

SHELL  
K-MOUNT MICHEAL 80(1)A

NTS 82-675  
"Mount Michael Project  
Southeastern British Columbia  
1980 Geological Report"  
SHELL CANADIAN RESOURCES LTD.  
CL# 285, 286, 289-92,  
304  
by:  
Alan M. White  
April 28/81

435

SHELL  
K.M. MOUNT MICHAEL 80(12)A

# OPEN FILE

MOUNT MICHAEL PROJECT  
SOUTHEASTERN BRITISH COLUMBIA  
1980 GEOLOGICAL REPORT

B.C. COAL LICENCES

285, 286, 288, 289, 290, 291, 292, ~~293~~ & 304

HELD BY:

SHELL CANADA RESOURCES LIMITED

OPERATED BY:

CROWS NEST RESOURCES LIMITED

KOOTENAY LAND DISTRICT

NTS 82G/15  
GEOLOGICAL BRANCH  
ASSESSMENT REPORT

LAT: 49°58' NORTH  
LONG: 114°45'30" WEST

00 435

REPORT BY: ALAN M. WHITE

SUBMITTED: APRIL 28, 1981

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A P P E N D I C E S

- 1(a)        ITEMIZED COST STATEMENTS  
              (Copy of Application to Extend Term of Licence,  
              Group #264 Including Mt. Michael)
- 1(b)        ITEMIZED COST STATEMENT  
              (Copy of Application to Extend Term of Licence  
              Group #264 Mt. Michael only)
- 2            BIBLIOGRAPHY
- 3            PROFESSIONAL VERIFICATION OF REPORT

## 1.0 SUMMARY

The Mount Michael Prospect is part of the Upper Elk Coalfield in the Rocky Mountains of southeastern British Columbia. The name refers to the ridge which is between the Horseshoe Ridge Project and the Ewin Pass Project at latitude 50. It is two kilometres north of Crows Nest Resources' Line Creek open pit mine development. A large coal preparation plant and railway loading facility are under construction 9.5 kilometres further away on the mine hauling road. From here it is 17 kilometres to the town of Sparwood and 1150 kilometres to the Vancouver area coal ports.

In regional geological terms, the Horseshoe Ridge and Mt. Michael projects are located almost contiguously on the eastern limb of the Fording Syncline. The Line Creek development is on the western limb of this syncline on the opposite side of Line Creek from Horseshoe Ridge. The surface follows the geological structure with dip slopes on the synclinal limbs favourable for open pit mine development.

On Mount Michael there exists not only the entire early Cretaceous coal bearing formation (Mist Mountain)<sup>1</sup> of the Kootenay Group, but it is thickened threefold by repeats due to thrust faulting.

1) Gibson, D.W. (1979)

## 1.0 Summary (continued)

On the west facing dip slopes 47 metres of coal were found in a 350 metre succession of strata. Beneath this on the east facing slopes 61 metres of coal were found in 900-metre section. As exploration to date was done by hand trenching, the entire succession is expected to contain more coal.

Crows Nest Industries constructed an access road to Ewin Pass along the east slope and carried out some bulldozer trenching in the past. These sites were re-examined in 1978 (reported in 1979) by Crows Nest Resources Limited in a reconnaissance manner. Data from this area were used in this report only to the extent which was necessary to interpret the structure of the overlying west slopes, where the 1980 program concentrated. It consisted of on-foot geological mapping and hand trenching of the coal outcrops.

Analytical results of the west slope hand trenches are not yet available. Middle to upper range medium volatile bituminous rank is expected based on the stratigraphic position of the coal seams and on information from the surrounding properties. Such coal is in high demand and would be a much desired supplement to Line Creek. The quality of coal in the lower strata outcropping on the east slope, is similar to that of Line Creek.

## 1.0 Summary (continued)

The Mount Michael Prospect is well established now, but it is still in the grass roots phase. It would be premature to calculate reserves at this stage. There is, however, potential for very substantial tonnages. Thus intensive exploration is warranted.

The Prospect is at the stage when extensive drilling is needed for further evaluation. Continuous core (diamond) drilling is planned for 1981 on the west slopes. The upper strata are the most immediate target. At least some of the holes, however, shall be deep enough to intersect the entire coal bearing succession including the lower strata outcropping on the east slopes. Detailed geological mapping of both slopes is both essential and urgent but it does not have to precede drilling.

Road access to and on the upper west slopes is necessary. Gaining it on the south end of Mt. Michael from the existing Dry Creek road is the best alternative from technical, cost and environmental viewpoints alike.

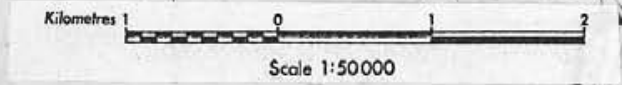
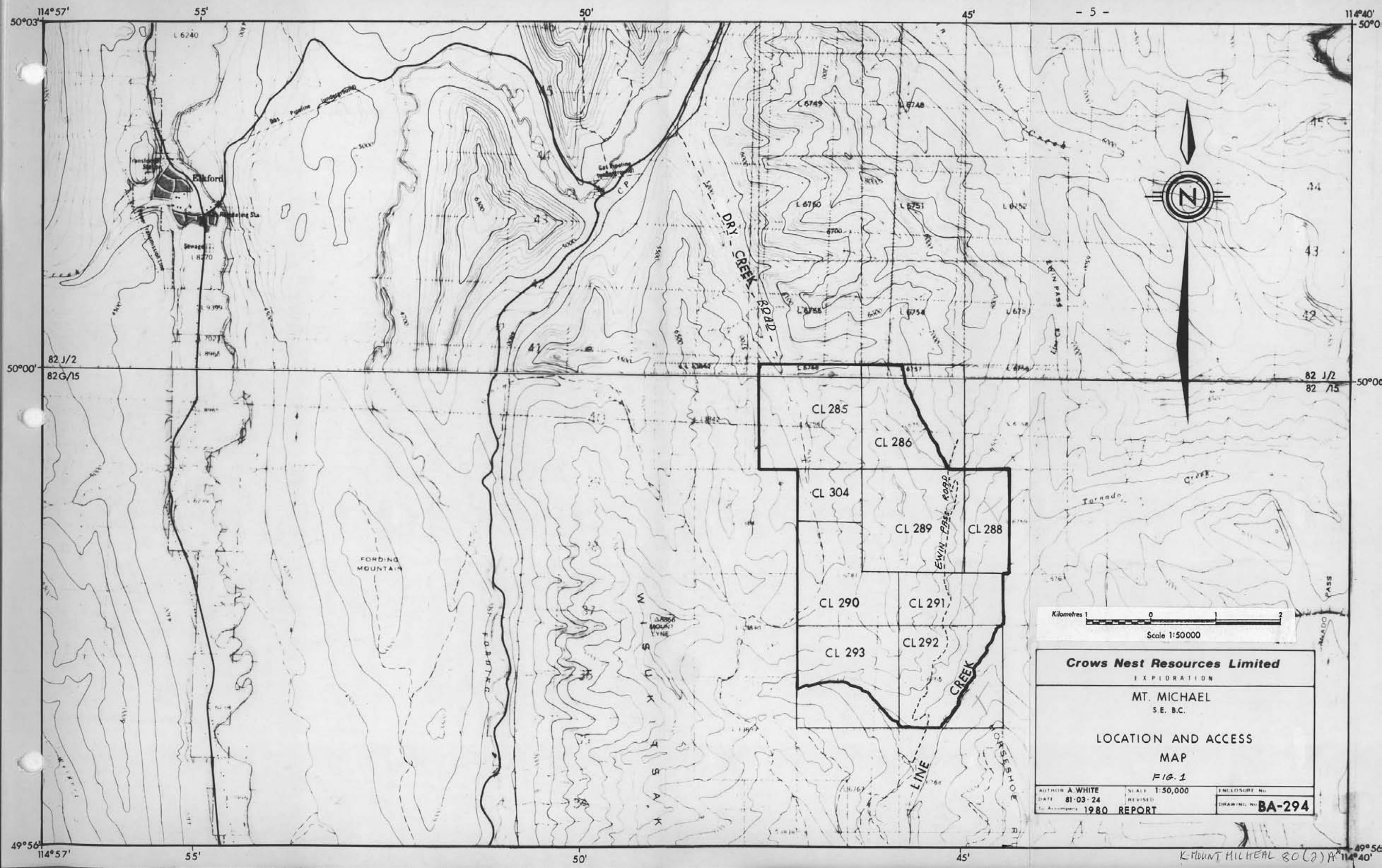
The Mt. Michael Project is part of Group #264, Central Block of B.C. Coal Licence held by Shell Canada Resources Limited, operated by its wholly-owned subsidiary Crows Nest Resources Limited.

## 2.0 INTRODUCTION

### 2.1 Location and Physiography

The Mount Michael licences are located 12 km southeast of Elkford in the Upper Elk Coalfield of southeastern B.C. (Figure 1). They are centered at approximately  $114^{\circ}45'30''$  west longitude,  $49^{\circ}58'$  north latitude (NTS Map Sheet 82G/15 Tornado Mountain).

In elevation the property varies between 1800 m and 2475 m. A north trending ridge is the main physiographic feature, with a steep, east facing slope and a more moderate west facing slope. The eastern slope has very little tree cover and has several avalanche chutes. Outcrop is fairly abundant, with some sandstone beds being exposed laterally over several hundred metres. Vegetation on the western slope varies from moderately thick spruce forest at the valley bottom to sub-alpine shrubs and grasses near the ridge top. Outcrop is rare on the lower slopes but becomes more common near the top of the slope.



<b>Crows Nest Resources Limited</b>		
EXPLORATION		
MT. MICHAEL S.E. B.C.		
LOCATION AND ACCESS MAP FIG. 1		
AUTHOR: A. WHITE	SCALE: 1:50,000	ENCLOSURE NO.
DATE: 81-03-24	REVISED:	DRAWING NO. BA-294
To Accompany: 1980 REPORT		

## 2.2 Access

Currently only the lower elevations on Mt. Michael can be reached by vehicular traffic. On the east side, the Ewin Pass access road traverses across the lower part of the slope from Line Creek to Ewin Pass. On the west side an old fire access road along Dry Creek allows four-wheel drive access to the bottom of that slope from the Fording Highway. These roads are shown on Figure 1.

During 1980 a helicopter was used to gain access to the top of the ridge and the lower slopes were explored from the aforementioned roads.

### 3.0 SUMMARY OF WORK DONE

#### 3.1 Previous Work

Only limited work has been done on the Mt. Michael licences prior to 1980. The Geological Survey of Canada published a geological report by R. A. Price in 1961 which included the Mt. Michael project area. This report showed that the Mt. Michael area contained the Jurassic Cretaceous coal-bearing strata.

Prior to 1978 Crows Nest Industries explored the lower part of the eastern slope by bulldozer trenching, while in the process of building the Ewin Pass access road. N. Elphinstone also covered the area briefly in the report on his reconnaissance in 1951.

John Fischer (1978) mapped the eastern slope as part of his reconnaissance mapping of the North Central Block for Crows Nest Resources Limited. He measured several stratigraphic sections and coal seams along the east slope. The west side of the ridge was looked at very quickly and one stratigraphic section was measured. The geology was plotted on 1:5,000 air photo blow-ups. Mr. Fischer made special note of a 6 metre thick seam seen roughly parallelling the top of the ridge which he tentatively identified as the number 7 seam. In his report he recommended examining that seam and several others in detail as they occurred in a dip slope situation.



### 3.2 Scope and Objectives of the 1980 Program

The 1980 program on Mt. Michael was planned to cover the upper thrust plate with emphasis on the coal-bearing Mist Mountain Formation. The mapping was not restricted to this thrust sheet or to the licences if it was felt information from elsewhere would be useful in interpreting the structure or stratigraphy. In practice the mapping actually concentrated on the area west of the ridge on Mt. Michael.

The 1980 program on the Mt. Michael prospect had four main objectives:

- determine the extent of the coal-bearing Mist Mountain Formation;
- determine the number and thickness of coal seams;
- prepare a geology map covering the licences; and
- prepare cross-sections of the property showing an interpretation of the structural geology of the property.

In the performance of this work \$39,887.00 were spent. An itemized cost breakdown of these expenses is presented in Appendix 1 (a & b) (copy of Application to Extend Term of Licence Group #264, Ewin Pass and Mt. Michael and Mt. Michael only).

