

HORSE SHOE RIDGE.

K-SHELL-LINE CREEK
(HORSE SHOE RIDGE)
78(4)B

GEOLOGICAL
REPORT

-1978-

OPEN FILE

420

GEOLOGICAL REPORT

WORK DONE FROM FEB. 1, 1978 TO JAN. 30, 1979

HORSESHOE RIDGE

KOOTENAY LAND DISTRICT, B.C.

B.C. COAL LICENCES

NOS. 292, 295, 296, 299

368, 369, 373

HELD BY SHELL CANADA RESOURCES LIMITED

OPERATED BY CROWS NEST RESOURCES LIMITED

NTS 82G/15

LAT. $49^{\circ} 57'$ N, LONG. $114^{\circ} 45'$ W

BY **GEOLOGICAL BRANCH**
ASSESSMENT REPORT
PAT GILMAR & JEFF SCHLENDER
1979-04-30

00 420

OPEN FILE

PROFESSIONAL VERIFICATION OF REPORT

Entitled: Horseshoe Ridge Coal Project
Kootenay Land District, B.C., 1978
B.C. Coal Licenses
Nos. 292, 295, 296, 299, 368, 369, 373

Mr. Patrick C. Gilmar planned and carried out the 1978 geological field program on Horseshoe Ridge B.C. Coal Licenses held by Shell Canada Resources Ltd. and operated by Crows Nest Resources Ltd. He also prepared this report. Mr. Frank Martonhegyi supervised the activity of this program under the general direction of the undersigned.

Pat Gilmar, B.Sc., graduated in Geology from the University of Calgary, in 1978. Prior to his graduation Mr. Gilmar worked as a field assistant for a number of major mining companies in British Columbia and Alberta.

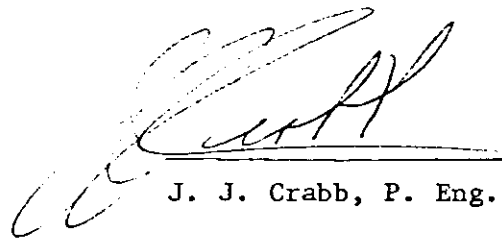
Frank Martonhegyi, M.E., graduated in Mining Geological Engineering from the University of the Heavy Industry, Hungary, in 1962; and received post-graduate training at the University of Saskatchewan, Saskatoon, in 1969-1971. His experience in Western Canadian coal exploration since 1971 includes positions with:

- CanPac Minerals Ltd., Calgary, Alberta
- Shell Canada Resources Ltd., Calgary, Alberta
- Crows Nest Resources Ltd., Calgary, Alberta

His prior work experience includes underground coal mining geology, geotechnical engineering and geochemistry in Hungary, Austria and Canada.

He currently holds the position of Staff Geologist for Crows Nest Resources Ltd., supervising coal exploration in British Columbia.

I consider both the aforementioned geologists to be well qualified to undertake the responsibilities they were assigned on this project. I am satisfied that the attached report dated April 30, 1979 has been competently prepared and justly represents the information obtained from this project.



J. J. Crabb, P. Eng.

April 30, 1979

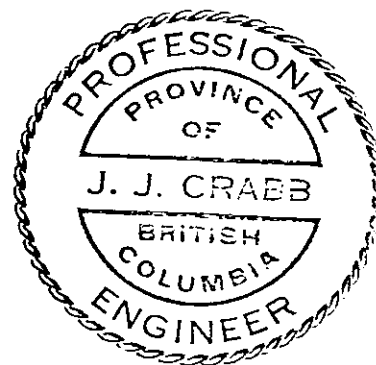


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SUMMARY

The Horseshoe Ridge project area (S.E. Central Block), covering approximately 1683 hectares near the south end of the Upper Elk Coalfield (Crowsnest Coalfield), is held by Shell Canada Resources Limited and operated by its wholly owned subsidiary Crows Nest Resources Limited. The licences are 28 logging road kilometres northeast of Sparwood, British Columbia and are ten kilometres, by the same road, from the nearest railway (CPR) and CNRL's proposed coal preparation plant. The Horseshoe Ridge open pit mine development lies on the eastern limb of the Fording River Syncline and is a convenient economic extension of CNRL's proposed Line Creek Ridge open pit mine on the western limb.

The lower Coal Bearing Member of the Kootenay Formation outcrops on Horseshoe Ridge and contains, in 5 seams, an aggregate thickness of 25.6 metres coal. The low to medium volatile, metallurgical grade coal is in a stratigraphic sequence correlatable to the succession at Line Creek Ridge. Although in a dip-slope situation, the coal seams dip steeper (55 degrees west) and the structure is more complicated at Horseshoe Ridge. However, thrust faulting has caused favourable repetitions of the coal seams and brought more coal to surface-mineable depths than could be expected from the dips. The extent of oxidation may also be less here.

Grass-root exploration is completed, including 3698 metres of drilling in 15 holes. It delineated 28 million tonnes surface mineable recoverable (considering 20% losses) raw coal reserves of probable category, with an average overburden ratio of 6.8:1. Seams #9 and #10B with thicknesses 7.01 and 7.23 metres respectively are probably amenable for hydraulic underground mining in less steep and structurally less disturbed areas. Such resources and those which are surface mineable at higher overburden ratios exist but were not considered at this stage. The southern extension of the Kootenay Formation (Teepee Mt.) is not explored, however, the Basal Sandstone (Moose Mtn. Member) is present and the lowermost part of the Coal Bearing Member may also be preserved.

Further exploration is proposed to cover the unexplored areas and to generate geological information adequate for a feasibility study on the reserve areas. For this latter purpose 1600 metres rotary drilling in 6 holes, 1100 metres diamond drilling in 4 holes, bulldozer trenching and detailed mapping is recommended to be done in 1979.

LOCATION

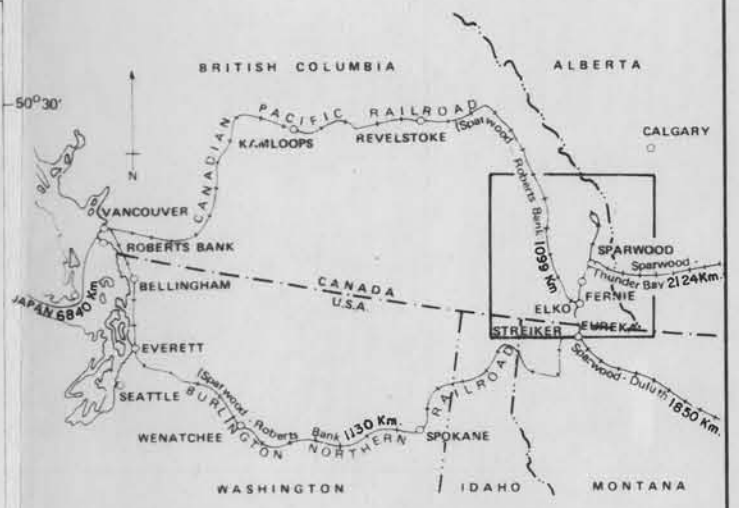
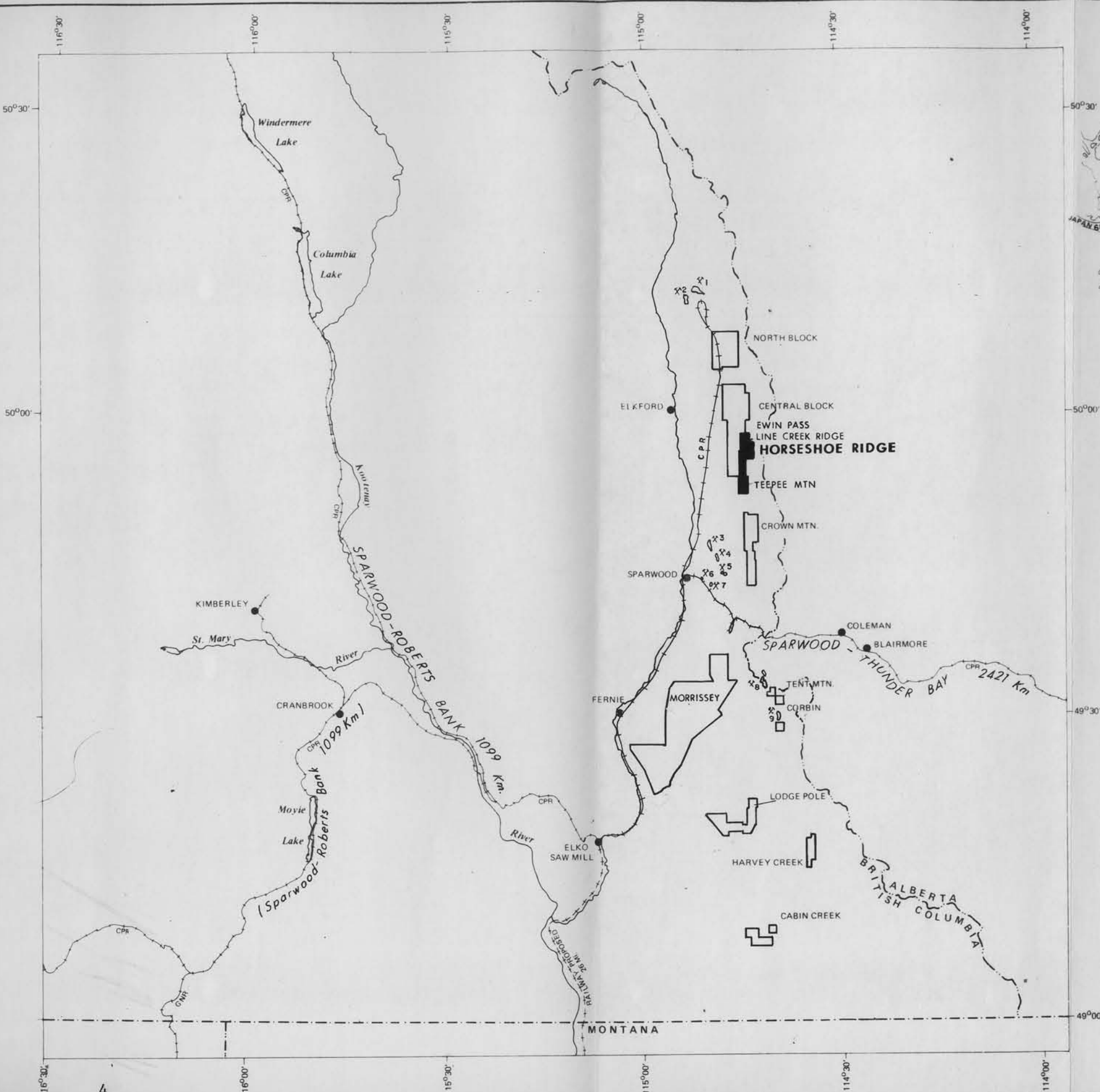
Crows Nest Resources Ltd. is the operator on 7,547 ha of land, currently under Crown Coal Licence to Shell Canada Resources Ltd., in the Line Creek area of the Upper Elk Coal Field. Of this total, in excess of 4,452 ha are underlain by the Kootenay Formation coal-bearing sequence. The Horseshoe Ridge project area lies within seven licences (1683 ha), namely CL292, CL368, CL373, CL369, CL299 of Group CB, and CL295 and CL296 of Group CS.

Horseshoe Ridge is centered at latitude $49^{\circ} 57'$ N and longitude $114^{\circ} 45'$ W, 25 km northeast of Sparwood, British Columbia in the Upper Elk Coal Field. It is within 9.5 km of the Canadian Pacific Railroad line in the Elk Valley. (Figures 1 & 2) The licences lie about midway between two major operating metallurgical coking coal properties, the Kaiser Resources Harmer Ridge 16 km to the south and the Fording River Coal's open pit operations to the north.

Vehicular access into the area is via an all-weather, gravel base road presently used by CNI logging operations in the area.

The Central Block area consists of several explored units, the principal ones being Line Creek Ridge, Horseshoe Ridge, and Ewin Pass. This report covers primarily Horseshoe Ridge and only briefly mentions the southern extension of the Kootenay Formation (Teepee Mt.)

Figure 1



LEGEND

- OPERATING MINES**
- FORDING COAL LTD.
 - 1 CLODE PIT
 - 2 GREENHILLS PIT
 - KAISER RESOURCES LTD.
 - 3 HARMER PITS 1 & 2
 - 4 ADIT 29 PIT
 - 5 CAMP 8 & ADIT 40A PITS
 - 6 BALMER SOUTH HYDRAULIC UNDERGROUND MINE
 - 7 BALMER NORTH CONVENTIONAL UNDERGROUND MINE
 - COLEMAN COLLIERIES LTD.
 - 8 TENT MOUNTAIN PITS
 - BYRON CREEK COLLIERIES LTD.
 - 9 CORBIN PIT

COAL RIGHT OWNED/LICENCED BY
 [] SHELL - CNRL

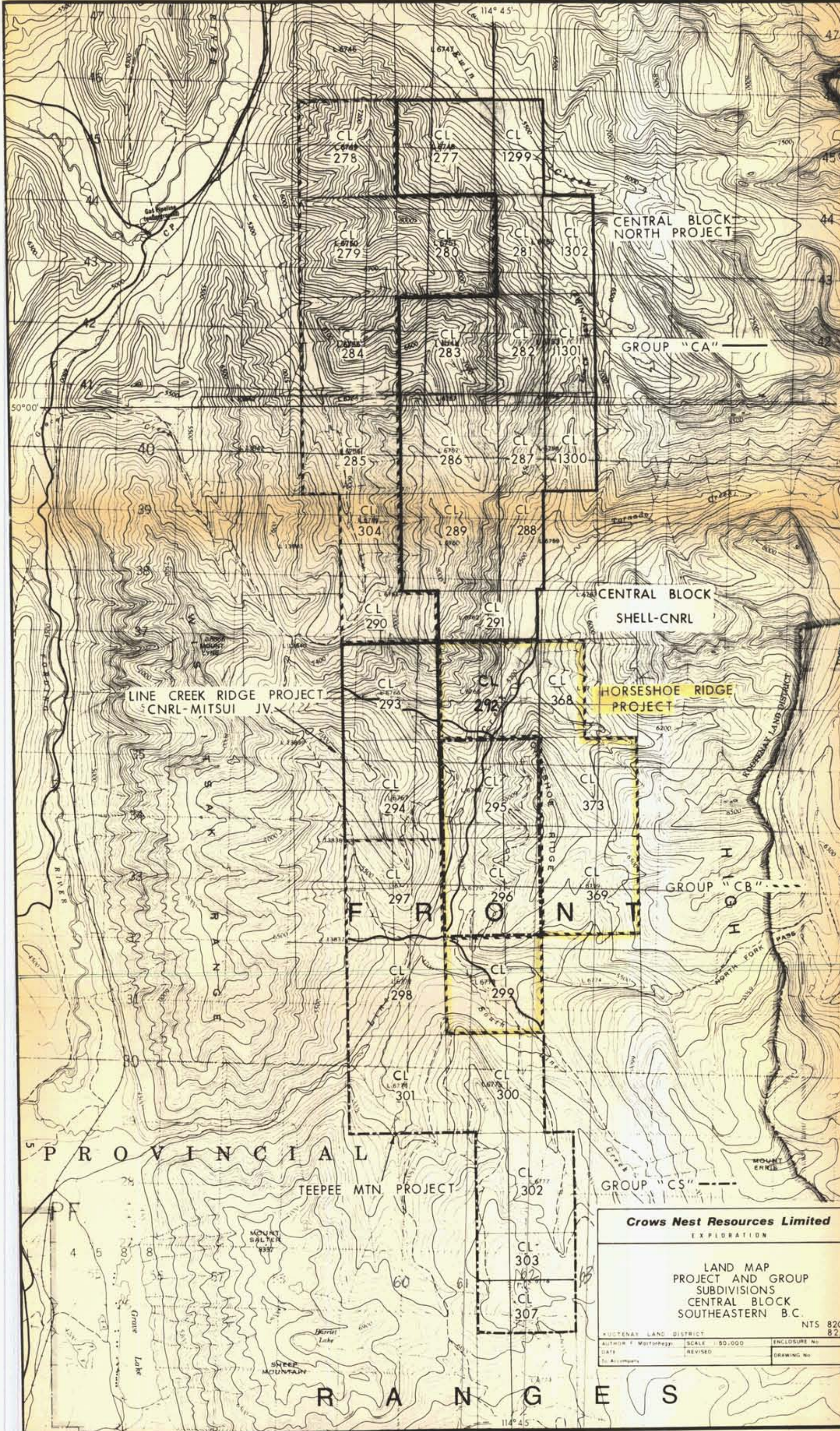
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Crows Nest Resources Limited
 EXPLORATION

HORSESHOE RIDGE
 SOUTHEAST B.C.
 LOCATION MAPS

Figure 2

AUTHOR: Martonhegyi	SCALE: 1:800 000	ENCLOSURE No.
DATE: Feb 11 1979	REVISED	DRAWING No. BA-238
To: accompany		



Crows Nest Resources Limited
EXPLORATION

LAND MAP
PROJECT AND GROUP
SUBDIVISIONS
CENTRAL BLOCK
SOUTHEASTERN B.C.

NTS 82G/82J

AUTHOR: F. Morfhegyi	SCALE: 1:50,000	ENCLOSURE No:
DATE:	REVISED:	DRAWING No:
By: Accompany:		

Topographically, the Horseshoe Ridge area is of rugged relief, with elevation differentials of up to 730 metres from the narrow ridge crest to the valley floor. One major drainage, Line Creek, drains the bulk of the reserve area from the west flank; south Line Creek receives drainage from the east slope and flows into Line Creek, which, in turn, is tributary to the Fording River some 9.5 km west.

WORK DONE

Prior to 1978

Work conducted on Horseshoe Ridge by CNI to the end of 1970 included road building, adit driving, rotary drilling and field mapping. A main access road traversing the west face of the ridge was constructed with numerous intersecting roads and bulldozer trenches exposing seams on both west and east faces. The licence area was flown in 1968 by Spartan Air Services who provided air photos on 1:36 000 and 1:24 000 scale. Geological mapping was done on 1:4 800 scale with cross sections completed on the same scale. Surveying was by CNI personnel.

Four adits totalling 176.6 metres were driven into the #9 and #10 seams on the southern half of the ridge. Adits 1 and 2 drove 33.5 metres into #10 seam and 66.4 metres into #9 seam respectively, and to the northeast Adit 13 drove 31.6 metres into #9 seam and Adit 14 drove 45.1 metres into #10 seam. Crosscuts totalling 56 metres were completed and bulk samples were taken for washability and carbonization tests.

Twelve rotary holes totalling 3,079 metres were drilled between March and September of 1970. All drilling was on the west face with 9 holes concentrated on the southern half of the ridge where they intersected mainly the #8, #9, and #10 seams and ended in the Moose Mountain Member. Recovered coal was sampled and holes logged by gamma ray and neutron.

1978 Program

Exploration was renewed in 1978 by Shell Canada Resources when previously cut roads were reopened by bulldozer and field mapping was carried out on 1:4 800 scale air photos. Three diamond drill holes totalling 619.51 metres were drilled on the west face of the ridge, coring through the #8, #9, and #10 seams to the Moose Mountain Member. Coal was sampled and the holes were logged by gamma ray, density, neutron-neutron and caliper (logging by BPB). Air photography by Northwest Survey Ltd. provided 1:20 000 and 1:40 000 scale photos and 1:2 000 metric contoured maps. Surveying was by Shell personnel.

GEOLOGY

Regional Stratigraphy

The Kootenay Formation of Upper Jurassic - Lower Cretaceous age is the coal-bearing sequence of south-eastern B. C. It is a thick sequence of clastic sediments representing delta progradation over marine shales, siltstones and sandstones of the Jurassic Fernie Formation.

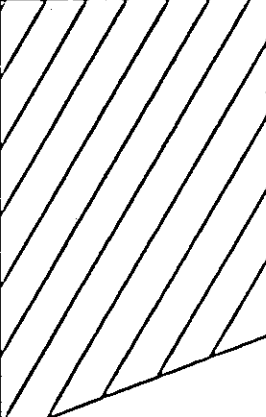
Deposition was initiated by an epeirogenic uplift of the source area in early phases of the Columbian Orogeny in Late Jurassic time. The Kootenay section thickens from east to west; the source of sediments being southwest and the shoreline on the east and northeast. Its thickness within the Upper Elk Coal Field ranges up to 1100 m.

The Kootenay Fm. can be subdivided into three main units (Table 1). A basal, cliff-forming "Moose Mountain Member" is composed predominantly of sandstones with minor siltstones and shales. It is a prograding sequence of delta front sheet sands, barrier bars and tidal channel deposits.

The middle, "Coal-bearing Member" is generally in sharp contact with the underlying Moose Mountain (sandstone-coal, or sandstone - bioturbated silty shale). It consists of alternating beds of sandstone, shale, siltstone and coal representing prograding delta plain environments. The Coal-bearing Member is 245 m - 860 m

Table 1

TABLE OF FORMATIONS

Norris 1959 ALBERTA		Newmarch 1953 BRITISH COLUMBIA		Jansa 1972 ALBERTA- B.C.		Gibson ALBERTA- B.C.	
CADOMIN FM.		CADOMIN FM.		CADOMIN FM.		CADOMIN FM.	
		ELK FORMATION		Elk Member		Pocaterra Creek Mbr.	
		KOOTENAY FORMATION		KOOTENAY FORMATION		KOOTENAY FORMATION	
KOOTENAY FORMATION				KOOTENAY FORMATION		KOOTENAY FORMATION	
Mutz Member				Coal Bearing Member		Coal Bearing member	
Hillcrest Member							
Adanac Member							
Moose Mountain Mbr.		Basal Kootenay Sand		Moose Mountain Mbr.		Basal Sandstone member	
FERNIE FM		FERNIE FM		FERNIE FM		Unit A Unit B	
						FERNIE FM	

D. W. GIBSON

BULLETIN OF CANADIAN PETROLEUM GEOLOGY
VOL. 25, NO. 4 (AUGUST 1977), P. 767-791

thick, including 6 m to 61 m of coal in the south contained within 2 to 8 seams, and up to 90 m of coal in 23 seams on the north.

The upper portion of the Kootenay Fm., the "Elk Member", consists of alternating sandstone, siltstone, shale and conglomerates with minor lenticular coal beds. It represents progradation of the alluvial plain over the delta plain coal-forming environments.

The upper contact of the Kootenay is an erosional surface. It is overlain by the Cretaceous Blairmore Group, beginning with rejuvenated piedmont-plain deposits of the Cadomin Formation (Cadomin Conglomerate).

Regional Structure

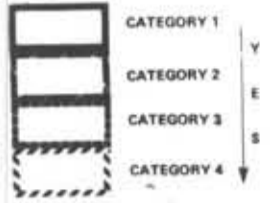
The Coal-Bearing Kootenay Formation occurrences in the front ranges of south-eastern B. C. are preserved in north-south trending synclines referred to as the East Kootenay Coalfields (Figure 3). High structural relief of Paleozoic rocks surrounding the Coalfields fades out in relatively incompetent rocks of the Fernie and Kootenay Formations. The structure within the synclines is complicated to varying degrees by thrust faults and their associated folds, and also by normal faults. This structural complexity increases towards the thinner, east side of the Coalfields where they have been thrust against underlying Paleozoics.

The East Kootenay Coalfields can be subdivided into three coal-bearing areas. From south to north they are the Flathead Coalfield, the Fernie Coalfield and the Upper Elk Coalfield. Since they are all part of the same depositional complex, the subdivision is based on erosional boundaries and structural boundaries.

