CONFIDENTIAL

# WOLF MOUNTAIN COAL LIMITED PARTNERSHIP

# SUMMARY OF 1983 EXPLORATION WORK

(April 1 1983 to March 31 1984)

COAL LICENCES 6084, 6085, 6086

DOUGLAS LAND DISTRICT

N.T.S. 92F/1(E)

LATITUDE 49 07 00

LONGTITUDE 124 02 00

OWNER OF LICENCES: NETHERLANDS PACIFIC MINING LIMITED

105-1285 WEST PENDER STREET, VANCOUVER, B.C.

MINE OPERATOR: WOLF MOUNTAIN COAL LIMITED PARTNERSHIP

105-1285 WEST PENDER STREET, VANCOUVER, B.C.


AUTHOR OF REPORT:

CRAIG ROBERTS EIT, BASc (Mining)



PREPARED AND SUBMITTED JULY 1984

REVISED MAY 1985

RESUBMITTED JULY 15 1985




Licences 6083 and 7470 (Hole 84-01) were dropped after the 1983 exploration program.

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## 1.0 INTRODUCTION

The Wolf Mountain property is located approximately 10 kilometers southwest of Nanaimo, as described in Section 2.0 of this report. A summary of the exploration work conducted prior to April 1 1983 is included in the report "Geological Report of the 1982 Wolf Mountain Exploration Programme", submitted to the British Columbia Ministry of Energy, Mines and Petroleum Resources on July 15 1983.

The Wolf Mountain Property was acquired by Netherlands Pacific Mining Company Inc. as part of a much larger block of coal licences in 1979. This block plus another which lay a few kilometers to the north were optioned to Gulf Canada Resources Limited in January 1981. After some regional exploration, Gulf dropped its option: the Wolf Mountain reserves were not substantial enough to interest Gulf. The property returned to Netherlands Pacific who retained the coal licences around Wolf Mountain but allowed the rest to revert to the Crown. In early 1982 Wolf Mountain Coal Limited Partnership was formed by a group of investors to develop the Wolf Mountain Property in a joint venture with Netherlands Pacific Mining Limited. Since 1982, operations at the Wolf Mountain property have been directed by Mr. N. Eric Roberts P. Eng.

The 1982 exploration programme conducted on Coal Licences 6083, 6084, 6085, 6086 and 7470 (see Figure 1 for locations) defined the location, extent and quality of the coal measures sufficiently well to allow a preliminary mine design and feasibility study to be completed in early 1983. This study concluded that extraction of the Wellington seam from the licence areas referred to above was economically viable using a selective, conventional room and pillar method. Selective mining would eliminate the need for a cleaning plant.

Before major purchases were made to equip the mine for the selective extraction system proposed, it was decided to drive a short exploration adit into the seam to substantiate the information provided by the exploration programme. In particular, the proposed selective mining system could only be sucessful if the high and low ash bands in the seam had the same sequence and thicknesses as the drilling programme had indicated. Driving the adit at the location chosen for the mine portals would also:

1) Precisely establish the location of the seam outcrop, which is covered by approximately 20 meters of glacial till at the chosen minesite location.