### 3.3 Work Done in 1980

During September and October, 1980, the author and an assistant mapped the geology west of the ridge on Mt. Michael. No work was performed on the east slope. Approximately 2,000 hectares covering B.C. Coal Licences 285, 286, 288 to 293 inclusive, and 304, were mapped at a scale of 1:5,000. Ten coal seams were hand trenched and their true thicknesses measured.

After the end of the field season the information obtained was compiled on a geologic base map for presentation. Eighty-four strike and dip measurements from the upper thrust plate were analyzed using stereographic techniques to help in interpreting the structure. Cross-sections were then drawn using the information from the geology map and the results of the stereographic analysis.

#### 4.0 GEOLOGY

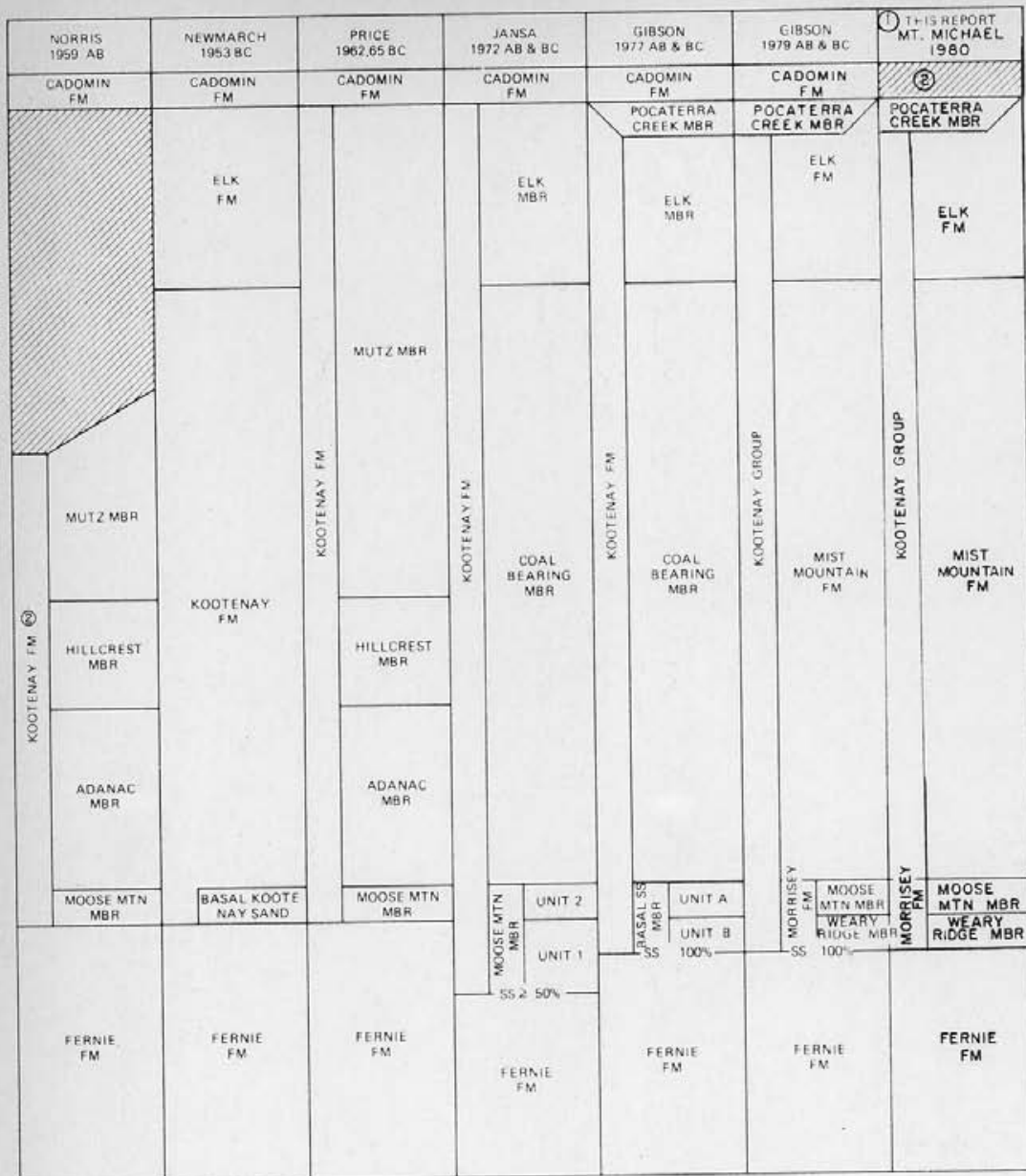
##### 4.1 Regional Stratigraphy

This report follows the stratigraphic nomenclature proposed by D. W. Gibson of the Geological Survey of Canada in 1979. It is shown in a tabulated form on Figure 2. Jurassic-Cretaceous Kootenay Group strata were investigated.

Withdrawal of the Fernie Sea northeastward and deposition of the Kootenay Group strata were initiated by an epirogenetic uplift of the source area on the southwest during an early phase of the Columbian Orogeny in late Jurassic time.

Kootenay Group strata, a thick sequence of clastic sediments, represent a delta pro-gradation northeastward, an environment favourable for coal deposition. It is a transition from a marine (underlying shales of the Fernie Formation) to a fully alluvial (overlying conglomerates and coarse sandstones of the Blairmore Group) environment.

There is coal present throughout Kootenay Group strata, however all workable seams occur in the Mist Mountain Formation. The Moose Mountain Member of the Morrissey Formation and the Elk Formation lie respectively under and over the main coal-bearing formation. Prior to 1979 these stratigraphic units were called the Moose Mountain, Coal Bearing and Elk Members of the Kootenay Formation.



- ① The terminology for this report follows that of Gibson 1979.
- ② The Cadomin Formation does not outcrop on Mt. Michael, but does appear slightly to the northeast on the peak of Mt. Banner.

*K-MOUNT MICHAEL 80(2)A*

<b>Crows Nest Resources Limited</b> EXPLORATION
SE BRITISH COLUMBIA
FORMATIONAL DIAGRAM
MT. MICHAEL
<i>FIG 2</i>
A WHITE 81-03-25
NTS AA-543

#### 4.1 Regional Stratigraphy (continued)

The Moose Mountain Member is a resistant, generally cliff-forming unit comprised of massive, medium to coarse-grained, medium-gray weathering sandstone. There are commonly two coal horizons within this sandstone, but their small thickness (rarely over one metre) and the overlying massive sandstone make them unattractive for economic consideration. The distinctive nature and prominence of this unit makes it an easily traceable marker horizon throughout the Crows Nest Coalfields of southeastern B.C.

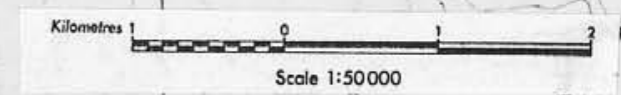
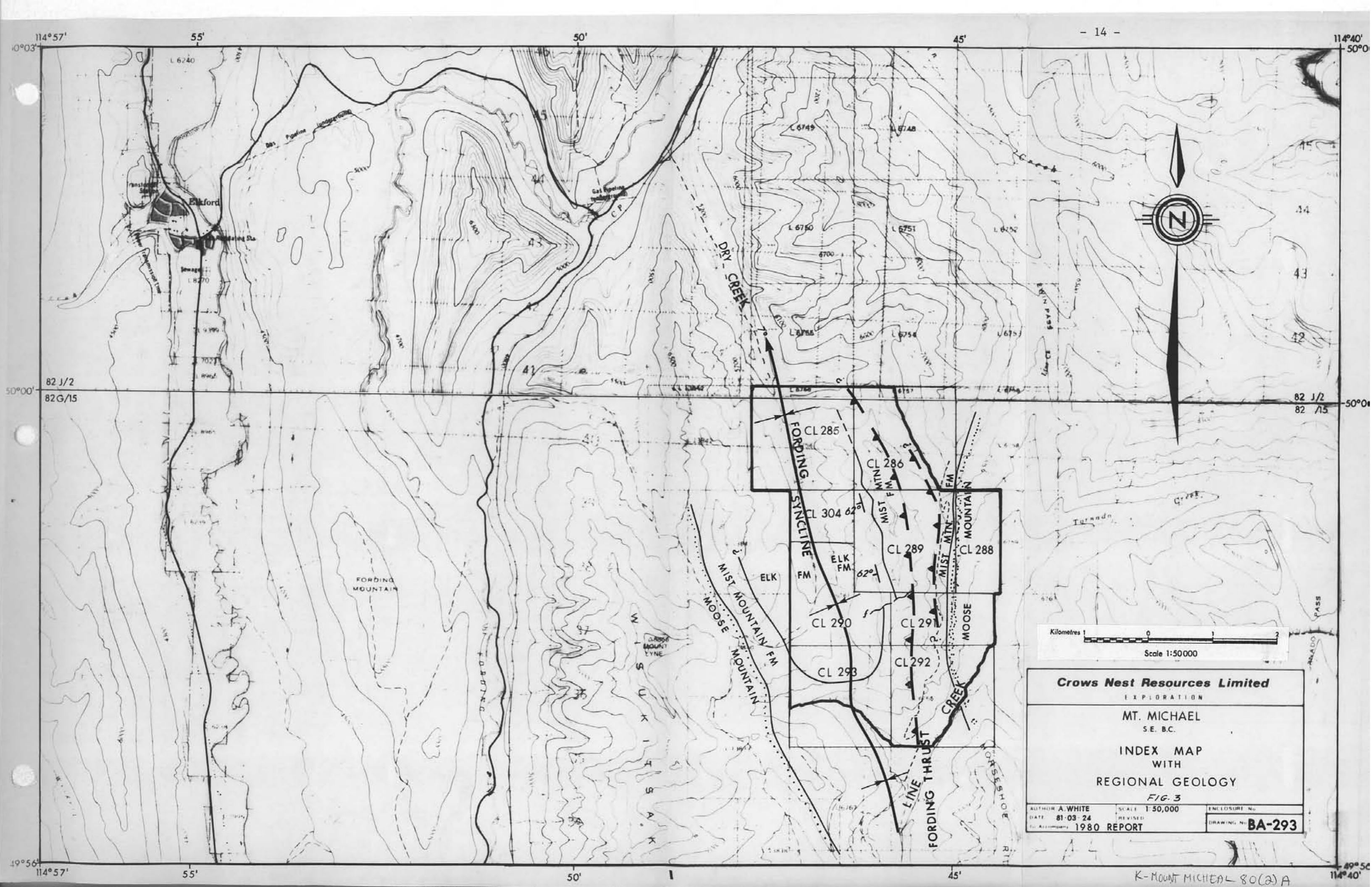
The Mist Mountain Formation is the main coal-bearing unit of the Kootenay Group. It overlies conformably but abruptly the Moose Mountain Member.

It is comprised of a generally recessive, interbedded sequence of brownish tinted sandstones, gray to brown siltstones, gray and black shales, gray mudstones and coal seams. In the Elk Coalfield this formation ranges in thickness between 400 metres and 660 metres. The coal seams attain a thickness of up to 10 metres and a lateral extent of several kilometers.

#### 4.1 Regional Stratigraphy (continued)

The Elk Formation lies conformably but abruptly over the Mist Mountain Formation. It consists of an interbedded sequence of cliff-forming sandstones, shales and siltstones and thin (less than 1 m), sporadic coal seams.

