilchena Creek and along that portion of the Nicola River between Douglas and Nicola Lakes. The rest of the main triangulation stations were occupied and a tie made to the astronomical pier at Merritt. On October 13th operations were closed and I returned to Victoria.

In all, some 65 dozen camera-plates were exposed. The summary of stations occupied is as follows:—

Main triangulation stations	5
Main photographic stations	93
Separate camera stations	198
Miles of compass traverse about	130

In addition, some stadia traverse was done and numerous connections were made to survey corners.

GENERAL.

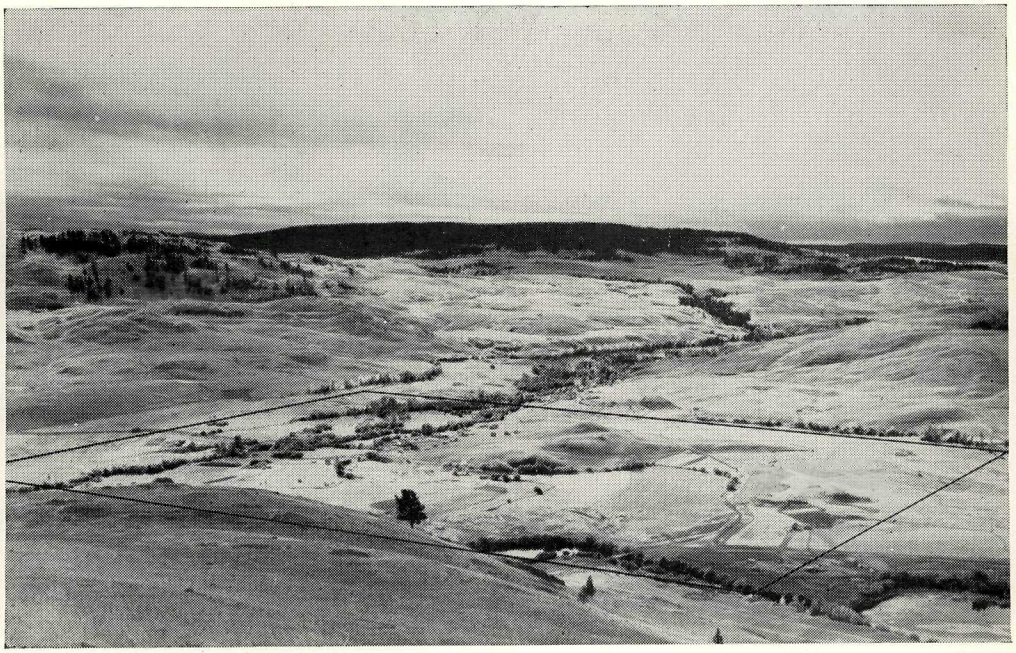
The atmospheric conditions during the season were good. Smoke from bush fires was in evidence often, but no time was lost from this other than that caused by the change in procedure owing to the fire near Hatheume Lake. This fire was brought under subjection by the Fire Warden and did not delay us. With the exception of the first three weeks in September we had very little rain, and throughout the season lost but a few days on this account. The latter part of September and the time in October until we closed down gave excellent camera weather. The days were usually fine and warm with very clear atmosphere. So dry did it become that forest fires began to appear again in the second week in October.

The country done this year is really a ranching area and any grain or hay grown is for feeding live stock owned locally. A pest of grasshoppers in the open areas gave the ranchers considerable concern, as thousands of acres of grass were cut down by them, as well as much grain and vegetables. At times the ground was so thickly covered with them that a step could not be taken without treading on some. During some of their flights the cloud of insects was so thick that camera-work had to be delayed for a few minutes until it was past. In the Pennask-Hatheume country we found considerable activity in the latter part of the season. The large meadows there produce an abundant crop of marsh-grass that was being cut for winter feed for cattle to appear later from adjacent parts. The area is much too high for cultivation and is held solely for range and the hay-crop in the meadows.

The timber in the area under survey is very similar to that of last year—jack-pine with some fir and bull-pine in the lower country, and jack-pine, spruce, and balsam in the high elevations. The open country is dotted with patches and belts of fir, bull-pine, and poplar. The usual pine or timber grass is found in timber except in high altitudes, and in parts this growth is mixed with the various weeds, such as lupine and wild bean. Bunch-grass is generally abundant on the open country, but continued grazing in some areas has reduced this to a poor growth.

