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CB - AUSTRALIAN 30(1)A

PRELIMINARY REPORT ON THE
CARIBOO COAL AND CLAY SYN.
PROPERTY AT AUSTRALIAN

A. LAKES

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FEB 14th 1930

GEOLOGICAL BRANCH
ASSESSMENT REPORT

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Puella Bay Mining & Dev. Co. Ltd.,
Vancouver, B. C.

Gentlemen:

In your interest I made a preliminary examination of the property of the Cariboo Coal & Clay Syndicate adjoining Australian station on Pacific Great Eastern R. R. Cariboo district, British Columbia.

The object of this examination was to determine whether the property shows sufficient commercial promise to warrant exploration and development. The property is prospective at present as no coal has been opened below the zone of weathering.

About five inches of snow covered the ground and the ice from Fraser River had piled considerably above water level obscuring the outcrop of the most important coal seam which occurs on the west bank. No pits have been sunk into this coal sufficiently to determine its width. For these reasons I was unable to examine it fully nor could I obtain check samples. I shall therefore have to rely upon description by W. S. Bacon in his report of Nov. 29, 1929, for data regards this seam and upon sample analysed by J. R. Williams for F. H. Hutton, Nov. 23, 1929, and analysis by Jean de Souza Costa, Dec. 20, 1929 regards calorific value of the coal from this outcrop. I examined and sampled the upper seam $\frac{1}{2}$ mile up Australian Creek from the railway. I viewed the various outcrops and am convinced that there are at least two workable coal seams on the property. As the outcrops and shallow workings are in localities 2 to 4-miles apart and conditions suggest continuity I believe that considerable acreage is underlain by coal.

Herewith my report presenting such facts as were obtainable, the facts that are obscure with reasonable surmise regards them, together with maps and charts in explanation. Preliminary exploration by boring and test pits will be necessary to determine essential facts that are at present obscure. The results of this work will form basis for development program and should define the commercial possibilities.

Respectfully submitted,

"Arthur Lakes"
Mining Engineer & Geologist

Vancouver, B. C.
February 14, 1930.

PRELIMINARY REPORT
ON THE
CARIBOO COAL & CLAY SYNDICATE
PROPERTY

PROPERTY

The property comprises 24 leases, about 15,360-acres, adjacent to Pacific Great Eastern Railway which affords direct transportation to Vancouver and coast markets.

COAL SHOWINGS

There are at least two workable seams of sub-bituminous coal possibly 100 to 140 feet apart. Upper seam "A" is 7 $\frac{1}{2}$ -ft. thick with 10-in. parting in the middle at its exposure near the railway. Upper seam "B" across the Fraser is reported to be about the same width. The most important lower seam "C" is reported to exceed 8-ft. thickness at outcrop near Doyle's camp and 12-ft. at its probable south extension near Ferry ("X" on plan "B"). The true thickness at Doyle's has not been disclosed by pit or erosion.

The outcrops and shallow workings are in localities 2 and 4-miles apart (Plan "B") and conditions suggest continuity of the lower seam across the river at Doyle's. Therefore indications are that considerable area is underlain by coal at comparatively shallow depth on both sides of the river.

Fraser River divides the property in two parts. The railway is on the east side where upper seam "A" occurs. Upper seam "B" which may be continuation of seam "A" and lower seam "C" outcrop near Doyle's on the west side. The coal exposure near Ferry is on the railway side. Seam "C" is reported to outcrop 750-ft. along the river, 100-ft. back from the river, and 8-ft. thick above water level, still continuing downward beneath. Exposures of coal occur south along the river for 3-miles and in the old working on the east river bank at "X". Drift coal and other exposures occur north of Doyle's camp for more than a mile. Dip of coal on the west bank is westerly, on the east side being NW to easterly indicating a gentle anticlinal with the river following axis part of the way. The beds dip generally less than 10° with maximum 15° at "A".