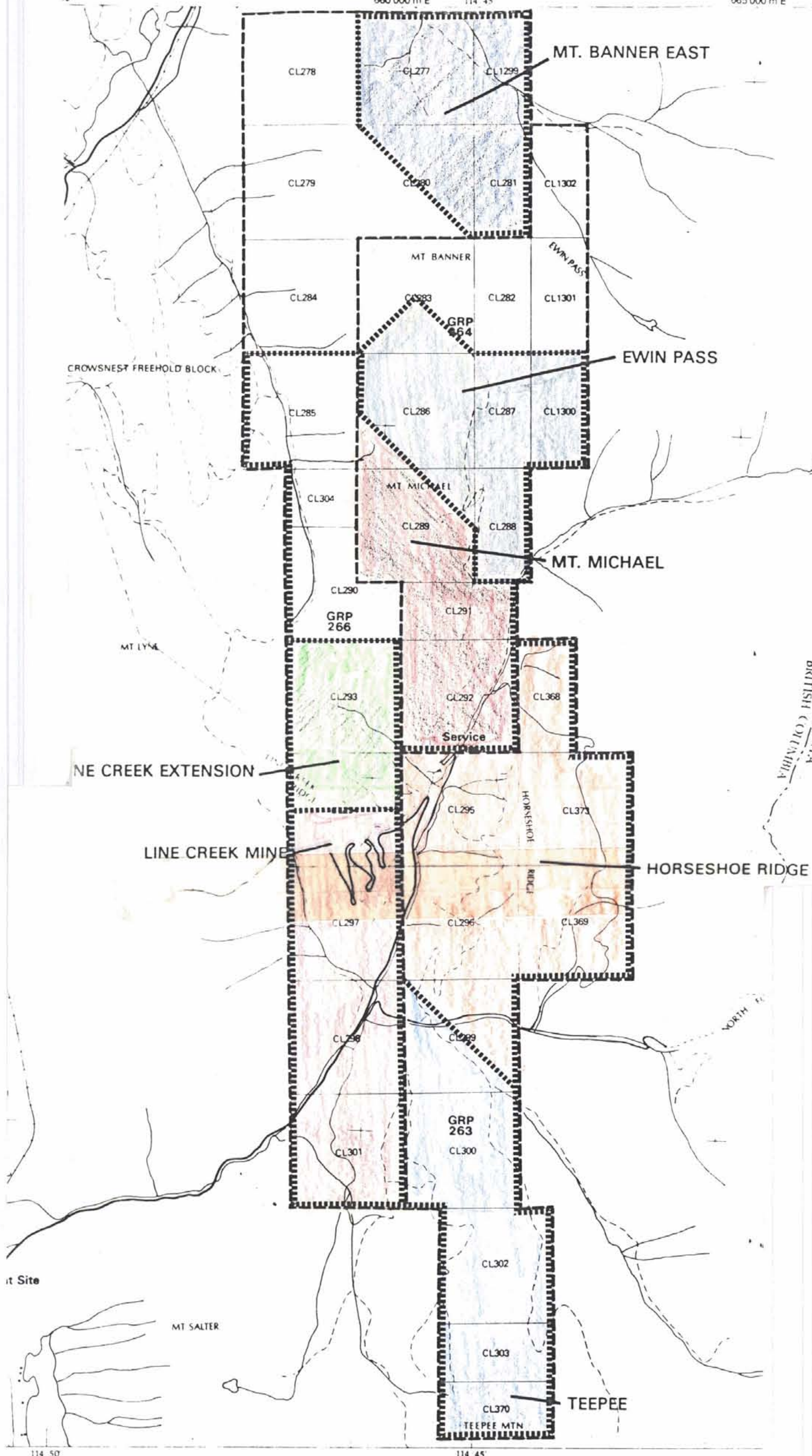
The exact base of the Elk Formation is somewhat arbitrary as it is defined as being 'the base of the first major sandstone or conglomerate above the uppermost major coal seam in the Mist Mountain Formation'. Therefore the stratigraphic position of the Mist Mountain-Elk formational contact may vary slightly from project to project.



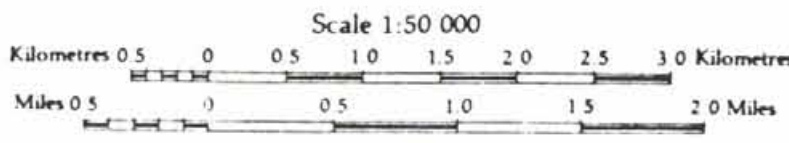
**Crows Nest Resources Limited**  
 EXPLORATION  
 MT. MICHAEL  
 S.E. BC.  
 INDEX MAP  
 WITH  
 REGIONAL GEOLOGY  
 FIG. 3

AUTHOR A. WHITE	SCALE 1:50,000	ENCLOSURE No.
DATE 81-03-24	REVISED	DRAWING No. BA-293
To Accompany 1980 REPORT		





By the Survey and Mapping  
Bureau, Mines and Resources  
Department of British Columbia  
and 1960 (1:50,000 Scale  
Drawing CL 1000-2)



PROJECT BOUNDARY  
PROPERTY BOUNDARY



Transverse Mercator Projection  
Universal Transverse Mercator Grid Zone II

Vertical datum: 1985 International datum  
Approximate Mean Sea Level 1275  
Annual change decreasing 1.4

**Crows Nest Resource**  
EXPLORATION

CENTRAL B.C.  
SE B.C.

**PROJECT LC**  
MAP

AUTHOR: K. PERRY SCALE: 1:50,000  
DATE: 81/07/30 BY: [unintelligible]



#### 4.2 Regional Structure

The Mount Michael prospect area is affected by two main structural elements, the Fording Thrust Fault and the Fording Syncline.

The Fording Thrust has caused a threefold (1300 m as compared to the normal 450 m) thickening of the Kootenay coal-bearing strata by repeat. The Fording Thrust and sequences of the lower plates outcrop along the steep east-facing slopes and dip westward under the uppermost plate.

The northerly plunging Fording Syncline dominates the upper plate structures. The west facing slopes of the prospect area are the surface expression of the east limb of this syncline. This so-called dip slope situation is favourable for open pit mine development. Such potential is further enhanced by the underlying coal bearing lower plates. Dry Creek is the surface expression of the synclinal axis. Coal licences on the west limb (Burnt Ridge) are held by B.C. Coal.

Figure 3: "Index Map with Regional Geology" shows the regional stratigraphic and structural features.

#### 4.3 Mt. Michael Geology

The results of the mapping program are presented on Figure 4 'Geology Map'.

Our first target was to determine the Mist Mountain-Elk formational contact. After a reconnaissance of the area, a laterally extensive, resistant sandstone bed, above the uppermost workable coal seam, was chosen by the author as being the base of the Elk Formation. Chained traverses were then run from the top of the ridge towards the valley floor to locate this sandstone on the map. By this method the base of the Elk Formation was accurately located at several points, and was interpolated between these points to end up with the location as drawn on the map. This Mist Mountain-Elk formational contact was likewise determined near the nose of the syncline at the south end of the property.

A resistant sandstone, traceable over 1500 metres was noted along the ridge top. It was found useful to use this sandstone as a stratigraphic marker and it has tentatively been named 'Ridge Sandstone'. A type section (Figure 5) was measured between this sandstone and the Elk-Mist Mountain contact.

#### 4.3 Mt. Michael Geology (continued)

No work was done between the Ridge Sandstone and the Moose Mountain Member on the eastern slope. It is known however, that the Fording Thrust outcrops on the eastern slope of Mt. Michael and that most of the eastern slope is underlain by coal-bearing Mist Mountain Formation strata.

##### Coal Stratigraphy

Several chained traverses on the west facing slope revealed the coal seams as marked on the map. The traces of the seams were later interpolated between these locations. The coal seams were hand trenched to allow an accurate measurement of their true thicknesses.

Eleven coal seams were found in the 356 metres of section between the Ridge Sandstone and the base of the Elk Formation. They ranged in thickness between one and eight metres, with an aggregate thickness of 47 metres. Nine of these seams, totalling 44.6 m, are greater than two metres thick. These are shown on the type section (Figure 5).

#### 4.3 Mt. Michael Geology (continued)

Channel samples were taken from the hand trenches of five of the seams. The results of the analysis have not yet been received, so they will be included in next year's report.

##### Structure

Eighty-four strikes and dips from the upper thrust plate were analysed using stereographic techniques to determine the attitude of the limbs of the Fording Syncline on the Mt. Michael property. This information was used to determine the best layout for the cross-section grid, and to obtain the average strikes and dips of the bedding for use in drawing the cross-sections.

The attitudes from the east and west limbs of the syncline were plotted and analysed separately and then compiled for easy understanding. This work is presented in Figures 6 through 10. The results are summarized as follows:

#### 4.3 Mt. Michael Geology (continued)

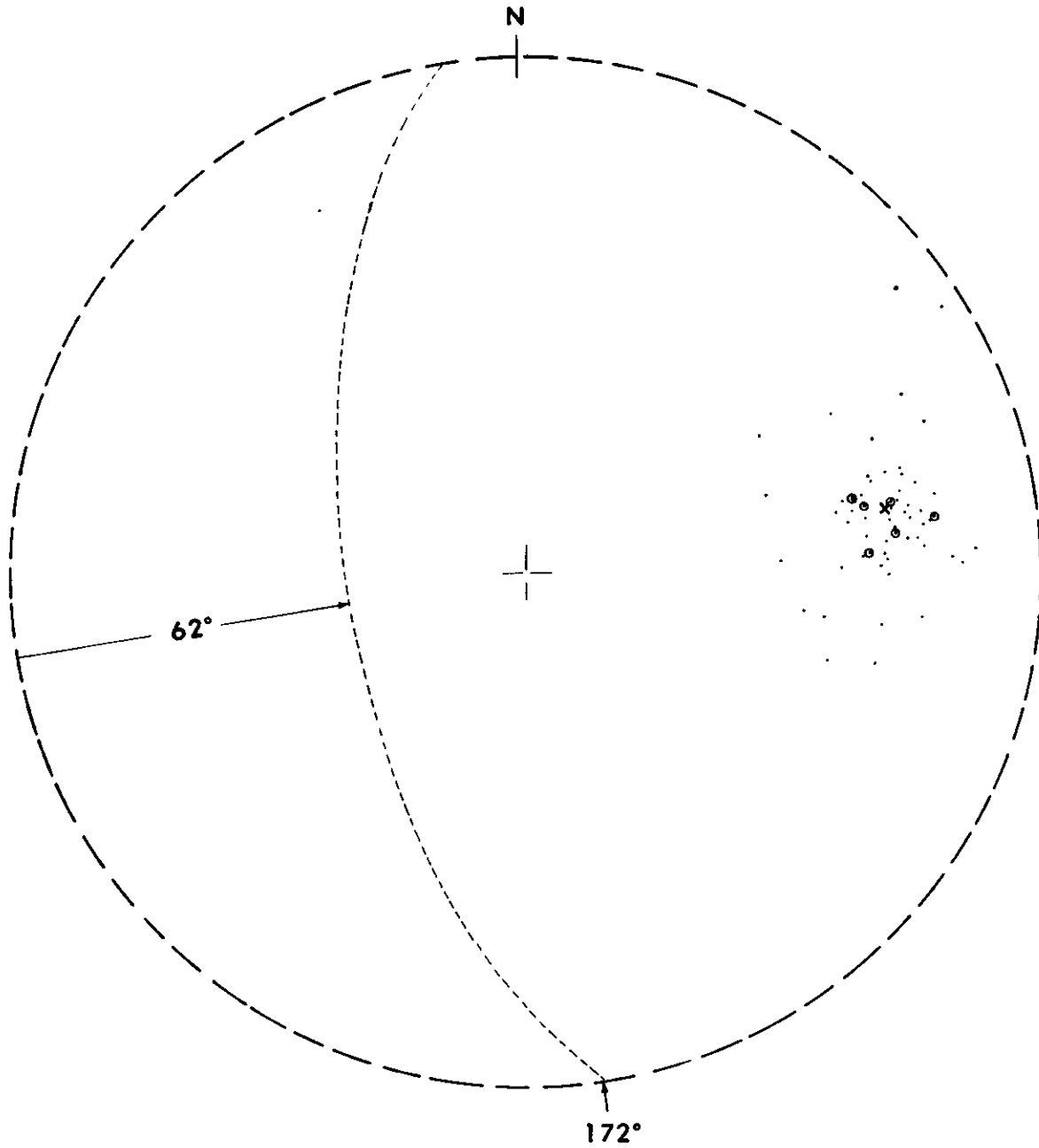
East Limb of Syncline:	172°/61° West
West Limb of Syncline:	345°/72° East
Axial Plane:	349°/85° West
Fold Axis:	Trends 348° Plunges 08°

Using this data, the cross-section grid was laid out with the base line at an azimuth of 348° (parallel to the plunge of the fold axis) and the cross-section lines at 258° (approximately the prevailing dip direction).

Cross-sections were drawn using average bedding dips of 62° westerly on the east side of the fold axis, and 72° easterly on the west side of the fold axis (Figs. 11 to 17).

The Mist Mountain-Elk contact was projected along the plunge of the fold axis from its outcrop at the south end of the property.

The position of the westerly dipping Fording Thrust and a subsidiary thrust were interpreted from air photos, and located on the map and cross-sections. Their exact attitude, however, has not yet been determined.