REGIONAL GEOLOGY MAP

Figure 3

CLASSIFICATION FOR COAL EXPLORATION AND DEVELOPMENT EASTERN SLOPES OF ALBERTA

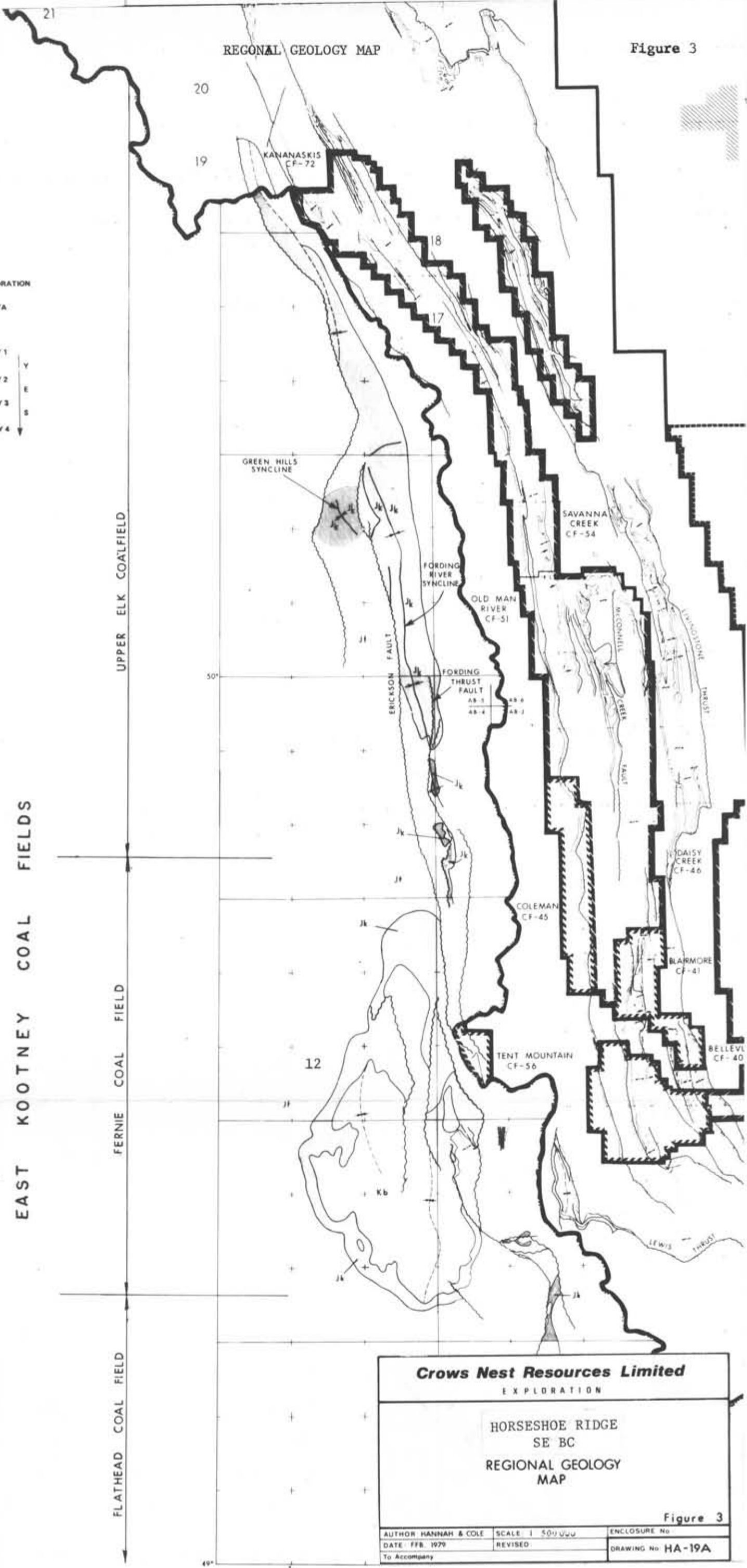


EAST KOOTNEY COAL FIELDS

UPPER ELK COALFIELD

FERNIE COAL FIELD

FLATHEAD COAL FIELD



Crows Nest Resources Limited
 EXPLORATION

HORSESHOE RIDGE
 SE BC
 REGIONAL GEOLOGY
 MAP

Figure 3

AUTHOR HANNAH & COLE	SCALE 1:50,000	ENCLOSURE No
DATE FEB. 1970	REVISED	DRAWING No HA-19A
To Accompany		

UPPER ELK COALFIELD

The Upper Elk Coalfield is an elongate basin composed of two major synclines (Greenhills and Fording) separated by an anticline and the northern extension of the Erickson normal fault. The eastern, Fording syncline, can be traced northward from Alexander Creek to the Kananaskis Lakes. On its south end, it is symmetric with moderate to steep dips on both limbs. To the north it becomes more asymmetric with a west dipping axial plane, vertical strata on the west limb and moderately dipping strata on the east limb.

On the west side of the Erickson Fault, the Greenhills syncline has been downthrown approximately 900 m. It can be traced northerly up to Elk River valley from Fording Mountain to where it is cut off by the Elk River Thrust. The Greenhills Syncline is slightly asymmetric with a west dipping axial plane.

Only erosional remnants of the Kootenay Formation are preserved in the south of the Fording Syncline. A 10° north plunge on the syncline preserves an increasing thickness of Kootenay section to the north. Faulting and folding has caused some repetitions of the section and thickening of the coal seams.

Horseshoe Ridge - Stratigraphy

The Kootenay Formation outcrops along the entire length of Horseshoe Ridge, the base being marked by the prominent Moose Mountain Member sandstone. Below the basal sandstone the recessive Fernie shales form the lower slope and valley to the east of the ridge where they are in fault contact with Paleozoic limestones. Above, the Blairmore Formation and Elk Member have been eroded away leaving the coal measures exposed on the entire west face.

Interbedded resistant sandstones with recessive siltstones, shales and coal give the coal measures a ribbed appearance. A section through the measures from the base to the upper #8 seam correlates very closely with the Line Creek type section, excepting that the lower seams are generally closer together and less defined on Horseshoe Ridge. (Figure 4) The thickness of this lower section containing the #8, #9, #10A and #10B seams is 150 metres, 25.6 metres of which is coal (17%) (Figure 5). Above the #8 seam repeated faults and folds have hindered correlation with Line Creek strata but in these upper coal measures four seams greater than 1 metre thick were encountered with their thickness and distance above the #8 seam being highly irregular.

The #10A seam usually lies approximately 10 metres above the basal sandstone with siltstone and shale filling the section in-between. The seam is often split by a carbonaceous shale and its

CORRELATION CHART A

Horseshoe Ridge to Line Creek Ridge

Figure 4

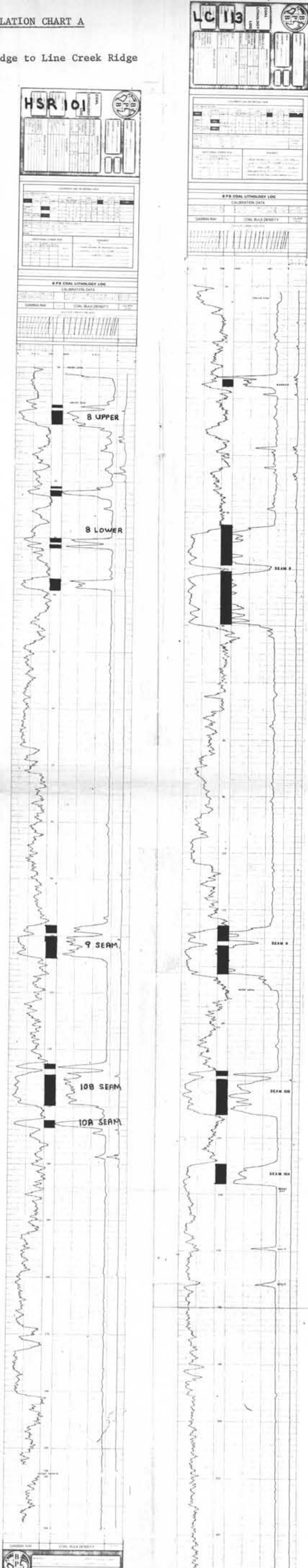


Figure 5

Figure 5

TYPE SECTION

SEAM 8 (upper)

SEAM 8 (lower)

SEAM 9

SEAM 10B

SEAM 10A

Basal Sandstone

Ss, med. to coarse

Ss, vt.

Slsln/Ss, f, interbedded

Carb. Sh.

Coal

Carb. Sh.

Coal

Carb. Sh.

Ss, Slsln, Sh, interbedded

Carb. Sh, Coaly

Coal, Sh, split

Carb. Sh.

Slsln, interbedded Ss.

Ss, med.

Slsln, sandy.

Ss, med.

Slsln, sandy.

Ss, fq, silty

Ss, m-coarse

Ss, f.

Slsln, sandy.

Coal

Carb. Sh.

Coal

Slsln, sandy

Carb. Sh.

Coal

Ss, vt.

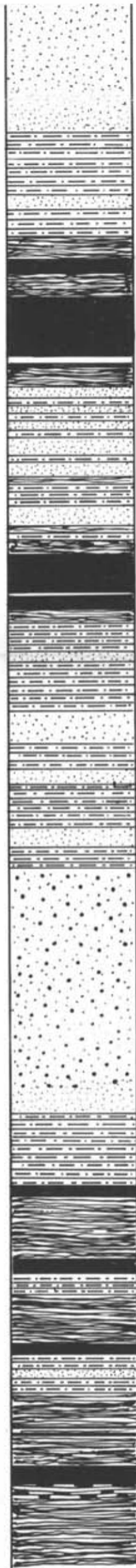
Slsln.

Carb. Sh.

Coal, Sh.

Coal, Sh.

Carb. Sh.



150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
[m]

thickness is quite variable, averaging 2.4 metres. The overlying #10B seam, separated from the #10A by a carbonaceous shale up to 10 metres thick, is consistently thick averaging 7.2 metres and containing a small shale split near the top.

Fine sandstone, siltstone and shale separate the #9 seam from the basal seams. This seam also remains consistently thick, averaging 7.0 metres and often containing a small shale split near the top.

Approximately 40 metres of sandstone, siltstone and shale overlie the #9 seam. This section is dominantly interbedded fine sandstone and siltstone and contains a ridge forming, fine to medium grained sandstone unit near the top.

The #8 seam is split into an upper and lower seam with up to 10 metres of shale/siltstone section inbetween. The lower #8 seam consists of several small seams interbedded with silt and shale (3.7 metres coal in 10 metres). The upper #8 seam averages 5.3 metres and generally has only one small shale split.

Horseshoe Ridge - Structure

Horseshoe Ridge forms part of the east limb of the Fording River Syncline and is characterized by complex folding and faulting. Generally, the ridge is an asymmetric syncline striking north, the west limb near vertical and the east limb forming a large dip-slope condition with coal bearing strata dipping west 25° - 70° . The east limb, which contains the bulk of the coal reserves, is characterized by a series of west dipping high angle thrust faults trending generally $N10^{\circ}W$ and increasing in frequency to the north. These thrusts are sub-parallel to the bedding with greatest occurrence along the lower coal measures resulting in several repetitions of the #10 seams and basal sandstone.

Along the synclinal axis and to the west of it the coal measures are complexly folded and faulted. This shear zone extends the entire length of the property and within it the upper coal measures (above #8 seam) are highly deformed and discontinuous.

RESERVES AND MINEABILITY

Exploration to date delineated 28 million tonnes surface mineable recoverable raw coal reserves of probable category with an average overburden ratio of 6.8:1.

Horseshoe Ridge coal reserves were calculated from fourteen 1:2 000 scale, east-west geologic cross-sections spaced two hundred metres apart. Drill holes on these sections were projected along strike a maximum of one hundred metres. Coal reserves, using a minimum seam thickness of 0.5 metre, are based on the following assumptions and calculations. Due to steeper dips and greater fault density, a higher mining loss factor and dilution factor were used on the northern reserve area.

1. Assumptions

a) In place coal seam density (t/m ³)	1.46 (undiluted)
b) Waste density (t/m ³)	2.60
c) Geologic loss (GL)	10% (by vol.)
d) Mining loss (ML)	
North (section 5534400 northward)	15% (by vol.)
South (section 5534200 southward)	10% (by vol.)
e) Out of seam dilution (SD), North only	5% (by vol.)

2. BCM (insitu) - BCM (ROM) - tonnes (ROM)

(a)	(b)	(c)
a) BCM (insitu) - direct measurement from planimeter		
b) BCM (ROM) North = BCM (insitu) x (1-ML) x (1-GL) x (SD by vol.)		
	= BCM (insitu) x (0.85 x 0.90 x 1.05)	
BCM (ROM) South = BCM (insitu) x (1-ML) x (1-GL)		
	= BCM (insitu) x 0.90 x 0.90	
c) density diluted coal $\frac{(1.46 \times 0.95) + (2.60 \times 0.05)}{1}$ = 1.517 t/m ³		
tonnes (ROM) = BCM (ROM) x density diluted coal		
	= BCM (ROM) x 1.517	

The property can be divided into five reserve areas based on mineability and topography, namely three spurs and two gullies jutting westward from the north-south trend of Horseshoe Ridge. (Figure 9) A summary of the reserves is outlined in Table 2.

The South Spur area proves to be the most promising with over 15 million raw tonnes at 5.90:1. An alternate pit (50-100 metres higher) cuts raw tonnes by one third but lowers the ratio to 5.45:1. Six rotary drill holes, three diamond drill holes and four Adits in this area provide good control on the quantity and quality of the reserves. Here the coal measures retain a 55° dip or less around the #8, #9, and #10 seams where the bulk of the reserves are calculated. Two faults were mapped along these seams but their effect is favorable in that they thicken and repeat the seams.

This area has good potential for containing greater reserves at a lower overburden ratio, since along the synclinal axis thickening of the lower seams may have occurred. In the shear zone west of the axis, reserves were cut by 50% due to poor geological control and possible mining losses. This calculation was conservative and the zone could contain significantly greater mineable reserves.

Control in the South Gully and Central Spur areas remains good with one diamond and five rotary drill holes. Reserves are mainly from the #8, #9, and #10 seams where dips have steepened, ranging from 50° to 70° , and more frequent thrusting has repeated the #8 seams and lower #10A seam.

Table 2

HORSESHOE RIDGE RESERVES

RESERVE AREA	SECTION NUMBER	DRILL HOLE CONTROL	PIT FLOOR ELEVATION (Meters)	WASTE ROCK (BCM) x 1000	RAW TONNES COAL x 1000	PIT RATIO				
1 NORTH SPUR	5535200	1	1660	29,491	12,859	3,912	7.54	7.30		
	5535000	2	1640		16,632				2,151	7.73
2 NORTH GULLY	5534800	0	1740	25,230	11,155	2,390	10.56	12.15		
	5534600	0	1690		14,075				1,457	9.66
3 CENTRAL SPUR	5534400	1	1780	21,561	12,546	2,861	7.54	7.86		
	5534200	3	1780		9,015				1,264	7.13
4 SOUTH GULLY	5534000	4	1700	23,531	9,897	3,212	7.33	7.05		
	5533800	2	1700		13,634				1,809	7.53
5 SOUTH SPUR	5533600	2	1560	90,993	28,898	15,412	5.90	5.92		
	5533400	4	1560		30,877				4,722	6.54
	5533200	1	1580		15,078				2,948	5.11
	5533000	1	1580		7,334				1,021	7.18
	5532800	0	1550		6,318				1,267	4.99
	5532600	1	1570		2,488				571	4.36
TOTAL				190,806	27,787	6.87				
DELETING AREA 2				165,576	25,397	6.52				

ALTERNATE AREA 5

RESERVE AREA	SECTION NUMBER	DRILL HOLE CONTROL	PIT FLOOR ELEVATION (Meters)	WASTE ROCK (BCM) x 1000	RAW TONNES COAL x 1000	PIT RATIO				
5 SOUTH SPUR	5533600	2	1700	55,437	18,071	10,167	5.45	5.24		
	5533400	4	1670		19,284				3,109	6.20
	5533200	1	1650		10,583				2,124	4.98
	5533000	1	1640		3,911				626	6.25
	5532800	0	1630		2,603				609	4.27
	5532600	1	1620		985				252	3.91

The North Gully area has no drill hole control but outcrop information and projections suggest it to be a poor prospect. Dips remain 60° or greater and are often steepened by numerous thrust faults which have sheared the basal seams and sandstone.

The North Spur area has fair control with one diamond drill hole and one rotary drill hole. Dips of the coal seams and basal sandstone range between 60° - 70° and the measures are badly sheared by a predominance of thrust faults.

Seams #9 and #10B are probably amenable for hydraulic underground mining in less steep and structurally less disturbed areas. Such resources and those which are surface mineable at higher overburden ratios exist but were not considered at this stage.

COAL QUALITY

Analyses of drill hole and adit samples (Table 3) indicate the Horseshoe Ridge coal to be of low to medium volatile bituminous rank, low (less than 0.5%) in sulphur and of good metallurgical character. Raw coal mined is expected to yield 75% clean coal with ash content less than 10% and FSI over 5 1/2. Eighty-five percent of the open pit mineable reserves is expected to be unoxidized.

Due to extraneous material picked up by reverse circulation drilling no emphasis was placed on raw values from rotary coal samples. These samples were washed at 1.45 s.g. and proximates and FSI done on the float fractions. Diamond drill coal sample analyses were determined on raw, 1.4 s.g. floats and 1.5 s.g. floats. Unoxidized coal was reached in three of the four adits and bulk samples from Adit #2 (#9 seam), Adit #13 (#9 seam) and Adit #14 (#10 seam) were sent to the Department of Energy, Mines and Resources in Ottawa.

Average coal quality values from the three sample sources for the #8, #9, and #10 seams are listed in the following table.

Table 3

WEIGHTED AVERAGE ANALYSES

SEAM #	MOISTURE	VOLITILES a.d.b.	ASH d.b.	FSI
8 Upper	1.5	25.5	7.6	7 1/2
8 Lower	1.2	24.6	9.5	6 1/2
9	1.4	22.4	8.0	5.0
10B	1.4	21.9	7.7	5.0
10A	1.2	21.9	10.5	6 1/2

CNI drill holes @ 1.45 s.g.

* SHELL drill holes 101, 102, 103 @ 1.5 s.g.

RECOMMENDATIONS

Detailed mapping of outcrops and trenches, followed by a two phase drill program is recommended for the 1979 field season. Bulldozer trenches along existing roads and hand trenches near the ridge top are required prior to further drilling to increase control for proper drill locating. Detail mapping and correlation of the numerous sandstone outcrops should precede a first phase drill program of 6 rotary holes totalling 1600 metres (Table 4). A second phase diamond drill program of 4 cored holes totalling 1100 metres should follow, based on information gained from the previous holes.

Since the South Spur area contains the bulk of the coal reserves at the lowest overburden ratio it should receive the greatest attention. Along the synclinal axis and in the shear zone to the west it is likely that thickening of the seams has occurred, substantially increasing the reserves. Conversely, if the coal is badly sheared the mineable reserves will be lowered. Three holes totalling 750 metres should be drilled in this area.

The reserve areas to the north, excepting the North Gully area, each require one rotary drill hole. Here, three holes totalling 850 metres can be located on existing roads to intersect the upper #8 seam down to the basal sandstone. The North Gully area should be trenched and mapped in detail and possibly drilled during the second phase drill program.

PROPOSED ROTARY DRILL HOLES

	SECTION #	ELEVATION (metres)	ANGLE	DEPTH (metres)
HSR 1	5532800	1650	vertical	150
HSR 2	5533000	1710	vertical	250
HSR 3	5533400	1825	65°	350
HSR 4	5533600	1895	70°	350
HSR 5	5534400	1930	55°	250
HSR 6	5534800	1870	55°	250
			TOTAL	1600 metres

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PA - SHELL - LINE CREEK (HORSESHOE RIDGE) 78(4)B

HORSESHOE RIDGE

APPENDIX B

DRILL HOLE SUMMARIES
(15 Drill Holes)

DRILL HOLE SUMMARY

HOLE No. 51
LOCATION 5533524.79N; 661825.06E
ELEVATION 1947.5 M
DRILL DATE March 19/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N20°E
WATER LEVEL 94.5 M
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
8 UPPER	34.90	43.28	8.38	5.39				
8 LOWER	55.78	58.37	2.59	1.66	1.3	24.8	6.0	8.0
	67.21	70.41	3.20	2.06	1.1	22.7	15.9	4.5
9	174.80	177.09	2.29	1.44	1.1	20.8	7.7	4.5
	177.85	187.76	9.91	6.24				
10B	204.98	207.20	2.22	1.40	1.2	21.2	7.0	4.5
	208.33	217.93	9.60	6.04	1.2	21.2	9.2	5.0
10A	222.50	224.49	1.99	1.25	1.4	22.9	8.0	7.5
	225.09	226.71	1.62	1.02				

Note: Specific Gravity for
 Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 52
LOCATION 5534293.48 N; 661855.13 E
ELEVATION 1958.2
DRILL DATE March 20/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N05°W
WATER LEVEL 72.0 M
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
8 UPPER	41.76	48.31	6.55	3.47	1.8	25.6	9.3	6.5
8 UPPER	121.46	124.51	3.05	1.62	1.0	26.5	7.4	8.0
	126.13	127.92	1.79	0.95				
	132.59	136.58	3.99	2.11	1.40	26.8	8.5	7.0
8 LOWER	145.79	147.52	1.73	0.92	1.1	26.8	10.6	7.0
	151.94	154.08	2.14	1.13	1.0	26.3	9.6	6.0

Note: Specific Gravity for
 Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 53
LOCATION 5535113.73 N; 661781.12 E
ELEVATION 1929.2 M
DRILL DATE March 31/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N05°W
WATER LEVEL 72.0 M
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
? [	22.07	25.09	3.02	1.23				
? [	112.93	114.64	1.71	0.86	0.80	27.4	10.5	8.0
[	167.34	179.19	11.85	8.81	1.7	22.5	10.7	4.0
10B [	183.18	186.39	3.21	2.35	2.2	23.4	4.8	6.0
[	189.74	196.75	7.01	5.13				
10A [	200.68	204.37	3.69	2.70	1.4	24.2	10.4	6.5
[	205.50	207.97	2.47	1.81				
10A [	214.43	217.63	3.20	2.34				
[	218.85	222.05	3.20	2.34	1.50	23.2	9.0	6.5

Note: Specific Gravity for Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 54
LOCATION 5533823.62 N; 661850.88 E
ELEVATION 1852.9 M
DRILL DATE March 31/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N03°E
WATER LEVEL 80.0 M
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
8 UPPER	18.29	20.82	2.53	1.30	0.90	25.2	6.8	7.0
8 LOWER	50.14	52.73	2.59	1.33				
	55.17	56.24	1.07	0.55				
9	171.75	183.79	12.04	6.38	1.30	22.9	8.0	6.0
	191.26	193.40	2.14	1.13				
10B	197.36	211.99	14.63	7.75	1.1	22.8	7.8	6.0
10A	216.80	220.98	4.18	2.22	1.0	23.5	8.3	8.0

Note: Specific Gravity for
 Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 55
LOCATION 5533310.83 N; 661834.02 E
ELEVATION 1935.9 M
DRILL DATE April 15/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N20°E
WATER LEVEL 40.0 M
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
9	76.50	87.72	11.22	8.21	1.2	21.9	8.3	4.5
10B	112.01	113.48	1.47	1.04	0.7	22.6	8.0	5.0
	114.91	123.29	8.38	5.93				

Note: Specific Gravity for Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 56
 LOCATION 5533340.32 N; 661832.12 E
 ELEVATION 1936.3 M
 DRILL DATE April 15/1970
 HOLE DIRECTION VERTICAL
 OUTCROP ATTITUDE N20°E
 WATER LEVEL 33.5 M
 LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
9	88.70	99.76	11.06	8.09	1.0	21.2	7.1	5.0
10B	122.83	124.51	1.68	1.19				
	125.58	134.17	8.59	6.07	1.1	20.6	9.0	4.5
10A	138.47	142.13	3.66	2.59				

Note: Specific Gravity for Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 57
LOCATION 5533192.21 N; 661532.88 E
ELEVATION 1789.2 M
DRILL DATE May 18/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N30°E
WATER LEVEL NIL
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
8 UPPER	62.48	63.55	1.07	0.91	1.2	26.5	5.8	8.5
	65.14	69.59	4.45	3.77	1.6	25.7	6.7	8.0
	72.85	76.20	3.35	2.84				
8 LOWER	79.61	81.53	1.92	1.63	1.1	23.6	8.7	6.0
	82.45	83.55	1.10	0.93				
	85.19	87.33	2.14	1.81				
	89.67	91.35	1.68	1.42				
9	95.77	98.76	2.99	2.54	1.7	21.9	10.5	5.5
	196.60	197.97	1.37	1.16				
10B	198.88	205.53	6.65	5.64	1.8	21.7	7.8	5.5
	224.27	226.47	2.20	1.87				
	227.23	236.98	9.75	8.27				

