LILLYBURT

SOUTHEAST
BRITISH
COLUMBIA

GEOLOGICAL
REPORT
1981

AUTHOR:
B. McKINSTRY

VOLUME 1

C. SHELL - LILLYBURT 81 LWB

Crows Nest Resources LIMITED
Eau Claire Place, 525 - 3rd Avenue S.W., Calgary, Alberta (403) 232-4355
P.O. Box 2699, Station M, Calgary, Alberta T2P 2M7 Telex 03-822505

February 28, 1982

CONFIDENTIAL OPEN FILE

Ministry of Energy, Mines and
Petroleum Resources,
525 Superior Street,
Victoria, B.C.
V8V 1T7.

Dear Sirs,

Enclosed please find our report on the Lillyburt Project.

This report has been prepared by Mr. B. McKinstry, an employee of Crows Nest Resources Limited.

Mr. B. McKinstry, M.Sc., graduated in Geology from Carleton University, Ottawa in 1971. Prior to graduation, Mr. McKinstry worked as an assistant for a major mining firm and after graduation as a geologist with a mining firm, a research assistant at Carleton University and as a geologist with a consulting firm. Mr. McKinstry has been employed by Crows Nest Resources Limited as a Senior Geologist since 1981.

Mr. McKinstry's work was carried out under the supervision of our District Manager, British Columbia, Mr. Frank Martonhegyi.

I consider the aforementioned geologists to be well qualified to undertake the responsibilities they were assigned on this project. I am satisfied that the attached report has been competently prepared and justly represents the information obtained from this project.

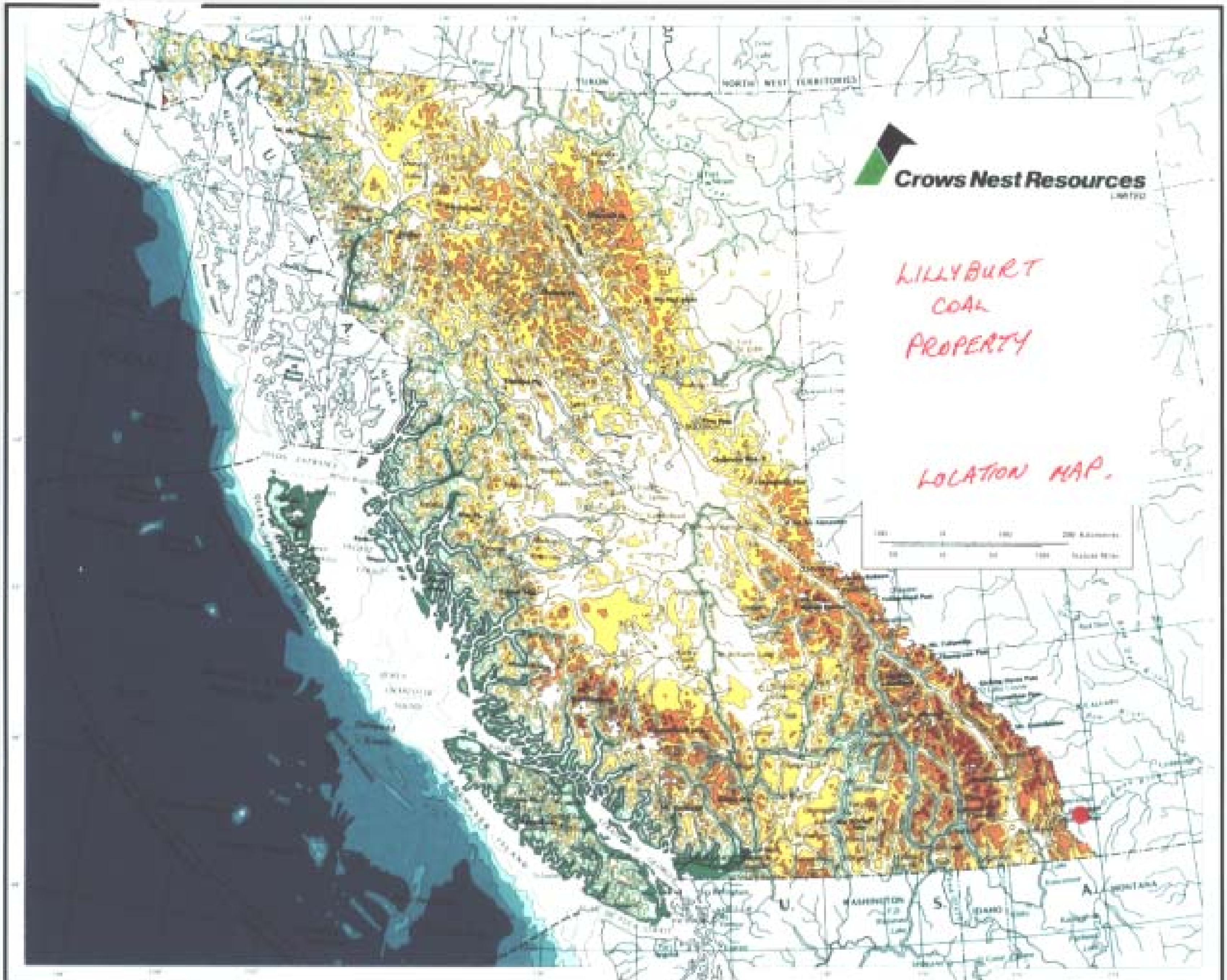
Yours very truly,

H.G. Rushton

H.G. Rushton, P. Geol.,
Vice-President - Exploration.

BMcK/ch

pt. 1 of 5



YUKON
NORTH WEST TERRITORIES
Crows Nest Resources
LIMITED
LILLYBURT
COAL
PROPERTY
LOCATION MAP.
WASHINGTON
IDAHO
MONTANA

LILLYBURT PROJECT

1981 GEOLOGICAL REPORT

VOLUME I

Kootenay Land District, British Columbia

B.C. Coal Licence Numbers: 4080-4089 inclusive

Group Number: 243

Owner: Shell Canada Resources Limited

Operator: Crows Nest Resources Limited

NTS 82G/7

Longitude: 114° 37' West

Latitude: 49° 22' North

Exploration Period: June - September, 1981

Report Prepared by: B. McKinstry, Senior Geologist

February, 1982

5/DJa.1

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

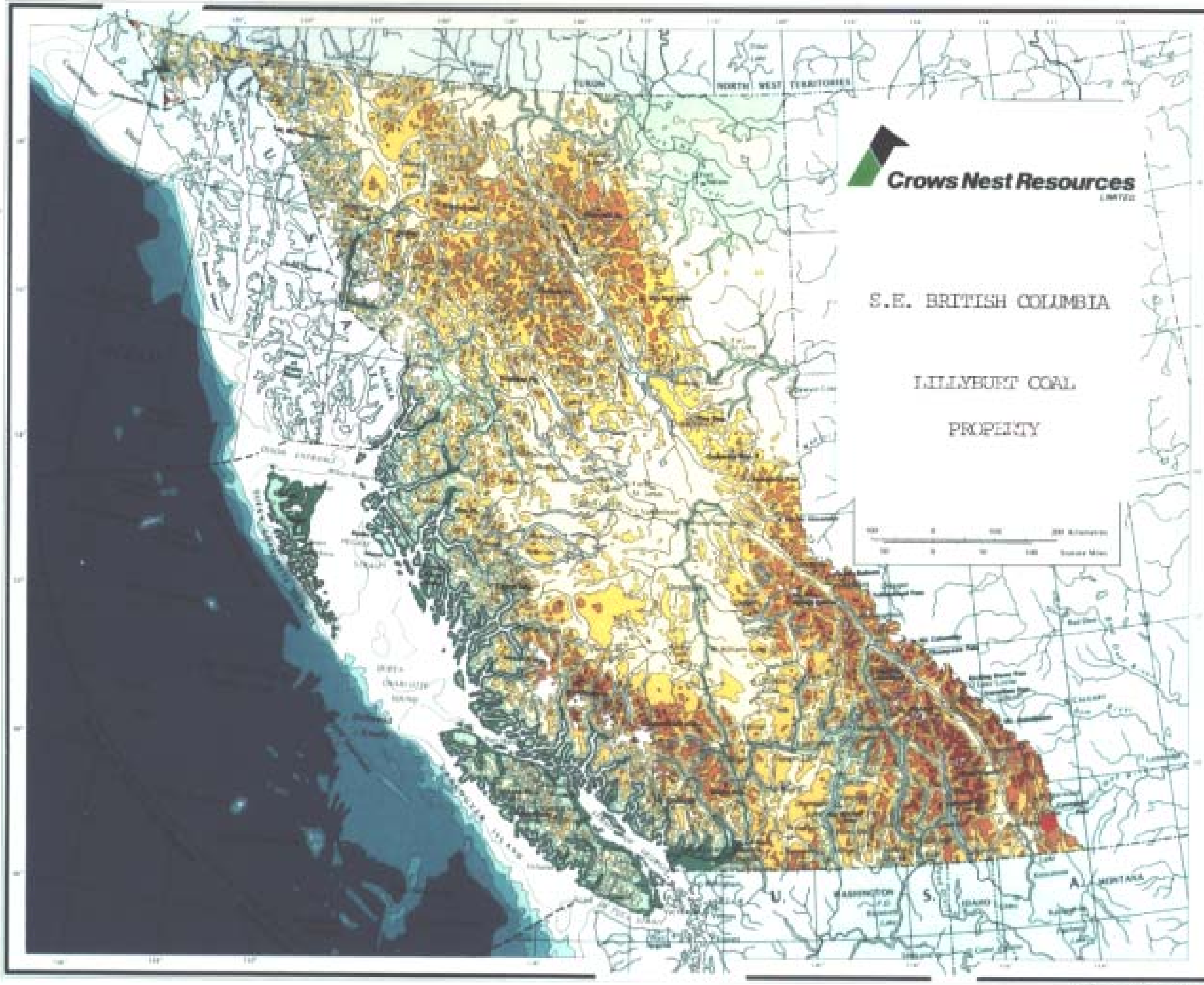
LIST OF APPENDICES

see K-Lillyburt 81(3)A

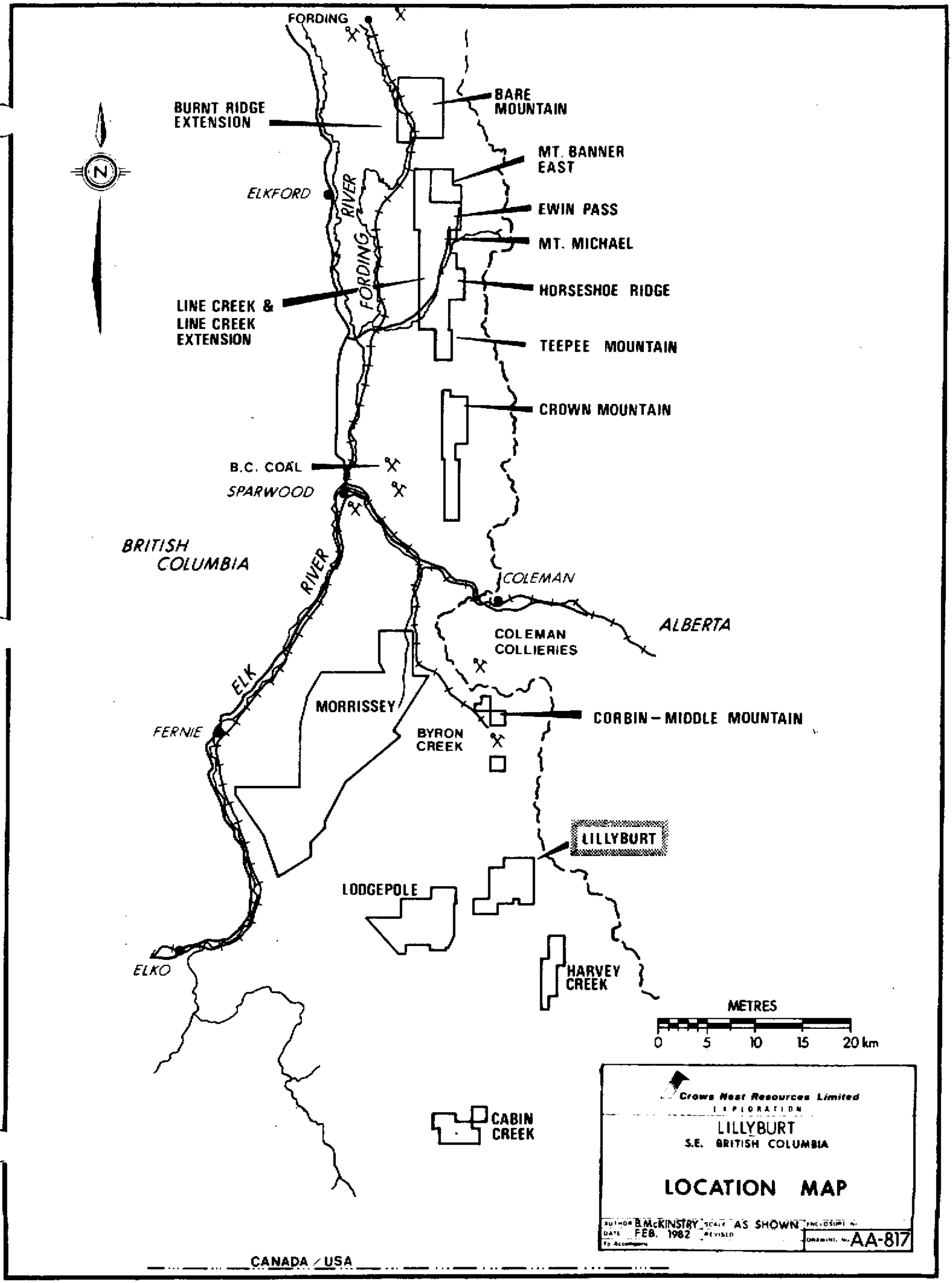
see K-Lillyburt 81(2)A

see K-Lillyburt 81(3)A

LIST OF PHOTOS 8(1)A


Crows Nest Resources
LIMITED
S.E. BRITISH COLUMBIA
LILLYBURT COAL
PROPERTY
YUKON
NORTH WEST TERRITORIES
WASHINGTON
IDAHO
MONTANA
U.
S.
A.

ENCLOSURE 1


FORDING
BURNT RIDGE
EXTENSION
BARE
MOUNTAIN
MT. BANNER
EAST
ELKFORD
RIVER
FORDING
EWIN PASS
MT. MICHAEL
HORSESHOE RIDGE
LINE CREEK &
LINE CREEK
EXTENSION
TEEPEE MOUNTAIN
CROWN MOUNTAIN
B.C. COAL
SPARWOOD
BRITISH
COLUMBIA
RIVER
COLEMAN
ALBERTA
COLEMAN
COLLIERIES
ELK
MORRISSEY
CORBIN – MIDDLE MOUNTAIN
FERNIE
BYRON
CREEK
LILLYBURT
LODGEPOLE
HARVEY
CREEK
ELKO
METRES
0 5 10 15 20 km
CABIN
CREEK
CANADA / USA
Crows Nest Resources Limited
EXPLORATION
LILLYBURT
S.E. BRITISH COLUMBIA
LOCATION MAP
AUTHOR B.McKINSTRY
SCALE AS SHOWN
DATE FEB. 1982
AA-817

SUMMARY

The Lillyburt coal property is located within British Columbia coal licences 4080 through 4089 inclusive, covering some 2459 hectares of land. The licences are located in the northeast end of the Flathead River Valley in southeastern B.C. (Enclosure 1). Access to the property is obtained via the Corbin Valley forestry access road from the Corbin coal loading facilities (15 kilometers) or via the Lodgepole forestry access road from Morrissey Station on the main C.P.R. railway line (45 kilometers). Total rail distance to Roberts Bank, Vancouver, is approximately 1150 kilometers.

The coal licences have been held since 1978 by Shell Canada Resources Limited with operations carried out by its wholly-owned subsidiary, Crows Nest Resources Limited. Exploration to date has included 25 rotary holes, 4 Diamond Drill holes, numerous backhoe trenches, geological mapping, ground control and location surveys and photogrammetric mapping.

Geology within the area of interest is dominated by normal faults to the north, east, and south and by a thrust fault to the west. Drilling data indicate Jurassic-Cretaceous Fernie, Kootenay and Cretaceous Blairmore stratigraphy have been folded into an open, asymmetric syncline with axial plane trending east-west, and fold axis plunging eastward. Thickness of the coal-bearing member of the Kootenay Formation is 300 meters on the south limb

of this syncline but reduced to 140 meters on the north limb. Within the coal-bearing member, there are five seams of economic interest totalling 21 meters in aggregate thickness. All seams exceed 1 meter; with the thickest averaging 10 meters, being the third seam in an ascending order from the Fernie-Kootenay contact.

Total indicated resources of coal underlying the east block of the property are estimated to be some 130 million tonnes. Geological in place "reserves" are calculated to be 24.8 million tonnes with an overburden ratio of 3.8 cubic meters rock per tonne coal.

Analyses from rotary cuttings and drill core for 1979, 1980 and 1981 drilling indicate coal at Lillyburt to be medium volatile bituminous. A tabulated breakdown of quality characteristics for each seam is included in this report.

BOREHOLES	LICENCE NO.
DIAMOND	
300-300A 302 306	4084
301	4083
ROTARY	
303 304 305 307 308 309	4083

1.0 INTRODUCTION

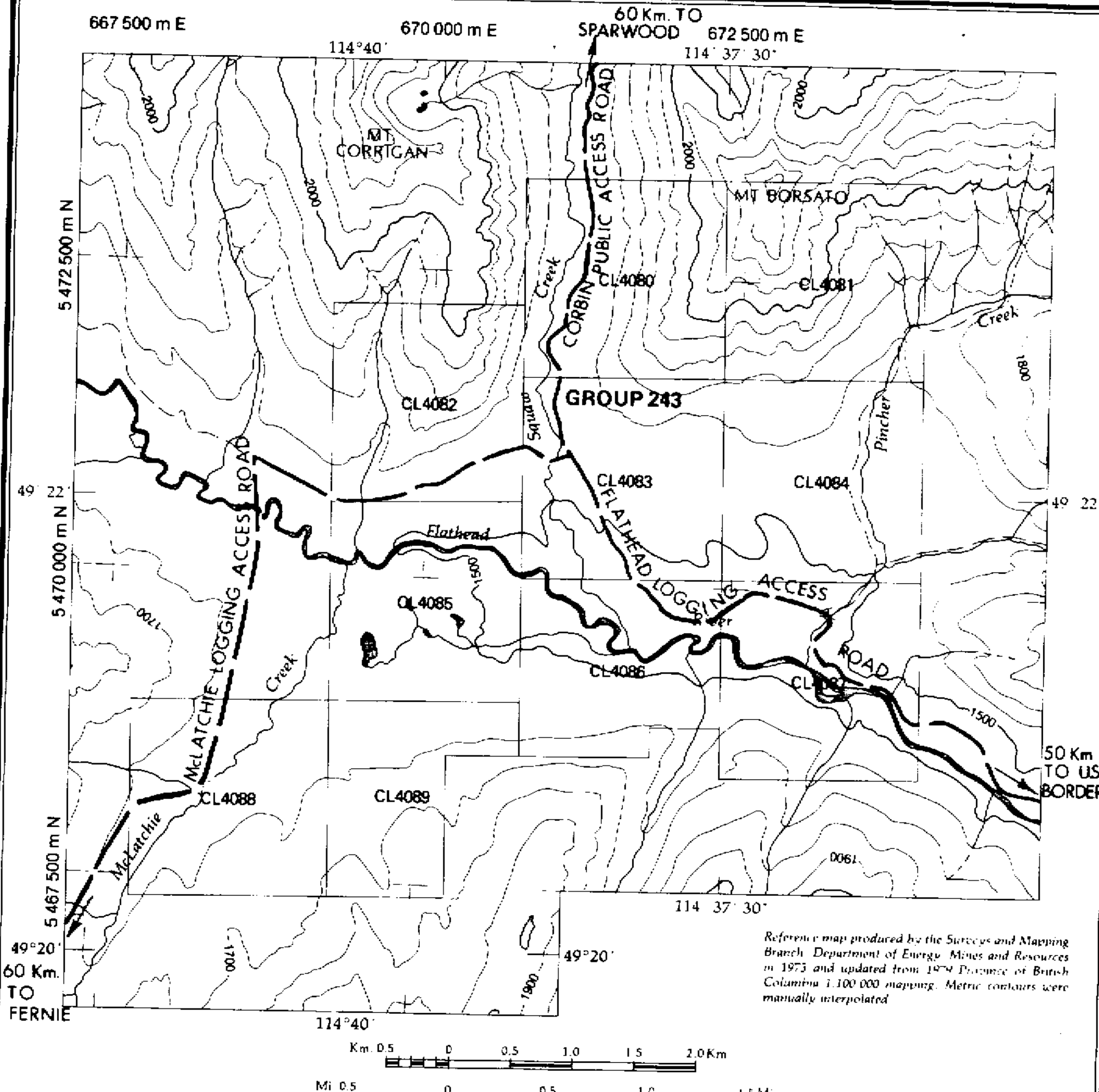
1.1 Location and Access NTS 82G/7

The Lillyburt Coal Prospect is located in and near the Flathead River Valley in the Front Range of the Rocky Mountains of southeastern British Columbia. (Photo #1)

The prospect is 40 and 15 kilometers from the nearest railway points at Morrissey Station and the Corbin Mine Loop respectively. In addition, it is 60 kilometers by logging and forestry access roads from the towns of Sparwood and Fernie. (Enclosure #2). The port of Vancouver is approximately 1150 kilometers by rail from the property. Most of the project area has been extensively logged providing a dense network of roads throughout the property. (Photo #2). These roads have been utilized for drilling access and backhoe trenching.

1.2 Geography and Physiography

Topography in the area is of relatively moderate relief ranging from 1480 meters near the Flathead River increasing to 1720 meters at the northern boundary. (Photo #3) The Flathead River forms a natural boundary to the south while Squaw Creek bisects the



Contour Interval 100m
Transverse Mercator Projection
Universal Transverse Mercator Grid Zone 11

Legend

- Road; Highway, Main road
- Road; Loose surface, Dry weather
- Track or trail
- Railway
- River
- Stream
- Contours
- Licence boundary

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
SE BRITISH COLUMBIA

ACCESS MAP

NTS. 82/G7
AUTHOR B. McKINSTRY
DATE FEB. 1982
To Accompany

ENCLOSURE 2

property into east and west halves. Extensive logging operations have removed a substantial percentage of forest vegetation. The abandoned townsite of Flathead is located on Coal Licence #4087 within the property.

1.3 Environmental Considerations

Extensive logging operations in previous years has greatly facilitated access within the property. Past policy has been to direct drill and trench activity onto log landings or old logging roads whenever possible. This procedure has allowed for minimal environmental disturbance throughout most of the property. In 1981, 4 diamond holes and 3 rotary holes were drilled, 4 km of previous logging roads were re-opened, 5 km of existing road were utilzed and 2 km of new road constructed. Total surface disturbance was approximately 4.5 hectares. Environmental procedures included the installation of mud sumps and settling ponds on drill sites as required and maintenance of erosion control along road access and drill sites. All 1981 drill sites were either recontoured or levelled. (Photos 4 & 5). Those sites and access roads unsuitable for public use were seeded and fertilized. In addition, the access road to hole 305 was recontoured to original slope condition, seeded and fertilized. (Photo 6). A separate detailed report on reclamation work performed within the property is being submitted to the B.C. Ministry of Energy, Mines and Petroleum Resources concurrently. [Densmore, (1982)].

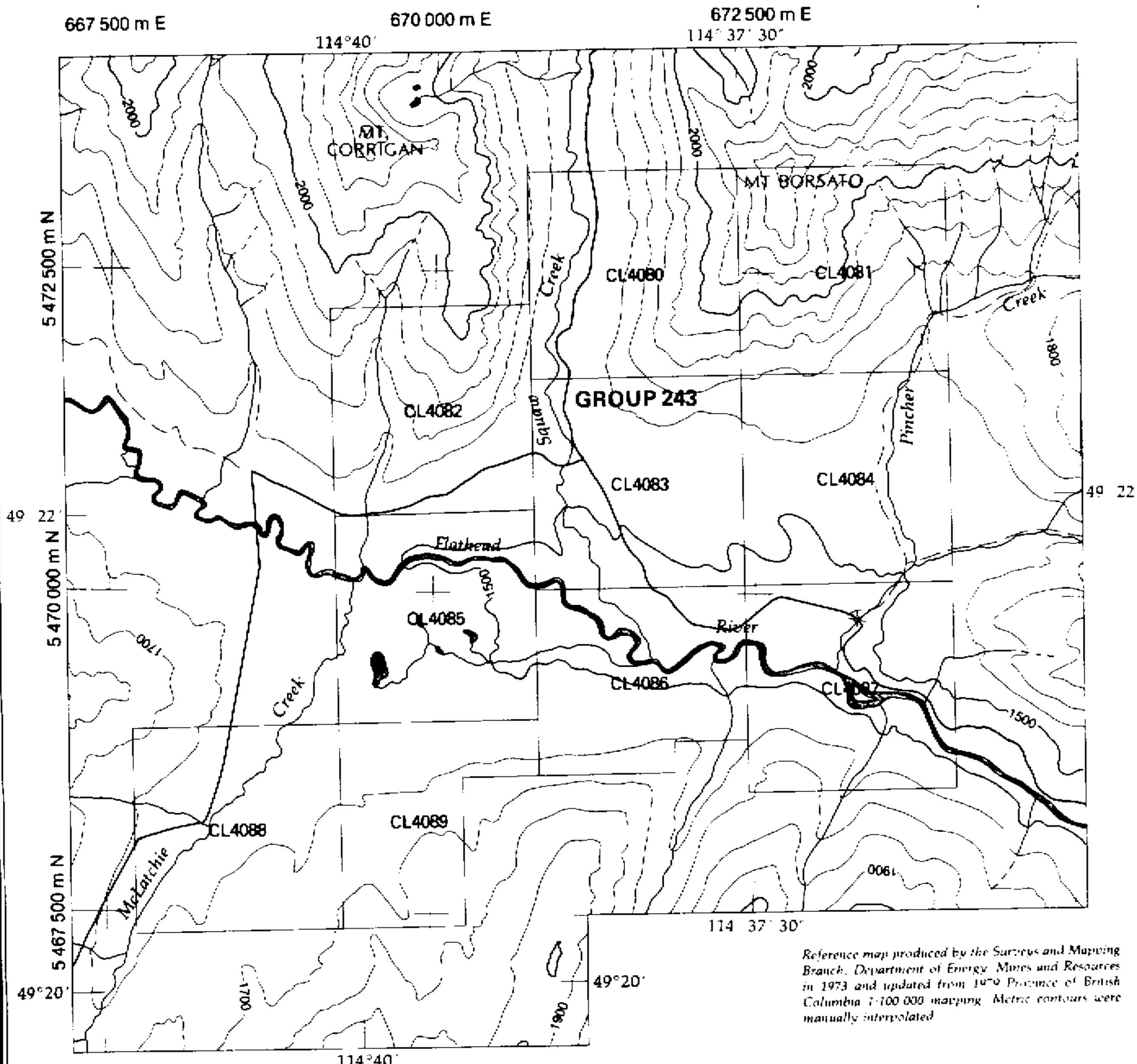
1.4 Tenure of Land and Coal Rights

The Lillyburt Coal Property consists of 10 B.C. Coal Licences, held by Shell Canada Resources Limited, a wholly-owned subsidiary of SCRL. The licences (occupying some 2459 hectares of land) were acquired by SCRL in 1978 and have been recently grouped (#243). Enclosure #3 details the position of license boundaries with respect to topographic features.

2.0 WORK DONE

2.1 Summary of Previous Work

In 1978, aerial photography and ground control surveys were done on photogrammetric topographic maps which were constructed at a scale of 1:5000 with five-meter contour intervals.



Reference map produced by the Surveys and Mapping Branch, Department of Energy, Mines and Resources in 1973 and updated from 1979 Province of British Columbia 1:100 000 mapping. Metric contours were manually interpolated.

Km. 0.5 0 0.5 1.0 1.5 2.0 Km.

Mi. 0.5 0 0.5 1.0 1.5 Mi

Contour Interval 100m
Transverse Mercator Projection
Universal Transverse Mercator Grid Zone 11

T.N.
1 42'
Grid North

Legend

- Road: Highway, Main road
- Road: Loose surface, Dry weather
- Track or trail
- Railway
- River
- Stream
- Contours 2000 1500
- Licence boundary

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. BRITISH COLUMBIA

INDEX MAP TO COAL LICENSES

NTS 82/G7
AUTHOR B. McKINSTRY
DATE FEB 1982
To Accompany

ENCLOSURE 3

Reconnaissance geological mapping at a scale of 1:5000 was initiated in 1979. Preliminary rotary drilling was carried out on the property in three localities totalling 571 meters. In addition, three backhoe trenches and six hand trenches were dug for a total length of 30 meters.

During the 1980 field season, an additional nineteen vertical rotary holes were drilled throughout the property totalling 3388 meters. Three backhoe trenches were excavated along the north limb of the syncline for a total distance of 275 meters. Reconnaissance geological mapping continued at the scale of 1:5000.

2.2 Scope and Objectives of 1981 Exploration

Preliminary results from previous years (1979, 1980) suggest significant geological in-situ reserves exist within the Lillyburt coal prospect. Objectives for the 1981 exploration period included:

(a) completion of geological mapping of the property at 1:2000 scale.

(b) expansion of the drilling program to further delineate the structure and geology of the property and obtain additional coal samples for quality analysis.

(c) utilization of different surface geophysical techniques to delineate coal horizons, overburden depth and faulting.

2.3 Work Accomplished, 1981

Three rotary holes and four diamond holes were drilled throughout the property within the period June 27th and September 2, 1981. Total drilling amounted to 2194 meters. The rotary holes (LBR-303 to LBR-305 inclusive) were drilled with an Ingersoll-Rand 1700 reverse circulation rig (Photo #7) while the diamond drill holes (LBD-300A to LBD-302 and LBD-306) were completed using a Longyear 44 (Photo #8). All rotary cuttings and diamond drill core were logged and their descriptions are included with this Report (Appendix I). Coal intersections were sampled and were sent for analysis to the Crows Nest Resources Laboratory, Fernie, B.C. and Loring Laboratories, Calgary, Alberta. Holes were geophysically logged by Roke Oil Enterprises Ltd., Calgary, Alberta and Davies Exploration Logging Ltd., Calgary, Alberta. Roke logs were run at a general scale of 1:1000 and a detail scale of 1:20 and by Davies at a general scale of 1:200 and a detail scale of 1:20. Table I indicates the types of logs utilized in each borehole.

TABLE I

BOREHOLE	LOGGER	LOGS RUN
300 A	Roke	Gamma ray-Neutron, Gamma ray-sidewall Densilog
301	"	Focused Beam, Gamma ray-Neutron, Gamma ray-sidewall Densilog
302	"	Gamma ray-Neutron, Gamma ray-sidewall Densilog
303	"	Gamma ray-Neutron, Gamma ray-sidewall Densilog
304	"	Focused Beam, Gamma ray-Neutron, Gamma ray-sidewall Densilog
305	Davies	Density detail, Gamma ray-Neutron, Density-Caliper-Resistivity- Gamma
306	Roke	Focused beam, Gamma ray-Neutron, Gammarian-sidewall Densilog
307	-	None
308	Roke	Gamma ray-Neutron, Gamma ray-sidewall Densilog
309	Roke	Focused Beam, Gamma ray-Neutron, Gamma ray-sidewall Densilog

Drill holes were systematically logged through the rods using the neutron-neutron and natural gamma tool. The drill rods were then removed, and an attempt to log the open hole was made using the natural gamma, caliper and high resolution density tool. Open hole logging was not always successful due to caving problems in large seams, leading to varying unique geophysical log types for each hole.

Assay results for the 1980 and 1981 drilling program are submitted with this report (Appendix II). Chapter five is a detailed consideration of these results.

Access road upgrading, and drill site preparation were accomplished with a caterpiller D8-K bulldozer. A John-Deere extendable was used to emplace and later remove several culverts.

All survey control in the Lillyburt area is based on the Crows Nest Control Network, using the results established in the fall of 1979. The stations used were "SQUAW", "ROB", and "LB112Z." All topographic control has been adjusted using the results of a CNRL ground survey, 1981. From these stations, six drill holes and nine control points for photogrammetric mapping were surveyed. Conventional survey methods using both a 1-second and 20 second theodolite and electronic distance measuring equipment were used to obtain survey data. All calculations were done in the UTM system with distances being reduced to plane and bearings referenced to 117°W. The relative accuracy of the traverses was 1/10,000 or better (Appendix III).

Inadvertently, survey coordinates for LBD-301 were not measured during the field season. The coordinates have been obtained from photo and map evidence and are as follows:

LBD-301

NORTHING:	5470598.0
EASTING:	671855.0
ELEVATION:	1531.0 m

The easting and northing coordinates are considered accurate to within five meters and the spot elevation to within two meters.

Drill sites and reopened access roads were fertilized and seeded. Due to previous logging operations, access to most drill sites involved minimal surface disturbance.

Separate from the exploration program, a rectangular grid of cut lines was constructed for geophysical purposes. Shell Mineral Resources used this grid to conduct EM-34, EM-31 and DC resistivity surveys.

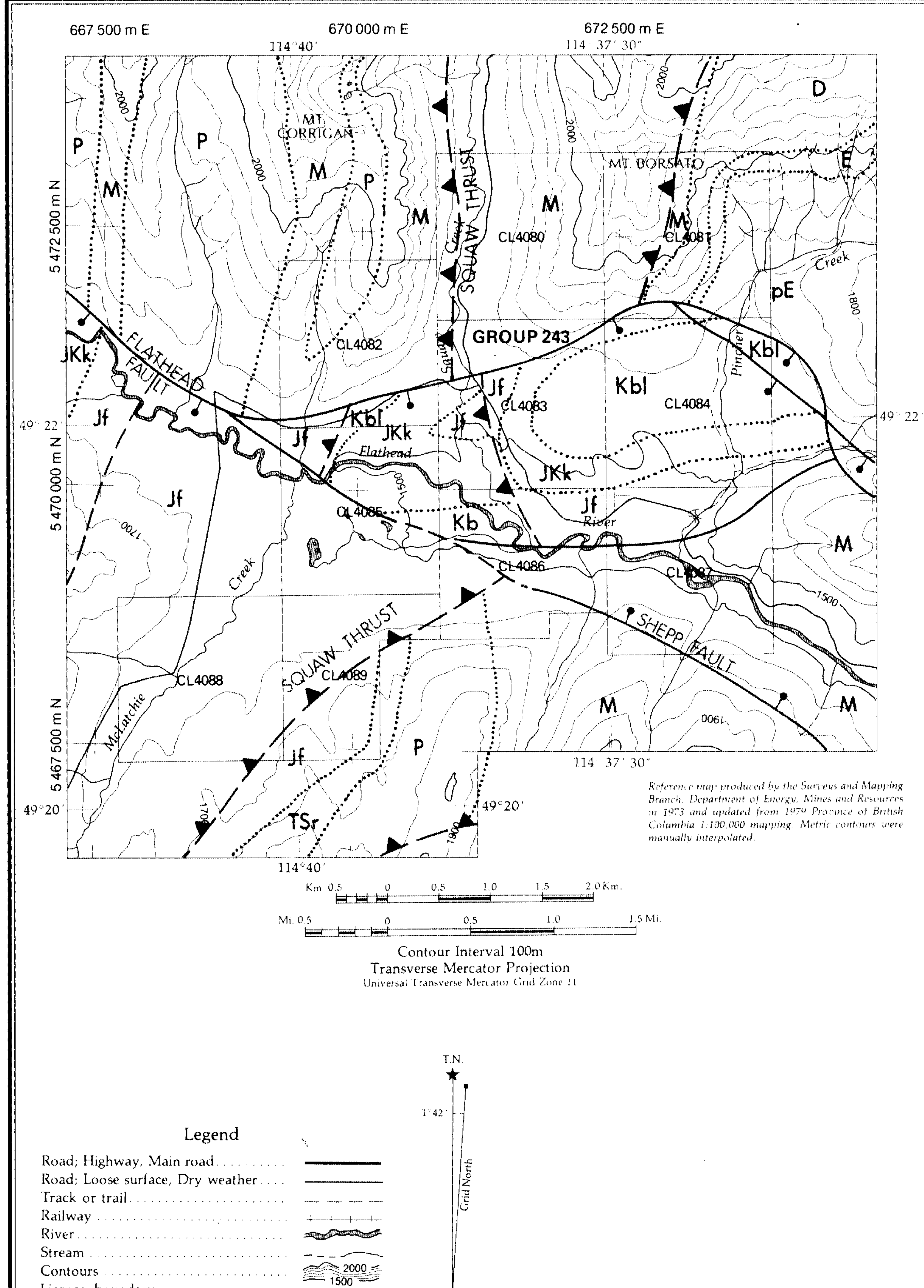
2.4 Costs of Work Done, 1981

Total expenditure as of December 31, 1981, for the 1981 field season was $535,082. A detailed summary of expenditures can be found in Appendix IX.

