

BK. BOWRON RIVER 76(1)A.

OPEN FILE

R E P O R T

ON

THE BOWRON RIVER COAL DEPOSIT

OF

NORCO RESOURCES, LTD.

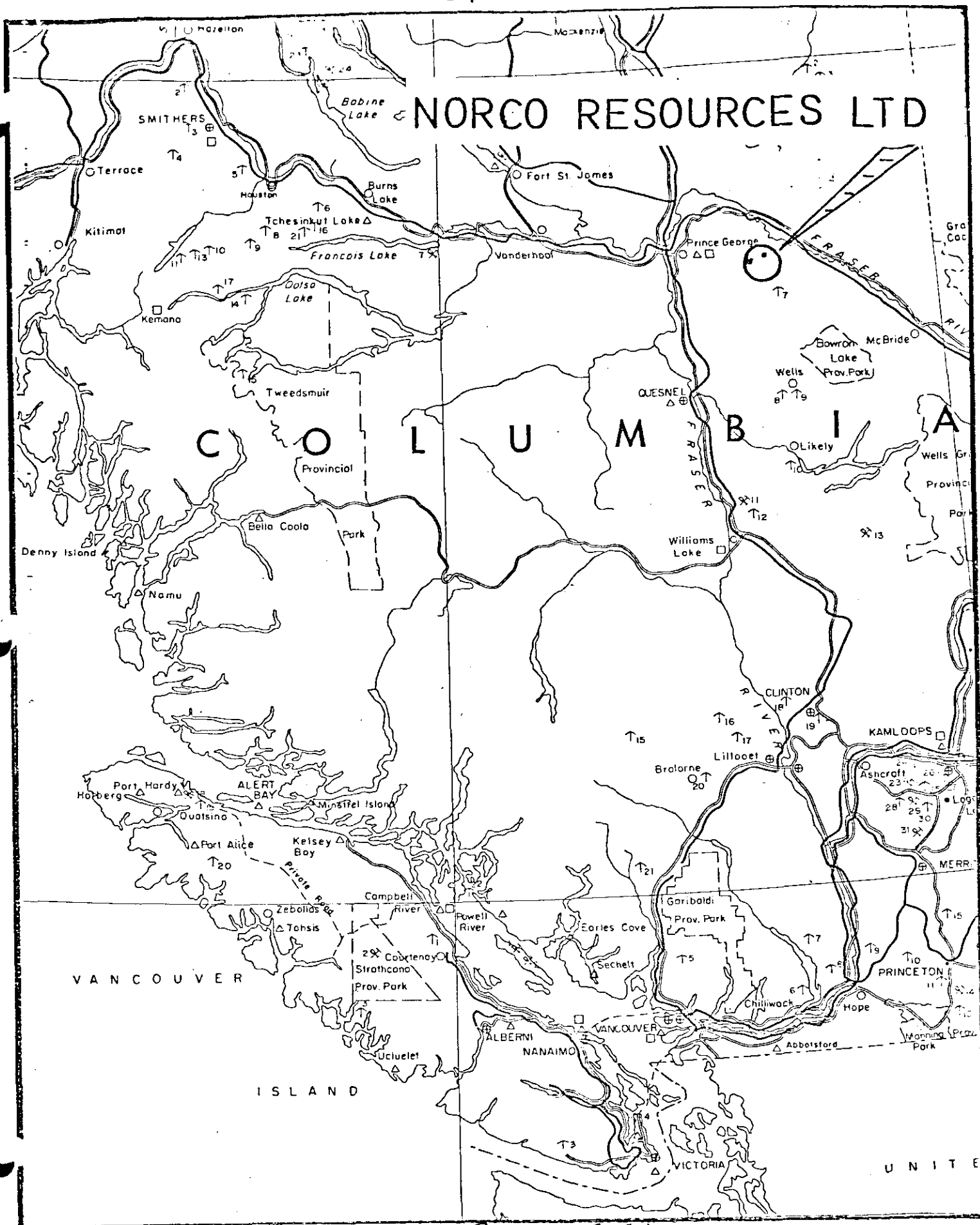
by

L.S. TRENHOLME, M.Sc.

March 10, 1976

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NORCO RESOURCES LTD



BR- Bowron River 76 (1)A

General Location Map 1 inch to 50 miles

PLATE I.

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INTRODUCTION

Norco Resources, Ltd. holds 3 square miles of property in the Bowron River Valley under licence from the Government of British Columbia.