Note: Specific Gravity for
 Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 58
LOCATION 5533401.46 N; 661346.23 E
ELEVATION 1804.4 M
DRILL DATE May 3/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N90°E
WATER LEVEL 58.0 M
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
	11.13	12.13	1.00	1.00				
	44.04	45.81	1.77	1.77				
	147.07	147.61	0.54					
	148.29	149.20	0.91	0.89	0.90	27.7	6.3	8.0
	150.05	151.18	1.13	1.11				
	158.80	160.17	1.37	1.33				
8 UPPER	191.32	192.69	1.37	1.31				
	193.85	203.00	9.15	8.75	0.80	25.4	6.4	7.0

Note: Specific Gravity for
 Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 59
LOCATION 5533695.70N; 661551.28 E
ELEVATION 1853.5 M
DRILL DATE May 11/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N10°E
WATER LEVEL 95.0 M
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
6?	162.70	164.74	2.04	1.31	1.3	26.0	4.8	7.5
	202.23	203.91	1.68	1.08				
	211.68	214.06	2.38	1.53				
	215.22	216.93	1.71	1.10				
	252.68	258.32	5.64	3.63				
8 UPPER	259.69	261.00	1.31	0.84				

Note: Specific Gravity for Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 65
LOCATION 5532663.47 N; 661365.21 E
ELEVATION 1727.8 M
DRILL DATE June 16/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N20°E
WATER LEVEL 41.0 M
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
9	53.12	59.89	6.77	4.07	1.3	25.0	7.0	6.5
10R	86.11	87.39	1.28	0.82				
	88.39	96.62	8.23	5.29	1.7	22.4	7.2	5.0
10A	100.13	101.96	1.83	1.18	1.2	21.5	15.2	5.5

Note: Specific Gravity for Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 66
LOCATION 5534088.38 N; 661857.38 E
ELEVATION 1869.3 M
DRILL DATE July 17/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N05°W
WATER LEVEL NIL
LOGS RUN GAMMA RAY, NEUTRON, DENSITY

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
8 UPPER	7.16	13.20	6.04	3.02	1.7	26.9	5.6	7.5
	14.63	17.22	2.59	1.30				
8 UPPER	62.48	70.71	8.23	4.12	2.6	24.8	6.1	8.5
	80.1	82.75	2.65	1.33	1.8	25.4	7.0	7.5
8 LOWER	91.53	92.51	0.98	0.49				
	94.34	95.86	1.52	0.76				
9	210.16	219.91	9.72	4.86		23.1	6.5	5.5
10B	226.16	228.08	1.92	0.96	1.3	22.4	6.7	4.0
	230.58	241.46	10.88	5.44				
10A	247.04	251.25	4.21	2.11	0.80	22.4	14.1	7.5

Note: Specific Gravity for Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 67
LOCATION 5533393.84 N; 661646.31 E
ELEVATION 1925.3 M
DRILL DATE June 17/1970
HOLE DIRECTION VERTICAL
OUTCROP ATTITUDE N30°E
WATER LEVEL 107.0 M
LOGS RUN GAMMA RAY, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
5?	9.60	10.97	1.37					
6?	50.29	53.34	3.05	2.19	2.2	24.8	7.6	1.0
	76.35	81.02	4.67	3.36	2.0	24.1	7.5	
8 UPPER	141.34	142.49	1.15	0.81	1.8	22.3	12.0	7.5
	143.71	148.74	5.03	3.56				
8 LOWER	174.71	178.03	3.32	2.35	1.1	22.8	8.5	5.5
9	278.07	291.24	13.17	10.38	1.6	21.2	7.2	5.5
10B	307.54	309.00	1.46	1.10	1.6	20.8	6.7	4.5
	310.44	320.19	9.75	7.36				
10A	324.46	326.59	2.13	1.61	1.2	21.2	6.0	7.5

Note: Specific Gravity for
 Coal Analysis is 1.45

DRILL HOLE SUMMARY

HOLE No. 101
LOCATION 5533018.1 N; 661474.5 E
ELEVATION 1716.3 M
DRILL DATE Sept. 10/1978
HOLE DIRECTION 22° 06' / 55° 30'
OUTCROP ATTITUDE
WATER LEVEL ground level
LOGS RUN GAMMA RAY, DENSITY LOGS (LSD & BRD), CALIPER, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES	ASH	FSI
						a.d.b.	d.b.	
8 UPPER	7.62	9.75	2.13	2.06				
8 LOWER	21.55	22.51	0.96	0.93				
	30.05	30.84	0.79	0.76				
	31.25	31.82	0.57	0.55				
	37.10	39.20	2.10	2.03				
9	98.25	99.50	1.25	1.21		21.13	9.59	3.5
	100.05	103.78	3.73	3.60		21.62	7.40	5.0
10B	122.65	123.51	0.86	0.83		20.43	8.15	3.5
	124.48	129.50	5.02	4.85		21.22	8.05	3.5
10A	132.45	133.71	1.26	1.22		20.11	12.33	6.0
10B	210.71	216.86	6.15	5.94				
	217.15	217.93	0.78	0.75		19.45	12.01	3.5
10A	218.51	220.98	2.47	2.39		20.81	13.12	5.0

Note: Specific Gravity for
 Coal Analysis is 1.50

DRILL HOLE SUMMARY

HOLE No. 102
LOCATION 5534194.5 N; 661942.5 E
ELEVATION 1951.9 M
DRILL DATE Sept. 13/1978
HOLE DIRECTION $083^{\circ} 43' / 57^{\circ} 12'$
OUTCROP ATTITUDE STRIKE 355° DIP 58° W
WATER LEVEL 24.0 M
LOGS RUN GAMMA RAY, DENSITY (LSD & BRD), NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES a.d.b.	ASH d.b.	FSI
8 LOWER	7.00	7.40	0.40	0.36				
	7.80	11.90	4.10	3.72				
	16.05	16.72	0.62	0.60				
	18.71	19.42	0.71	0.64				
9	91.33	98.65	7.32	6.74		24.04	6.54	5.0
10B	101.45	102.13	0.68	0.62		23.50	7.87	4.5
	103.63	104.85	1.22	1.11		23.74	8.24	5.5
	105.60	109.60	4.00	3.65		23.33	8.25	6.5
10A	112.60	113.93	1.33	1.22				
	114.70	115.45	0.75	0.69				

Note: Specific Gravity for
 Coal Analysis is 1.50

DRILL HOLE SUMMARY

HOLE No. 103
LOCATION 5534995.1 N; 661923.7 E
ELEVATION 1989.4M
DRILL DATE Sept. 18/1978
HOLE DIRECTION N44°E; Dip 56° From Horz.
OUTCROP ATTITUDE
WATER LEVEL 28.0 m

LOGS RUN GAMMA RAY, DENSITY LOGS (LSD & BRD), CALIPER, NEUTRON

SEAM No.	TOP	BASE	APP. THICK	TRUE THICK	MOISTURE	VOLITILES a.d.b.	ASH d.b.	FSI
10A	14.38	17.63	3.25	2.95		21.06	9.45	0
	20.61	21.39	0.78	0.71		22.11	9.55	0
	21.95	22.90	0.95	0.86				
10A	35.32	36.30	0.98	0.89		20.77	10.87	1.5
	39.05	39.81	0.76	0.69		22.66	10.59	4.5
	40.49	41.60	1.11	1.01				
10A	129.40	131.72	2.32	2.18		22.09	9.77	4.0
	135.10	136.20	1.10	1.03		22.70	8.75	7.0
	137.00	138.40	1.40	1.32				

Note: Specific Gravity for Coal Analysis is 1.50

APPENDIX D
COAL SEAM THICKNESS SUMMARY

SEAM THICKNESS (meters)

SEAM #	53	103	52	102	66	54	59	51	58	67	56	55	57	101	65	AVERAGE
6																
7																
8 UPPER			4.10		4.22		4.47	5.39	10.06	4.37			7.52	2.06		5.27
8 LOWER			2.05	4.10	2.58	1.88		3.72		2.35			8.33	4.42		3.67
9	8.81			6.74	4.86	7.51		7.68		10.38	8.09	8.21	6.80	4.81	4.07	7.01
10B	7.48			5.11	6.40	7.75		7.44		8.46	7.26	6.97	10.14	6.41	6.11	7.23
10A	4.60	3.97		1.91	2.11	2.22		2.27		1.61	2.59			1.81	1.18	2.42

APPENDIX I

Reports on Geodetic Survey

Survey Control for Crows Nest Resources Limited
Fernie - Sparwood, B.C.

Photogrammetric Mapping Project (1978)
Fernie - Sparwood Area, S.E. B.C.

Title Page, Table of Contents, Cost Allocations and Reference Only

REPORTS ON GEODETIC SURVEY

WORK DONE FROM JUNE 27, 1978 TO JANUARY 31, 1979

SURVEY CONTROL FOR CROWS NEST RESOURCES LIMITED

FERNIE - SPARWOOD, BRITISH COLUMBIA

PHOTOGRAMMETRIC MAPPING PROJECT (1978)

FERNIE - SPARWOOD AREA - S.E. BRITISH COLUMBIA

COVERING ALL COAL LAND IN S.E. BRITISH COLUMBIA

HELD BY SHELL CANADA RESOURCES LIMITED

OPERATED BY CROWS NEST RESOURCES LIMITED

MORRISSEY FREEHOLD

B.C. COAL LICENCES

264 TO 313 INCL., 365 TO 373 INCL., 408, 412 TO 414 INCL.

490 TO 495 INCL., 588 TO 601, 1299 - 1302 INCL., 4080 TO 4089 INCL., 4090, 4092

KOOTENAY LAND DISTRICT, B.C.

NTS 82G AND 82J

LAT. $49^{\circ} 05'$; TO $50^{\circ} 10'$ N, LONG. $114^{\circ} 30'$ TO $115^{\circ} 10'$ W

BY

SHELL CANADA RESOURCES LIMITED - SURVEYING DEPARTMENT
GENERAL SURVEY CONTRACTOR

NORTHWEST SURVEY CORPORATION (YUKON) LIMITED
SUBCONTRACTOR ON PHOTOGRAMMETRIC MAPPING

1979-04-26

CROWS NEST RESOURCES LIMITED - EXPLORATION
SHELL CANADA RESOURCES LIMITED - SURVEYING

GROUND CONTROL SURVEY AND PHOTOGRAMMETRIC MAPPING
SOUTHEASTERN BRITISH COLUMBIA

DISTRIBUTION OF AFE Z4670: UNDIVIDED COSTS
TO PROJECTS AND GROUPS OF LICENCES
ON THE BASIS OF HOLDING ACREAGES

<u>*HOLDINGS/PROJECTS</u>	<u>AFE</u>	<u>ACREAGE</u>	<u>%</u>	<u>\$ COSTS</u>
NORTH BLOCK=GROUP "NA"	4853A	7,840	8.0	29,440
CENTRAL BLOCK NORTH	4851J	10,264	10.5	38,640
HORESESHOE RIDGE	4851E	6,532	6.7	24,656
LINE CREEK J.V.	4851D	1,854	1.9	6,992
(Central Block Total)		(18,650)	(19.4)	(71,392)
(Group "CA")		(6,088)	(6.2)	(22,816)
(Group "CB")		(8,082)	(8.6)	(31,648)
(Group "CS")		(4,480)	(4.6)	(16,928)
CROWN MOUNTAIN TOTAL	4851Z	6,317	6.5	23,920
(Group #31)		(3,117)	(3.2)	(11,776)
(Group #32)		(3,200)	(3.3)	(12,144)
CORBIN=GROUP #6	4851Q	1,760	1.8	6,629
(Coal Mountain)		(640)	(0.7)	(2,578)
(Tent Mountain)		(1,120)	(1.1)	(4,051)
MORRISSEY FREEHOLD	4851U	43,200	44.1	162,288
LODGEPOLE=GROUP #104	4851S	3,345	3.4	12,512
LILLYBURT	4851R	6,122	6.3	23,184
HARVEY CREEK TOTAL	4851T	7,307	7.5	27,600
(Group #105 Renewal)		2,992	(3.1)	11,408
(Remainder)		4,315	(4.4)	16,192
CABIN CREEK=Group #106	4851V	3,200	3.3	12,144
<u>TOTAL</u>	<u>Z4670</u>	<u>97,741</u>	<u>100.0</u>	<u>368,000</u>

= 39,556ha

\$3.77/acre

*All B.C. Coal Licences except Morrissey Freehold

\$9.30/ha

1979-01-31

F. Martonhegyi
Exploration

D. Poulson
Surveying

H. Hofer
Finance Analyst

J. J. Crabb
Manager - Exploration

REFERENCE

THESE REPORTS COVER IN ONE UNIT ALL B.C. COAL LICENCES IN SOUTH-
EASTERN BRITISH COLUMBIA

HELD BY SHELL CANADA RESOURCES LIMITED
OPERATED BY CROWS NEST RESOURCES LIMITED

TWO SETS WERE FILED WITH

ADMINISTRATOR FOR COAL
MINISTRY OF ENERGY, MINES & PETROLEUM RESOURCES
GOVERNMENT OF BRITISH COLUMBIA
VICTORIA, B.C.

ON APRIL 30, 1979, TO WHOM FURTHER COPIES WILL BE SUPPLIED AT
REQUEST.

CROWS NEST RESOURCES LIMITED

APPENDIX J

Location Surveys

Horseshoe Ridge - Sparwood Area - S.E. B.C.

INTER-OFFICE CORRESPONDENCE

Date APRIL 24, 1979

To CROWNEST RESOURCES LIMITED (CNRL)

From SHELL CANADA RESOURCES LIMITED
 SURVEYING SECTION


Subject LOCATION SURVEYS
 HORSESHOE BLOCK - SPARWOOD AREA, S.E. BRITISH COLUMBIA
 DRILL HOLE: HSR 101
 HSR 102
 HSR 103

Two CNI Stations (T6 & T7) on Horseshoe Ridge (Stations SCRL 103 & 104 respectively) were found and occupied by Doppler Satellite as part of the photo mapping and control network. They were tied by Doppler Satellite to Geodetic Control Station 'Northwest' with 2nd order accuracy. Station 104 was positioned by closed traverse between stations Northwest and Tornado and held fixed as the datum for the surveying of the above drill locations.

Conventional survey methods using 1" theodolite and electronic distance measuring equipment were used to obtain co-ordinates and elevations for these drill locations.

Calculations were done in the U.T.M. system with distances and bearings converted to plane and results were reported to CNRL in tabular form for plotting, a copy of which is enclosed.

The total cost of the work was \$6437



D.C. Poulsom

BKbp

Attachment:

HORSESHOE RIDGE DRILL HOLES
 REFERENCED TO 117° WEST LONG

<u>DRILL HOLE</u>	<u>NORTHINGS</u>	<u>EASTINGS</u>	<u>ELEVATION(m)</u>
HSR 101	5533018.1	661474.5	1716.3
HSR 102	5534194.5	661942.50	1951.9
HSR 103 (Approx)	5534995.1	661923.7	1989.4

<u>DRILL HOLE</u>	<u>AZIMUTH</u>	<u>SLOPE</u>
HSR 101	83°43'	57°12'
HSR 102	122°06'	55°30'

CONTROL STATIONS

<u>NAME</u>	<u>NORTHING</u>	<u>EASTING</u>	<u>ELEVATIONS (m)</u>
104 (Doppler)	5532740.96	662007.42	2020.8
NORTHWEST (DOPPLER)	5539195.22	645450.24	2415.5
104 (TRAVERSE)	5532740.96	662007.42	2020.8



LEGEND

DATA SOURCE	FOLDS	FAULTS	FORMATION CONTACTS
C.N.I.	X X		
SHELL	X X		
G.S.C.	X X		
B.C.D.M.R.	X X		

- STRIKE & DIP
- NORMAL FAULT
- THRUST FAULT
- Kb - BLAIRMORE
- Jk - KOOTENAY
- Jf - FERNIE

SHELL CANADA RESOURCES LIMITED
 COAL DEVELOPMENT
 GEOLOGY COMPILATION MAP **FIGURE 6**
 CENTRAL BLOCK
 - LINE CR.
 - HORSESHOE RIDGE
 - EWING PASS
 CROWN MTN. (NORTH)

420

NTS. 82G/15
 AUTHOR: HANNAH McCULLOUGH COLE SCALE: 1:50,000 DRAWING No.: VC-17C
 DATE: Sept. 1977 REVISED: ENCLOSURE No.:
 To Accompany

APPENDIX F
COST STATEMENT

420



GROUP "CS"

COST STATEMENT
APPENDIX F

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 23)

APPLICATION TO GROUP LICENCES

Licensee(s) SHELL CANADA RESOURCES LIMITED

Land district KOOTENAY

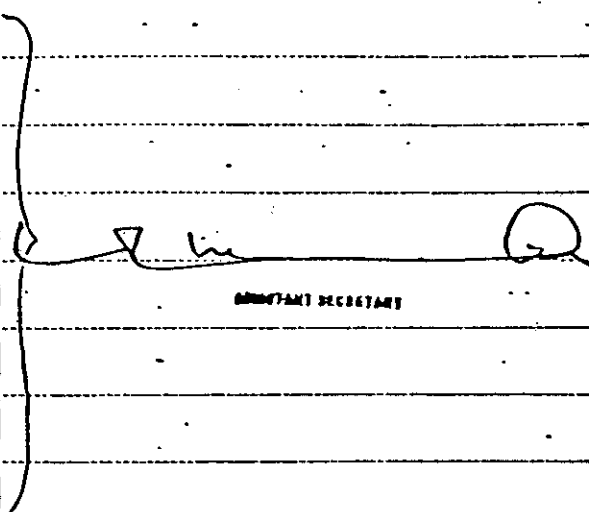
Location S.W. OF ELKFORD, B.C.

420

Date of application JANUARY 31, 1979

I/We, the undersigned licensee(s)* of the following coal licences, desire to group them according to the provisions of the *Coal Act*:

I/We, desire to consolidate the licences to obtain a uniform anniversary date: Yes No

Licence Number	HA.	AC.	Anniversary Date	Signature of Licensee
295	260	640	January 31	 ASSISTANT SECRETARY
296	260	640	"	
298	260	640	"	
300	260	640	"	
301	260	640	"	
302	260	640	"	
303	130	320	"	
370	130	320	"	
8 Licences	1620	4480		

* May be signed by a person authorized to sign on behalf of the licensee.

FOR DEPARTMENTAL USE ONLY

All Licences were issued in 1975

Approved uniform date.....

Recording Fee: \$5 for each licence in the group.



(NEW, PRELIMINARILY CALLED "CS")

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 19)

APPLICATION TO EXTEND TERM OF LICENCE

1. I, GORDON A. SCHWARTZ agent for SHELL CANADA RESOURCES LIMITED
(Name) (Name)
P.O. Box 100 P.O. Box 100
(Address) (Address)
CALGARY, ALBERTA T2P 2H5 CALGARY, ALBERTA T2P 2H5

Valid FMC No. 171 929

hereby apply to the Minister to extend the term of Coal Licences No(s) 295, 296, 298, 300, 301, 302, 303, 370; EIGHT LICENCES COVERING APPROXIMATELY 4,480 ACRES OR 1820 HA. for a further period of one year.

2. I have performed, or caused to be performed, during the period FEBRUARY 1, 1978 to JANUARY 30, 1979, work to the value of at least \$ 139,853 on the location of coal licences as follows:

CATEGORY OF WORK

Table with 3 columns: Category of Work, Licence No(s), and Apportioned Cost. Rows include Geological mapping, Surveys (Geophysical, Geochemical, Other), Road construction, Surface work, Underground work, Drilling, Logging, sampling, and testing, Reclamation, and Other work (specify).

3. I wish to apply \$ 139,456 of this value of work on Coal Licence(s) 295, 296, 298, 300, 301, 302, 303, 370; APPLICATION FILED CONCURRENTLY TO GROUP THESE EIGHT LICENCES INTO ONE NEW GROUP.

N.A. 4. I wish to pay cash in lieu of work in the amount of \$ on Coal Licence(s) No(s).

N.A. 5. I wish to apply \$ of this value of work to claim a refund of cash in lieu of work in the amount of \$ which was paid to extend the term of Coal Licence(s) No(s) from

to, 19 Mining Receipt No. for prior payment of cash in lieu of work is attached for adjustment.

6. The work performed on the location(s) is detailed in the attached report entitled GEODETIC GROUND CONTROL SURVEY AND PHOTOGRAMMETRIC MAPPING - CENTRAL BLOCK, VIOLETWAY LAND DISTRICT, B.C. COAL PROJECT PROGRESS REPORT - HORSESHOE RIDGE, VIOLETWAY LAND DISTRICT, B.C. - EXPLORATION AND GEOLOGICAL EVALUATION; BOTH OF THESE REPORTS ARE IN PREPARATION AND WILL BE SUBMITTED IN NINETY DAYS.

1979-01-31

(Date)

G.A. Schwartz

(Signature and position)

LANDMAN

* Applications to group licences may be filed to apportion costs on a maximum of 10 licences.

(FORMS TO BE SUBMITTED IN DUPLICATE)

FOR DEPARTMENTAL USE ONLY

Value of work reported \$ Value of work applied on licences \$
Value of work approved \$ Value of credit remaining \$

Work performed. Yes No

The program of operations detailed hereunder was carried out during the period from FEBRUARY 1, 1978 to JANUARY 30, 1979. Total costs are \$ 139,853, an average of \$ 31.22 per acre, or \$ 77.14 per hectare.

GEOLOGICAL MAPPING Yes No Cost \$ 14,565

	Area (Acres)	Scale	Time
Reconnaissance	<u>4000 Ac = 1620 Ha</u>	<u>1:5,000</u>	<u>70 MAN-DAYS</u>
Detail: Surface	<u>-</u>	<u>-</u>	<u>-</u>
Underground	<u>-</u>	<u>-</u>	<u>-</u>
Other (specify)	<u>-</u>	<u>-</u>	<u>-</u>

GEOPHYSICAL OR GEOCHEMICAL SURVEYS Yes No Cost \$ NIL

Method - Line miles -

OTHER SURVEYS Yes No Cost \$ 23,278

Grid - Topographic PHOTOGRAMMETRIC GEODETIC GROUND CONTROL AND LOCATION MAPPING

ROAD CONSTRUCTION Yes No Cost \$ 10,829 UPGRADING & MAINTENANCE

Length: On Licences - Access (off licences) -

SURFACE WORK Yes No Cost \$ NIL

Length - Licence Number(s) -

Trenching -

Seam tracing -

Crosscutting -

Other -

UNDERGROUND WORK Yes No Cost \$ NIL

Test adits: Number - Average length - Total footage -

Other workings: Area - Total footage -

DRILLING Yes No Cost \$ 60,955

	Hole Size	Number of Holes	Total Footage
Core: Diamond <input checked="" type="checkbox"/> Wireline <input type="checkbox"/>	<u>HQ</u>	<u>3</u>	<u>2032 feet = 614 m.</u>
Rotary: Conventional <input type="checkbox"/>	<u>-</u>	<u>-</u>	<u>-</u>
Reverse circulation <input type="checkbox"/>	<u>-</u>	<u>-</u>	<u>-</u>
Other <u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>

Contractor TONTO DRILLING Where core stored CURL LAB FERNIE, B.C.

LOGGING, SAMPLING, AND TESTING (check) Yes No Cost \$ 29,270

Lithology: Drill samples Core samples Bulk samples

Logs: Gamma-Neutron Density Other

Testing: Prox. analysis FSI Washability

Carbonization Petrographic Plasticity Other

OTHER WORK (specify details) NONE Cost \$ NIL

REPORTS:

Reclamation work (Permit No. 54) Detail of work SEEDING & FERTILIZING DRILL SITES AND SIDE ROADS, EROSION PREVENTION CROSS CUTS ON ROADS, DITCHING, REPORT WILL BE SUBMITTED BY MARCH 31'79 Cost \$ 956

OPERATIONS:

Work was supervised by PAT GILMAR Position GEOLOGIST

Is this person a registered or licensed Professional Engineer in British Columbia? Yes No

NOTE—Where the licensee intends to perform, during the extended term of his licence, work not set out in the plan of operations filed under section 15 (2) (c), a supplemental plan of operations is to be attached.

