

PROVINCE OF ALBERTA

Research Council of Alberta.

Report No. 23.

University of Alberta, Edmonton, Alberta.

SOIL SURVEY DIVISION

Preliminary Soil Survey
Adjacent to the Peace River,
Alberta
West of Dunvegan

BY

F. A. WYATT and O. R. YOUNGE.

Printed by order of
THE LEGISLATIVE ASSEMBLY OF ALBERTA



EDMONTON:
PRINTED BY W. D. McLEAN, KING'S PRINTER
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LETTER OF TRANSMITTAL.

HONOURABLE J. E. BROWNLEE,
Premier of Alberta,
Chairman, Research Council of Alberta,
Edmonton, Alberta.

SIR:—I have the honour to transmit a report entitled "Preliminary Soil Survey Adjacent to the Peace River, Alberta, West of Dunvegan".

This report contains the results of a soil survey conducted by Mr. O. R. Younge's party during the summer of 1929 for an area of 56 miles east and west by 78 miles north and south. A soil map in colours accompanies the report.

This report should be of great assistance to the people already situated in the surveyed area, but most especially to intending settlers who will occupy these lands in the near future.

Respectfully submitted,
F. A. WYATT.

Department of Soils,
University of Alberta,
Edmonton, May 22nd, 1930.

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MAPS AND ILLUSTRATIONS

- Soil survey map west of Dunvegan between Clear Hills and Saddle
Hills. Scale 1 mile to 4 inches.....(In pocket)
- Six plates containing thirteen figures.

Preliminary Soil Survey Adjacent to the Peace River, Alberta West of Dunvegan*

BY

F. A. WYATT and O. R. YOUNGE.

DESCRIPTION OF AREA.

The area covered by this report is located between Dunvegan on the east and the Alberta-British Columbia boundary line on the west. It extends from the Clear hills on the north to the Saddle hills on the south. The area surveyed is located in townships 76 to 88 inclusive and ranges 4 to 13 inclusive, west of the 6th meridian. The dimensions of the area are 56 miles (east and west) by 78 miles (north and south). The extent of the area above outlined is about 113 townships (2,614,200 acres).

The general topography of the country is unobscured by rolling, especially in so far as the plain and plateau parts are concerned, and it is here the better soils are found.

However, there is considerable rough land found in the surveyed area. The most important ranges of hills are the Clear hills, about 20 miles north of the Peace river, and the Saddle hills, about 30 miles south of the Peace river. The Clear hills have an elevation of about 3,600 feet and are about 700 feet above the adjacent plain, while the Saddle hills have an elevation of about 3,000 feet and are about 700 feet above the adjacent plain. Both the above ranges of hills are rough and the soil is infertile—altogether unsuitable for agricultural purposes other than some grazing. They should be set aside as forest reserves.

The only other elevation of importance is the Blueberry hill, with an elevation of 2,600 feet. This plateau lies to the north of the Saddle hills and is separated from that range of hills by a wide valley. The topography of the Blueberry plateau is for the greatest part suitable for cultivation, but the soils are in general only of medium fertility.

The area is drained by the Peace river and its tributaries. The Peace river enters the surveyed area in Tp. 82, R. 13, and flows in a northeasterly direction until it reaches a point in Tp. 84, R. 7, from which it bends southeasterly and continues in this direction, leaving the surveyed area in Tp. 80, R. 4, west of the 6th meridian. The area as a whole is well drained by a network of channels, most of which enter the Peace river through deeply eroded stream beds. Where these tributary channels enter the Peace they are as deep and

*This is the first soil report published by the Research Council of Alberta.

in some instances as wide as the Peace itself. These tributary channels, except for the larger ones, rapidly decrease in depth and width with an increase in distance from the banks of the Peace river until at a distance of from 4 to 6 miles they merge into the level plain.

The principal streams entering the Peace river from the south are the Pouce Coupe river, Hamelin creek, Ksituan river and the Spirit river. Those entering from the north are the Clear river, Montagneuse river and Hines creek. The Clear and the Pouce Coupe rivers are by far the most important of these streams, as they drain over half of the surveyed area.

In certain parts there are considerable areas too flat for good drainage, and as a consequence contain much muskeg and willow swamp.

The chief stands of merchantable timber occur in the area designated as "Proposed Pouce Coupe Forest Reserve", which lies south of the Peace river, between ranges 6 and 13, west of the 6th meridian. The main timber belts occur in Tp. 78, R. 8 to 10, Tp. 77, R. 10, Tps. 80 to 82, R. 11, Tps. 82 and 83, R. 10, as well as a small belt in Tp. 84, Rgs. 7 and 8. A small timber belt also exists in the folds of the south slope of the Clear hills in Tp. 88, R. 8. Small patches of pine and spruce are to be found scattered throughout the Saddle hills and the Blueberry hill, especially in the folds of the western and northern slopes. The above ranges of hills have, to a large extent, been repeatedly swept by fires, and as a consequence the timber resources have been greatly depleted. Much young pine, spruce and poplar restocking is now taking place over these hills. The Saddle hills, consisting chiefly of 3rd class wooded soil, carry some grass vegetation which might eventually be of some value for summer pasture; the Clear hills on the other hand are practically devoid of pasture above the line between 2nd class and 3rd class wooded soils.

The forest covering on the area, excluding the hills and timber belt above mentioned, consists mostly of poplar and willow with scattered areas of spruce and pine. The presence of brule and the remains of decayed trees clearly indicate that the whole area of 1st and 2nd class wooded soils, as well as parts of the parkland soils, was at one time rather heavily wooded.

The cost of clearing on the arable lands varies from very heavy to very light. In some instances clearing involves only the removal of scattered downfall. However, most of the clearing will fall in the medium to heavy class. In general, the better soils require less clearing than the soils of poorer quality. This condition is attributed to the fact that the better soils have not supported a heavy covering of trees for as long a period of time as have the poorer soils, and fires have been more effective in the heavily grassed areas of the parklands in keeping down the tree growth.

TRAVERSES.

Under the heading of traverses will be found a more detailed account of the location, topography, soil, vegetative covering, settlement, etc., of the various areas. The traverses are as follows:

1. Tp. 76, Rgs. 13 to 11.
2. Tp. 77, Rgs. 13 to 7.
3. Tp. 78, Rgs. 13 to 6.
4. Tp. 79, Rgs. 13 to 5.
5. The region north of Tp. 80 and south of the Peace river, between the British Columbia-Alberta boundary and the Peace river in R. 6.
6. The region lying between Hines creek and Peace river, from Tp. 80 to Tp. 84, R. 5.
7. From Dunvegan to the Montagneuse river in Tp. 85, R. 5.
8. From the Montagneuse river in Tp. 85, R. 5, to the elevation 1 mile west of Sec. 1, Tp. 87, R. 9.
9. From the elevation 1 mile west of Sec. 1, Tp. 87, R. 9, to the British Columbia-Alberta boundary in Sec. 32, Tp. 86, R. 13.
10. The area lying between the Clear river and the British Columbia-Alberta boundary, from Sec. 36, Tp. 85, R. 13, to the Peace river in Sec. 1, Tp. 83, R. 12.
11. From the Clear river in Sec. 32, Tp. 84, R. 11, to the Montagneuse river in Sec. 36, Tp. 84, R. 6.
12. From the point of intersection of the base line with the British Columbia-Alberta boundary in Sec. 33, Tp. 88, R. 13, to Sec. 36, Tp. 88, R. 4.

Traverse 1: Tp. 76, Rgs. 13 to 11. Good second class wooded soil from British Columbia boundary to 3,000 foot elevation $1\frac{1}{2}$ miles east of British Columbia boundary. Topography of W2 is rolling, in a series of long swells (east and west). Lands slope toward Swan lake on the southwest and to Pouce Coupe river on the north. The covering is only medium to light willow and poplar up to 5 inches. Cost of clearing estimated at \$5.00 to \$10.00 per acre. Area near boundary about 60% scrub willow. Mesa (W3) extends east 3 to $3\frac{1}{2}$ miles, then gives way to W2 three-fourths of a mile wide, and an arm of W1 along drainage channel. Approximately 1 mile east of first plateau occurs an extension of the Saddle hill range. This promontory is about 1 by $2\frac{1}{2}$ miles. The Saddle range proper begins about the centre of Township 76, Range 12, and extends east. The west border cuts the township line near Sec. 34, Tp. 75, R. 12, other points being in R. 13 and Sec. 32, Tp. 76, R. 12. A narrow strip of mixed swamp and muck extends back one-quarter to one-half mile from main drainage channels. This constricted area is suitable for hay and pasture, but is considered too low for small grain production. About 50% open meadow; remainder, heavy clearing—mostly 10-inch spruce, poplar and willow.

The Saddle range is rolling to rough, and is cut by frequent erosion courses. Area has been covered with thick stand of pine of which one-third now remains (6 to 8-inch). Pine burns are

now restocking with alder and aspen. Much muskeg and swamp near streams. Soil in this area nearly devoid of A₁ horizon; in many places fires have left exposed bare gravel, clay and sand. Area is a poor W3 and wholly unsuited for settlement.

Some settlement on W1 and W2 near boundary. Road construction in this area presents no serious difficulty. Areas fairly well supplied with running surface water; with little expenditure, adequate reservoirs for storage of run-off easily constructed. W1 and W2 areas considered fit for settlement.

Traverse 2: Tp. 77, Rgs. 13 to 7. Erosion course of Pouce Coupe river below 2,600 foot contour in general is W2 soils. Area of W2 soils south of Pouce Coupe river in Tp. 77, R. 13 and W. ½ of Tp. 77, R. 12, is a continuation of the W2 to the south. The E. ½ of Tp. 77, R. 12, and eastward below 2,600 foot contour is rolling to rough topography. The W2 area adjacent to the Pouce Coupe river pinches off about half way across Tp. 77, R. 9, giving way to the large W3 area of the Saddle range. North of the Pouce Coupe river the areas below 2,600 foot contour are undulating, fair quality W2 soils. These soils are somewhat higher in silty material than those to the south. The covering is mostly heavy clearing, costing about \$15.00 to \$25.00 per acre. Timber is chiefly 6 to 10-inch aspen with 10% of 10 to 15-inch spruce and pine. About 3 miles east of the Tp. 77, R. 13 outline, the line of the W3 area swings nearly north, giving way to a seven-eighths mile wide belt of W2. The W2 in this area is level to undulating and contains many large shallow muskegs, especially near the river. The covering is medium, being 3 to 6-inch aspen and willow, with 10 to 20% open. Cost of clearing is estimated at \$10.00 to \$15.00 per acre. The W2 area east of the lake in T p.77, R. 11, has been fire swept and is about 30 to 40% open. Clearing consists of brule and poplar restocking, and can be done at \$8.00 to \$12.00 per acre. This region also contains much muskeg, estimated at 8 to 10% of the total area.

The W3 soils occur about 3 miles northeast of the lake in Tp. 77, R. 11, the south outline paralleling the 2,800 foot contour until it cuts the Pouce Coupe river in Tp. 77, R. 9. This W3 area extends east to include the major portion of Tp. 77, R. 7. On the west end, this W3 area is rolling to undulating, cut here and there by wide shallow erosion courses. The plateau is comparatively level on top. The east end of this area is more rugged in topography, consisting of a network of deep erosion courses separated by high, steep ridges. Indications are that this whole W3 area has been repeatedly swept by fires, hence very little timber now remains. A belt of (10 to 30-inch) timber, 3 by 6 miles, occurs in Tp. 77, Rgs. 10 and 9. The bulk of the area is restocking with a sparse growth of aspen, alder, willow and a small percentage of pine and spruce. Very little grass occurs on the ridges and table lands, and about the drainage channels it is only sparse. As a potential grazing area this region is only of third rate importance.