The writer served as a director of Northern Coal Mines Ltd., predecessor to Norco Resources Ltd., from May 1971 to August 1975 and has made one visit to the company's coal property (June 1969) at which time the underground workings were accessible for inspection.

The writer's chief association with coal deposits was gained during his direction of the drilling and preliminary evaluation stages of the Sukunka coal deposit, near Chetwynd, B.C.

This report is based on extensive study of company records and of various geological reports listed under "Selected References".

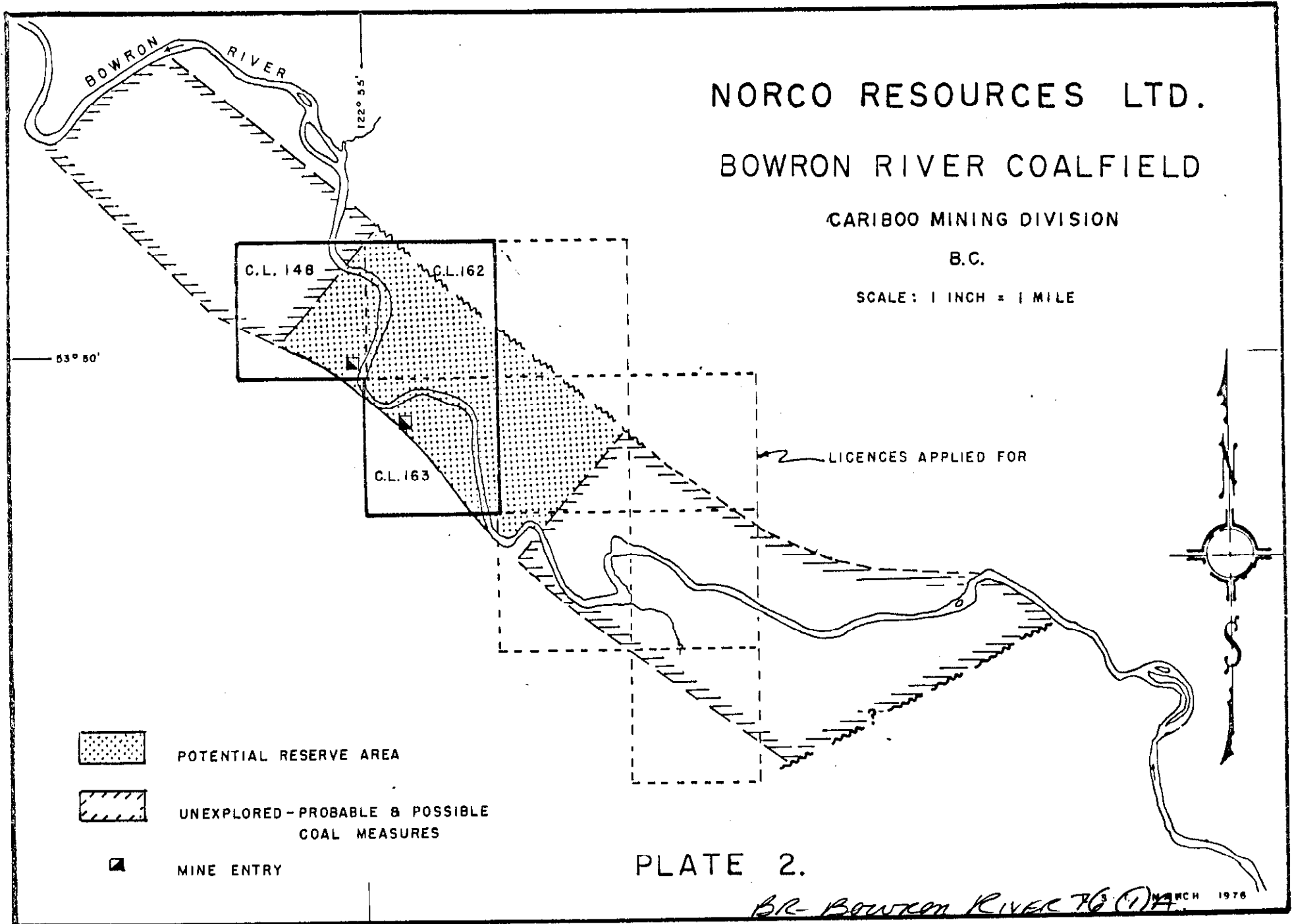
NORCO RESOURCES LTD.

BOWRON RIVER COALFIELD

CARIBOO MINING DIVISION

B.C.