3.0 GEOLOGY

3.1 Regional Geology

The Lillyburt Coal Prospect is located in the Flathead Valley graben structure as outlined by Price (1965). The property is bounded by the south-dipping Flathead normal fault to the north and east and a north-dipping normal fault located in the Flathead River to the south (Enclosure #4). Westward, coal-bearing strata are confined by the Squaw Thrust. Strata to the north and south of the property consist of Cambrian to Pennsylvanian carbonates. Shales of the Jurassic Fernie Formation are dominant west of the Squaw Thrust. Precambrian Purcell sandstones, argillites and limestones outcrop to the east of the property. Thrusting and



GEOLOGICAL LEGEND

CRETACEOUS

Kbl — Blairmore Group

JURASSIC - CRETACEOUS

JKk — Kootenay Group

JURASSIC

Jf — Fernie Formation

TRIASSIC

TSr — Spray River Group

PENNSYLVANIAN

P — Rocky Mountain Formation

MISSISSIPPIAN

M — Rundle Group + Banff Formation

DEVONIAN

D — Palliser + Alexo Formations
Fairholme Group

CAMBRIAN

E — Elko + Flathead Formations

PRECAMBRIAN

pE — Purcell Group

geological contact (approximate)

thrust fault (approximate) teeth on upthrust side

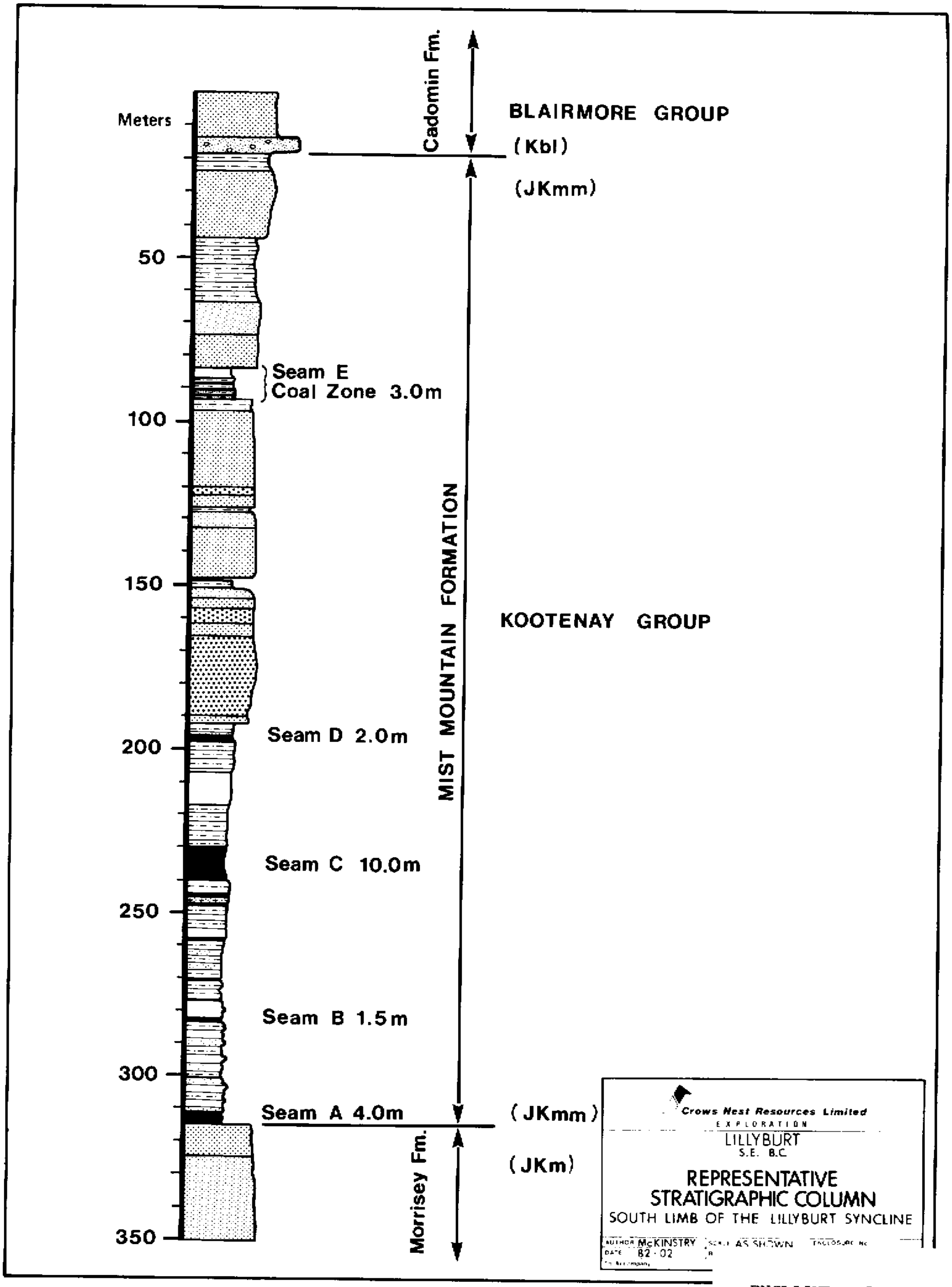
gravity fault (approximate) solid circle on downthrown side

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. BRITISH COLUMBIA
GEOLOGICAL COMPILATION MAP

82 G/7

AUTHOR MCKINSTRY	SCALE 1:50 000	ENCLOSURE No.
DATE 82-02	REVISED	DRAWING No. AA-822
To Accompany		



Meters
50
100
150
200
250
300
350
Cadomin Fm.
BLAIRMORE GROUP
(Kbl)
(JKmm)
Seam E
Coal Zone 3.0m
MIST MOUNTAIN FORMATION
KOOTENAY GROUP
Seam D 2.0m
Seam C 10.0m
Seam B 1.5m
Seam A 4.0m
(JKmm)
(JKm)
Morrisey Fm.
Crows Nest Resources Limited
EXPLORATION
LILLYBURT
S.E. B.C.
REPRESENTATIVE
STRATIGRAPHIC COLUMN
SOUTH LIMB OF THE LILLYBURT SYNCLINE
McKINSTRY
AS SHOWN
82 · 02

associated folding are dominant structural features within the strata surrounding the Lillyburt prospect but are of minimum importance within the property. However, due to the influence of the Flathead normal fault, high angle normal faulting and strike-slip faulting at a local scale dominate the geology within the property. (Appendix IV)

3.2 Lillyburt Stratigraphy

Coal at Lillyburt occurs in the upper Jurassic to Lower Cretaceous coal bearing member (Mist Mountain Formation) of the Kootenay Group. Underlying and overlying the Kootenay Group is the Jurassic Fernie Group and Cretaceous Blairmore Group respectively.

Dark grey and black shales, siltstones and occasional sandstones of the Fernie Group crop out on the west end of the property on both sides of the Flathead River. Due to the recessive nature of these rocks, exposures are of limited extent.

Evidence from drill hole LBD-301 suggests a thickness greater than 330 meters for Kootenay strata in the southern portion of the property. This thickness may be reduced to 175 meters in the north, close to the Flathead normal fault (LBD-300A). A typical columnar section for the property is detailed in Enclosure #5. The Kootenay Group sequence extends from the basal sandstone

(Morrissey Formation) to the base of the Cadomin conglomerate of the Blairmore Group. Drilling has detailed five coal measures of greater than one meter in thickness. Between these seams are siltstones, sandstones and shales typical of the Mist Mountain Formation.[1]

The Morrissey Formation, underlying the coal measures, is primarily a sandstone sequence. The sandstone is salt and pepper in colour, equigranular, and well sorted with occasional coaly fragments. The lowermost section is fine grained but the unit coarsens upward to a distinctive 10 meter thick medium grained, well indurated sandstone at the top. (The contact between the Morrissey and Mist Mountain Formations is abrupt with a 2-5 meter coal seam (seam 'A') overlying the medium grained sandstone.)

The Mist Mountain Formation is a complex succession of sediments of deltaic and fluvial origin. It is approximately 300 meters thick. The lower 125 meters consist of carbonaceous siltstone, coal, shale, carbonaceous mudstone and fine grained sandstone. The sediments repeatedly fine upward from sandstone to mudstone or coal. The number of coal seams varies from 6 to 10 and range in thickness from 0.1 to 25 meters. This lower section is considered

1 [Stratigraphic nomenclature is that of Gibson, (1979)].

by the writer to represent a wave dominated deltaic environment [Horne & Ferm, (1978)]. The upper 175 meters of section is dominated by sandstone. Again, fining upward units are common but occasional coarsening upward sandstone beds have been observed. Sandstones tend to be medium grained but grain size variability ranges from fine to coarse. Interbedded with these sandstone units are sandy siltstones, mudstones, and silty coal. Coal seams are much less abundant and thicknesses are less than 2 meters. The coal occurs in a zone, or as inconsistent lenses in the succession. This upper section of the Mist Mountain Formation is interpreted to be representative of a fluvial environment, shoreward of the deltaic complex.

It is considered by the writer that the Elk Formation, which overlies the Mist Mountain Formation in other localities, is stratigraphically absent at Lillyburt due to depositional variation.

Thus, the Cadomin conglomerate, the basal member of the Cretaceous Blairmore Group unconformably overlies the Mist Mountain Formation. Thickness of this unit varies from 10-15 meters and is characterized by its resistance to weathering and blocky outcrop nature. The conglomerate is framework-supported, with the majority of clasts consisting of round to sub-round black chert and white quartzite pebbles and cobbles. Overlying the conglomerate is a monotonous succession of mudstones, siltstones and fine grained sandstones. Although these rocks weather recessively, the dark red and apple green colour of the mudstones make this a distinctive mappable unit.

3.3 Structural Geology

Lillyburt, located within the Flathead Valley graben structure, is characterized by small and large scale gravity faulting (Appendix V). The Flathead normal fault is the predominant structure in the area, separating Jurassic-Cretaceous Kootenay and Cretaceous Blairmore strata from surrounding Pre-Cambrian to Pennsylvanian carbonates to the north and east. Displacement on this fault has been estimated to be approximately 1200 meters near the Flathead townsite [Price, (1965)]. Associated with this major structure are several strike-slip faults and normal faults sub-parallel to the main fault system. Local scale disruption within the Kootenay stratigraphy is in the order of tens of meters. The southern margin of the property is again defined by a large scale gravity fault which juxtaposes Jurassic Fernie shales against Pennsylvanian and Mississippian carbonates. Displacement and attitude of this structure is as yet unknown. The western boundary of the property is defined by the Squaw Thrust which has transposed Jurassic Fernie strata over Cretaceous Blairmore rocks. A subsidiary thrust may be present within Squaw Creek. Its existence is postulated on the basis of repetition of a Fernie-Kootenay succession from west to east across the property. Within the major structural block, east of Squaw Creek and north of the Flathead River, the coal-bearing sedimentary rocks have been folded into a open asymmetric, east-plunging syncline.

Borehole LBD-300A successfully cored the Flathead Fault zone and terminated in carbonaceous limestones of the Mississippi Banff Formation. The fault zone is approximately 40 meters wide at this locality. Brecciation and alteration are so intense, it is virtually impossible to recognize rock-type. (Photos #9 and 10). Geological constraints suggest the fault zone dips 60° southward. Subsidiary faulting within the property is consistently high angle (55-75°), and normal in sense. Fault traces are curvilinear, and displacements range from 5 to 50 meters. Recognition of faults is best determined from geophysical log traces (Appendix VII) and brecciation within diamond drill core (Photo #11). This is best exemplified with the loss of section apparent in borehole LBD-302.

3.4 Coal Geology

1980-81 rotary and diamond drilling has defined five seams of economic interest at Lillyburt. Geophysical log interpretation suggests seam E, the highest seam in the sequence, is more of a coal zone. Shale and carbonaceous siltstone partings up to one meter thick separate the coal bands from each other. The zone can be up to 15 meters thick but individual coal bands are less than one meter thick. Seam D, 50 meters below seam E in section, has a very consistent geophysical signature from drill hole to drill hole, and averages one meter thick. This seam may stratigraphically lens out or be faulted out on the eastern half of the south limb of the syncline (i.e. compare LBD-301 and LBR-214 geophysical logs ... Appendix VII). Seam C is the thickest seam on the property, attaining an aggregate thickness of 35 meters at one locality (LBD-302). However thickness tends to vary from 10 to 15 meters. A prominent 13-meter split is evident on the east end of the south limb (LBR-206) but lenses out westward over a 1200 meter strike length (LBD-301). Aside from this parting, contamination of the seam is slight. In an unfaulted section, seam C is located 75 meters downsection from seam D. A further 40 meters downsection is seam B. It is from one to two meters thick, shaley, commonly with a siltstone parting, and is sometimes difficult to distinguish from other discontinuous coal seams common in this interval. Thirty to forty meters further downsection and conformably lying upon the Morrissey Formation sandstone is seam A. This seam varies from 2.5 - 8.5 meters thick and can be quite shaley. The seam has been used extensively as a correlation tool and datum level (Appendix VII).

4.0 COAL RESERVES

The estimates of in-situ coal reserves and resources are considered to be unchanged from those calculated in 1980, [McKinstry, (1980)].

5.0 COAL QUALITY

Enclosed with this report are trench and drillhole coal analyses obtained during the 1980 and 1981 exploration field season (Appendix II). Tables 2 and 3 have been drafted to better illustrate the proximate analytical characteristics on a seam by seam basis. Volatile matter increases upsection from an average 26% (DAF basis) in seam A to 32% (DAF basis) in Seam E. Free Swelling Index values are consistently below 2.0 in seams A, B and C. Seam C constitutes 43% of the reserve estimate for the south limb of the syncline. This seam is strongly oxidized with FSI Values rarely greater than 1.0. Raw ash content averages 40% but beneficiation at 1.60 specific gravity reduces this value to approximately 13% with yields between 40% and 50%. The sulphur content is very low (0.3-0.5%) and heat content averages 7250 Kcal/Kgm. Table 2 is a detailed account of analyses in each borehole. Table 3 summarizes this borehole data on a seam by seam basis.

TABLE 2

SEAM A

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-201	169.0-177.5	RAW	.51	39.0						
	(6.5M)	WASH (1.62 S.G.)	1.36	19.9	19.7	59.0	1.5		40	
LBR-207	95.5- 96.0	RAW	1.0	56.4						
	(.5M)	WASH (1.62 S.G.)	.86	19.6	22.1	57.4	1.5		23	
	97.0-101.0	RAW	.85	25.9						
	(4.0M)	WASH (1.62 S.G.)	.70	16.5	22.3	60.5	4.5		63	
	101.0-105.0	RAW	.71	33.4						
	(4.0M)	WASH (1.62 S.G.)	.89	14.1	23.4	61.6	6.0		52	
	97.0-105.0	RAW	.64	30.1						
	(COMPOSITE)	WASH (1.62 S.G.)	1.84	14.8	23.0	60.3	4.0	.60	58	7114
LBR-208	88.0-96.0	RAW	.73	45.8						
	(8.0M)	WASH (1.62 S.G.)	.63	18.7	21.5	59.1	3.0		35	
LBR-209	179.0-184.0	RAW	1.04	63.4						
	(5.0M)	WASH (1.62 S.G.)	.74	21.8	20.7	56.7	1.0		16	
LBR-211	74.5-75.5	RAW	.59	62.1						
	(1.0M)	WASH (1.62 S.G.)	.94	26.2	18.9	53.9	1.0		8	
	75.5-76.5	RAW	.55	47.1						
	(1.0M)	WASH (1.62 S.G.)	1.16	25.0	21.7	52.1	1.0		22	
	76.5-77.5	RAW	.56	54.1						
	(1.0M)	WASH (1.62 S.G.)	1.60	39.8	18.4	40.1	0.5		3	

1A/CZe.2

SEAM A (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-211	77.5-78.5	RAW	.52	57.6						
	(1.0M)	WASH (1.62 S.G.)	1.3	29.3	21.5	47.9	1.0		10	
	74.5-78.5	RAW	.54	55.0						
	(COMPOSITE)	WASH (1.62 S.G.)	1.38	26.7	21.3	50.6	1.0	.52	12	5964
LBR-212	138.0-140.0	RAW	.55	48.1						
	(2.0M)	WASH (1.62 S.G.)	1.54	27.8	22.9	47.7	1.0		23	
	140.0-141.0	RAW	.74	32.8						
	(1.0M)	WASH (1.62 S.G.)	1.89	18.2	23.0	56.9	1.5		51	
	141.0-143.0	RAW	.55	52.4						
	(2.0M)	WASH (1.62 S.G.)	1.61	30.9	20.3	47.2	1.0		8	
	138.0-143.0	RAW	2.43	43.1						
	(COMPOSITE)	WASH (1.62 S.G.)	1.44	22.1	22.7	53.7	1.0	.53	30	6355
LBR-213	34.0-35.0	RAW	.8	70.8						
	(1.0M)	WASH (1.62 S.G.)	.92	15.4	23.9	59.8	4.5		2	
	35.0-36.0	RAW	1.23	38.1						
	(1.0M)	WASH (1.62 S.G.)	1.08	19.0	22.4	57.5	1.0		41	
	36.0-37.0	RAW	.52	27.3						
	(1.0M)	WASH (1.62 S.G.)	1.25	16.1	23.6	59.0	3.5		58	
	37.0-38.0	RAW	.63	21.5						
	(1.0M)	WASH (1.62 S.G.)	1.40	13.9	26.1	58.6	7.5		59	

SEAM A (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-213	34.0-38.0	RAW	.95	42.5						
	(COMPOSITE)	WASH (1.62 S.G.)	2.2	19.2	23.5	55.1	3.0	.52	41	6587
LBR-214	252.5-253.0	RAW	.96	54.4						
	(.5M)	WASH (1.62 S.G.)	.32	16.9	21.8	60.95	1.0		23	
	253.0-259.0	RAW	.96	44.0						
	(6.0M)	WASH (1.62 S.G.)	.60	15.8	23.1	60.5	3.5		47	
	252.5-259.0	RAW	.59	47.0						
	(COMPOSITE)	WASH (1.62 S.G.)	1.07	16.5	22.4	60.0	2.5	.51	41	6985
LBD-301	300.1-303.2	RAW	.84	50.8			1.0			
	(3.1M)	WASH (1.6 S.G.)	.62	17.6	20.0	61.8	1.5		23	
LBD-302	302.59-304.15	RAW	.84	46.5						
	(1.56M)	WASH (1.6 S.G.)	1.01	16.3					17	
	304.15-304.81	RAW	.85	21.8						
	(.66M)	WASH (1.6 S.G.)	1.04	13.5					71	
WEIGHTED	302.59-304.81	RAW	.84	39.2						
AVERAGE	(2.22M)	WASH (1.6 S.G.)	1.02	15.5					33	
LBR-304	175.3-176.8	RAW	.29	36.6						
	(1.5M)	WASH (1.6 S.G.)	.75	13.7	22.4	63.15	7.5	.59	37	7369
	176.8-177.7	RAW	.59	41.4						
	(.9M)	WASH (1.6 S.G)	.78	18.4	21.0	59.8	7.0	.58	12	7076

1A/CZe.4

SEAM A (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-304 WEIGHTED AVERAGE	175.3-177.7	RAW	.4	38.4						
	(2.4M)	WASH (1.6 S.G.)	.76	15.5	21.9	61.85	7.5	.58	11	7259
LBR-305	189.0-190.5	RAW	.82	50.2						
	(1.5M)	WASH (1.6 S.G.)	.96	15.5	20.4	63.1	1.5	.55	20	7090
	190.5-192.0	RAW	.76	45.1						
	(1.5M)	WASH (1.6 S.G)	1.04	15.4	21.4	62.4	4.0	.55	39	7116
WEIGHTED AVERAGE		RAW	.79	47.7						
	(3.0M)	WASH (1.6 S.G.)	1.1	15.4	20.8	62.7	2.0	.55	30	7104

1A/CZe.5

SEAM B

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-201	133.0-135.7	RAW	.47	37.4						
	(2.7M)	WASH (1.62 S.G.)	1.80	12.5	20.0	65.7	3.5		51	
LBR-206	204.7-206.2	RAW	.84	28.2						
	(1.5M)	WASH (1.62 S.G.)	1.01	15.8	19.6	63.6	0.0		72	
LBR-207	57.0-59.0	RAW	.88	37.0						
	(2.0M)	WASH (1.62 S.G.)	.74	15.4	20.3	63.6	1.0		60	
	63.0-66.0	RAW	.82	32.9						
	(3.0M)	WASH (1.62 S.G.)	.62	22.9	19.1	57.4	1.5		59	
WEIGHTED		RAW	.84	34.5						
AVERAGE	(5.0M)	WASH (1.62 S.G.)	.67	19.9	19.6	59.85	1.5		59	
LBR-208	52.0-54.0	RAW	.69	29.9						
	(2.0M)	WASH (1.62 S.G.)	.64	15.2	18.8	65.3	1.5		70	
LBR-209	126.0-130.0	RAW	.94	49.5						
	(4.0M)	WASH (1.62 S.G.)	1.38	18.4	21.1	59.1	1.5		44	
LBR-214	213.0-214.0	RAW	1.14	57.0						
	(1.0M)	WASH (1.62 S.G.)	.46	18.1	20.8	60.7	1.0		31	
	218.0-220.0	RAW	1.29	68.0						
	(2.0M)	WASH (1.62 S.G.)	.48	14.9	19.6	64.9	1.0		24	
LBR-215	28.0-30.0	RAW	.83	48.5						
	(2.0M)	WASH (1.62 S.G.)	.70	18.6	19.1	61.6	1.0		24	

SEAM B (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-215	30.0-33.0	RAW	.92	43.9						
	(3.0M)	WASH (1.62 S.G.)	1.25	12.5	20.8	65.45	1.0		48	
	33.0-34.0	RAW	1.17	73.5						
	(1.0M)	WASH (1.62 S.G.)	.50	18.9	20.4	60.2	5.0		4	
	34.0-35.0	RAW	1.15	83.6						
	(1.0M)	WASH (1.62 S.G.)	.65	17.4	21.3	60.7	7.5		2	
	28.0-35.0	RAW	.49	63.4						
	(COMPOSITE)	WASH (1.62 S.G.)	.85	19.8	19.4	59.9	1.0	.51	18	6726
LBD-301	272.5-273.5	RAW	.92	18.7						
	(1.0M)	WASH (1.6 S.G.)	.65	9.35	19.3	70.7	1.0		70	
LBD-302	252.4-253.0	RAW	1.23	15.7						
	(.6M)	WASH (1.6 S.G.)	1.34	9.0					84	
	256.0-256.5	RAW	1.19	40.0						
	(.5M)	WASH (1.6 S.G.)	1.05	14.8					43	
LBR-304	138.1-138.7	RAW	.64	63.2						
	(.6M)	WASH (1.6 S.G.)	.74	14.3	20.1	64.9	1.5	.57	16	7287

LILLYBURT

SEAM C

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LB-2	174.2-175.4	RAW	.61	33.46			1.0			
	(1.2M)	WASH (1.6 S.G.)	.67	7.50	23.51	68.32	3.0		58	
	175.4-192.2	RAW	.32	40.29			1.0			
	(16.8M)	WASH (1.6 S.G.)	.97	11.59	22.51	64.93	1.5		49	
	192.2-195.0	RAW	.51	36.42			1.0			
	(2.8M)	WASH (1.6 S.G.)	.77	13.89	21.03	64.31	1.0		55	
WEIGHTED		RAW	.36	39.4			1.0			
AVERAGE	(20.8M)	WASH (1.6 S.G.)	.64	11.7	22.4	65.26	1.5		50	
LB-3	4.0-52.0	RAW	.72	28.29	22.4	65.0	1.0			
	(48.0M)	WASH (1.6 S.G.)	.79	9.27	22.83	67.11	1.0		42	
LBR-201	65.0-74.5	RAW	.47	27.7						
	(9.5M)	WASH (1.62 S.G.)	3.28	10.8	20.7	65.22	1.0		53	
LBR-203	99.5-104.5	RAW	.74	77.56						
	(5.0M)	WASH (1.62 S.G.)	.99	18.14	21.30	59.57	1.0		8	
	104.5-107.0	RAW	.63	49.85						
	(2.5M)	WASH (1.62 S.G.)	3.13	18.43	20.9	57.5	1.0		33.5	
	99.5-107.0M	RAW	.47	63.40						
	(COMPOSITE)	WASH (1.62 S.G.)	2.71	15.15	21.73	60.41	1.0	.32	18	7009
LBR-207	16.0-21.0	RAW	.76	36.12						
	(5M)	WASH (1.62 S.G.)	2.37	28.40	20.06	49.17	1.0		63	

1A/CZe.8

SEAM C (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-207	21.0-25.0	RAW	.82	61.05						
	(4M)	WASH (1.62 S.G.)	1.82	18.01	21.26	58.91	1.5		24	
	25.0-27.0	RAW	.78	58.54						
	(2M)	WASH (1.62 S.G.)	.70	19.85	20.95	58.5	3.5		24	
	16.0-27.0	RAW	1.6	52.85						
	(COMPOSITE)	WASH (1.62 S.G.)	3.37	23.58	20.36	52.7	1.0	.34	41	6179
LBR-212	23.5-25.5	RAW	.52	32.25						
	(2.0M)	WAH (1.62 S.G.)	1.80	16.68	21.41	60.11	0.5		57	
	25.5-26.5	RAW	.66	57.2						
	(1.0M)	WASH (1.62 S.G.)	.70	11.48	25.0	62.79	3.0		30	
	23.5-26.5	RAW	1.31	22.15						
	(COMPOSITE)	WASH (1.62 S.G.)	1.19	14.95	22.8	61.07	1.0	.38	45	7036
LBR-214	158.0-160.5	RAW	.52	46.87						
	(1.5M)	WASH (1.62 S.G.)	1.22	16.05	22.5	60.19	1.0		40	
	160.5-166.0	RAW	.68	52.60						
	(5.5M)	WASH (1.62 S.G.)	1.72	11.03	22.75	64.5	1.0		37	
	166.0-168.0	RAW	.78	65.14						
	(2M)	WASH (1.62 S.G.)	1.42	27.07	22.05	49.46	1.0		16	
	168.0-172.5	RAW	1.06	85.5						
	(4.5M)	WASH (1.62 S.G.)	1.04	22.8	20.8	55.4	1.0		2	

SEAM C (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-214	172.5-177.0 (4.5M)	RAW	.82	51.8						
		WASH (1.62 S.G.)	1.01	16.2	21.3	61.45	1.0		20	
	177.0-179.0 (2M)	RAW	1.08	37.8						
		WASH (1.62 S.G.)	1.03	15.8	20.9	62.3	1.0		28	
	158.0-179.0 (COMPOSITE)	RAW	.67	43.8						
		WASH (1.62 S.G.)	1.46	13.9	21.8	62.8	1.0	.28	32	7135
LBD-301	220.9-222.5 (1.6M)	RAW	.72	34.5			1.0			
		WASH (1.6 S.G.)	.84	8.2	23.1	67.8	3.5		54	
	222.5-225.2 (2.7M)	RAW	.67	18.7			1.0			
		WASH (1.6 S.G.)	1.33	9.2	20.9	68.6	1.0		75	
	225.2-225.5 (.3M)	RAW	.87	82.7			0.0			
	225.5-230.7 (5.2M)	RAW	.74	34.2			1.0			
		WASH (1.6 S.G.)	1.63	12.3	21.3	64.7	1.5		51	
	220.9-230.7 (COMPOSITE)	RAW	.71	36.5						
		WASH (1.6 S.G.)	1.64	11.8	21.7	64.8	1.0	.28	52	7600
LBR-304	59.7-61.3 (.6M)	RAW	.67	36.4						
		WASH (1.6 S.G.)	2.96	9.2	20.5	67.3	1.0	.26	46	7502
	61.3-62.5 (1.2M)	RAW	.75	34.0						
		WASH (1.6 S.G.)	3.22	9.1	21.7	65.9	1.5	.35	53.0	7493

SEAM C (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-304	62.5-63.4	RAW	.74	20.0						
	(.9M)	WASH (1.6 S.G.)	2.14	9.2	20.7	68.0	1.0	.22	68	7505
	63.4-64.3	RAW	.66	70.6						
	(.9M)	WASH (1.6 S.G.)	.61	15.3	19.9	64.1	1.5	.54	15	7174
	64.3-64.9	RAW	.68	20.3						
	(.6M)	WASH (1.6 S.G.)	1.92	7.1	22.3	68.7	1.0	.22	73	7757
	64.9-66.4	RAW	.67	25.9						
	(1.5M)	WASH (1.6 S.G.)	2.74	8.75	21.5	67.0	1.0	.22	56	7510
	66.4-67.05	RAW	.70	35.0						
	(.65M)	WASH (1.6 S.G.)	2.04	12.8	20.4	64.8	1.0	.24	39	7220
	67.05-68.6	RAW	.83	32.0						
	(1.55M)	WASH (1.6 S.G.)	1.41	8.1	21.2	69.4	.5	.22	40	7701
	68.6-70.1	RAW	.79	36.1						
	(1.5M)	WASH (1.6 S.G.)	1.3	12.0	19.3	67.3	.5	.21	38	7745
	70.1-71.6	RAW	.46	32.4						
	(1.5M)	WASH (1.6 S.G.)	1.3	13.5	19.4	65.8	.5	.25	41	7220
	71.6-73.15	RAW	.61	31.6						
	(1.55M)	WASH (1.6 S.G.)	1.88	11.3	20.5	66.3	1.0	.32	44	7406
	73.15-74.7	RAW	.64	20.5						
	(1.55M)	WASH (1.6 S.G.)	1.16	12.2	19.7	66.9	1.0	.33	60	7334

SEAM C (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-304	74.7-76.2 (1.5M)	RAW WASH (1.6 S.G.)	.73 1.89	22.0 12.0	19.9	66.2	1.0	.33	59	7340
	76.2-77.7 (1.5M)	RAW WASH (1.6 S.G.)	.74 1.85	27.6 12.0	20.5	65.6	1.0	.31	43	7317
	77.7-79.25 (1.55M)	RAW WASH (1.6 S.G.)	.65 1.53	24.5 11.5	19.6	67.3	1.0	.31	48	7428
	79.25-80.8 (1.55M)	RAW WASH (1.6 S.G.)	.70 .73	56.8 13.0	21.3	64.9	4.0	.39	21	7339
WEIGHTED AVERAGE	(21.1M)	RAW WASH (1.6 S.G.)	.69 1.75	32.4 11.2	20.45	66.6	1.0	.30	47	7434
LBR-305	94.8-96.3 (1.5M)	RAW WASH (1.6 S.G.)	.83 .28	58.2 15.8	21.8	62.1	1.5	.31	22	7032
	96.3-97.8 (1.5M)	RAW WASH (1.6 S.G.)	.79 1.58	48.1 12.9	21.2	64.3	2.0	.27	38	7162
	97.8-99.1 (1.3M)	RAW WASH (1.6 S.G.)	.58 1.49	51.1 12.5	21.3	64.7	1.5	.27	33	7209
	99.1-100.6 (1.5M)	RAW WASH (1.6 S.G.)	.56 2.0	43.2 9.3	21.6	67.2	1.5	.28	40	7520
	100.6-102.1 (1.5M)	RAW WASH (1.6 S.G.)	.55 1.69	39.1 10.0	21.2	67.1	1.5	.23	41	7442

SEAM C (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-305	102.1-103.6	RAW	.59	55.9						
	(1.5M)	WASH (1.6 S.G.)	1.05	15.0	19.8	64.1	1.5	.18	23	7004
	103.6-105.1	RAW	.65	33.6						
	(1.5M)	WASH (1.6 S.G.)	1.3	12.4	18.4	67.8	1.5	.17	59	7311
	105.1-106.7	RAW	.74	60.6						
	(1.6M)	WASH (1.6 S.G.)	1.26	13.1	19.4	66.2	1.0	.16	14	7223
	106.7-108.2	RAW	.85	39.1						
	(1.5M)	WASH (1.6 S.G.)	1.70	10.9	19.7	67.7	1.0	.20	46	7386
	108.2-109.7	RAW	.70	51.1						
	(1.5M)	WASH (1.6 S.G.)	1.3	13.9	19.3	65.5	1.0	.19	25	7128
	109.7-111.2	RAW	.57	32.2						
	(1.5M)	WASH (1.6 S.G.)	1.2	12.1	19.4	67.3	1.5	.25	31	7291
	111.2-112.8	RAW	.63	44.9						
	(1.6M)	WASH (1.6 S.G.)	.92	14.8	19.2	65.0	1.5	.24	27	7083
	112.8-114.3	RAW	.68	38.4						
	(1.5M)	WASH (1.6 S.G.)	1.02	12.8	19.7	66.5	1.5	.26	42	7261
	114.3-115.8	RAW	.81	40.3						
	(1.5M)	WASH (1.6 S.G.)	1.02	13.1	19.8	66.1	1.5	.29	45	7241
	115.8-116.4	RAW	.81	63.0						
	(.6M)	WASH (1.6 S.G.)	.92	14.3	19.7	65.1	1.5	.30	23	7105

SEAM C (Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-305 WEIGHTED AVERAGE		RAW	.69	45.9						
	(21.6M)	WASH (1.6 S.G.)	1.26	12.8	20.1	65.84	1.5	.24	34	7231
LBR-309	22.0-23.0	RAW	.95	49.2						
	(1M)	WASH (1.6 S.G.)	.65	15.3	20.0	64.0	1.5	.49	28	7104
	24.0-25.0	RAW	.86	43.0						
	(1M)	WASH (1.6 S.G.)	.69	10.7	20.1	68.5	1.0	.44	45	7552
WEIGHTED AVERAGE		RAW	.90	46.1						
	(2M)	WASH (1.6 S.G.)	.67	13.0	20.0	66.33	1.0	.46	36	7328
LBR-309	52.0-78.5	RAW	.74	39.3						
	(26.5M)	WASH (1.62 S.G.)	1.1	14.4	23.6	60.8	1.0	.32	53	7073

SEAM C (UPPER)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-206	113.0-114.0 (1.0M)	RAW WASH (1.62 S.G.)	1.17 .73	77.5 17.1	26.6	55.5	3.5		10	
	114.0-117.0 (3.0M)	RAW WASH (1.62 S.G.)	.94 .77	57.4 12.9	26.0	60.3	3.0		32	
	117.0-123.0 (6.0M)	RAW WASH (1.62 S.G.)	.84 1.0	36.6 13.7	24.6	60.7	1.0		56	
	113.0-123.0 (COMPOSITE)	RAW WASH (1.62 S.G.)	1.43 1.11	46.1 12.9	24.9	61.0	1.5	.31	45	7280
LBR-209	52.0-56.0 (4.0M)	RAW WASH (1.62 S.G.)	.95 1.37	21.4 14.7	24.8	59.1	1.5		68	
	56.0-58.0 (2.0M)	RAW WASH (1.62 S.G.)	.63 .85	26.6 13.9	22.9	62.3	1.0		71	
	58.0-61.0 (3.0M)	RAW WASH (1.62 S.G.)	.76 .72	29.1 13.5	24.7	61.0	1.5		62	
	61.0-64.0 (3.0M)	RAW WASH (1.62 S.G.)	.76 .55	35.7 14.1	24.5	60.8	1.5		53	
	64.0-69.0 (5.0M)	RAW WASH (1.62 S.G.)	.99 .92	54.2 16.7	22.9	59.4	1.0		30	
WEIGHTED AVERAGE	(52-69M)	RAW WASH (1.62 S.G.)	.86 .92	35.5 14.9	23.9	60.2	1.5		53	