The soils of this area are characterized by almost a complete absence of A₁ horizon, the organic material present frequently being only a thin covering of moss and leaves. Consequently the leached

layer of unsorted material, gravel, clay or sand generally lies exposed to view.

The whole W3 area is considered as unsuited for agricultural pursuits other than forestry, excepting 2 to 3% of total area occurring as small isolated patches of good W2 soils.

Traverse 3: Tp. 78, Rgs. 13 to 6. Between the British Columbia boundary and a line drawn through a point $\frac{1}{4}$ mile south of Sec. 19, Tp. 78, R. 13, and $\frac{1}{4}$ mile east of Sec. 32, Tp. 78, R. 13, and produced northeast in a huge curve, lies an area of good W1 soils. This area constitutes the outer fringe of the second class prairie soils in the Pouce Coupe and Rolla areas in British Columbia. (For further information regarding W1, see report on traverse 4.)

Between the British Columbia boundary and the east line of the W1 area, and up to the 2,500 foot contour of the plateau farther east, lies a narrow belt of W2 soils. This belt extends north and east to within $\frac{1}{2}$ mile of Henderson creek in Sec. 24, Tp. 79, R. 13, on the one hand and Sec. 36, Tp. 78, R. 13, on the other hand. The elevation (W3) above the 2,500 foot contour extends east about 4 miles to a line through Sec. 34, Tp. 77, R. 13, north and east to Twin lakes in about Sec. 2, Tp. 78, R. 12, then north and west 3 miles, and finally northeast to a point about $\frac{1}{2}$ miles to $\frac{3}{4}$ miles south of the railway grade in Sec. 11, Tp. 79, R. 12. (This line follows a contour line not shown on the maps.) From the above line to a line through Sec. 35, Tp. 77, R. 11, north to within $\frac{1}{4}$ mile of the railway grade in Sec. 12, Tp. 79, R. 11, lies an area connecting the W2 area to the south and the W2 area to the north. The W1 and W2 soils near the British Columbia boundary are now being settled. These soils are nearly level near the boundary, but are more rolling and rough as one approaches the plateau to the east. Some muskegs occur near the base of the plateau. The covering is chiefly 3 to 8-inch aspen with much heavy willow and alder.

The W3 area, which comprises the plateau, is rolling to rough, consisting of a series of deep, wide valleys and intervening narrow ridges and hills. This area is too rough for cultivation and the valleys are 50 to 60% muskeg or swamp. Covering is chiefly 10 to 12-inch aspen with 30 to 40% of 8 to 12-inch pine and spruce. In some regions there are solid belts of pine. Very little grass occurs. Soils are inclined to be gravelly and silty, with only a thin A_1 horizon.

The W2 to the east of this plateau has an undulating to rolling topography, with ridges running north and south and interspersed with many narrow belts of muskeg. The muskeg is estimated to cover from 15 to 20% of this area. The covering is medium to heavy clearing (with 10 to 15% open area), consisting of 3 to 8-inch aspen and 15% 6 to 9-inch pine. The muskegs usually carry 3 to 6-inch spruce and tamarack. Cost of clearing is estimated at \$10.00 to \$15.00 per acre. Running water is plentiful in early summer, but negligible in the dry, late summer and fall. Grasses are fairly tall, but appear rather thin on the ground. Area is only secondary grazing lands and should not be settled until the larger blocks of W2 lands have been occupied.

The W3 extension in Tp. 78, R. 10, is about 2 to 3 miles wide, the north limits extending from Sec. 1, Tp. 79, R. 11, south and east to about Sec. 17, Tp. 78, R. 10, east to the curve in the railway grade in Sec. 16, Tp. 78, R. 10, and then south and east to a point in Sec. 26, Tp. 77, R. 9. The narrow belt of W3 in Tp. 78, R. 10 and 11, is restocking with 1 to 4-inch aspen and 10% of 1 to 3-inch pine and spruce. Some remnants of the old forest still prevail in the form of patches of green timber and large area of brule. This extension often lacks the A₁ layer, the A₂ horizon (7 to 12 inches) frequently lying exposed to view.

North of the W3 area in the Saddle range lies a huge area of W2 soils, which extends north to the Peace river in R. 10, and east to a point in Sec. 25, Tp. 80, R. 9, finally tapering off in Sec. 17, Tp. 79, R. 6.

Within this huge area lies a small area of muck soils, extending across Tp. 78, R. 9. This area occurs near the railway grade, and is from ½ to 3 miles wide, by about 6 miles long. The soils in this basin are of peat origin, now sufficiently decomposed to produce a rank growth of slough grasses and willow. Owing to the location being a basin deficient in drainage, this choice area is deemed unsuited for grain growing. It is well suited for livestock, however.

The W2 soils in Tp. 78 are mostly heavily wooded with 8 to 20-inch aspen, 10 to 30-inch spruce and pine, and considerable willow. Large patches of brule occur where the timber has been fire killed, such as in the south half of Tp. 78, Rgs. 8 and 9. The timbered areas can be cleared only at excessive cost, possibly \$20.00 to \$50.00 per acre. The fire killed areas can be cleared at \$8.00 to \$15.00 per acre. Streams run only in spring and early summer.

A narrow ribbon of W1 extends from the muck area in Tp. 78, R. 9, to Sec. 3, Tp. 78, R. 8, where it widens to the east including the major portion of Tp. 78, R. 7. The southwest extremity consists of fire killed or semi-open timber, while the remainder is heavy clearing. Cost of clearing approximately \$20.00 to \$50.00 per acre. The timber is 70% aspen 7 to 14-inch, and 30% pine and spruce 8 to 18-inch. There is a heavy undergrowth of willow. Many small springs, originating in the Saddle hills, supply water during the early summer, but dry as the season advances. Provision might easily be made for storing spring run-off by damming coulees. The soil profile shows an A₁ of 4 to 5 inches and an A₂ of 2 to 4 inches.

The west extremity of the A2 is in the east outline of the W1, which cuts the township line in Sec. 31, Tp. 77, R. 6, curves north and east and cuts the range line at about the intersection of the range line with the railway grade in Sec. 25, Tp. 78, R. 7, swings west and north through Sec. 1, Tp. 79, R. 7, and finally joins the Blueberry area in about Sec. 17, Tp. 79, R. 6.

The A2 area in Tp. 78, R. 6, is all being actively farmed at the present time, settlement having taken place some 20 to 25 years ago.

The water supply in this area is taken care of by storing run-off in reservoirs, by streams or by shallow wells. These methods possess certain disadvantages and are usually inadequate.

Traverse 4: Tp. 79, Rgs. 13 to 5. The area traversed by the Pouce Coupe river and the Henderson creek systems and immediately adjacent to these channels, is a level to undulating table land of W1 soils. This W1 belt stretches from the British Columbia boundary east to the Blueberry plateau.

Much of this area, comprising eroded portions along the streams and tributary coulees is too rough for cultivation. In Tp. 79, R. 13 and Tp. 80, R. 13, the valley of the Pouce Coupe varies from 1 to 2 miles in width and 300 to 600 feet in depth. Much of the area in valleys and coulees is barren exposures or covered with bush, consequently the area otherwise suited only for pasture is materially reduced. The Pouce Coupe river flows all summer, whereas all the tributaries (in this region) coming from both sides, dry during middle summer (about July).

The covering is chiefly a fire killed poplar and willow association with 30 to 40% being open stretches. Considerable stretches of swamp willow occur on the degenerated peat formations adjacent to the east border of the W1 area. Clearing is light to medium. The cost of clearing is estimated at \$8.00 to \$12.00 per acre. The tongue of W1 soils in the basin in Tp. 79, R. 11, is about 20% open meadow, the remainder being heavily wooded with 5 to 9-inch aspen and willow. Cost of clearing this area is estimated at \$15.00 to \$20.00 per acre.

Most of the open stretches in this region have been settled during 1929, the area having been subdivided during that season. Settlers are experiencing considerable difficulty with the supply of water. Shallow wells have been dug in swamps and muskegs, but are generally unsatisfactory as to constancy and quality of water. The topography is too level to afford much relief by trapping of run-off, except in the coulees adjacent to the Pouce Coupe river.

Lying to the east of the W1 area near the British Columbia boundary is a huge expanse of W2 soils, which has its eastern boundary a line through these points: From Sec. 1, Tp. 79, R. 7, through Sec. 18, Tp. 79, R. 6, west and northwest through Sec. 17, Tp. 79, R. 7, and Sec. 4, Tp. 80, R. 8, to cut the base line in Sec. 35, Tp. 80, R. 9. This area includes the south two-thirds of the Blueberry plateau. It is undulating to level in topography, with a series of sloping to steep escarpments on the west edge in Tps. 79 and 80, R. 11. Near the center of Tp. 80, R. 10, is a large floating muskeg, which is the source of the Hamelin creek. Small dry muskegs are fairly common throughout the area, but do not exceed 5% of the total.

Belts of timber occur along the western slopes of the Blueberry plateau and also south of the Ksituan river in Tp. 79, Rgs. 9, 8 and 7. Of these two timber belts only the latter is of commercial importance. The latter belt is an extension of the timber area in Tp. 78, R. 8 and 9 (see traverse 3). Over almost the whole remaining area sufficient local timber is obtainable for the building needs of settlers. With the exception of the timber belts outlined, the area as a whole is medium to light clearing. The cost of clearing of this area is estimated at \$8.00 to \$15.00 per acre. The clearing is somewhat heavier at the lower levels than, for instance,

on the top of the plateau where there are 60 to 70% open stretches with only scrub willow and poplar restocking. A fair covering of grass occurs here.

This area, like the W1 to the west, is devoid of water over the greater portion during the late summer months. Construction of reservoirs and storing of ice from the lakes will undoubtedly have to be resorted to in order to insure an adequate supply of water.

The construction of roads should present no serious difficulty, excepting for an outlet to Rolla, British Columbia, over the Pouce Coupe river. The most feasible crossing appears to be in Sec. 10, Tp. 80, R. 13.

This W2 area, because of its accessibility and ease of clearing, should be thrown open for settlement as soon as the soil areas of better quality have been settled, and not before.

A small W1 area lies between the W2 area and a line drawn from the Ksituan in Sec. 14, Tp. 79, R. 7, parallel to the W2 outline to about Sec. 2, Tp. 80, R. 8, and then west to Sec. 4, Tp. 80, R. 8. This area, like the extension of the area to the north ending in Sec. 17, Tp. 80, R. 8, is a transition belt between the badly leached W2 soils and the less badly leached A2 soils of the Spirit River district. Both these patches are heavily timbered with spruce and aspen. The cost of clearing these areas would run about \$25.00 to \$50.00 per acre. These areas might well be reserved for forestry purposes until such time as the timber is fire killed.

Lying to the east of the various W1 and W2 areas described, and south of the Hamelin creek (the two lines joining in Sec. 17, Tp. 80, R. 8, and about Sec. 29, Tp. 80, R. 8), is the north extremity of the A2 area which extends east and south toward the Birch hills. The topography is undulating to level with deep-wide canyons near the Peace river. The Ksituan, Howard and Dunvegan erosion channels are tremendous coulees. The area to the north of the Ksituan is unfortunately situated, in that it has no communication with railway except by the round-about way through Blueberry and south to the old railway grade in about Sec. 26, Tp. 78, R. 8, and then east to Spirit River. A market road serving this area could be constructed at some cost across the Howard and the Ksituan rivers, following the old pack trail through Sec. 1 to 15, Tp. 79, R. 7.