* If reclamation work reported in separate report give details of report identification.

VALUATION OF WORK: COST STATEMENT
(Sec. 27, B.C. Reg. 436/75)

ON-PROPERTY COSTS: For period from FEBRUARY 1, 1978 to JANUARY 30, 1979

1. OPERATOR'S FEES, SALARIES, AND WAGES:

	Average Number of Employees	Average Rate	Average Number of Days	Amount
Professional and technical	4	\$125/MAN DAY	20	\$ 10,000
Machine operators and support				
Miners				
Other				
Total operator's costs \$				10,000

2. CONTRACTORS AND CONSULTANTS:

Name	Service	Contract Amount
<u>SCRL SURVEY DEPT</u> (INCLUDING SUB CONTRACTOR NORTHWEST SURVEY)	<u>GEODETIC GROUND CONTROL SURVEY</u> <u>PHOTOGRAMMETRIC MAPPING</u> <u>GEODETIC LOCATION SURVEY</u>	\$ 21,028
<u>TONTO DRILLING</u>	<u>DIAMON DRILLING</u>	\$ 47,819
<u>DRAIN BROTHERS CONSTRUCTION</u>	<u>BULLDOZER, BACKHOE WORK</u>	\$ 10,829
<u>GALLANT TRUCKING</u>	<u>WATER SUPPLY (TRUCK)</u>	\$ 1,780
<u>B & R DRILLING</u>	<u>DRILLING SUPERVISION</u>	\$ 3,000
<u>A.C.N. GEOL. CONSULTANTS</u>	<u>GEOL. CONSULTANT</u>	\$ 1,800
Total contractor and consultant costs \$		86,256

N.A. 3. EQUIPMENT AND INSTRUMENTS USED: Owned _____ Rented _____

Type	Rented From	Amount
Total equipment and instrument rentals \$		NIL

4. FIELD CAMP COSTS:

	Amount	
Food <u>\$16/MAN-DAY, 200 MAN-DAYS</u>	\$ 3,200	
Accommodation <u>\$18/MAN-DAY, 200 MAN-DAYS</u>	\$ 3,600	
Fuel	\$ 3,000	
Other <u>MISCELLANEOUS (COMMUNICATION, POWER PLANT, TRAILER)</u>	\$ 1,800	
Total field camp costs \$		11,600

5. SAMPLING, ANALYSIS, AND TESTING:

Service	Performed by	Amount
<u>WIRELINE LOGGING</u>	<u>BPE INDUSTRIES</u>	\$ 4,170
<u>ANALYSIS</u>	<u>CNI LAB</u>	\$ 2,380
Totals, samplings, analysis, and testing \$		6,550

6. SUPPLIES AND MATERIALS COSTS:

	Amount	
Process supplies		
Operating and maintenance supplies	\$ 1,776	
Office and technical supplies	\$ 740	
Other supplies and materials		
Total, supplies and materials \$		2,516

7. TRANSPORTATION COSTS (Ground transportation details):

Vehicle	Owner	Rental Rate	Amount
<u>two 4x4 trucks</u>	<u>WHEELAWAY</u>	<u>\$1200/month</u>	\$ 3,600
<u>one truck</u>	<u>KIKI TRUCKING</u>	<u>\$25/hour 100 hours</u>	\$ 2,500

including rentals

Air support details:

Aircraft Type HELICOPTER 206B	Owner KONTING	Charter \$ 375/hour 9 hours	\$ 3,375
_____	_____	_____	_____
_____	_____	_____	_____
Total transportation costs \$			9,475

8. RECLAMATION WORK:

INTERIOR REFORESTATION CO. LTD. \$ 956

9. TRAVEL EXPENDITURES (operator's costs only):

Number of Personnel	Number of Trips	Amount
EXPENDITURES IN ADDITION TO FIELD/CAMP COST ARE INCLUDED		
AS OVERHEAD IN THE \$125 PER MAN-DAY ALLOCATION		
Total travel expenditures \$		N.A.
Total costs \$		127,353

(Secs. 28 and 29, B.C. Reg. 436/75)

OFF-PROPERTY COSTS: Period from February 1, '78 to January 30, 1979

- | | |
|---|----------|
| (a) Logistics and field support INCLUDED AS OVERHEAD IN \$125/MAN-DAY | \$ _____ |
| (b) Technical and feasibility studies | _____ |
| (c) Preparation of reports 100 MAN-DAYS, \$125 PER MAN-DAY | 12,500 |
| (d) Supplies and services INCLUDED AS OVERHEAD IN \$125/MAN-DAY | _____ |
| (e) Mobilization and demobilization of equipment INCLUDED IN CONTRACT AMOUNTS | _____ |
| (f) Travelling expenses | _____ |
- (Items)
- CALGARY - PROPERTY - CALGARY TRAVELLING IS INCLUDED AS OVERHEAD IN \$125/MAN-DAY, NO OTHER TRAVELLING IS CONSIDERED.

Supporting Cost Statements Attached	Total \$ 12,500
ALL SUPPORTING COST IS INCLUDED IN \$125/MAN-DAY	Amount N.A.

Total supporting costs \$ N.A.

SUMMARY

On-property costs	\$ 127,353
Off-property costs	\$ 12,500
Total costs \$	139,853

Statement of costs verified by ACCOUNTING DIVISION, FINANCE & ADMINISTRATION, ECRL

1979-01-30

(Date)

[Signature]
ANALYST, ADMINISTRATION & PLANNING
ECRL

GROUP 29
(OLD)
REGROUPED

15° 50'

49° 55'

GROUP 30
(OLD)
REGROUPED

P R O V I N C I A

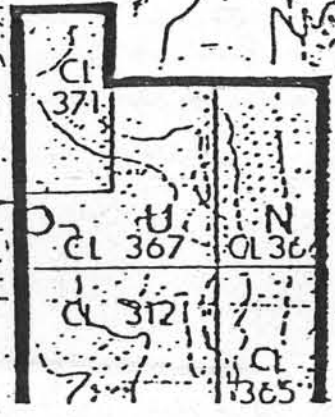
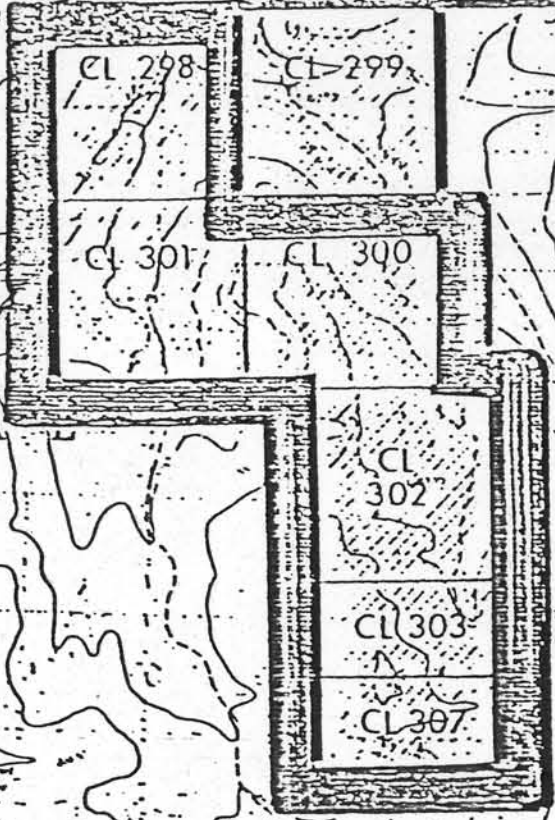
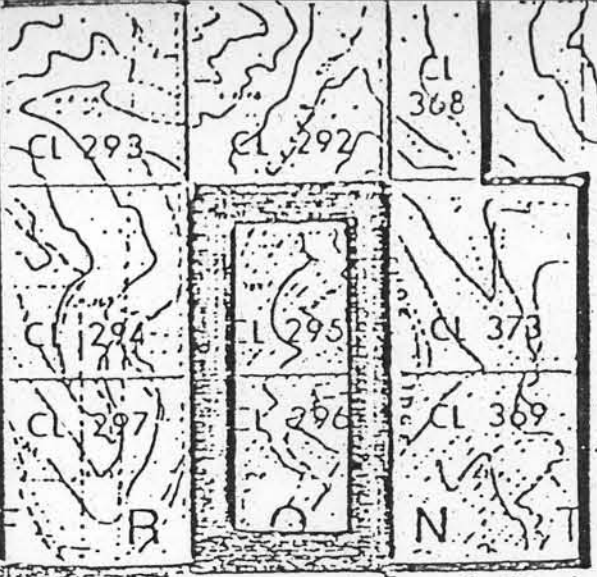
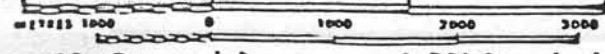
R A N G E S

O R E S T

R O C K Y

GROUP 31
MAINTAINED

GROUP
31
(New)





DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 23)

APPLICATION TO GROUP LICENCES

Licensee(s) SHELL CANADA RESOURCES LIMITED
 Land district KOOTENAY
 Location S. W. OF ELKFORD, B. C.
 Date of application JANUARY 31, 1979

I/We, the undersigned licensee(s)* of the following coal licences, desire to group them according to the provisions of the *Coal Act*:

I/We, desire to consolidate the licences to obtain a uniform anniversary date: Yes No

Licence Number	HA.	AC.	Anniversary Date	Signature of Licensee
277	260	640	January 31	
278	260	640	"	
279	260	640	"	
280	260	640	"	
284	260	640	"	
285	260	640	"	
290	211	520	"	
292	260	640	"	
297	260	640	"	
299	260	640	"	
304	82	202	"	
368	130	320	"	
369	260	640	"	
373	260	640	"	
TOTAL	14 Licences	3283	8082	

ASSISTANT SECRETARY

* May be signed by a person authorized to sign on behalf of the licensee.

FOR DEPARTMENTAL USE ONLY

All Licences were issued in 1975

Approved uniform date _____

Recording Fee: \$5 for each licence in the group.



New, Preliminarily called "CB"

DEPARTMENT OF MINES AND PETROLEUM RESOURCES

Coal Act (Sec. 19)

APPLICATION TO EXTEND TERM OF LICENCE

I, Gordon A. Schwartz agent for Shell Canada Resources Ltd.
P.O. Box 100 Calgary, Alberta T2P2H5

Valid FMC No. 171 929

hereby apply to the Minister to extend the term of Coal Licences No(s) 277, 278, 279, 280, 284, 285, 290, 292, 297, 299, 304, 368, 269, 373, 14 licences covering approximately 8420 acres = 3413 Hectares

I have performed, or caused to be performed, during the period February 1, 1978 to January 30, 1979, work to the value of at least \$ 294,973 on the location of coal licences as follows:

CATEGORY OF WORK

Table with 3 columns: Category of Work, Licence No(s), and Apportioned Cost. Rows include Geological mapping, Surveys (Geophysical, Geochemical, Other), Road construction, Surface work, Underground work, Drilling, Logging, sampling, and testing, Reclamation, and Other work.

I wish to apply \$ 203,285 of this value of work on Coal Licence(s) 277, 278, 279, 280, 284, 285, 290, 292, 297, 299, 304, 368, 369, 373; application filed concurrently to group these fourteen licences into one new group

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

I wish to apply \$ of this value of work to claim a refund of cash in lieu of work in the amount of \$ which was paid to extend the term of Coal Licence(s) No(s) from to, 19. Mining Receipt No. for prior payment of cash in lieu of work is attached for adjustment.

The work performed on the location(s) is detailed in the attached report entitled Geodetic Ground Control Survey and Photogrammetric Mapping-Central Block, Kootenay Land District, B.C.; Coal Project final report-line Cr. Ridge, Kootenay Land District, B.C.-Exploration and Geological evaluation; coal project progress report-North Central Block, Kootenay Land District, B.C.-Exploration and Geological Evaluation; all these three reports are in preparation and will be submitted in 90 days.

(Date) -1979---01---30

(Signature and position)

* Applications to group licences may be filed to apportion costs on a maximum of 10 licences.

Landman - SCRL

(FORMS TO BE SUBMITTED IN DUPLICATE)

FOR DEPARTMENTAL USE ONLY

Value of work reported \$ Value of work applied on licences \$
Value of work approved \$ Value of credit remaining \$

Work performed. Yes No

The program of operations detailed hereunder was carried out during the period from February 1, 1978
to January 30, 1979. Total costs are \$ 294,973, an average
of \$ 35.03 per acre. or \$86.56 per hectar

GEOLOGICAL MAPPING Yes No Cost \$ 32,750

	Area (Acres)	Scale	Time
Reconnaissance	9000Ac = 3642 Ha 640Ac = 259 Ha	1: 16,000 1: 15,000	25 man-days 30 man-days
Detail: Surface	2560Ac = 1036 Ha 5Ac = 2 Ha	1: 16,000 1: 2,000	80 man-days 14 man-days
Underground	NIL	NIL	
Other (specify)	measuring stratigraphic sections 610 m	1: 500	35 man-days

GEOPHYSICAL OR GEOCHEMICAL SURVEYS Yes No Cost \$ NIL

Method _____ Line miles _____

OTHER SURVEYS Yes No Cost \$ 41,978

Grid _____ Topographic Geodetic Ground Control and Location Survey
Photogrammetric Mapping

ROAD CONSTRUCTION Yes No Cost \$ 13,870

Length: On Licences 10 kilometres Access (off licences) 3 kilometres Upgrading and Maintenance Only

SURFACE WORK Yes No Cost \$ 4,140

	Length	License Number(s)
Trenching	<u>10 m</u>	<u>277</u>
Seam tracing	<u>2000 m</u>	<u>278, 279, 280</u>
Crosscutting	_____	_____
Other	_____	_____

UNDERGROUND WORK Yes No Cost \$ NIL

Test adits: Number _____ Average length _____ Total footage _____

Other workings: Area _____ Total footage _____

DRILLING Yes No Cost \$ 94,490

	Hole Size	Number of Holes	Total Footage
Core: Diamond <input checked="" type="checkbox"/> Wireline <input type="checkbox"/>	<u>HQ</u>	<u>4</u>	<u>2,936 ft=895m</u>
Rotary: Conventional <input type="checkbox"/>	_____	_____	_____
Reverse circulation <input type="checkbox"/>	_____	_____	_____
Other	_____	_____	_____

Contractor Tonto Drilling Where core stored CNRL Lab Fernie, B.C.

LOGGING, SAMPLING, AND TESTING (check) Yes No Cost \$ 46,645

Lithology: Drill samples Core samples Bulk samples

Logs: Gamma-Neutron Density Other

Testing: Prox. analysis FSI Washability

Carbonization Petrographic Plasticity Other

OTHER WORK (specify details) Geotechnical Installations, Tests, Survey Cost \$ 60,200

REPORTS:

Reclamation work (Permit No. 54) Detail of work* Seeding and Fertilizing Drill Sites, side roads, erosion control trenching

Report will be submitted by March 31, 1979 Cost \$ 900

OPERATIONS:

Work was supervised by Ted Hannah Position Geologist

Is this person a registered or licensed Professional Engineer in British Columbia? Yes No

NOTE—Where the licensee intends to perform, during the extended term of his licence, work not set out in the plan of operations filed under section 15 (2) (c), a supplemental plan of operations is to be attached.

* If reclamation work reported in separate report give details of report identification.

VALUATION OF WORK: COST STATEMENT
(Sec. 27, B.C. Reg. 436/75)

ON-PROPERTY COSTS: For period from February 1, 1978 to January 30, 1979

1. OPERATOR'S FEES, SALARIES, AND WAGES:

	Average Number of Employees	Average Rate	Average Number of Days	Amount
Professional and technical	5	\$125 / man-day	53	33,125
Machine operators and support	NIL			
Miners	NONE			
Other	NIL			

Total operator's costs \$ _____

2. CONTRACTORS AND CONSULTANTS:

Name	Service	Contract Amount
SCRL - Survey Dept. (including subcontractor Northwest Survey)	Geodetic Ground Control Survey Photogrammetric Mapping Geodetic Location Survey	\$ 38,578
Tonto Drilling	Diamond Drilling	\$ 64,300
Drain Brothers Construction	Earth Moving (bulldozer etc)	\$ 11,420
Ackles Trucking	Water Supply (truck)	\$ 11,450
Gallant Trucking	Water Supply (truck)	\$ 2,100
A.C.M. Geol. Consultants	Geol Consultant	\$ 3,900
B&R Drilling	Drilling Supervision	\$ 1,450
Jamieson Geol. Consultants	Bulldozer Supervision	\$ 630
(TOTAL CONTRACTOR & CONSULTANT COSTS)		\$133,828

N.A. 3 EQUIPMENT AND INSTRUMENTS USED:

Owned	Rented	Amount
_____	_____	NIL
_____	_____	
_____	_____	
Total equipment and instrument rentals		\$ NIL

4. FIELD CAMP COSTS:

	Amount	
Food 536 man-days, \$16 per man-day	\$ 8,572	
Accommodation 536 man-days, \$18 per man-day	9,648	
Fuel	2,060	
Other Miscellaneous (Communication, Power Plan, Trailer)	2,400	
Total field camp costs		\$ 22,680

5. SAMPLING, ANALYSIS, AND TESTING:

Service	Performed by	Amount
Wireline logging	BPB Industries	\$ 8,600
Geotechnical tests	Golder Associates	60,200
Analysis	CNI Lab	2,940
Totals, samplings, analysis, and testing		\$ 71,740

6. SUPPLIES AND MATERIALS COSTS:

	Amount	
Process supplies		
Operating and maintenance supplies	6,100	
Office and technical supplies	2,350	
Other supplies and materials		
Total, supplies and materials		\$ 8,450

7. TRANSPORTATION COSTS (Ground transportation details):

Vehicles	Owner	Rental Rate	Amount
four 4x4 trucks	Minchuk Leasing	* \$1,200/month	\$ 4,800
three trucks	-Kiki Trucking	\$25/hour, 92 hours	\$ 2,300

* including repairs

Air support details:

Aircraft Type	Owner	Charter
Helicopter 206 B	Kenting	\$375/hour 14.7 hours \$ 5,275
		Total transportation costs \$ 12,375

8. RECLAMATION WORK:

Interior Reforestation Co. Ltd. \$ 900

9. TRAVEL EXPENDITURES (operator's costs only):

Number of Personnel	Number of Trips	Amount
Expenditures in addition to field/camp cost are included as overhead in the \$125 per man-day allocation		
Total travel expenditures		\$ N.A.
Total costs		\$ 283,098

(Secs. 28 and 29, B.C. Reg. 436/75)

OFF-PROPERTY COSTS: Period from February 1, 1978 to January 30, 1979

- (a) Logistics and field support included as overhead in \$125 per man day \$
- (b) Technical and feasibility studies day N/A
- (c) Preparation of reports 95 man-days, \$125 per man day \$ 11,875
- (d) Supplies and services included as overhead in \$125 per man-day N.A.
- (e) Mobilization and demobilization of equipment included in contract amounts N.A.
- (f) Travelling expenses (Itemize) N.A.

Calgary-Property - Calgary travelling is included as overhead in the \$125 per man-day, no other travelling has been considered

Supporting Cost Statements Attached Total \$ 11,875
 all supporting cost is included in the \$125 per man-day Amount N.A.

Total supporting costs \$ N.A.

SUMMARY

On-property costs \$ 283,098
 Off-property costs \$ 11,875
 Total costs \$ 294,973

Statement of costs verified by Accounting Division, Finance & Administration, SCRI

1979 - 01 - 30
 (Date)

Helmut Hoff
 (Signature and position)

Analyst, Administration and Planning
 CNRL

PE-SHELL-LINE CREEK
(HORSESHOE RIDGE)
78 (2) B.

MAPS.
CROSS SECTIONS
1978

420

K-SHELL- LINE CREEK (HORSESHOE RIDGE) 78(2)B

HORSESHOE RIDGE

GEOLOGICAL BRANCH,
ASSESSMENT REPORT

00 420

APPENDIX G

DOWNHOLE GEOPHYSICAL LOGS
1978 Drill Holes 101, 102, 103

APPENDIX H

GRAPHIC LOGS

(DH 101, 102, 103 and Sections #1 - #9)



BOREHOLE HSR-101
 CLIENT SHELL (CANADA) LTD.

AREA JURASSIAN RIDGE
 COUNTRY CANADA
 DATE LOGGED 7/29/77

COAL

LITHOLOGY

LOG

BOREHOLE DATA

PARAMETER	VALUE
ELEVATION OF TD	818
DEPTH REACHED	194
DEPTH TO CASING	134
CASING SIZE	4 1/2
BIT SIZES	1 1/2, 1 3/8, 1 1/4, 1 1/8, 1 1/2
CASING SIZES	1 1/2, 1 3/8, 1 1/4, 1 1/8, 1 1/2

SONDE TYPE

SONDE TYPE	COMBINATION
SONDE	LOG
LOG SUITE	GAMMA RAY
LOG SUITE	L.S. DENSITY
LOG SUITE	CALIPER

OPERATION DATA

FIRST READING	1:34
LAST READING	1:54
INTERVAL (MIN)	7:25/42
LOGGERS	J.P. GORDEAN
WITNESS	

FLUID DATA

NATURE	FLUID
LEVEL	SHOULDER LEVEL
VISCOSITY	
PH	

EQUIPMENT AND RECORDING DATA

LOG	EQUIPMENT		TAPING		PANEL		CAL COEFF		DEPTHS		SEAM LOG RUN	
	SONDE	SOURCE	LOG TAPED	RECORD SPEED	DIRECT REPLAY	T.C. SECS	NORM	FROM	TO	INTERVAL		
GAMMA RAY	129	300A/1	y	9	d	9	1	1.43	193	0	193	y
L.S. DENSITY		100mC 3710	y	9	e	9	1	7.42	194	0	194	y
CALIPER		SIDEWALL POSITION	y	9	r	9	1	1/3	194	0	194	y

COAL QUALITY / SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	TO	INTERVAL TOTAL
136	107	41
26	13	13
120	95	28
19	5	5
16	12	13
7	8	8
		56

ADDITIONAL SONDES RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG
09	N-N	10:1	
P1	VERT.		

REMARKS

RUN SLOWED TO 2m/min. OVER COAL.
 SEAMS. GAMMA TC = 48sec.
 LSD TC = 1 sec.