SCALE: 1 INCH = 1 MILE



POTENTIAL RESERVE AREA

UNEXPLORED - PROBABLE & POSSIBLE
COAL MEASURES

MINE ENTRY

PLATE 2.

BR BOWRON RIVER TO (DA) MARCH 1976

SUMMARY

1. Norco Resources Ltd. owns three Coal Licences with combined area of 1920 acres, situated 35 miles east of Prince George, B.C. in the Bowron River Basin.
2. Application has been made for adjoining licences and it is presumed that this will receive favourable consideration when the company can demonstrate its ability to conduct a major development program.
3. Total drill-indicated and inferred tonnages of coal in place on the Norco property and adjoining Crown lands are estimated at 81 million short tons of good quality thermal bituminous coal but no valid estimate of recoverable reserves can be made prior to further work.
4. Coal in the vicinity of present workings contains substantial quantities of an "Amber Resin" believed to have a market value of at least \$0.80 per pound. These might generate annual profits of close to \$2 million with a modest investment.
5. Documented reports of anomalous radioactivity at certain horizons warrant further investigation.
6. The deposits are conveniently located with respect to road and rail transportation, water, electricity and other services.
7. A first-stage expenditure of \$35,000 is recommended to test the physical properties and marketability of the resins. This, if encouraging, should be followed by a second-stage expenditure of \$65,000 to confirm mineability.

PROPERTY

The company's coal properties are situated in the valley of the Bowron River, 35 miles east of Prince George, B.C. at Lat. 52° 50' N., Long. 122° 55' W. (N.T.S. Reference 93H/13). At present the company holds three coal licences (C.L. 148, C.L. 162 and C.L. 163) of one square mile each (Plate 2). Additional contiguous licences were relinquished for financial reasons, but representations have been made to the provincial government for the future reinstatement of some of the licences to avoid multiple ownership of the deposit. The three licences which have been retained contain 85% of the indicated reserves and 31% of the inferred reserves of the Bowron River coal field as herein calculated.

ACCESS

Present access is by 37 miles of gravel road eastward from Buckhorn, a community on No. 97 Highway, 10 miles south of Prince George. However, the principal workings are within 6 miles of (paved) Highway No. 16, which extends eastward from Prince George, and within 17 miles of the Prince George - Jasper section of the Canadian National Railway.

TOPOGRAPHY

The deposits underlie the flat-bottomed Bowron River Valley at an elevation of 2,400 feet. Beyond the valley, local hills attain elevations of about 4,000 feet. Future roads or railways to the property would not encounter steep gradients.

HISTORY

- i) "Coal seams outcrop in the Banks of the Bowron River and were discovered about 1870. Some exploration was carried out just before 1914. Then very little was done until 1946. In most years since then some exploration has been carried out by a series of companies. In the last four years exploration has been successful in tracing seams for a distance of two miles and to depth of 1800 feet."

(Black, September, 1967)

- ii) 1967 Drilling under the supervision of Dr. J.M. Black completed holes WL-1A to WL-7 inclusive as shown on Plate 3. These recovered BQ (1½") core.

About 32 holes of earlier programs are not identified on the accompanying maps, Plates 3 and 4. All were drilled near the southwest (sub-outcrop) margin of the coal measures and contribute little information on reserves.

iii) Underground Work

During the 1960's, two entries, about 3100 feet apart were driven on the coal seams.

- a) The south entry explored the upper of two seams for a length of 600 feet with average width of 8 feet.
- b) The north entry "slope" was driven at -12° to expose upper and lower seams having thicknesses of 8 - 10 feet and 6 - 7 feet respectively.

iv) Bethlehem Option - 1971

- a) 5 vertical holes (71-1 to 71-5) were drilled for a total of 7,474 feet, recovering NQ (1-7/8") core.
- b) A comprehensive report on this program, submitted by Dr. Richard E. Kucera, contains detailed description of the stratigraphy and a structural interpretation; both based on core examination, surface mapping and photo-geological studies.

v) 1971 - 1976

No further work has been done on the property and the underground workings have been allowed to flood.

All relevant data have been compiled so as to be available for resumption of activities.

The company has informed the Department of Mines and Petroleum Resources of its interest in acquiring additional licences as soon as funds for a major program become available.

GEOLOGY

The coal measures occur within a few hundred feet of the base of a thick succession of Tertiary (?) sedimentary and volcanic strata which occupies a trough-like depression in the underlying Slide Mountain strata of Mississippian age.