The total area of water in the Hatheume-Pennask-Quilchena Plateau is very considerable, as the topographical plan will show. From one station alone twenty-five lakes were counted, ranging from one of 5 or 6 acres in extent to Pennask, the largest lake in that area. Many meadows and swamps exist in all parts of the plateau.

The main trunk road from Merritt to Kamloops is tapped at Quilchena by a branch road to Minnie Lake, and by another up Quilchena Creek to join the main road from Merritt to Princeton. Near Quilchena the Douglas Lake Road leaves the main Merritt–Kamloops Road. Settlers' roads extend up Spahomin and Quilchena Creeks into the Pennask-Hatheume Lake area. This area is well cut up by settlers' roads and trails. A very good pack-trail connects Pennask Lake with Princeton by way of the Siwash-Quilchena Summit. Another trail connects the same lake with Trout Creek (Okanagan slope) by way of Brenda Lake.



Comparison of vertical aerograph with ground view. Lower picture taken 5,000 feet above ground of area outlined on upper view taken in connection with photo-topographical survey of the area.

There was not a great deal of game seen during the summer, although deer seem to be fairly plentiful. A few grizzlies are said to exist and now and then make a raid on live stock at the edge of the open country near Minnie Lake. Black bear are also there, but not as numerous as farther north. Grouse are plentiful and large flocks of prairie-chickens inhabit the open range. In the Upper Country the beaver is still very much in evidence, although trapping in years gone by has no doubt thinned their numbers. Coyotes are very numerous. Nearly all of the lakes and streams are well stocked with fish. Hatheume is an exception to this. Settlers inform me that the fish in this lake died some few years ago.

The map-work is under way at present and when completed will portray the topography of between 400 and 500 square miles. A triangulation sheet covering both this and last year's work will be submitted, as well as the usual timber-grazing cover sheet. With this report I am turning in a few photographs taken from various points throughout.

I have, etc.,

R. D. McCAW, B.C.L.S.

PHOTO-TOPOGRAPHICAL SURVEY, HAYES, ONE-MILE, AND SUMMERS CREEKS, KAMLOOPS DIVISION OF YALE DISTRICT.

BY G. J. JACKSON.

VICTORIA, B.C., December 28th, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—I have the honour to submit the following report on the photo-topographic survey made by me during the past summer:—

The area covered was in the Kamloops District in the vicinity and to the east of Princeton, consisting of all the country drained by Hayes (5-Mile) Creek and part of that by 1-Mile and Summers Creeks.

The main 5-Mile Creek commences at Osprey Lake, on the Okanagan-Similkameen watershed, and flows in a south-westerly direction through Link and Chain Lakes, and about 8 miles from the head is joined from the north by Siwash Creek. About 13 miles farther down it is joined from the south-east by Red Creek. At about 25 miles from the head it flows into the Similkameen River. There are several smaller creeks which join it from the east at various points along its course.

After outfitting at Princeton I commenced work in the vicinity of Osprey Lake on June 3rd. Here I connected with the work done by R. D. McCaw during the season of 1917. Working down 5-Mile Creek to the mouth, sufficient stations were occupied to obtain the topography of the valley and several side-trips were made up the smaller creeks.

Red Creek was then ascended to the head, several stations being occupied along it and on the summit. I then worked up Siwash Creek to the headwaters, making side-trips to the watershed on both sides. At the watershed of Siwash and Quilchena Creeks a connection was made with Mr. McCaw's work of this season.

Camp was then moved down to Princeton and after occupying several stations along the Similkameen and up 1-Mile and Summers Creeks the party was disbanded on September 12th.

The season, on the whole, was very good for photographic work. Only four days were lost from rain, although during June and again in September there were many cloudy days with showers. During the first three weeks of August we were handicapped considerably by smoke from forest fires.

The area for the most part was very difficult for our work, as it was all thickly timbered and in most places covered with windfalls. The country is comparatively flat, with low timbered hills, so that satisfactory stations were hard to find, and this necessitated a lot of cutting to get clear views.

The triangulations was controlled by two stations of the Geological Survey of Canada—namely, Kathleen and Missezula—supplemented by two new ones of our own.

During the season 55 dozen views were taken and the following stations occupied:—

Primary stations	2
Secondary stations	2
Main photographic stations	103
Secondary photographic stations	101
Land and railway ties	13

About 20 miles of horse-trail were cut out.

The Kettle Valley Railway from Princeton to Penticton reaches the 5-Mile Valley about 8 miles from Princeton and follows it up past Osprey Lake and into the Valley of Trout Creek, in which it continues down to the Okanagan.