B PB COAL LITHOLOGY LOG

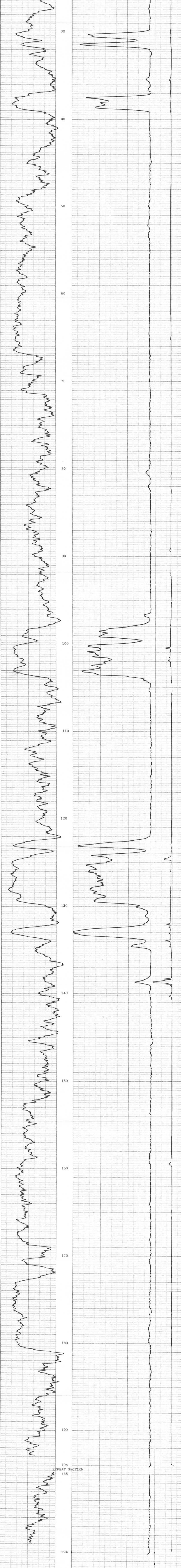
CALIBRATION DATA

JIG No 01	VALUE 30 @ 2" DIAM	JIG CAL DATE 7/8/78	VALUE 371 @ 2" DIAM	GLCM ³	2 ms 580 cps
JIG MARK SHOWN AT ABOVE VALUE -		JIG No 118	SPAN 3.013	NORM 500 cps	7 ms 950 cps

GAMMA RAY	DEPTH	COAL BULK DENSITY	CALIPER
-----------	-------	-------------------	---------

HOLE SIZE CORRECTION DATA

DEPTH	6.000	5.000	4.000	3.000	2.000	1.000	0
-------	-------	-------	-------	-------	-------	-------	---



GAMMA RAY	DEPTH	COAL BULK DENSITY	CALIPER
-----------	-------	-------------------	---------





BOREHOLE _____ 138-101
 CLIENT _____ S. ELLI (CANADA) LTD.
 AREA _____ HORSFIELD, ALDAB
 COUNTRY _____ CANADA
 DATE LOGGED 25/07/12
 LOGS _____

SEAM THICKNESS LOG
 EQUIPMENT AND RECORDING DATA
 OPERATIONAL DATA REFER TO LITHOLOGY LOG
 BOREHOLE DATA REFER TO LITHOLOGY LOG

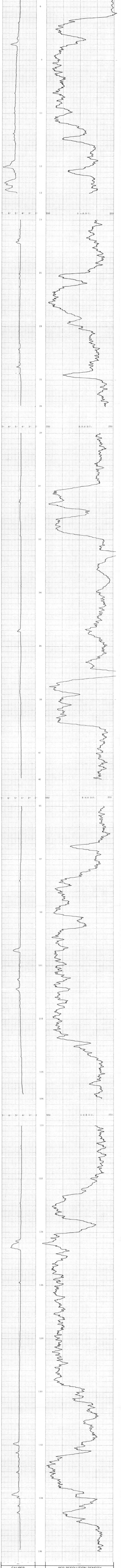
SEAM THICKNESS LOG INTERVALS
 SOFTENING AND CALIBRATION REFER TO LITHOLOGY LOG

COAL COMBINATION _____
 SONDE _____
 FROM 1.36 1.17 41 26 13
 TO 1.22 45 19 5
 INTERVAL 1.6 1.2 1.3 7 9

LOG SUITE _____
 CALIPER _____
 BR DENSITY _____

420

B P B SEAM THICKNESS LOG





BOREHOLE HSR-101
 CLIENT SIBEL (CANADA) LTD.
 AREA HORSESHOE RIDGE
 COUNTRY CANADA
 DATE LOGGED 25/7/72
 OPERATOR
 01-0058

BOREHOLE DATA REFER TO LITHOLOGY LOG
 OPERATION DATA REFER TO LITHOLOGY LOG
 EQUIPMENT AND RECORDING DATA

LOG NAME
 LOG NUMBER
 LOG DATE
 LOG TIME
 LOG LOCATION

SONDE TYPE
 COAL QUALITY LOG INTERVALS

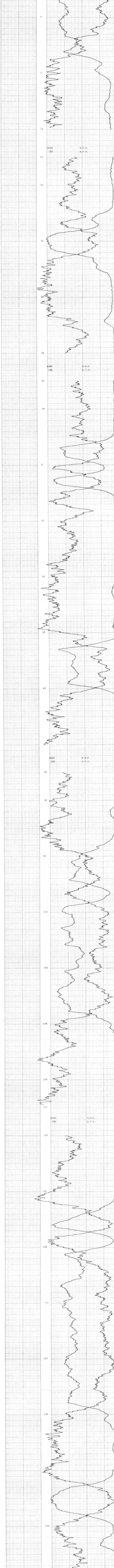
LOG SUITE
 GAMMA RAY
 LS DENSITY

420

B P B COAL QUALITY LOG

DEPTH	GAMMA RAY
	COAL BULK DENSITY

HOLE SIZE CORRECTION DATA	
DEPTH	DIAMETER
2	1.25
4	1.3
6	1.35
8	1.4
10	1.45
12	1.5
14	1.55
16	1.6
18	1.7
20	1.8
22	2.0
24	2.2
26	2.4
28	2.6
30	2.8
32	3.0
34	3.2
36	3.4
38	3.6
40	3.8
42	4.0
44	4.2
46	4.4
48	4.6
50	4.8
52	5.0
54	5.2
56	5.4
58	5.6
60	5.8
62	6.0
64	6.2
66	6.4
68	6.6
70	6.8
72	7.0
74	7.2
76	7.4
78	7.6
80	7.8
82	8.0
84	8.2
86	8.4
88	8.6
90	8.8
92	9.0
94	9.2
96	9.4
98	9.6
100	9.8
102	10.0
104	10.2
106	10.4
108	10.6
110	10.8
112	11.0
114	11.2
116	11.4
118	11.6
120	11.8
122	12.0
124	12.2
126	12.4
128	12.6
130	12.8
132	13.0
134	13.2
136	13.4



DEPTH	COAL BULK DENSITY
	GAMMA RAY

BOREHOLE HSR-101
 CLIENT SIBEL (CANADA) LTD.
 AREA HORSESHOE RIDGE
 COUNTRY CANADA
COAL QUALITY LOG





BOREHOLE HSR-102
 CLIENT SHELL (CANADA) LTD.

AREA JORSEHOE RIDGE
 COUNTRY CANADA
 DATE LOGGED 21/09/78

DEPTH SCALE
100'
 OF 1000 LOGS

COAL

LITHOLOGY LOG

LOG

PERMANENT DATUM GROUND LEVEL
 ELEVATION OF #10 878
 MASS BENCH MARKS FROM DRILL STARTER DELLI STARTER
 DEPTH REACHED 142
 CASING SHOE 1 TO 4 TO TD
 BIT SIZES 3 TO 4 TO TD
 CASING SIZES 1 TO 2 TO TD

FLUID DATA
 NATURE FRESH WATER
 LEVEL 24m
 VISCOSITY 100mC
 TEMPERATURE 21

COAL COMBINATION 420
 SONDE

LOG SUITE
 GAMMA RAY
 U.S. DENSITY
 CALIPER
 OPERATOR D. GORRAN

OPERATION DATA
 FIRST READING 139
 LAST READING 139
 INTERVAL LOGGED V25/42
 UNIT - TRUCK No
 ENGINEER
 WITNESS

EQUIPMENT AND RECORDING DATA												
COAL COMBINATION SONDE												
LOG	EQUIPMENT	TAPING	PANEL	CAL	DEPTHS		SEAM LOG RUN					
SONDE	SOURCE	LOG TAPE	RECORD SPEED	DIRECT REPLAY	SPEED	T.C SECS	NORM	FROM	TO	INTERVAL		
GAMMA RAY	129	300API	y	9	d	9	1	1.43	138	0	138	y
U.S. DENSITY	100mC	3710	y	9	d	9	1/3	7.42	139	0	139	y
CALIPER	SIDEWALL POSITION		y	9	r	9	1/3	-	139	0	139	y

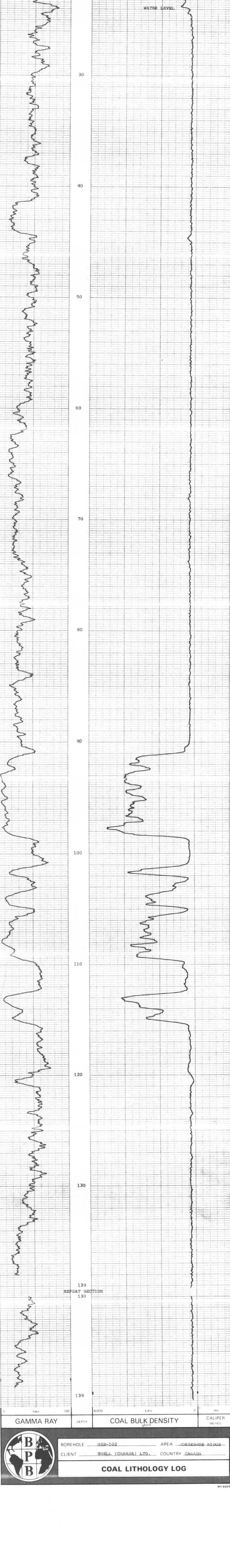
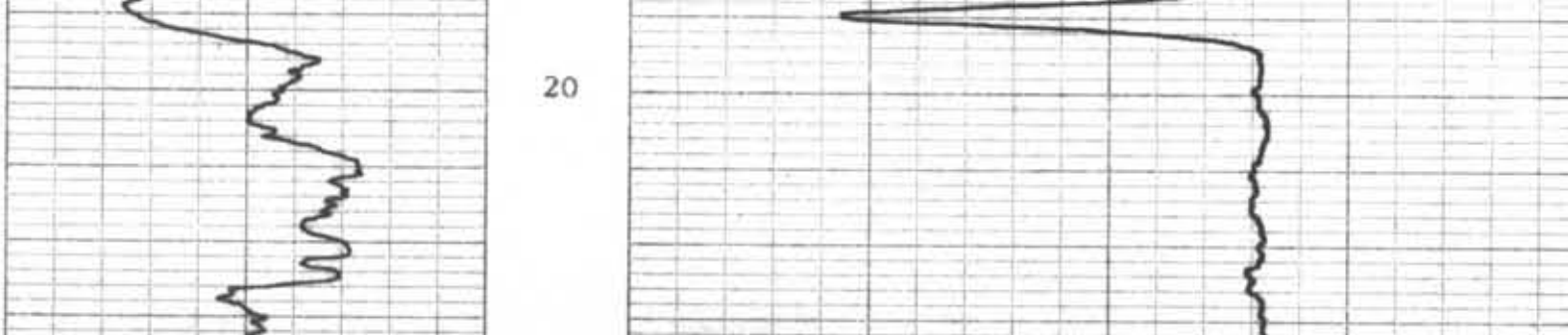
COAL QUALITY/SEAM THICKNESS LOG INTERVALS (Refer to relevant log)			
FROM	117	14	INTERVAL TOTAL = 39
TO	89	3	
INTERVAL	28	11	

ADDITIONAL SONDES RUN				REMARKS	
SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG	REFER TO	ADDITIONAL HEADINGS
9	N-N	100:1			

B P B COAL LITHOLOGY LOG

CALIBRATION DATA					
JIG No. 01	VALUE 300	2" DIAM	JIG CAL DATE 7/8/08/25	VALUE 3710	DU @ gl/cm ³
JIG MARK SHOWN AT ABOVE VALUE -			JIG No 118	SPAN 0.026	NORM 7.42

GAMMA RAY	DEPTH	COAL BULK DENSITY	CALIPER
-----------	-------	-------------------	---------



GAMMA RAY	DEPTH	COAL BULK DENSITY	CALIPER
-----------	-------	-------------------	---------



BOREHOLE HSR-102
 CLIENT SHELL (CANADA) LTD.

AREA JORSESSLOP RIDGE
 COUNTRY CANADA
 DATE LOGGED 28/09/18

DEPTH SCALE
 20 1
 OF LOSS

BOREHOLE DATA REFER TO LITHOLOGY LOG
 OPERATION DATA REFER TO LITHOLOGY LOG

EQUIPMENT AND RECORDING DATA
 COAL COMBINATION SONDE

LOG
 LOG TYPING PANEL CODE
 LOG FILE NUMBER SPEED SCS MMH
 CALIPER Y 2 F 2 I 0.7-1.4

SONDE TYPE
 COAL
 SOURCE SONDE AND CALIBRATION
 REFER TO LITHOLOGY LOG

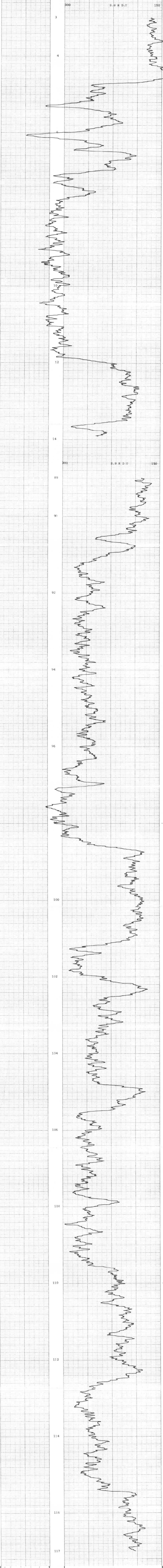
COMBINATION
 SONDE

LOG SUITE
 CALIPER
 BR DENSITY

SEAM THICKNESS LOG INTERVALS
 FROM 1.7 1.4
 INTERVAL 8.9 3
 FROM 28 1.1
 TO
 TOTAL
 INTERVAL 4.9
 REMARKS
 FILE LOGGED HISTORICAL DRILL RECORDS

420

B P B SEAM THICKNESS LOG



CALIPER INCHES	DEPTH	BED RESOLUTION DENSITY



BOREHOLE HSR-102
 CLIENT SHELL (CANADA) LTD.

AREA JORSESSLOP RIDGE
 COUNTRY CANADA

SEAM THICKNESS LOG



BOREHOLE HSR-102
 CLIENT SIBEL (CANADA) LTD.

AREA HURSHOCK RIDGE
 COUNTRY CANADA

DATE LOGGED 21/09/18

BOREHOLE DATA REFER TO LITHOLOGY LOG
 OPERATION DATA REFER TO LITHOLOGY LOG

EQUIPMENT AND RECORDING DATA
 COAL COMBINATION SOURCE

LOG TYPING
 LOG HSR-102 SERIAL 117 SHEET 2 OF 2
 SCALE 1:1 DATE 21/09/18

SONDE TYPE:
 COAL COMBINATION
 SONDE

LOG SUITE:
 GAMMA RAY
 L.S. DENSITY

REMARKS
HOLE LOGGED THROUGH DRILL ROUSE

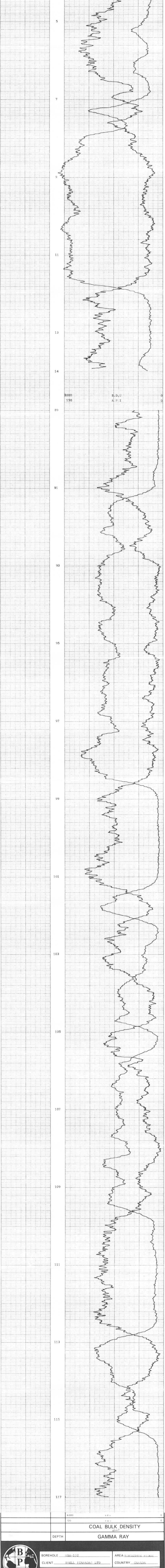
B P B COAL QUALITY LOG

DEPTH	GAMMA RAY
	COAL BULK DENSITY

HOLE SIZE CORRECTION DATA	
2"	1.2
4"	1.25
6"	1.35
8"	1.4
	1.45
	1.5
	1.55
	1.6
	1.7
	1.8
	1.9
	2.0
	2.2
	2.4
	3.0

FROM	TO	COAL QUALITY	LOG INTERVALS
117	114		
89	3		
28	1		
1	0		

420



DEPTH	GAMMA RAY
	COAL BULK DENSITY

BOREHOLE HSR-102 AREA HURSHOCK RIDGE
 CLIENT SIBEL (CANADA) LTD. COUNTRY CANADA

COAL QUALITY LOG





NEUTRON-NEUTRON LOG

COMPANY SHELL (CANADA) LTD.

BOREHOLE HSR-102

STATE BRITISH COLUMBIA COUNTRY CANADA

PERMANENT DATUM JERILD LAVAL Elev. m

LOG MEASURED FROM JERILD LAVAL 0.4 m above P.D.

DILLING MEASURED FROM 0.4 m above P.D.

DATE 1978/09/18

TIME 139

WELL HEADS 0

WELL DEPTH 139

LOGGING DEPTH 142

LOGGING INTERVAL 142

WELL NUMBER 411 CH. 2-21

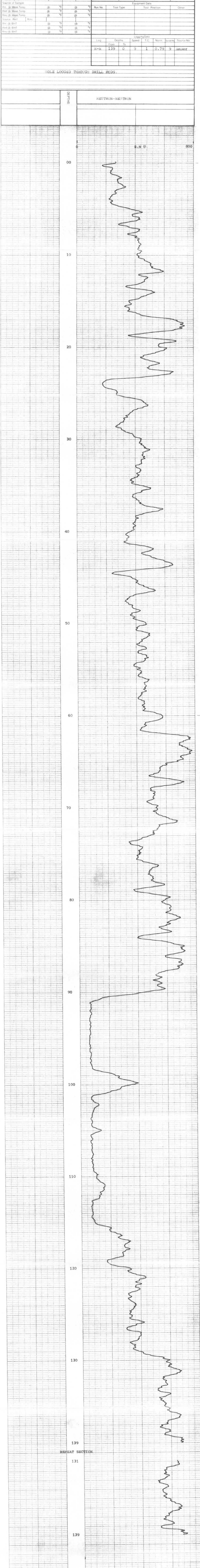
WELL SIZE 4" to 7 1/2"

LOGGING SPEED 10" to 10"

LOGGING TIME 2.46 HRS

LOGGING BY D. JORDAN

420



COMPANY SHELL (CANADA) LTD

BOREHOLE HSR-102

STATE BRITISH COLUMBIA

COUNTRY CANADA



BOREHOLE H.S.-103
 CLIENT SHELL (CANADA) LTD.

AREA HORSESHOE RIDGE
 COUNTRY CANADA
 DATE LOGGED 78/09/22

DEPTH SCALE
 100
 OF LOGS

COAL

LITHOLOGY

LOG

BOREHOLE DATA

PERMANENT DIAL	38	8 1/8	8	8
ELEVATION OF #10	38	8 1/8	8	8
ADJUSTMENTS FROM	0	0	0	0
DEPTH REACHED	201	202		
BIT SIZES	1 4" TO 3"	2 4" TO 2 1/2"		
CASING SIZES	1 4" TO 3"	2		

FLUID DATA

NATURE	WATER
LEVEL	28
VISCOSITY	
PH	

SONDE TYPE

COAL COMBINATION	
SONDE	
LOG SUITE	
GAMMA RAY	
L.S. DENSITY	
CALIPER	

OPERATION DATA

FIRST READING	201
LAST READING	201
INTERVAL LOGGED	201
UNIT - TRUCK No.	275/42
ENGINEER	J. GIBBALS

420

EQUIPMENT AND RECORDING DATA

LOG	EQUIPMENT	LOG TAPED	TAPING	PANEL	CAL COEFF	DEPTHS	SEAM LOG RUN
GAMMA RAY	129	000API	y	9 d 9 1	1.43	200 0 200	y
L.S. DENSITY	100mC	3710	y	9 d 9 1/3	7.42	201 0 201	y
CALIPER	SIDEWALL POSITION		y	9 e 9 1/3	-	201 0 201	y

COAL QUALITY / SEAM THICKNESS LOG INTERVALS (Refer to relevant log)

FROM	143	43	25	INTERVAL TOTAL
TO	127	33	12	
INTERVAL	16	10	13	+ 39

ADDITIONAL LOGS RUN

SONDE	LOG	GENERAL SCALE LOG	DETAIL SCALE LOG	REFER TO ADDITIONAL HEADINGS
09	N-N	100:1		
P1	VERT			

REMARKS
 LOG SLOWED TO 2m/min. OVER COAL.
 SRAWS GAMMA T.C. = 4sec.
 L.S.D. T.C. = 1sec.

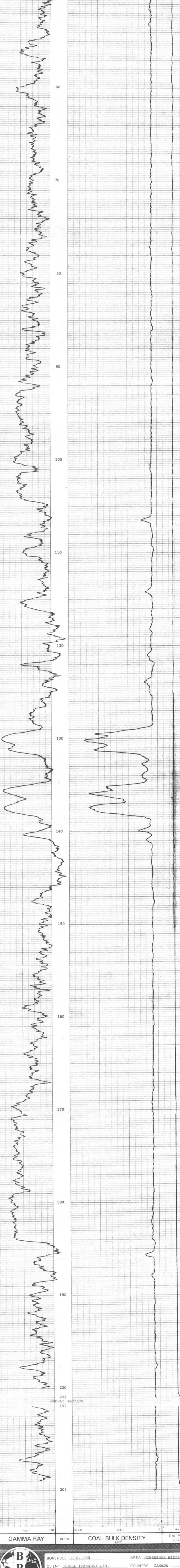
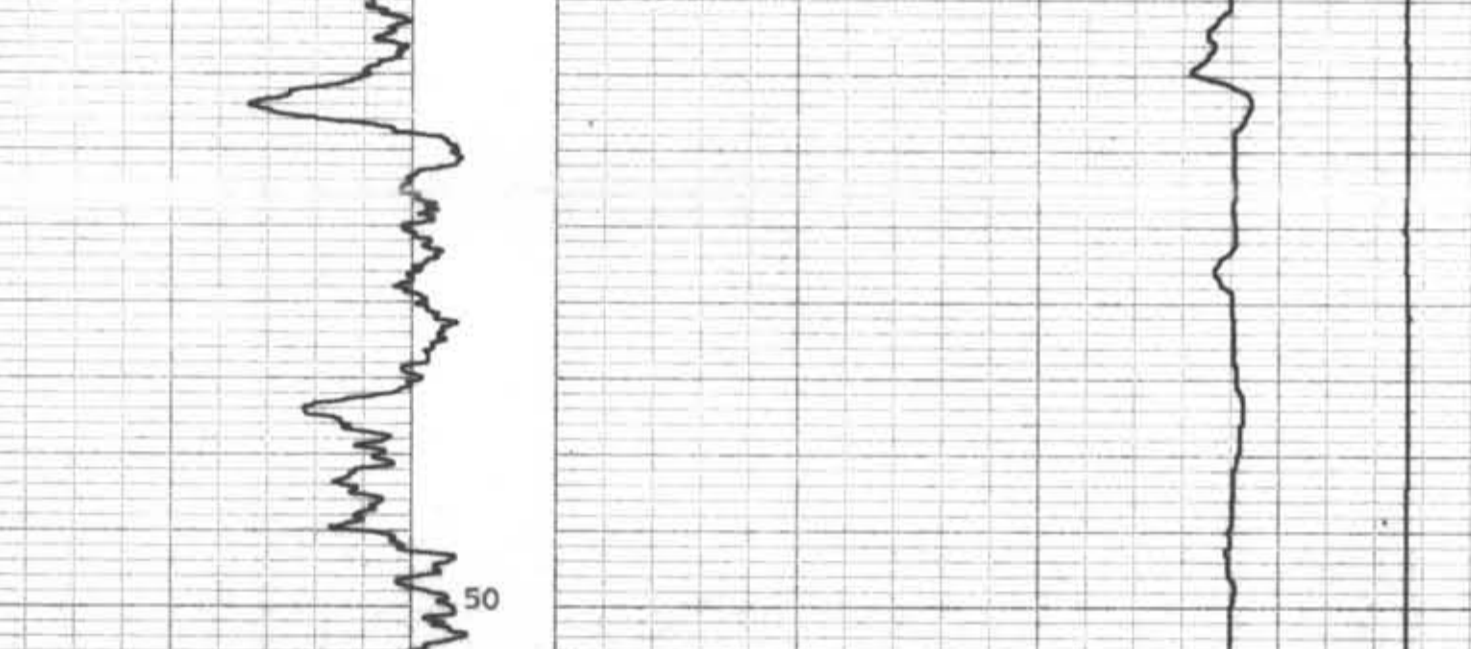
B.P.B. COAL LITHOLOGY LOG

CALIBRATION DATA

JIG No. 01	VALU@00@ 2" DIAM	JIG CAL DATE 78/08/28	VALUE 3710	EDUC@	g/cm ³	2	ms	580	cps
JIG MARK SHOWN AT ABOVE VALUE =		JIG No 118	SPAN 0.013	NORM	500	7	ms	950	cps

GAMMA RAY	DEPTH	COAL BULK DENSITY	CALIPER
-----------	-------	-------------------	---------

HOLE SIZE CORRECTION DATA



GAMMA RAY	DEPTH	COAL BULK DENSITY	CALIPER
-----------	-------	-------------------	---------





BOREHOLE IS-103
 CLIENT SIBEL (CANADA) LTD.

AREA OROSSLOK RIDGE
 COUNTRY CANADA
 DATE LOGGED 78/08/22

DEPTH SCALE
20.1
 OF LOGS

BOREHOLE DATA REFER TO LITHOLOGY LOG
 OPERATION DATA REFER TO LITHOLOGY LOG

SEAM THICKNESS LOG

EQUIPMENT AND RECORDING DATA

COAL COMBINATION SONDE SIDEWALL POSITION
 LOG 100 100 100 100 100 100
 CALIPER 1 2 3 4 5 6
 BRUSHING 1 2 3 4 5 6

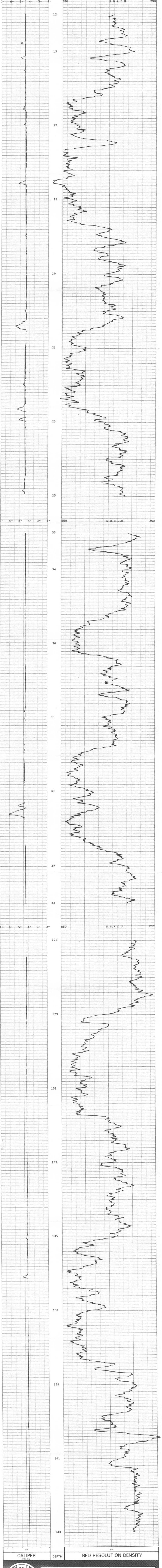
SONDE TYPE: COAL
 COMBINATION SONDE

SEAM THICKNESS LOG INTERVALS

LOG SUITE
 CALIPER
 BR DENSITY

SEAM THICKNESS LOG INTERVALS

B P B SEAM THICKNESS LOG



CALIPER INCHES	DEPTH	BED RESOLUTION DENSITY
----------------	-------	------------------------

BOREHOLE IS-103 AREA OROSSLOK RIDGE
 CLIENT SIBEL (CANADA) LTD. COUNTRY CANADA

SEAM THICKNESS LOG

420

STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: HORSESHOE RIDGE

AUTHOR: P. GILMORE

DATE: 1979

AREA: HORSESHOE RIDGE, B.C.