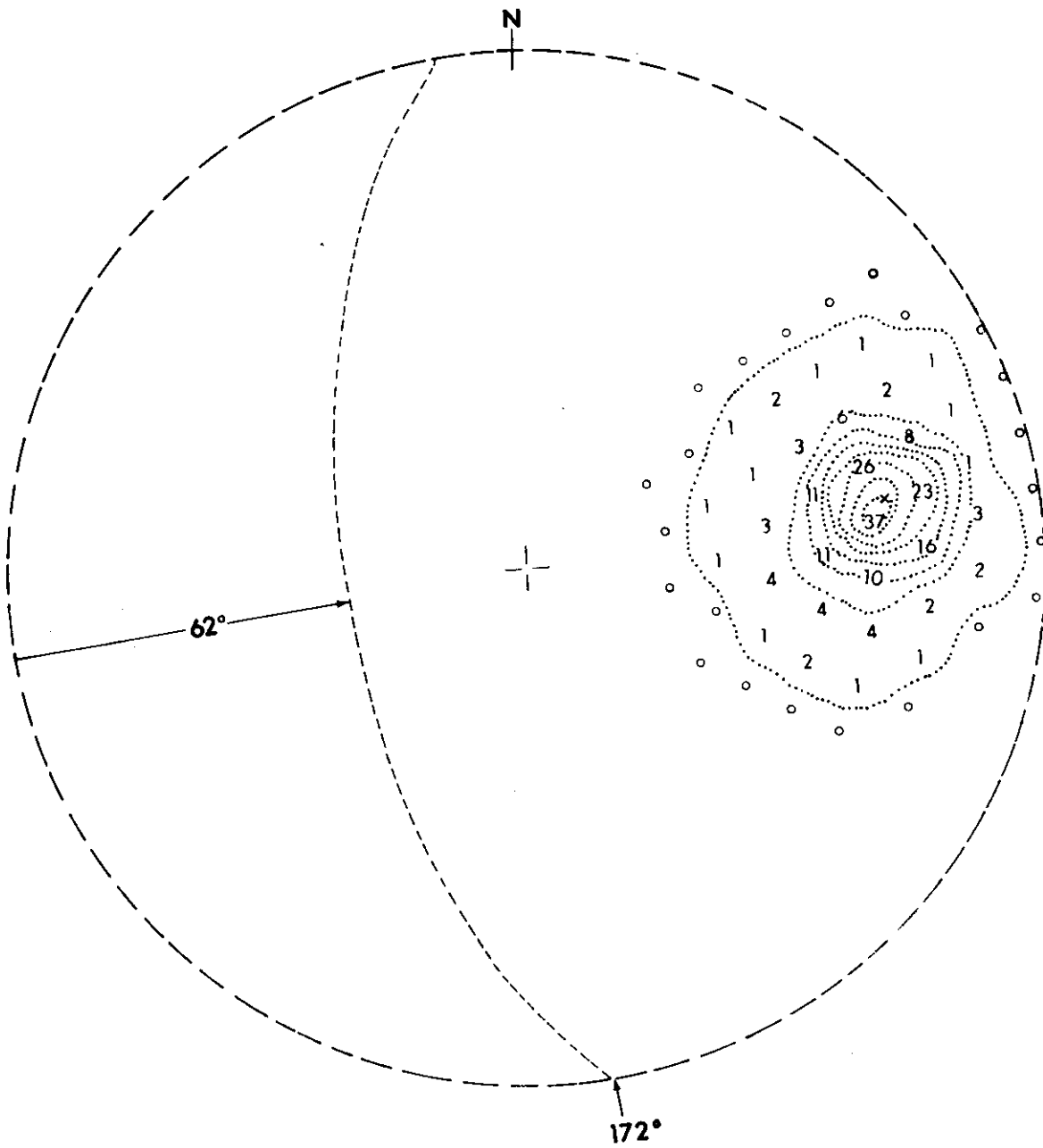


**AVERAGE STRIKE AND DIP OF EAST LIMB IS 172°/62°W  
BASED ON 60 BEDDING MEASUREMENTS**

- 1 POLE
- 2 POLES
- x AVERAGE OF POLES

<b>Crows Nest Resources Limited</b>		
EXPLORATION		
FIG. 6		
MT. MICHAEL (WEST)		
EAST LIMB OF SYNCLINE		
POLES TO BEDDING		
AUTHOR: A WHITE	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: AA-516
To Accompany MT. MICHAEL REPORT		

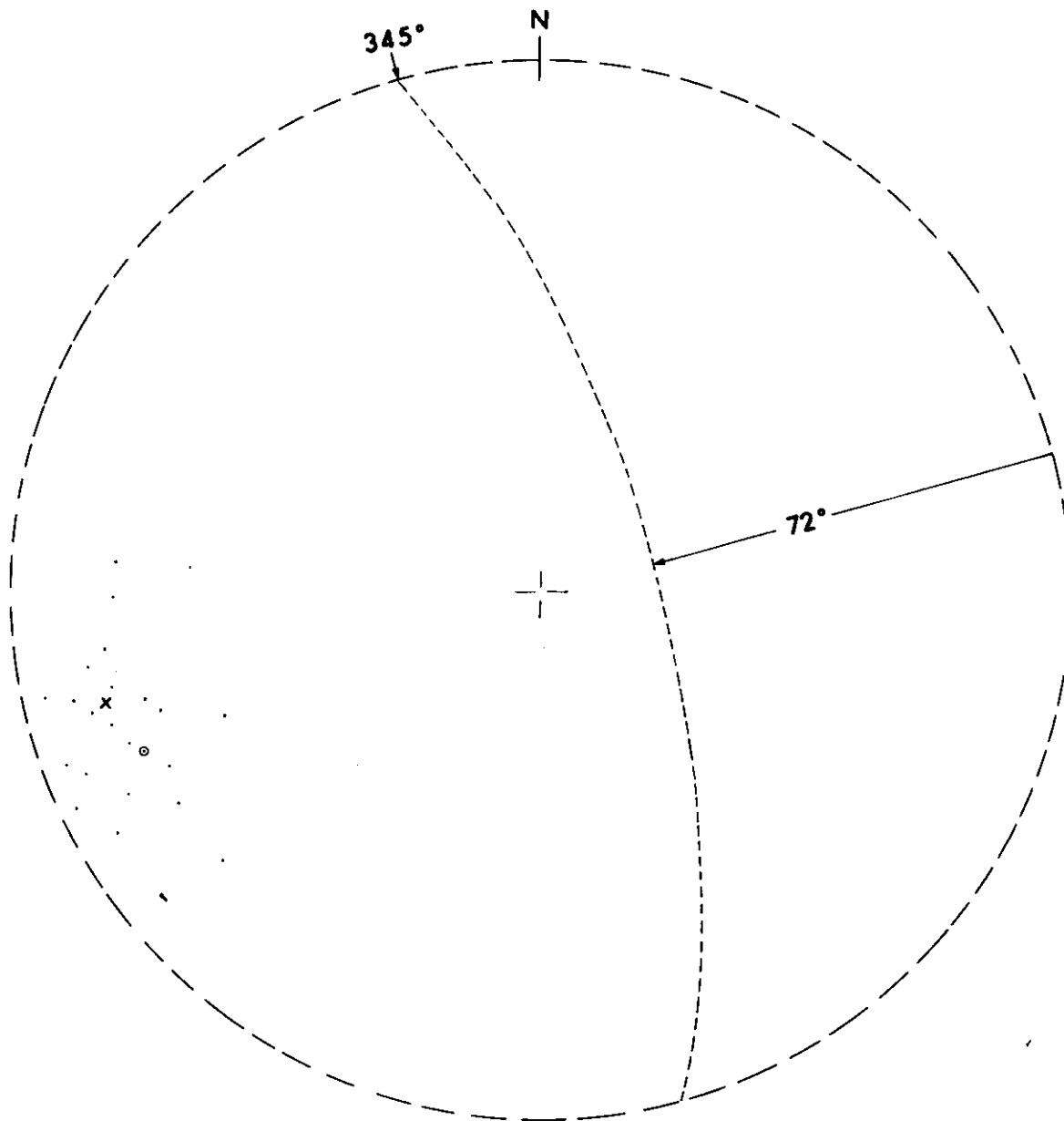
K. MOUNT MICHAEL 80(2)A



NOTE: CONTOUR INTERVAL IS 5 PTS.

<b>Crows Nest Resources Limited</b> EXPLORATION		
FIG. 7 MT. MICHAEL (WEST) CONTOURED POINT DIAGRAM EAST LIMB OF SYNCLINE		
AUTHOR: A. WHITE	SCALE:	ENCLOSURE No.:
DATE:	REVISED:	DRAWING No. AA-514
To Accompany	MT. MICHAEL REPORT	

K-MOUNT MICHAEL 80(2)A



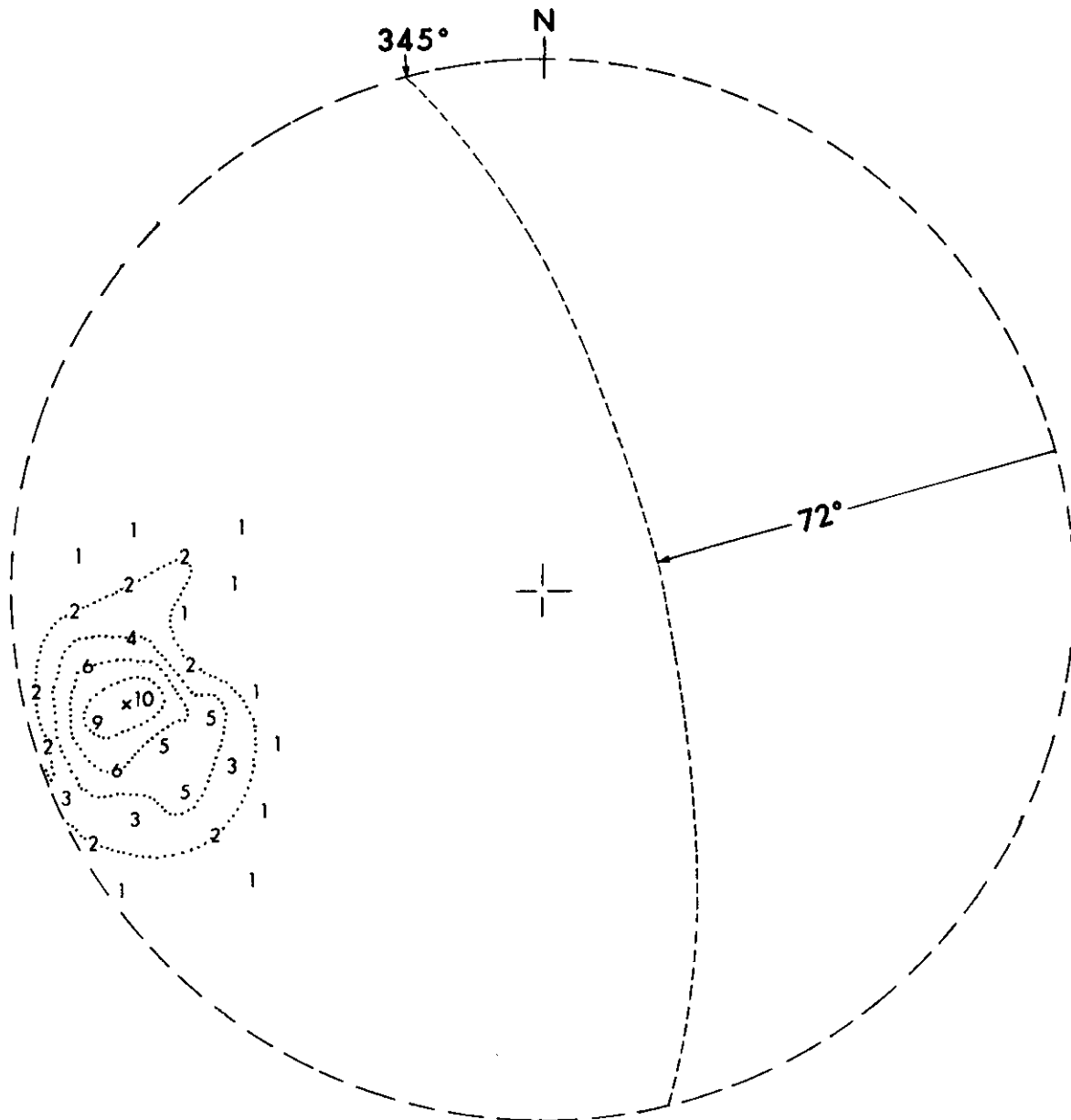
AVERAGE STRIKE AND DIP OF WEST LIMB IS 345°/72°E  
BASED ON 24 BEDDING MEASUREMENTS