General descriptions are provided by Black (1967) and a more detailed account of structure and stratigraphy is given by Kucera. (1971)

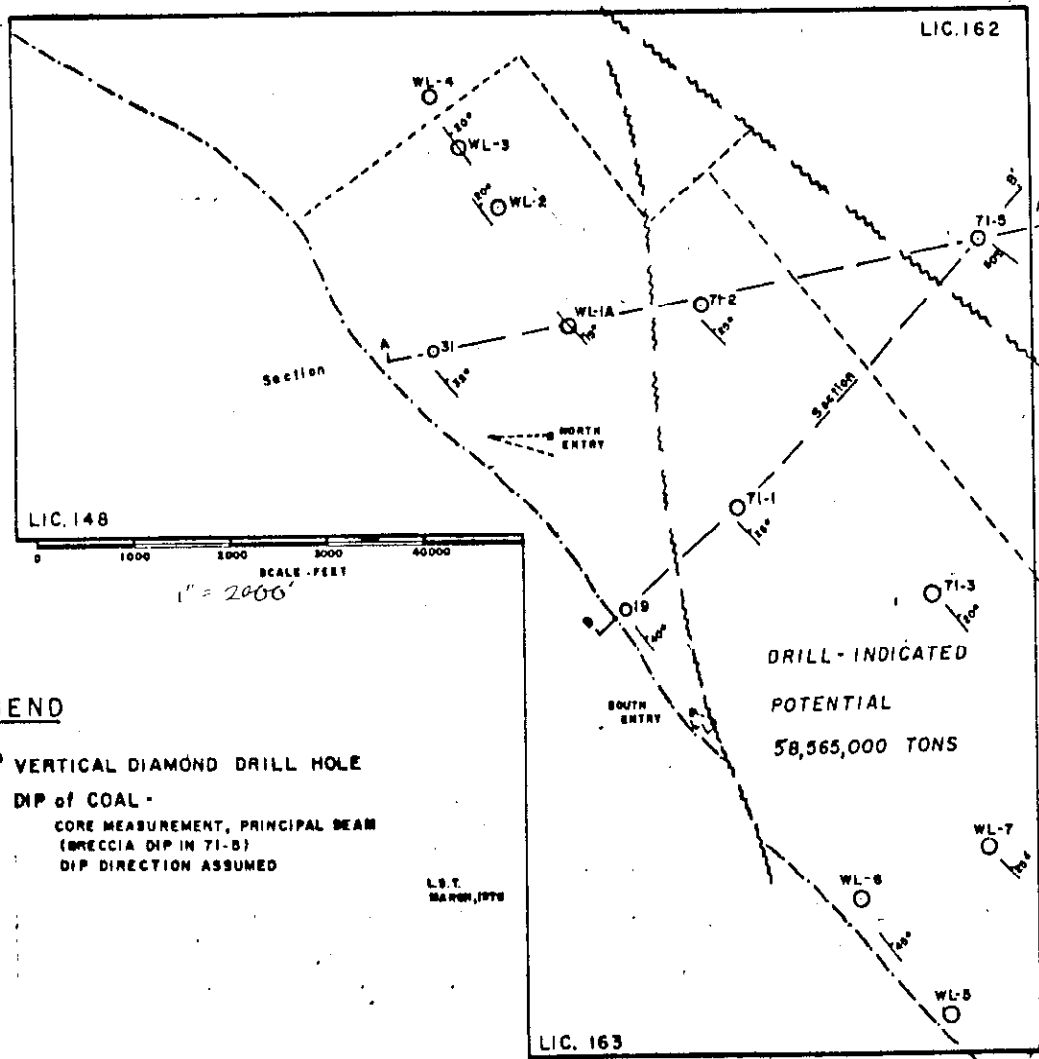
UNEXPLORED - POSSIBLE COAL MEASURES

PLATE 3

BR-Bowron River 76(1)A

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SURFACE PLAN
BOWRON RIVER BASIN



LIC.148

LIC.162

LIC.163

LEGEND

- VERTICAL DIAMOND DRILL HOLE
- DIP of COAL -
CORE MEASUREMENT, PRINCIPAL BEAM
(BRECCIA DIP IN 71-B)
DIP DIRECTION ASSUMED