SOURCE OF DATA:

Measured in field.

LOCATION: SECTION 1

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	
[m]							
0							
				0			
		0.8			Sltstn		
		4.0			Ss, f.		
		0.7			Sltstn.		
					Ss, f		
		7.0			Ss/Sltstn		
					Sltstn		
					Sh		
					Coal	SEAM 9	
		4.0			Ss, f.		
		6.5			Ss/Sltstn		
		1.7			Sh/Sltstn.		
		1.1			Coal		
		2.1			Sh/Coal/Sltstn.		
		5.5			Coal	SEAM 10B	
		3.7			Sh/Sltstn		
		1.1			Coal		
		0.7			Coal Sh		
		1.3			Sh		
		2.4			Coal	SEAM 10A	
		1.5			Sh/Sltstn		
		0.8			Shaley Coal		
		3.5			Sh/Sltstn		
		0.5			Sh/Coal		
		1.0			Coal		
		1.0			Carb Sh		
				355	Ss/Sh below		
				56	Ss dominant		

HA-22E

420

STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: HORSESHOE RIDGE

AUTHOR: P. GILMORE

DATE: 1979

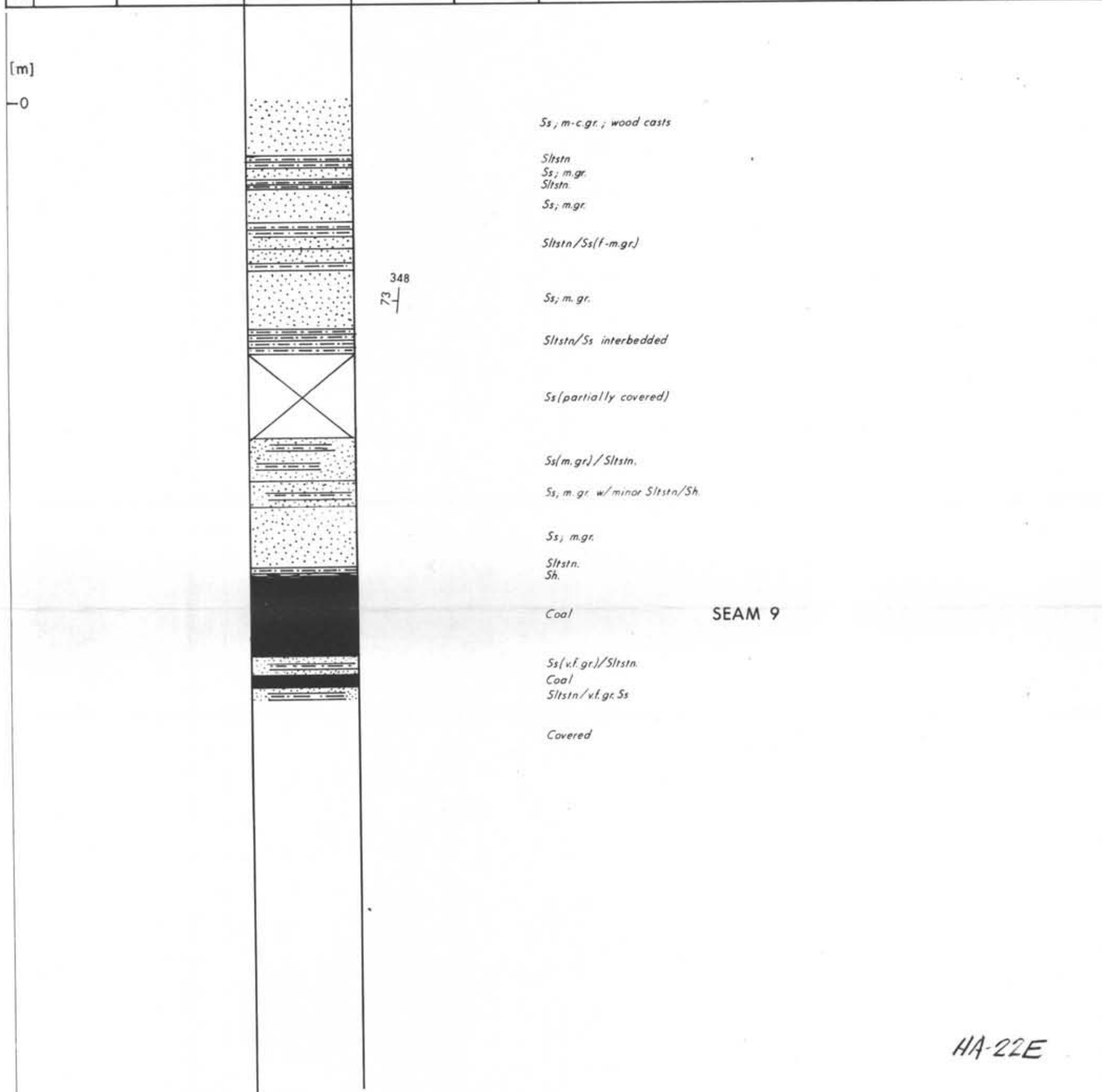
AREA: HORSESHOE RIDGE, B.C.

SOURCE OF DATA:

Measured in field.

LOCATION: SECTION 5

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	



HA-22E

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STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: HORSESHOE RIDGE

AUTHOR: P. GILMORE

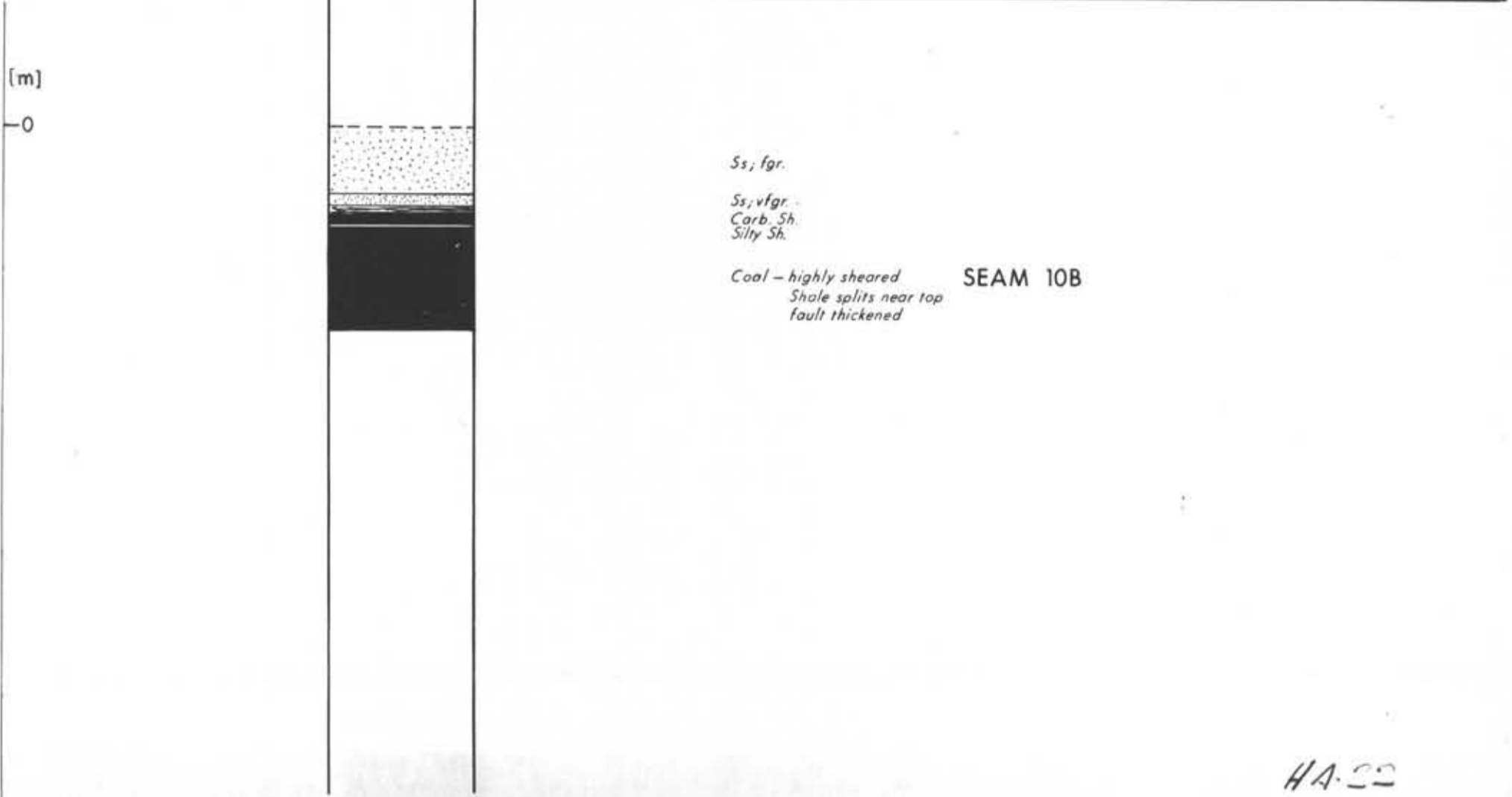
DATE: 1979

AREA: HORSESHOE RIDGE B.C.

SOURCE OF DATA: Measured in field.

LOCATION: SECTION 6

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	



HA-22

420

STRATIGRAPHIC SECTION

DESIGNATION: _____ PART _____ OF _____

PROJECT: HORSESHOE RIDGE

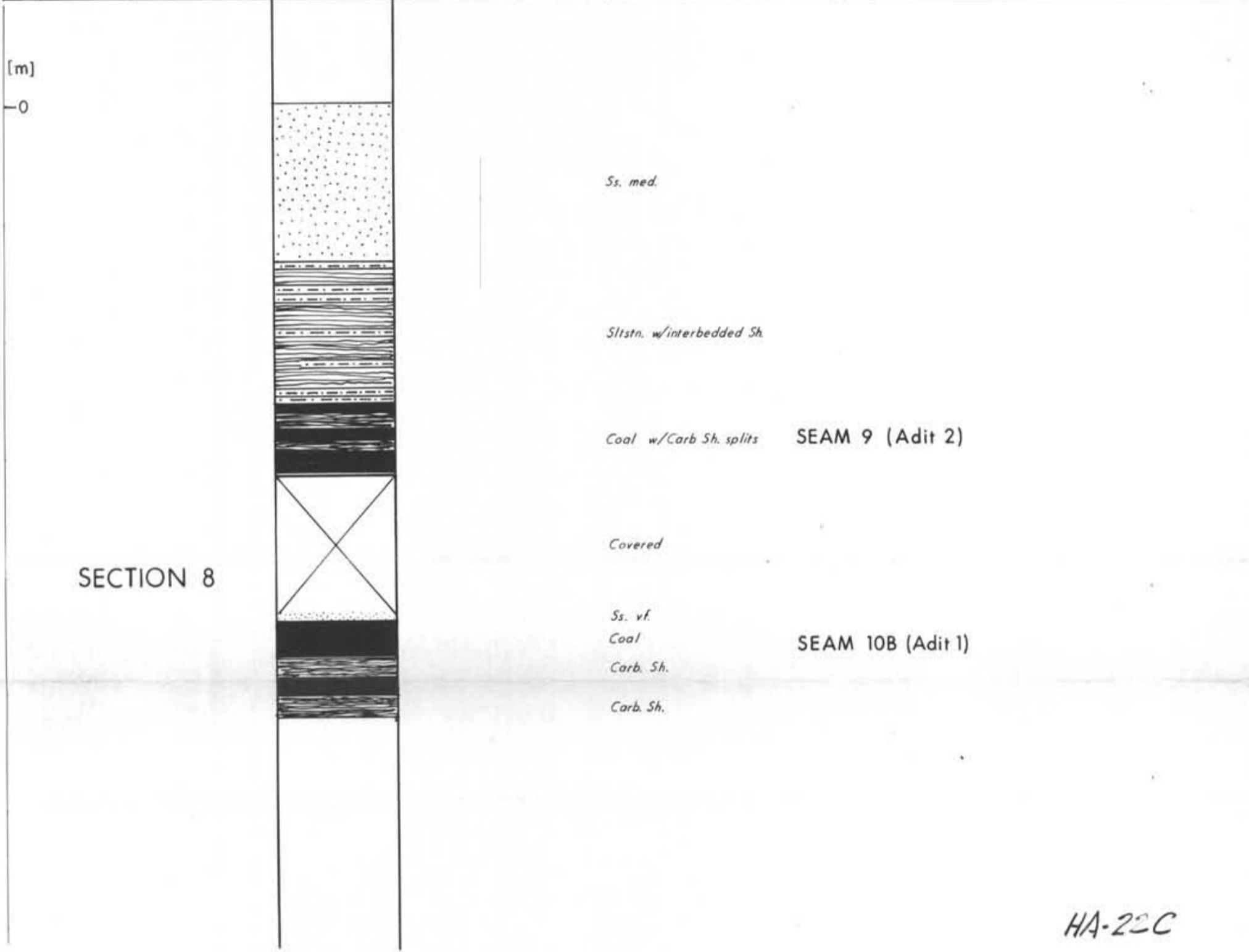
AUTHOR: P. GILMORE DATE: 1979

AREA: HORSESHOE RIDGE, B.C.

SOURCE OF DATA: Measured in field.

LOCATION: SECTIONS 7 & 8

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	



HA-22C

420

STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: HORSESHOE RIDGE

AUTHOR: P. GILMORE

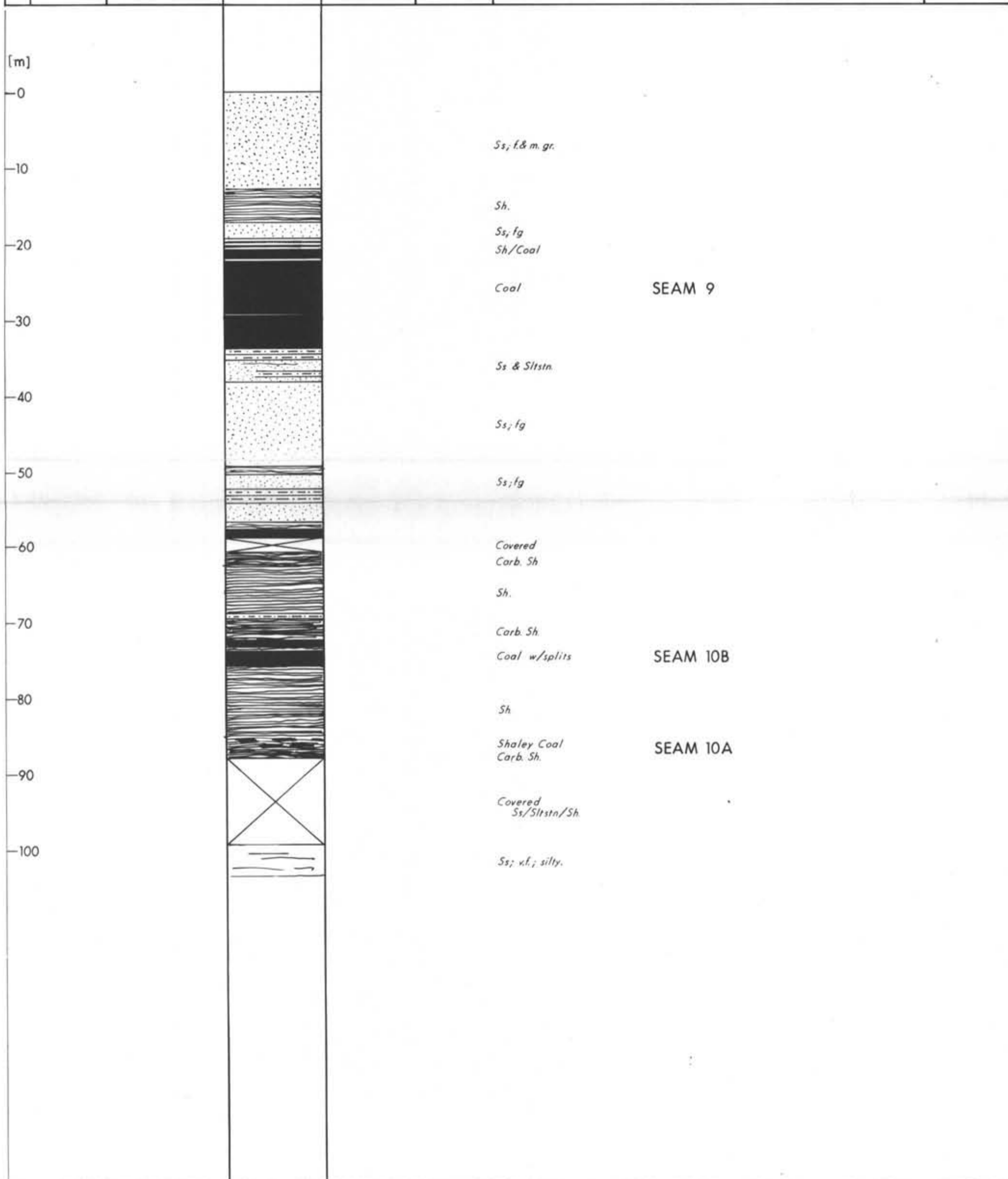
DATE: 1979

AREA: HORSESHOE RIDGE, B.C.

SOURCE OF DATA: Measured in field.

LOCATION: SECTION 9

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	



420

STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: HORSESHOE RIDGE

AUTHOR: P. GILMORE

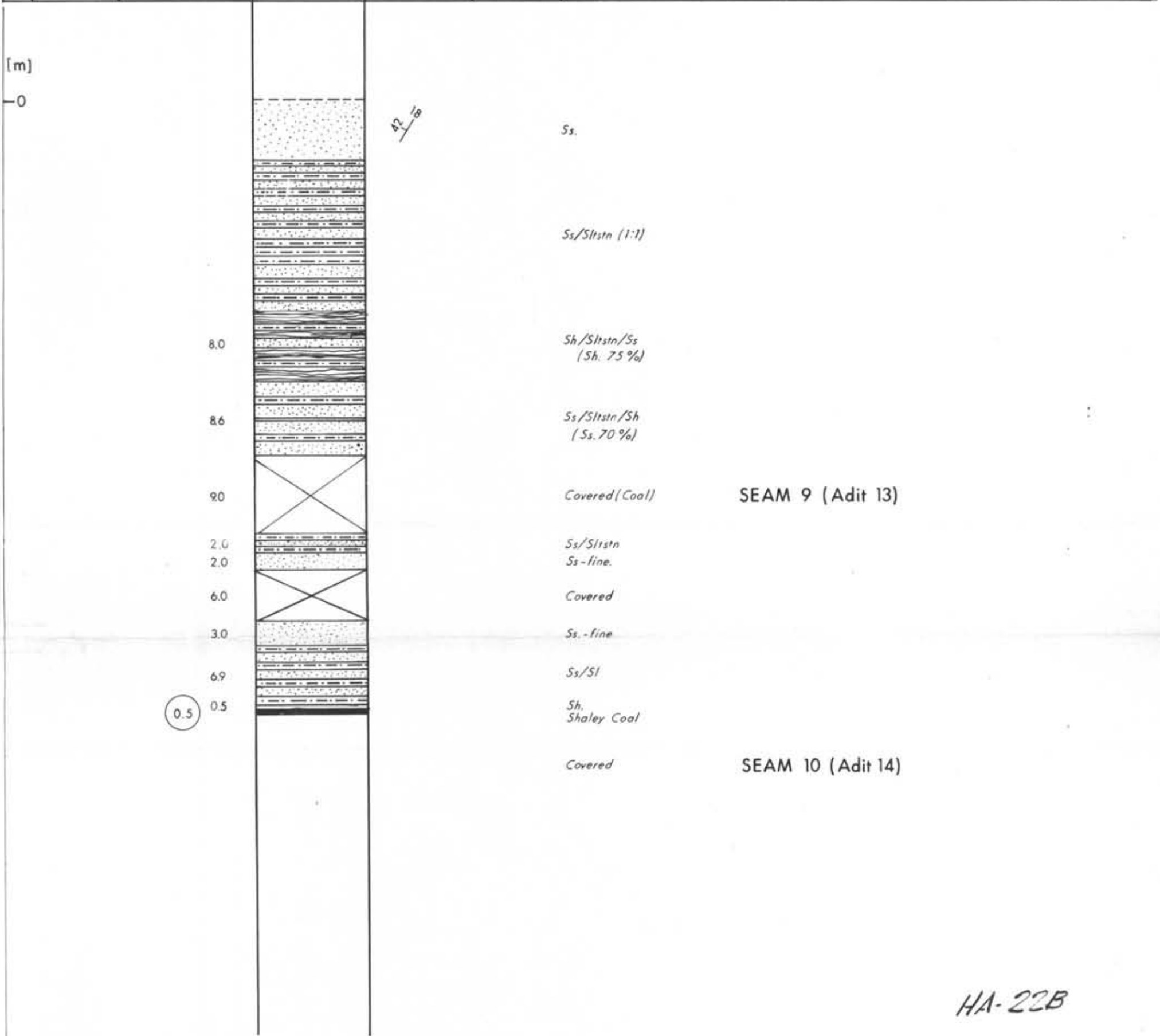
DATE: 1979

AREA: HORSESHOE RIDGE, B.C.

SOURCE OF DATA: Measured in field

LOCATION: SECTION 2 Adits 13 & 14

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	



HA-22B

420

STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: HORSESHOE RIDGE

AUTHOR: P. GILMORE

DATE: 1979

AREA: HORSESHOE RIDGE, B.C.

SOURCE OF DATA:

Measured in field.