2) Determine whether the roof and floor conditions were

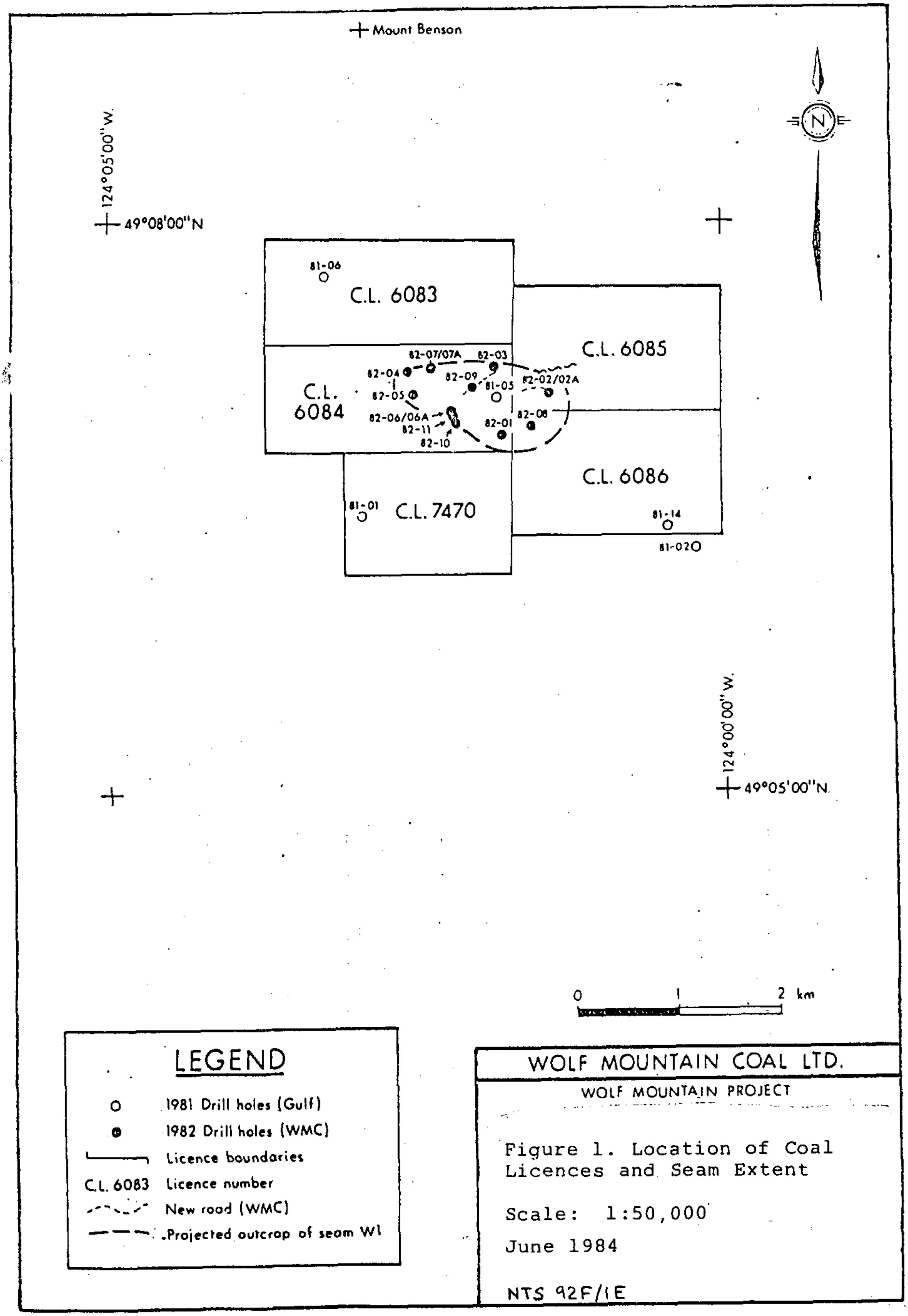



Figure 1. Location of Coal Licences and Seam Extent

Scale: 1:50,000

June 1984

NTS 92F/1E

suitable for the mining system proposed.