AVAILABILITY

If preliminary exploration proves continuation of lower seam across the river from Doyle's a shaft could be sunk on east side and the coal developed therein. A short spur connection with the railway would permit production from this area. Later the shaft could be deepened and a drift run under the river to tap the downward continuation of the important west part of the coal seam as sketched on Exhibit "C". This would be feasible as formation is

fairly hard, impervious clay which would make a water tight roof for the tunnel under the river. The rock is easily drilled and broken. The cost would be less than erection of an aerial tram across the river and coal mined at the west side would also be subjected to minimum handling thus maintaining better market product.

COAL QUALITY

Whilst the coal occurs in the upper, or Tertiary measures which are usually lignitic there are numerous places in the interior of British Columbia and in Washington where good commercial coal is being mined. Account of certain geologic conditions, outlined in this report, the coal in this vicinity has been altered from lignite into good grade, hard, sub-bituminous which withstands weather disintegration.

ANALYSES

All samples are from weathered coal as no work has been done below that zone. Analyses therefore show lesser calorific value and higher moisture and ash than may be expected below this zone. Analyses indicate that the upper seams "A" and "B" are inferior to lower seam "C".

- (1) Seam "A" across $7\frac{1}{2}$ -ft. width in two cuts with 10-in. parting excluded but thin partings included in cut from wall to wall.

Moisture	Volatile Combustible Matter	Fixed Carbon	Ash	Sulphur
18.84%	30.03%	31.57%	19.56%	1.59%

Calorific value of sample 6,720 B.T.U.
" " raw coal 11,070 B.T.U.

- (2) Seam "B" coal partings removed, outcrop at 7-mile Creek "Upper seam"

Moisture	V. C. M.	Fixed Carbon	Ash	Sulphur
17.15%	30.45%	45.32%	7.08%	1.04%

Calorific value of sample 7,940 B.T.U.
" " raw coal 10,500 B.T.U.

- (3) Seam "C" lower at west bank Fraser River. Analysis of sample given J. R. Williams by F. H. Hutton, Nov. 23, 1929. Probably sample weathered coal similar to that being used for fuel at Doyle's camp.

Moisture	V. C. M.	Fixed Carbon	Ash	Sulphur
14.82%	32.38%	52.20%	0.60%	

Calorific value (approximate B.T.U.) 12,560
Specific Gravity 1.56

- (4) Analysis of coal sample supplied Jean de Souza Costa for his exhaustive tests Dec. 19, 1929.

Moisture	V. C. M.	Fixed Carbon	Ash	Sulphur
12.8%	28.3%	56.4%	2.4%	0.1%

Calorific value 12,800 B.T.U.

Specific gravity 1.35

Porosity 14.6%

Resistance, compression test 2,583 lb. per sq. in.

It is probable that this coal was cleaned of all foreign matter.

The coal is dull black at surface with white coating but when broken is shiny black. It is hard and resists weather disintegration. Its chemical analysis and calorific value puts it in sub-bituminous class competing in quality with Alberta and British Columbia coals on Vancouver market as indicated on Plates I and II herewith.

MARKET

This coal would be adaptable for (1) domestic uses which burning tests show it as good as other coals in use in Vancouver, (2) commercial use and (3) as pulverized coal in development of cheap power which is attaining greater adaptation each year, (4) manufacture of by-products as indicated in report of Jean de Souza Costa, though the immediate market for these in Vancouver needs further investigation and (5) local manufacture of clay products and cement in conjunction with the large clay deposits in immediate vicinity of the coal and the limestone reported nearby.

The coking qualities have not been determined and possible commercial value in this respect is unknown.

Incidentally the diatomite possibilities may be developed in conjunction with other developments. These will require further investigation.