Excepting the small portion in Tp. 80, R. 8, and the south halves of Tp. 79, Rgs. 6 and 5, the whole area is medium to heavy clearing. The bush progressively becomes denser as one approaches the Peace river. Most of the heavy bush east of the central line through Tp. 80, R. 7, has been killed by recent fires, the timber still standing. The clearing is estimated to cost \$8.00 to \$20.00 per acre, unless further fires completely wipe out the timber and brule.

This area also lacks surface water, but this shortcoming may be somewhat alleviated by the construction of reservoirs at the heads of the many coulees.

Much of this area, especially in Tp. 79, Rgs. 7 and 6, has been settled during 1929.

The soils adjacent to the Peace river and back for a distance of 4 to 5 miles are not quite as good as those further removed. This

feature is attributed to depletion of the A₁ horizon by more continuous forest growth. About 2 to 5% of the area is swamp and muskeg, most of which occur in Tp. 80, R. 7. The area carries an abundance of summer pasture, but very little forage suitable for hay.

The area in Tp. 80, R. 8, has been settled since 1919 and good crops are being grown there every season.

Traverse 5: The region north of Tp. 80 and south of the Peace river in R. 6. The W1 area adjacent to the British Columbia boundary in Tp. 80, R. 12 and 13, extends north to the Peace river. This area extends east from the British Columbia boundary to a line drawn through Sec. 32, Tp. 80, R. 11, curving west of north through a point about Sec. 36, Tp. 81, R. 12, then swinging northeast to intersect the canyon in about Sec. 1, Tp. 83, R. 11.

A network of channels drain the whole area. These channels become deep, wide canyons within 4 to 6 miles of the Pouce Coupe and Peace rivers. A rolling topography characterizes the area lying west of the Pouce Coupe. Small, dry sloughs are quite plentiful. Recent fires have killed the medium to heavy growth of 5 to 9-inch aspen and willow commonly found. Cost of clearing should not exceed \$8.00 to \$15.00 per acre.

The topography east of the Pouce Coupe river is level to gently undulating, with belts of dry willow swamp alternating with belts of 5 to 14-inch spruce and aspen. The clearing is heavy and will cost \$15.00 to \$30.00 per acre. Very little open ground is to be found anywhere. No evidence of general fires having swept the area for 10 to 15 years. The timber is of no commercial importance, except a 15 by 4-5 mile strip adjacent to the Peace river, beginning in Sec. 35, Tp. 82, R. 12, and extending northeast. The timber is 50% pine 10 to 20-inch, 15 to 20% spruce 12 to 30-inch, the remainder being 8 to 12-inch aspens.

Lying to the east of the W1 area described, is an extension of the W2 area comprising the Blueberry plateau. The east limit of this area is a line produced from Sec. 35, Tp. 80, R. 9, to a point about 3 miles north of Sec. 36, Tp. 80, R. 10, then curving northwest 4 miles and northeast 4 miles through a point about 8 miles north of Sec. 36, Tp. 80, R. 10, then northeast 3 miles and west of north 4 miles, and again northeast to join the Peace river in about Sec. 28, Tp. 83, R. 9.

The topography is undulating to level, with large stretches of willow swamp. The north half of the area is deficient in drainage and hence contains a large muskeg system in Tp. 82, R. 10. The Blueberry plateau extends about 3 miles north of the base line in Sec. 31, Tp. 81, R. 10, and then merges with the plain.

A 4 to 5 mile wide belt, adjacent to the east limit of the area and extending 10 miles north of the base line, is 20 to 60% open stretches with only scrub clearing. Cost of clearing this belt is estimated at \$5.00 to \$10.00 per acre. The regions to the west and north of this belt changes from medium to heavy clearing of 80% aspen 4 to 12-inch, and 20% spruce and pine 6 to 14-inch. Clearing of this heavy bush is estimated at \$15.00 to \$30.00 per acre.

Extending from the east limit of the W2 soils to the Peace river lies a broad expanse of W1 soils. Its south limit is the Hamelin creek, while on the north it parallels the south contour of an elevation in Tp. 84, Rgs. 7 and 8. This elevation is a rolling pine-covered W3 area.

The topography of the W1 area is level to undulating, with a slightly elevated ridge extending from about Sec. 2, Tp. 82, R. 9, to Sec. 2, Tp. 83, R. 8. The area comprising this ridge is of rolling topography.

The level stretches on the west and south of this ridge contain many large willow flats. Beaver dams, some of which contain water, are frequently encountered. (Plate II, Fig. 2.)

The areas west and south of the low ridge carries a park-like association of 3 to 8-inch aspen, willow and scattered spruce. Approximately 40 to 60% of this belt is open stretches carrying scrub willow. Cost of clearing is estimated at \$5.00 to \$10.00 per acre. This was fire swept in 1928. Another fire will practically reduce cost of clearing to the lowest figure quoted. The area east of the low ridge is chiefly heavy poplar park with 4 to 10-inch aspens and willow. About 20 to 30% of the area is open stretches. Cost of clearing this is estimated at \$10.00 to \$15.00 per acre. The area north of the ridge and the ridge itself are covered with heavy bush, mostly 6 to 10-inch poplar and willow, interspersed with 5-10% spruce and pine. Cost of clearing this area is estimated at \$15.00 to \$30.00 per acre. About 10 to 20% of Tp. 83, R. 8 and 9, is shallow peat or wet willow swamp. Drainage to the Peace river may readily be effected. The quality of the soils of this W1 area improve as one approaches the Peace river on the east.

The entire area north of Tp. 80 and south of the Peace river requires roads before settlement can take place. Roads connecting with the outside may readily be constructed along the base line in Tp. 80 to connect with Rolla, British Columbia, and south across the Blueberry plateau, crossing the Hamelin creek in Tp. 80, R. 9, to connect with the road to Spirit river. In the event that railway extension north of the Peace river is carried forward to the British Columbia boundary, ferries could be installed at Sec. 35, Tp. 82, R. 12, Tp. 83, R. 9, and Tp. 83, R. 7, or Tp. 82, R. 6.

The water supply is meagre throughout the entire area. The Hamelin creek and the Pouce Coupe river are the only streams flowing throughout the season. Run-off is not readily stored because of the flat nature of the area. Reservoirs may be constructed in the canyons near the Peace river, but this will prove of help to only a small section of the area. No lakes are near enough to be of any value as source of ice for storage. The whole question of water supply undoubtedly resolves itself into the operation of community wells until such times as settlers privately can undertake the expenditure of drilling for water at depth.

The W1 soils adjacent to the Pouce Coupe river and those north of Tp. 80 in Rgs. 7 to 9 comprise the most promising soil areas south of the Peace river as yet not settled. These lands preferably should be settled prior to any of the W2 areas, even though the latter possess superior communication facilities at the present time.

Traverse 6: The region lying between Hines creek and Peace river, from Tp. 80 to Tp. 84, R. 5. This area of A2 soils is an extension of the A2 soils near Fairview. The area west of Hines creek is not as good as that near Fairview, because the former has a shallower A₁ horizon and a thicker A₂ horizon.

The topography is undulating to rolling and is characterized by deep erosion channels extending inland from the Hines creek and the Peace river. The Hines creek channel varies in width from 1/3 mile at Sec. 28, Tp. 83, R. 5, to 1 1/4 to 1 1/2 miles at Sec. 6, Tp. 81, R. 4. The rough lands (Plate IV, Fig. 3) comprising these eroded areas are only third class grazing lands. Extending northwest to the mouth of the Montagneuse from Sec. 31, Tp. 82, R. 5, lies a 1 1/2 to 2 mile wide strip of rough W2 soils. To the north of this again, lies an area of W1 soils which meet A2 soils in a line drawn from Sec. 32, Tp. 83, R. 5, to the Montagneuse river in Sec. 36, Tp. 84, R. 6.

The covering of the A2 area is mostly scrub poplar and willow, with scattered bluffs of 4 to 8-inch aspens. Cost of clearing is estimated at about \$8.00 to \$15.00 per acre. The covering of the W2 is open 3 to 6-inch aspen, with much brule. Dry sloughs are numerous. The W1 is flat to undulating, and is covered with a heavy growth of 1 to 4-inch aspens. Cost of clearing is estimated at \$8.00 to \$18.00 per acre.

Considerable new settlement has taken place during 1929.

The water supply in this region appears wholly dependent on reservoirs and beaver dams. Roads are cheaply and readily constructed, except over the numerous canyons.

Traverse 7: From Dunvegan to the Montagneuse river in Tp. 85, R. 5. Extending north from the Peace river to a line drawn through Sec. 10, Tp. 82, R. 5, to Sec. 2, Tp. 83, R. 4, lies the west portion of the Fairview A2 area. The belt adjacent to the Peace river is rolling, but further inland this soon gives way to a level topography. The areas near the Peace river and Hines creek are cut by deep erosion channels. Practically the whole arable area is under cultivation.

Extending north from the limits of the A2 area and within the curve of the Hines creek, lies a W3 area fringed by mixed W3 and W2 soils. The heart of the region is a sand dune and peat swamp area centering on Sec. 25, Tp. 82, R. 5. The topography consists of level muskegs separated by ridges of brown sand and low sand dunes. At the center of the area there is no A₁ horizon, but towards the edges this horizon is present. Owing to repeated fires, this region is now devoid of timber, but is restocking with aspen and pine. This area has no agricultural significance. A small marl deposit (8 inches thick) was found in a swamp in Sec. 19, Tp. 82, R. 4. Further search would undoubtedly reveal other deposits.

The W2 area between Lake George and the east outline of Tp. 83, R. 4, is a rolling to rough transition area between the W3 to the south and the A2 to the north. The ridges in this small area are quite stony, gravelly and inclined to be sandy. The depressions

are inclined to be swampy. Farming in this area is deemed a somewhat doubtful venture.

From the Hines creek and the W1 area to the west and extending north to the edge of the Clear hills and northwest to the Montagneuse river, lies an extension of the A2 area further northwest. The north boundary of the A2 area goes through the following points: From Sec. 11, Tp. 84, R. 4, in a U-curve through Sec. 31, Tp. 84, R. 4, to a point in Sec. 20, Tp. 84, R. 4, northwest through a point $\frac{1}{4}$ miles west of Sec. 36, Tp. 84, R. 5, to a point about $\frac{1}{2}$ mile east of Sec. 14, Tp. 85, R. 5, then a big U-curve through a point about $2\frac{1}{2}$ miles east of Sec. 12, Tp. 86, R. 5, and $\frac{1}{4}$ mile south of Sec. 13, Tp. 86, R. 5, to a point about the center of Sec. 34, Tp. 85, R. 5.

The A2 area is undulating to gently rolling. The covering is medium to heavy clearing, with 10 to 20% open stretches. Cost of clearing is estimated at \$10.00 to \$25.00 per acre. Water is supplied from lakes and reservoirs, but usually such supply is inadequate. Large systems of muskeg (Plate V, Fig. 1) exist in the basin in Tp. 86, Rgs. 4 and 5. About 15 to 20% of the basin is swamp. Small muskegs are numerous over the remainder of the area, usually not exceeding 5% of the total. Large proportion of this area was settled in 1929. Roads are inadequate, but reasonably easy to construct.