1A/CZe.15

SEAM C (UPPER - Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-210	120.0-125.0	RAW	.90	52.4						
	(5.0M)	WASH (1.62 S.G.)	1.47	11.1	25.5	61.9	3.5		38	
	125.0-128.0	RAW	.83	26.1						
	(3.0M)	WASH (1.62 S.G.)	1.22	13.9	23.0	61.9	1.0		74	
	128.0-131.0	RAW	.81	30.2						
	(3.0M)	WASH (1.62 S.G.)	2.08	11.7	23.3	62.9	1.0		64	
	120.0-131.0	RAW	1.38	26.1						
	(COMPOSITE)	WASH (1.62 S.G.)	1.09	11.5	24.3	63.0	1.0	.29	53	7386
LBD-302	187.02-187.4	RAW	1.42	56.3						
	(.38M)	WASH (1.6 S.G.)	1.63	8.1					23	
	187.4-192.0	RAW	1.34	22.9						
	(4.6M)	WASH (1.6 S.G.)	1.59	10.1					68	
	192.0-193.45	RAW	1.25	27.7						
	(1.45M)	WASH (1.6 S.G.)	2.53	10.8					54	
	193.45-194.35	RAW	1.17	28.5						
	(.9M)	WASH (1.6 S.G.)	1.33	11.1					57	
	194.35-196.37	RAW	1.08	28.9						
	(2.02M)	WASH (1.6 S.G.)	2.23	10.4					55	
	196.37-198.4	RAW	1.04	32.5						
	(2.03M)	WASH (1.6 S.G.)	1.23	14.7					51	

1A/CZe.16

SEAM C (UPPER - Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBD-302	198.4-199.6	RAW	1.02	76.0						
	187.02-198.4 (WEIGHTED AVERAGE)	RAW	1.22	27.85						
		WASH (1.6 S.G.)	1.74	11.1					58	

1A/CZe.17

SEAM C (LOWER)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-206	140.0-150.25	RAW	.82	60.6						
	(10.25M)	WASH (1.62 S.G.)	1.05	20.5	22.6	55.8	1.5			
LBR-209	69.0-71.5	RAW	.76	88.3						
	(2.5M)	WASH (1.62 S.G.)	2.33	20.4	20.9	56.3	1.0			
	71.5-73.5	RAW	1.04	52.2						
	(2.0M)	WASH (1.62 S.G.)	.88	15.8	22.8	60.5	1.0			
	73.5-75.5	RAW	.95	56.6						
	(2.0M)	WASH (1.62 S.G.)	.75	17.4	21.7	60.2	1.5			
	75.5-78.5	RAW	.73	46.0						
	(3.0M)	WASH (1.62 S.G.)	.79	17.2	21.6	60.4	1.0			
	69.0-78.5	RAW	.85	60.7						
(WT.AVERAGE)	(9.5M)	WASH (1.62 S.G.)	1.21	17.8	21.7	59.3	1.0			
LBR-210	131.0-134.0	RAW	.71	22.6						
	(3.0M)	WASH (1.62 S.G.)	4.19	10.5	23.0	62.3	1.0			
	134.0-139.0	RAW	.91	40.2						
	(5.0M)	WASH (1.62 S.G.)	.97	16.2	21.8	61.0	1.0			
	131.0-139.0	RAW	.97	29.3						
(COMPOSITE)	(8.0M)	WASH (1.62 S.G.)	2.9	11.6	21.9	63.6	1.0	.28	65	7266
✓LBD-302	207.5-209.83	RAW	.79	40.8						
	(2.33M)	WASH (1.6 S.G.)	1.05	16.5					32	

1A/CZe.18

SEAM C (LOWER - Cont'd)

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
✓ LBD-302	✓209.83-210.11	RAW	.95	38.4						
	(.28M)	WASH (1.6 S.G.)	1.15	19.7					35	
	✓210.11-216.75	RAW	.95	28.7						
	(6.64M)	WASH (1.6 S.G.)	1.31	10.6					58	
	207.5-216.75	RAW	.91	32.0						
(WT.AVERAGE)	(9.25M)	WASH (1.6 S.G.)	1.24	12.4					51	

1A/CZe.19

SEAM D

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LB-2	138.9-139.6	RAW	.57	59.2			1.0			
	(.7M)	WASH (1.6 S.G.)	.58	17.5	23.0	58.9	5.5		32	
LBR-201	23.5-25.5	RAW	.40	25.95						
	(2.0M)	WASH (1.62 S.G.)	1.16	9.9	23.7	65.2	7.0		64	
LBD-301	146.8-147.35	RAW	.72	46.0			1.0			
	(.55M)	WASH (1.6 S.G.)	1.04	16.2	21.5	61.2	2.0		33	
LBR-304	27.4-28.65	RAW	.61	41.3						
	(1.25M)	WASH (1.6 S.G.)	1.65	8.5	23.7	66.2	5.0	.77	39	7731

1A/CZe.20

SEAM E

HOLE #	SAMPLE INTERNAL	ANALYSIS TYPE	% MOISTURE	% ASH	% V.M.	% F.C.	FSI	% S	% YIELD	CALORIFIC VALUE
LBR-210	66.0-69.0 (3.0M)	RAW	.92	49.7						
		WASH (1.62 S.G.)	.76	18.2	23.4	57.6	1.5		36	
LBD-301	87.4-88.25 (.85M)	RAW	.82	52.8			2.0			
		WASH (1.6 S.G.)	.71	18.3	25.6	55.4	8.0		38	
	88.25-89.36 (1.11M)	RAW	.96	82.1			0.0			
		WASH (1.6 S.G.)	.97	11.3	25.7	62.0	8.5		4	
	89.36-90.45 (1.09M)	RAW	.75	22.0			7.5			
		WASH (1.6 S.G.)	.71	10.2	27.3	61.8	8.5		72	
	90.45-91.35 (.9M)	RAW	.8	87.4			0.0			
	91.35-92.14 (.79M)	RAW	.56	34.6			6.5			
		WASH (1.6 S.G.)	1.21	14.3	24.8	59.7	8.5		52	
	87.4-92.14 (COMPOSITE)	RAW	.63	69.9						
		WASH (1.6 S.G.)	.67	15.4	28.7	55.2	8.0	.68	18	7294

TABLE 3

SEAM	HOLE #	MOISTURE (%) (Raw)	MOISTURE (%) (Float)	ASH (%) (Raw)	ASH (%) (Float)	V.M.(%)	F.C.(%)	FSI (Raw)	FSI (Float)	SULPHUR(%) (Raw)	SULPHUR(%) (Float)	YIELD(%)	CALORIFIC VALUE (Kcal/Kg)
A	LBR-201	.51	1.36	39.0	19.9	19.7	59.0		1.5			40	
	LBR-207	.64	1.84	30.1	14.8	23.0	60.3		4.0		.60	58	7114
	LBR-208	.73	.63	45.8	18.7	21.5	59.1		3.0			35	
	LBR-209	1.04	.74	63.4	21.8	20.7	56.7		1.0			16	
	LBR-211	.54	1.38	55.0	26.7	21.3	50.6		1.0		.52	12	5964
	LBR-212	2.43	1.44	43.1	22.1	22.7	53.7		1.0		.53	30	6355
	LBR-213	.95	2.2	42.5	19.2	23.5	55.1		3.0		.52	41	6587
	LBR-214	.59	1.07	47.0	16.5	22.4	60.0		2.5		.51	41	6985
	*S.G. = 1.62 FOR THE ABOVE. ALL RESULTS ARE QUOTED ON AN AIR DRY BASIS.												
	TOTAL AVERAGE	.93	1.33	45.7	20.0	21.8	56.82		2.0		.54	34	6601
	LBD-301	.84	.62	50.8	17.6	20.0	61.8	1.0	1.5			23	
	LBD-302	.84	1.02	39.2	15.5							33	
	LBR-304	.40	.76	38.4	15.5	21.9	61.85		7.5		.58	11	7259
	LBR-305	.79	1.10	47.7	15.4	20.8	62.7		2.0		.55	30	7104
	*S.G. = 1.60 FOR THE ABOVE. ALL RESULTS ARE QUOTED ON AN AIR DRY BASIS.												
	TOTAL AVERAGE	.72	.88	44.0	16.0	20.9	62.1		3.5		.56	24	7187

SEAM	HOLE #	MOISTURE (%)		ASH (%)		V.M.(%)	F.C.(%)	FSI		SULPHUR(%)		YIELD(%)	CALORIFIC VALUE (Kcal/Kg)
		(Raw)	(Float)	(Raw)	(Float)			(Raw)	(Float)	(Raw)	(Float)		
B	LBR-201	.47	1.80	37.4	12.5	20.0	65.7		3.5			51	
	LBR-206	.84	1.01	28.2	15.8	19.6	63.6		0.0			72	
	LBR-207	.84	.67	34.5	19.9	19.6	59.85		1.5			59	
	LBR-208	.69	.64	29.9	15.2	18.8	65.3		1.5			70	
	LBR-209	.94	1.38	49.5	18.4	21.1	59.1		1.5			44	
	LBR-214	1.29	.48	68.0	14.9	19.6	64.9		1.0			24	
	LBR-215	.49	.85	63.4	19.8	19.4	59.9		1.0		.51	18	6726
	*S.G. = 1.62 FOR THE ABOVE. ALL RESULTS ARE QUOTED ON AN AIR DRY BASIS.												
	TOTAL AVERAGE	.79	.84	44.4	16.6	19.7	62.6		1.5		.51	48	6726
	LBD-301	.92	.65	18.7	9.35	19.3	70.7		1.0			70	
	LBD-302	1.19	1.05	40.0	14.8							43	
	LBD-304	.64	.74	63.2	14.3	20.1	64.9		1.5		.57	16	7287
	*S.G. = 1.60 OR THE ABOVE. ALL RESULTS ARE QUOTED ON AN AIR DRY BASIS.												
	TOTAL AVERAGE	.92	.81	40.6	12.8	19.7	66.7		1.5		.57		7287

SEAM	HOLE #	MOISTURE (%)		ASH (%)		V.M.(%)	F.C.(%)	FSI		SULPHUR(%)		YIELD(%)	CALORIFIC VALUE (Kcal/Kg)
		(Raw)	(Float)	(Raw)	(Float)			(Raw)	(Float)	(Raw)	(Float)		
C	LB-2	.36	.64	39.4	11.7	22.4	65.26	1.0	1.5			50	
	LB-3	.72	.79	28.3	9.3	22.8	67.1	1.0	1.0			42	
	LBR-201	.47	3.28	27.7	10.8	20.7	65.2		1.0			53	
	LBR-203	.47	2.71	63.4	15.1	21.7	60.4		1.0		.32	16	7009
	LBR-207	1.6	3.37	52.8	23.6	20.4	52.7		1.0		.34	41	6179
	LBR-209	.74	1.1	39.3	14.4	23.6	60.8		1.0		.32	53	7073
	LBR-212	1.3	1.19	22.1	14.9	22.8	61.1		1.0		.38	45	7036
	LBR-214	.67	1.46	43.8	13.9	21.8	62.8		1.0		.28	32	7135
	*S.G. = 1.62 FOR THE ABOVE. ALL RESULTS ARE QUOTED ON AN AIR DRY BASIS.												
	TOTAL AVERAGE	.79	1.8	39.6	14.2	22.0	61.9	1.0	1.0		.33	41	6886
	LBD-301	.71	1.64	36.5	11.8	21.7	64.8		1.0		.28	52	7600
	LBR-304	.69	1.75	32.4	11.2	20.45	66.6		1.0		.30	47	7434
	LBR-305	.69	1.26	45.9	12.8	20.1	65.8		1.5		.24	34	7231
	LBR-309	.90	.67	46.1	13.0	20.0	66.3		1.0		.46	36	7328
	*S.G. = 1.60 FOR THE ABOVE. ALL RESULTS ARE QUOTED ON AN AIR DRY BASIS.												
	TOTAL AVERAGE	.80	1.33	40.2	12.2	20.5	66.0		1.0		.32	42	7398

1A/CZd.4

SEAM	HOLE #	MOISTURE (%)		ASH (%)		V.M.(%)	F.C.(%)	FSI		SULPHUR(%)		YIELD(%)	CALORIFIC VALUE (Kcal/Kg)
		(Raw)	(Float)	(Raw)	(Float)			(Raw)	(Float)	(Raw)	(Float)		
C UPPER	LBR-206	1.43	1.11	46.1	12.9	24.9	61.0		1.5		.31	45	7280
	LBR-209	.86	.92	35.5	14.9	23.9	60.2		1.5			53	
	LBR-210	1.38	1.09	26.1	11.5	24.3	63.0		1.0		.29	53	7386
	LBD-302	1.22	1.74	27.85	11.1							58	
	*S.G. = 1.62 FOR LBR-206, LBR-209 AND LBR-210 S.G. = 1.60 FOR LBD-302 ALL ANALYSES ON AN AIR DRY BASIS.												
	TOTAL AVERAGE	1.22	1.21	33.9	12.6	24.4	61.8		1.5		.30	52	7333
C LOWER	LBR-206	.82	1.05	60.6	20.5	22.6	55.8		1.5				
	LBR-209	.85	1.21	60.7	17.8	21.7	59.3		1.0				
	LBR-210	.97	2.9	29.3	11.6	21.9	63.6		1.0		.28	65	7266
	LBD-302	.91	1.24	32.0	12.4							51	
	*S.G. = 1.62 FOR LBR-206, LBR-209 AND LBR-210 S.G. = 1.60 FOR LBD-302 ALL ANALYSES ON AN AIR DRY BASIS												
	TOTAL AVERAGE	.88	1.6	45.6	15.6	22.1	60.7		1.0		.28	58	7266

SEAM	HOLE #	MOISTURE (%) (Raw)	MOISTURE (%) (Float)	ASH (%) (Raw)	ASH (%) (Float)	V.M.(%)	F.C.(%)	FSI (Raw)	FSI (Float)	SULPHUR(%) (Raw)	SULPHUR(%) (Float)	YIELD(%)	CALORIFIC VALUE (Kcal/Kg)
D	LB-2	.57	.58	59.2	17.5	23.0	58.9	1.0	5.5			32	
	LBR-201	.40	1.16	25.95	9.9	23.7	65.2		7.0			64	
	LBD-301	.72	1.04	46.0	16.2	21.5	61.2	1.0	2.0			33	
	LBR-304	.61	1.65	41.3	8.5	23.7	66.2		5.0		.77	39	7731
	*S.G. = 1.62 FOR LB-2 AND LBR-201 S.G. = 1.60 FOR LBD-301 AND LBR-304 ALL ANALYSES ON AN AIR DRY BASIS												
	TOTAL AVERAGE	.57	1.10	43.1	13.0	23.0	62.9	1.0	5.0		.77	42	7731
E	LBR-210	.92	.76	49.7	18.2	23.4	57.6		1.5			36	
	LBD-301	.63	.67	69.9	15.4	28.7	55.2		8.0		.68	18	7294
	*S.G. = 1.62 FOR LBR-210 S.G. = 1.60 FOR LBD-301 ALL ANALYSES ON AN AIR DRY BASIS												

1A/CZd.6

6.0 GEOPHYSICAL SURVEY RESULTS

As previously mentioned, a rectangular cut-line grid was constructed for geophysical survey purposes across the property. Shell Mineral Resources Limited conducted an EM-31, EM-34 and DC resistivity survey over the grid using various dipole configurations. Preliminary results suggest the E-M survey techniques could discern resistivity contrast between Kootenay-Blairmore, and Kootenay - carbonate strata respectively. However, the methods failed to detect (a) resistivity contrast between overburden and rock, or (b) specific coal horizons in the Kootenay Group. A more detailed report of survey results will be submitted at a later date.

7.0 RECOMMENDATIONS FOR FURTHER WORK

Further exploration work on the Lillyburt project should consider the following:

(a) Drilling to define or enhance:

- i) Coal Quality.
- ii) Structure.
- iii) Stratigraphy.
- iv) Overburden Depth and Ratio.

(b) Geological Mapping (Scale 1:2000):

i) Detailed mapping of all outcrops on property licences 4082 and 4085 inclusive.

(c) Geotechnical:

i) Study of hydrology; installation of piezometers.

ii) Geotechnical core logging.

(d) Geophysical Surveys:

i) Continued testing of surface geophysical methods such as electromagnetics and seismics to

(a) obtain overburden depth profiles

(b) delineate structures

(c) map significant geological contacts (i.e. Fernie-Kootenay contact, Morrissey sandstone, Cadomin conglomerate, carbonate - Kootenay strata contact)

(e) Bulk Sampling

obtain a representative coal sample from seam C.

8.0 BIBLIOGRAPHY

Bethune, P. de, 1936. Un cas d'involution de nappes du second genre dans les Montagnes Rocheuses du Canada (geologie des environs du Flathead Townsite, Colombie Britannique): Memoires de L'Institut Geologique de l'Universite de Louvain, Tome X, p. 151-197.

Densmore, B., 1982. CNRL Reclamation Report for Lillyburt, S.E. British Columbia.

D'Orsay, M., 1979. Geological Report on the Lillyburt Project, Coal Licence No's: 4080-4089 inclusive, Kootenay District, Map Reference 82G7.

Dowling, D.B., 1915. Coal Fields in British Columbia: Geological Survey of Canada, Memoir 69, 350p.

Gibson, D.W., 1977. Sedimentary facies in the Jura-Cretaceous Kootenay Formation, Crowsnest Pass area, southwestern Alberta and southeastern British Columbia: Bulletin of Canadian Petroleum Geology, v.25, p. 767-791.

Gibson, D.W., 1979. The Morrissey and Mist Mountain Formations - newly defined litho stratigraphic units of the Jura-Cretaceous Kootenay Group, Alberta and British Columbia. Bulletin of Canadian Petroleum Geology, v.27 p. 183-208.

Horne, J.C. and Ferm, J.C., 1978. Carboniferous depositional environments: eastern Kentucky and southern West Virginia; University of South Carolina, Dept. of Geology, Columbia, South Carolina. 151p.

MacKenzie, J.D., 1916. Geology of a portion of the Flathead coal area, British Columbia: Geological Survey of Canada, Memoir 87, 53p.

McKinstry, B.W., 1980. Report on Coal Licences 4080 to 4089 inclusive, Kootenay Land District, British Columbia.

McMechan, R.D., 1981. Stratigraphy, sedimentology, structure and tectonic implications of the Oligocene Kishenehn Formation, Flathead Valley graben, southeastern British Columbia. Queen's University PhD dissertation, Kingston, Ontario. 327p.

Price, R.A., 1965. Flathead Map Area, British Columbia and Alberta, Geological Survey Canada Memoir 336. 221p.

Robertson, W.F., 1909. Report of the Ministry of Mines, British Columbia, p. 175.

Rose, B., 1918. Crowsnest and Flathead coal areas, British Columbia: Geological Survey of Canada, Summary Report 1917, Part C, p. 28C-35C.


NKP

Photo #1 A view of the Lillyburt coal prospect looking northeastward from Lodgepole coal property. The thicker arrow indicates the general area of exploration interest. NKP indicates the location of North Kootenay Pass.

Photo #2 A view of Lillyburt looking northwestward towards Squaw Creek. This photo illustrates the valley setting of the property and the extent of previous logging activity.

1

Photo #3 Another view of the property illustrating topographical relief. Mount Borsato is to the left of center in the photo.

Photo #4 A reclaimed rotary drillhole site at LBR-303. Logging slash is distributed about the site afterward to facilitate regrowth.

5/DJa.28

Photo #5 Another reclaimed rotary drillhole site at LBR-309. Rotary hole LBR-207 is located near the white targeting material to the right of center in the photo. This drillhole was used as a control point in aerial photography.

Photo #6 The access road to LBR-305 was recontoured and reseeded due to its proximity to the Flathead logging road.

1

Photo #7 The Ingersoll-Rand 1700 drilling rig was used for all 1981 rotary holes. Visible in the photo are the rig and pipe trucks, a pickup with spare casing and coal samples.

Photo #8 The Longyear 44 was used to drill all 1981 HQ core holes. To the left of the drilling shack is the mud tank and sump pit, with a water reserve tank in the background.

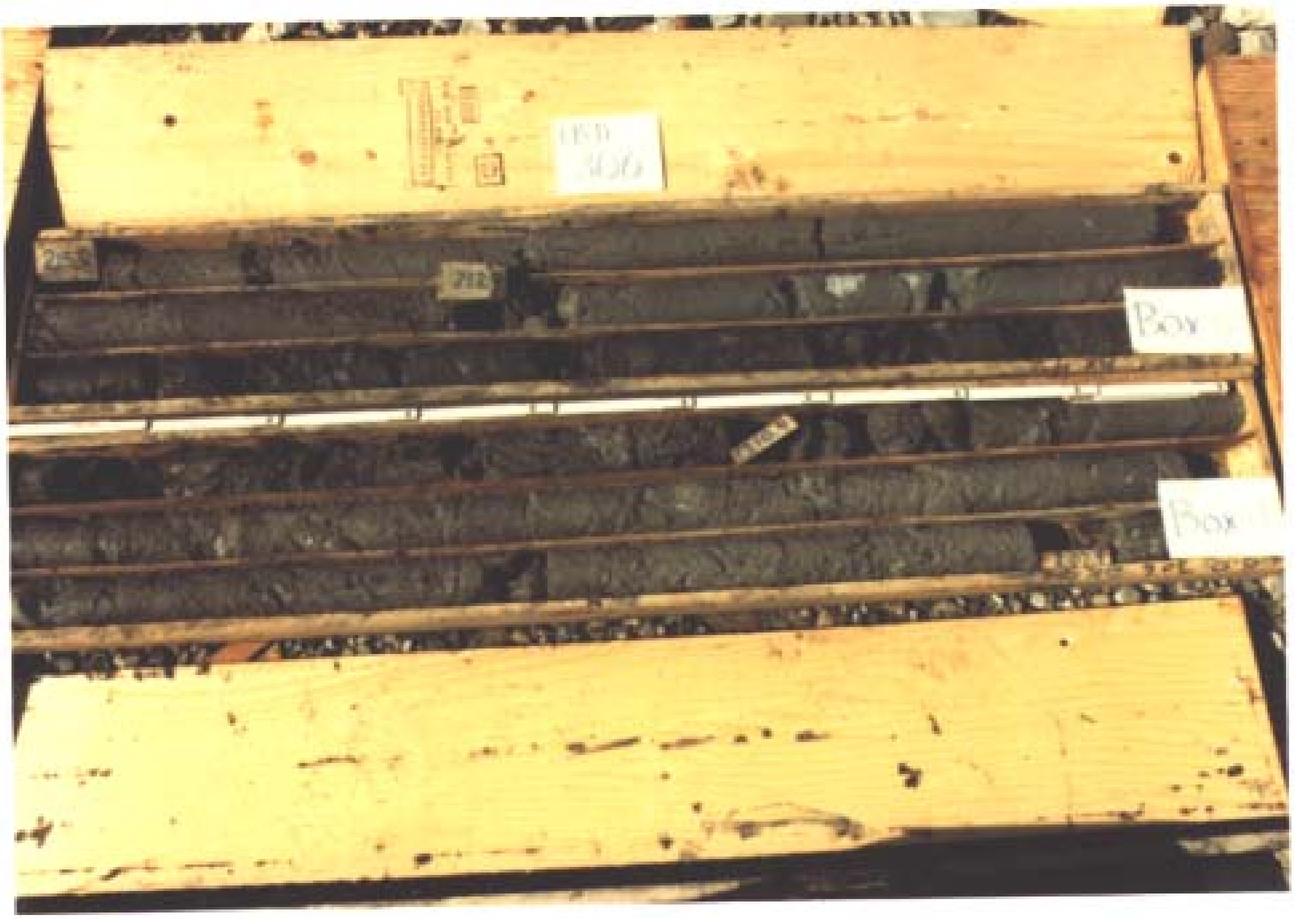

Box
Box

Photo #9 Although LBD-306 did not successfully core the Flathead Fault, it did penetrate 10 meters of the zone. This photo illustrates the gouge nature of the core. Notice the small white fragment of limestone in Box 42.

Photo #10 LBD-300A successfully cored the Flathead Fault, revealing it to be a zone 40 meters thick. The gouge is very calcareous and this is seen in the photo with numerous thin white veinlets of calcite throughout the core. A specimen of this core, if left uncovered to the elements would decompose to mud in less than a week. The zone is very carbonaceous at this locality.

1

2

Photo #11 The term 'breccia' as opposed to 'gouge' is best exemplified in this photo. The silty sandstone has been strongly fragmented with the fragments rotated and suspended in a silty matrix. This texture was commonly observed where loss of section was apparent on geophysical log traces.

CROWS NEST RESOURCES LIMITED (Exploration)

B.C. COAL LICENCES
TENURE STANDING

BLOCK: LILLYBURT
GROUP: # 243
PROJECT: LILLYBURT
YEAR: 1981
DATE: DECEMBER 1981

LICENCE			ACQ/ADM		RENTALS		REQUIREMENT WORK						BUDGET		EXP	POTL	REMARKS
NO.	LEGAL DESCRIPTION	AREA TOTAL AC/HA.	YEAR	FEES $	ANNUAL $	TOTAL TO NEXT ANN. $ 10^3	EXPIRED $ 10^3	CURRENT YEAR LIC. YEAR	CURRENT YEAR $	PRE-FULFILMENT YEAR	PRE-FULFILMENT $	ANNIVERSARY DATE	CURRENT YEAR AFE	CURRENT YEAR $ 10^3	TOTAL $ 10^3	SHELL CLASS.	
10 LIC		2479	78	300	12,395	49.5	80.5	3	30,987.5	7 3/4	847,793	DECEMBER 31	-	-	977.7	Y	THE LICENCES ARE
4080	LOT 1662	259															IN GOOD STANDING
4081	LOT 1663	259															UNTIL DECEMBER 31s
4082	LOT 10333	259															1988 WITH AN EXCESS
4083	LOT 1661	259															CREDIT OF $41.99 FOR
4084	LOT 1660	259															THE SUBSEQUENT TERM
4085	LOT 7750	259															
4086	LOT 7749 & 7754	259															
4087	LOT 1659	259															
4088	LOT 7752	259															
4089	LOT 7753	187															
				WORK DONE	1978-79	1980	1981										
				$	74,372.	318,891	535,082										

BA - 312

APPENDIX VIII

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

APPLICATION TO EXTEND TERM OF LICENCE

I, LESLIE GRAMANTIK (Name) agent for SHELL CANADA RESOURCES LIMITED (Name)

P.O. BOX 100 CALGARY (Address)

ALBERTA T2P 2H5

Valid FMC No. 207568

hereby apply to the Minister to extend the term of Coal Licence(s) No(s). 4080 TO 4089 INCL. TEN LICENCES, GROUP #243, 2479 HECTARES

for a further period of one year.

2. Property name LILLYBURT, KOOTENAY LAND DISTRICT

3. I am allowing the following Coal Licence(s) No(s). to forfeit N/A

4. I have performed, or caused to be performed, during the period JANUARY 1981 to DECEMBER 31st, 19 81, *work to the value of at least* $ 535,082.00

on the location of coal licence(s) as follows:

CATEGORY OF WORK

	Licence(s) No(s).	Apportioned Cost
Geological mapping	4083, 4084	38,962.
Surveys: Geophysical	4083, 4084	13,250
Geochemical	-	-
Other	-	-
Road construction	4083	11,185.
Surface work	4083, 4084	800.
Underground work	-	-
Drilling	4083, 4084	350,033.
Logging, sampling, and testing	4083, 4084	92,416.
Reclamation	4083, 4084	17,906
Other work (specify)	-	-
Off-property costs	GEOLOGICAL REPORT	10,530.

5. I wish to apply $ 535,082.00 of this value of work on Coal Licence(s) No(s). 4080 TO 4089 INCL.

6. I wish to pay cash in lieu of work in the amount of $ N/A on Coal Licence(s) No(s).

7. The work performed on the location(s) is detailed in the attached report entitled THE GEOLOGICAL REPORT WILL BE SUBMITTED IN 90 DAYS

Dec 22nd, 81 (Date)

[signature] (Signature)

ASSISTANT LANDMAN (Position)

(FORMS AND REPORT TO BE SUBMITTED IN DUPLICATE)

APPENDIX IX

CATEGORY OF WORK

GEOLOGICAL MAPPING Yes ☒ No ☐

		Area (Hectares)	Scale	Duration
Reconnaissance				
Detail:	Surface	495	1:2000	108 MAN DAYS
	Underground			

*Other (specify) SURVEYING GEOPHYSICAL CUT LINES

Total Cost $ 38,962

GEOPHYSICAL/GEOCHEMICAL SURVEYS Yes ☒ No ☐

Method ELECTRO MAGNETIC

Grid

Topographic

*Other (specify)

Total Cost $ 13,250

ROAD CONSTRUCTION Yes ☒ No ☐

Length 210 METERS Width 6 METERS

On Licence(s) No(s). 4083

Access to DRILL HOLE 305

Total Cost $ 11,185

SURFACE WORK Yes ☐ No ☐

	Length	Width	Depth	Cost
Trenching				
Seam Tracing				
Crosscutting				
*Other (specify)	LINE CUTTING			

Total Cost $ 800

UNDERGROUND WORK Yes ☐ No ☒

	No. of Adits	Maximum Length	No. of Holes	Total Metres	Cost
Test Adits					
*Other workings					

Total Cost $

DRILLING Yes ☒ No ☐

		Hole Size	No. of Holes	Total Metres	Cost
Core:	Diamond				
	Wireline	9.8cm	4	1201	270,034
Rotary:	Conventional				
	Reverse circulation	13.3cm	6	993	79,999
*Other (specify)					

Contractor SDS AND COATES ATP

Where is the core stored? AT THE SITE

Total Cost $ 350,033

LOGGING, SAMPLING AND TESTING Yes ☒ No ☐

Lithology: Drill samples ☒ Core samples ☒ Bulk samples ☐

Logs: Gamma-neutron ☒ Density ☒ $ 60,073

*Other (specify) FOCUSED BEAM ELECTRIC

Testing: Proximate analysis ☒ FSI ☒ Washability ☐

Carbonization ☐ Petrographic ☐ Plasticity ☐

*Other (specify) RESISTIVITY $ 32,343

TOTAL COST 92,416

OTHER WORK (specify details) Cost

RECLAMATION 17,906

GEOLOGICAL REPORT 10,530

Total Cost $ 28,436

On-property costs 524,552

Off-property costs 10,530

Total Expenditures $ 535,082

Dec 22/81
(Date)

[signature]
(Signature)

MANAGER ACCOUNTING C.N.R.L.
(Position)

*A full explanation of other work is to be included.

K-SHELL LILLYBURT 81(5)A

Lillyburt 1981
Shell Canada
MAPS

B. McKinstry

407
3 of 5

CONFIDENTIAL
OPEN FILE

OPEN FILE

CONFIDENTIAL
OPEN FILE

CONFIDENTIAL
OPEN FILE

OPEN FILE

CONFIDENTIAL

~~CONFIDENTIAL~~

pt. 3 of 5 00 407

M E M O R A N D U M

DATE : FEBRUARY 24, 1982

T O : CROWS NEST RESOURCES LIMITED (C.N.R.L.)

FROM : SHELTECH CANADA

SUBJECT: LILLYBURT (4151-H) - S.E. BRITISH COLUMBIA

All survey control in the Lillyburt area is based on the photo control network completed in the summer of 1981. The two stations used were 'V59C1' and 'U59C1' (formerly 'ROB').

From these stations three offset traverse points and six drill holes were surveyed.

Conventional survey methods using a 1" theodolite and electronic distance measuring equipment were used to obtain survey data. All calculations were done in the UTM system with distances being reduced to plane and bearings referenced to 117°W. The results were given to C.N.R.L. personnel in both tabular and map form.

A L Melton

A. L. Melton

RB/cm

s729

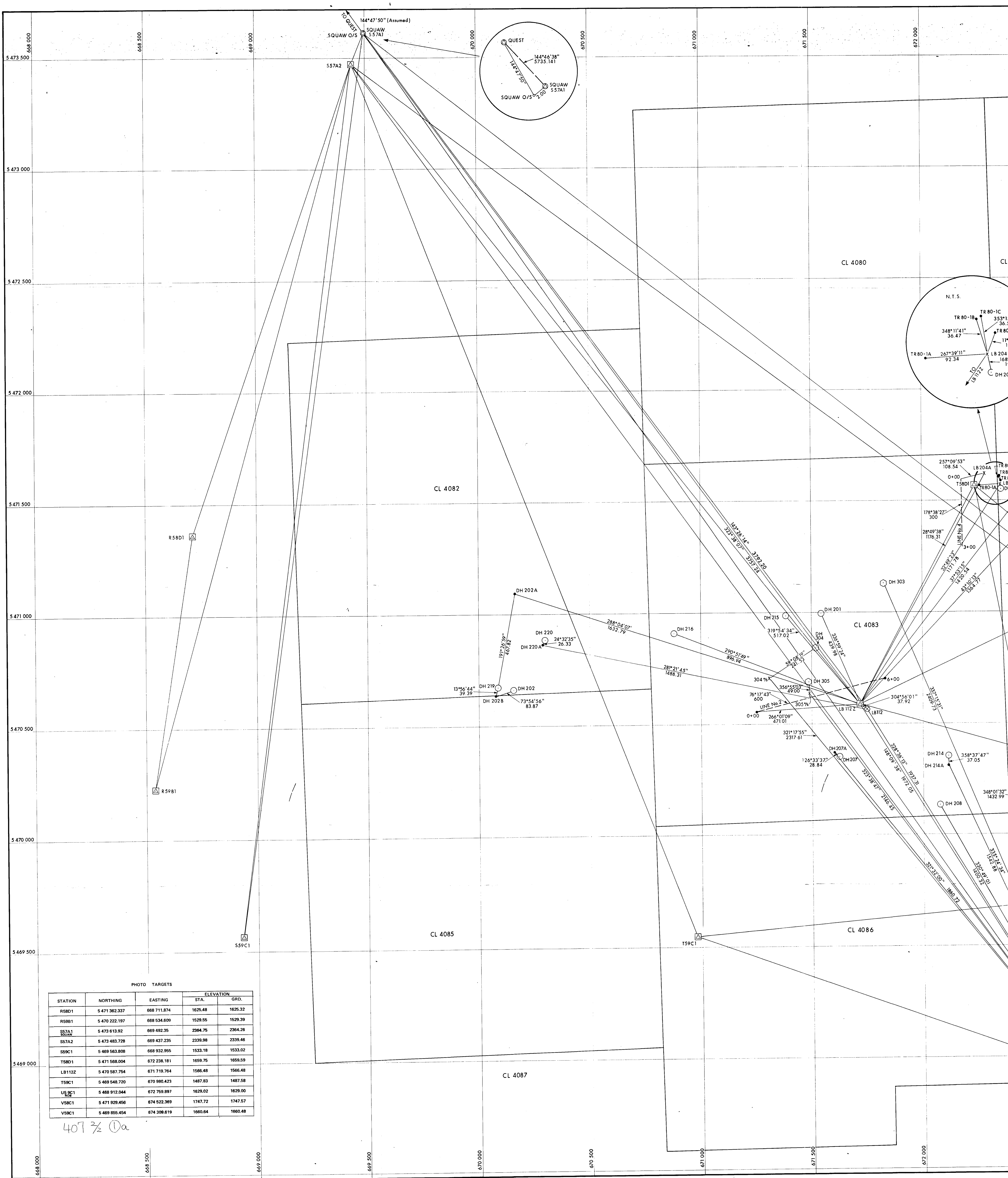


PHOTO TARGETS

STATION	NORTHING	EASTING	ELEVATION STA.	ELEVATION GRD.
R58D1	5 471 362.337	668 711.874	1625.48	1625.32
R59B1	5 470 222.197	668 534.609	1529.55	1529.39
S57A1 SQUAW	5 473 613.92	669 492.35	2364.75	2364.26
S57A2	5 473 483.728	669 437.235	2339.98	2339.46
S59C1	5 469 563.808	668 932.955	1533.18	1533.02
T58D1	5 471 568.004	672 238.181	1659.75	1659.59
LB112Z	5 470 587.754	671 719.764	1566.48	1566.48
T59C1	5 469 548.720	670 980.423	1487.83	1487.58
U5 9C1 ROB	5 468 912.044	672 759.897	1629.02	1629.00
V58C1	5 471 929.456	674 522.369	1747.72	1747.57
V59C1	5 469 855.454	674 309.619	1660.64	1660.48

407 2/2 1a

PHOTO STATION REFERENCES

STATION	REFERENCE	AZIMUTH	DISTANCE	DESCRIPTION	NORTHING	EASTING
DH 203	1	80°	15.60	STUMP	5471555.5	672374.3
	2	304°	28.30	STUMP	5471568.7	672335.4
	3	208°	10.10	TREE	5471543.9	672354.2
DH 200	1	350°	14.90	STUMP	5470330.0	673697.5
	2	280°	15.10	STUMP	5470326.9	673685.2
	3	170°	11.70	TREE	5470312.8	673702.1
DH 205	1	112°	29.50	TREE	5470054.4	673073.8
	2	200°	48.80	DEAD FALL	5470019.6	673029.8
	3	302°	45.00	ROCK	5470089.3	673008.3
DH 215	1	306°	49.00	BLAZE ON TREE	5471012.2	671347.2
	2	142°	41.20	BLAZE ON STUMP	5470950.9	671412.2
	3	354°	39.20	BLAZE ON DEAD TREE	5471022.3	671382.8
DH 207	1	20°	15.40	ROCK	5470366.4	671631.1
	2	96°	33.90	DEAD FALL	5470348.4	671659.6
	3	208°	47.85	DEAD FALL	5470309.7	671603.4
T 58D1	1	302°	7.40	TREE	5471571.9	672231.9
	2	78°	17.00	STUMP	5471571.5	672254.8
	3	176°	18.10	STUMP	5471551.9	672239.3
T 59C1	1	350°	29.50	DEAD TREE	5469577.8	670975.3
	2	258°	38.00	DEAD FALL PILE	5469540.8	670943.3
	3	142°	21.10	TREE	5469532.1	670993.4
V 59C1	1	240°	21.00	DEAD FALL	5469845.0	674291.4
	2	100°	11.70	STUMP	5469853.4	674321.1
	3	42°	17.30	ROCK	5469868.3	674321.2
V 58C1	1	180°	14.90	STUMP	5471914.6	674522.4
	2	268°	27.50	ROCK	5471928.5	674494.9
	3	12°	13.50	DEAD TREE	5471942.7	674525.2
U 59C1	1	158°	9.10	DEAD FALL	5468903.6	672763.3
	2	44°	5.10	STUMP	5468915.7	672763.4
	3	304°	5.70	STUMP	5468915.2	672755.2

STATION	NORTHING	EASTING	ELEVATION
QUEST	5 478 299.78	666 184.06	2441.74
SQUAW	5 473 613.92	669 492.35	2364.26
ROB	5 468 912.04	672 759.89	1629.02
LB 112	5 470 566.03	671 750.85	1568.11
KB 112Z	5 470 587.75	671 719.76	1566.48
TRAVERSE STATIONS			
LB 200	5 471 708.70	672 592.35	1710.28
LB 202	5 471 704.39	672 782.81	1684.70
LB 203	5 471 582.93	672 653.89	1674.65
LB 204	5 471 572.33	672 355.11	1664.10
LB 204A	5 471 618.18	672 287.14	-
LB 205	5 471 713.69	672 694.54	1702.01
DH 202A	5 471 094.47	670 167.59	1592.15
DH 202B	5 470 635.98	670 074.63	1532.02
DH 206A	5 470 419.82	672 976.78	1494.96
DH 207A	5 470 369.15	671 602.69	1491.52
DH 214A	5 470 315.11	672 118.12	1536.46
DH 220A	5 470 859.53	670 291.77	1537.01
DRILL HOLES			
DH 1	5 470 580.18	672 602.57	1510.89
DH 2	5 470 595.61	671 655.86	1553.43
DH 3	5 471 589.00	672 359.80	1662.53
DH 200	5 470 324.32	673 700.06	1504.11
DH 201	5 470 992.76	671 547.85	1521.36
DH 202	5 470 659.20	670 155.22	1521.82
DH 203	5 471 552.83	672 358.90	1663.54
DH 204	5 471 731.08	672 538.09	1707.83
DH 205	5 470 065.44	673 046.48	1480.01
DH 206	5 470 450.18	672 938.92	1495.40
DH 207	5 470 351.97	671 625.86	1491.36
DH 208	5 470 134.74	672 077.33	1484.38
DH 209	5 470 218.44	672 488.99	1489.77
DH 210	5 470 313.90	672 462.85	1509.43
DH 211	5 470 111.19	672 596.16	1475.63
DH 212	5 470 246.63	672 985.66	1487.30
DH 213	5 470 250.67	673 340.89	1507.60
DH 214	5 470 352.15	672 117.24	1528.85
DH 215	5 470 983.35	671 386.87	1522.43
DH 216	5 470 907.35	670 881.70	1508.22
DH 219	5 470 674.21	670 084.12	1531.48
DH 220	5 470 883.48	670 302.71	1531.05
TRENCHES			**GROUND ELEVATION**
80-1A	5 471 568.57	672 262.85	1659.52
80-1B	5 471 608.03	672 347.66	1662.19
80-1C	5 471 608.63	672 350.83	1662.58
80-1D	5 471 589.88	672 358.72	1663.92
80-2A	5 471 700.94	672 557.35	1702.44
80-2B	5 471 636.06	672 560.28	1686.20
80-3A	5 471 743.14	672 729.53	1701.82
80-3B	5 471 774.85	672 643.39	1723.43
80-3C	5 471 742.28	672 735.75	1699.98
80-3D	5 471 721.55	672 752.92	1690.09

DRILL HOLES (1981)

DH	N	E	GROUND ELEV.
DH 300	5 471 481.13	672 464.64	1643.2
DH 302	5 470 383.04	672 581.84	1535.6
DH 303	5 471 134.44	671 828.36	1552.7
DH 304	5 470 844.64	671 518.11	1515.1
DH 305	5 470 689.67	671 484.92	1517.5
DH 306	5 471 600.81	673 035.62	1677.8

TRAVERSE POINTS

STA.	N	E	ELEV.
304 o/s	5 470 720.74	671 310.78	1499.6
305 o/s	5 470 640.74	671 487.55	1516.7
306 o/s	5 471 600.52	673 038.32	1677.8

NOTE: Elevation at 'Squaw' to ground plus 49cm to top of bar.