L.S.T.
MARCH, 1978

DRILL-INDICATED
POTENTIAL
58,565,000 TONS

INFERRED POTENTIAL
22,845,000 TONS

UNEXPLORED
POSSIBLE COAL MEASURES

10,000 N

10,000 N

0,000 E

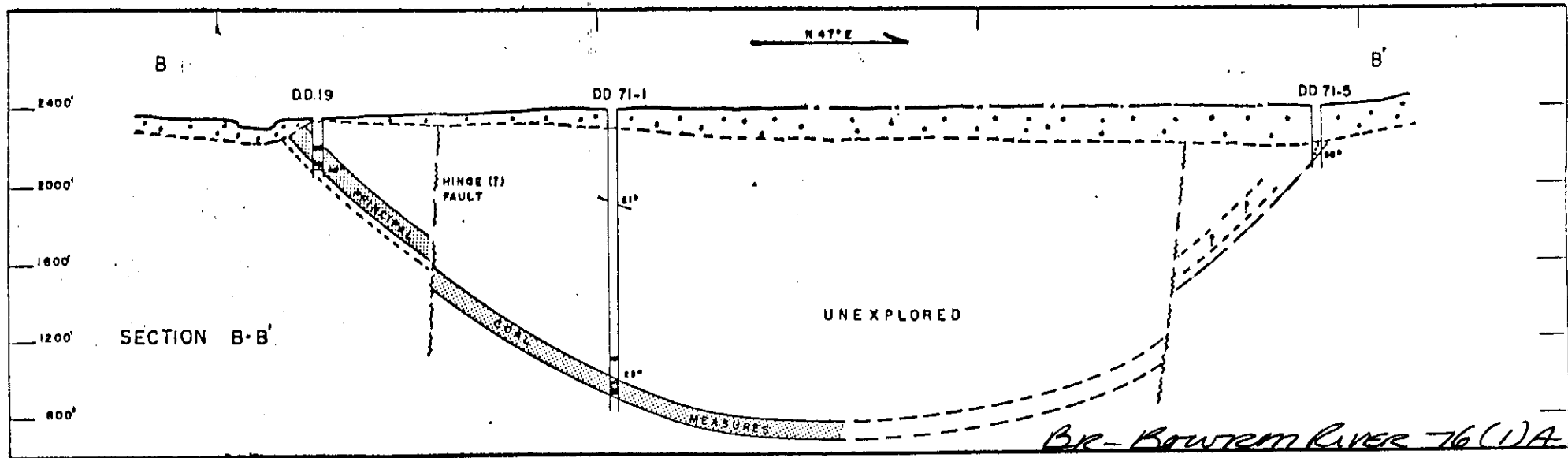
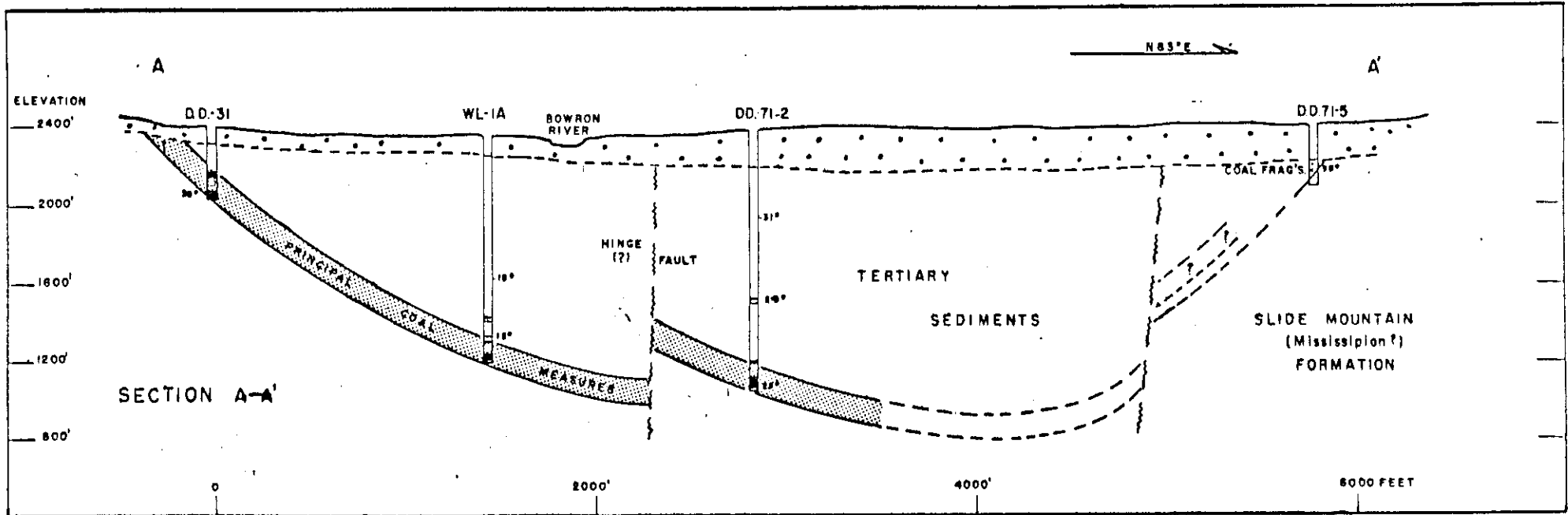
COAL RESERVES

Black, in 1967, calculated indicated and probable reserves of 20,185,000 short tons of coal in place.