There is a wagon-road along the general course of the railway from Princeton to Osprey Lake, but from there eastward it is not in good repair.

At Link Lake a pack-trail branches off and leads to Pennask Lake by way of Tepee and Galena Lakes over Galena Ridge to the headwaters of Siwash and Quilchena Creeks; thence down Quilchena Creek. There is a good trail up Siwash Creek for about 12 miles, and from there to the head we cut out a rough one to connect with the Pennask Trail. Up Red Creek we found a trail for about 2 miles, but for the rest of the way had to cut a new one through the fallen timber.

The only land suitable for agriculture is the bottom of 5-Mile Valley and several thousand acres of open range between 5-Mile and 1-Mile Creeks near Princeton. Here there are several ranchers engaged in general farming and cattle-raising.

The valley of 5-Mile Creek is narrow, averaging about a mile in width and rising quite steeply on both sides. The last 3 miles at the mouth is a deep narrow canyon. The valley and sides are thickly timbered with black pine and towards the lower stretches there is some yellow pine and fir. Large patches have been burnt in recent years and are now covered with dead timber and windfalls.

Red Creek drains an area of about 75 square miles. This has been badly swept by fire and there is little green to be seen until the headwaters are reached, where there are several meadows with a little grass growing on them.

Siwash Creek has its source in a large flat containing many lakes and meadows which drain south to this creek and north to Quilchena Creek. Considerable hay is cut each year as feed for the cattle which are driven in and wintered there. From this flat the creek runs southerly through a very narrow valley with heavily wooded sides to 5-Mile Creek. It is joined from the east by three creeks which drain a large rolling country extending back to the Okanagan watershed. In this area there are several lakes and hay meadows, but these hardly yield enough to make the cutting worth while. All the Siwash basin is heavily wooded with black pine, the area to the west being badly burnt and full of windfalls.

Game is not plentiful, but there are a few deer and both black and grizzly bear. Beaver were in all the creeks and lakes, but in very small numbers. Grouse were seen over the whole area and up Siwash Creek fool-hens were very numerous. Nearly all the lakes contain trout of good size, while in the creeks small ones are very plentiful.

The work on the maps is now in progress, and, as usual, triangulation, topographical, grazing, and timber maps will be prepared.

I have, etc.,

G. J. JACKSON, B.C.L.S.

SURVEY OF THE BOUNDARY BETWEEN THE PROVINCES OF ALBERTA AND BRITISH COLUMBIA.

BY ARTHUR O. WHEELER.

December 31st, 1921.

J. E. Umbach, Esq.,
Surveyor-General, Victoria, B.C.

SIR,—During the season of 1921 the two divisions of the Interprovincial Boundary survey worked together with the object of completing the second section of the survey—viz., the portion lying between the Canadian Pacific Railway at Kicking Horse Pass and the Canadian National Railways at Yellowhead Pass—and so to permit of an early publication of the report and map-sheets of the said section.

Instructions.

The two divisions were instructed by the Surveyor-General of Dominion Lands, acting on behalf of the Governments concerned, to collaborate with the above object in view. Mr. Cautley's division had, therefore, to survey and monument the four passes that cross the continental divide between Howse Pass and Yellowhead Pass, both surveyed in 1917, of which it was considered advisable to make a survey—viz., Fortress Lake Pass, Athabaska Pass, Whirlpool Pass, and Tonquin Pass.

There are two passes over the continental divide between Howse Pass and Fortress Lake Pass—viz., Bush Pass and Thompson Pass—but an exploration by the topographical division had made it apparent that their survey in detail would not justify the cost. The first, Bush Pass, is a mountaineer's pass, and the second is a narrow gap closed at its western entrance from Bush River Valley by a deep, cliff-bound canyon.

The programme of the topographical division was to close the gap between where work had been discontinued in 1920 and the Tonquin Pass, to which place it had been carried southward from Yellowhead Pass in 1917. Collaboration, also, was necessary with Mr. Cautley's division to establish the monument-sites and erect monuments above timber-line upon outstanding points of the rock-crests containing the valleys of the several passes.

Survey Operations.

Mr. Cautley outfitted his division at Edmonton and proceeded to Jasper, which place he made his headquarters. He commenced work at Fortress Lake Pass, where he arrived with his party on June 10th.

The topographical division organized at Banff and commenced work by testing cameras and other instruments. On June 9th the party left Banff and travelled by trail to Jasper, where it arrived on the 22nd and proceeded to get ready for the survey.