100 50 0 100 200 300 METRES

SCALE 1 : 5 000

LEGEND

- PHOTO TARGET (CEMENTED I.P.)
- FOUND GEODETIC STATION
- FOUND 12" SPIKE
- X — PLANTED 12" SPIKE
- PLANTED 6" NAIL
- DRILL HOLE
- DRILL HOLE (1981)
- RESITIVITY SURVEY

NOTE: CO-ORDINATES OF QUEST & SQUAW WERE TAKEN FROM 1979 DOPPLER OBSERVATIONS AND USED AS THE DATUM IN THIS AREA.

SURVEY DONE BY Sheltech Canada, 1980, 1981.

ALL DISTANCES ARE IN METRES AND DECIMALS THEREOF AND HAVE BEEN REDUCED TO PLANE.
ALL ELEVATIONS ARE TO THE TOP OF POST UNLESS NOTED OTHERWISE
ALL BEARINGS ARE REFERRED TO 117°W

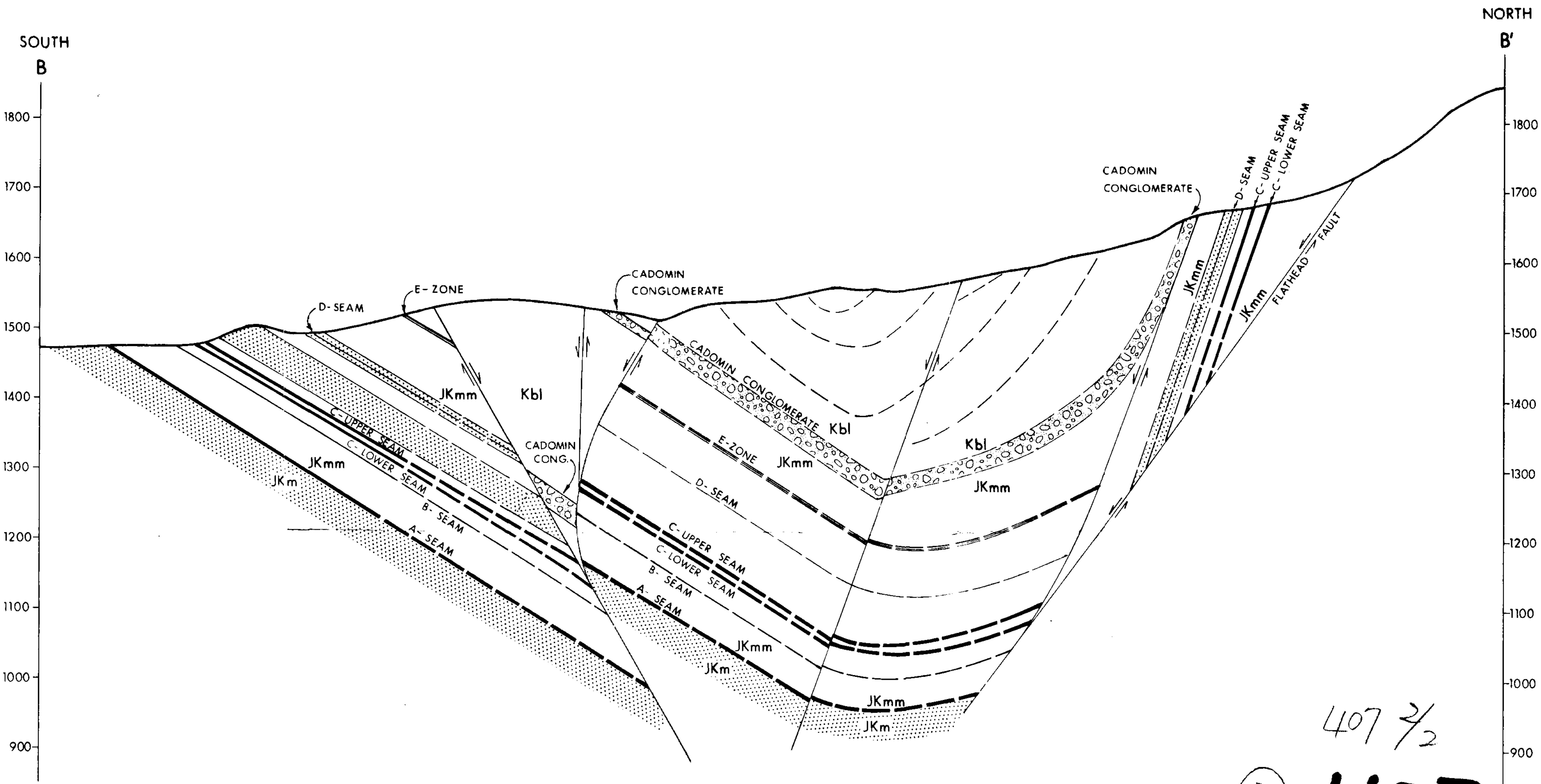
K-SHELL-Lillyburt 81 (2)A

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
SE BRITISH COLUMBIA
407 2/2 1b

TRAVERSE SURVEY MAP

N.T.S. 82 G/7		UTM. ZONE 11
AUTHOR: Sheltech	SCALE: 1: 5000	ENCLOSURE No:
DATE: 80 12 08	REVISED: 81 NOV.	DRAWING No: HI-62E
To Accompany		



407 2/2

② 407

GEOLOGICAL LEGENDS

CRETACEOUS

Kbl — Blairmore Group

JURASSIC - CRETACEOUS

JKk — Kootenay Group

JKmm — Mist Mountain Formation

JKm — Morrissey Formation

GEOLOGICAL SYMBOLS

CONGLOMERATE (Cong.)

SANDSTONE (Ss) MEDIUM GRAINED

COAL

FAULT (arrows indicate relative movement)

GEOLOGICAL CONTACT (known, approximate)

100 50 0 100 200 300 METRES

SCALE 1 : 5000

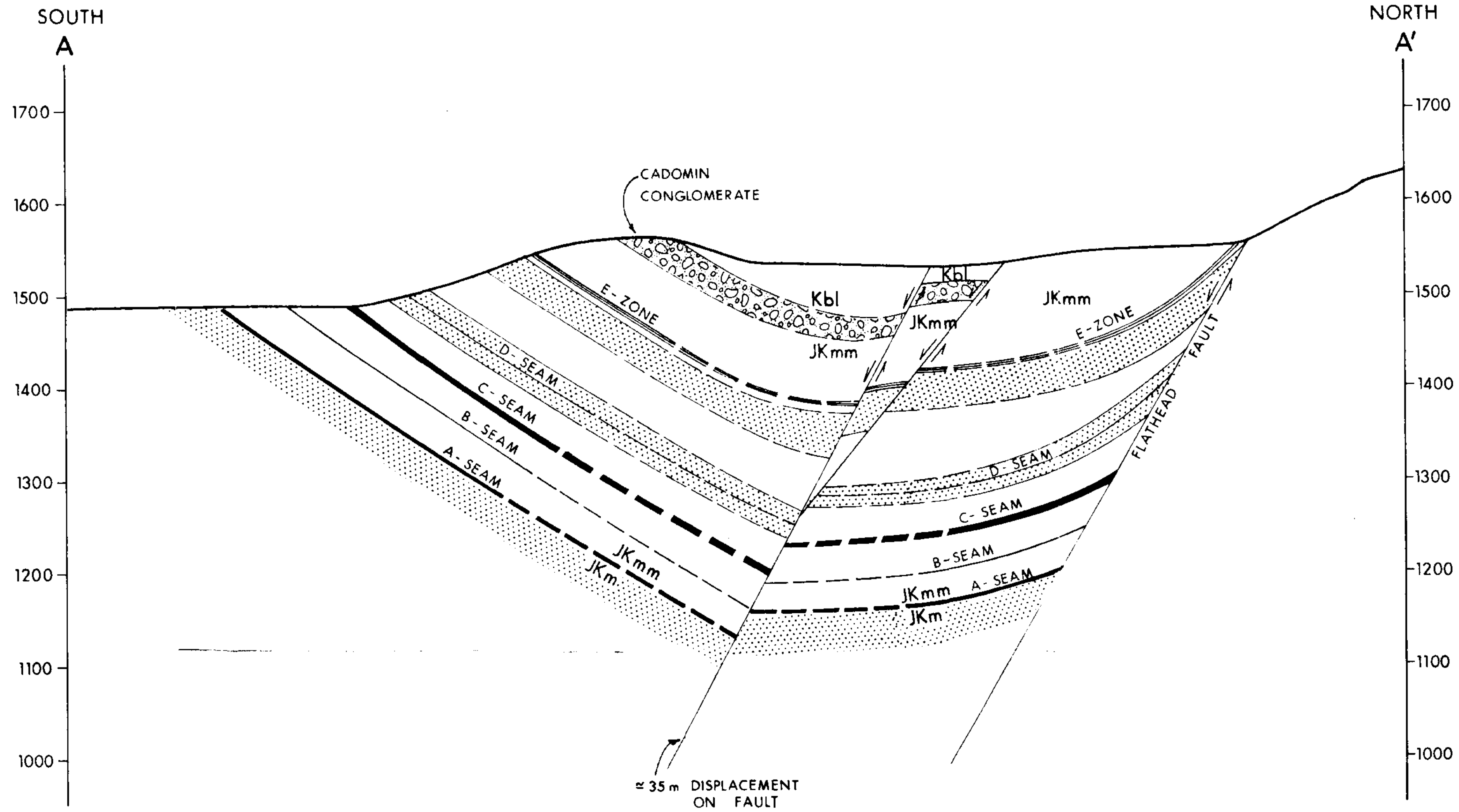
K-SHELL-Lillyburt 81(2)A

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
SE. BRITISH COLUMBIA

CROSS-SECTION B-B'

AUTHOR: B. McKINSTRY	SCALE: 1 : 5000	ENCLOSURE No.
DATE: FEB. 1982	REVISED:	DRAWING No. HC-96E
To Accompany		



407 2/2

③ 407

GEOLOGICAL LEGENDS

CRETACEOUS

Kbl — Blairmore Group

JURASSIC - CRETACEOUS

JKk — Kootenay Group

JKmm — Mist Mountain Formation

JKm — Morrissey Formation

GEOLOGICAL SYMBOLS

CONGLOMERATE (Cong.)

SANDSTONE (Ss) MEDIUM GRAINED

COAL

FAULT (arrows indicate relative movement)

GEOLOGICAL CONTACT (known, approximate)

100 50 0 100 200 300 METRES

SCALE 1 : 5 000

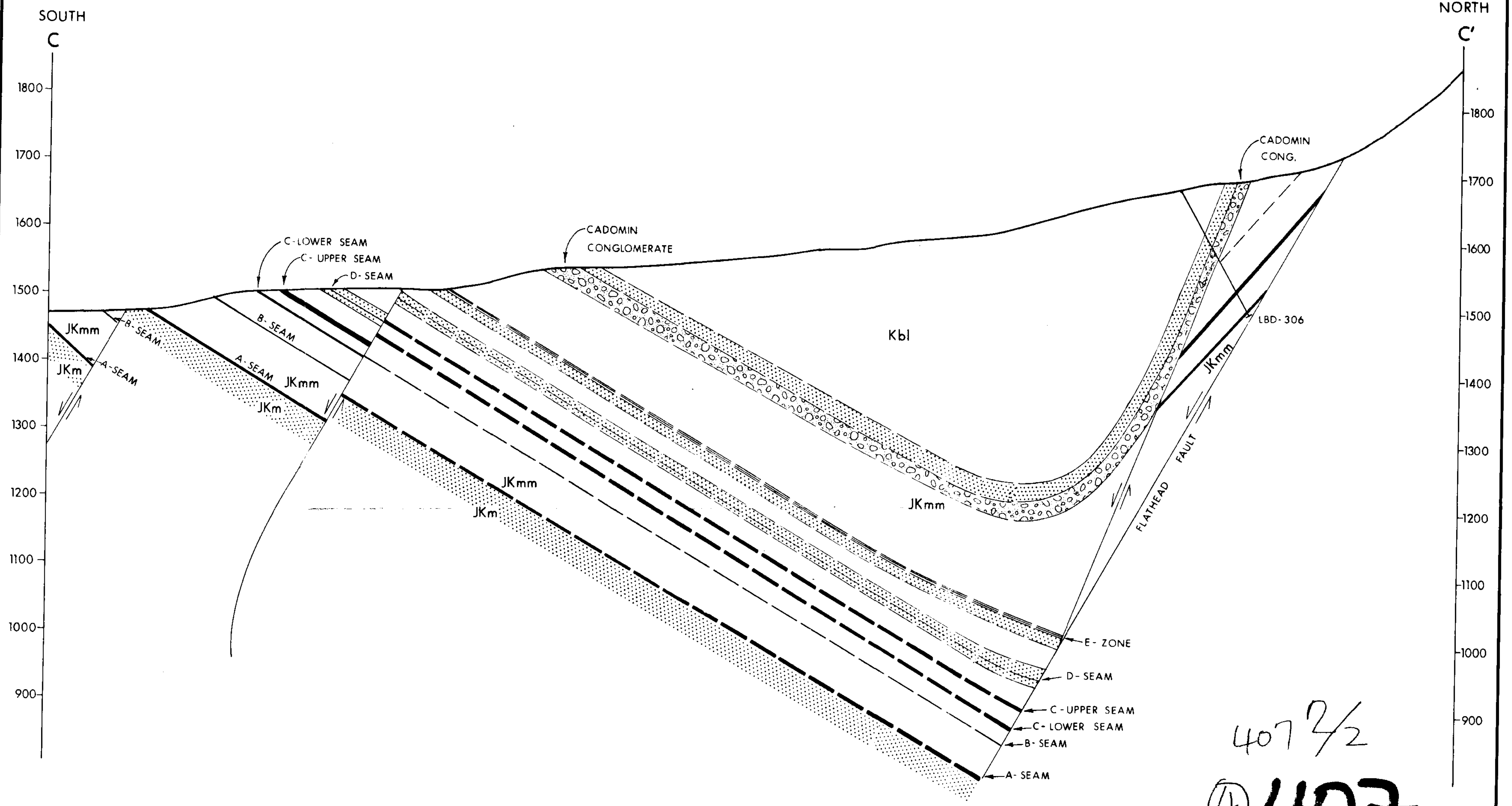
K-SHELL-Lillyburt 81(2)A

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. BRITISH COLUMBIA

CROSS-SECTION A-A'

AUTHOR: B. McKINSTRY	SCALE: 1:5 000	ENCLOSURE No.:
DATE: FEB. 1982	REVISED:	DRAWING No. HC-96D
To Accompany		



407 2/2

④ 407

K-SHELL-Lillyburt 81(2)A

GEOLOGICAL LEGENDS

CRETACEOUS

Kbl — Blairmore Group

JURASSIC - CRETACEOUS

JKk — Kootenay Group

JKmm — Mist Mountain Formation

JKm — Morrissey Formation

GEOLOGICAL SYMBOLS

CONGLOMERATE (Cong.)

SANDSTONE (Ss) MEDIUM GRAINED

COAL

FAULT (arrows indicate relative movement)

GEOLOGICAL CONTACT (known, approximate)

100 50 0 100 200 300 METRES

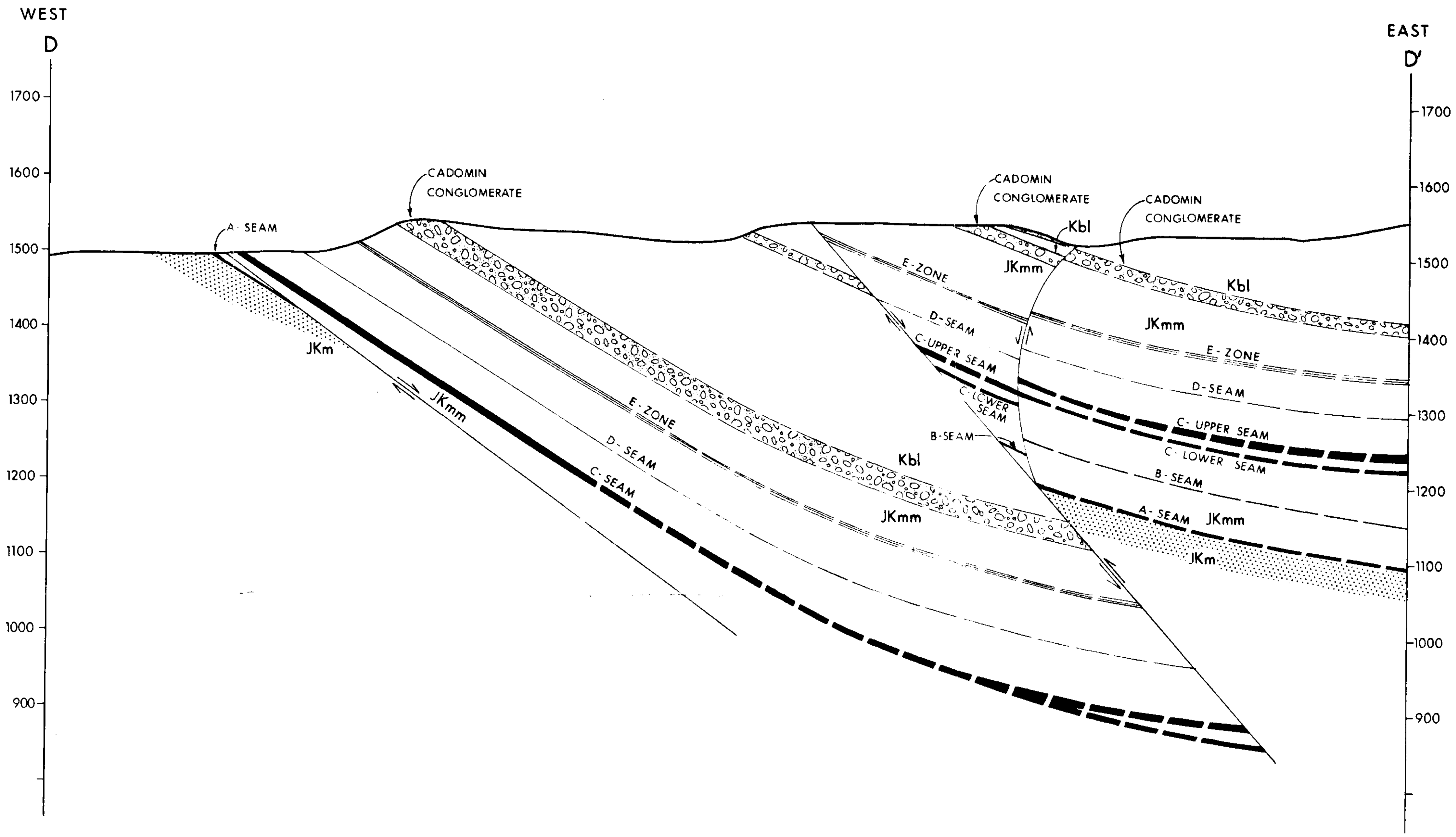
SCALE 1:5 000

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. BRITISH COLUMBIA

CROSS-SECTION C-C'

AUTHOR: B. McKINSTRY	SCALE: 1:5 000	ENCLOSURE No:
DATE: FEB 1982	REVISED:	DRAWING No HC-96F
To Accompany		



407 2/2 (5) 407

K-SHELL-Lillyburt 81(2)A

100 50 0 100 200 300 METRES

SCALE 1 : 5 000

GEOLOGICAL LEGENDS

CRETACEOUS

Kbl — Blairmore Group

JURASSIC - CRETACEOUS

JKk — Kootenay Group

JKmm — Mist Mountain Formation

JKm — Morrissey Formation

GEOLOGICAL SYMBOLS

CONGLOMERATE (Cong.)

SANDSTONE (Ss) MEDIUM GRAINED

COAL

FAULT (arrows indicate relative movement)

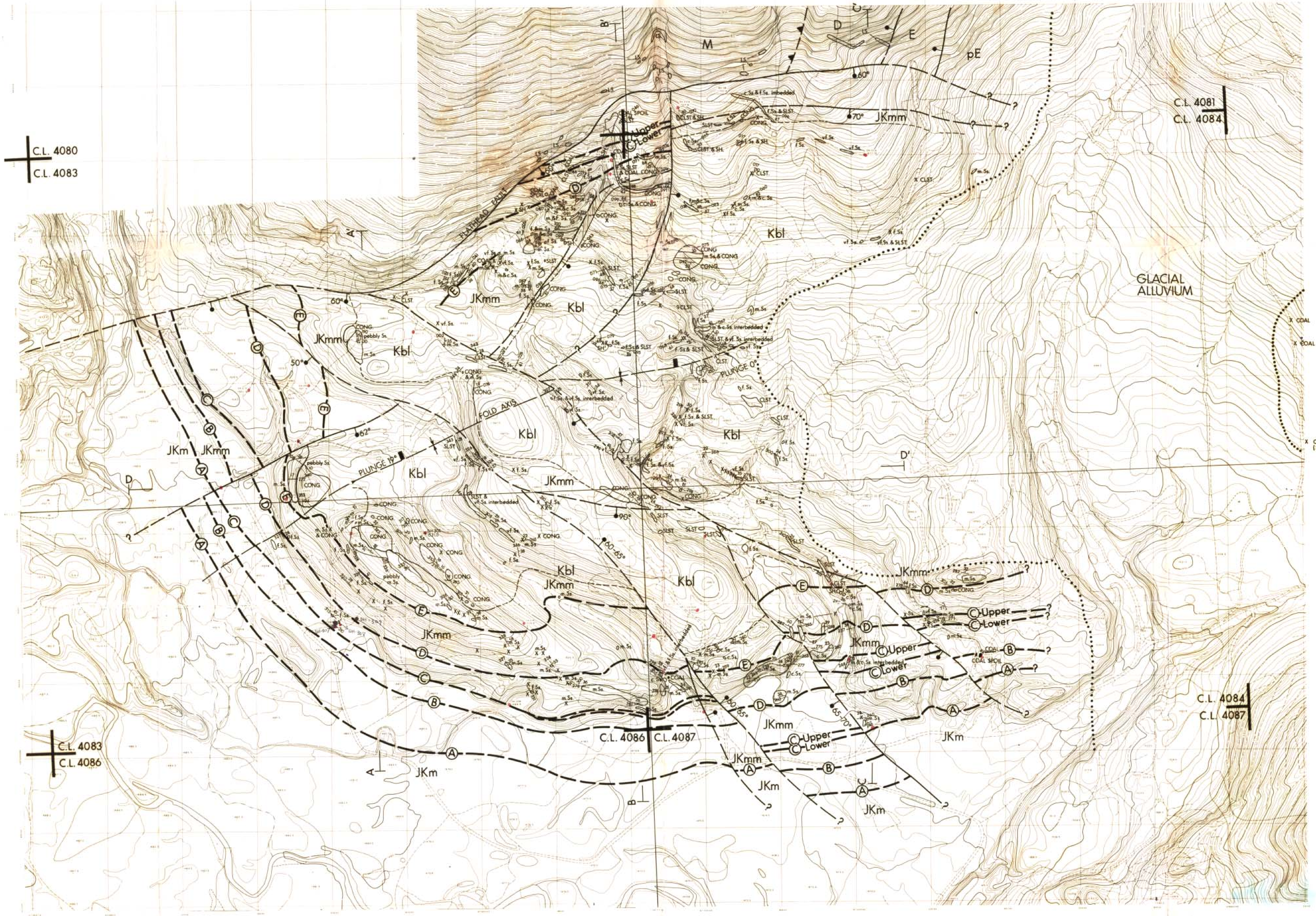
GEOLOGICAL CONTACT (known, approximate)

Crowe Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. BRITISH COLUMBIA

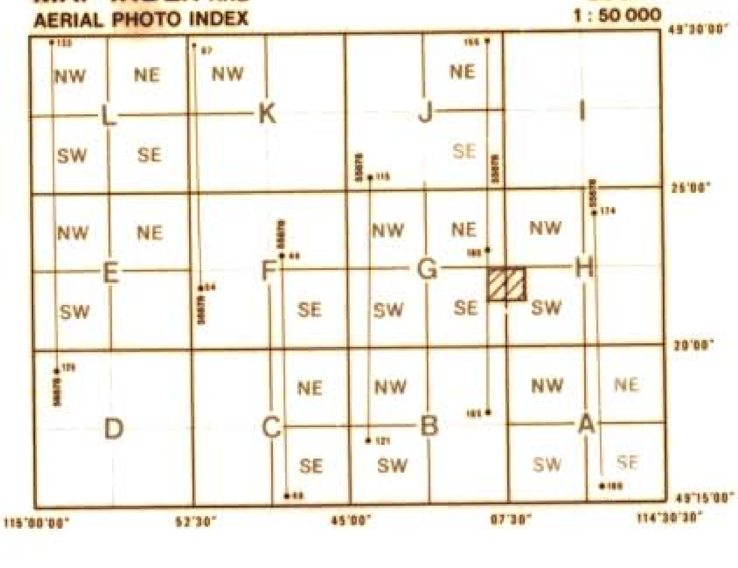
CROSS SECTION D-D'

AUTHOR: B. McKINSTRY	SCALE: 1: 5 000	ENCLOSURE No.:
DATE: FEB. 1982	REVISED:	DRAWING No: HC-96G
To Accompany		



MAP INDEX AND AERIAL PHOTO INDEX

82G/7
1 : 50 000



REFERENCE

MAIN ROAD		RIVER, LAKE	
SECONDARY ROAD		INTERMITTENT RIVER	
TRACK OR TRAIL		TREED AREA	
RAILWAY		LINE OF TREES	
HEDGE FENCE		INDIVIDUAL TREES	
BRIDGE CULVERT		VERTICAL INTERVAL	1812 1810 1808
CUT FILL		DEPRESSION	WELL
SWAMP		SPOT HEIGHT	• 1507.5
DRILL HOLE		CONTROL POINT	

MAP PROJECTION : UNIVERSAL TRANSVERSE MERCATOR
CENTRAL MERIDIAN REFERENCE 117° W.

PREPARED BY : THE ORTHOSHOP
A DIVISION OF McMURCHY - WARNE SURVEYS (ALBERTA) LTD
CALGARY , ALBERTA

100 50 0 100 200 300 METRES

SCALE 1 : 5 000

G.N.
T.N.

GEOLOGICAL LEGEND

CRETACEOUS
- Kbl — Blairmore Group

JURASSIC-CRETACEOUS
- JKk — Kootenay Group
  - JKmm — Mist Mountain Formation
  - JKm — Morrissey Formation

JURASSIC
- Jf — Fernie Formation

TRIASSIC
- TSr — Spray River Group

PENNSYLVANIAN
- P — Rocky Mountain Formation

MISSISSIPIAN
- M — includes Rundle Group and Banff Formation

DEVONIAN
- D — includes Fairholme Group and Palliser and Alexo Formations

CAMBRIAN
- E — includes Elko and Flathead Formations

PRECAMBRIAN
- pE — Purcell Group

ABBREVIATION	ROCK TYPE
CONG.	CONGLOMERATE
c.Ss.	SANDSTONE (coarse grained)
m.Ss.	SANDSTONE (medium grained)
f.Ss.	SANDSTONE (fine grained)
SLST.	SILTSTONE
SH.	SHALE
MDST, CLST.	MUDSTONE, CLAYSTONE
COAL	COAL
LS.	LIMESTONE

- GEOLOGICAL CONTACT (defined, approximate)
- THRUST FAULT (approximate) TEETH ON UPTHRUST SIDE
- GRAVITY FAULT (defined, approximate) SOLID CIRCLE ON DOWNTHROWN SIDE, ARROWS INDICATE RELATIVE MOVEMENT
- SYNCLINE (approximate; dip unknown; plunge indicated)
- COAL SEAM TRACE
- CROSS SECTION LINE
- BOREHOLE
- ROCK OUTCROP, AREAL EXTENT OF OUTCROP
- TRENCH
- BEDDING (inclined, vertical)
- SHEAR ZONE
- JOINTING (inclined, vertical)

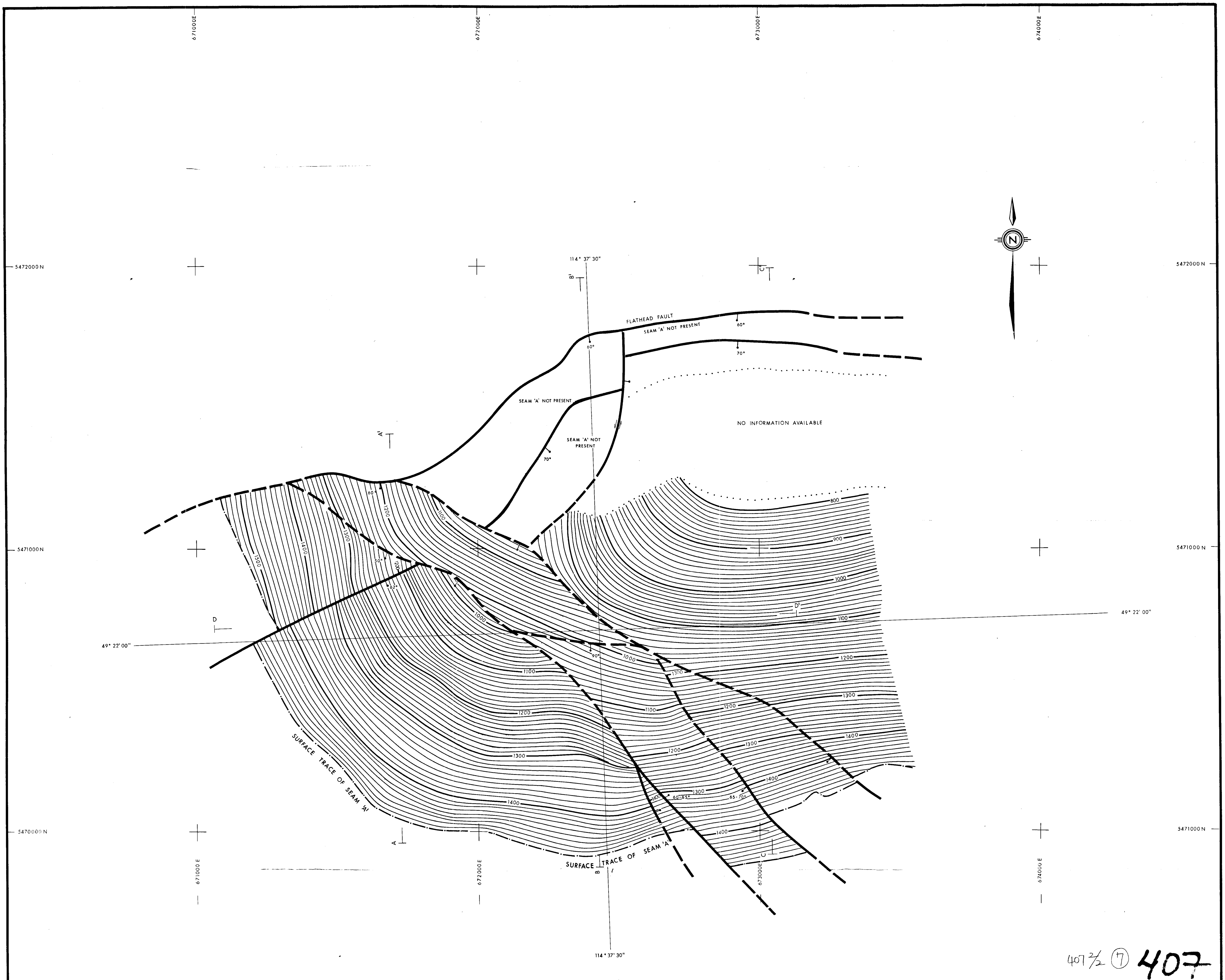
6
407
407 3/2
K-SHELL-Lillyburt 81(2)A

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. B.C.