The 1971 drilling programme substantially extended the area of known coal deposition. However, much more closely spaced drilling would be required to make any reliable estimate of actual mineable reserves.

The present calculation of 81.4 million tons of total coal in place considers only an explored strike length of 14,000 feet and a horizontal width of 5,000 feet terminated down dip by an assumed limiting fault on the northeast flank of the basin, as inferred from the log of D.D.H. 71-5.

The strike limits are determined by D.D.H. WL-4 to the northwest and an arbitrary extension of 2,200 feet beyond D.D.H. 71-4 to the southeast. The coal-bearing strata probably extend beyond these limits.



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PLATE 4.

VERTICAL SECTIONS

BOWRON RIVER BASIN

L. S. T. MARCH, 1976

NORCO RESOURCES LTD.

Summary of Potential Reserves on Property and Vicinity

I. Drill-Indicated Reserves Short Tons

Block	Norco Property	Adjoining Lots			Total	Total Reserve
		Lot 9594	Lot 9590	Lic. 1644		
A	7,344,000					7,344,000
B	9,500,000					9,500,000
C	2,631,000					2,631,000
D	9,160,000					9,160,000
E ¹	4,127,000					4,127,000
E ²	7,174,000					7,174,000
F ¹	4,757,000					4,757,000
F ²	3,260,000		1,086,000		1,086,000	4,346,000
G ¹	1,855,000		1,200,000	600,000	1,800,000	3,655,000
G ²			2,331,000		2,331,000	2,331,000
H ¹				1,776,000	1,776,000	1,776,000
H ²			441,000	1,323,000	1,764,000	1,764,000
	49,808,000		5,058,000	3,699,000	8,757,000	58,565,000

II. Inferred Reserves Short Tons

Block	Norco Property	Lot 9594	Lot 9590	Lic. 1644	Total	Total Reserve
CI	1,392,000					1,392,000
DI	2,880,000					2,880,000
EI	2,800,000	2,646,000	600,000		3,246,000	6,046,000
FI		132,000	3,900,000		4,032,000	4,032,000
GI			4,535,000		4,535,000	4,535,000
HI			3,500,000	460,000	3,960,000	3,960,000
	7,072,000	2,778,000	12,535,000	460,000	15,773,000	22,845,000

TOTAL: 56,880,000 2,778,000 17,593,000 4,159,000 24,530,000 81,410,000

COAL QUALITY

The rank is "High Volatile B Bituminous". This coal is indicated to be good quality thermal coal, somewhat high in sulphur, and, subject to further testing, might be suitable for blending with other coals to produce a good quality metallurgical coke (Donaldson, 1972).

Summary of Coal Analyses - Air Dry Basis

<u>Location</u>	<u>Moisture</u>	<u>Ash</u>	<u>V.M.</u>	<u>F.C.</u>	<u>S.</u>	<u>B.T.U.</u>	<u>F.S.I.</u>	<u>Analyst</u>
"Ventilation Slope" 9' Seam	0.40	9.8	43.0	46.8	0.80	11,070	3	Coast Eldridge
"Main Slope" 200'	5.7	4.0	39.1	51.2	0.80	-	1	N.K.K. - Japan
"Main Slope" 400'	4.92	2.77	36.50	55.31	0.85	12,550	2½	Superintendence Company
Bethlehem 19 samples 4 drill holes		24.63	36.73	42.0	1.30	11,000	?	Commercial Testing & Engineering 1971

Summary of Washing Tests

<u>Sample Description</u>	<u>Medium S.G.</u>	<u>Recovery %</u>	<u>% Ash</u>	<u>% S</u>	<u>Laboratory</u>
a) 13 Core Samples - 182' from 6 drill holes					Commercial Testing & Engineering 1969
CORE (Raw Coal)		100.0	7.96	1.29	
FLOAT	1.40	86.0	4.66	1.22	
SINK	1.40	14.0	22.86	1.79	
b) Bulk Sample "Main Slope"					
FLOAT	1.50	100.0	14.6	-	Osaka
SINK	1.50	82	6.3	-	Shipbuilding
FLOAT	1.60	18	52.2	-	Company
SINK	1.60	85.6	7.3	-	
	1.60	14.4	57.9	-	

RESIN POTENTIAL1. General

The Bowron River coal deposit is known to contain significant amounts of natural resins which may be commercially important. Their extraction as primary products in a coal mining operation could be very profitable.