- 1 POLE
- 2 POLES
- x AVERAGE OF POLES

<b>Crows Nest Resources Limited</b> EXPLORATION		
FIG. 8 MT. MICHAEL (WEST) WEST LIMB OF SYNCLINE POLES TO BEDDING		
AUTHOR: A. WHITE	SCALE:	ENCLOSURE No:
DATE:	REVISED:	
To Accompany	MT. MICHAEL REPORT	DRAWING No: AA-517

K. MOUNT MICHAEL 80(2)A

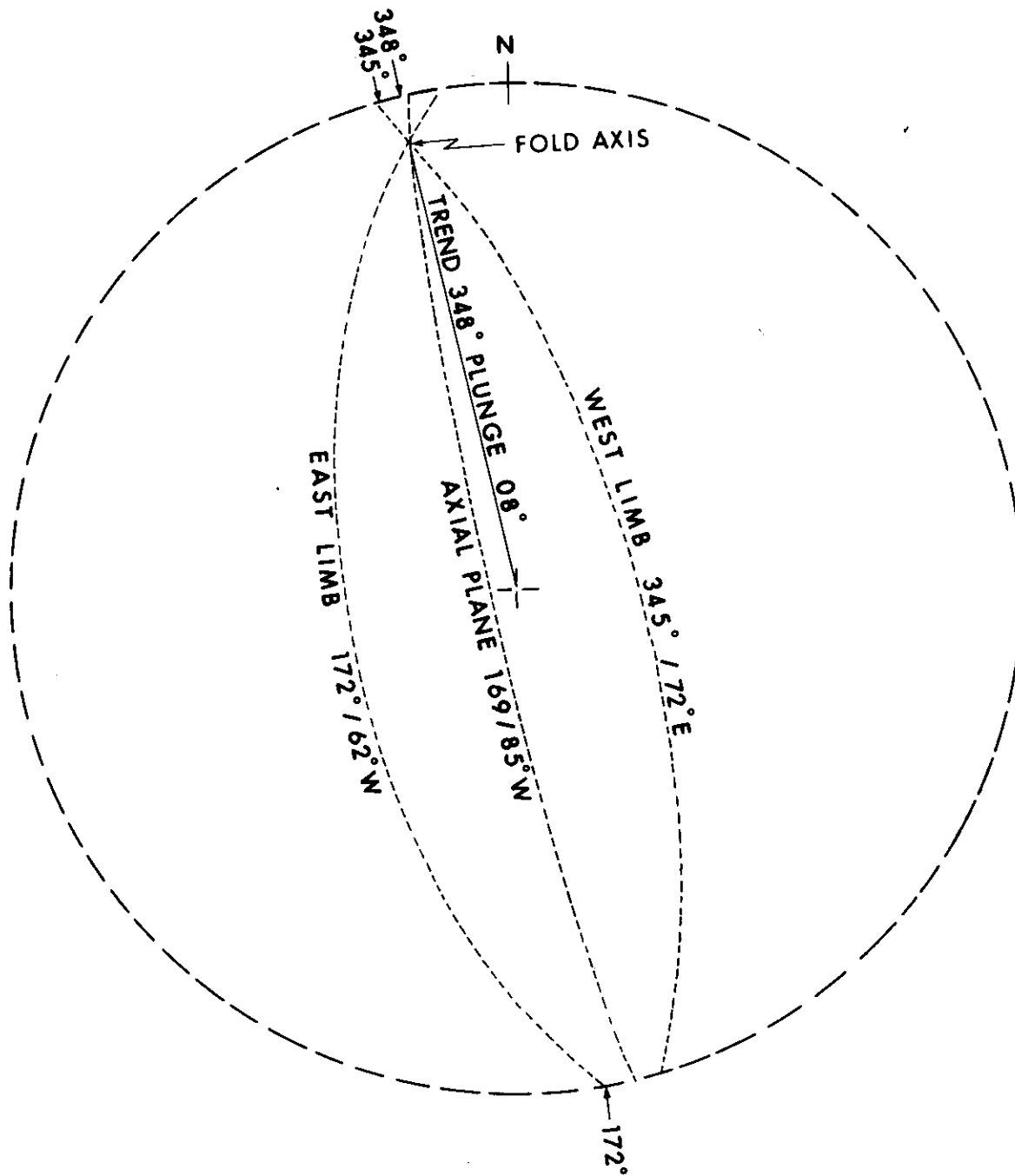




NOTE: CONTOUR INTERVAL IS 2 POINTS

<b>Crows Nest Resources Limited</b> EXPLORATION		
FIG. 9 MT. MICHAEL (WEST) CONTOURED POINT DIAGRAM WEST LIMB OF SYNCLINE		
AUTHOR: A. WHITE	SCALE:	ENCLOSURE No:
DATE:	REVISED:	DRAWING No: AA-515
To Accompany M.T. MICHAEL REPORT		

K-MOUNT MICHAEL 80(2)A



EAST LIMB      172° / 62° W  
 WEST LIMB     345° / 72° E  
 AXIAL PLANE   169° / 85° W  
 FOLD AXIS     TRENDING 348°  
                   PLUNGING 08°

<b>Crows Nest Resources Limited</b>		
EXPLORATION		
FIG. 10		
MT. MICHAEL (WEST)		
STEREOGRAPH COMPILATION		
AUTHOR: A. WHITE	SCALE:	ENCLOSURE No.:
DATE:	REVISED:	DRAWING No. AA-513
To Accompany MT. MICHAEL REPORT		

K-MOUNT MICHAEL 80(2)A

#### 4.4 CONCLUSIONS

The results of the 1980 program on Mt. Michael have established it as a sound project. It was determined that the coal bearing Mist Mountain Formation outcrops along the length of the Mt. Michael ridge. The contact between this formation and the Elk Formation was established to within 25 metres throughout the property. Within the 350 metre section between the ridge top and the base of the Elk Formation to the west, 47 metres of coal were found in eleven seams. These occur in a dip slope situation as they strike nearly the same direction as the trend of the ridge (slightly west of north) and dip 62 degrees to the west. As yet the east facing slope has only been explored by mapping and some hand trenching so the potential for more coal exists.

Due to the grass roots nature of the program and the lack of data it would be premature to calculate reserves or mineability at this time. The dip slope situation does suggest, however, that the property may be amenable to open pit mining.

Coal quality data are not yet available from the samples collected in 1980. It is expected, however, that the coal will be middle to upper, medium volatile bituminous rank based on the stratigraphic position of the seams and information from the surrounding projects.

#### 4.4 Conclusions (continued)

An application for a work permit to build an access road and drill sites on the west facing slope of Mt. Michael, has been submitted to the government for approval. The continuous core (diamond) drilling has been planned to explore the upper 400 metres of Mist Mountain strata as this is the main target zone. Some of the holes, however, shall be drilled deep enough to intersect the complete section to the Moose Mountain Member, if possible.

At the same time it is planned to carry out detailed mapping of both the east and west slopes.



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

APPLICATION TO EXTEND TERM OF LICENCE

Bolton Agnew ..... agent for Shell Canada Resources Limited .....  
(Name) (Name)  
 P.O. Box 100 .....  
(Address) (Address)  
 Calgary, Alberta, T2P 2H5. ....

Valid FMC No. 207568 .....

hereby apply to the Minister to extend the term of Coal Licence(s) No(s). 282, 283, 286 to 289 Incl.,  
 291, 292, 1300, 1301 & 1302; 11 Licences; 1949 Hectares  
 for a further period of one year.

2. Property name Ewin Pass and Mt. Michael, Group #264, 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 30, 1980 ..... to  
 January 31, 1981, work to the value of at least \$ 543,401.84 .....

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

CATEGORY OF WORK

	Licence(s) No(s).	Apportioned Cost
Geological mapping	282, 283, 286-289, 291, 292	\$100,630.72
Surveys: Geophysical		
Geochemical		
Other: Location	282, 283, 286-289	5,950.00
Road construction	286-289, 291, 292	26,573.82
Surface work	282, 283, 286-289	16,974.25
Underground work	286, 288, 289	24,547.00
Drilling	282, 286	223,764.88
Logging, sampling, and testing	282, 286, 288, 289	39,780.27
Reclamation	282, 283, 286-289	73,995.20
Other work (specify)		
Off-property costs		31,185.70

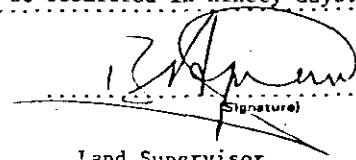
5. I wish to apply \$ 543,401.84 of this value of work on Coal Licence(s) No(s).  
 282, 283, 286-289 Incl., 291, 292, 1300, 1301, 1302 .....

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 Ewin Pass Geological  
 Report '79 was submitted in April, 1980; Ewin Pass Geological Report '80 and  
 Mt. Michael Geological Report '80 will be submitted in ninety days.

1981.01.28 .....

(Date)



(Signature)

Land Supervisor

(Position)

Land supervisor

CATEGORY OF WORK

GEOLOGICAL MAPPING

Yes  No

	Area (Hectares)	Scale	Duration
Reconnaissance	2,000	1:5,000	174 Man-Days
Detail: Surface	390	1:2,000	104 Man-Days
Underground			

\*Other (specify) .....

Total Cost \$ 100,630.72.

GEOPHYSICAL/GEOCHEMICAL SURVEYS

Yes  No

Method .....

Grid .....

Topographic Location Survey .....

\*Other (specify) .....

Total Cost \$ 5,950.00.

ROAD CONSTRUCTION

Yes  No

Length 15 km upgrading & maintenance Width 5 m

On Licence(s) No(s) 286 to 289 Incl., 291, 292

Access to .....

Total Cost \$ 26,573.82

SURFACE WORK

Yes  No

	Length	Width	Depth	Cost
Trenching	5.5 km	1 m	up to 2.0 m	
Seam Tracing				
Crosscutting				

\*Other (specify) .....

Total Cost \$ 16,974.25

UNDERGROUND WORK

Yes  No

	No. of Adits	Maximum Length	No. of Holes	Total Metres	Cost
Test Adits					
*Other workings	Re-sampling three existing adits.				

Total Cost \$ 24,547.00

DRILLING

Yes  No

	Hole Size	No. of Holes	Total Metres	Cost
Core: Diamond				
Wireline	HQ	6	1,369.2	
Rotary: Conventional				
Reverse circulation				

\*Other (specify) .....

Contractor Tonto (5 Holes), Acadia (1 Hole) Drilling

Where is the core stored? On-Site: Ewin Pass

Total Cost \$ 223,764.88

LOGGING, SAMPLING AND TESTING

Yes  No

Lithology: Drill samples	<input type="checkbox"/>	Core samples	<input checked="" type="checkbox"/>	Bulk samples	<input checked="" type="checkbox"/>
Logs: Gamma-neutron	<input checked="" type="checkbox"/>	Density	<input checked="" type="checkbox"/>		
*Other (specify) Caliper					
Testing: Proximate analysis	<input checked="" type="checkbox"/>	FSI	<input checked="" type="checkbox"/>	Washability	<input checked="" type="checkbox"/>
Carbonization	<input checked="" type="checkbox"/>	Petrographic	<input checked="" type="checkbox"/>	Plasticity	<input type="checkbox"/>

\*Other (specify) .....

Total Cost \$ 39,780.27

OTHER WORK (specify details)

Reclamation: seeding, fertilizing, harrowing existing roads, adit sites and new drill sites on Lic's: 282, 283, 286 to 289 Incl.

Total Cost	\$ 73,995.20
On-property costs	512,216.14
Off-property costs	31,185.70
Total Expenditures	\$ 543,401.84

1981.01.28  
(Date)

*W. Kowalski*  
(Signature)

Manager - Accounting, CNRL  
(Position)

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

Application to extend term of licence for the entire group was submitted January 28th, 1981

CATEGORY OF WORK

GEOLOGICAL MAPPING

Yes  No

Area (Hectares) 2000 Scale 1:15000 Duration 174 man-days  
 Reconnaissance .....  
 Detail: Surface .....  
 Underground .....  
 \*Other (specify) .....  
 Total Cost \$ 33,693.00

GEOPHYSICAL/GEOCHEMICAL SURVEYS

Yes  No

Method .....  
 Grid .....  
 Topographic .....  
 \*Other (specify) .....  
 Total Cost \$ .....

ROAD CONSTRUCTION

Yes  No

Length ..... Width .....  
 On Licence(s) No(s) .....  
 Access to .....  
 Total Cost \$ .....

SURFACE WORK

Yes  No

	Length	Width	Depth	Cost
Trenching	.....	.....	.....	.....
Seam Tracing	.....	.....	.....	.....
Crosscutting	.....	.....	.....	.....
*Other (specify)	.....	.....	.....	.....
Total Cost				\$ .....