GEOLOGY MAP

N.T.S.-82G/7		U.T.M. ZONE 11
AUTHOR: B. McKINSTRY	SCALE: 1:5000	ENCLOSURE No:
DATE: 82-02	REVISED:	DRAWING No: HC-96A
To Accompany		



407 2/2 (7) 407

K-SHELL-Lillyburt 81(2)A

GEOLOGICAL LEGEND

- Structure Contour
- Fault Plane (defined, approximate)
- A —— A' Cross Section Line
- No information
- Surface Trace of Seam (approximate)

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. BRITISH COLUMBIA

STRUCTURE CONTOUR MAP

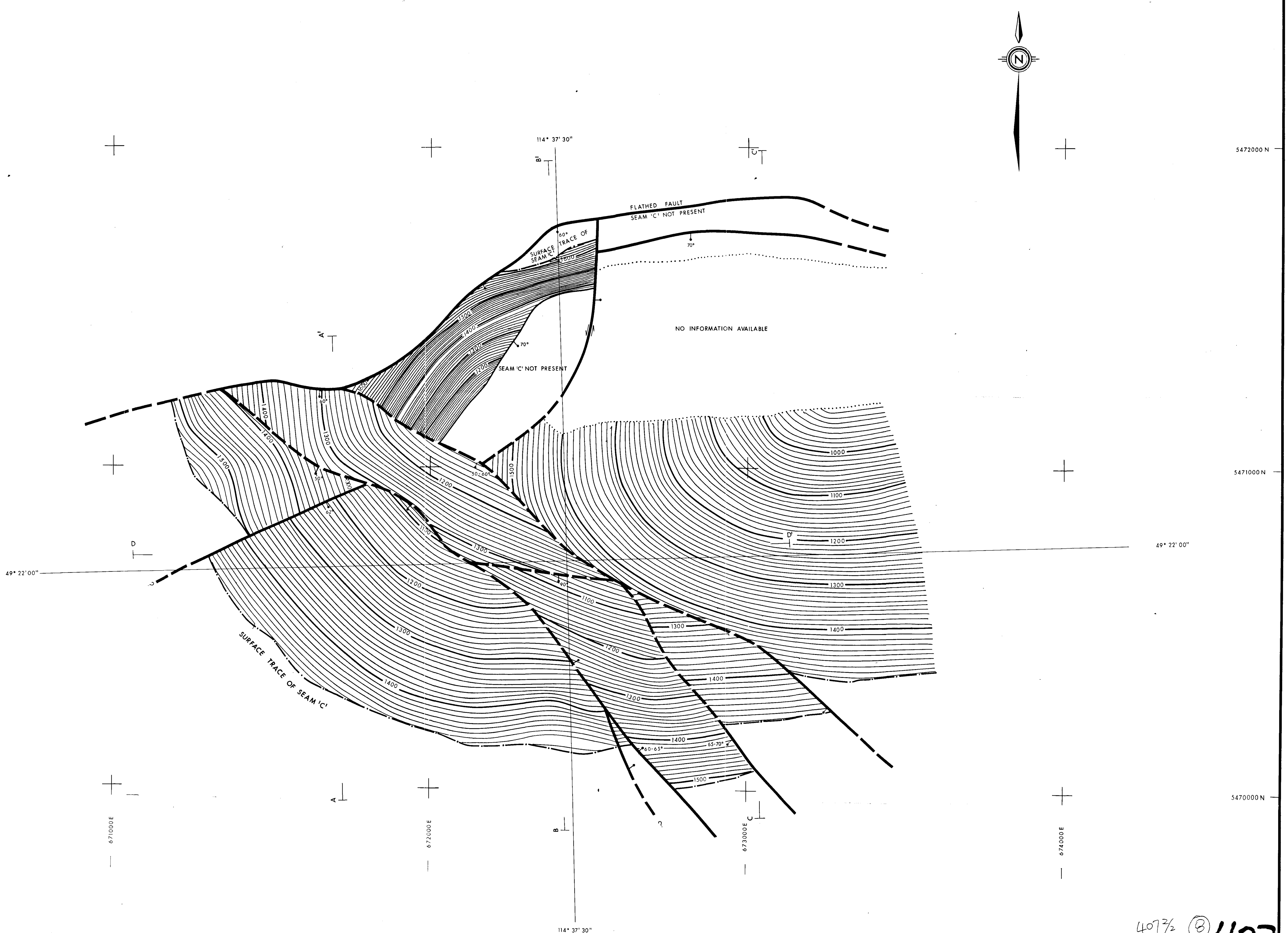
BASE OF SEAM 'A'

AUTHOR: B. MCKINSTRY	SCALE: 1:5000	ENCLOSURE No:
DATE: FEBRUARY, 1982	REVISED:	DRAWING No: HC-96B
To Accompany		

NOTE:
1. HANGING WALL OF FAULT BLOCKS CONTOURED.
2. DIPS OF FAULT PLANES NOTED, WHERE MEASURED OF INFERRED.
3. INTERSECTION OF FAULT PLANES & HANGING WALL CONTOURS OMITTED FOR CLARITY.

100 50 0 100 200 300 METRES

SCALE 1 : 5 000



GEOLOGICAL LEGEND

Structure Contour
Fault Plane (defined, approximate)
A——A' Cross Section Line
No Information
Surface Trace of Seam (approximate)

NOTE:
1. HANGING WALL OF FAULT BLOCKS CONTOURED.
2. DIPS OF FAULT PLANES NOTED, WHERE MEASURED OF INFERRED.
3. INTERSECTION OF FAULT PLANES & HANGING WALL CONTOURS OMITTED FOR CLARITY.

100 50 0 100 200 300 METRES
SCALE 1:5000

407 2/2 ⑧ 407
K-SHELL ..Lillyburt 81(2)A

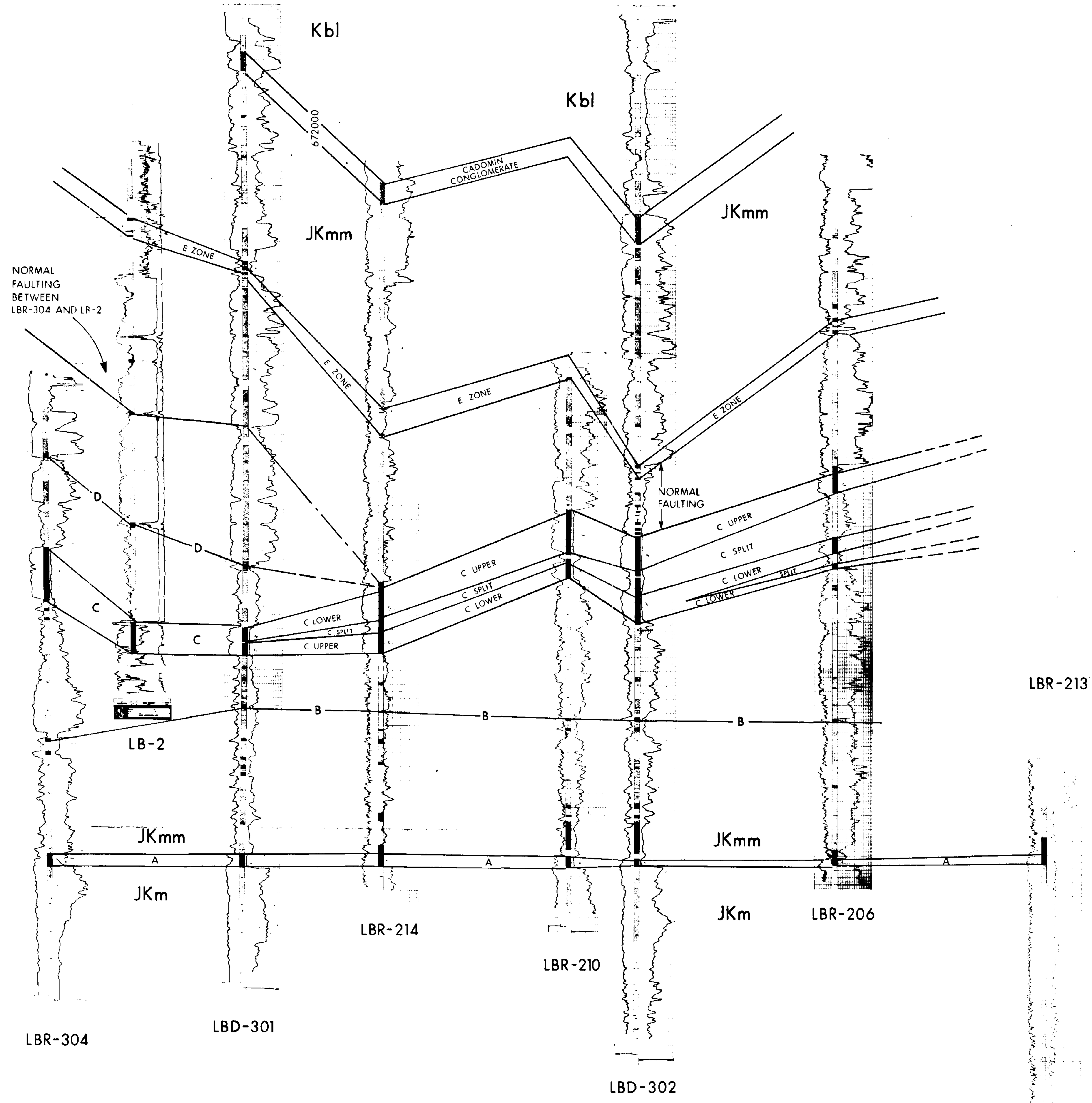
Crows Nest Resources Limited
EXPLORATION

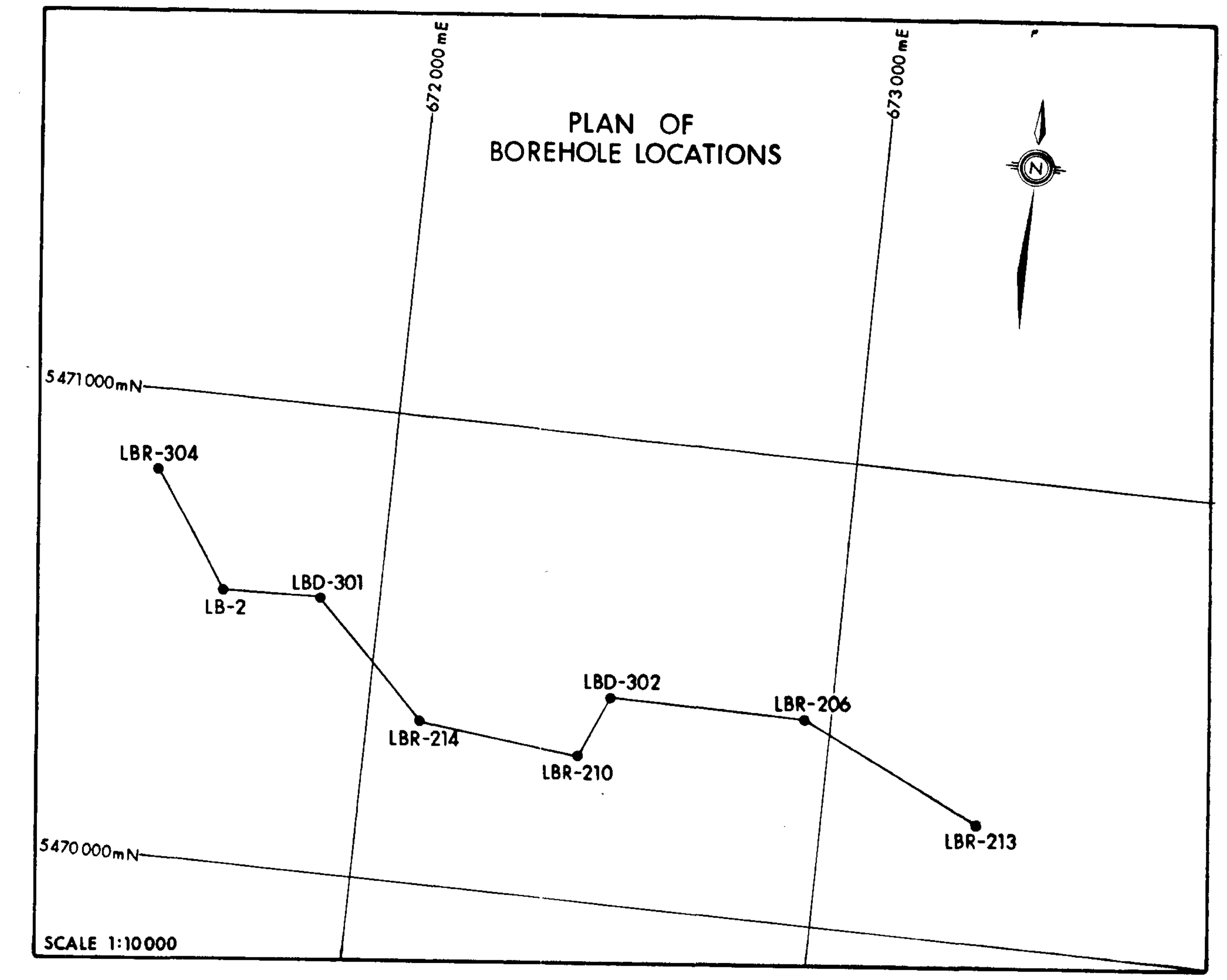
LILLYBURT
S.E. BRITISH COLUMBIA

STRUCTURE CONTOUR MAP

BASE OF SEAM 'C'

AUTHOR: B. MCKINSTRY	SCALE: 1:5000	ENCLOSURE No:
DATE: FEBRUARY, 1982	REVISED:	DRAWING No: HC-96C
To Accompany		





401 7/2 (9) 407

LEGEND

Kbl CRETACEOUS - BLAIRMORE GROUP SANDSTONE, MUDSTONE, CONGLOMERATE

JK JURASSIC - KOOTENAY GROUP

JKmm MIST MOUNTAIN FORMATION SANDSTONE, COAL, SILTSTONE, MUDSTONE, SHALE

JKm MORRISSEY FORMATION SANDSTONE

—B— COAL SEAM

SYMBOL	ROCK TYPE
	SHALEY COAL
	COALY SHALE
	CONGLOMERATE
	SANDSTONE (coarse grained)
	SANDSTONE (medium grained)
	SANDSTONE (fine grained)
	SILTSTONE
	SHALE
	MUDSTONE, CLAYSTONE
	COAL
	LIMESTONE

K-SHELL - Lillyburt 81(2)A

NOTE: (1) ALL HOLES EXCEPT LBD-301 WERE DRILLED VERTICAL. LBD-301 WAS INCLINED PERPENDICULAR TO BEDDING AND REFLECTS TRUE THICKNESSES. THE APPARENT THICKNESSES IN OTHER BOREHOLES IS APPROXIMATELY 15-20% GREATER THAN TRUE THICKNESS.

(2) CORRELATION DIAGRAM IS ORIENTED APPROXIMATELY PARALLEL TO STRIKE.

VERTICAL SCALE 1:1000

Metres 800 600 400 200 0 100 200

HORIZONTAL SCALE 1:5000

Metres 100 50 0 100 200 300 400

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. B.C.

STRATIGRAPHIC CORRELATION DIAGRAM

AUTHOR: B. McKINSTRY	SCALE: AS SHOWN	ENCLOSURE No.:
DATE: 82 - 02	REVISED:	DRAWING No: HC-96 H
To Accompany		

K-Lillyburt 81(ii)A

CONFIDENTIAL

OPEN FILE

L... B... ROJE...

1981 GEOLOGICAL REPORT

ADDENDUM

GEOPHYSICS FOR COAL EXPLORATION

EM & DC RESISTIVITY SURVEYS

Kootenay Land District, British Columbia

B.C. Coal Licence Numbers: 4080-4089 inclusive

Group Number: 243

Owner: Shell Canada Resources Limited

Operator: Crows Nest Resources Limited

NTS 82G/7

Longitude: 114° 37' West

Latitude: 49° 22' North

Exploration Period: June - September, 1981

Report Prepared by: B. McKinstry, Senior Geologist

Submitted: February, 1982

Addendum Prepared by Andrea Allison, Geophysicist

Submitted: December, 1982

2/FIc.1

Crows Nest Resources LIMITED
Eau Claire Place, 525 - 3rd Avenue S.W., Calgary, Alberta (403) 232-4355
P.O. Box 2699, Station M, Calgary, Alberta T2P 2M7 Telex 03-822505

March 15, 1983

Ministry of Energy, Mines and
Petroleum Resources
525 Superior Street
Victoria, B.C.
V8V 1T7

Dear Sirs:

Enclosed please find our report on the results of the geophysical survey done at Lillyburt during the summer of 1981.

The results of this work were not available at the time of submission of the 1981 Lillyburt Geological Report, but are being filed now as an addendum to that Report. For reference purposes, the Lillyburt Location Map, Index Map and Geological Compilation Map from the 1981 Geological Report are included in this addendum as appendix II.

The geophysical survey work and the present addendum were conducted and prepared by Andrea Allison, an employee of Shell Canada Resources Limited, Minerals Division, for Crows Nest Resources Limited.

Ms. Allision received a B.Sc. in Physics from Loyola-Concordia University, Montreal in 1974 and an M.Sc. from U.B.C. in 1977. She worked as a geophysicist with Shell Canada Resources from 1977 to 1982.

I consider the aforementioned person to be well qualified to undertake the responsibilities assigned on this project. I am satisfied that the attached report has been competently prepared and justly represents the information obtained from this project.

Yours very truly,

H.G. Rushton

H.G. Rushton, P. Geol.
Vice President, Development

BMcK/md

<u>TABLE OF CONTENTS</u>

2/FIc.2

LIST OF FIGURES

2/FIc.3

LIST OF ENCLOSURES

4/FIc.

2/FIc.5

INTRODUCTION

Historical

In 1980 a study was undertaken of non-seismic geophysical methods applied to exploration for coal. A complete report of this research is in Jones, 1981. In particular, Jones studied the application of geophysical methods to solving the following fundamental problems in coal exploration.

1) The determination of the depth of overburden.
2) The determination of seam thickness.
3) The establishment of seam continuity.
4) The location of the seam edge.

The first part of the report was a theoretical examination and literature search of the following methods: gravity, magnetics, resistivity, induced polarization (IP) and electromagnetics (EM).

As a second step, DC Resistivity surveys were conducted on three properties; Merritt, Lillyburt and Blackfoot. The operations report is given in Fudge, 1980 and an interpretation of the data is in Jones, 1981. The analysis of the data at Merritt showed limited success in determining the depth of the overburden. Frank Jones states that the resistivity technique was capable of the accurate determination of the depth of the overburden only if sufficient geophysical control (such as a focussed electric log) was available for calibration.

Present Study

In 1981 this research was applied to coal exploration at Lillyburt. Three techniques; DC Resistivity, Electromagnetics (EM) and Induced Polarization (IP) were used to determine:

1) The depth of overburden.
2) Fault contacts and/or basement lithology changes.

The DC Resistivity and Electromagnetics (EM) methods measure the Resistivity of the subsurface. The data is presented in the form of apparent resistivity values. Apparent resistivity is defined as the resistivity of a uniform earth which would have produced the observed voltage reading with the given signal current.

In order for these methods to succeed for the above purpose the "rocks" must possess certain physical characteristics. In order to determine the depth of overburden there must be a sufficient resistivity contrast between the overburden and the material below. Also, the resistivity must be constant throughout each individual layer. In order to be able to detect faults and/or lithology changes there must again be a sufficient resistivity contrast between the rocks on both sides of the contact.

A general description of the geophysical equipment and survey geometry will be given followed by a detailed discussion on data acquisition, data presentation and interpretation of the results.

OPERATION

The EM method used was the magnetic induction method. Current flow is induced in the ground by the varying magnetic field of a vertical or horizontal magnetic dipole transmitter. A magnetic dipole transmitter consists of a loop antenna through which an alternating electric current is forced; similarly, a magnetic dipole receiver is a loop antenna in which an electromotive force is measured in the presence of a varying magnetic field.

The EM equipment used was the Geonics EM 34-3 and EM 31. Appendix I gives a list of the instrument specifications.

In this method the exploration depth is mainly increased by increasing the distance between transmitter and receiver dipoles. The EM 31 was used to sample the very shallow overburden. The EM 34-3 was used to sample increasing depths by increasing the cable length from 10 to 20 to 40 meters.

The depth of overburden was thought to be less than approximately 30 m. Therefore, measurements with the 40 m cable separation should be sampling the basement material.

DC Resistivity and IP measurements were taken using the Dipole-Dipole array. A schematic diagram of the array geometry is in Figure #1. Current is injected through the current electrodes and the resulting potential difference between the voltage electrodes measured. For our survey an electrode separation of 25 m (a = 25 m) was used.

DC Resistivity measurements were also taken by means of Schlumberger soundings. A schematic diagram of the array geometry is in Figure #2. When the current electrodes are close together (i.e. AB/2 = L small) shallow layers only contribute to the resistivity profile. With increasing L the apparent resistivity has a contribution from greater depths.

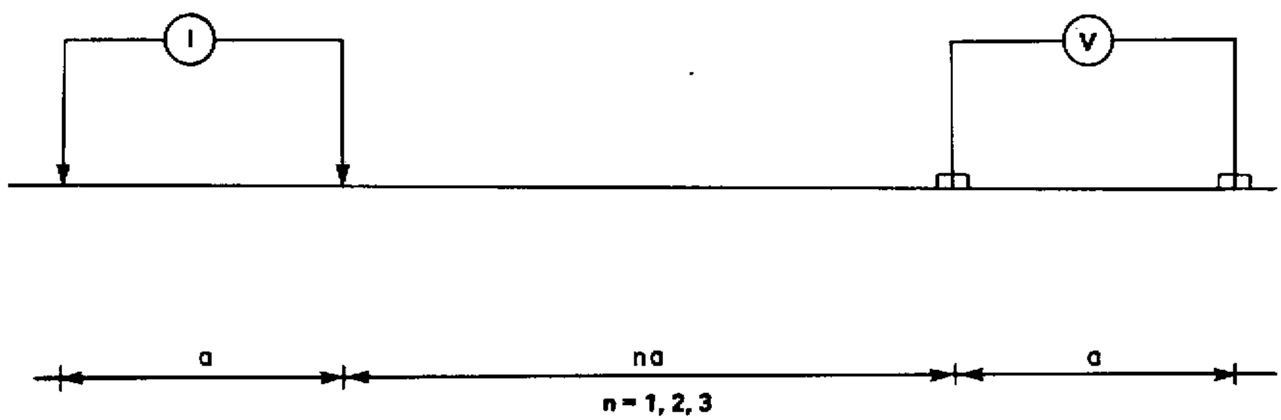


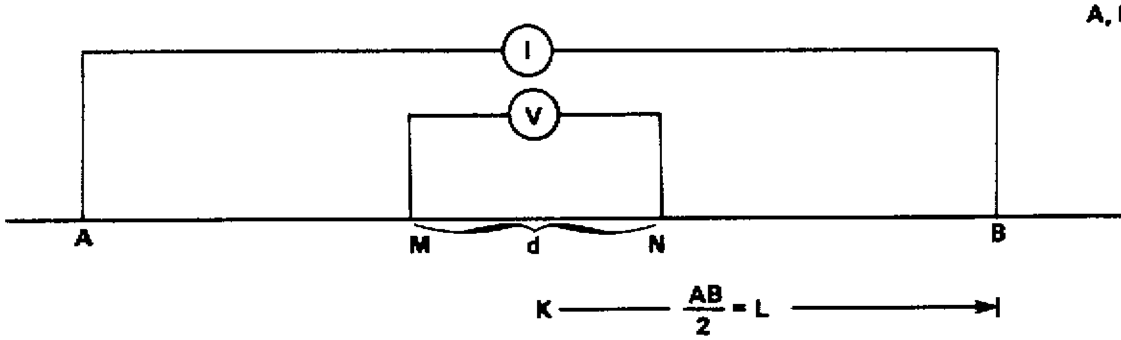
FIGURE NO. 1

Crows Nest Resources Limited
EXPLORATION

SCHEMATIC DIAGRAM OF

THE DIPOLE — DIPOLE ARRAY

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HF-101E
To Accompany		



M, N — CURRENT
ELECTRODES

A, B — CURRENT
ELECTRODES

FIGURE NO. 2

Crows Nest Resources Limited
EXPLORATION

DC RESISTIVITY
SCHLUMBERGER SOUNDINGS
GEOMETRY

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No.:
DATE:	REVISED:	DRAWING No.: HF-101D
To Accompany		

DATA ACQUISITION

Nine lines, with a total length of 11 km. were surveyed at Lillyburt. These are shown in Figure 3; Lillyburt 1981 Geophysical Cut Lines.

The preparation of geophysical cut lines involved flagging 25 m intervals and placing pickets at 100 m intervals. Because these intervals were chained before brush was cut along the lines, there is a possible inaccuracy of a few metres in station locations. In addition the field crew believes that there was possibly a mis-survey of pickets and suggest only an accuracy of ± 50 meters. To correct these problems in future work, they recommend the recording of station numbers for each picket and also that the bush be cut prior to the chaining of flag and picket locations.

Figures 4 through 12 show the EM31 and EM34 results for lines 1 to 9 respectively. Profiles of apparent resistivity versus station number are plotted. The EM31 and EM34 give conductivity values, but for comparison with dipole-dipole and schlumberger sounding DC resistivity measurements the apparent resistivity in ohm-meters is plotted. Both horizontal coplanar (vertical dipole) and vertical coplanar (horizontal dipole) measurements were taken.

Figure 13 shows the Schlumberger soundings taken on Line #1. Figure 14 shows the Schlumberger soundings taken on Line #2 and Figure 15 those taken on Line #8. Figure 16 shows the Schlumberger sounding taken about LB-R-304.

Figure 17 shows the dipole-dipole array resistivity and IP measurements taken over part of Line #1; Figure 18 shows the results for Line #5.

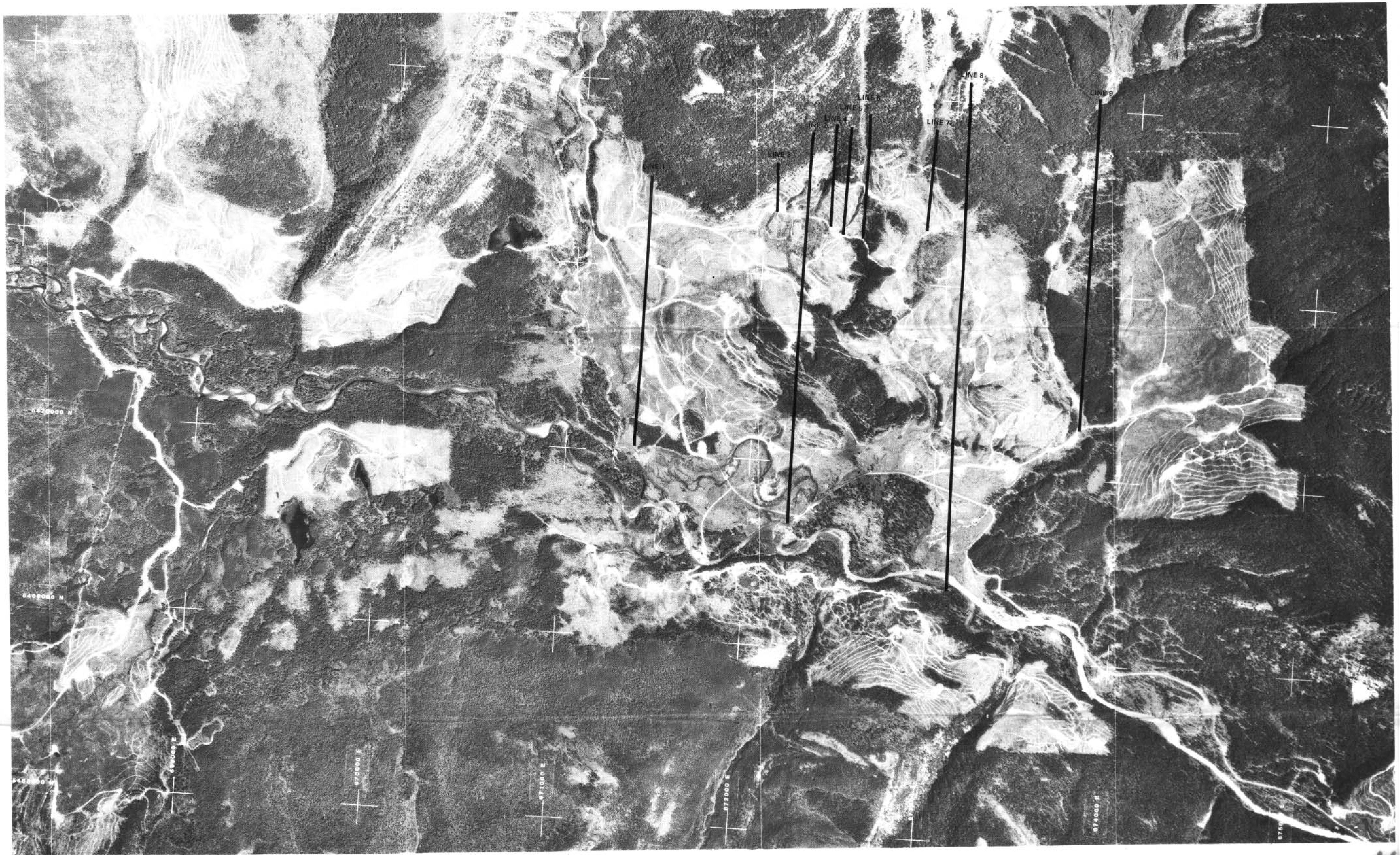


FIG. 3

K-SHELL Lillyburt 82(11)E

407

5/5

①

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. BRITISH COLUMBIA

1981 GEOPHYSICAL CUT LINES

N.T.S. 82/G 7

AUTHOR: C. LANGILL	SCALE: 1:10,000	ENCLOSURE No:
DATE: JULY 1982	REVISED:	DRAWING No: HI-84B
To Accompany		

0 100 200 400 600 800 1000 Metres

SCALE 1:10,000

Grid North

INTERPRETATION

As mentioned in the Introduction, some DC resistivity work was done over Lillyburt in 1980 (Fudge, 1980). Figure 19 shows the location of the work.

Schlumberger soundings were expanded about LC 0-00, LC 0+65S, LC 2-20S, LC 3+60S, and LD 0-23. These are the points labelled SPL-1, SPL-2, SPL-3, SPL-4, and SPL-5 on Figure 19.

From the apparent resistivity profiles an attempt was made to deduce the resistivity layering. For this, inverse computer modelling using the program from the package rented from Phoenix Geophysics was carried out. This program fits apparent resistivity data obtained over a layered earth.

The basic procedure is to put in initial guesses for resistivities and layer thicknesses and then the program iterates through to a 'best' fit with the observed data.

The model parameters are listed in Figures 20, 21, 22, 23 and 24 for stations LC 0-00, LC 0+65S, LC 2+20S, LC 3+60S and LD 0+23S respectively. The comparison of model results with observed data is also shown.

One of the main purposes of this year's survey was to determine overburden depth over the valley floor.

Consider Figure #5: the EM profiles for Line #2. Look at station 13+00S which is situtated on the valley floor. The EM31 profile shows an apparent resistivity of 100 ohm-meters. However, the EM34-3 profiles for both the 20 m and 40 m coil separations also give an apparent resistivity of 100 ohm-meters. Therefore, there is no contrast in resistivity between the overburden and underlying siltstones and sandstones.

The EM results are however able to determine fault contacts. Figure 4 shows the EM profiles for Line #1. There is a fault contact at 5+50S. Permian limestones are on one side of the fault with Cretaceous - Jurassic shales, siltstones and coals on the south side.

This fault can also be located on the other lines.

Line #2	5+50S (8+00S?)
Line #4	2+00S
Line #5	2+00S
Line #6	4+00S
Line #7	2+00S
Line #8	7+50S
Line #9	3+50S - 8+00S (gradual decrease in resistivity)

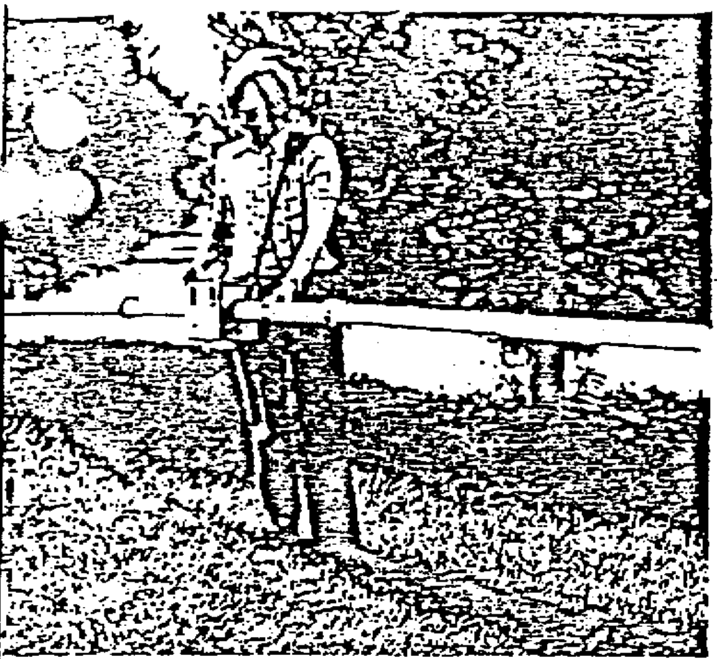
BIBLIOGRAPHY

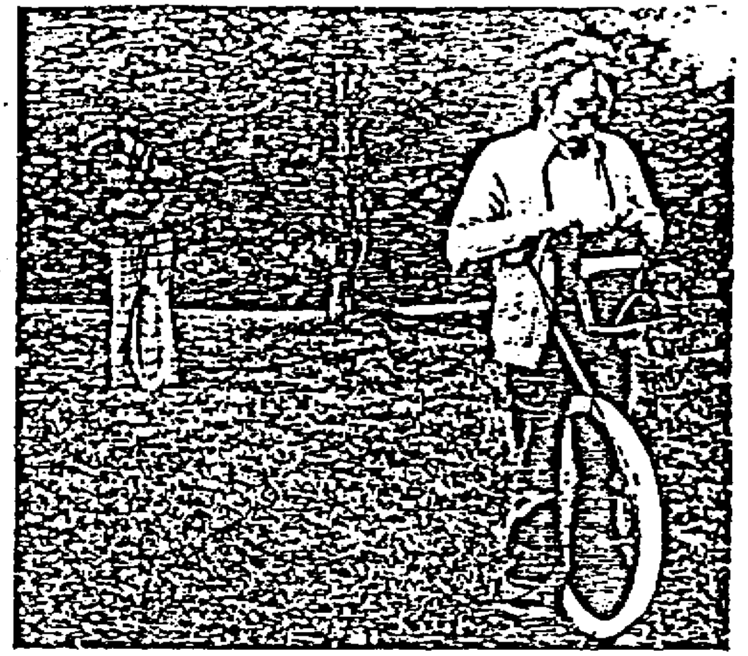
Fudge, D.T. and Company, 1980
"Preliminary Report of Resistivity Test Profiles on Western Canadian Coal Deposits" Report to Crows Nest Resources Limited.

Jones, F.P. 1981
"Non-Seismic Geophysics Applied to Exploration for Coal" Report to Shell Canada Resources Limited.

APPENDIX I

Specification Sheet for EM 31 and EM 34-3.





EM31

The Geonics EM31 provides a measurement of terrain conductivity without contacting the ground using a patented inductive electromagnetic technique. The instrument is direct reading in millimhos per meter and surveys are carried out simply by traversing the ground.

The effective depth of exploration is approximately six meters making it ideal for [illegible] geophysics. By eliminating ground contact, measurements are easily [illegible] in regions of high resistivity such as gravel, permafrost and bedrock. Over a [illegible] half space the EM31 reads identically with conventional resistivity [illegible] the measurement is analogous to a conventional galvanic resistivity survey [illegible] a fixed array spacing. Interpretation curves supplied with each instrument then permit an estimate of a layered earth.

The advantages of the EM31 are the speed with which surveys can be carried out, the ability to precisely measure small changes in conductivity, and the continuous readout which provides a previously unobtainable lateral resolution.