GEOLOGY

The coal bearing formation is about 700-ft. thick consisting of interbeds of cemented gravels and conglomerate, sandstone, shale, hard clay, and infusorial earth. This is underlaid by volcanic basalts, andesites, and tuffs, and overlaid by about 3,000-ft. of basalt lavas, conglomerates, and sandstones which have since been eroded away in this vicinity so that the coal outcrops or lies at shallow depths below surface.

The weight of overlying sediments compressed the coal and the heat from overlying later basalt lavas altered it so that what would normally have been lignite is now hard, resistant, sub-bituminous coal of good physical quality and calorific value.

SUMMARY

Summing up, the known factors are (1) excellent transportation facilities to markets at Vancouver and the coast, (2) at least two workable coal seams within close proximity of each other whose weathered

samples show good quality coal, (3) probability that the beds will prove continuous east and west of the river over considerable acreage, (erosion has cut down the pre-existing surface to within shallow depth of coal seams), (4) the seams may be opened by shafts at shallow depth which will reduce development cost to minimum, (5) flat or gentle dip of seams will permit cheap mining of the whole of the better grade coal, (6) impervious clay roof which stands firmly and will work easily therefore the cost of dead work should be at minimum in material that possibly may be put to commercial use, (7) timber, water, and other mining facilities adjacent to the proposed works and power generation by coal from the seams, (8) Fraser River makes necessary means of transport for important west coal showings to the east side where the railway is situated, (9) cost of spur would be low account of the gentle topography, (10) overburden covers most of the surface partially obscuring outcrops of coal seams and formation. The factors not observable which will have to be determined by preliminary exploration before we can outline true commercial possibilities and plan program of development are: (11) undetermined thickness, attitude, and position of the lower seam east and west of the river, (12) character of footwall of lower seam which would form roof of the tunnel under the river, (13) undetermined character and calorific value of the coal below the zone of weathering.

To determine the unknown factors will require from \$5,000 to \$10,000 in preliminary exploration by pits near Doyle's and by bore holes into the deeper measures east and west of the river. In view of the indicated importance of the coal showings this expenditure is small. The cost would depend upon results of initial work and the extent then deemed advisable. In addition, the drill hole locations should be plotted by stadia survey taking into account structural features indicative of coal extension, the more favorable water localities for drilling, etc.

The pits and survey work could best be done while the river is frozen. The drilling will have to await spring thaw when water is available in the creeks near hole locations.

Regards the clay and infusorial earth deposits. I advise that these be investigated as they may afford good commercial possibilities in view of the comparative scarcity of developed higher grade clay deposits in Canada. Until the various deposits have been located and examined to determine position and extent consideration of their commercial possibilities is entirely speculative despite the good results from analyses by Jean de Souza Costa, January 22, 1930, which indicates various commercial uses.

CONCLUSIONS

Analyses of weathered coal, its hardness and resistance to disintegration, the indications of continuity over considerable area, and the exceptional advantages regards transportation and working conditions justify expectation that this coal area may develop important commercial possibilities as a producer of sub-bituminous coal when explored below the zone of weathering. It may be developed and marketed more expeditiously and at less cost than 80% of new ventures. Certain factors will have to be determined before this expectation is proven. The cost of this will be small. The chances for success appear to be better than the average.

RECOMMENDATION

In view of the indicated superiority of the coal in lower seam "C" I advise that attention be concentrated upon it for the initial investigations and that the upper seam "A" be given secondary consideration.

I recommend preliminary exploration to determine essential facts at present obscure. Success of this work will form basis for development program and should fully define commercial possibilities to justify expenditure necessary to put the property into production. Until this is done no estimate of development expense can be made.

The clay and infusorial earth possibilities should be investigated further.

Following are additional data with maps and charts in explanation of this report.

Respectfully submitted,

(sgd). Arthur Lakes

Mining Geologist & Engineer

Vancouver, B. C.
February 14, 1930.