A small area of W2 soils lies in the curve of the A2 area already described. The east limit of this area is a line drawn from Sec. 8, Tp. 85, R. 4, through Sec. 18, Tp. 85, R. 4, and north to a point 2 miles east of Sec. 36, Tp. 85, R. 5. This area consists of a ridge from the Clear hills. It slopes from the hills with a gentle gradient and is otherwise undulating. The covering is chiefly 6 to 12-inch poplar with scattered belts of pine and spruce. Cost of clearing is estimated at \$15.00 to \$35.00 per acre. Small swamps are prevalent.

Higher up in the basin, north of the A2 area in Tp. 86, R. 4 and 5, lies a small area of W1 soils. The topography is undulating. Covering is medium to heavy clearing of 4 to 6-inch aspen and willow, with about 15 to 20% open. Cost of clearing approximately \$10.00 to \$25.00 per acre.

This valley is reasonably well provided with water from springs originating in the Clear hills. A few settlers took up land in 1929.

Extending from the center of Sec. 34, Tp. 85, R. 5, to a point about $\frac{1}{4}$ mile north and $\frac{1}{2}$ mile east of Sec. 21, Tp. 86, R. 5, lies a ridge $\frac{3}{4}$ mile wide. This ridge is a W3 soil. A long tongue of W2 separates this ridge from the W1 and A2 areas in the basin to the east. Both the W2 and W3 areas are heavily wooded with 6 to 10-inch aspen, willow and alder, and 5 to 10% of spruce and pine.

The Montagneuse river and Hines creek run throughout the entire season. Some difficulty in securing an adequate supply of water will be experienced by settlers somewhat removed from water courses.

Traverse 8: From the Montagneuse river in Tp. 85, R. 5, to the elevation 1 mile west of Sec. 1, Tp. 87, R. 9. This traverse includes

the largest single area of A2 soils in the area surveyed. This area is found chiefly in Tp. 86, Rgs. 5 to 9, and Tp. 87, Rgs. 7 and 8.

The topography of this A2 area is level to undulating or gently rolling. (Plate IV, Fig. 1.) Most of the area is well drained by the various branched tributaries to the Eureka river. These tributaries nearly all rise in the Clear hills and most of them flow throughout the entire season. At the junction of the Clear and Eureka rivers both valleys are nearly a mile wide and 300 to 400 feet deep. The eroded areas carry only a fair growth of grass and considerable bush, hence they are only third class grazing areas. Small dry swamps are prevalent, representing about 2 to 3% of the area. Settlers consist chiefly of isolated trappers, although some new breaking was done by new settlers during 1929. Settlement has been at a standstill, owing to the terrible road conditions existing from Sec. 7, Tp. 85, R. 4, to Sec. 31, Tp. 86, R. 6 (over the St. John-Fairview road).

A road to serve this area may easily be constructed from Hines Creek P.O. (in Sec. 21, Tp. 83, R. 4) west and north through the center of the area. The covering on this extensive area varies from light to heavy clearing. (Plates III and IV.) The area as a whole is 20 to 40% open, willow flats, the remainder being 3 to 6-inch poplar and willow with odd spruce and pine. Clearing will cost from \$8.00 to \$15.00 per acre.

Owing to its situation, its relatively plentiful supply of flowing waters, its relative ease of clearing and its productive soil, this extensive region is undoubtedly the choicest unsettled area awaiting development in the Peace River district at the present time.

Between the limits of the A2 area and the W2 soils further north in Tp. 87, R. 6, lies a narrow belt of W1 soils. This area consists of badly mixed A2 and W1 and W2 soils. The topography is undulating and slopes from the hills in the north. Clearing is heavy, costing \$10.00 to \$25.00 per acre. About 5 to 10% of area is muskeg and swamp.

Between the W3 area of the Clear hills and the A2 area of the table lands, lies a narrow belt of W2 soils. The W2 soils of this area vary from undulating to rolling, and nearly always slope south from the Clear hills plateau. About 10 to 15% of the area is swamp and muskeg. The covering is generally heavy clearing, consisting of 4 to 12-inch aspen with 15 to 20% of 6 to 12-inch pine and spruce. (Plate I.) Willow and alders are also prevalent. Cost of clearing is estimated at \$15.00 to \$35.00 per acre.

There appears to be no urgent necessity for the utilization of these lands, hence they should be closed against settlement until all better grades of soils have been occupied.

A small timber area exists in the folds of the Clear hills in Tp. 88, R. 8. The area is 2 by 2½ to 3 miles and contains chiefly 12 to 20-inch pine and spruce. This small belt of timber should prove of particular value to adjacent prospective settlements.

Traverse 9: From the elevation 1 mile west of Sec. 1, Tp. 87, R. 9, to the British Columbia-Alberta boundary in Sec. 32, Tp. 86, R. 13. West of the A2 area described in traverse 8 lies an isolated

elevation which chiefly consists of W2 soils encircled by a belt of W1 soils of varying width. The outline of the W2 area briefly is as follows: Beginning in a point $1\frac{1}{2}$ miles west of Sec. 36, Tp. 86, R. 9, and paralleling the A2 outline west of Sec. 12, Tp. 87, R. 9, then describing a U-curve about 1 mile wide to join a point about $\frac{1}{2}$ mile south of the lake in Sec. 4, Tp. 87, R. 9. From this point the line swings northwest again to a point about $\frac{1}{2}$ mile north and $1\frac{1}{2}$ miles east of Sec. 12, Tp. 87, R. 10. The line swings west of south through a point about $1\frac{1}{2}$ miles east of southeast corner Sec. 2, Tp. 87, R. 10, to a point about 5 miles northeast of the Clear-Eureka river junction. From this point it swings northeast so as to parallel the A2 outline back to the starting point. Within this W2 area lie two pseudo-elliptical areas of W3 soils. These W3 areas constitute the timbered hogbacks of the elevation. The east W3 area is roughly 3 by $\frac{1}{2}$ miles and the west W3 area is about $4\frac{1}{2}$ by 1 miles. Each of the two lie about halfway across the north outline of Tp. 86, R. 9.

The W2 area is undulating to rolling and covered with a medium growth of 3 to 6-inch aspen and scattered pine. Cost of clearing is estimated at \$10.00 to \$15.00 per acre.

The W3 areas are rough, timber covered hogbacks, nearly devoid of A₀ and A₁ horizons. The A₂ horizon is about the same as for the W2 area, namely 7 to 8 inches. This elevation should not be opened for settlement immediately.

Surrounding the above mentioned elevation is an area of W1 soils. The W1 soils in this area have an undulating to rolling topography. Small muskegs are numerous, but do not exceed 5% of the area. The covering is chiefly medium to heavy clearing. Cost of clearing is estimated at \$10.00 to \$25.00 per acre. The basin in Tp. 87, R. 9, is about 20 to 30% open willow and dwarf-birch flats, which indicate a muskeg origin.

Immediately west of the W1 area described, lies the so-called "Clear Prairie" A2 soil area of Tp. 87, R. 10. This area of A2 soils extends up the Clear river in a narrow belt slightly south of west across Rgs. 11 and 12 in Tp. 86.

The north two-thirds of the A2 area in Tp. 87, R. 10, is 40 to 60% open; the remainder is 4 to 8-inch aspen bluffs. Cost of clearing over all is estimated at \$7.00 to \$10.00 per acre. About one-third of this area is now settled. Flowing water is plentiful, but is not distributed over the whole basin. A noteworthy feature of the soils in this basin is that they are lighter in texture than the ordinary A2 soils of the region. They are underlain by a brown, sandy clay which extends to depths greater than 10 to 12 feet.

The lower third of the A2 in Tp. 87, R. 10, and the A2 adjacent to the headwaters of the Clear river, is about 20 to 40% open. The openings are chiefly willow and dwarf-birch flats. The bush occurs in bluffs consisting of 4 to 6-inch aspens and willow, with a scattering of spruce and pine. About 5 to 8% of the area is tamarack and spruce covered, dry swamp. Cost of clearing is estimated at \$10.00 to \$15.00 per acre. The area is fairly well

drained and adequately supplied with flowing water. At the junction of the McLean creek and Clear river, the canyon of the Clear river is about 300 to 400 yards wide and 150 feet deep.

To the north and west of the elongated A2 area just described, lies an area of W1, nearly divided by a ridge of W2, 1 to 1½ miles wide, paralleling the stream which cuts diagonally across Tp. 87, R. 11. This W1 is connected with the W1 in Tp. 87, R. 9, by means of a belt of W1 soils lying to the north of the A2 in Tp. 87, R. 10.

The east portion of the W1 area is undulating to rolling in topography. Little evidence of muskegs. Most of the area has been swept by recent fires, hence clearing is light to medium. Covering consists of 3 to 6-inch aspens, willow and poplar scrub and wind-fall. Cost of clearing is estimated at \$8.00 to \$12.00 per acre. No water was observed except in the creek already mentioned. Summer pasture is plentiful.

The west area of W1 soils consists of a long, sloping plateau, an extension from the Clear hills. The outer edges of the plateau are of rolling topography, but the center is a plain with a uniform slope to the south. About 8 to 10% of muskeg exists on the west extremities of the area. This area has no water, as far as could be ascertained, excepting the McLean creek. The covering near the east side and in the center is medium to heavy clearing of pine, aspen, alder and willow. Clearing will cost about \$15.00 to \$25.00 per acre. Small openings with a rank growth of grass are quite common. The west extremity of the area is heavy bush, consisting of belts of aspen and willow alternating with solid belts of 9-inch pine. Clearing in this region will cost approximately \$20.00 to \$40.00 per acre. (Plate I.) Owing to its inaccessibility, this latter W1 area should not be thrown open for settlement for some time.

North and west of the combined A2 and W1 areas lies an extensive area of W2 soils. This area is bounded on the north by the Clear hills plateau, and on the west by the British Columbia-Alberta boundary. In the belt contiguous to the W3 area of the Clear hills, the topography is decidedly rolling. On approaching the A2 and W1 areas the topography becomes undulating. About 10 to 15% of the belt under the Clear Hills plateau is muskeg and swamp. Deep, tortuous erosion channels cut their way south from the Clear hills. On the more extensive benches are found large, level alder and willow flats. The soil on these flats approaches a muck soil and is equal in quality to a W1 soil. An area of this description is situated in Tp. 87, R. 13, and Tp. 86, R. 13.

The covering on the area as a whole varies from light to heavy clearing; with most of it medium. The W2 in Tp. 87, R. 9, is heavy clearing; cost of clearing being estimated at \$15.00 to \$35.00 per acre. Heavy clearing also exists in the W2 extension in Tp. 87, R. 11. This is chiefly 6 to 8-inch pine and 10 to 12-inch aspen, of no commercial importance. Clearing is estimated at \$18.00 to \$40.00 per acre. The clearing on the remainder of the area is chiefly scattered 8 to 10-inch pine, 4 to 10-inch aspen and willow and alder. Cost of clearing this area is estimated at \$10.00 to

\$20.00 per acre. The grass vegetation over the whole area is sparse except on the alder-willow flats mentioned, where it is usually quite rank.

Construction of roads will entail a considerably greater expenditure than on the better soil areas to the south and east.

Water is not plentiful except in the main drainage channels coming from the Clear hills. Reservoirs could be located in convenient ravines, however.

The north projection of the W2 area is Tps. 87 and 88, Rgs. 11 and 12, is not considered suitable for immediate settlement.