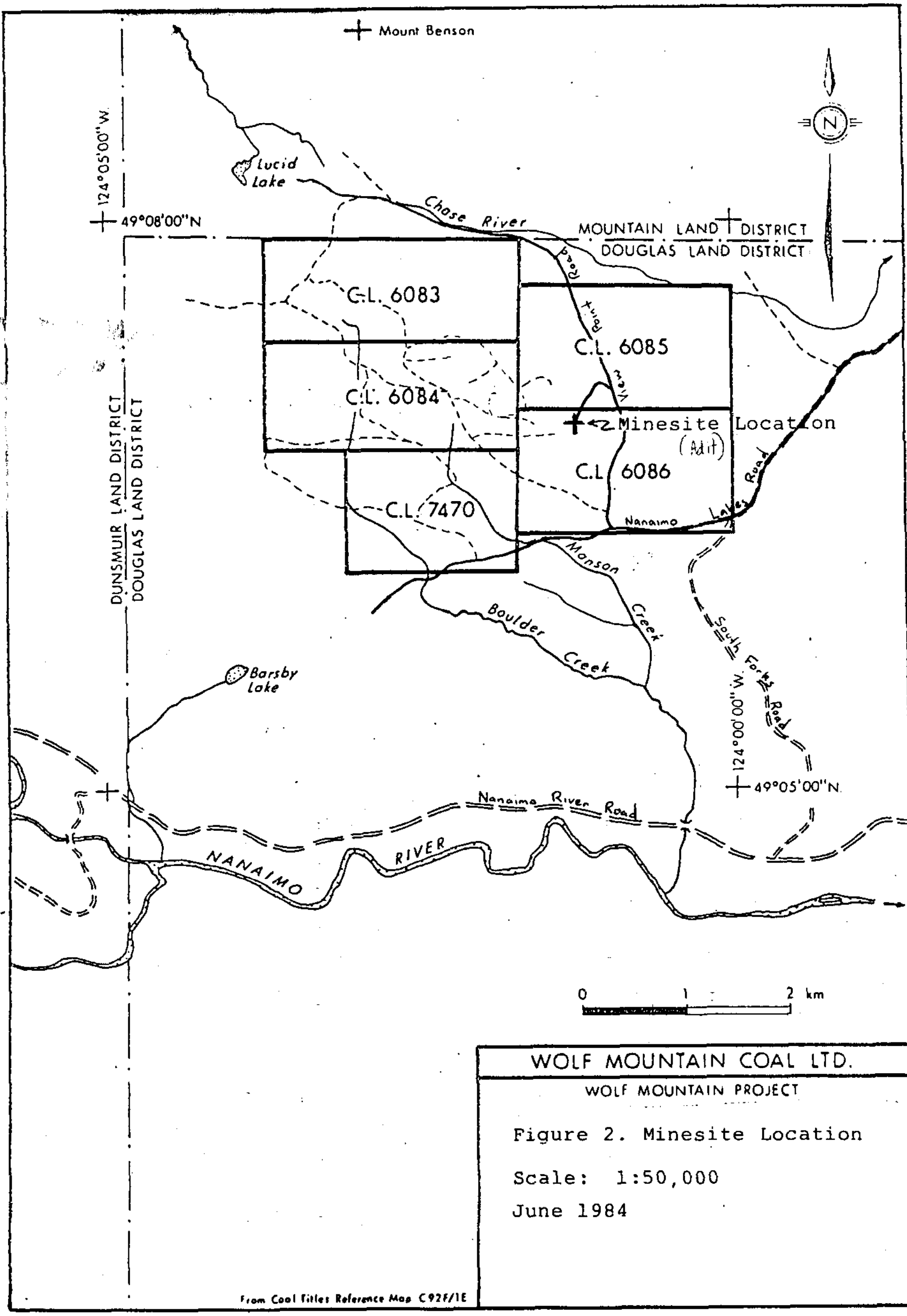
3) Allow the seam to be more comprehensively sampled.

4) Allow the exploration adit to be sighted to conform with the proposed mine plan and to become the return airway if and when the mine was developed.

Figure 2 is an index map showing the location chosen for the minesite in relation to the licence areas and identifiable geographic features.

*

The 1983 exploration programme thus consisted of the construction of an access road to the proposed minesite, surface excavation at the minesite in preparation for driving the exploration adit, the driving of the exploration adit and the sampling of the Wellington seam once exposed in the adit. The main objective of the 1983 exploration programme was to determine the mining conditions in the Wellington seam and to substantiate the coal quality predicted by the 1982 programme. No exploration drilling was conducted during the 1983 programme. Following the 1983 exploration programme, licences 6083 and 7470 were dropped, while licences 6084, 6085 and 6086 were retained.