PROPERTY & TITLE

The 24-sections were applied for and advertised Nov. 23, 1929, over name of F. H. Hutton as leases for coal, gas, and petroleum. Whether working rights have been granted and whether there may be further requirements for title remains for investigation. These leases do not give rights to clay, infusorial earth, nor to timber.

SITUATION

The leases are contiguous to Australian station on P.G.E. Railway, 329-miles north of tide water terminus at Squamish, and 20-miles south of the present terminus at Quesnel. Extension of this railway 75-miles north will connect with the Canadian National R.R. at Fort George. About 40-miles of railway from Clinton to Ashcroft would connect the P.G.E. with the main lines of C.P.R. and C.N.R. running into Vancouver. Clinton is 162-miles south of Australian. It is rumoured that this connection is contemplated in the near future. This would greatly increase marketing facilities and probably reduce freight rates. The present freight rate would be reduced materially in event that this property is put on commercial production. Its situation in this respect would make it favored competitor with the coals of British Columbia and Alberta.

The property is also reached by the Cariboo auto highway from Vancouver to Prince George. The relation of the property to Vancouver and various other localities is shown on Exhibit "A".

CLIMATE

The area east of the coast range is in the so called dry belt. Precipitation is light. The weather is cold for about 3 months but there are no climatic conditions that will interfere with year round operations on mining basis. The Fraser River makes travel 11-miles by road from Australian to Doyle's via Ferry in summer but by crossing the ice the trip is only 1½-miles in winter.

TIMBER

Low wooded hills on the leases will provide sufficient timber for mining purposes.

WATER Fraser River and confluents afford water for all purposes. Until thaw there will be insufficient for diamond drill purposes hence exploration by bore holes will be delayed until April.

GEOLOGY

The coal bearing strata were deposited in lake basins which afforded flourishing growth and subsequent accumulation of vegetable remains formed important coal seams. Basalt overlies these strata. Basalt is an igneous rock that rose from the interior of the earth through fissures and flowed over surface hence its source is beneath the coal. The weight of superimposed rocks and the heat from overlying volcanics compressed and altered the coal on this property from what would normally have lignite to sub-bituminous and bituminous. The deeper coal should have higher fuel ratio and less moisture than the upper beds.

As the coal was formed in lake basins these would limit expanse of the coal measures and there would also be more or less irregularity in width of coal seams and occurrence. However various outcrops indicate wide-spread occurrence and lead to belief that considerable part of the property will be underlaid by commercial coal. A small amount of boring will help to ascertain the facts in this respect.

Indications of major faulting were not in evidence.

CLAY

As much of the country rock is residual clay it is probable that workable clay deposits exist on this property. As none have been definitely located I shall not try to detail commercial uses until more is known about their occurrence. I refer you to analyses by Jean de Souza Costa, January 22nd, 1930, which gives results from four samples of clay and one of infusorial earth. He suggests that the clays are adaptable for the following uses: (1) manufacture of superior fire brick, (2) manufacture of alumina cement, (3) manufacture of architectural terra cotta and for ordinary fire brick, (4) manufacture of ornamental terra cotta, (5) the infusorial earth mixed with clay making insulating material. More information should be forthcoming regards the localities of the various clays and the size of deposits before their significance can be outlined.

Residual clays are formed by alteration of rock in place. Transported clays are formed by weathering and transportation and deposition by water, etc.

The residual clays here were probably formed by hot solutions rising from below altering the basalts and sediments of original strata.

Much of the residual clay is probably metamorphosed reducing its value. There are probably beds of transported clay which may be of good value. The better deposits should be searched out and their extent determined. Obviously the deposits nearer the railway would prove most valuable other things being equal.

INFUSORIAL EARTH

This material occurs in the property. The extent has not been determined. Until more is known regards the deposits their possibilities are speculative. A sample analysed by de Souza Costa gave the following:

Silica	Alumina	Lime	Ferric Oxide	Soda	Water
75.85%	9.88%	0.29%	2.92%	1.63%	8.37%

The iron content would probably cause this to burn brown.