Traverse 10: The area lying between the Clear river and the British Columbia-Alberta boundary, from Sec. 36, Tp. 85, R. 13, to the Peace river in Sec. 1, Tp. 83, R. 12. The major portion of this area constitutes an extension of the W2 area described under traverse 9. This area extends from the British Columbia boundary east to the outline of the A2 and W1 soil areas adjacent to the Clear river. From the junction of the Clear and Eureka rivers, the line roughly parallels the Clear river to Sec. 36, Tp. 84, R. 12. From there it follows the 2,200 foot contour line to a point about $2\frac{3}{4}$ miles east of Sec. 13, Tp. 84, R. 13. From this point it describes a U-curve, approaching to within about 1 miles of the Clear river at a point 3 miles south of the Clear river and Wolf creek junction. The line swings through a point about a half mile north of Sec. 36, Tp. 83, R. 13, to connect with the British Columbia boundary at a point due west of the latter location.

The whole W2 area in this region consists of a level to undulating plateau. The escarpments of the plateau are rough and broken. That part of the area lying in R. 13 lacks drainage, and, as a result, is about 15 to 20% swamp and muskeg. Small scattered beaver dams occur and a creek flows east from the muskeg in Tp. 84, R. 13. On the whole, the W2 area lacks reserves of water. Road construction throughout the area is a comparatively simple matter.

The covering over that portion lying in R. 13 is about 50% of 8 to 10-inch pine, with the remainder 4 to 10-inch aspen and willow. Spruce and tamarack abound in the muskegs. Cost of clearing this portion is estimated at \$15.00 to \$35.00 per acre. The east portion of the area is mostly poplar restocking with pine belts about the fringe of the plateau. (Plate II.) Clearing of this portion will cost approximately \$8.00 to \$15.00 per acre.

The grass vegetation is usually sparse throughout. Much of the top soil has been damaged by repeated fires. Boundary lake can be drained into British Columbia. About 200 to 300 tons of hay may be cut on the low meadow bordering the lake.

South of the W2 area just described lies a level table land of A2 soils. This area is cut up by the wide, deep canyons extending inland 3 to 5 miles from the Peace river. Small swamps, carrying spruce, dot the area. The clearing is chiefly scrub aspen and willow. Cost of clearing is estimated at \$5.00 to \$12.00 per acre. No water is to be found on this area during the greater portion of the season. Owing to the flat nature of the country, storing of water

PLATE I.



Fig. 1—Heavy clearing on wooded soil. This type of growth characterizes the W3 and W2 areas, except where the trees have been destroyed by fire.



Fig. 2—Severe burn on wooded soil. Note the fallen dry timber. Another fire would destroy most of the timber and make the area suitable for breaking, with a minimum cost for clearing.

PLATE II.



Fig. 1—Restocking on an area which has been severely burned. Note young poplar with strips of pine. Photograph represents good topography of W2 area on south slope of Blueberry plateau.



Fig. 2—Ancient beaver dams are numerous on the level topography of both the wooded and parkland soils. Some of the dams are a half mile in length.

PLATE III.



Fig. 1—Giant willows are often found growing on the wet areas of the fertile soils. The one shown in the picture has a diameter of 20 inches.



Fig. 2—Fertile parkland soils on Eureka prairie. Note medium clearing. These soils have from 120 to 140 acres of arable land per quarter section.

PLATE IV.



Fig. 1—Fertile parkland soils (A2) on Eureka prairies, north side of Peace river. Note open area with light clearing and good topography.



Fig. 2—Parkland soils. Note black soil in foreground and wheat stalks in background. (Yield estimated at 50 bu. per acre.)



Fig. 3—Clear River valley, showing rough lands unsuited to cultivation.

PLATE V.



Fig. 1—Open muskegs are numerous in certain parts of the wooded soil areas.



Fig. 2—A heavy stand of red clover on second class wooded soil. The soil was well prepared and heavily manured before seeding the clover. This crop would furnish excellent feed and improve the wooded soils if proper efforts were taken to insure its growth. Clover should be especially included in any program dealing with the management of the wooded soils.

PLATE VI.



Fig. 1—Soil profile of second class wooded area (W2). Note badly leached light colored horizon near surface.

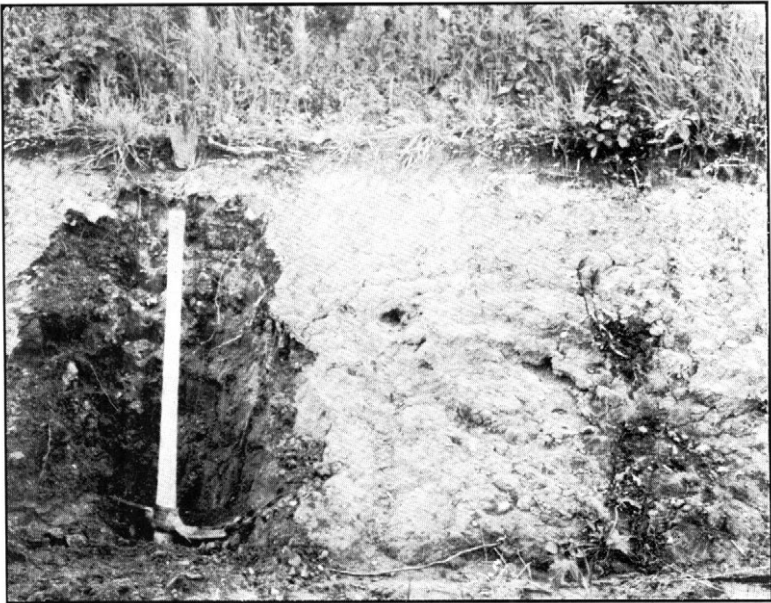


Fig. 2—Soil profile of third class wooded area (W3). Note badly leached light colored horizon beginning almost at the surface and extending down for about 3 feet.

by means of reservoirs is hardly feasible, except at the heads of the canyons.

Road construction at right angles to the Peace river is a simple matter. Roads paralleling the river nearer than 5 miles must cross too many deep, wide canyons.

A few squatters have located on the half mile wide river bench extending from the mouth of the Clear river to the British Columbia boundary. A few others are squatted adjacent to the river in Tp. 83, R. 13. Boats plying between Hudson's Hope and Peace River freight grain at 10 to 12 cents per bushel, and supplies are brought in at 50 to 75 cents per hundredweight.

This small area is a very good quality A2 soil. The A₁ horizon over a good share of the area approaches a depth of 7 to 8 inches, and shows little evidence of leaching. Immediate settlement of this area should be encouraged.

Traverse 11: From the Clear river in Sec. 32, Tp. 84, R. 11, to the Montagneuse river in Sec. 36, Tp. 84, R. 6. East of the Clear river lies a continuation of the A2 area of Tp. 83, R. 11, 12 and 13. This area also connects with the A2 area of Tp. 86, R. 8, by means of a narrow belt along the Clear river. The east limits of this area lie in the following points: From a point $\frac{1}{2}$ mile west of Sec. 36, Tp. 85, R. 9, through a point 3 miles south of the Clear-Eureka river junction, then describing a curve to meet a point about 7 miles east of south and due south of the escarpment visible in Sec. 2, Tp. 89, R. 10. From this point the line probably continues to the Peace river, intersecting it at a point nearly opposite the west outline of the W1 area south of the Peace river.

This area is quite flat and consequently lacks adequate drainage. As a result much of this area consists of large, dry, willow swamps. The area is broken by the deep erosion courses near the Clear and Peace rivers. At a point 4 to 5 miles north of its mouth, the Clear river has a valley $1\frac{1}{2}$ to 2 miles wide and about 600 feet deep. Little of this erosion course is of value for pasture because of the predominance of bush over the grass vegetation. For a distance of 4 to 5 miles back from the rivers, the vegetation is medium heavy clearing, 3 to 6-inch aspens with many clumps of 9 to 10-inch pine. The ground is covered with a maze of windfall, resulting from old fires having destroyed the pine covering of which the numerous clumps of 9-inch pine are the living remnants. The cost of clearing this area (after another fire to remove windfall) is estimated at \$10.00 to \$15.00 per acre. The large willow flats in the center can be cleared at \$5.00 to \$10.00 per acre.

No water was observed anywhere in this area.

Road construction is a simple matter. This area is recommended for immediate settlement if the question of water reserves can be solved.

Between the Peace river on the south, the Montagneuse river on the east, and bounded on the north and west by the A2 and W2 areas, lies a large area of W1 soils. The W2 area mentioned is 2 to $3\frac{1}{2}$ miles wide and extends from about Sec. 19, Tp. 85, R. 6, to a point about $\frac{1}{2}$ mile west of the range line in Sec. 25, Tp. 85,

R. 9. The W2 represents a low elevation which rises above the surrounding plains.

The topography of the W1 area is flat at the west and undulating over the remainder of the area. Large muskegs exist in Tp. 85, R. 9, and also in Tp. 85, Rgs. 6 and 7. About 5 to 8% of the area may be classed as muskeg and swamp. The peat layer usually does not exceed a depth of 20 to 24 inches and reclamation is therefore not an impossible undertaking. The west end of the area consists of huge willow flats,—some of them 1,500 to 2,000 acres in extent—separated by aspen and willow scrub, with here and there an odd pine. Clearing in this area should not exceed \$5.00 to \$10.00 per acre. Much small windfall litters the ground wherever poplar predominates.

That portion of the area east of R. 9 carries a heavier growth of bush which consists chiefly of 3 to 8-inch aspen and willow. About 20 to 30% of this area is open willow flats. Cost of clearing is estimated at \$8.00 to \$15.00 per acre.

Roads may readily be constructed in any direction, and an outlet through to Fairview should be provided before much settlement takes place.

No water was observed in this area. Before the area can be effectively settled, some satisfactory solution of the water question is absolutely necessary. As there are no lakes available as sources of ice for storage, and as there is little run-off in an area of this flat topography, it becomes necessary to drill to horizons where water may be encountered in quantity.

The W2 area, the outlines of which have been described above, consists of a low ridge of mixed W1 and W2 soils. The topography is somewhat rolling. Small muskegs and swamp systems are common. About 10 to 15% of the area is classed as muskeg.

The covering is medium to heavy clearing, 3 to 6-inch aspen with 10 to 40% of 3 to 8-inch pine. Clearing will cost approximately \$12.00 to \$20.00 per acre. No surface water was observed in this area. Road construction should present no serious difficulties.

Owing to its location, this area should be thrown open for settlement at the same time as the adjacent W1 areas.

Traverse 12: From the point of intersection of the base line with the British Columbia-Alberta boundary in Sec. 33, Tp. 88, R. 13, to Sec. 36, Tp. 88, R. 4. The area covered in this traverse consists entirely of W3 soils. The south boundary of the area corresponds with the north limits of the W2 and in places with the east limits of certain A2 and W1 areas in Rgs. 4 and 5. These limits have been defined in some detail in traverses 8 and 9, which should be consulted for further information.

This high W3 area is reported by the fur traders and trappers of the region to extend north at least 200 miles from the south limits. No rumors are current of even small patches of good land within this vast region. The term "Clear hills" is apparently a misnomer, as the area is a plateau of altitudes varying from 3,500 to 3,700 feet.

The topography is generally rolling, consisting of ridges and low hills separated by wet muskegs and swamp. The area as a whole is perhaps 30 to 75% muskeg. In some sections the muskegs are continuous, with only small elevations here and there appearing like small islands in a vast sea of swamp. These swamps average 3 to 5 feet in depth, though exceptions to this are of common occurrence. Lakes, one-half mile in diameter and up, are fairly common. These lakes are generally surrounded by muskeg and are usually quite shallow. The face of the Clear Hills plateau is rough and broken, being cut by deep, wide drainage channels and broken escarpments.