Specifications

MEASURED QUANTITY	Apparent conductivity of the ground in millimhos per meter.
PRIMARY FIELD SOURCE	Self-contained dipole transmitter
SENSOR	Self-contained dipole receiver
INTERCOIL SPACING	3.66 meters
OPERATING FREQUENCY	9.8 kHz
POWER SUPPLY	8 disposable alkaline 'C' cells (approx. 20 hrs life continuous use)
CONDUCTIVITY RANGES	3, 10, 30, 100, 300, 1000 mmhos/meter
MEASUREMENT PRECISION	±2% of full scale
MEASUREMENT ACCURACY	±5% at 20 millimhos per meter
NOISE LEVEL	<0.1 millimhos per meter
OPERATOR CONTROLS	• Mode Switch • Conductivity Range Switch • Phasing Potentiometer • Coarse Inphase Compensation • Fine Inphase Compensation
[illegible]	Boom : 4.0 meters extended 1.4 meters stored Console : 24 x 20 x 18 cm Shipping Crate : 155 x 42 x 28 cm
WEIGHT	Instrument Weight : 9 kgm Shipping Weight : 23 kgm

EM34-3

Operating on the same principles as the EM31, the EM34-3 is designed to achieve a substantially increased depth of exploration and a readily available vertical conductivity profile.

The underlying principle of operation of this patented non-contacting method of measuring terrain conductivity is that the depth of penetration is independent of terrain conductivity and is determined solely by the instrument geometry i.e. the intercoil spacing and coil orientation. The EM34-3 can be used at three fixed spacings of 10, 20, or 40 meters and in the vertical coplanar (as shown) or horizontal coplanar mode. In the vertical coplanar mode, the instrument senses to approx. 0.75 of the intercoil spacing. In the horizontal coplanar mode, the instrument can sense to 1.5 times the intercoil spacing. For the horizontal coplanar mode, however, coil misalignment errors are more serious than in the vertical mode so greater care must be exercised to achieve the maximum 60 meter depth.

Simple operation, survey speed and straight forward data interpretation makes the EM34-3 a versatile and cost effective tool for the engineering geophysicist.

Specifications

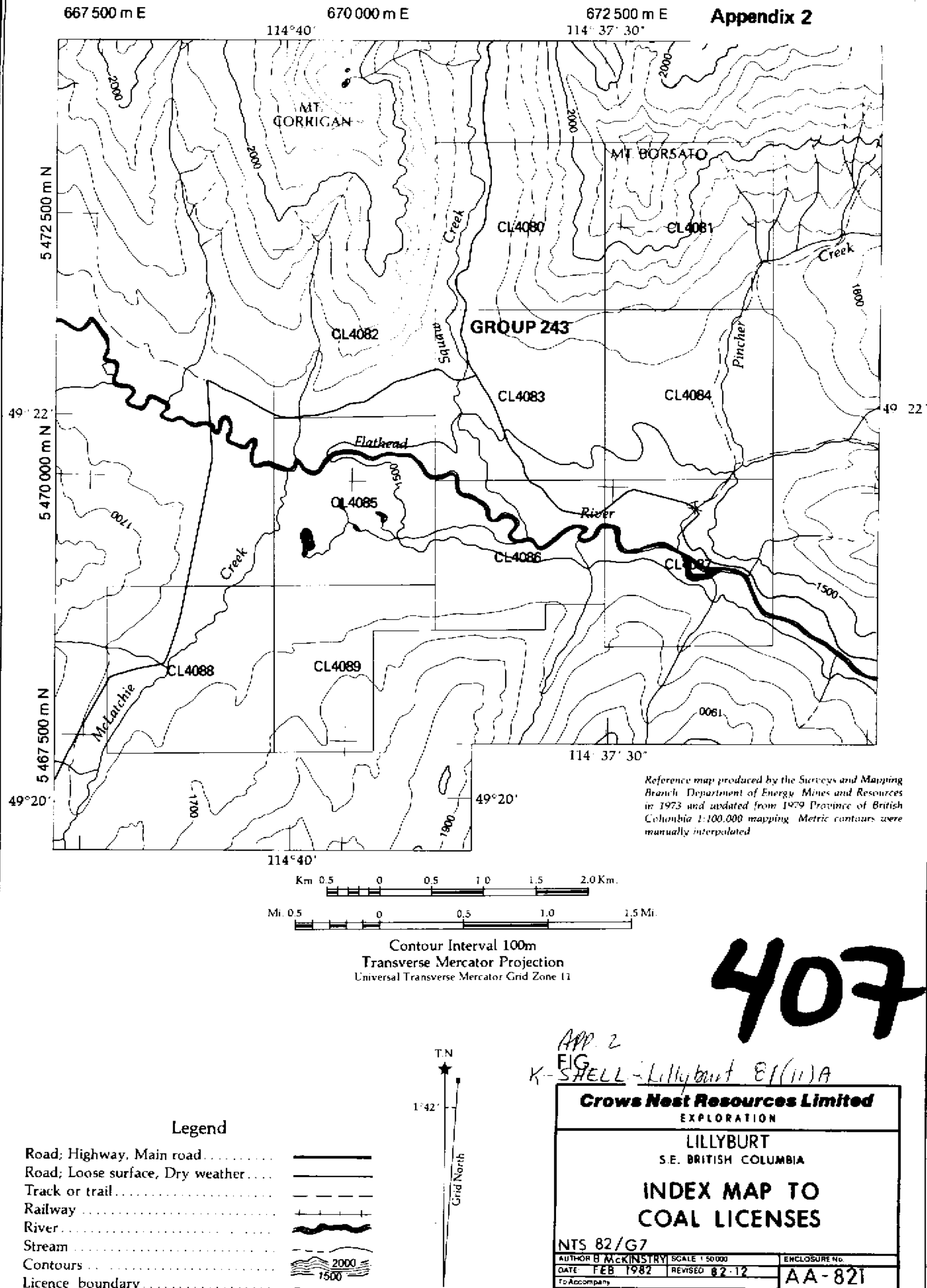
MEASURED QUANTITY	Apparent conductivity of the ground in millimhos per meter
PRIMARY FIELD SOURCE	Self-contained dipole transmitter
SENSOR	Self-contained dipole receiver
REFERENCE CABLE	Lightweight, 2 wire shielded cable
INTERCOIL SPACING & OPERATING FREQUENCY	• 10 meters at 6.4 kHz • 20 meters at 1.6 kHz • 40 meters at 0.4 kHz
POWER SUPPLY	Transmitter : 8 disposable 'D' cells Receiver : 8 disposable 'C' cells
CONDUCTIVITY RANGES	3, 10, 30, 100, 300 mmhos/meter
MEASUREMENT PRECISION	±2% of full scale deflection
MEASUREMENT ACCURACY	±5% at 20 millimhos per meter
NOISE LEVEL	< 0.2 millimhos per meter
DIMENSIONS	Receiver Console : 19.5 x 13.5 x 26cm Transmitter Console : 15 x 8 x 26cm Coils : 63cm diameter
WEIGHTS	Receiver Console : 3.1 kg Receiver Coil : 3.2 kg Transmitter Console : 3.0 kg Transmitter Coil : 6.0 kg Shipping Weight : 41. kg

GEO-PHYSI-CON CO. LTD.
155 - 8712 FISHER STREET [illegible]
CALGARY, ALBERTA T2H 2A7

APPENDIX II

Lillyburt Location Map, Coal License Index Map and Geological Compilation Map.

Appendix 2



407

APP. 2

FIG.

K-SHELL - Lillyburt E1(11)A

Crows Nest Resources Limited
EXPLORATION

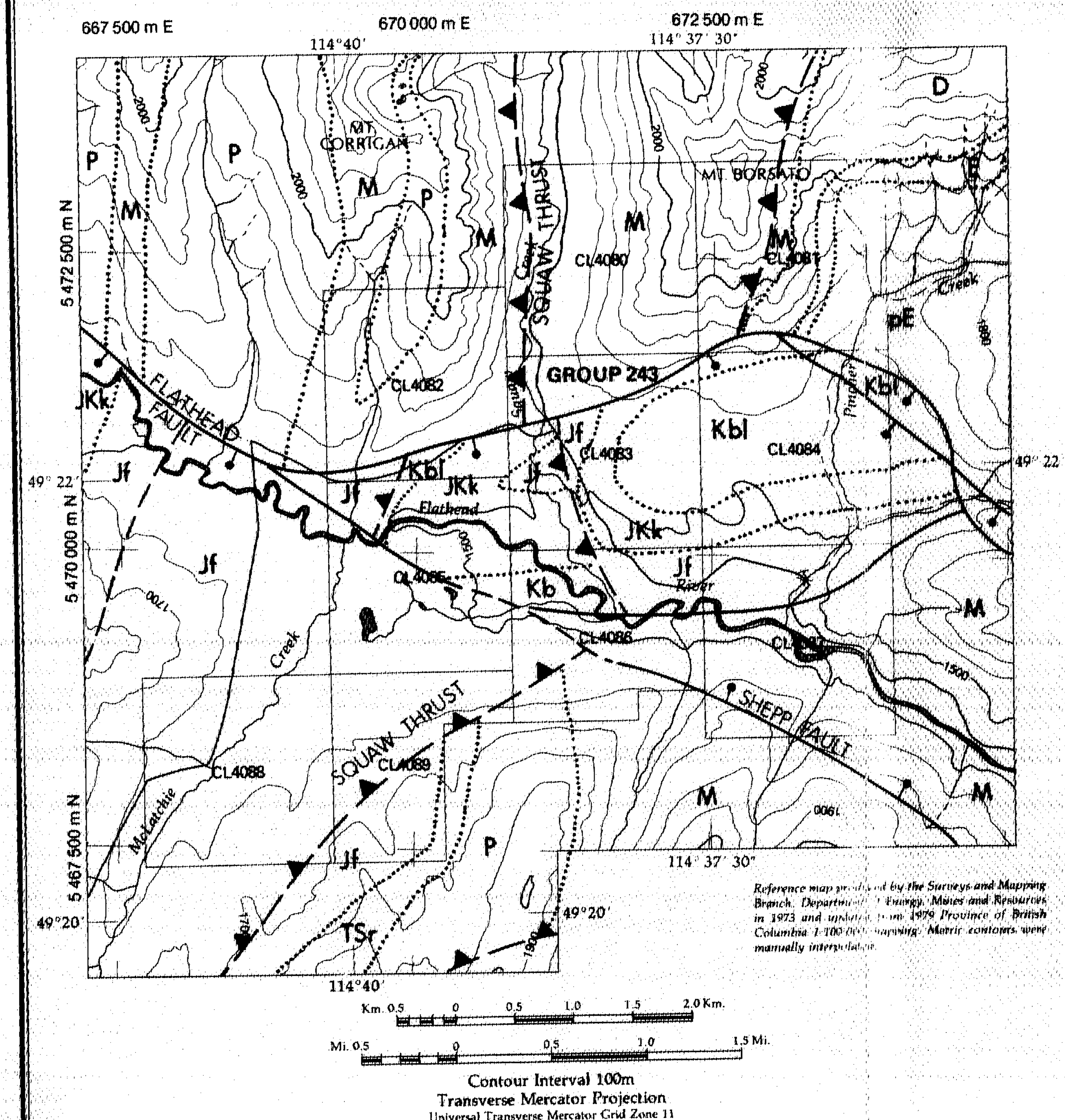
LILLYBURT
S.E. BRITISH COLUMBIA

INDEX MAP TO COAL LICENSES

NTS 82/G7

AUTHOR B McKINSTRY	SCALE 1:50000	ENCLOSURE No.
DATE FEB 1982	REVISED 82·12	AA-821
To Accompany		

Appendix 2



Legend

- Road; Highway, Main road
- Road; Loose surface, Dry weather
- Track or trail
- Railway
- River
- Stream
- Contours
- Licence boundary

GEOLOGICAL LEGEND

CRETACEOUS

Kbl — Blairmore Group

JURASSIC - CRETACEOUS

JKk — Kootenay Group

JURASSIC

Jf — Fernie Formation

TRIASSIC

TSr — Spray River Group

PENNSYLVANIAN

P — Rocky Mountain Formation

MISSISSIPPIAN

M — Rundle Group + Banff Formation

DEVONIAN

D — Palliser + Alexo Formations
Fairholme Group

CAMBRIAN

E — Elko + Flathead Formations

PRECAMBRIAN

pE — Purcell Group

geological contact (approximate)

thrust fault (approximate) teeth on upthrust side

gravity fault (approximate) solid circle on downthrown side

407

FIG App 2 SHELL - Lillyburt 81(11)A

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. BRITISH COLUMBIA
GEOLOGICAL COMPILATION MAP

82 G/7

AUTHOR MCKINSTRY	SCALE 1:50 000	ENCLOSURE No
DATE 82-02	REVISED 82 12	DRAWING No AA-822
To Accompany		

SEAM	SECTION O/C TO 2500 A	B	C	D	E	SECTION 2500 TO 3100 A	B	C	D	E	SECTION 3100 TO 3300 A	B	C	D	E
COAL AVERAGE THICKNESS (m)	6.70	2.2	24.6	1.5		5.06	2.74	21.81	2.86	6.17	4.45	3.13	18.92	3.32	6.95
STRIKE LENGTH OF INFLUENCE (m)	500	425	325	250		1500	1375	1150	950	775	1937.5	1950	1700	1475	1325
DIP SLOPE LENGTH (m)	330	200	120	50		560	560	560	560	560	200	200	200	200	200
VOLUME OF COAL ($\times 10^3$ m^3)	1106	187	959	19		4250	2110	14046	1522	2678	1724	1221	6433	979	1842
MASS OF COAL ($\times 10^3$ TONNES)	1659	280.5	1438.5	28.5		6375.5	3165	21069	2283	4017	2586	1831.5	9649.5	1486.5	2763

SEAM	SECTION 3300 TO 3500 A	B	C	D	E	SECTION 3500 TO 3900 A	B	C	D	E	SECTION 3900 TO 4300 A	B	C	D	E
COAL AVERAGE THICKNESS (m)	4.32	3.12	17.7	3.12	5.67	4.88	2.56	16.57	2.42	4.51	5.46	2.09	15.4	1.8	4.3
STRIKE LENGTH OF INFLUENCE (m)	2087.5	2100	1850	1700	1500	2225	2112.5	1887.5	1775	1612.5	1240	1237.5	1187.5	1150	1100
DIP SLOPE LENGTH (m)	200	200	200	200	200	400	400	400	400	400	400	400	400	400	400
VOLUME OF COAL ($\times 10^3$ m^3)	1804	1310	6549	1061	1701	4343	2163	12510	1718	2909	2708	1035	7315	828	1892
MASS OF COAL ($\times 10^3$ TONNES)	2706	1965	9823.5	1591.5	2551.5	6514.5	3244.5	1876.5	2577	4363.5	4062	1552.5	10972.5	1242	2838

WASTE & COAL

	SECTION O/C TO 2500	SECTION 2500 TO 3100	SECTION 3100 TO 3300	SECTION 3300 TO 3500	SECTION 3500 TO 3900	SECTION 3900 TO 4300
AREA (m^2)	71938	349044	589207	687390	730632	413051
STRIKE LENGTH BETWEEN SECTIONS (m)	330	560	200	200	400	400
VOLUME ($\times 10^6$ m^3)	23.7	195.5	117.8	137.5	292.3	165.2

407

TOTAL COAL = 88922 m^3 OR 133383 TONNES

TOTAL WASTE & COAL = $932 \times 10^6 m^3$
(LESS) COAL = $88.9 \times 10^6 m^3$
TOTAL WASTE = $843.1 \times 10^6 m^3$

RATIO OVERBURDEN TO COAL IS $843.1 \times 10^6 / 88.9 \times 10^6 = 9.5:1\ m^3/m^3$
OR $843.1 \times 10^6 / 133.38 \times 10^6 = 6.32:1\ m^3$/ TONNE

K-SHELL-Lillyburt 80 (5)A

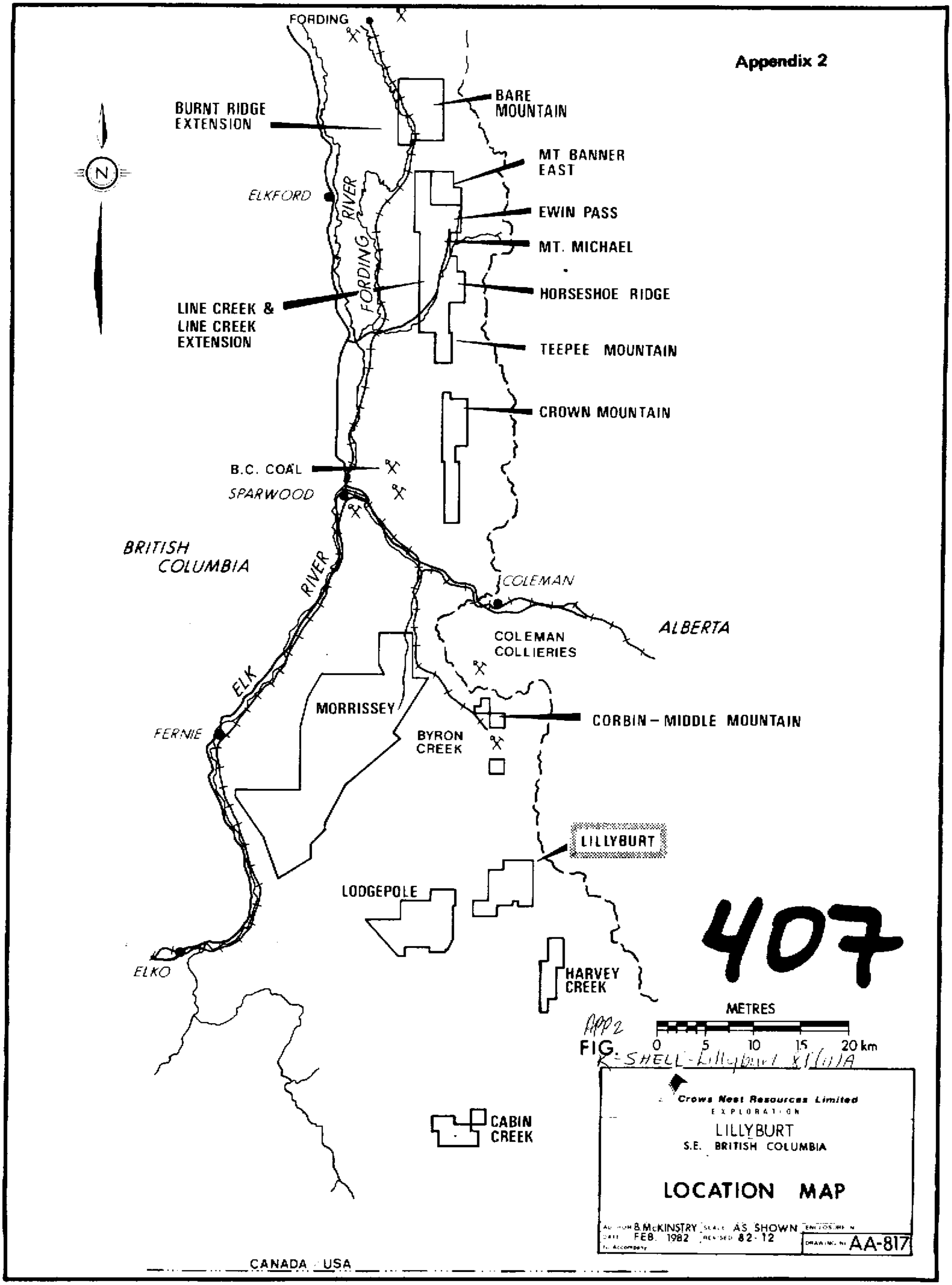
Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. B.C

GEOLOGICAL IN SITU RESOURCE CALCULATIONS
(LILLYBURT SYNCLINE)

AUTHOR: B.McKINSTRY	SCALE:	ENCLOSURE No: 5
DATE: 81·03·09	REVISED:	DRAWING No: BA-278
To Accompany		

Appendix 2



407

FIG. APP 2

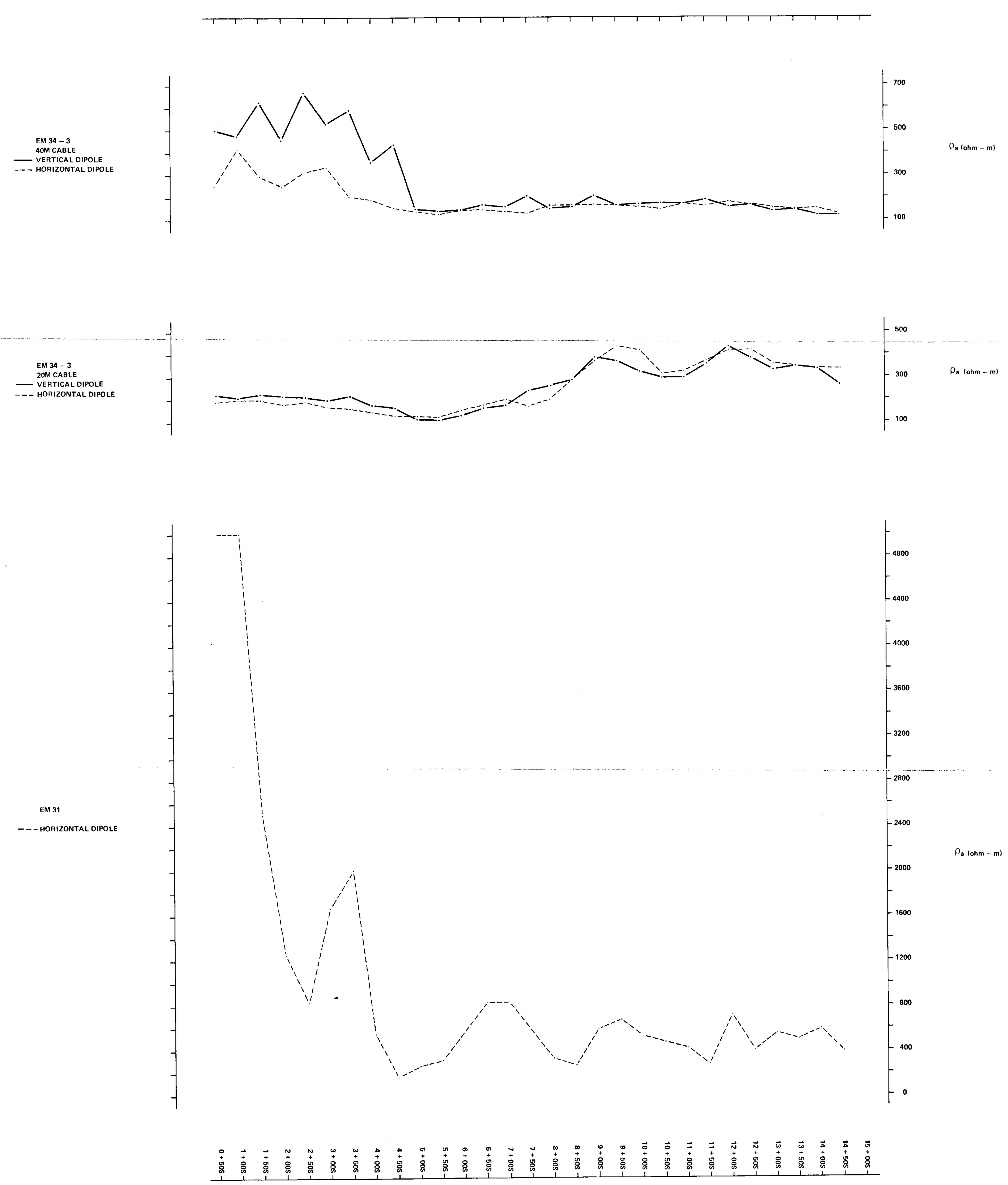
R-SHELL-Lillyburt XI(ii)A

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
S.E. BRITISH COLUMBIA

LOCATION MAP

AUTHOR B. McKINSTRY	SCALE AS SHOWN	ENCLOSURE N	
DATE FEB. 1982	REVISED 82-12	DRAWING N.	AA-817



0 50 100 150 200 metres

SCALE

407 5/5 (2)

K-SHELL-Lillyburt 8P(11)A

FIGURE NO. 4

Crows Nest Resources Limited

EXPLORATION

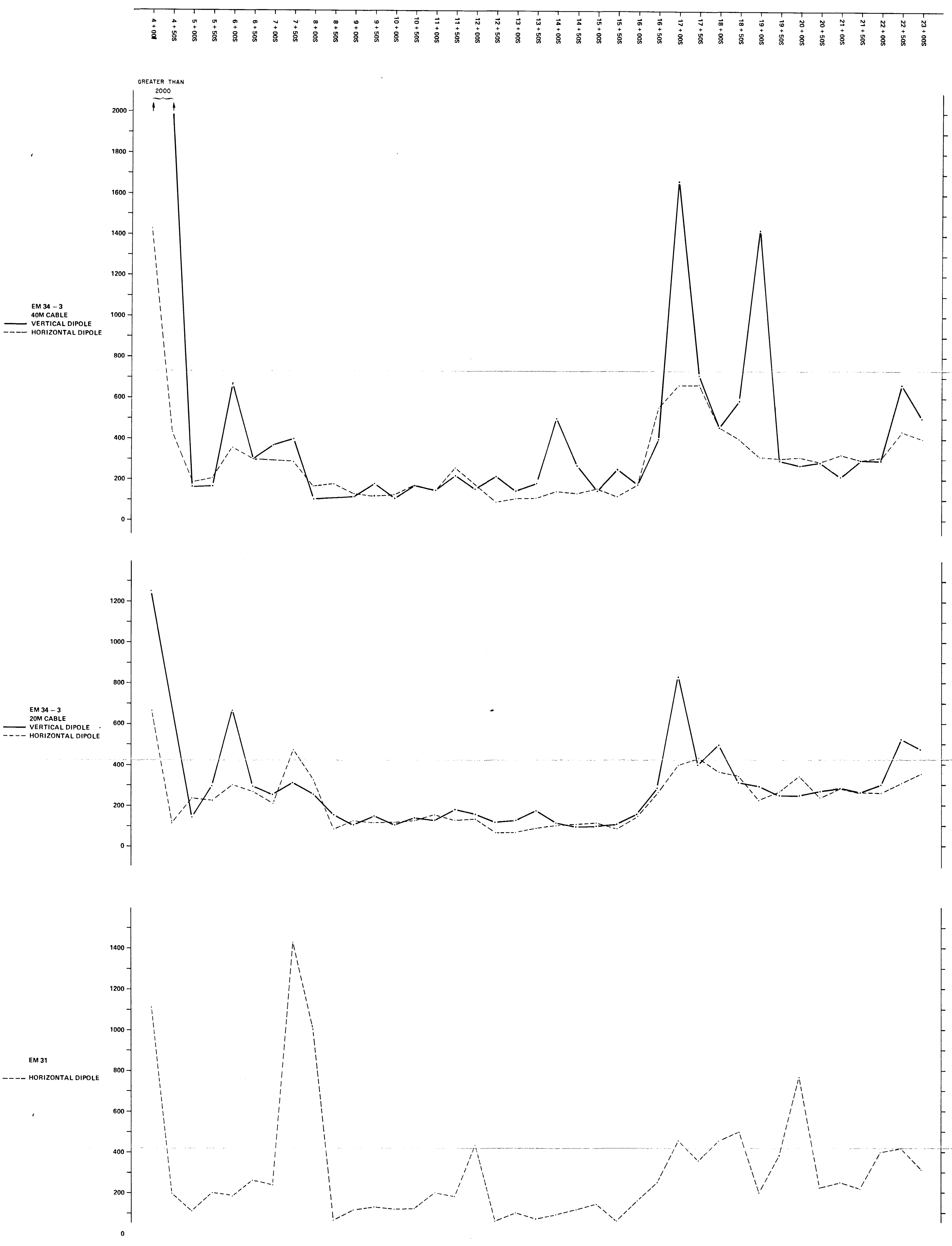
LILLYBURT LINE NO. 1

EM 34 AND EM 31

SURVEY PROFILES OF APPARENT RESISTIVITY

VS STATION NUMBER

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HD-101D
To Accompany		



0 50 100 150 200 metres

SCALE

407 5/5 (3)

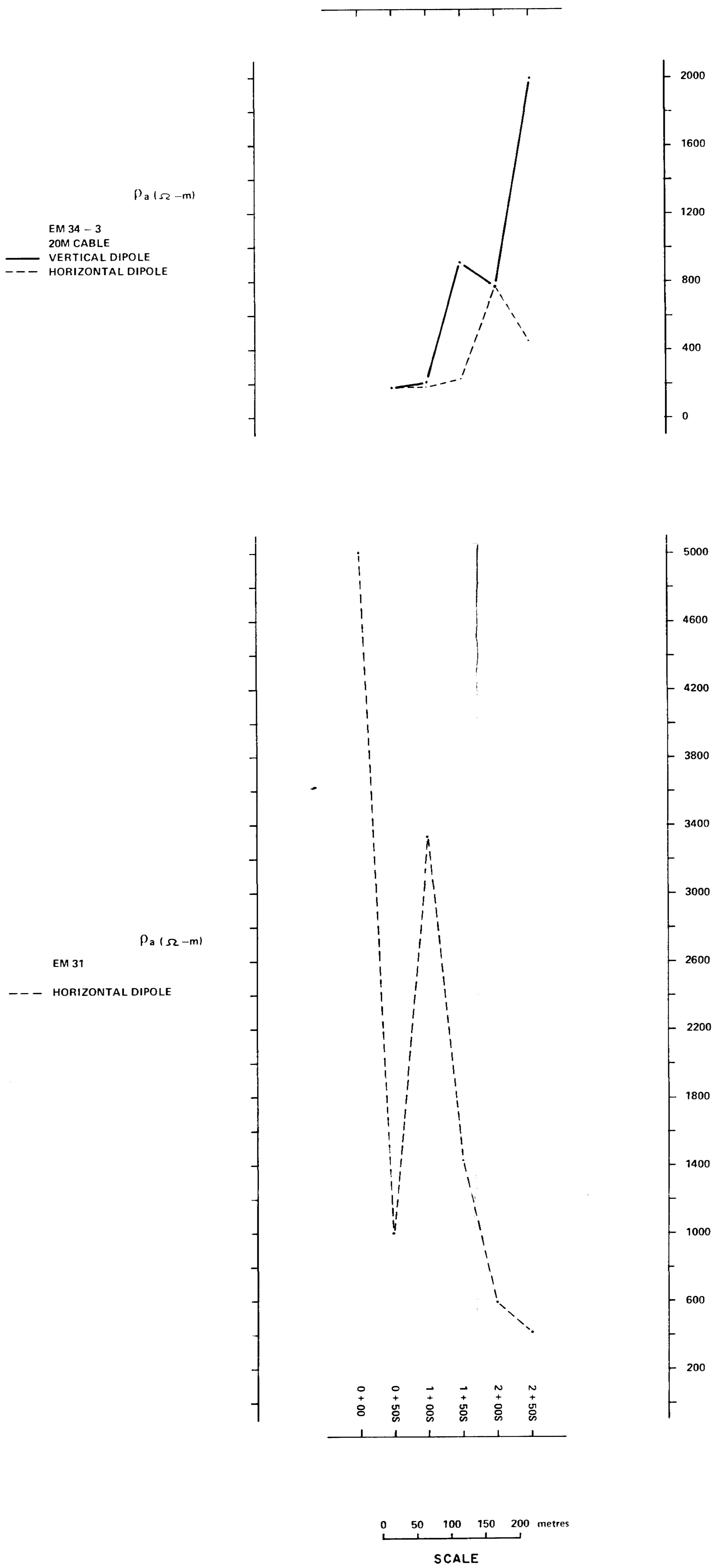
K-SHELL, Lillyburt 81(ii)A

FIGURE NO. 5

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 2
EM 34 AND EM 31
SURVEY PROFILES OF APPARENT RESISTIVITY
VS STATION NUMBER

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No.:
DATE:	REVISED:	DRAWING No.: HE-101C
To Accompany		



407 5/5 (4)

K-SHELL. Lillyburt 81(ii)A

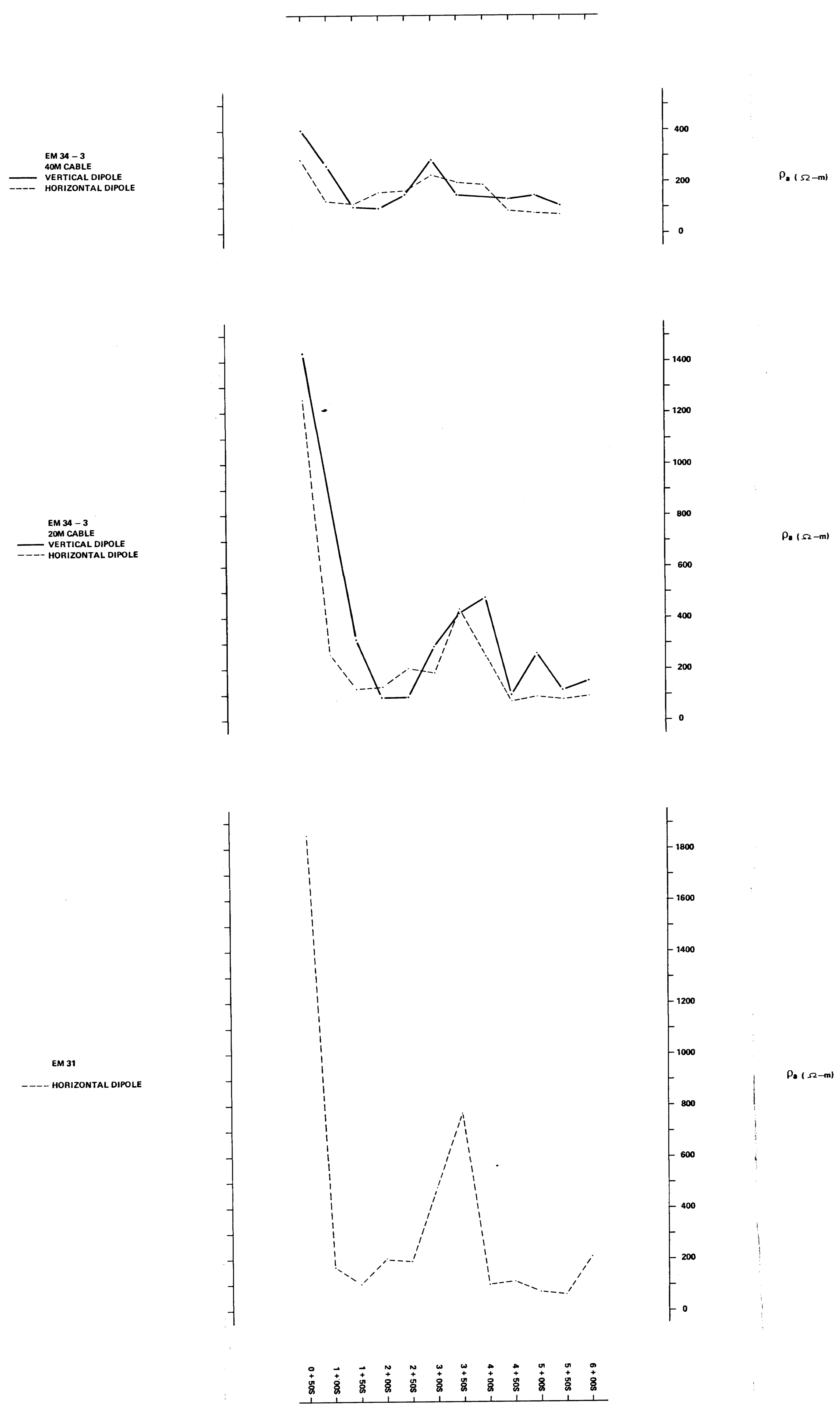
FIGURE NO. 6

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 3
EM 34 AND EM 31

SURVEY PROFILES OF APPARENT RESISTIVITY
VS STATION NUMBER

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HF-101A
To Accompany		



0 50 100 150 200 metres

SCALE

407 5/5 (5)