WOLF MOUNTAIN COAL LTD.

WOLF MOUNTAIN PROJECT

Figure 2. Minesite Location

Scale: 1:50,000

June 1984

## 2.0 LOCTAION AND ACCESS

The Wolf Mountain coal property lies close to the city of Nanaimo (population 47,000) and occupies part of the eastern coastal plain of central Vancouver Island, British Columbia.

The Wolf Mountain property is composed of three coal licences which are located along the western limits of the Nanaimo coalfield, approximately 10 kilometers southwest of Nanaimo. The property can be accessed either directly from the city of Nanaimo or from the Nanaimo River road which parallels the north side of the Nanaimo River 8 kilometers south of Nanaimo.

The direct route from Nanaimo follows the Nanaimo Lakes Road past the DND military camp. The pavement ends at the Nanaimo SPCA building. Approximately 5 kilometers past this point the route veers to the right at the first intersection after the SPCA. This intersection is the junction of the Nanaimo Lakes Road and the South Forks Road. One kilometer past this point the route again veers to the right at the intersection of Nanaimo Lakes Road and the View Point Road. The entrance to the mine property is 1.5 kilometers past this intersection on the View Point Road, and is accessed by turning left at the third "Y" intersection past the SPCA building. The mine is less than one kilometer past the gate at this intersection.

To access the mine from the Nanaimo River Road, a right turn is made from the Nanaimo River Road onto South Forks Road. Past the end of the pavement a left turn is made onto the Nanaimo Lakes Road at the first intersection since leaving the Nanaimo River Road. The same route is then followed as described above from the intersection of South Forks Road and the Nanaimo Lakes Road. These routes are shown in Figure 2. Note that some of the roads shown on this Figure are overgrown logging roads and no longer visible.

## 3.0 ROAD CONSTRUCTION

An access road of approximately 700 meters in length was constructed from MacMillan Bloedel's View Point logging road to the minesite between March and October 1983. The route, shown in Figure 3, is across MacMillan Bloedel land and was chosen to be of minimum length, to create as little surface disturbance as possible and to pass through an area covered primarily by second growth alder. The subgrade was constructed using gravel hauled to the site, and was well ditched and culveted to minimise any disturbance to several water courses that flow intermittently across the route. During several periods of heavy rainfall the road did not degrade and the water remained clear and uncontaminated despite heavy traffic on the road.

The prime contractor for the road construction was Greenaway Sand and Gravel, with sub contracts let to Veasey Banks Excavating, Cayman Excavating and J and J Drilling, all of Nanaimo. The road was surveyed and mapped by Duncan Kondra Engineering Limited of Nanaimo. To prevent trespassing on the property a steel gate was constructed at the bottom of the road and several warning signs were erected.