The erosion folds near the face of the plateau carry a little timber, consisting of 60 to 90% of 6 to 20-inch pine, and the remainder aspens and spruce. Owing to the ravages of repeated fires, the area has practically no commercial timber resources at the present time. Over that portion of the area that is not muskeg, the covering is chiefly aspen and pine restocking. Where the timber covering has been fire killed, the area is covered with windfall to a depth of 5 to 6 feet. Communication within the area is entirely by means of tortuous, pack trails. Trappers represent the only class of settlers in this region.

The area is practically devoid of grass, packers and freighters finding it necessary to carry their own fodder when traversing the area.

The soils are nearly devoid of the A_1 horizon. Owing to the absence of the A_1 horizon, the A_2 or leached layer is usually exposed. This layer varies in depth from 5 to 20 inches, depending on the texture of the soils. Coarse gravel and sand are common on the ridges. Stone and rock are present, but not common.

This area is considered of absolutely no agricultural value except as a forest and game reserve.

SOILS.

The area covered by this report lies wholly within the wooded soil belt of Alberta. The larger part of the area is, or has been, heavily wooded, and about 20 per cent. of the soil belongs to the poorer phase (Plate VI) of the wooded group. On both sides of the Peace river there are local areas where the surface drainage is poor, and it is here that the muskegs and swamps occur. In addition to the muskegs there are some poorly drained willow swamp areas. These, when cleared and broken, will in general become automatically drained and result in productive soils.

The soils on the Clear hills and the Saddle hills differ materially from those of the lower table lands and river valley. The hilly ranges contain soils which have very largely resulted from the weathering of the underlying parent materials, whereas the table land soils and the river valley soils have been more largely influenced by erosion and distributing agencies such as ice and water. The table lands in many cases have resulted from the weathering and assorting of secondary formations, often under laky conditions. The natural drainage, when adequate, has been largely responsible for the production of the better soils. (Plate IV.)

The parkland soils (Plate III, Fig. 2) and the first class wooded soils are invariably found on the table land and river valley areas where the topography and drainage are desirable, whereas the poorer phases of wooded soil occupy the areas of rough topography. (Plate IV, Fig. 3.) These stony soils usually are associated with the rougher hilly or morainal topography.

The soils of the surveyed area, to a very great extent, consist of the heavier textured classes varying from heavy loam to clay. The subsoil is almost universally heavy. The percentage of light sandy soils is extremely small. It is impossible in a survey of this kind to outline the various soil classes such as sands, clays, etc., but the major soil areas such as parkland, the various grades of wooded soils, muskegs, etc., are approximately outlined on the accompanying map.

The summarized statement of the areas in the various soil classes is shown in Table 1.

TABLE 1.—ESTIMATED AREAS OF THE VARIOUS SOIL CLASSES.

Soil class.	Acres.	Per cent.
Second class prairie soil (A2)	579,570	22.17
First class wooded soil (W1)	548,295	20.97
Second class wooded soil (W2)	762,655	29.18
Third class wooded soil (W3)	481,055	18.41
Rough lands	192,995	7.38
Muskeg (M)	33,120	1.26
River (R)	15,305	0.58
Lake (L)	1,205	0.05
Total.....	2,614,200	100.00

Table 1 shows that a little over 40 per cent. of the total area contains good soils (A2 and W1 classes). It is thought that an additional 30 per cent. contains soils which could very well be used for farms, even though it is only considered as the better phase of the marginal soils. The poorer phase of the wooded soils (W3), amounting to 18.4 per cent., should not be settled until there is a very urgent demand for the use of these sub-marginal lands. The rough lands constitute almost 8 per cent of the total area.

Table 2 shows the distribution of the various soil classes for each township and range in the surveyed area.

The summarized statement of the land settled and the lands vacant for the surveyed area is found in Table 3.

TABLE 2.—CLASSIFICATION OF LANDS IN SURVEYED AREA
(Estimated in acres).

Location.		Acres.					Lands too rough for cultivation	Lands in rivers, lakes and muskies
W. 6th M. Tp. R.		A2	W1	W2	W3			
76,	13*		645	15,810	4,145			
	12		2,135	9,730	10,480		695M	
	11				21,740		1,300M	
77,	13		430	12,235	5,010	865	2,060M	
	12			15,500	4,780		2,760M	
	11			16,750	5,135		1,155M	
	10			10,020	13,020			
	9			3,630	19,010		400M	
	8			1,790	21,250			
	7			5,990	17,050			
78,	13*		1,585	7,235	11,320		460M	
	12			8,650	13,730		660M	
	11			16,730	2,305		4,005M	
	10			11,730	11,310			
	9	5,355		17,540	30		115M	
	8		230	22,810				
	7	545	19,010	3,485				
	6	20,330	2,710					
79,	13*		10,150	5,125		2,475		
	12		8,350	13,370	1,320			
	11		3,930	18,570	260		280M	
	10			22,810	230			
	9			23,040				
	8		1,150	21,080		810		
	7	7,140	5,125	7,550		3,225		
	6	17,850		695		4,495		
	5	18,550				4,490		
80,	13*		11,415				6,335	
	12		12,670	10,200	170			
	11		1,110	21,930				
	10			19,300			3,740M	
	9		750	20,990			1,300M	
	8	12,900	3,630	5,190		1,320		
	7	17,450	1,210			4,380		
	6	18,780				3,685	575R	
	5	12,240				9,360	1,440R	
	4	9,330				12,270	1,440R	
81,	13*		13,960			3,790		
	12		18,080			4,960		
	11		3,820	19,220				
	10		3,555	19,485				
	9		14,630	8,065	345			
	8		22,005			1,035		
	7		17,710			5,330		
	6	4,810	1,985			14,515	1,730R	
	5	19,755				3,285		
	4	16,070				6,970		
82,	13*	1,250	10,340			5,470	690R	
	12	155	18,140			3,965	780R	
	11		8,180	12,390		2,045	425R	
	10		1,500	18,910			2,630M	
	9		17,855	5,185				
	8		23,040					

Location.		Acres.				Lands too rough for cultivation	Lands in rivers, lakes and muskegs
W. Td.	6th M. R.	A2	W1	W2	W3		
	7		22,175			750	115R
	6	15,960				5,930	1,150R
	5	4,665	3,225		11,520	3,630	
	4	16,730			5,760	550	
83,	13*	15,010				240	
	12	21,280				1,760	
	11	14,130	1,010	130		7,250	520R
	10	2,880		14,650		4,815	695R
	9		14,370	5,470		2,620	580R
	8		21,890			1,090	
	7		18,000		1,265	2,735	1,040R
	6		11,970	6,695		4,165	210R
	5	5,325	10,780	290	5,760	885	
	4	8,015		5,185	9,205		635L
84,	13*	1,595		9,855			3,800M
	12	3,110		19,930			
	11	17,050		3,860		2,130	
	10	20,230	1,940			870	
	9	1,985	16,100			4,320	635R
	8		9,245		5,530	7,055	1,210R
	7		4,145		8,610	8,555	60M
							1,670R
	6	595	12,400			9,645	400R
	5	20,550	2,000	115		375	
	4	16,430		1,340	5,270		
85,	13*			14,680			570L
	12			23,040			
	11	11,290		8,580		3,170	
	10	14,570	5,875			2,595	
	9	2,705	17,990	605		590	1,150M
	8	1,900	9,620	10,505		725	290M
	7	3,285	9,560	9,015		405	775M
	6	4,665	15,840	865		230	1,440M
	5	13,390	4,520	3,540	155	575	860M
	4	2,265		3,685	17,090		
86,	13*			15,250			
	12	7,155	1,380	13,220		1,055	230M
	11	7,555	3,370	11,235		690	190M
	10	3,715	7,970	8,765		2,590	
	9	7,170	4,610	7,345	2,360	1,555	
	8	17,960	250	1,150		3,680	
	7	22,350				690	
	6	20,260	2,780				
	5	10,570	3,745	4,060	3,340		1,325M
	4	4,320	4,200		14,520		
87,	13*			12,120			
	12		3,860	17,740			1,440M
	11		15,090	7,950			
	10	12,010	10,400	630			
	9	2,880	8,620	10,680	860		
	8	15,390	730	6,280	640		
	7	15,290		5,185	2,565		
	6	3,425	4,895	11,060	3,660		
	5	5,500		575	16,965		
	4				23,040		

Location. W. 6th M. Tp. R.	Acres.				Lands too rough for cultivation	Lands in rivers, lakes and muskegs
	A2	W1	W2	W3		
88, 13*	4,840	7,280	.....	.....
12	11,980	11,060	.....	.....
11	10,370	12,670	.....	.....
10	1,900	2,705	3,645	14,790	.....	.....
9	3,170	19,870	.....	.....
8	630	22,410	.....	.....
7	23,040	.....	.....
6	23,040	.....	.....
5	23,040	.....	.....
4	23,040	.....	.....
	579,570	548,295	762,655	481,055	192,995	15,805R 1,205L 33,120M

*Fraction of range.

TABLE 3.—SUMMARY OF SETTLED AND VACANT LANDS
IN THE SURVEYED AREA

Location. W. 6th M.	Soil class.				Total.
	A2	W1	W2	W3	
Total settlement (quarter sections)..	1,042	191	191	28	1,452
Total area settled (in acres)	166,720	30,560	30,560	4,480	232,320
Per cent of area settled	28	5	4	1	8.89
Total area unoccupied (in acres)	412,850	517,735	732,095	476,575	2,139,255*
Total area unoccupied (in square miles)....	645.0	808.9	1143.9	774.6	3,342.4*
Total area unoccupied (in townships)	18	22	32	21	93*

*Not including area in lake, muskeg, river and rough lands.

The above table shows that:

(1) Less than one-third of the A2 (parkland) is now occupied. This leaves over 400,000 acres to be settled.

(2) Only about 5 per cent of the first class wooded soil is now occupied, leaving about 517,000 acres to be settled.

(3) In the second class wooded soil areas there remain about 732,000 acres to be settled.

THE PARKLAND SOILS.

The parkland areas contain the best soils of the surveyed area. In general they are not true parkland (black) soils, but have been partially degraded by the timber growth which has or is at present occupying these soils.

The parkland soils occur in a broken belt between Fairview and the British Columbia boundary line, on the north side of the Peace river. These are in reality an extension of the area of similar soils found between Fairview and Grimshaw. On the south side of the Peace river there is another area of these soils in the Spirit River district, with its northwestern limit extending out to the Blueberry Mountain settlement. The northern limits of a similar area belonging to the Grande Prairie district are also shown on the map.

The better class of wooded soils (W1 and W2) occur as a transition belt adjacent to and surrounding the parkland soils. These merge into a poorer class of wooded soils (W3), the latter being found usually on the rougher topography.

These parkland soils have been formed on the plateaus adjacent to the drainage courses of the main streams, as well as on some of the alluvial plains. They consist very largely of silt and clay material and show the following general profile:

Horizon A₁—black loam to clay loam from 5 to 10 inches deep.

“ A₂—light-colored, leached layer, usually 1 to 3 inches thick, silty.

“ B₁—darker in color than A₂, heavy clay loam to clay; columnar and granular; from 6 to 15 inches thick.

“ B₂—from 2 to 8 inches thick and encountered at depths from 20 to 30 inches below the surface, usually granular.

“ C—This is the partly modified parent material, usually heavy textured, sometimes has the appearance of secondary shale. The tree and shrub roots often penetrate this to the depth of several feet.

From Table 4 it may be seen that they have a higher fertility index than do the wooded soils.

TABLE 4.—COMPOSITION OF SOILS.