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	.....	.....	.....	.....
Rotary: Conventional	.....	.....	.....	.....
Reverse circulation	.....	.....	.....	.....
*Other (specify)	.....	.....	.....	.....
Contractor	.....	.....	.....	.....
Where is the core stored?	.....	.....	.....	.....
Total Cost				\$ .....

LOGGING, SAMPLING AND TESTING

Yes  No

	Yes	No		Yes	No
Lithology: Drill samples	<input type="checkbox"/>	<input type="checkbox"/>	Core samples	<input type="checkbox"/>	<input type="checkbox"/>
Bulk samples	<input type="checkbox"/>				
Logs: Gamma-neutron	<input type="checkbox"/>	<input type="checkbox"/>	Density	<input type="checkbox"/>	<input type="checkbox"/>
*Other (specify)	.....	.....	.....	.....	.....
Testing: Proximate analysis	<input checked="" type="checkbox"/>	<input type="checkbox"/>	FSI	<input type="checkbox"/>	Washability
Carbonization	<input type="checkbox"/>	<input type="checkbox"/>	Petrographic	<input type="checkbox"/>	Plasticity
*Other (specify)	.....	.....	.....	.....	.....

OTHER WORK (specify details)

.....  
 .....  
 .....  
 Total Cost \$ .....  
 On-property costs 33,693.00  
 Off-property costs 6,194.00  
 Total Expenditures \$ 39,887.00

Original Dated 1981.01.28  
 (Date)

ORIGINAL SIGNED BY  
 W. S. KOWALSKI  
 (Signature)

(Position)

B I B L I O G R A P H Y

- ELPHINSTONE, N.P. (1951) - Report on the Former Imperial Coal and  
Coke Properties of the Upper Elk Valley; Crows Nest  
Industries Report
- FISHER, John (1979) - Geological Report, North Central Block,  
1978/1979, Crows Nest Resources Internal Report
- GIBSON, D.W. (1979) - The Morrissey and Mist Mountain Formations -  
Newly Defined Lithostratigraphic Units of the Jura-  
Cretaceous Kootenay Group, Alberta and British Columbia,  
Bulletin of Petroleum Geology, Vo.27, No.2, P.183-208
- PRICE, R.A. (1961) - Fernie Map Area, East Half, Alberta and  
British Columbia 82G/E.1/2 Geological Survey of  
Canada Paper 61-24.



## 5.0 PROFESSIONAL VERIFICATION OF REPORT

Entitled: MOUNT MICHAEL PROJECT  
SOUTHEASTERN BRITISH COLUMBIA  
1980 GEOLOGICAL REPORT

Mr. Alan M. White planned and carried out the 1980 geological field work on the Mt. Michael coal licences held by Shell Canada Resources Limited and operated by Crows Nest Resources Limited, and prepared this report. Mr. Frank Martonhegyi supervised the activity of this program under the general direction of the undersigned.

Alan White, B.Sc.(honours) graduated in Geology from the University of Waterloo in 1977. Between graduation and joining Crows Nest Resources Limited in 1980, Mr. White has worked continuously as a Geologist on various gold, base metal and uranium properties in Northern Ontario, the Northwest Territories and British Columbia. Mr. White worked closely with a well qualified consulting coal geologist for the first half of the summer before taking on the responsibility of the Mt. Michael Project.

## 5.0 Professional Verification of Report (continued)

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:

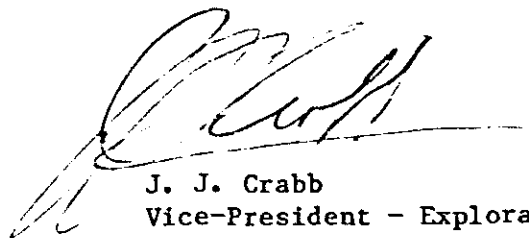
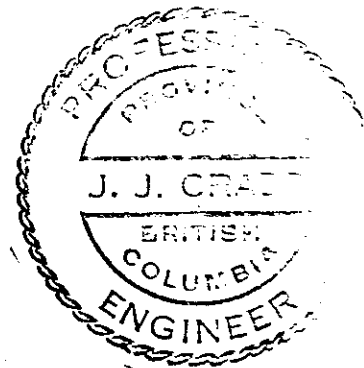
- CanPac Minerals Ltd., Calgary, Alberta.
- Shell Canada Resources Limited, Calgary, Alberta.
- Crows Nest Resources Limited, Calgary, Alberta.

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

He currently holds the position of District Manager - B.C. and other Canadian Coal Projects for Crows Nest Resources Limited.

5.0 Professional Verification of Report (continued)

I consider both the aforementioned geologists to be well qualified to undertake responsibilities they were assigned on this project. I am satisfied that the attached report dated April 28, 1981, has been competently prepared and justly represents the information obtained from this project.



J. J. Crabb  
Vice-President - Exploration

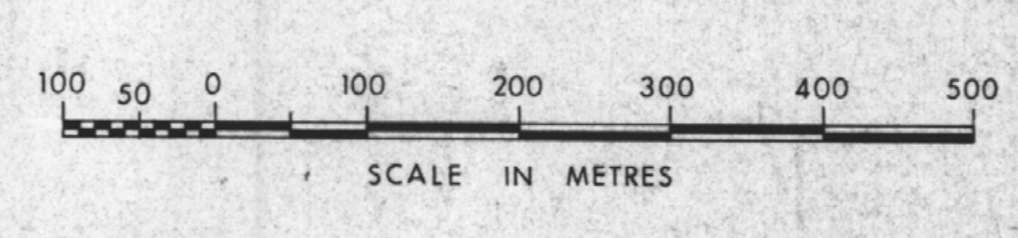
April 30, 1981





- LEGEND**
- STRIKE AND DIP OF BEDDING
  - GEOLOGIC CONTACT; OBSERVED, INFERRED
  - THRUST FAULT; OBSERVED, INTERPRETED
  - FAULT, UNKNOWN TYPE
  - COAL SEAM; OBSERVED, INFERRED
  - ANTICLINE
  - SYNCLINE
  - HAND TRENCH
  - TRAVERSE LINE WITH STRIKE AND DIP AT STATION
  - COAL LICENCE OUTLINE AND NUMBER

**NOTE**  
NOMENCLATURE FOLLOWS THAT OF GIBSON 1979



**Crows Nest Resources Limited**  
EXPLORATION  
MT. MICHAEL  
S.E. BC.

**GEOLOGY MAP**

FIG. 4 **435**

AUTHOR: A. WHITE	SCALE: 1:5000 METRES	ENCLOSURE No.: 5
DATE: 01-03	REVISED:	DRAWING No.: HE-74
To Accompany 1985 MT. MICHAEL REPORT		



435

FIG. 5

ENCLOSURE 2

STRATIGRAPHIC SECTION

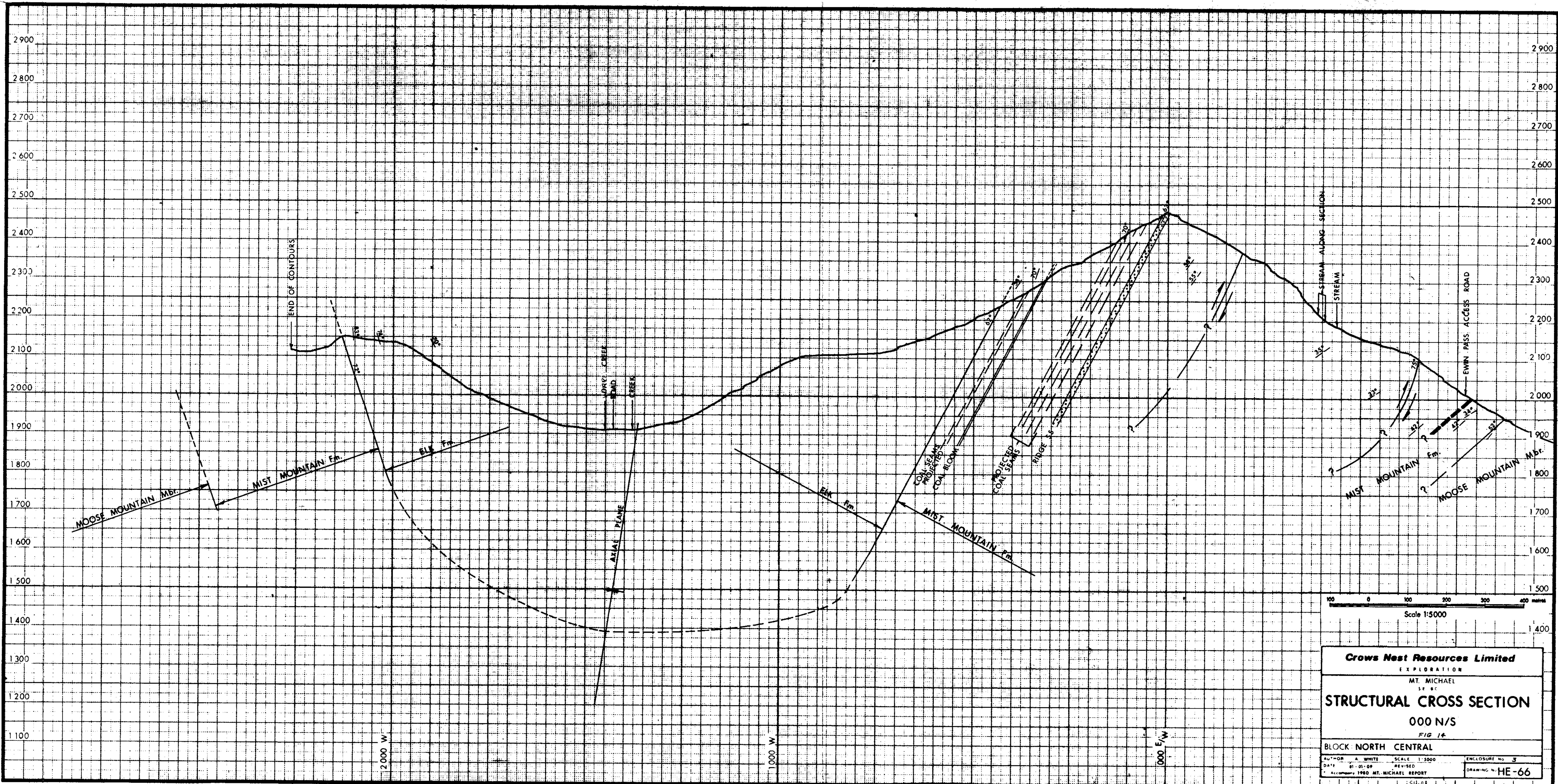
DESIGNATION:	TYPE SECTION	PART 1 OF 1
PROJECT: MT. MICHAEL	AUTHOR: A. WHITE	DATE: 1981
AREA: WEST SIDE OF RIDGE	SOURCE OF DATA: CHAINED TRAVERSE	
LOCATION: APPROXIMATELY ON SECTION LINE 0800 N		

SCALE	CONTROL POINT	INTERVAL	LITHOLOGY	STRIKE & DIP	DESCRIPTION		SAMPLE
					MAIN	AMPLIFIED	
[m]							
0					Sandstone		
					Covered		
					Shale		
50					Sandstone		
					Shale		
					Sandstone		
100					Interbedded shale + siltstone		
					Sandstone	Resistant, grey medium to coarse grained forms base of ELM Fm.	
150		1.0m			Shale		
					Coal	good Coal	
					Sandstone		
					Interbedded shale + siltstone		
		2.5m			Shale		
					Coal	Shaley Coal	
					Sandstone		
200		5.7m			Covered		
					Coal	with 20 cm Shale parting at 1.8 m from footwall	
					Shale		
					Sandstone		
250		2.4m			Covered		
					Coal		
		1.4m			Sandstone	NO SAMPLE	
					Coal		
					Sandstone		
					Shale		
		4.2m			Sandstone	with 10cm. parting at 2.2 -> 2.3m from footwall	
					Coal		
					Shale		
300					Sandstone		
					Shale		
					Covered		
					Shale		
					Sandstone		
					Coal	not trenched to get true thickness	
					Shale		
350					Sandstone		
					Shale		
		7.2m			Coal	with a Shale parting from 3.5 - 4.0m above footwall	
					Shale		
					Sandstone		
400		8.0m			Shale	with no obvious partings	
					Coal		
					Covered		
		3.2m			Sandstone		
					Coal		
					Shale		
450					Sandstone		
					Shale		
		7.4m			Coal		
					Shale		
500					Sandstone	grey-brown, medium grained, thin to moderate bedded, forms backbone of ridge, named "RIDGE SANDSTONE"	
					Shale		
550							
600							
650							
700							

ELK Fm.