K-SHELL-Lillyburt 81(ii)A

FIGURE NO. 7

Crows Nest Resources Limited

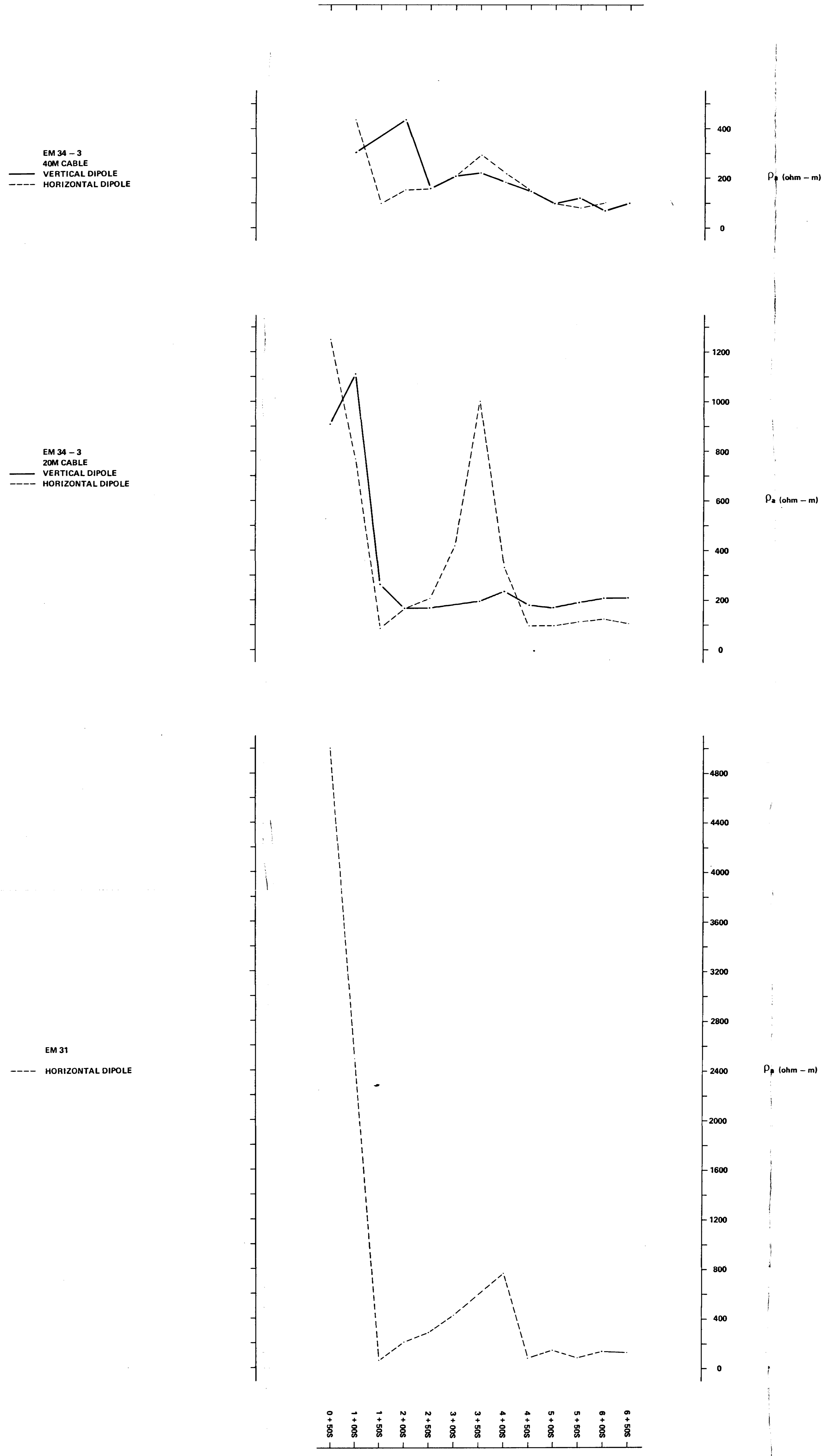
EXPLORATION

LILLYBURT LINE NO. 4

EM 34 AND EM 31

SURVEY PROFILES OF APPARENT RESISTIVITY VS STATION NUMBER

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HF-101B
To Accompany		



0 50 100 150 200 metres

SCALE

407 5/5 ⑥

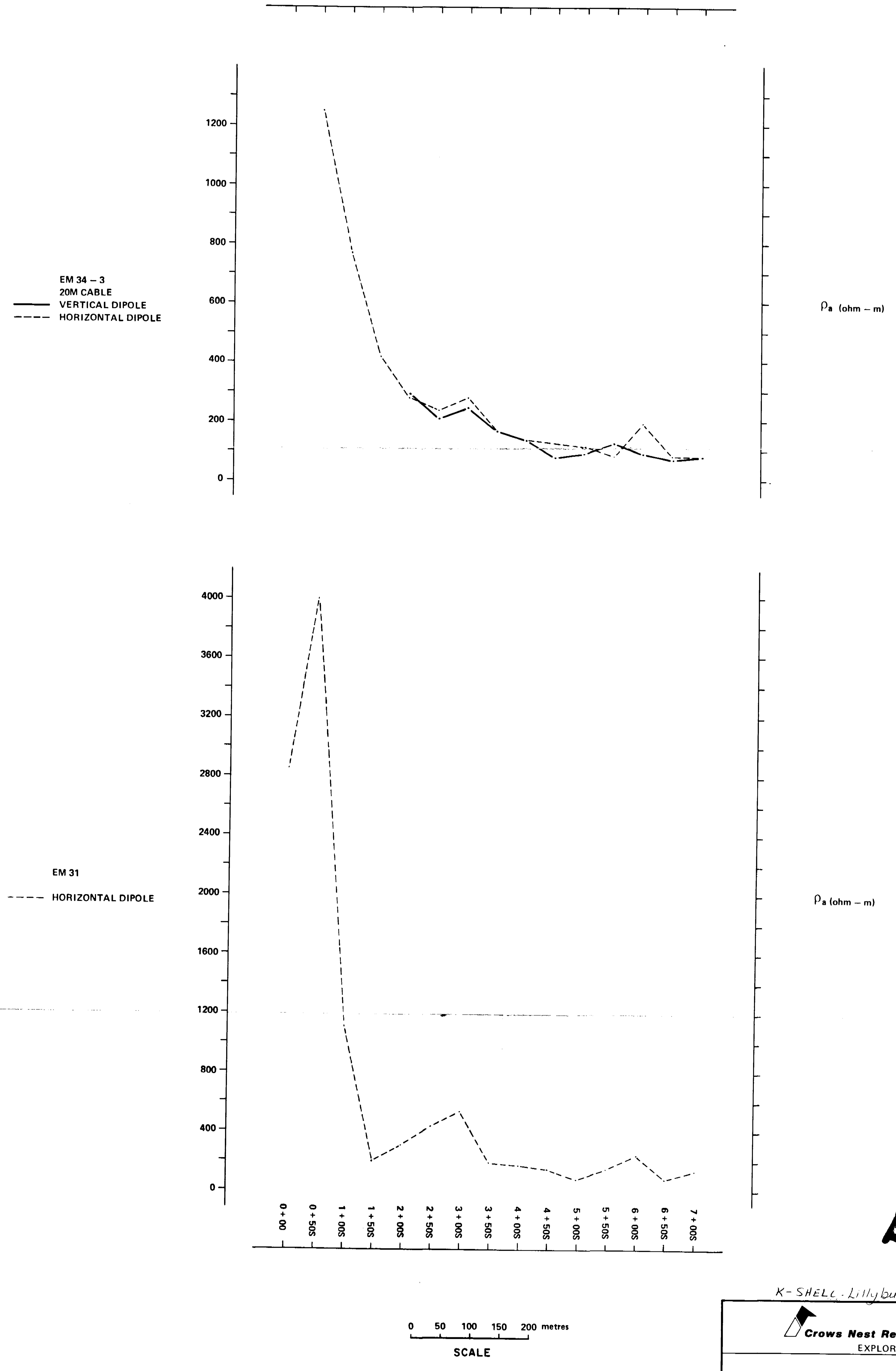
K-SHELL-Lillyburt 8)(ii)A

FIGURE NO. 8

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 5
EM 34 AND EM 31
SURVEY PROFILES OF APPARENT RESISTIVITY
VS STATION NUMBER

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No.:
DATE:	REVISED:	DRAWING No: HE-101D
To Accompany		



407 5/5

7

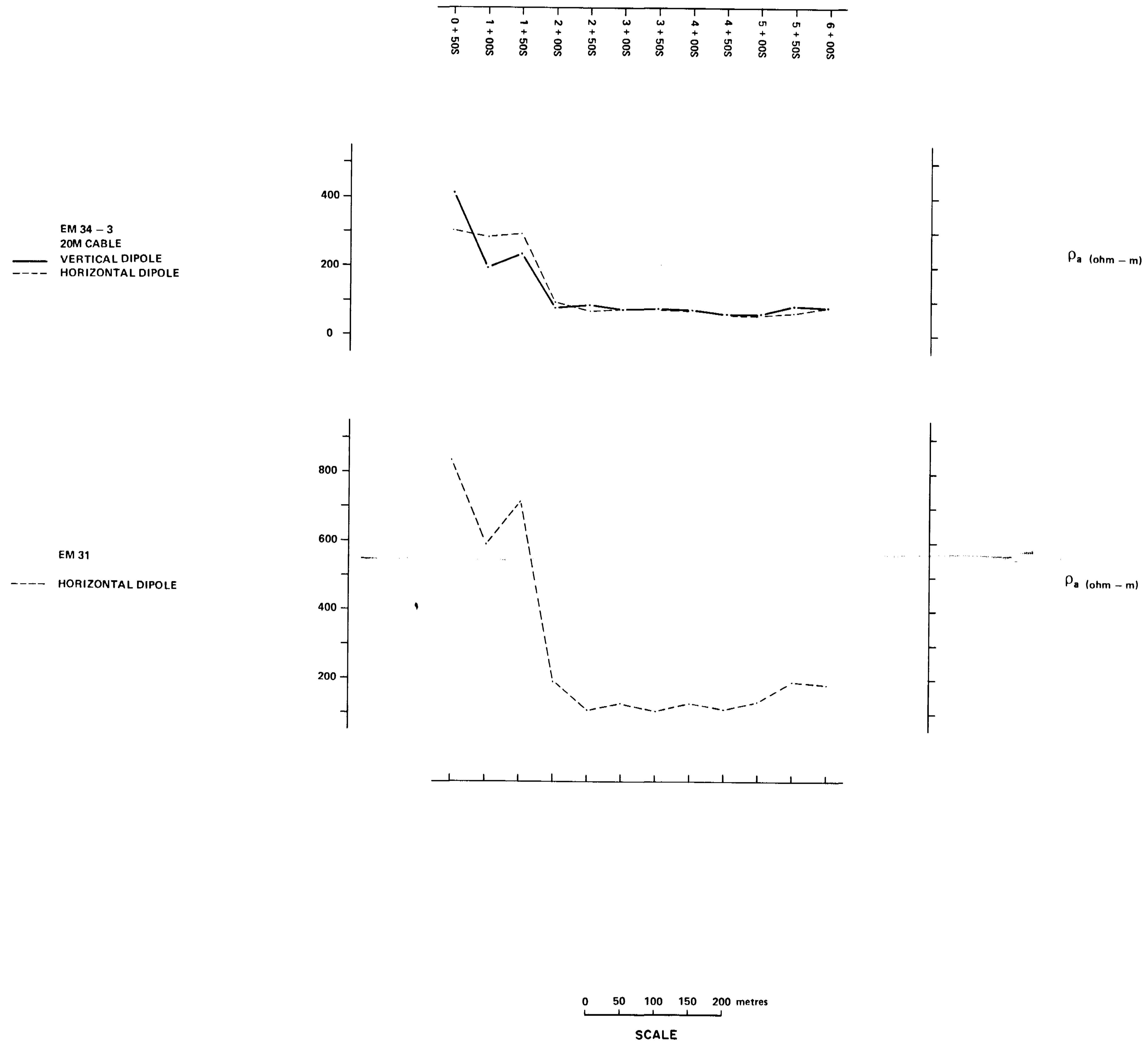
K-SHELL. Lillyburt EL(1)A

FIGURE NO. 9

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 6
EM 34 AND EM 31
SURVEY PROFILES OF APPARENT RESISTIVITY
VS STATION NUMBER

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HE-101A
To Accompany		



407 5/5 (8)

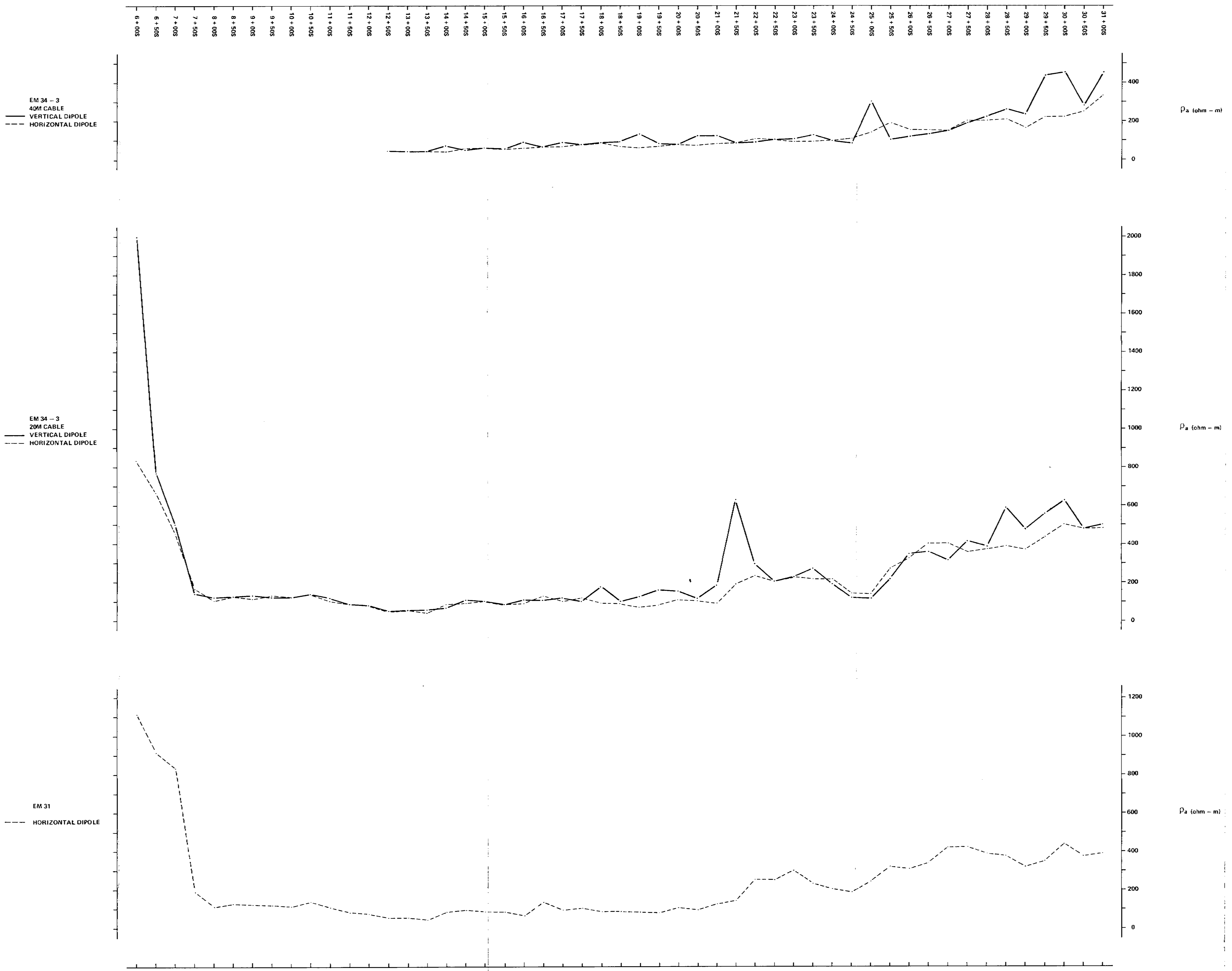
K - SHELL - Lillyburt 81 (ii)A

FIGURE NO. 10

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 7
EM 34 AND EM 31
SURVEY PROFILES OF APPARENT RESISTIVITY
VS STATION NUMBER

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No.:
DATE:	REVISED:	DRAWING No: HE - 101B
To Accompany		



0 50 100 150 200 metres

SCALE

407 5/5 9

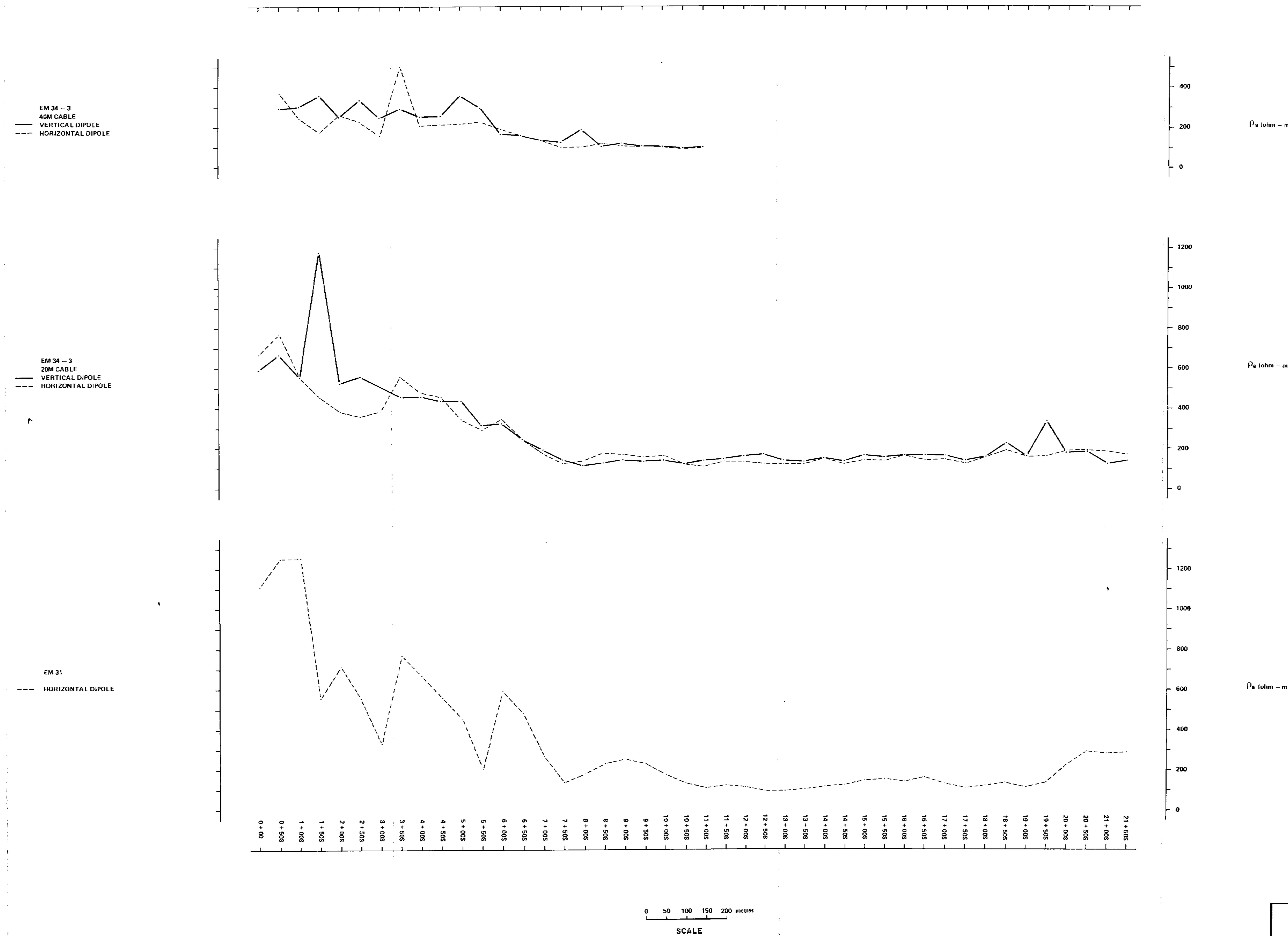
FIGURE NO. 11

K-SHELL-Lillyburt 81(11)A

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 8
EM 34 AND EM 31
SURVEY PROFILES OF APPARENT RESISTIVITY
VS STATION NUMBER

AUTHOR: A ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HE-101
To Accompany		



407 5/5 (10)

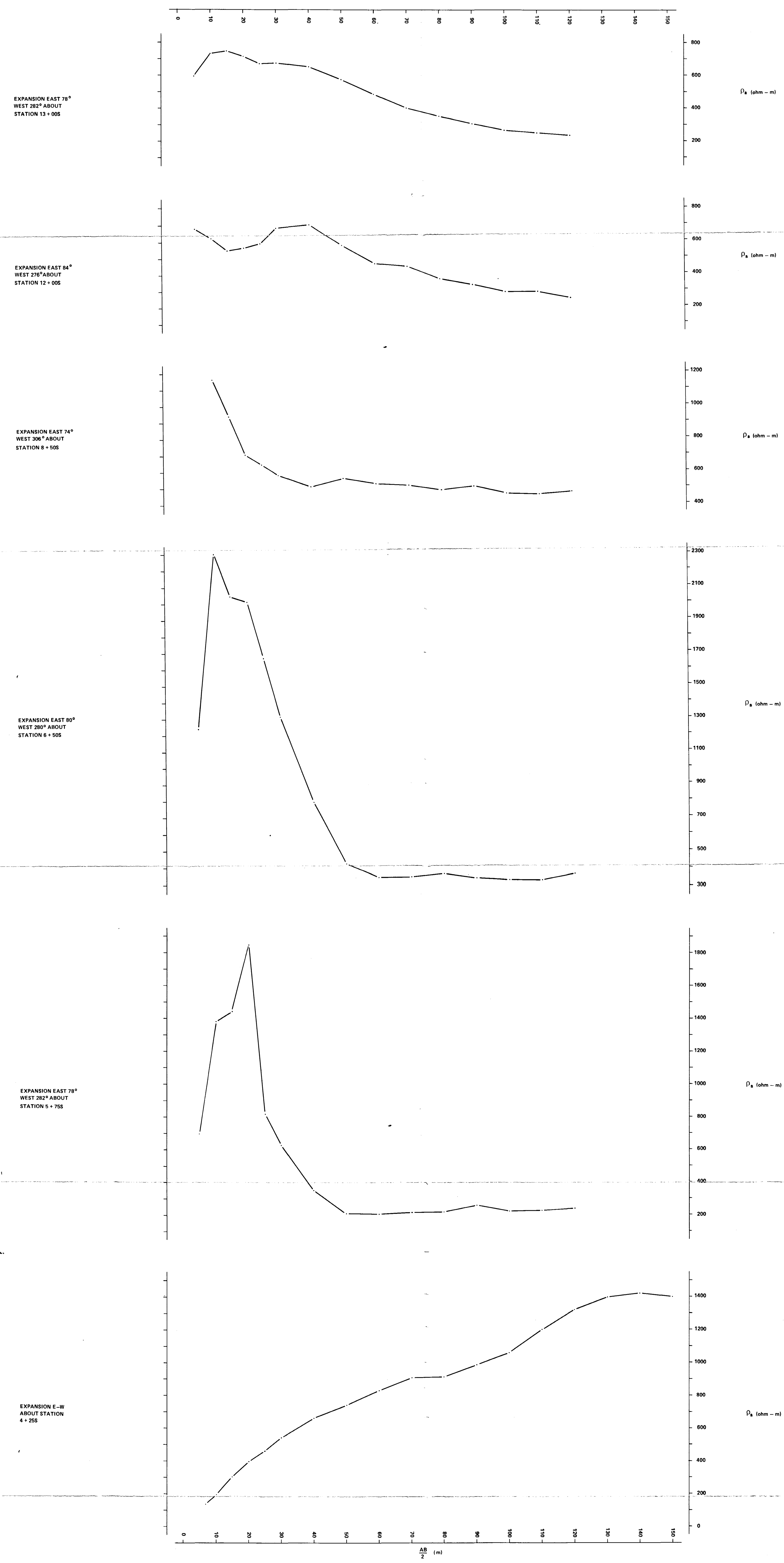
K-SHELL-Lillyburt 81/11A

FIGURE NO. 12

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 9
EM 34 AND EM 31
SURVEY PROFILES OF APPARENT RESISTIVITY
VS STATION NUMBER

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HF-101
To Accompany		



407 5/5 11

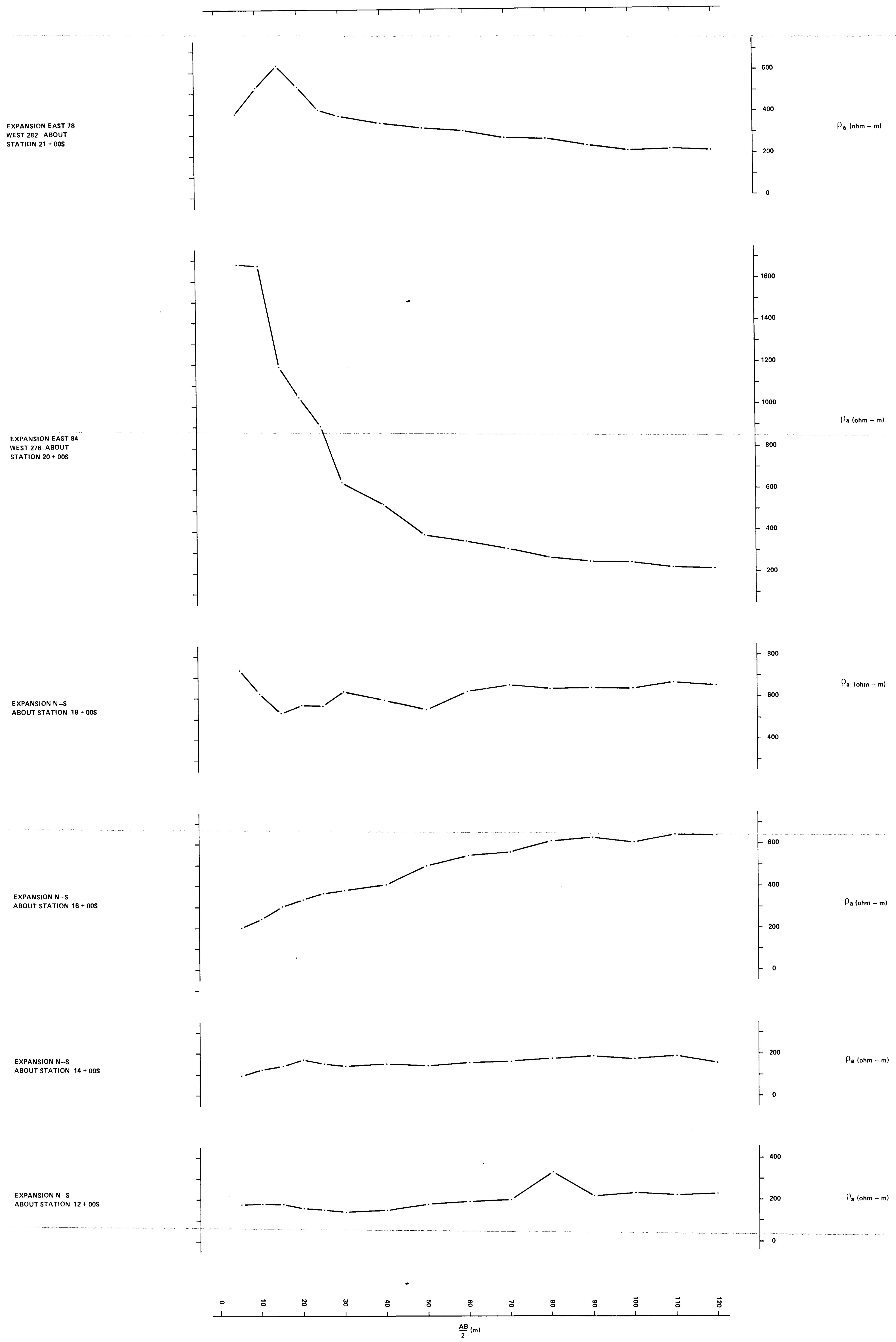
FIGURE NO. 13

K - SHELL - Lillyburt 81(11)A

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 1
SCHLUMBERGER SOUNDINGS
PROFILES OF APPARENT RESISTIVITY
VS DISTANCE $\left(\frac{AB}{2} = L\right)$ d = 5M

AUTHOR: A ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HD-101C
To Accompany		



407 5/5 (12)

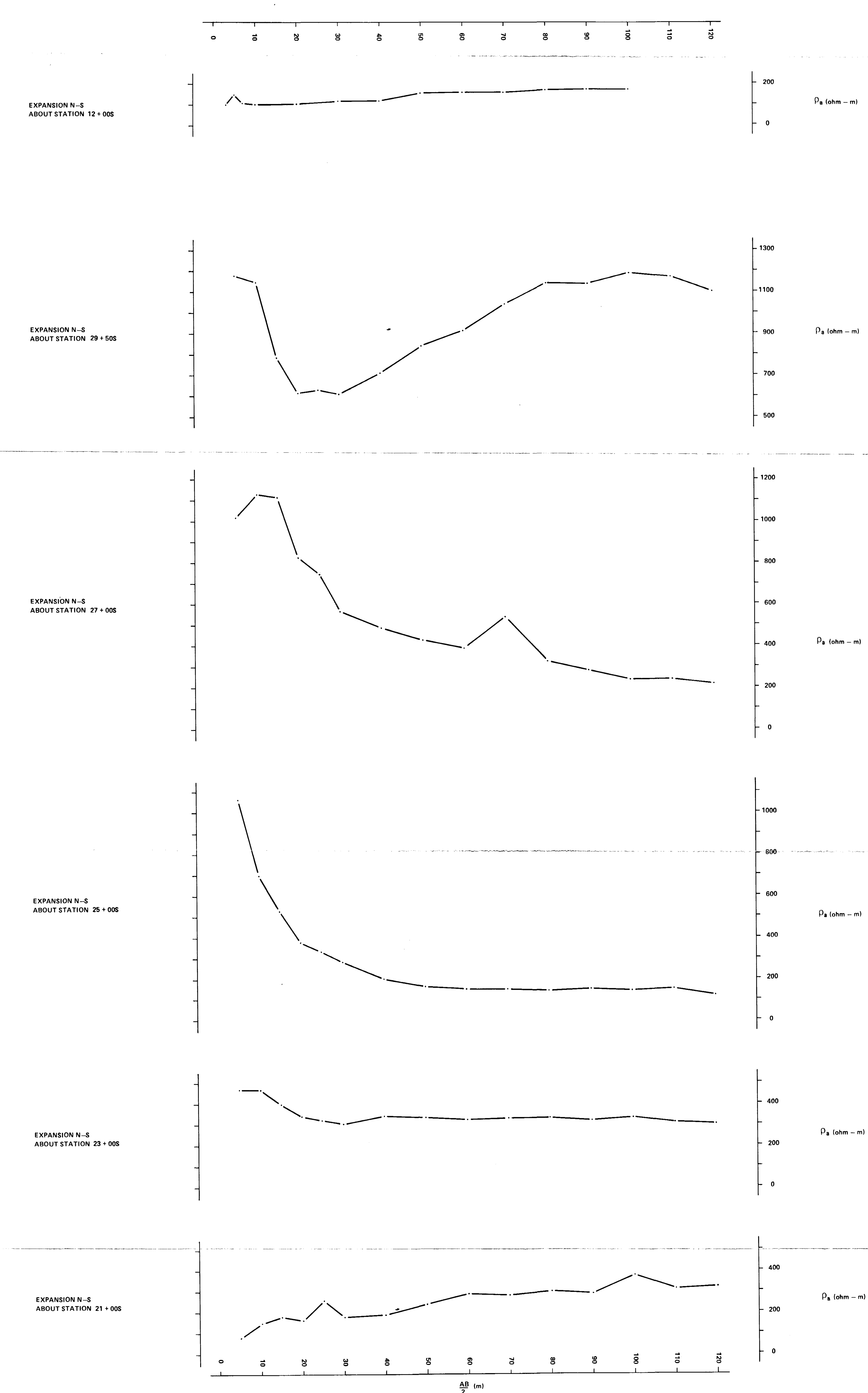
K-SHELL-Lillyburt 81 (II)A

FIGURE NO. 14

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 2
SCHLUMBERGER SOUNDINGS
PROFILES OF APPARENT RESISTIVITY
VS DISTANCE $\left(\frac{AB}{2} = L\right)$ d = 5M

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HD - 101
To Accompany		



407 5/5 (13)

K-SHELL - Lillyburt 81(11)A

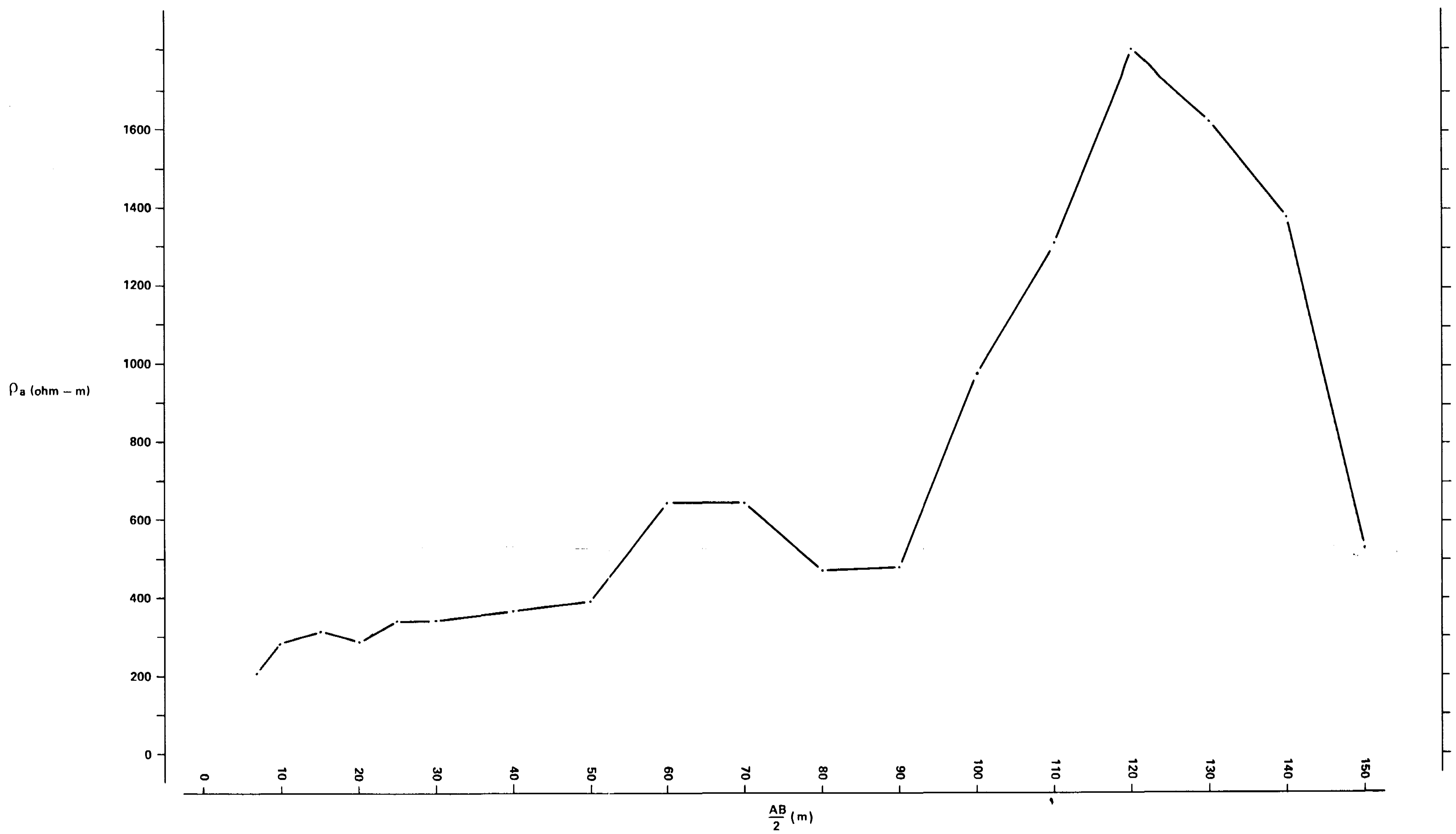
FIGURE NO. 15

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 8
SCHLUMBERGER SOUNDINGS

PROFILES OF APPARENT RESISTIVITY
VS DISTANCE $\left(\frac{AB}{2} = L\right)$ d = 5M

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No.:
DATE:	REVISED:	DRAWING No: HD-101A
To Accompany		



407 5/5 (14)

K-SHELL-Lillyburt 8)(11)A

FIGURE NO. 16

Crows Nest Resources Limited
EXPLORATION

LILLYBURT
SCHLUMBERGER SOUNDING
ABOUT DDH 304
EXPANSION DIRECTION – 28° EAST OF NORTH
PROFILE OF APPARENT RESISTIVITY
VS DISTANCE $\left(\frac{AB}{2} = L\right)$

AUTHOR: A ALLISON	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: HD-101 B
To Accompany		

DG 23

407 5/5 (15)