Parkland soils					Second class wooded soils				
Horizon	Depth	% Nitrogen	% Phosphorus	pH	Horizon	Depth	% Nitrogen	% Phosphorus	pH
A ₁	0.6"	.55	.077	6.0	A ₁ *	0-4"	.368	.075	5.4
A ₂	6-12"	.143	.046	5.6	A ₂	4-12"	.08	.026	5.2
B ₁	12-28"	.125	.050	5.8	B ₁	12-26"	.100	.070	5.5
B ₂	not sampled				B ₂	26-30"	.08	.070	7.2
C	not sampled				C	30-70"	.07	.067	7.0

*Includes A₀ horizon.

The data in the above table show that the second class wooded soil has suffered much greater leaching than has the parkland soil. This is indicated by the decided drop in nitrogen, phosphorus and the pH from the A₁ to the A₂ horizon, and the subsequent rise in values of these data from the A₂ to the B₁ horizon in the case of the

wooded soil, whereas there is no increase in nitrogen and only a very slight increase in phosphorus and pH from the A₂ to the B₁ horizon in the parkland soil.

Both of the above soils are slightly acid to the depth of from 2 to 2½ feet, but they are not sufficiently acid to prevent the growth of legumes. However, the data seem to indicate that the use of lime or marl would no doubt give increased yields for certain of the legumes such as alfalfa or sweet clover. The wooded soil is in greater need of lime than in the parkland soil. Both soils are inclined to be low in phosphorus and would no doubt respond to applications of this fertilizer.

The subsoils in both classes are good. In fact, the subsoil of the wooded area is very similar to that of the parklands. In this respect the wooded soils of the surveyed area differ from wooded soils in the areas west of Wabamun and Breton.

The parkland soils compare favorably with the parkland areas in the Edmonton district. This relationship is more clearly shown in Table 5.

TABLE 5.—QUANTITIES OF NITROGEN AND PHOSPHORUS AS POUNDS PER ACRE TO THE DEPTH OF 3 FEET.

Location.	Nitrogen.	Phosphorus.
Edmonton district (parkland soils)....	23,365	7,475
Eureka prairie (parkland soils)	22,460	6,220
Ksituan (second class wooded soils)....	12,480	6,500

From Table 5 it may be seen that the phosphorus content in both the northern soils is somewhat lower than in the soils from the Edmonton district. The parkland soils from the Eureka prairie contain nitrogen and organic matter about equal to that found in the soils from the Edmonton district. It is further seen that the wooded soils contain only about one-half as much nitrogen and organic matter as exists in the parkland soils.

THE WOODED SOILS.

About 69 per cent of the mapped area consists of wooded soils. These are divided into first, second and third class areas. The first class areas are the most desirable and contain the better soils. It is thought that the second class soils are sufficiently fertile to justify immediate settlement, but that the third class areas are undesirable, at least for the present. These third class areas are of relatively low fertility, of undesirable topography and often require heavy clearing, therefore they should not be settled until the time when such marginal lands become urgently needed to meet the demands of a thickly settled adjacent district. In fact, the greater part of the third class soils can never be considered as arable land.

In the mapped area virtually every degree of variation between the true parkland soils and the true wooded soils may be encountered, and the first class and second class wooded soils are actually transition phases between the parkland soils on one side and the older wooded soils on the other. The first class wooded soils are desirable, the second class wooded soils are marginal under our

present farming practices, whereas the third class wooded soils are sub-marginal.

The typical wooded soils are in general much less fertile than either the parkland soils or the plain soils. Typical wooded soils have been produced largely under the influence of a covering of trees. This has materially increased the rate and extent of leaching found in these soils. (Plate VI, Fig. 2.) The typical wooded soils in the mapped area have the following characteristic profile:

A₀—1 to 2 inches thick; leaf mold, neutral in reaction.

A₁—very thin and often absent, drab to grey colored, silty texture, platy structure, usually slightly acid.

A₂—5 to 10 inches thick, light colored, greatly leached silty material, usually devoid of structure, but may be platy or even porous. Almost invariably slightly acid in reaction. Where forest fires have been severe the A₂ horizon often is exposed as the surface. This horizon runs like putty when wet and when dry is very difficult to till. If weathered when dry it forms a powdery dust.

B₁—darker colored than A₂, clay loam to clay. Columnar and irregular granular. Varies from 12 to 16 inches in thickness and is encountered at depths of from 8 to 12 inches below the surface.

B₂—or lime layer is encountered in these soils at depths varying from 20 to 36 inches below the surface.

C—The present material consists of glacial or waterlaid material. It is slightly modified by weathering to the depth of several feet.

It should be pointed out that, while the upper horizons of these wooded soil profiles are greatly leached (Plate VI, Fig. 1), relatively low in fertility and often difficult to till, the subsoils are very good and much like the subsoils found in the parkland areas. In this respect they differ from the wooded soils encountered elsewhere in Alberta. Descriptions of the poorer subsoils found in the wooded soil area are to be found in the report for St. Ann Sheet.

The first class wooded soils differ in profile from the above description mainly as follows:

(1) There is invariably present the A₁ horizon, which is about 2 to 4 inches thick and dark brown to black in color.

(2) The A₂ or light colored leached layer is relatively thin (from 2 to 4 inches).

(3) The B₁ occurs much nearer the surface.

In our opinion there is no question of a doubt that the greater part of the wooded soils would respond to certain fertilizer treatments. Such treatments, however, are out of the question until the areas become more thickly settled and are adequately supplied with transportation. In the meantime, the management of these areas should include the growing of legume crops at regular intervals. There should be no great difficulty involved in growing legumes on these soils, provided proper precautions are taken in preparing the ground. In any case, it should be possible to grow clovers after

a liberal application of manure or manure and marl from some local source. That clover can be grown on similar soils is clearly shown by Plate V, Fig. 2.

WATER SUPPLY.

The question of water supply has been briefly mentioned in the traverse reports for each area described. It was pointed out that the surface water in many parts of the surveyed area was entirely inadequate and that this source of water would decrease with the clearing and breaking of the land. This is especially so on the south side of the Peace river. On the north side of the Peace river the district is supplied with more streams which would furnish water to a number of the settlers during the spring and early summer months, but even these streams are not located so as to be convenient to the greater number of future farms.

The scattered settlers now located in the area are almost without exception situated either near running water or near specially constructed reservoirs. Wells are almost unknown except for a few in the older, more thickly settled areas.

The measures now employed for securing water are as follows:

(1) *Running water.*—A few of the streams crossing the surveyed area flow throughout the entire season. Many of them are so shallow that they do not furnish water after the freeze-up. Some of the streams furnish running water only during the spring and early summer months. They constitute a source of water sufficient only for their immediate vicinities and are by no means adequate for the entire area. Only a limited number of homesteaders can be supplied with water from the streams.

(2) *Reservoirs.*—Wherever the topography is suitable, reservoirs may be constructed to store the water from surface run-off. Usually they do not carry sufficient water to meet the summer demands, and are either dry or frozen in the winter. The water is not desirable for household use, but has its value chiefly as a source for livestock. Reservoirs having a capacity sufficiently great to meet the year's demand are expensive to construct, and in many areas the topography would not permit the construction of such reservoirs. At best reservoirs could be used to satisfy only a small part of the needs of the area.

(3) *Ice.*—Where suitable bodies of water are within hauling distance, ice may be harvested and stored during the winter months. This method of storage involves considerable labor and expense, but will, with care, supply household requirements. It is entirely inadequate for livestock.

(4) *Wells.*—In certain localities shallow wells have been dug in convenient muskegs or swamps. These wells have proven fairly satisfactory so long as the muskegs or swamps have not been modified. As the forest covering is being removed, these swamps have a tendency to dry and in turn become a prey to succeeding fires. For this reason shallow wells which draw upon the water reserves of muskegs or swamps can be considered only temporary in nature.

From the above statements it is seen that the methods now employed for securing water are entirely inadequate for the needs of the greater part of the unsettled area. It would seem that the solution of the water problem would, to a certain extent, be dependent upon the ability to secure desirable sources of well water. The areas in need of wells are as follows: the Blueberry plateau and west to the Pouce Coupe river; practically the entire area north of Tp. 80 and south of the Peace river; the entire area lying between the Eureka-Clear river system and the Peace river; the area from the Peace river in Tp. 87 and between the Clear river and the British Columbia-Alberta boundary.

The following statement about the possible water supplies for the area has been kindly prepared by Dr. R. L. Rutherford:

"During the field season of 1929, I investigated water conditions in certain districts of the Peace River country. My investigations were carried on in the more settled districts where it is hard to obtain a supply of water for domestic purposes. In these districts the main source of supply has been from accumulations of surface water or shallow wells. Such a supply is becoming inadequate in many places, and requests have been made for an examination of these districts with a view to the determining of the possibility of a supply from underground sources. The information obtained and conclusions reached regarding such a possibility in the Spirit River and Waterhole districts will apply in general to much of the areas to the west on both the north and south sides of the Peace.

"From a study of the underlying bed rock in the Spirit River and Waterhole districts, I have concluded that it is impossible to obtain an adequate supply of suitable water in the upper strata. These are shales of marine deposition, usually referred to as the Smoky River shales. The decomposition of these at the surface has contributed the major portion of the material which forms the mantle of soils at the surface.

"There is a series of beds about 450 feet thick which carry thick sandstone beds, underlying these shales. This series is known as the Dunvegan formation. It is hoped that these beds might act as water reservoirs and may ultimately prove a possible source of water. The depths to the top of these sandstones in the Waterhole and Spirit River districts ranges on the average from 400 to 700 feet. In general this depth decreases from Peace River north and increases to the south, in these districts. From a general knowledge of the underlying structure of this formation, it may be said that it occurs relatively nearer to the surface in districts to the west of the Spirit River and Waterhole districts. Thus, should it prove to be a good water horizon, drilling depths in the new areas west of Spirit River and south of the Peace river will be less than at Spirit River. Similarly, in those new areas northwest of Fairview on the north side of the Peace, the depths to this horizon will be less than in the Waterhole district.

"As yet this formation has not been proven as to its possibilities as a water source, but should proposed tests in the settled districts prove satisfactory, I feel that similar results will be obtained in the new areas to the west.

"One further feature regarding water supply is significant. This is the nature and magnitude of glacial deposits. This is well illustrated in the district extending from Grimshaw west to Whitelaw, where the water supply is obtained from wells put down into these surface deposits of glacial material. Better water conditions prevail when these deposits carry an appreciable amount of gravel.

"I am informed by members of the Soil Survey party that a similar type of deposit occupies areas north of the Peace and west of the Montagneuse rivers, forming the Clear hills. These might afford a considerable supply of water to lower areas on the slope to the south toward the Peace. An additional feature, however, is significant, and that is

the areas underlain predominantly by glacial deposits are frequently too stony for agricultural operations, thus settlement tends to avoid or fringe such deposits. Consequently any water supply that may be obtained from such sources does not as a rule serve a wide area.

"Summarily, I am of the opinion that in general the problem of obtaining an adequate supply of water of suitable quality in these new areas is the same as in the areas that are settled in the Spirit River and Waterhole districts. The report above has indicated that present supply and methods of obtaining water in these new districts is inadequate and unsatisfactory."

ACCESSIBILITY.

The area to the west of Spirit River is served only by one road, hardly worthy of the name. This road is the abandoned E.D. and B.C. railway grade which extends from Spirit River to the British Columbia-Alberta boundary. The distance is 46 miles in an air line, and about 60 to 65 miles by the railway grade. The grade consists chiefly of a series of excavations, the surface 10 to 20 inches having been thrown up along the sides. This type of construction, coupled with inadequate provisions for drainage, has made the road a veritable quagmire, impossible to any but the lightest loads during the greater part of the season. In winter, however, the grade makes a good sleigh road.