On June 27th the party, in charge of A. J. Campbell, D.L.S., proceeded up the Athabaska Valley and occupied photographic stations there and in the Sunwapta Valley until July 9th, when the party proceeded up the Whirlpool River to the mouth of the Middle Branch of that stream.

On June 26th Mr. Wheeler left the party at Jasper and travelled to Fortress Lake, where he collaborated with Mr. Cautley in establishing the sites for the several monuments placed to make the boundary across the pass.

Mr. Campbell now explored up the Middle Whirlpool Valley and commenced cutting out a trail. On July 15th a light camp was taken to the summit of Athabaska Pass and two camera stations occupied in the vicinity of Mount Hooker to obtain some missing data.

Mr. Cautley's party arrived at Athabaska Pass Summit on the 19th and on the 22nd had the work sufficiently advanced for the Commissioners to decide upon the location of the monuments defining the boundary across it.

July 21st to 30th Mr. Campbell's party was employed in putting a trail up the valley of the Middle Whirlpool to give access to Whirlpool Pass for our own and Mr. Cautley's parties. From then until August 8th camera stations were occupied in the vicinity of Whirlpool Pass.

The party now cut trail down Goat River, on the western side of Whirlpool Pass Summit, to connect with a trail cut by us in 1920, which led up Goat River to reach Fraser Pass, over which pass a move was now made, and on August 11th the party camped at the head of the Fraser River.

From August 12th to September 2nd, during such time as the weather permitted, the party occupied camera stations on both sides of the Fraser Valley. Bush-fire smoke and, later on, rain and clouds interfered greatly during this part of the work.

By August 18th Mr. Cautley's division had the location at Whirlpool Pass laid out and the Commissioners were able to decide upon the position of the monuments. This was done between the 19th and 23rd and brass bolts and cairns placed on rock points above timber-line.

September 3rd Mr. Campbell moved the climbing party to the mouth of Geikie Creek and from the 5th to the 8th occupied five camera stations. He then moved to the Tonquin Valley and by way of Tonquin Pass, Maccarib Pass, and Marmot Pass arrived at Jasper, the closing of the survey with that of 1917 having been effected.

On September 11th I paid off three members of the party and instructed Mr. Campbell to proceed with two assistants up the valley of the Miette River to its head and to ascertain how

many passes of the continental divide, lying between Yellowhead Pass and Robson Pass, would be likely to require survey and monumenting. He was engaged upon this work until September 21st, on which date he arrived back at Jasper. Meanwhile one man had been left at Dominion Prairie, in the Miette Valley, with the horses, and on completion of the Miette exploration Mr. Campbell and his assistant returned with them and the packers to Banff, reaching that place on October 4th.

On September 13th I joined Mr. Cautley at Tonquin Pass and collaborated with him in locating the monuments across the two passages of the pass and in placing bolts and cairns upon the bounding rock ridges.

Testing the cameras and transits used for the photographic work completed the field season and the balance of the party was paid off between October 6th and 8th.

FORTRESS LAKE PASS.

Mr. Cautley's detailed survey of the pass summit, during which a number of cross-sections were made, showed it to be one of the most peculiar of the many crossing the continental divide. It consisted of a narrow neck or isthmus of land, thickly timbered, of which the greatest width is 35 chains and the least width 17 chains, separating the waters of Chaba River from those of Fortress Lake, the first flowing to Athabaska River and Hudson's Bay, and the last by way of its outlet, Wood River, to the Columbia and the Pacific Ocean. The difference of level of the two bodies of water is less than 20 feet and the floor of the flat is composed of sand and gravel. It is certain, from surface indications, that there is a very considerable seepage from the river to the lake. From crest to crest the valley is 2¾ miles wide.

A large body of good timber stands at the eastern end of the lake and rises high up the enclosing slopes for several miles along the lake-basin. At the west end also there is some good timber, which extends down the valley of Wood River and up the valley of Alnus Creek for a considerable distance. Alnus Creek from the north joins Wood River near its exit from the lake.

While on the way to the pass summit I met an old lumberman who had conceived the project of taking out this timber by way of Chaba River and had been prospecting the possibility of hauling it across the isthmus.