MIST MOUNTAIN Fm.

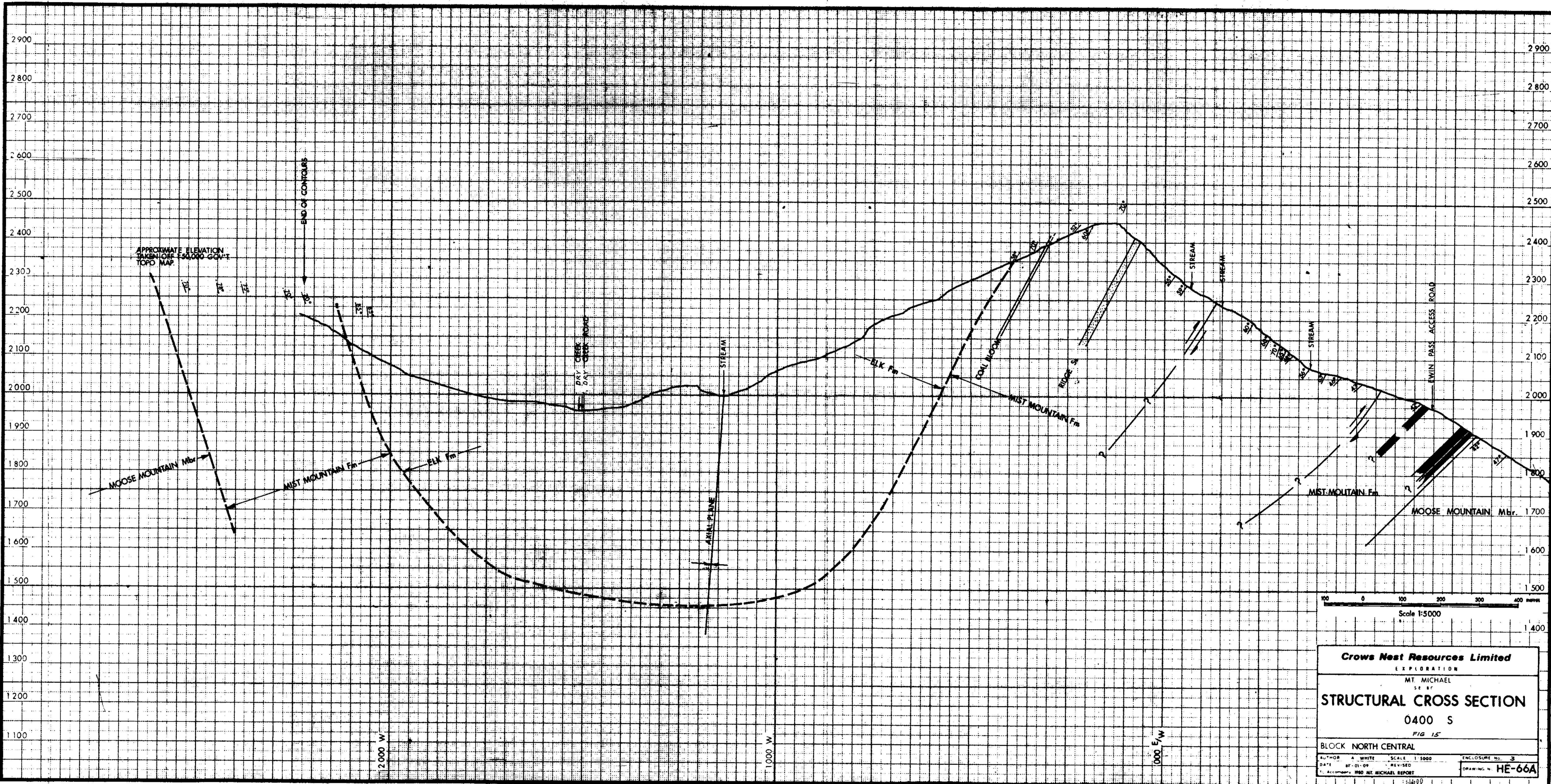




435

MT. MICHAEL 302 PA #1

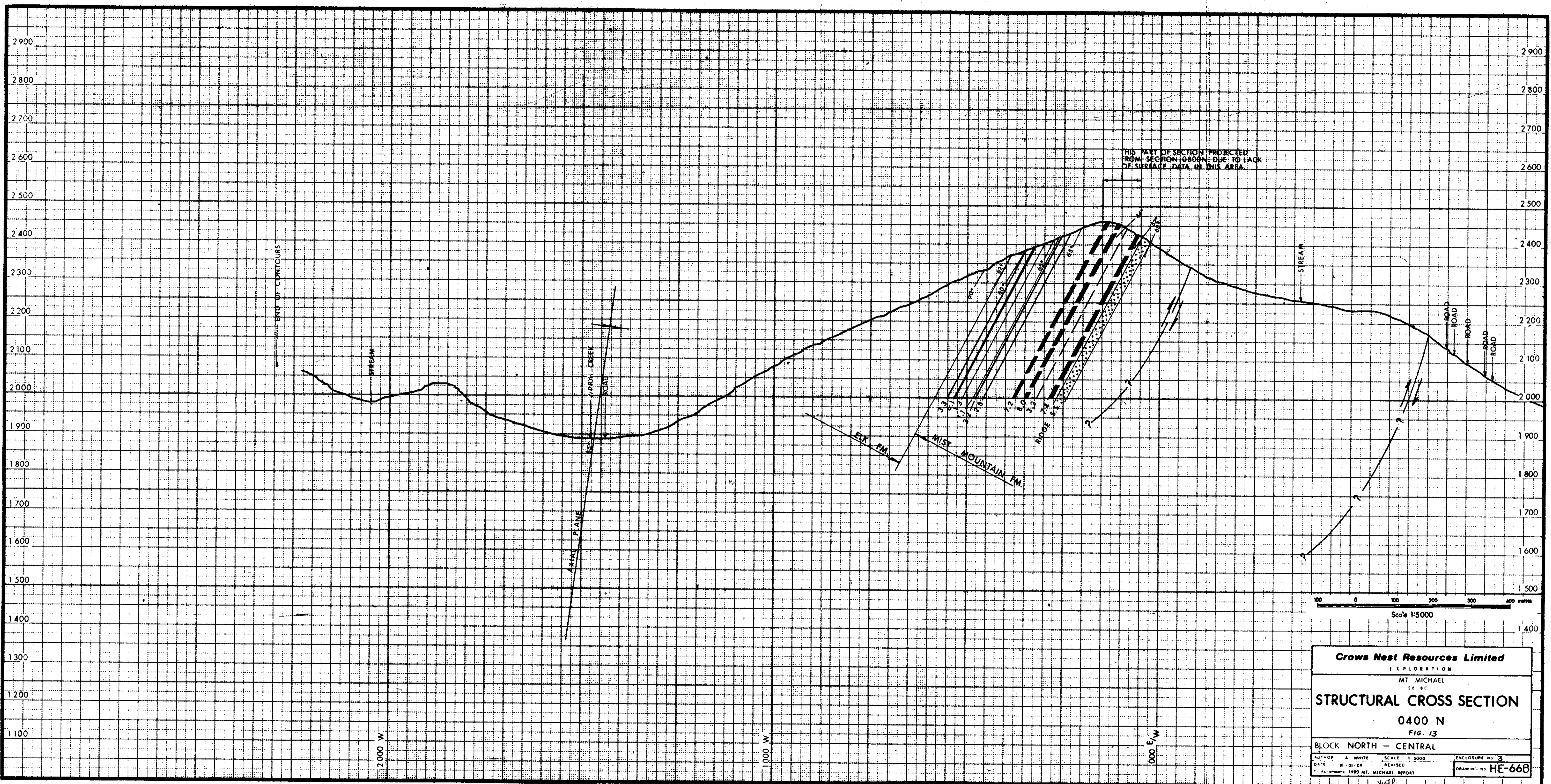




435

KNOWNT MICHAEL 8063A #1



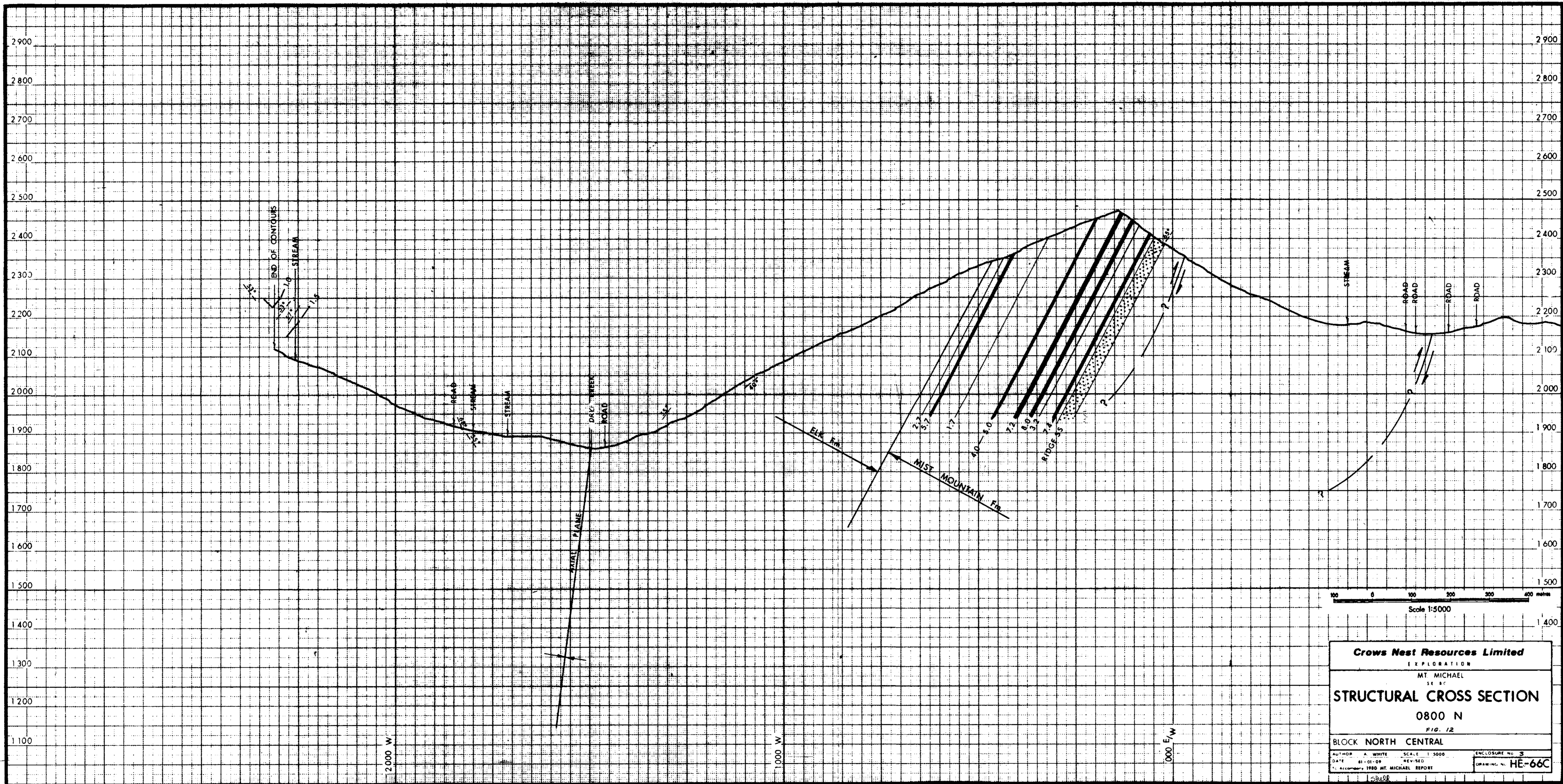


THIS PART OF SECTION PROJECTED FROM SECTION 0800N DUE TO LACK OF SURFACE DATA IN THIS AREA

<b>Crows Nest Resources Limited</b>		
EXPLORATION		
MT. MICHAEL		
SE BC		
<b>STRUCTURAL CROSS SECTION</b>		
0400 N		
FIG. 13		
BLOCK NORTH - CENTRAL		
AUTHOR A. WHITE	SCALE 1:5000	ENCLOSURE NO. 3
DATE 81-01-09	REVISED	DRAWING NO. HE-66B
ACCOMPANY 1980 MT. MICHAEL REPORT		