LOCATION: HSR-101 Graphic Log

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	
[m]							
10					Carb. Sh.		
					Coal, Sh.	SEAM 8 (upper)	
					Coal		
20					Carb. Sh.		
					Carb. Sh.		
					Siltstn.		
					Ss; v.f.		
					Siltstn.		
					Coal	SEAM 8 (lower)	
30					Carb. Sh.		
					Siltstn; sandy		
					Coal		
40					Carb. Sh.		
					Coal		
50					Siltstn; sandy		
					Ss; f.		
60							
					Ss; m-coarse		
70							
					Ss; fg; silty		
80					Siltstn; sandy		
					Ss; med.		
					Siltstn; sandy.		
					Ss; med.		
90					Siltstn; interbedded Ss.		
					Carb. Sh.		
100					Coal; Sh. split	SEAM 9	
					Carb. Sh; Coal		
110							
					Ss; Siltstn; Sh. interbedded		
120					Carb. Sh.		
					Coal	SEAM 10B	
130					Carb. Sh.		
					Coal	SEAM 10A	
					Carb. Sh.		
140							
					Siltstn/Ss; f; interbedded.		
150							
					Ss; v.f.		
160							
					Ss; med. to coarse		
170							
					Siltstn/Sh. splits		
180							
					Ss; med-coarse		
190							
					Sh; Siltstn.		
200							
					Ss; fine		
210							
					Ss; med.		
					Sh; Siltstn.		
220					Carb. Sh.		
					Coal	SEAM 10B	
					numerous Sh. splits.		
230							
					Carb. Sh/Coal	SEAM 10A	
					Ss; fine		
					Ss; med.		
					Ss/Coal/Sh.		
240							
					Ss; fine		
250							
260							
					Ss; med.		
270							
280							
270							

HA-22

420

STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: HORSESHOE RIDGE

AUTHOR: P. GILMORE

DATE: 1979

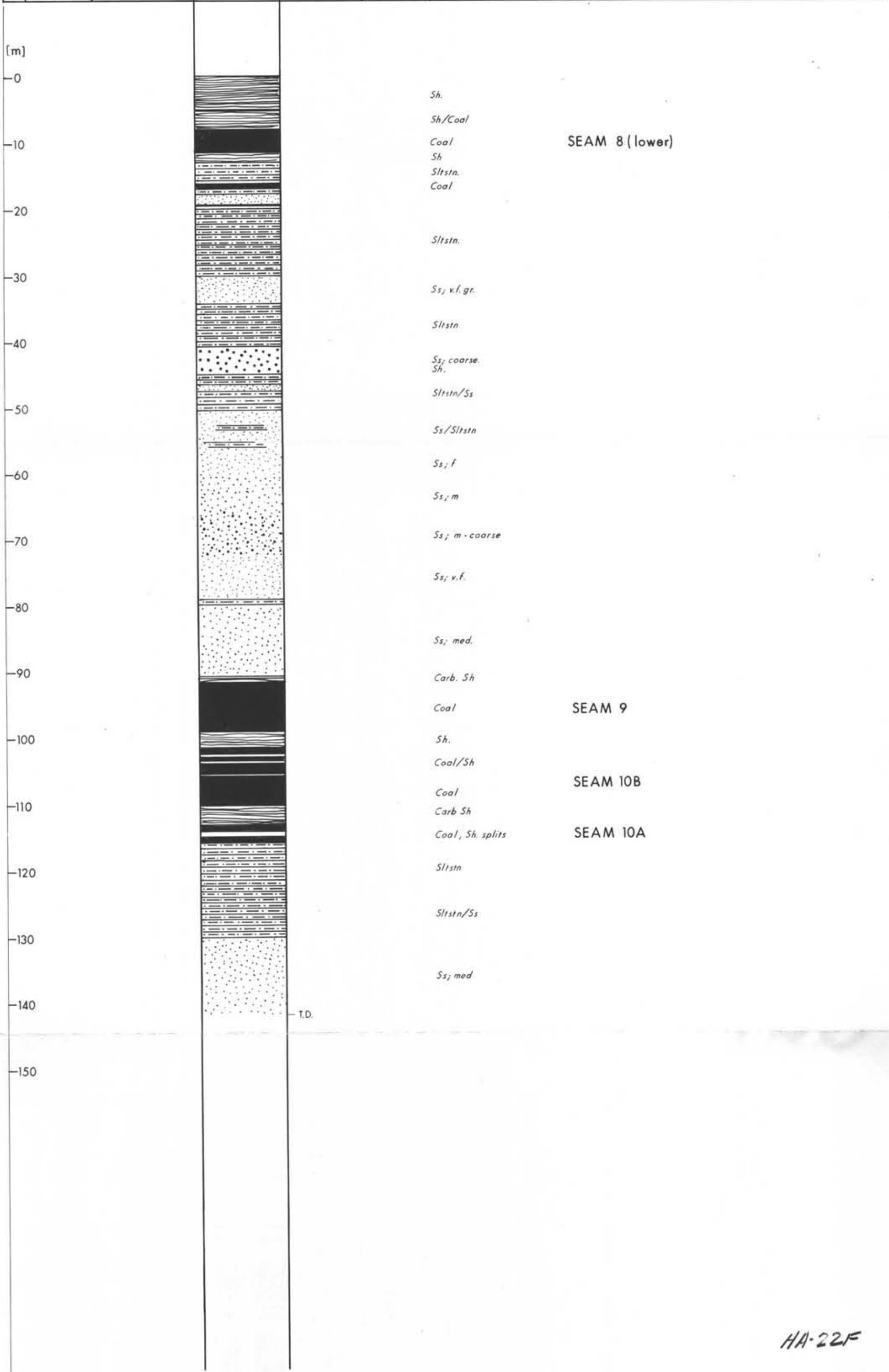
AREA: HORSESHOE RIDGE, B.C.

SOURCE OF DATA:

LOCATION: HSR - 102 Graphic Log

Measured in field.

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	



HA-22F

420

STRATIGRAPHIC SECTION

DESIGNATION:

PART _____ OF _____

PROJECT: HORSESHOE RIDGE

AUTHOR: P. GILMORE

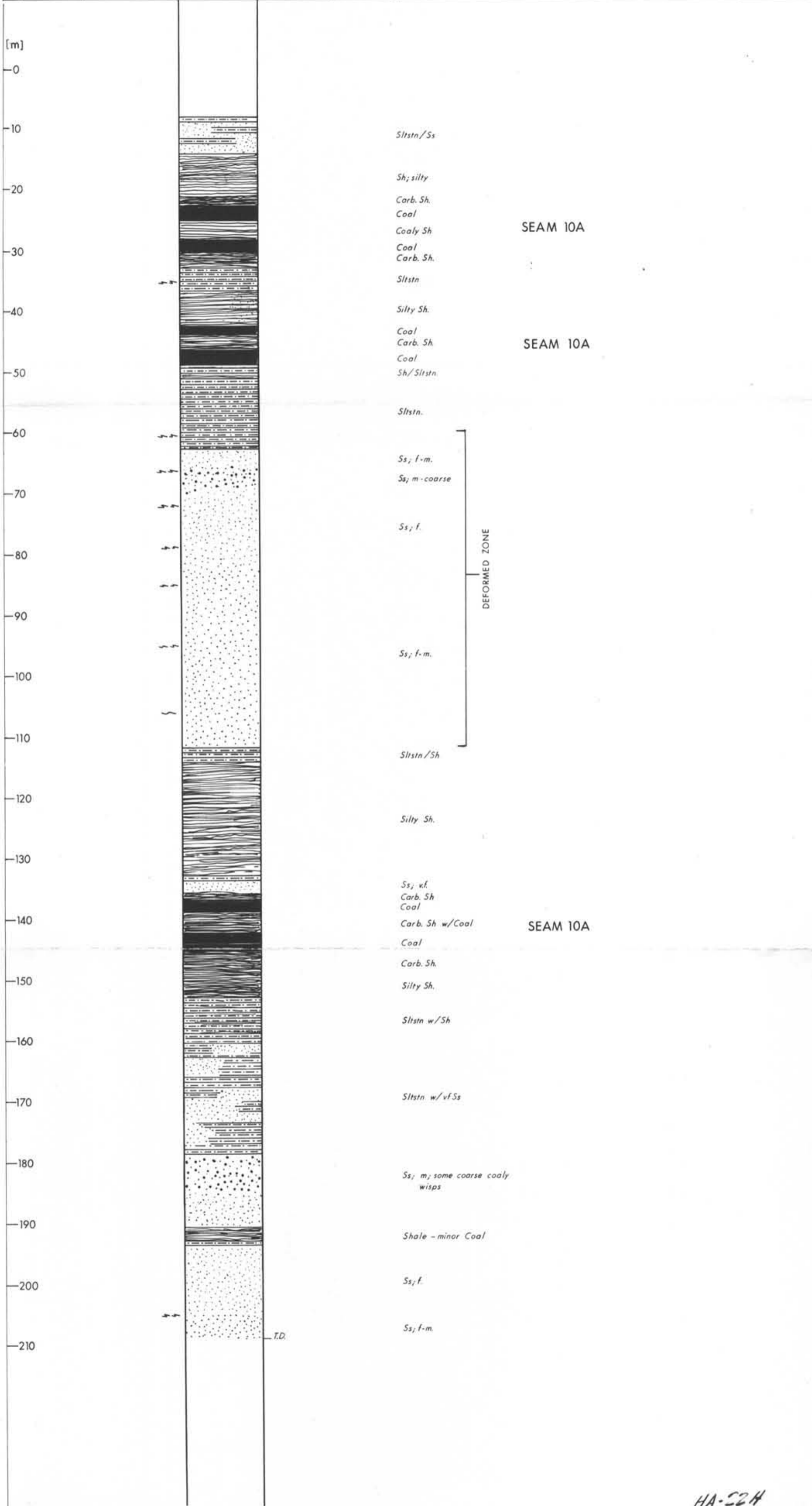
DATE: 1979

AREA: HORSESHOE RIDGE, B.C.

SOURCE OF DATA: Measured in field.

LOCATION: HSR - 103 Graphic Log

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	



HA-524



5536000 N

5534000 N

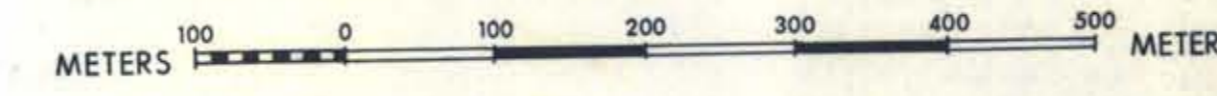
5532000 N

5530000 N

420

LEGEND

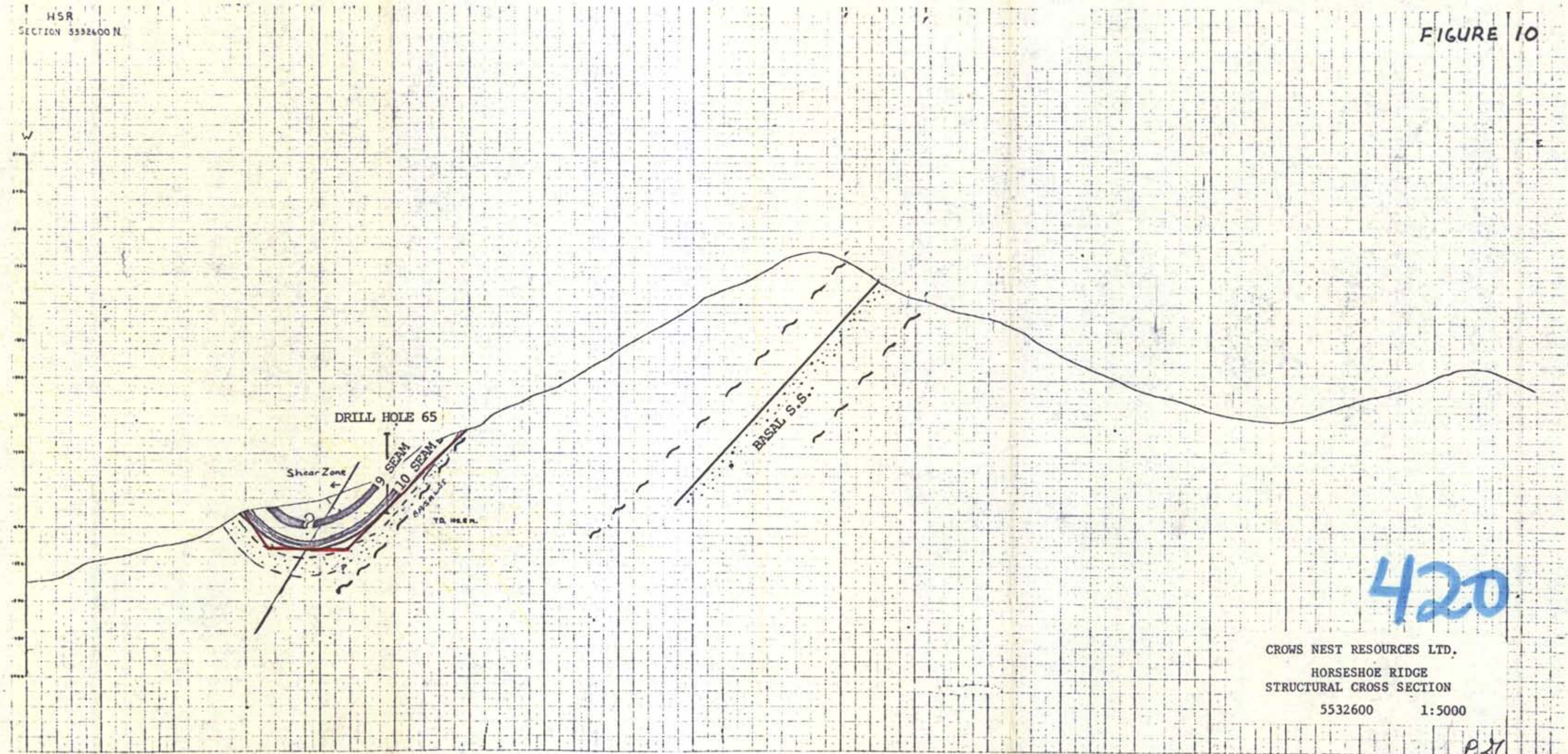
- ADIT 14 ADIT
- 103 CORED DRILL HOLE
- 56 ROTARY DRILL HOLE
- 10 COAL SEAM
- SEC 4 MEASURED SECTION
- SANDSTONE OUTCROP
- SUMMER ACCESS ROAD (UPGRADED 1978)
- PROPOSED ROTARY DRILL HOLE
- PIT RESERVE AREA



Crows Nest Resources Limited		
EXPLORATION		
HORSESHOE RIDGE PROJECT AREA SOUTHEAST BRITISH COLUMBIA		
GEOLOGICAL MAP		
Figure 9		
AUTHOR: P. GILMAR	SCALE: 1:13,000	ENCLOSURE No:
DATE: APRIL, 1979	REVISED:	DRAWING No: HA-23
To Accompany		

HSR
SECTION 5532600 N

FIGURE 10



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5532600 1:5000

P.J.

K-E

K-E

HSR
SECTION 5532800 N

FIGURE 11



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5532800 1:5000

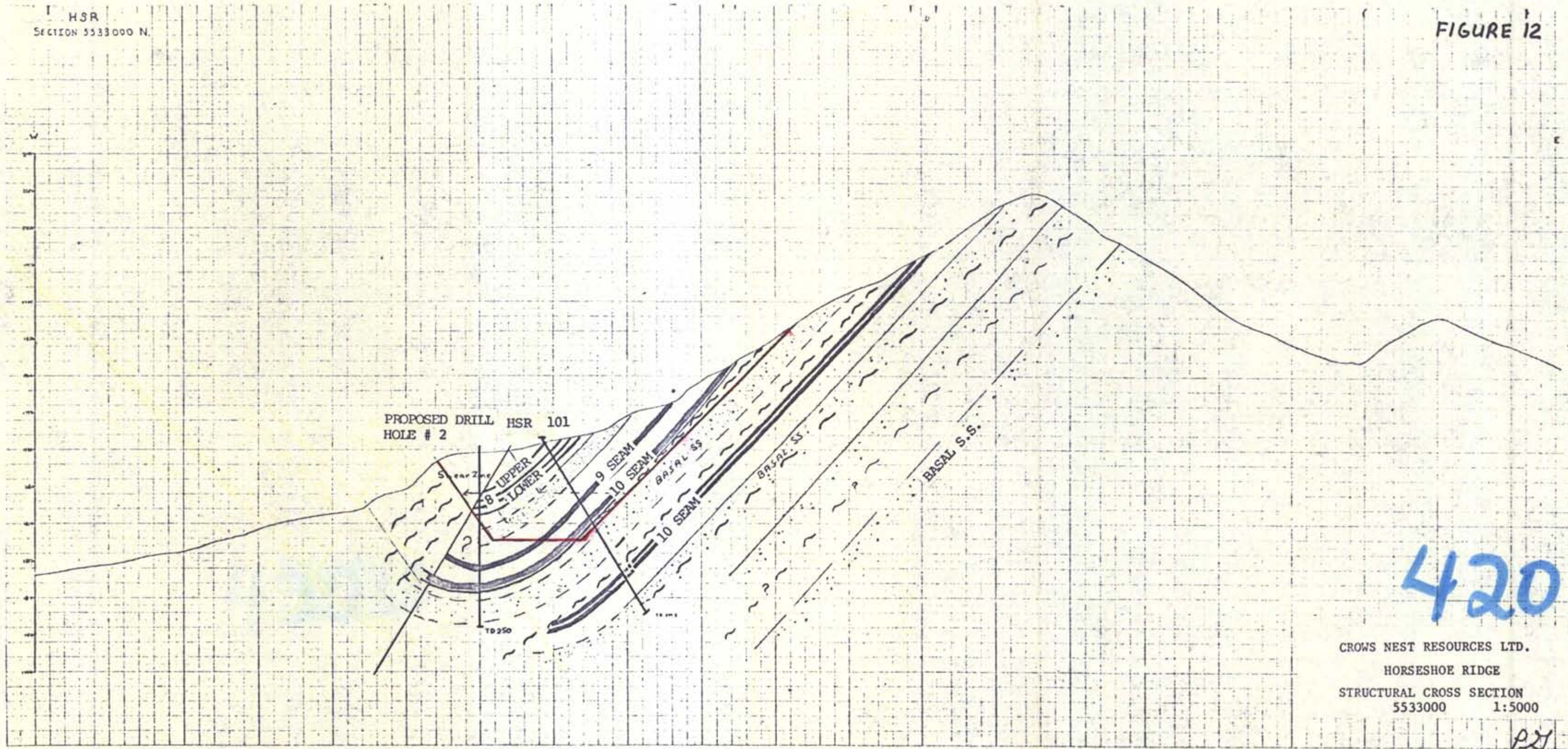
PJ

K-E

K-E

HSR
SECTION 5533000 N.

FIGURE 12



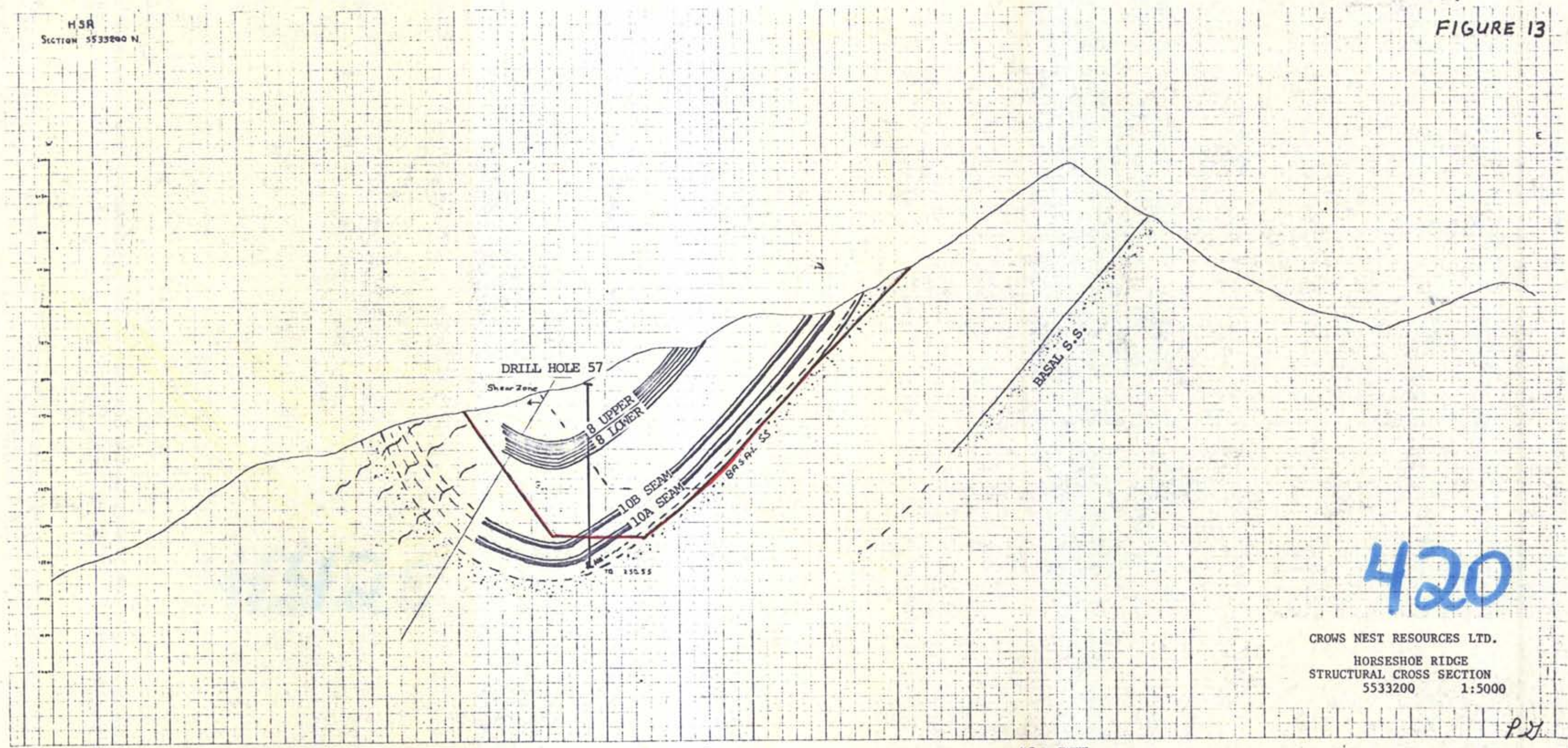
420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5533000 1:5000

PS

HSR
SECTION 5533200 N.