At a point about 12 miles west of Spirit River a graded road leads off northward (for about 10 miles) toward the Blueberry Mountain settlement. There is an area of good soil, now partly settled, extending for a distance of about 12 miles east of Blueberry Mountain post office and between the Ksituan and Hamelin creeks, which has as its only outlet the trail to Blueberry Mountain, thence south over the newly graded road to the old railway grade, and thence 12 miles east to Spirit River. The center of this area is only about 16 miles in a direct line from Spirit River, but at present the distance around by Blueberry Mountain and the old railway grade is at least 32 miles.

In order to effectively tap the first class wooded soil area (about 175,000 acres) north of the Hamelin creek, a road should be provided extending north from Blueberry Mountain and across the Hamelin creek in either range 8 or 9, the latter being more feasible as the canyon is not so extensive at this point. A connecting road to Spirit River, which would also serve the eastern Blueberry region, could be constructed from the crossing on the Hamelin creek, through Blueberry and southeastward so as to cross the Ksituan and Howard creeks at some point in the southeastern portion of Tp. 79, R. 7, and then on to Spirit River. The only obstacle in using such a proposed route would be the crossing of the Ksituan creek.

As an alternative to the route outlined above, a very satisfactory outlet to Fairview could be established by installing a ferry at some point on the Peace river in Tp. 83, R. 7, or Tp. 82, R. 6, and constructing roads from this point to tap the area west of the Peace river and connecting with Fairview. This latter route has the added advantage of being in a position to materially benefit by any railway extension westward from Fairview. Furthermore, no ex-

tensive canyons need be crossed, excepting perhaps that of the Hines river.

In so far as the first class wooded areas near the British Columbia-Alberta boundary are concerned, the shortest route to rail-head is by way of Pouce Coupe to Hythe. Roads to serve this area should be constructed across the Pouce Coupe river to connect with Rolla. The most feasible crossing of the latter river, north of the confluence with the Henderson creek, appears in Sec. 9 or 10, Tp. 80, R. 13. These areas are being rapidly settled and should be provided with some satisfactory outlet as soon as possible.

With respect to railway extensions westward from Spirit River, the greatest benefit to the area as a whole would accrue if such extension were routed as near as possible over the center of the Blueberry plateau to cross the Pouce Coupe river at some point north of the Henderson creek.

The area on the north side of the Peace river extending from Fairview to the British Columbia boundary contains the greatest amount of good soil encountered during the summer surveys. This area is about 10 to 20 miles wide and about 65 miles in length. It contains possibly as much good land as now exists between Fairview and Peace River Crossing.

The area to the west of Fairview and lying north of the Peace river is served only by a tortuous wagon trail which extends north and west from Fairview, through Tp. 86, R. 5, and Tp. 87, R. 10, to cut the boundary north of Boundary lake in Tp. 85, R. 13. This trail is impassable to anything but the lightest horse-drawn loads during the greater part of the season. Practically no work has been put on this road from the Montagneuse river to the British Columbia boundary. Nevertheless, the whole area could be served by a main trunk road with branch roads into side lying areas. The most feasible route for such a road is from Fairview to Hines creek, west to Sec. 14, Tp. 83, R. 5, north to Sec. 35, Tp. 84, R. 5, west to Sec. 33, Tp. 84, R. 5, north to Sec. 21, Tp. 85, R. 5, west to Sec. 20, Tp. 85, R. 5, north to Sec. 32, Tp. 85, R. 5, west to Sec. 36, Tp. 85, R. 7, north to Sec. 12, Tp. 87, R. 7, west to Sec. 12, Tp. 87, R. 9, west 1 mile and north 1 mile and then west to Sec. 13, Tp. 87, R. 10, north to Sec. 24, Tp. 87, R. 10, and west to Sec. 24, Tp. 87, R. 11, south to Sec. 25, Tp. 86, R. 11, and then parallel to the Clear river system to the boundary. Branch roads to connect with the proposed highway can be constructed into the areas adjacent to the Peace river and west of the Clear river, simply by constructing a road along the outline of R. 13 or paralleling this line through any point up to 3 to 4 miles east of the range line; east of the Clear river, by extending a branch road west from the proposed highway in Sec. 36, Tp. 85, R. 7, to Sec. 33, Tp. 85, R. 9, and then south or southwest to the Peace river.

The area west of the Clear river could also be served by the installation of a ferry on the Peace river, opposite the sloping river bench in Sec. 36, Tp. 82, R. 12. This location has greater natural advantages for the installing of a ferry than any other point seen on the Peace river within the limits of the surveyed area.

Before settlement can make much progress in the area north of the Peace river, it is absolutely essential that some satisfactory road be constructed. As the situation is at present, farm produce can only be hauled out to the railhead during the winter months, as the summer roads are exceedingly bad or impassable.

Any railway extension westward from Fairview to the British Columbia-Alberta boundary will, in all probability, cut through Tp. 85, R. 5, and then north and west through Tp. 87, Rgs. 9 and 10, thence south to the Clear river and westward to the boundary, or alternatively, from Tp. 85, R. 5, westward through Tp. 86, R. 9, south of the elevation, and thence westward paralleling the Clear river to its headwaters near the boundary. Whichever route the extension might take, it will serve the whole area quite effectively, though the former route would undoubtedly serve the area more effectively. Any route cutting the area much nearer to the Peace river will encounter the deep, wide Clear river valley and thus meet with construction difficulties.

SUMMARY.

The surveyed area covered by this report extends from Dunvegan to the British Columbia-Alberta boundary, and lies between the Saddle and Clear hills. The area covers about 113 townships, or 2,614,200 acres.

The extent of the different classes, beginning with the better soils, is listed as follows:

Second class prairie soils.....	579,570 acres	22.17%
First class wooded soils	548,295 "	20.97%
Second class wooded soils	762,655 "	29.18%
Third class wooded soils	481,055 "	18.41%
Rough lands	192,995 "	7.38%
Muskegs	33,120 "	1.26%
Rivers and lakes	16,150 "	.63%

Of the prairie soils and the first class wooded soils, there are almost one million acres yet to be settled. These two classes consist of soils which, without doubt, are sufficiently fertile to insure satisfactory crop returns. In the above two classes there are about 5,800 quarter sections, each of which contains from 120 to 140 acres of arable land.

In addition to the above two classes there are about three-fourths of a million acres of second class wooded soils, which it is thought would justify settlement, even though they are considered to be marginal lands.

The following summarized statement shows the unoccupied lands suitable for settlement in the surveyed area:

Second class prairie soils.....	2,580 quarter sections
First class wooded soils	3,235 " "
Second class wooded soils	4,575 " "

There are more than 600,000 acres of land (W3 and rough) in the surveyed area which should be set aside as forest and game reserves, and on which settlement should be prohibited.

The order of accessibility of the bulk of the areas is as follows:

South of the Peace river—

1. Second class prairie soils.
2. Second class wooded soils.
3. First class wooded soils.

North of the Peace river—

1. Second class prairie soils.
2. First class wooded soils.
3. Second class wooded soils.

The order of settlement should in every case follow the order of decreasing fertility of the soils, regardless of accessibility, presence or absence of surface water, cost of clearing, and the distance from railheads now existing.

The area as a whole is undulating to gently rolling, excepting the Clear Hills plateau and the Saddle range. These hilly areas (W3) are rolling to rough in topography and are of no agricultural importance except as forestry and game reserves. They are listed as third class wooded soils and constitute about 18 per cent of the total area surveyed.

Under the heading of second class wooded soils are included some 29 per cent (762,655 acres) of the area, and of this about one-twenty-fifth is now settled. These soils generally are of more rugged topography than the better soils and usually contain a little coarse gravel or small stone. The covering constitutes medium to heavy clearing, although so vast an area as the Blueberry plateau is medium to light clearing, with 20 to 60 per cent scrub willow and poplar. The bulk of the second class wooded soil area lies south of the Peace river. Much of the area in this class of soils is devoid of surface waters. Grass vegetation, as a rule, is only sparse and not of the most nutritious varieties. The pasturage is only of secondary value, and wild hay stands are almost unknown. Settlement of the second class wooded soils should not be encouraged until the better soils have been occupied.

The first class wooded soils constitute about 21 per cent of the surveyed area. Of this amount of land, about one-twentieth is now occupied. This leaves 517,735 acres as yet unoccupied (809 square miles or 22 townships). The topography of the area is generally level to undulating, being comparable in this respect to the second class prairie soils. Large sections of the area are level, willow flats, which can be readily and cheaply brought under cultivation. The bush vegetation is on the whole lighter than on the second class wooded soils. The soils are practically free of rock and gravel. Large sections are devoid of surface water and lack facilities for the storage of run-off. Road construction is a comparatively simple matter, except where canyons are encountered.

The greater part of the areas of the first class wooded soils are north of Tp. 80 in Rgs. 7 to 9; from Tp. 79 to the Peace river in Rgs. 12 and 13; and north of the Peace river in Tps. 84 and 85, Rgs. 5 to 10. Owing to its location, the bulk of the area is some-

what removed from the most practical railway routes, but will derive considerable benefit from any railway lines that may be constructed in the surveyed area.

The second class prairie soils constitute about 22 per cent of the total area; of this less than one-third is now occupied. This leaves 412,850 acres as yet untenanted (645 square miles or 18 townships). The occupied portion of the area is almost wholly adjacent to Spirit River or Fairview, and has been settled for a period of years. The topography of the area is generally level to undulating. The drainage is adequate, thus leaving little acreage in swamps or muskegs. The bush vegetation is mostly medium to heavy clearing, but various considerably with the amount of open land. Little or no rock and gravel is to be found anywhere. Surface water, in the form of creeks, is comparatively plentiful, but will not meet all the needs of settled communities, even at the outset. Large sections of the area are devoid of potential storage facilities because of the level topography and absence of coulees. Road construction within the area is a simple matter.

The bulk of the second class prairie soils can be represented by a long 5 to 15-mile wide belt lying north of the Peace river and extending from Dunvegan, along both sides of the Eureka-Clear river systems to the British Columbia-Alberta boundary in Tp. 83, R. 13. Of this area about two-thirds will be directly benefitted by the most feasible railway route which may eventually serve the surveyed area.

The better areas should be provided with transportation facilities at the earliest possible date.

It is doubtful if there exists any other single area of similar size in the north country where the percentage of unoccupied desirable soil is as great as that found in the surveyed area covered by this report.

LIST OF PUBLICATIONS
OF
THE SCIENTIFIC AND INDUSTRIAL RESEARCH
COUNCIL OF ALBERTA.
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ANNUAL REPORTS OF COUNCIL

- No. 3 (for the calendar year 1920); pp. 36. Price 5 cents.
No. 5 (for the calendar year 1921); pp. 86. (Out of print.)
No. 8 (for the calendar year 1922); pp. 64. Price 35 cents.
No. 10 (for the calendar year 1923) with 4-color map of Alberta coal areas; pp. 76. Price 50 cents. Map No. 6 only, 15 cents.
No. 12 (for the calendar year 1924); pp. 66. Price 35 cents.
No. 16 (for the calendar year 1925); pp. 65. Price 35 cents.
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No. 25 (for the calendar year 1929); (In Preparation).
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REPORTS—FUELS

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No. 2 (1920); pp. 138+14. Supplements the information contained in Report No. 1.
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