Bulk sampling, laboratory testing and market research would be the initial requirements to determine their economic value.

2. Resin Content of Coal

Two types have been recognized:

- a) Soluble, invisible "Refined Resin"
One analysis by Coast Eldridge, 4.05%
- b) Visible Amber Resin
Visual estimates by J.M. Black: about 4% in underground exposures and frequent references in logs of drill cores.
- c) Observations in Petrographic Study by J.R. Donaldson, G.S.C., 1972
- d) Qualitative descriptions by Battelle Memorial Institute.

There has been no systematic sampling for resin content either of drill cores or of underground coal exposures.

3. Results of Research (by Battelle Memorial Institute)

<u>"Refined Resin"</u>	<u>Amber Resin</u>
Megascopically invisible	Amber nodules elongated to about 1 inch, random distribution through seams.
Microscopic: opaque, reddish brown, irregular outlines	Light amber, transparent, sharp edges, conchoidal fracture
Completely soluble in pyridine; actually "a soluble fraction of the coal".	Completely insoluble in chloroform, benzene or pyridine
Softens about 200° C.	Does not soften at 400° C. Melts and volatilizes about 450° C.
Possible Uses: a) Low cost rubber extender b) Compares favourably with Congo resin in varnishes c) High quality baked coatings	Uses: Not tested, but appears to be superior to "Refined Resin" for coating and varnishes.

4. Markets

Natural and synthetic resins have many uses, particularly in special purpose varnishes resistant to heat and acids. The substitution of natural resins by synthetic resins has been affected to a large extent by a more reliable source of supply for the latter; most of the natural resins being imported from Africa and the Far East.

However, substantial quantities of natural resins are still being imported from Africa, India and Malaya and prices have risen from about 27¢ per lb. in 1972 to about 80¢ per lb. in 1976.

The research conducted by the Battelle Memorial Institute found that the Bowron River "Refined Resin" was superior in most respects to the Congo Resin and that the Bowron River "Amber Resin" would likely prove superior to both (high melting point, light colour). It can therefore be assumed that the "Amber Resin" would command a still higher price if specifications can be documented and a steady source of supply can be assured.

5. Production

The resin-bearing coal seams in the vicinity of the present underground workings could supply a plant of 500 tons per day capacity (or larger) for many years. Initial production could be achieved with a modest amount of development work, and mining with conventional low-cost equipment should be practical. Assuming that the Amber Resin will be separated from the coal by air classification, the preparation plant should be fairly simple. It is contemplated that the coal would be used for power generation at the site or elsewhere.

6. Profit Potential

Subject to favourable results from research, market studies and trial mining preliminary calculations indicate a profitable operation, as follows:

Revenue:		<u>Per Ton</u>	<u>Per Ton</u>
Resin (3%) 60 lbs. @ \$0.80	(2.00)	\$ 48.00	
Coal @ 25.00	(50.00)	<u>25.00</u>	\$ 73.00
Capital Cost:			
\$10 million over 10 years			6.00
Operating:			
Mining,	\$30.00		
Preparation	<u>5.00</u>	\$ 35.00	41.00
Taxes & Royalties			<u>18.00</u>
NET PROFIT:			\$ 14.00
Per annum (350 x 500 tons) x \$14.00	=	\$2,450,000.	

It is not here implied that an operation of 500 tons per day is the optimum for this property. However, an operation of this size could provide the mining and processing experience necessary to judge the feasibility of a much larger operation.

RADIOACTIVITY

Various references in the company's progress reports are made to analyses for uranium but these have not been verified at time of writing. Other references are as follows:

1. Geological Survey of Canada - Project 680106

"In British Columbia 125 stations of Tertiary coal areas were surveyed In most areas readings above or even approaching the two times background were rarely obtained, with the following exceptions:"

<u>Location</u>	<u>Reading Above Background</u>	<u>Background Microcentgens</u>	<u>Total Reading Background</u>
White Lake	16	14	2.14
Princeton	19	8	3.37
Chu Chua	33	7	5.71
Bowron River	40	4	11.0

2. Kucera (1971) Reports

"A scintillometer survey of rocks along the Bowron River, 500 feet south of the Northern Coal camp, reveals that fine-grained sandstones 5 to 10 feet below the upper coal zone are radioactive with readings up to 7 times background count...."