K-SHELL-Lillyburt Sulilia

FIGURE NO. 17

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 1

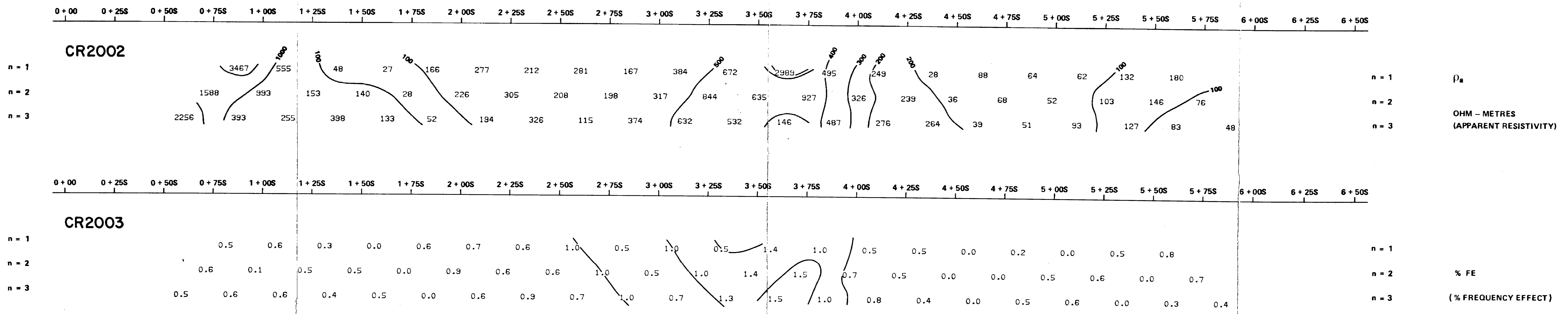
RESISTIVITY AND IP PSEUDO SECTION

DIPOLE - DIPOLE ARRAY

FREQ - 0.25 HZ AND 2.0 HZ

a = 25 METRES

AUTHOR: A. ALLISON	SCALE: 1:5000	ENCLOSURE No.:
DATE:	REVISED:	DRAWING No: HC-101B
To Accompany		



K – SHELL – Lillyburt 8r (11) A

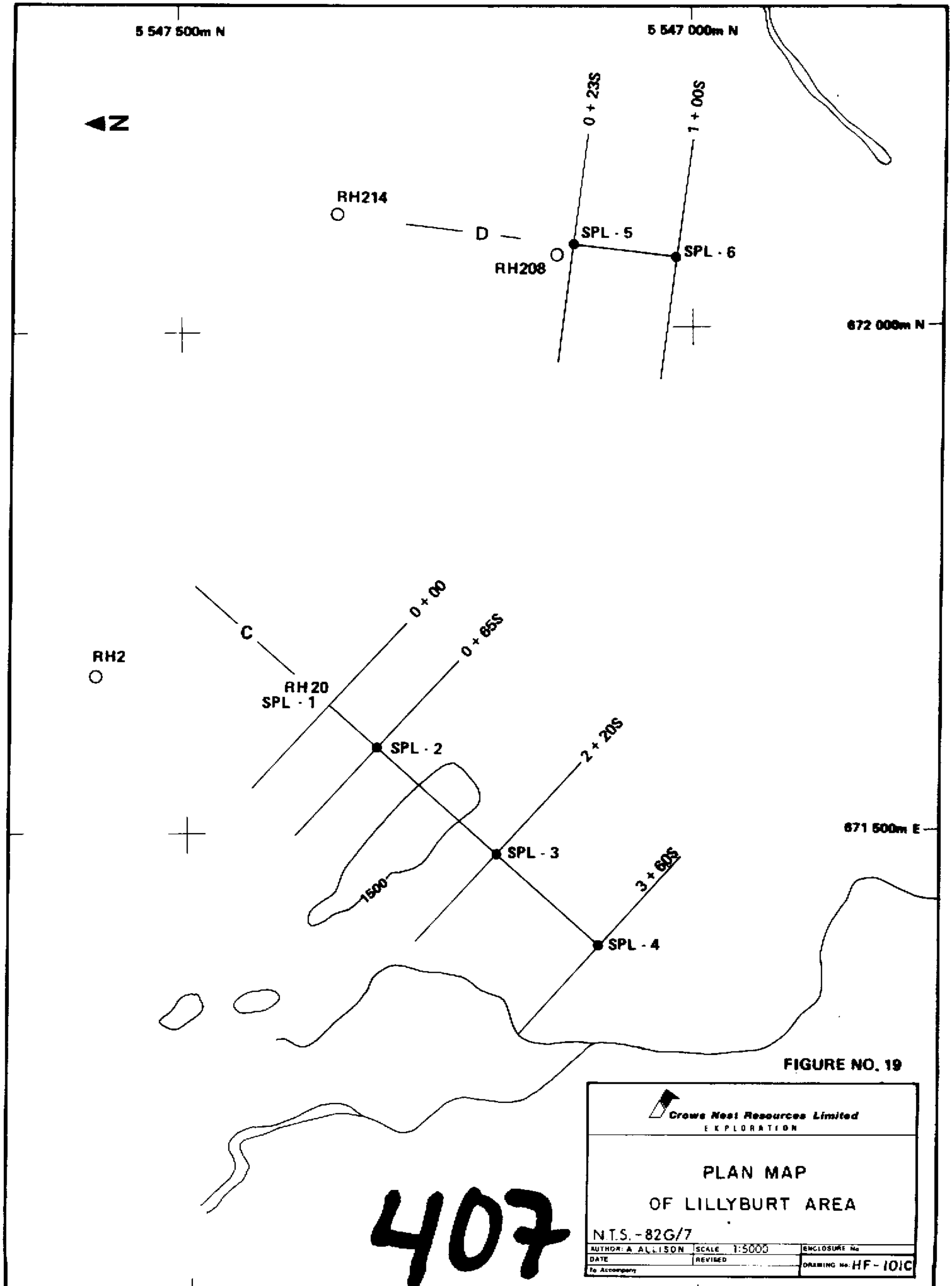
FIGURE NO. 18

Crows Nest Resources Limited
EXPLORATION

LILLYBURT LINE NO. 5
RESISTIVITY AND IP PSEUDO SECTION
DIPOLE – DIPOLE ARRAY
FREQ – 0.25 HZ AND 2.0 HZ
a = 25 METRES

AUTHOR: A. ALLISON	SCALE:	ENCLOSURE No.:
DATE:	REVISED:	DRAWING No: HC - 101 A
To Accompany		

407 S/S (16)



K-SHELL - Lillyburt 81(11)A

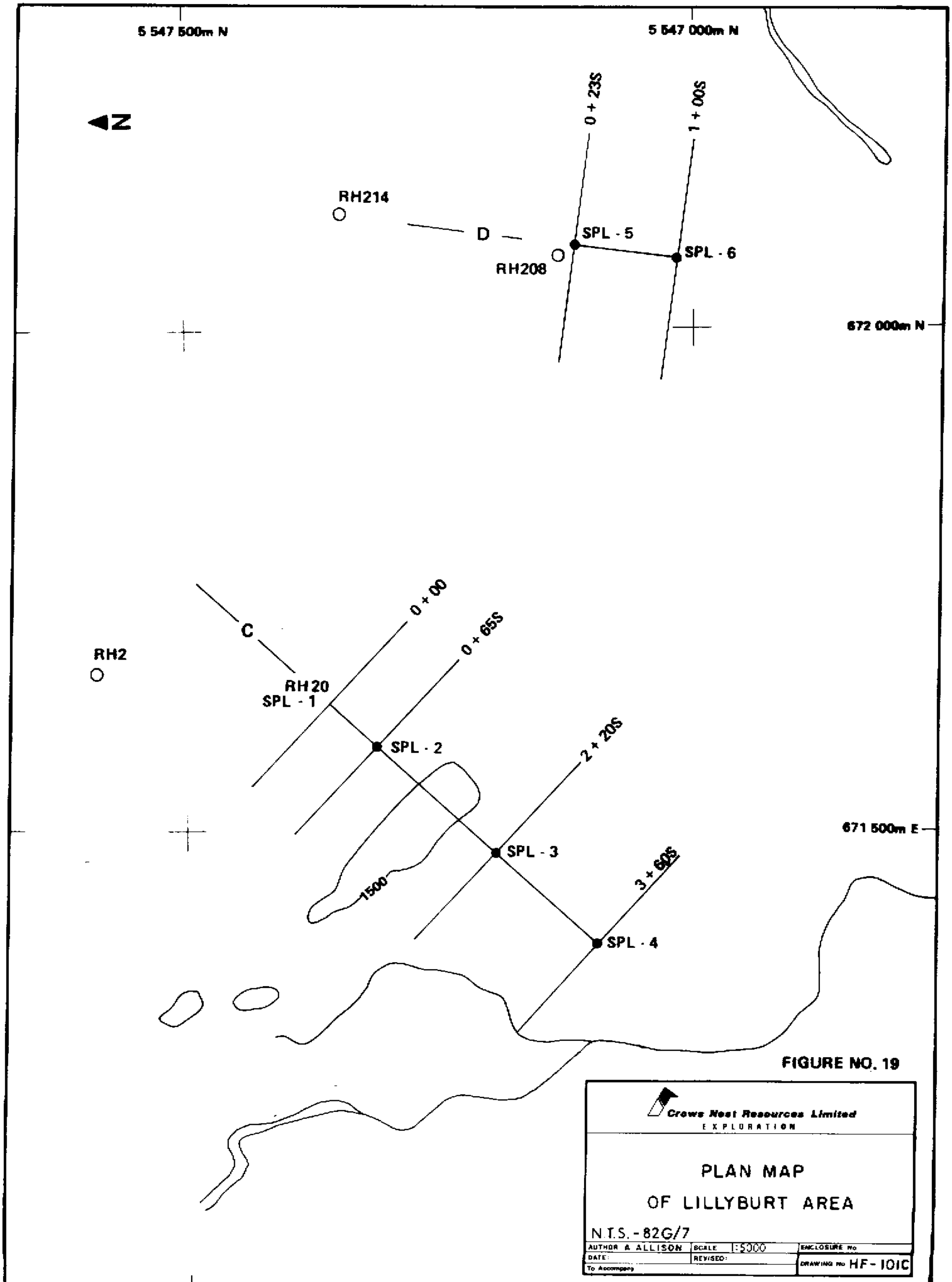


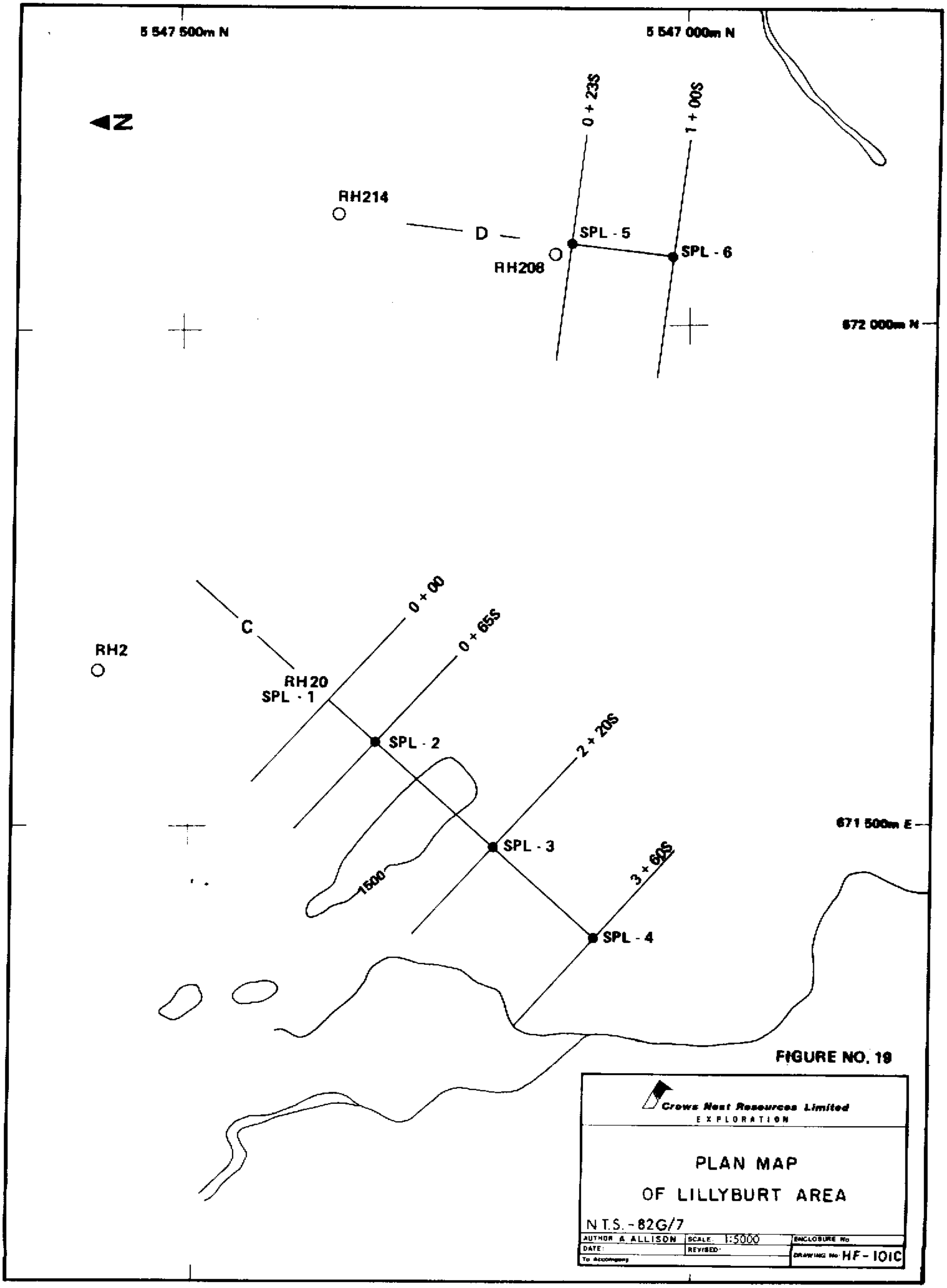
FIGURE NO. 19

Crows Nest Resources Limited
EXPLORATION

PLAN MAP
OF LILLYBURT AREA

N.T.S. - 82G/7

AUTHOR A. ALLISON	SCALE 1:5000	ENCLOSURE No
DATE:	REVISED:	DRAWING No HF - 101C
To Accompany		


5 547 500m N
5 547 000m N
N
0 + 23S
1 + 00S
RH214
D
SPL - 5
SPL - 6
RH208
672 000m N
C
0 + 00
0 + 65S
RH2
RH20
SPL - 1
SPL - 2
2 + 20S
671 500m E
SPL - 3
3 + 60S
1500
SPL - 4
FIGURE NO. 19
Crows Nest Resources Limited
EXPLORATION
PLAN MAP
OF LILLYBURT AREA
N.T.S. - 82G/7
AUTHOR A. ALLISON
SCALE 1:5000
ENCLOSURE No
DATE:
REVISED:
To Accompany
DRAWING No HF - 101C

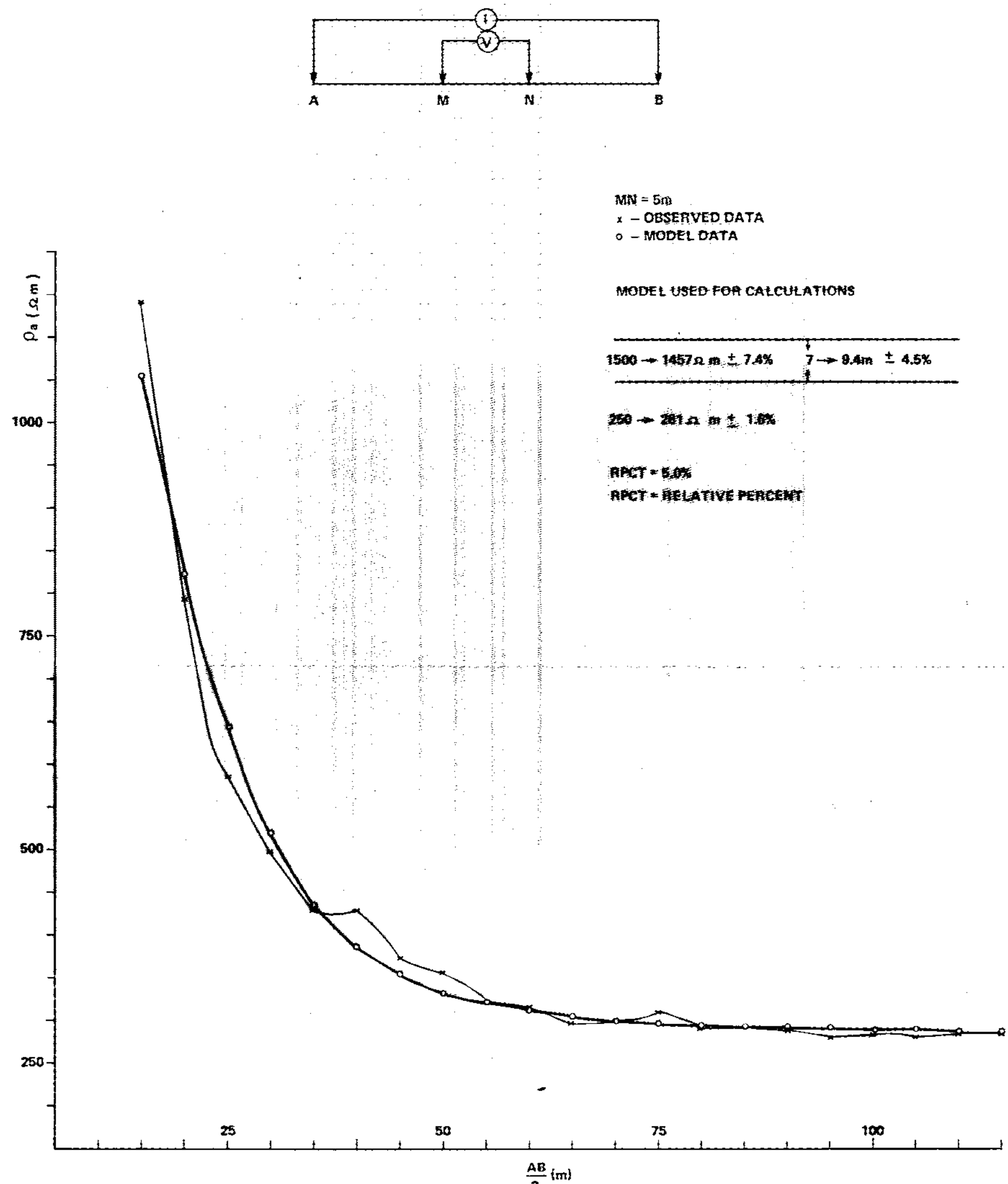


FIGURE NO. 20

K - SHELL

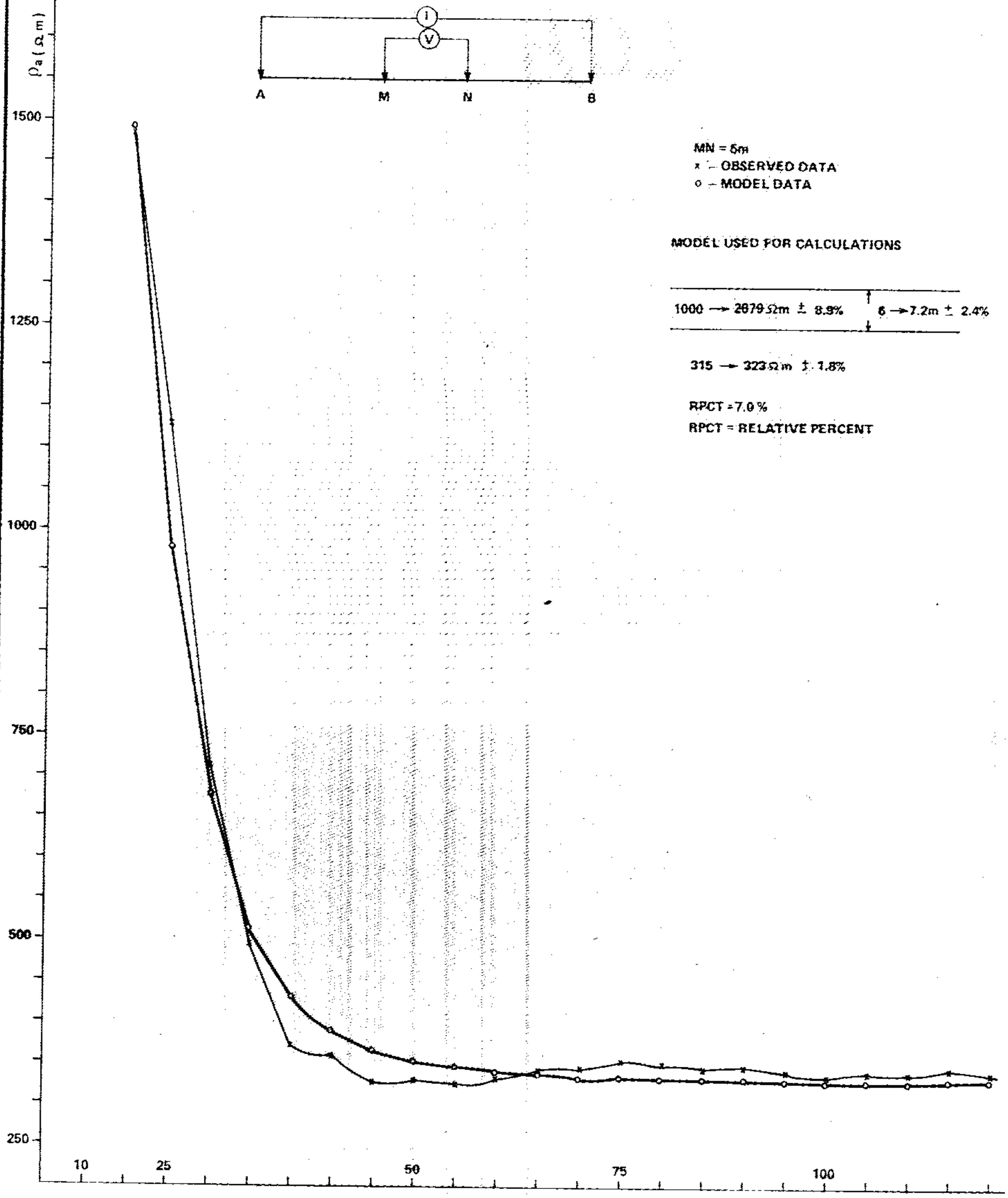
Crows Nest Resources Limited
EXPLORATION

SCHLUMBERGER SOUNDINGS

LC 0 – 00

DRAWING No. HG-1018

407



K - SHELL-

FIGURE NO. 21

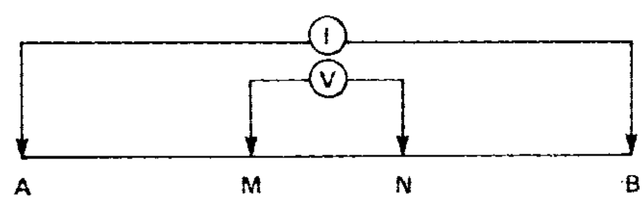
Crows Nest Resources Limited
EXPLORATION

SCHLUMBERGER SOUNDINGS

LC 0 + 65S

HG-101C

407



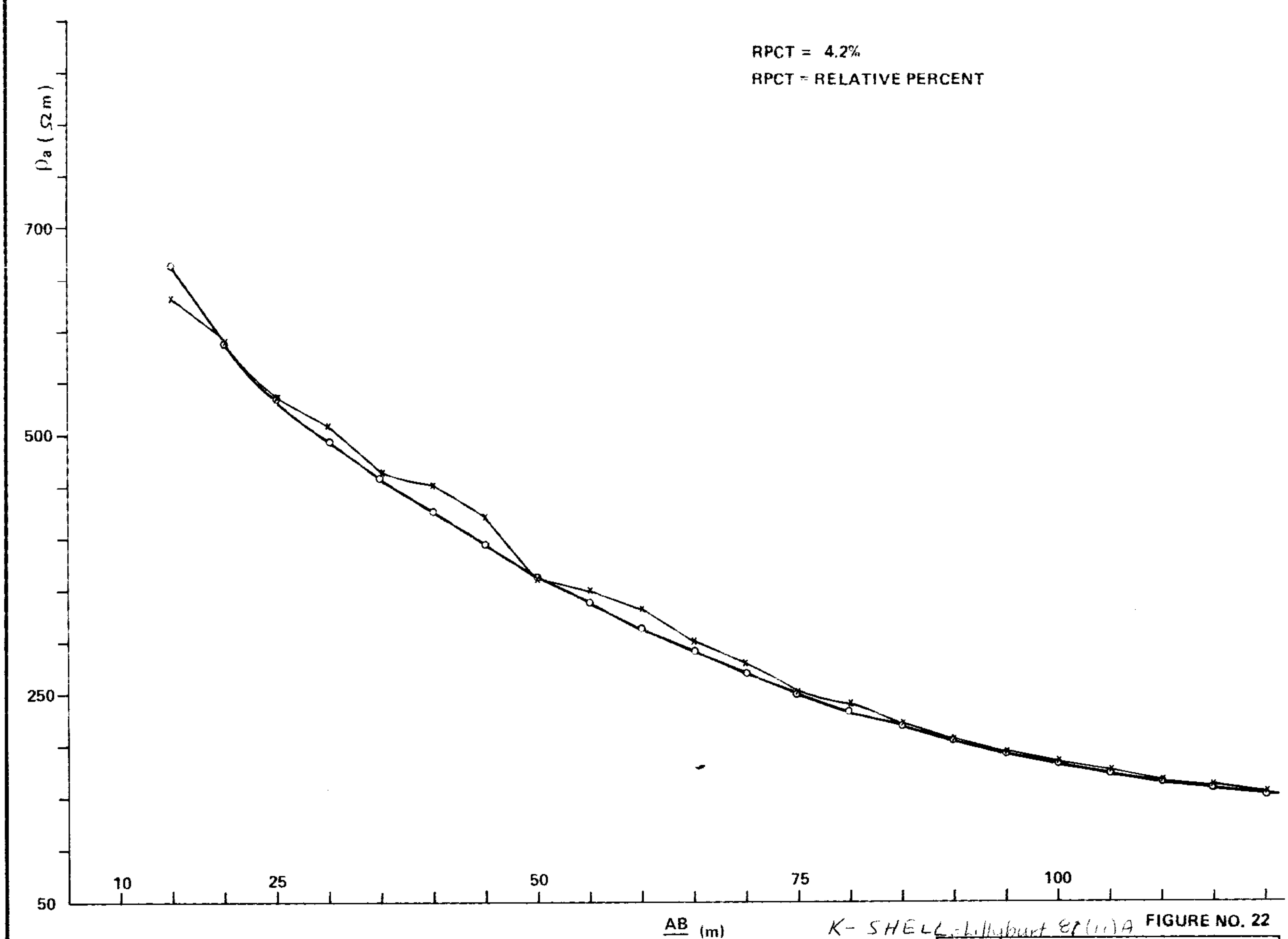
MN = 5m
x – OBSERVED DATA
o – MODEL DATA

MODEL USED FOR CALCULATIONS

900 → 885 Ω m ± 4.4%	7 → 6m ± 7.1%
350 → 492 Ω m ± 2.1%	18 → 27m ± 2.3%

139 → 106 Ω m ± 2.9%

RPCT = 4.2%
RPCT = RELATIVE PERCENT



K- SHELL - Lillyburt 8(ii)A

FIGURE NO. 22

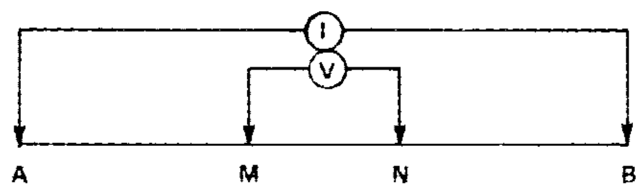
Crows Nest Resources Limited
EXPLORATION

SCHLUMBERGER SOUNDINGS

LC 2 – 20S

407

AUTHOR A. ALLISON	SCALE	ENCLOSURE No
DATE	REVISED	DRAWING No HG - 101A



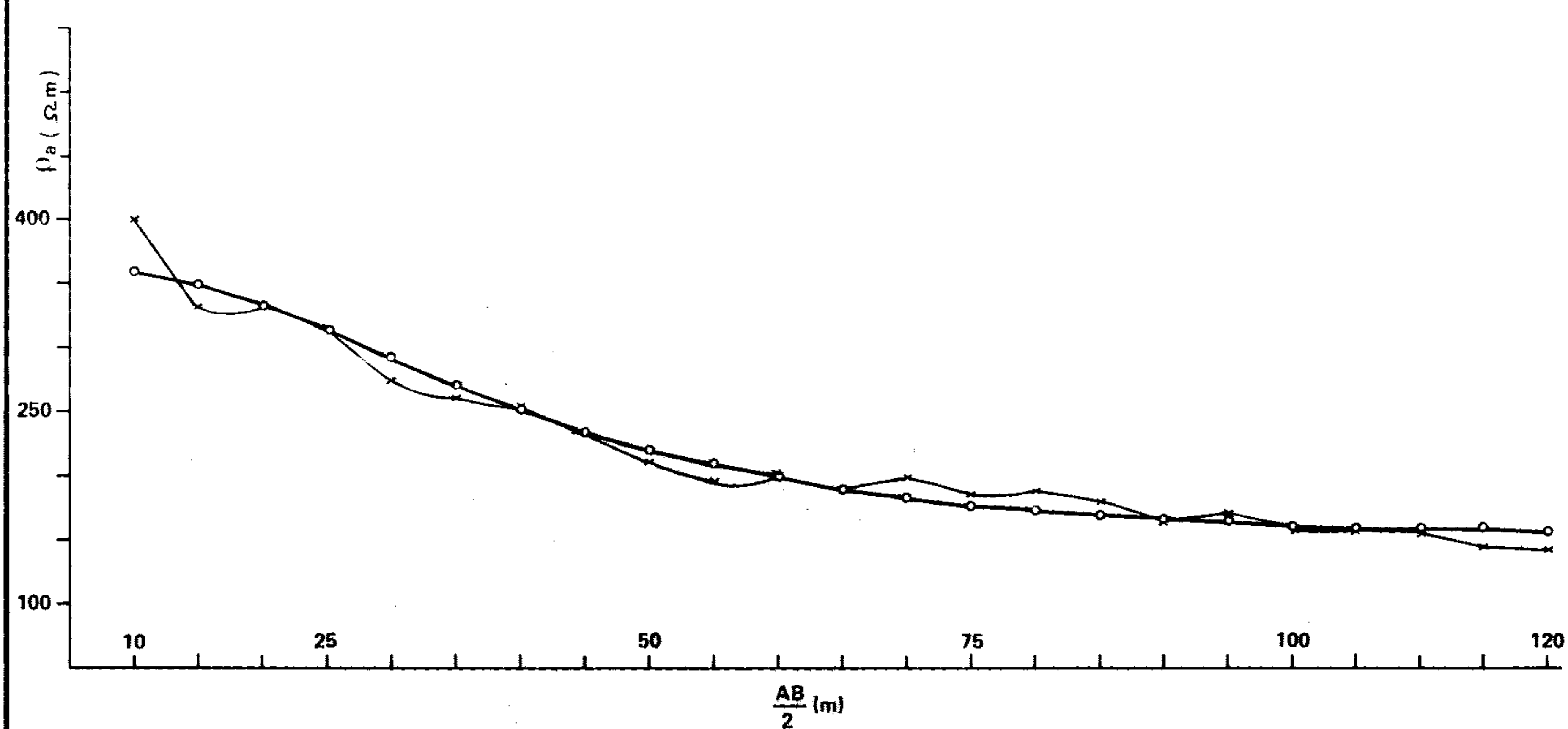
MN = 5m
x – OBSERVED DATA
o – MODEL DATA

MODEL USED FOR CALCULATIONS

500 → 366 Ω m ± 3.6%	6 → 18 m ± 7.3%

170 → 146 Ω m ± 3.1%

RPCT = 5.8 %
RPCT = RELATIVE PERCENT



K-SHELL-Lillybut 81(II)A

FIGURE NO. 23

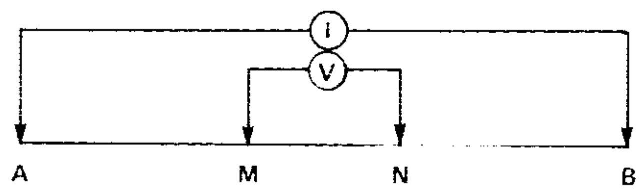
Crows Nest Resources Limited
EXPLORATION

SCHLUMBERGER SOUNDINGS

LC 3 + 60S

AUTHOR: A. ALLISON
DATE
SCALE
REVISED
ENCLOSURE No
DRAWING No HG-101

407



MN = 5m
o – OBSERVED DATA
x – MODEL DATA

MODEL USED FOR CALCULATIONS

1200 → 1418 Ω m ± 11.4%	6 → 5.5m ± 8.2%
275 → 292 Ω m ± 3.0%	

RPCT = 12.6%
RPCT = RELATIVE PERCENT

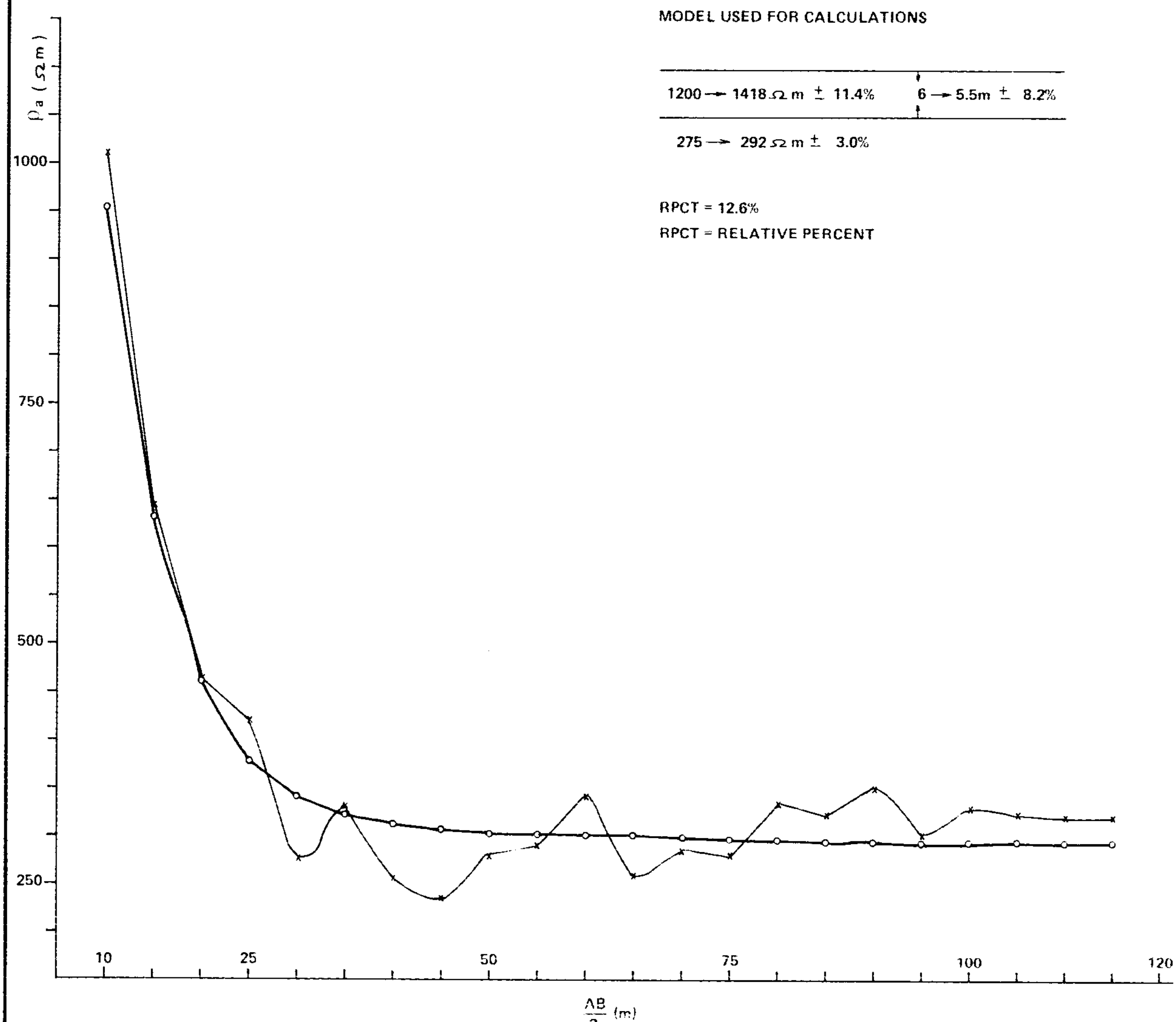


FIGURE NO. 24

Crows Nest Resources Limited
EXPLORATION

SCHLUMBERGER SOUNDINGS
LD 0 – 23

407

AUTHOR A. ALLISON
DRAWING No. HG-131E