435  
KAMOUNT MICHAEL 8012/89

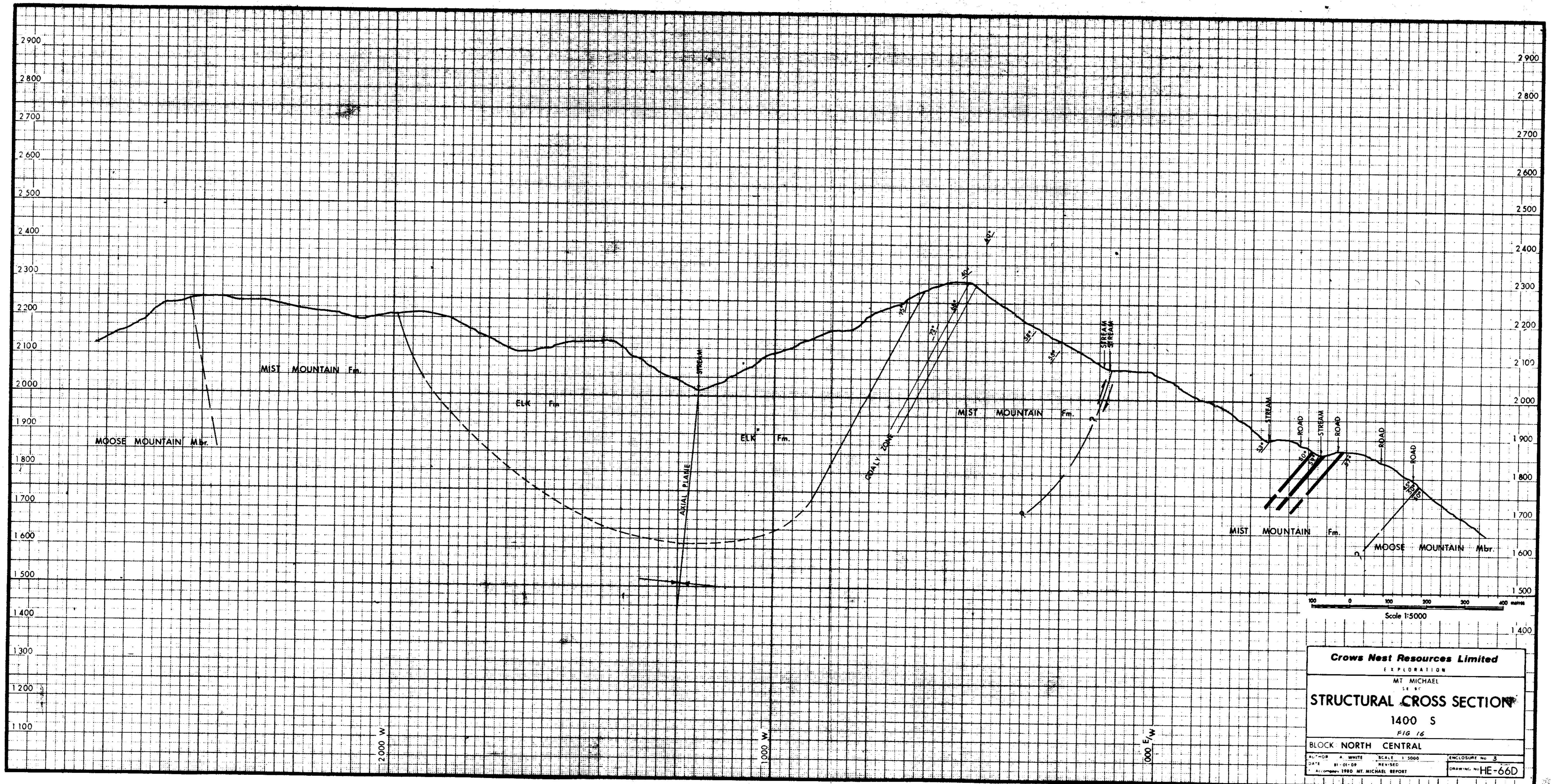




**Crows Nest Resources Limited**  
 EXPLORATION  
 MT MICHAEL  
 SE BC  
**STRUCTURAL CROSS SECTION**  
 0800 N  
 FIG. 12  
 BLOCK NORTH CENTRAL  
 AUTHOR: A. WHITE    SCALE: 1:5000    ENCLOSURE NO. 3  
 DATE: 01-01-09    REVISED:    DRAWING NO. HE-66C  
 ACCORDING TO 1980 MT. MICHAEL REPORT

435  
 K/MOUNT MICHAEL 8062 JA \*1  
 0800N

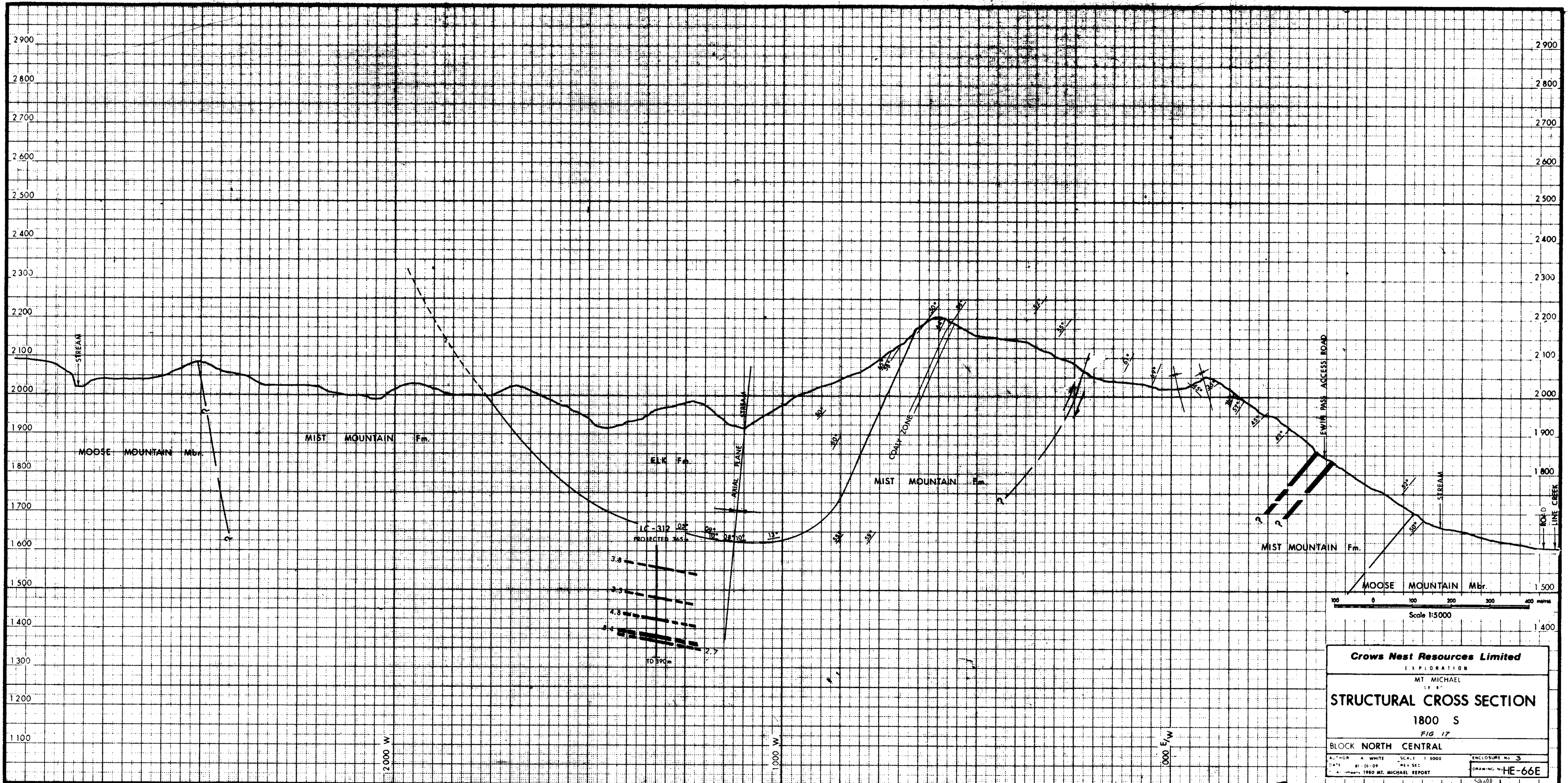




435

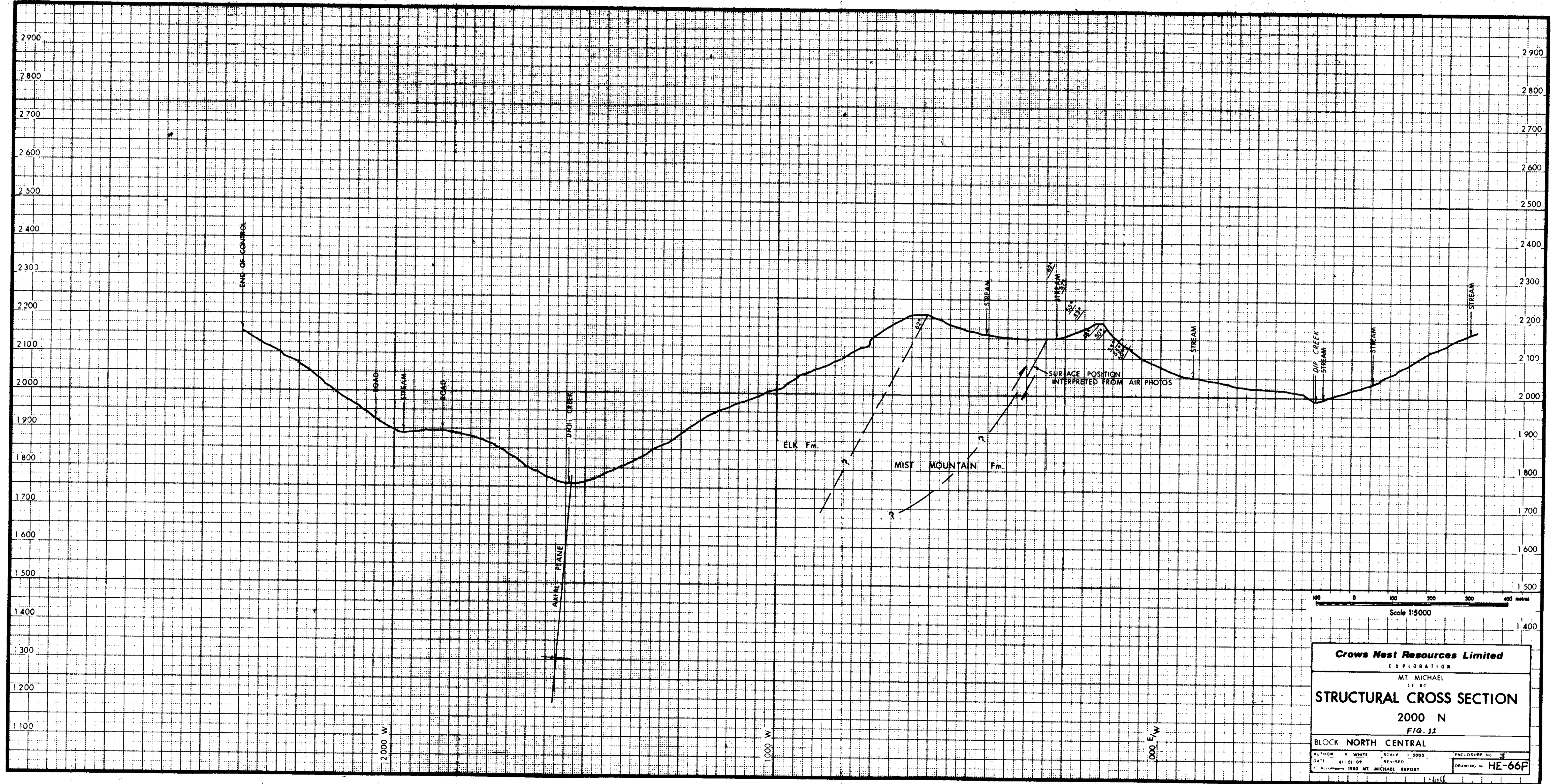
K. MOUNT MICHAEL 80(2)A





435  
 K. Mount Michael  
 80(2)A1





435

KAMOUNT MICHAEL 80 (27) 1