3. Kucera (1971, p.3)

"One foot of breccia in this drill hole (D.D.H. 71-3) at a depth of 290 feet is radioactive with readings of 4 to 5 times background count".

The present writer does not know which, if any, of the other drill holes were checked for radioactivity and thus can offer no opinion as to the potential economic importance of these occurrences. Obviously, all available existing drill cores and future cores should be carefully checked for radioactivity.

CONCLUSIONS

1. The large "potential" coal reserves calculated for the Bowron River Coalfield can only be classed as "geologic" reserves until more is known about the continuity of individual seams and by what means and to what extent they can be exploited.
2. The occurrence of substantial amounts of amber resin with the coal in underground workings and drill holes offers the possibility of earning substantial profits from a medium - to - small-scale operation. This, in turn, could facilitate evaluation of large-scale mining potential.
3. Anomalous radioactive readings may be of more than academic interest and should receive close attention.

RECOMMENDATIONS

The objectives of new work should be to provide samples of resin-bearing coal for technical and market research and to permit inspection of underground workings by potential major participants. This will require de-watering and probably partial re-timbering of some 700 feet of the northern workings ("Main Slope")

Assuming favourable results from coal and resin testing, a second stage program of development could be considered. This would consist essentially of extending present headings to demonstrate mineability and would be the first phase of a larger development program designed to prove a 10-year mineable reserve of 2 million tons in the immediate vicinity.

COST ESTIMATEStage I

i) De-watering, timbering, sampling	\$ 17,500	
ii) Shipping and Research	12,500	
iii) Travel, supervision, miscellaneous	<u>5,000</u>	\$ 35,000

Stage II (Contingent on results of above)

Underground development

500 lineal feet @ \$130.00	<u>65,000</u>
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TOTAL STAGE I AND STAGE II:	<u>\$ 100,000</u>
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Respectfully submitted,

L.S. Trenholme

L.S. Trenholme, M.Sc.

Vancouver, B.C.

March 10, 1976.

L.S.T.
10/31/76

SELECTED REFERENCES

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- A-2 "Northern Coal Mines Ltd. Report by J.M. Black, P.Eng., Consulting Geologist, January 31, 1967"
- A-3 "Report on Northern Coal Mines, Ltd., by J.M.Black, P.Eng., September 8, 1967"
- B-1 Sink-Float Analysis of Drill Cores - 1969.
- B-2 Black, J.M. Letter Report on Cleaning Tests, June 4, 1969.
- B-3 Superintendence Company (Canada) Ltd. "Proximate Analysis of Mine Sample from Main Slope" November 19, 1968.
- B-5 Proximate Analysis "Main Slope at 200 feet" Nippon Kaiji Jentei Kyokai, April 6, 1968..
- B-6 Proximate Analysis - Coast Eldridge, January 28, 1964.
- B-7 Donaldson, J.R., Geological Survey of Canada Technical Report No. 93-H-13W-1
- C-2 Battelle Memorial Institute.
Report on Refined Resins, November 30, 1966.
- C-3 Battelle Memorial Institute
Summary Report on Resins, February 28, 1967.
- C-4 Battelle Columbus Laboratories
Letter and Attachments, November 29, 1972.

CERTIFICATE

The undersigned certifies that:

1. He is a graduate geologist: B.Sc. (Sask.) 1936
M.Sc. (McGill) 1939
and has practised as a mining and exploration geologist to the present time.
2. He is a member in good stand of the Association of Professional Engineers of the Province of British Columbia.
3. This report on the property of Norco Resources Ltd. is based on careful analysis of results reported by earlier workers, who are considered to be competent and reliable, and on a brief visit to the property in June, 1969.
4. He does not now own and does not expect to receive any shares of the Capital Stock of Northern Coal Mines Ltd., or Norco Resources Limited or any other financial interest in these companies or in any of the properties referred to in this report.
5. Permission is hereby granted to Norco Resources Ltd. to use this report or any part of it for the purpose of a financial prospectus.

L.S. Trenholme

L.S. Trenholme

*LSY
10-3-76*

Dated at Vancouver, B.C.
the 10th day of March,
1976.