There are numerous uses of infusorial earth which might make deposits on this property commercially important in conjunction with production from the coal beds.

MARKETS

According to statistics more than 5000 tons of coal is sold per day in Vancouver and the coast cities of British Columbia. About 500,000 tons per annum comes from Alberta. Puget Sound cities draw a large tonnage from British Columbia.

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According to statistics more than 5000 tons of coal is sold per day in Vancouver and the coast cities of British Columbia. About 500,000 tons per annum comes from Alberta. Puget Sound cities draw a large tonnage from British Columbia.

The analyses of weathered coal from this property classifies well with competitive coals as indicated on Plate II. It is to be expected that coal below this zone will show improvement over these analyses.

With its railroad connections and short distance to the coast it is to be expected that lower freight rates will prevail on this coal in event of commercial production favoring the competitive value of this coal over others which require longer haul. The cheapness of mining will be another factor.

BOYLES BROS. LTD.

CARIBOO COAL & CLAY CO. LTD.

LOG OF DIAMOND DRILL HOLE NUMBER ONE

<u>Footage</u>	<u>Description</u>
- 13	Sandy clay
13 - 27	Interbedded gravel and sand
27 - 45	Fine sand
45 - 63	Gravel
63 - 80	Soft clay
80 - 100	Carbonaceous clay
100 - 114.5	Coal seam, 100 - 101 Poor coal 101 - 105 Sampled 105 - 114.5 Much clay but some hard coal Good core in whole seam sent in as testing material.
114.5- 162	Sandy clay. Much sand in places. A little carbonaceous.
162 - 164	Coal. A little tar. Seems to be a better coal than the seam above. Cracks but little on drying. Sampled.
164 - 177	Carbonaceous clay. 164 - 173 Much carbonaceous. 173 - 177 Very carbonaceous. A very poor coal.
177 - 205	Hard clay
205 - 207	Sandstone
207 - 208	Conglomerate
208 - 209	Sandstone
209 - 246	Soft clay. Very heavy
246 - 247	Carbonaceous clay
247 - 249	Coal. Perhaps larger seam than indicated. Sample sent in.
249 - 254	No core obtained.
254 - 258	Heavy clay
258 - 266	Light-coloured clay. Seems pure. Cores well. Shows minor faulting.
266 - 320	Brown Clay. Pure. Cores well.
320 - 628	Carbonaceous clay.

(signed) K. C. Watson.

BOYLES BROS. LTD.

CARIBOO COAL & CLAY CO. LTD.

DIAMOND DRILL HOLE NO. 2

Location. 1564 North of the S.E. Corner of Lot 4,
91 East of the S.E. Corner of Lot 4.

20	Glacial Clay
20 - 42	Clay
42 - 48	Sand
48 - 180	Glacial drift and clay
180 - 190	Interbedded gravel, sand and clay
190 - 212	Fine sand
212 - 220	Gravel and boulders
220 - 229	Fine sand and small boulders
229 - 235	Gravel and clay. Hole cemented from 213 - 235. Cement core shows a little flake gold.
235 - 284	Fine sand and gravel with a little clay
284 - 317	Gravel
317 - 353	Sand
353 - 362	Boulder
362 - 450	Glacial clay
450 - 565	Clay
565 - 639	Sandy clay