A trail leads from Jasper to Fortress Lake, which is an objective for tourists. It is a very bad trail in spots and entails a dangerous crossing of Sunwapta River near its junction with the Athabaska; there is also a crossing of the Athabaska River close by its junction with the Chaba. To avoid the dangerous Sunwapta crossing Mr. Cautley travelled several miles up that stream and built a good bridge across the Sunwapta Canyon at a place where there is a most wildly picturesque fall and where the canyon is some 30 to 40 feet wide. He then cut out a trail to connect with that up the Athabaska. I was very glad to take advantage of this safe route.

ATHABASKA PASS.

The summit is reached by a rather boggy trail up the South Whirlpool River, with no very steep hills intervening. It is a peculiar fact that, although this line of travel was one of the main fur-trading routes of the North-west and Hudson's Bay Companies during the early part of the nineteenth century, and although hundreds of voyageurs and Indians must have passed over it with their outfits, to-day it is so grown over and obliterated as to be almost indistinguishable, except for a modern horse-track and a few old blazes and rotten logs where cut out of the way and piled on one side many years ago.

At the summit of the pass it is very beautiful in fine weather, park-like alp-lands and open grassy meadows, interspersed with groves of spruce and balsam, are hemmed in by the perpendicular precipices of McGillivray Rock on the east side and the snowy heights of Mount Brown on the west. It is distinguished by three little mountain tarns, of which the centre one is renowned under the cognomen of "Committee's Punch Bowl," with reference to the early days of the fur-traders. From this little lake, which is directly on the watershed, the water flows north to the Arctic Ocean and south to the Pacific. The main source of the Whirlpool River is the outflow from the Kane and Scott Glaciers, which have their origin in ice-fields surrounding Mount Hooker. They join the stream from the pass summit—Arctic Creek—some miles down the valley. The small stream flowing south from the Committee's Punch Bowl to join Wood River is named Pacific Creek.

On the east side McGillivray Rock apparently rises almost sheer for more than 2,000 feet directly from the waters of the Punch Bowl. On the west is a high rocky plateau much indented by ice-cut troughs, holding small ponds and lakelets and rising gradually to the steep walls of Mount Brown. The polished surfaces of these rock ridges and the general appearance of the passage across the divide give rise to the speculation that, in terms of geological time, the pass has here only recently been uncovered by the ice.

It will be remembered that the heights of Mounts Brown and Hooker were originally set by David Douglas, the botanist, at respectively 16,000 and 15,700 feet above sea-level, and for many years have been handed down in text-books at those or higher figures. The two mountains have now been definitely located by the Boundary Survey and their altitudes established at 9,156 feet for Mount Brown and 10,782 feet for Mount Hooker.

The valley at the pass summit is confined by the crest ridge of McGillivray Rock and the south ridge of Mount Brown, 2¼ miles from point to point. As a line of travel across the mountains from east to west it is a rough and awesome road, and in the light of modern methods of travel one can well appreciate the herculean labours of the early explorers.

WHIRLPOOL PASS.

The name "Whirlpool Pass" has not been definitely accepted by the Geographic Board and is subject to change. The Middle Whirlpool River flows in a narrow valley that may well be designated a canyon near its junction with the South Whirlpool. There was no previous access in the form of a trail up the valley, so, as stated above, Mr. Campbell's party set to work to make one in order to assist Mr. Cautley's party to get to the summit of the pass and so avoid loss of time. The making of the trail, which had to be placed high up on the side of the canyon, entailed a lot of hard work, as the location is a difficult one. Mr. Campbell and his men made a very good trail. Once the canyon is passed the going is easier, and a broad, wide-open meadow some 6 or 7 miles up the valley helped greatly. Here there is unlimited pasture for a large number of horses. About 4 miles on lies the summit of the pass, which is thickly timbered with spruce, pine, and balsam of moderate size. There is also a body of good-sized timber near the mouth of the valley.

The approach on both sides of the summit of the pass is rough and rocky and in many places is boggy. On the western side the valley of Goat River is thickly timbered, but the timber is of comparatively small size, chiefly pine and spruce.

The most striking feature of the summit is the inroad of two small rocky gorges which are cut back to the watershed, that division-line passing directly at their heads. They are very wild and picturesque in a miniature sort of way. The sky-line limits of the valley are 2 miles apart in an air-line.

FRASER RIVER VALLEY.

Some 3 miles down Goat River Valley from the summit of Whirlpool Pass a tributary valley leads northward over a high, open grass-land divide, which separates its waters from the waters of Fraser River and forms the beginning of a broad valley leading north-west, in which the initial source of Fraser River flows. The watershed parallels the Fraser Valley and by occupying stations from side to side it was a simple matter to map its location. The valley is described in the report of the Surveyor-General for 1920.