FIGURE 13



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5533200 1:5000

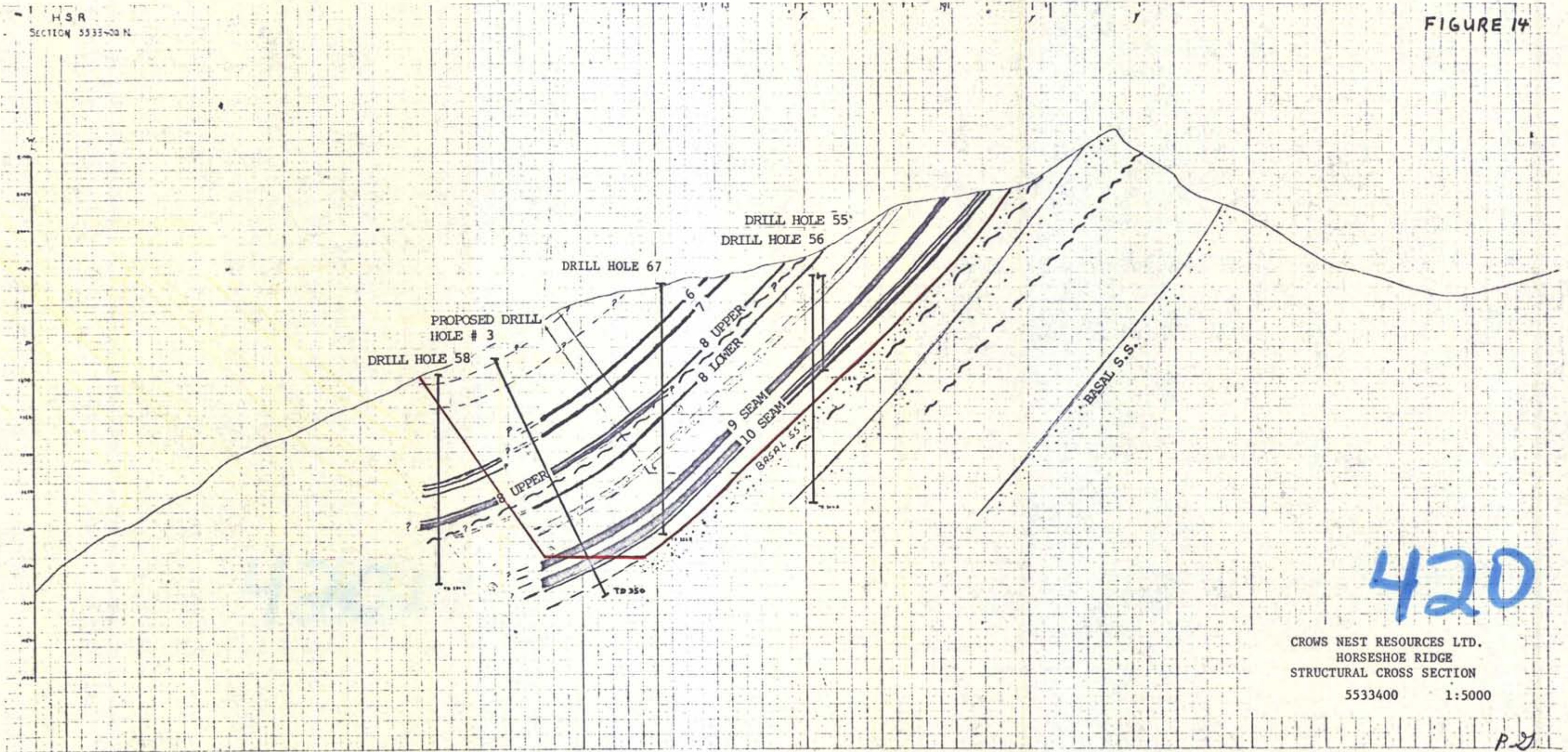
P21

N-E
WALMETER
1:5000

N-E
WALMETER
1:5000

HSR
SECTION 5533-00 N

FIGURE 14



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5533400 1:5000

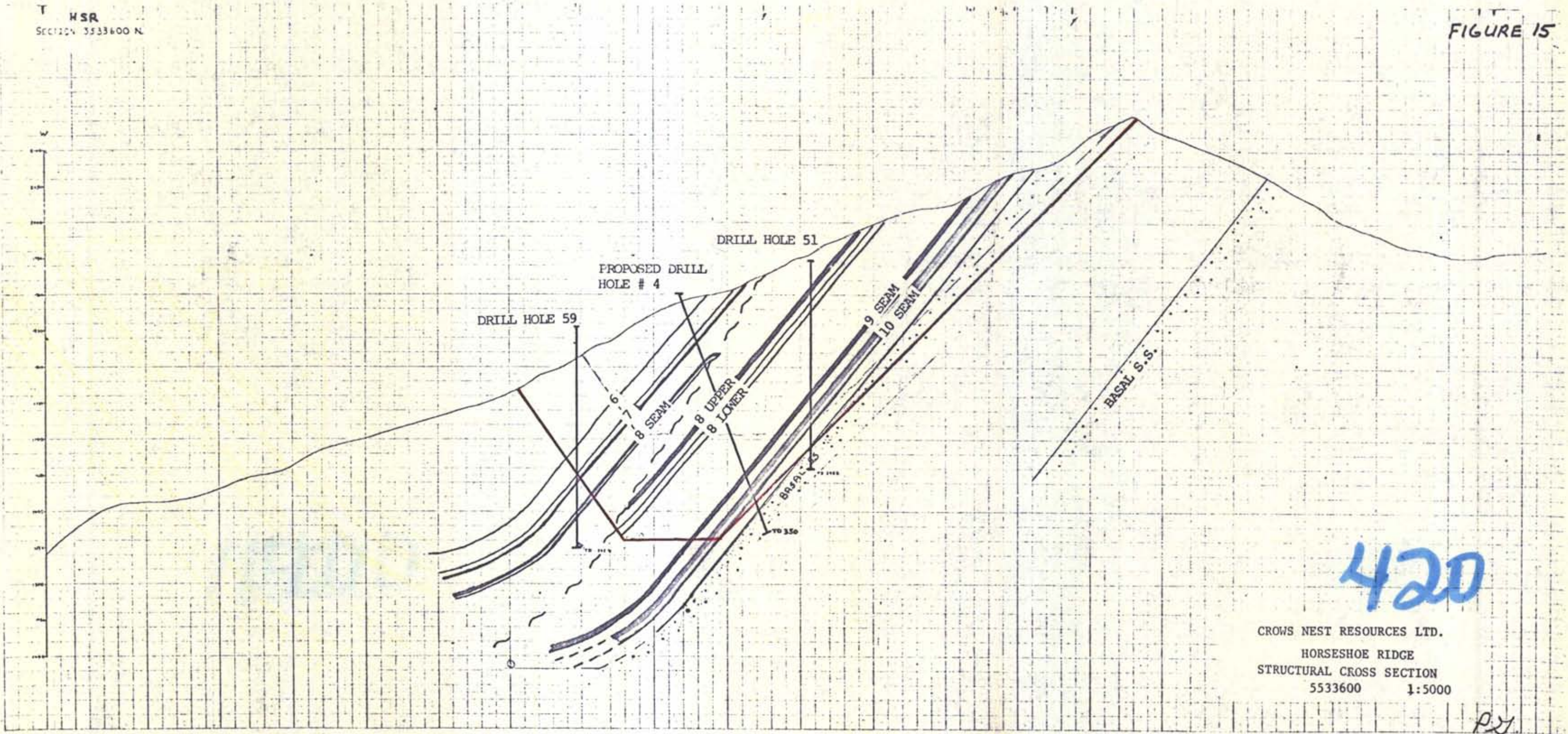
P. 21

K-E

K-E

T HSR
SECTION 5533600 N

FIGURE 15



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5533600 1:5000

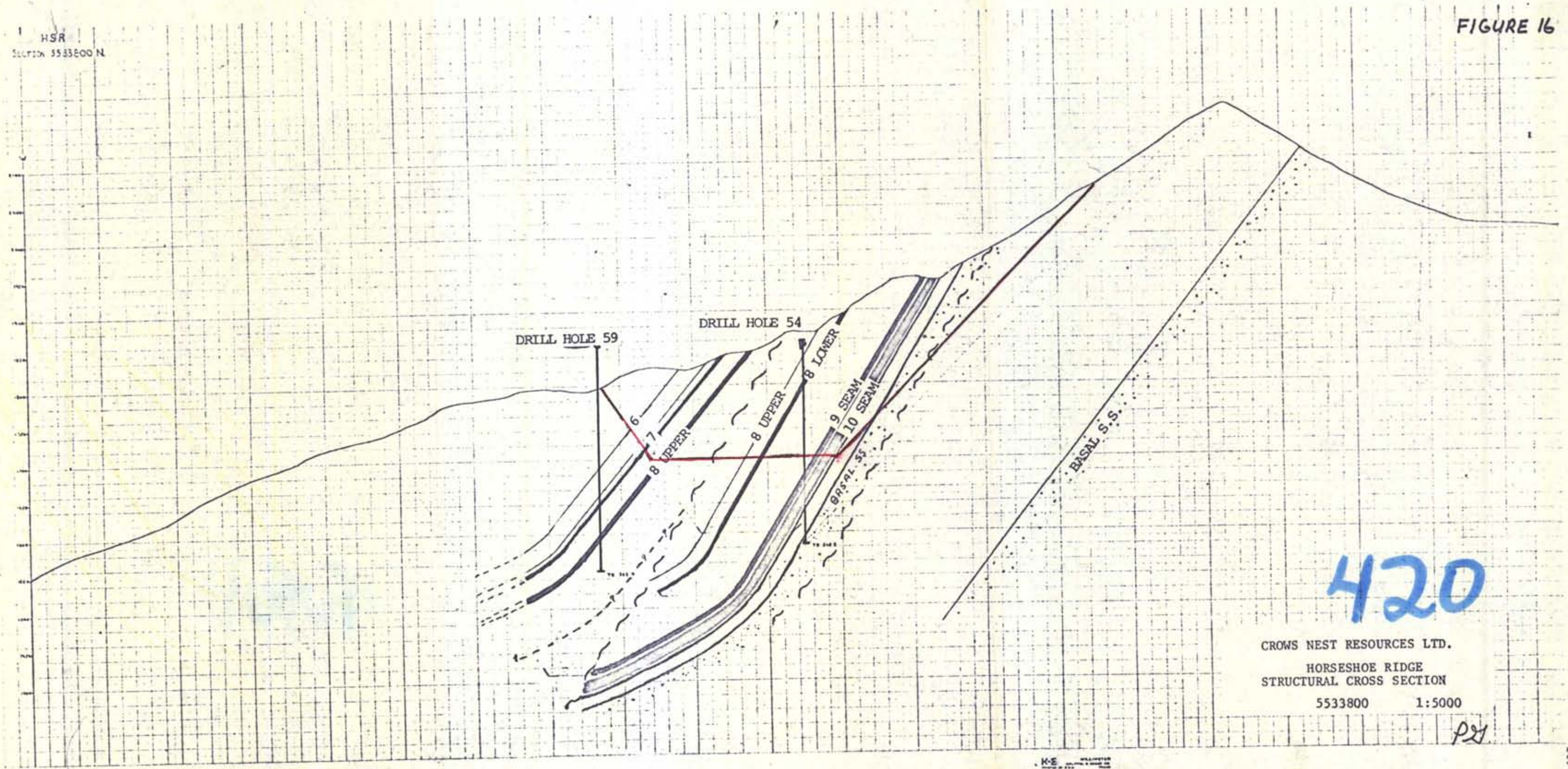
K-E

K-E

PJ

HSR
SECTION 5533E00 N

FIGURE 16



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5533800 1:5000

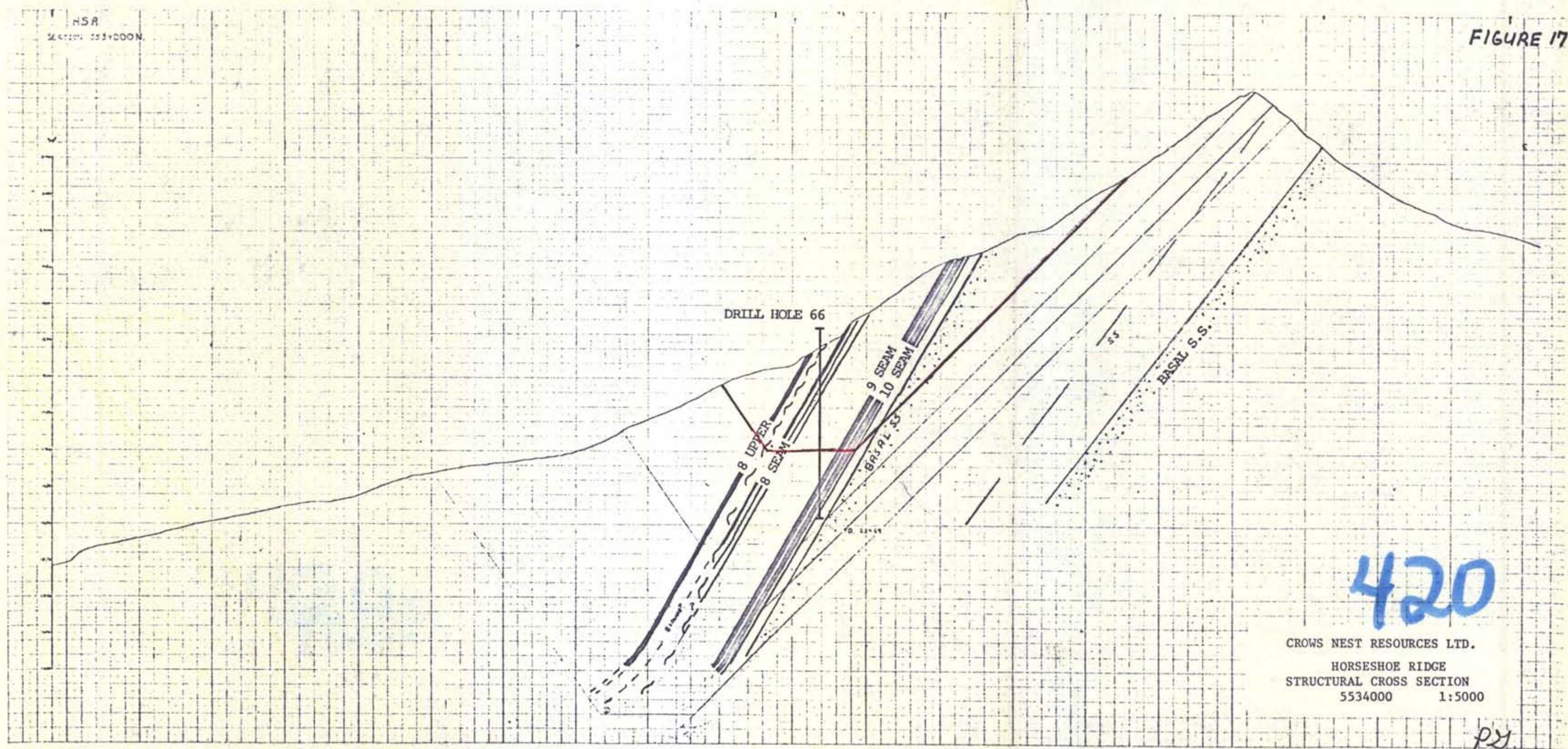
PS

K-E

K-E

HSR
SECTION: 553+000M

FIGURE 17



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5534000 1:5000

PSY

K-E

K-E

K-E

HSR
SECTION 553+200 N.

FIGURE 18

DRILL HOLE 52 HSR 102
DRILL HOLE 66

8 UPPER
8 UPPER
8 LOWER
9 SEM
10 SEM

BASAL S.S.

BASAL S.S.

420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5534200 1:5000

K-E

K-E

K-E

HSR
SECTION 5534400 N

FIGURE 19

DRILL HOLE 52
PROPOSED DRILL
HOLE # 5
8 UPPER
8 LOWER
9 SEAM
10A SEAM
10A SEAM
10A
10A
BASAL S.S.

420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5534400 1:5000

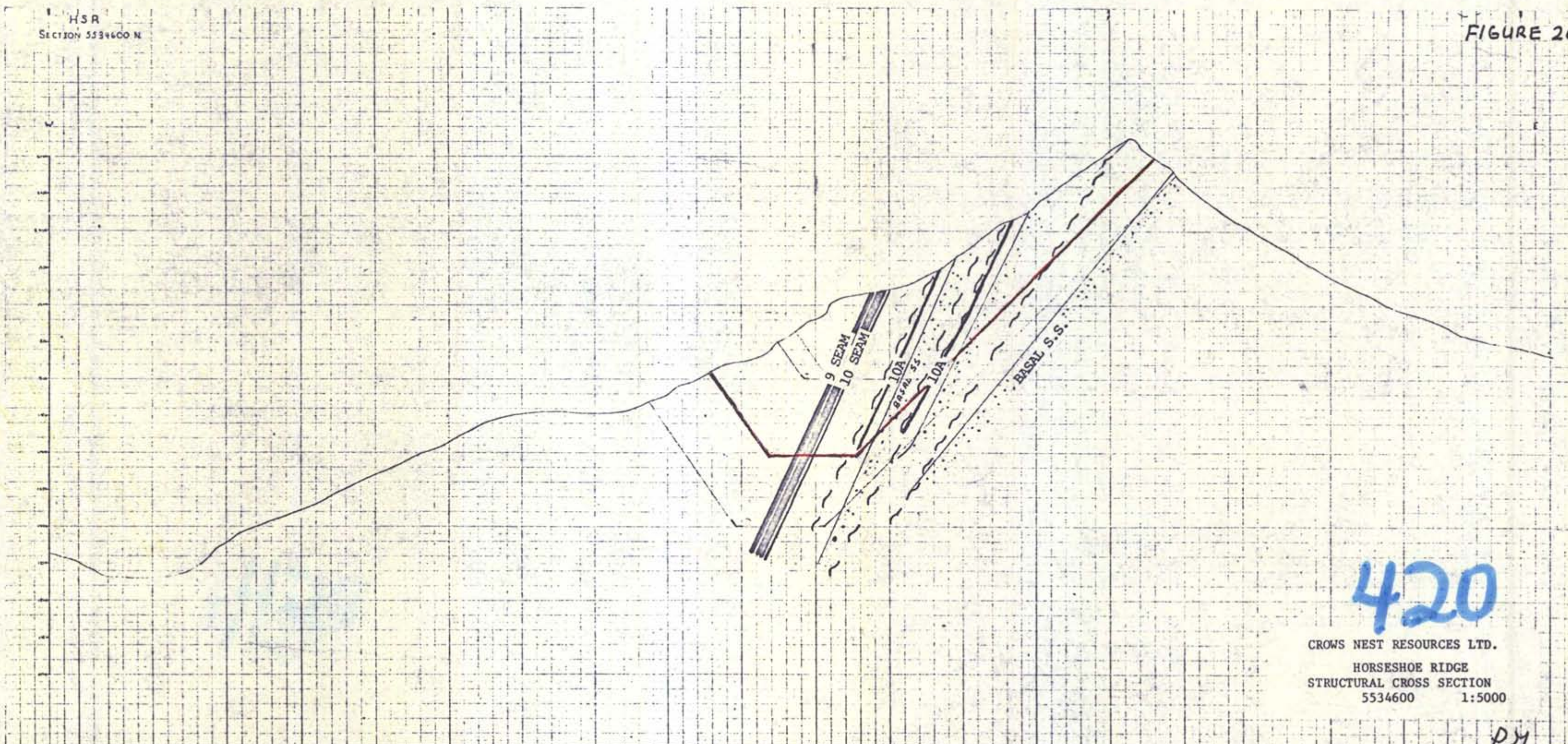
PS

K-E

K-E

HSR
SECTION 5534600 N

FIGURE 20



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5534600 1:5000

PJ

N-E

N-E

H.S.R.
SECTION 5534800 N.

FIGURE 21

PROPOSED DRILL
HOLE # 6

9 SEAM

10A SEAM
GREAT S.S.

10A

BASAL S.S.

TO 250

420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5534800 1:5000

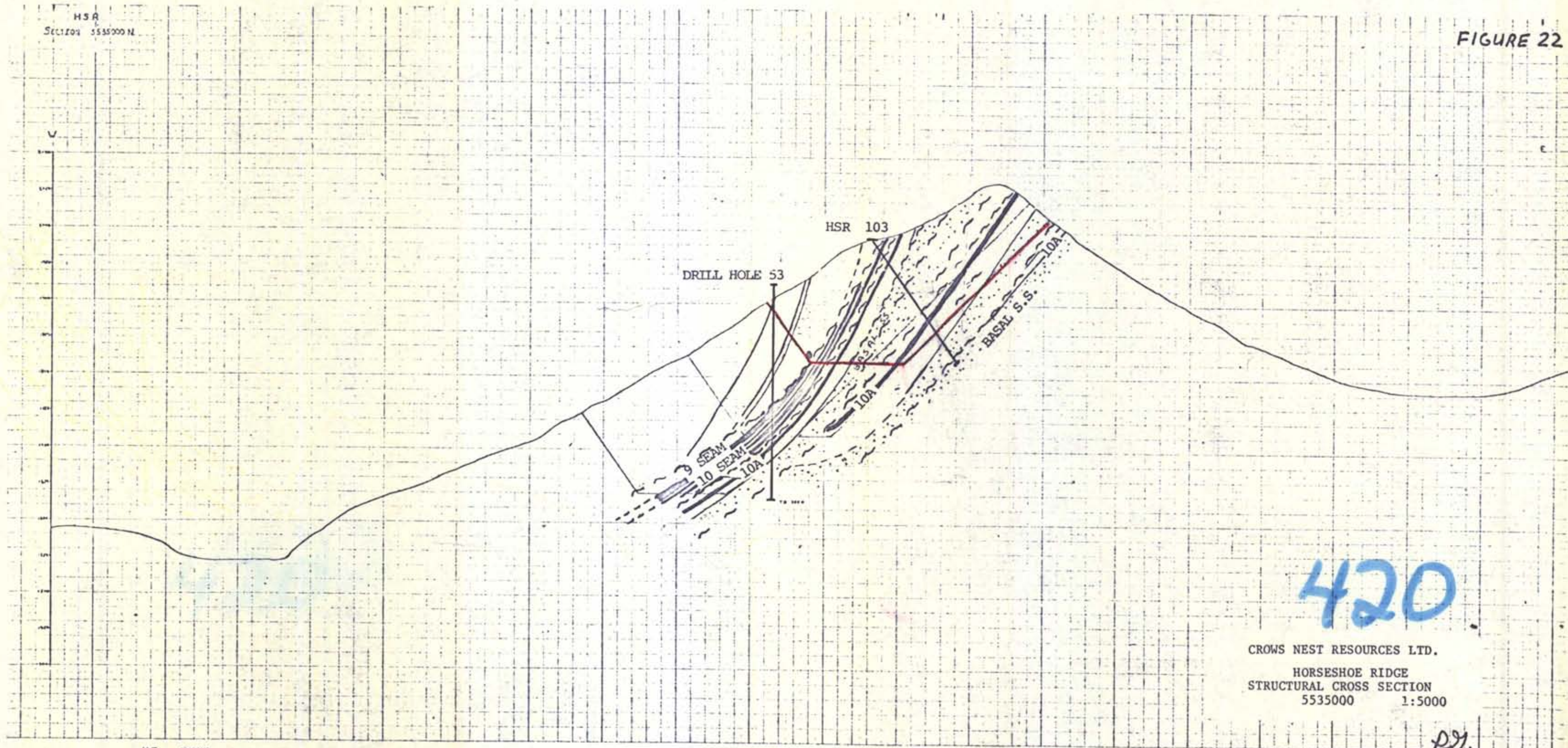
py

N-E

N-E

HSR
SECTION 5535000 N

FIGURE 22



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5535000 1:5000

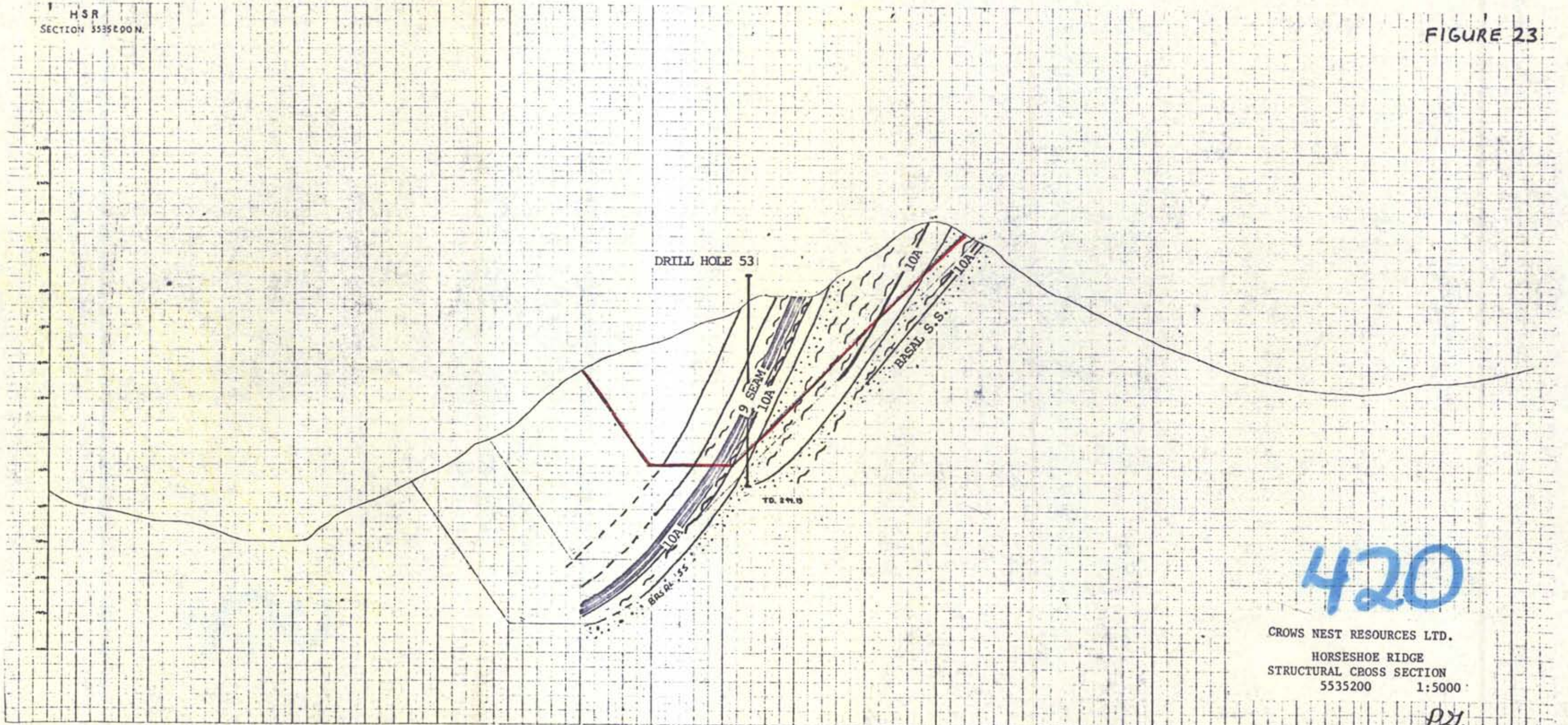
pg.

K-E MILLIMETER

K-E MILLIMETER

HSR
SECTION 5535200N

FIGURE 23



420

CROWS NEST RESOURCES LTD.
HORSESHOE RIDGE
STRUCTURAL CROSS SECTION
5535200 1:5000

P21

MILLIMETER

M-E

M-E