(signed) K. C. Watson

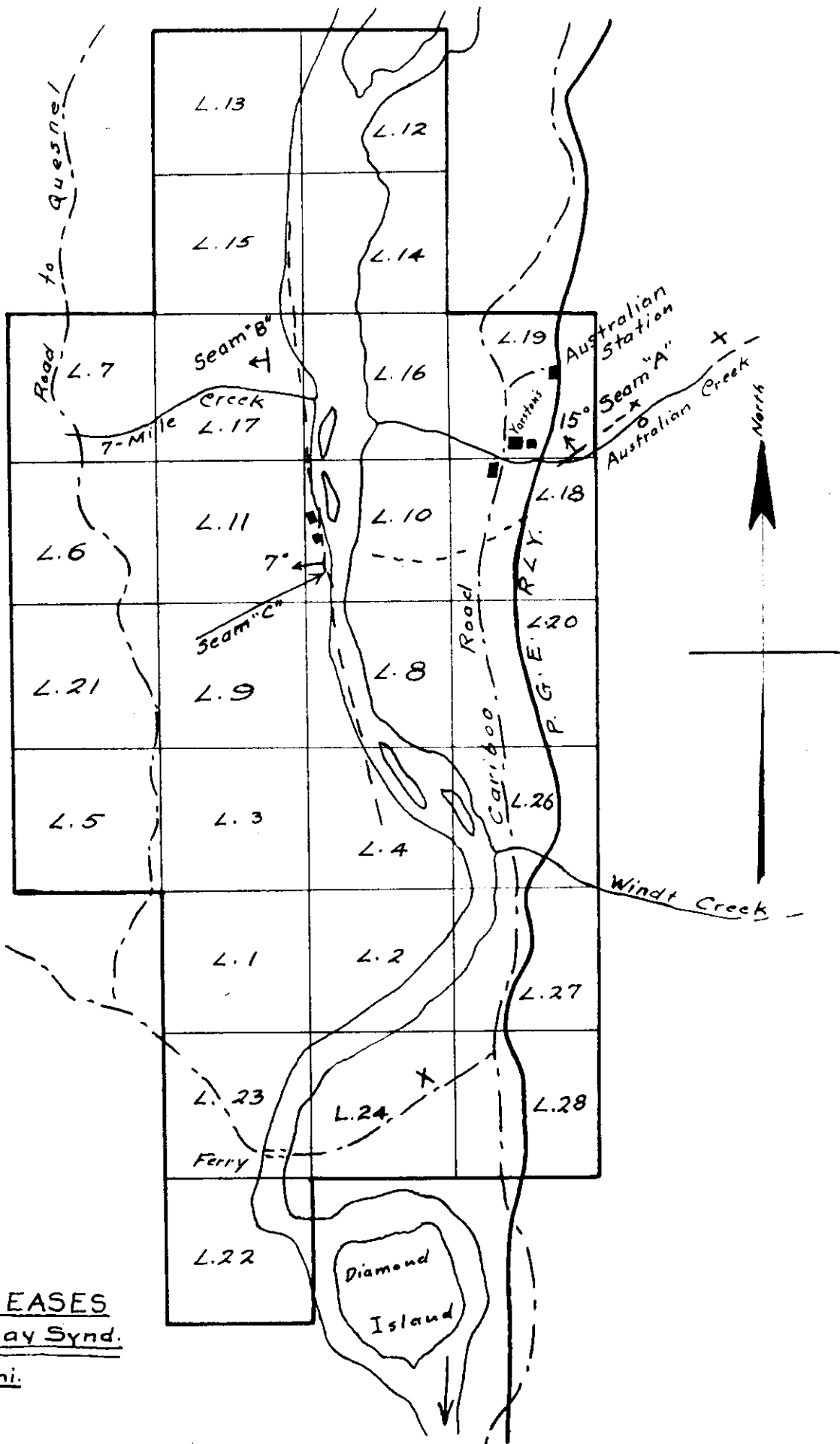
Foreman.

BOYLES BROS. LTD.
 CARIBOO COAL & CLAY CO. LTD.
 DIAMOND DRILL HOLE NO. 3

Location. North 1983 feet and East 2762 feet of the S.W. corner of Lot 4.
 Elevation - Collar of hole is at 1785.