Some 20 miles down the valley Geikie Creek comes in on the east from a snow-bound amphitheatre at the southern base of Mount Geikie. On the north side of the Geikie Range lies the wide-open valley of Tonquin Pass, across which the watershed is located, passing close to the west end of Moat Lake.

Scenically it is a very beautiful spot, showing wide-open, grassy alp-lands, surrounded on all sides by snowy peaks of rugged and bizarre formation. The Geikie Range, of which Mount Geikie (10,854 feet) is the key-note, rises in sheer inaccessible cliffs, presenting a wonderful array of pinnacles, towers, ramparts, and serrated crests.

In the centre of the pass stands Tonquin Hill (7,858 feet), and I know of no more wonderful and impressive view of primitive nature at its wildest and best than can be had from the summit. Tonquin Hill divides the pass into two passages, of which the northern one has been named Vista Passage, owing to the fact that it lies close below Vista Peak; the southern one has been named Moat Passage, on account of Moat Lake filling up a considerable part of it. The entire width of the valley at the summit of Tonquin Pass from crest to crest of the bounding rock-ridges

is 3¼ miles in an air-line. The Moat Passage is a little over 2 miles and the Vista Passage 1¾ miles; the last two estimates are to Tonquin Hill.

Here also the impression of geologically recent uncovering of the ice is conveyed, for, upon close investigation, the wide-spreading grassy meadows are found to be thickly strewn with large boulders and marshy places; and it would seem that the entire valley had, at some bygone age, been filled in by rock-slides, which as yet are insufficiently covered by humus and verdure to be easy for travel.

This valley was covered by the 1917 survey south from Yellowhead Pass and on the east by Mr. Bridgland's survey of Jasper Park, which lies on the Alberta side of the watershed; so that our survey of the Fraser Valley connected with it and completed the survey of the watershed from the Canadian Pacific Railway to the Canadian National Railways.

GAME AND FISH.

Both game and fish were more apparent than in previous years. Small deer were seen frequently while passing over the trails, and particularly so at the summit of Fortress Lake Pass. The high valleys above the lake-basin are the haunts of caribou, and moose have also been seen in the vicinity of the eastern end of the lake.

Small deer were seen at Athabaska Pass and caribou and smaller deer in the Fraser Valley and in Tonquin Pass and its surrounding open, grassy valleys. Caribou and sheep were noted at the head of the Miette Valley. Mountain-goats are frequently seen high up on the peaks throughout.

Brown bear were plentiful in the vicinity of Jasper, and, in fact, may be encountered at any time in the valleys. Grizzlies are not so much in evidence, but are to be seen occasionally.

Some large trout up to 5 lb. weight were caught in the South Whirlpool River and up to 3 lb. in the Middle Whirlpool Valley, where the stream meanders in a tortuous, deep channel through the wide meadow referred to above. A smaller size can be had in plenty where the stream has a swifter and more shallow course. It is likely that all the tributary streams of the Whirlpool and of the Athabaska below the canyon carry trout.

GENERAL REMARKS.

The section of mountains lying between Fortress Lake Pass and Tonquin Pass contains some very fine scenic effects, particularly those bordering on Wood River and between it and Athabaska Pass. A fine region also lies at the heads of the Middle and North Whirlpool Rivers right up to Tonquin Pass, where the mountains are better known.

All this wide area of mountainous country is difficult of access at present. Trails are few and far between and such as are in existence are little better than horse-tracks and furnish the worst kind of travel. They are for the most part rocky and boggy and the axe is frequently called into requisition. The trail leading from Tonquin Pass to the Athabaska Valley is the worst I have ever seen, so much so that it is only possible to ride over it at intervals.

All the valleys are more or less heavily timbered, but, with some few exceptions, the timber is so located as to make it a negligible quantity owing to inaccessibility. The chief exceptions to this are the bodies of timber at both ends of Fortress Lake and those tributary to the main Whirlpool River. In the first case it depends upon the possibility of being able to use the Chaba and Wood Rivers for transportation purposes. There are some good stands of merchantable timber in the Fraser Valley, but this stream above its entrance into the valley of Yellowhead Pass is guarded by a deep, precipitously walled canyon and it is questionable if it will permit of the passage of logs.

The second section of the survey between the Canadian Pacific Railway and the Canadian National Railways is now finished and as soon as possible the report and maps will be completed and published.

I have, etc.,

ARTHUR O. WHEELER,

Interprovincial Boundary Commissioner.

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