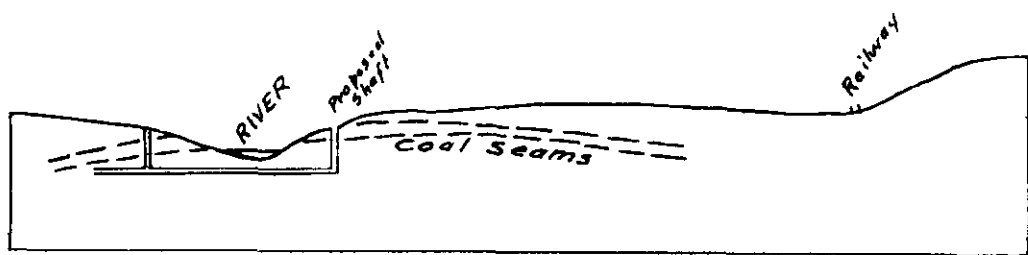
<u>Footage</u>	<u>Description</u>
5	Carbonaceous clay
5 - 12	Coal
12 - 19	Broken seam of coal
19 - 151	Brown clay
151 - 200	Brown clay, little carbonaceous material.
200 - 230	Pure brown clay
230 - 324	Clay, brown
325 - 344	Dark brown clay
344 - 475	Young sandstone
475 - 482	Carbonaceous clay
482 - 484	Carbonaceous clay
484 - 497	Poor coal.
494 - 509	Coal
509 - 535	Coal with clay partings
535 - 543	Coal
543 - 563	Coal
563 - 568	Carbonaceous clay
568 - 597	Clay with streaks of coal
597 - 620	Light sandy clay

(signed) K. C. Watson
 Foreman

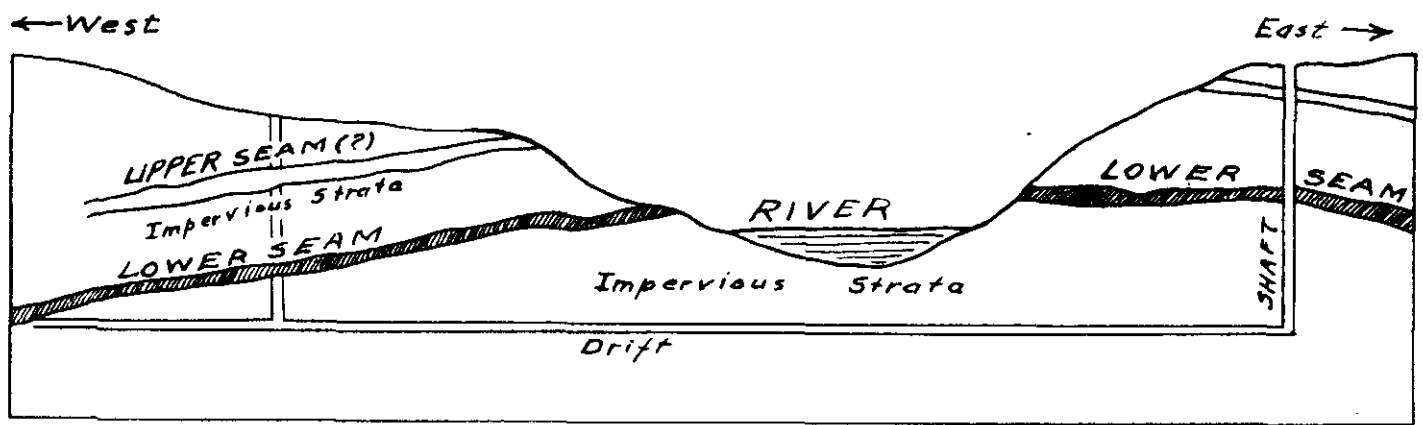


PLAN OF COAL LEASES
Cariboo Coal & Clay Synd.

SCALE ± 1 in to 1 mi.



1. SKETCH SHOWING RELATION RAILWAY TO SUGGESTED SHAFT.



2. SKETCH SHOWING SUGGESTED METHOD OF OPENING MAIN COAL SEAM East & West of River.