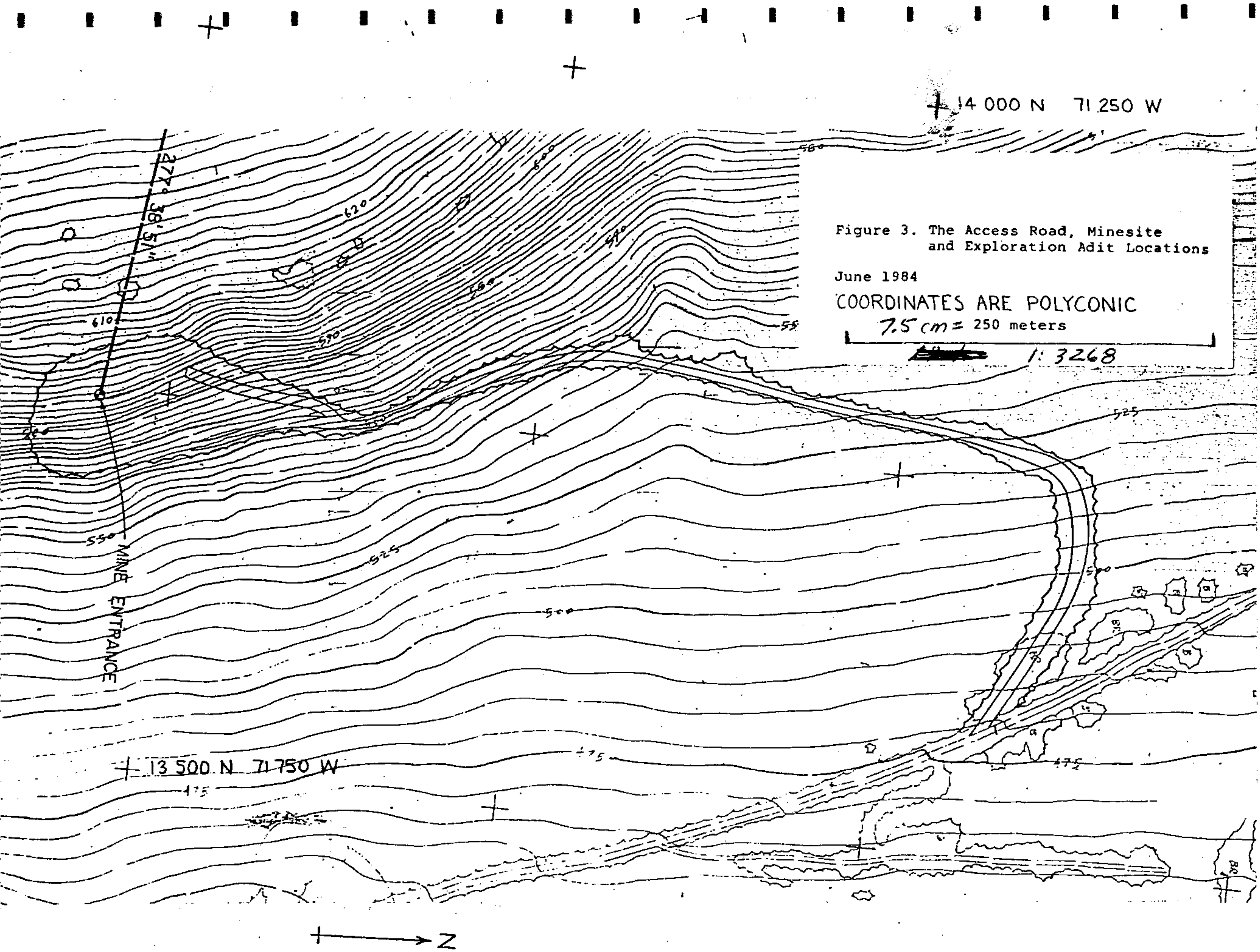



Figure 3. The Access Road, Minesite and Exploration Adit Locations

June 1984

## 4.0 SITE PREPARATION

The projected location of the Wellington seam outcrop at the minesite was surveyed in May 1983 and the expected seam elevation was established. To determine whether the outcrop could be exposed without a major surface excavation, a bulldoser was used to make a small cut into the hillside to try to penetrate through the glacial till cover to the seam outcrop. The till proved to be too thick to penetrate, although the sandstone floor of the seam was found. Because of the steepness of the hillside at this location, calculations showed that a major benched excavation would be necessary to expose the seam outcrop in a manner that conformed with the Coal Mines Regulations. Rather than attempt this excavation with the associated environmental disturbance, it was decided in mid June 1983 to drive an exploration adit through the glacial till into the seam. Since the adit was to be driven in the planned minesite location, surface preparations for the adit were designed so that they would conform with the planned mine layout. Thus additional surface disturbance would be minimised if and when the mine was proceeded with.

Further surface excavation was carried out to complete the minesite as planned after a limited production permit was granted in late 1983. The extent of the surface disturbance to July 1984 is shown in Figure 3. The same contractors were used for the surface preparation as were used for the access road construction. The surface area was also surveyed and mapped by Duncan Kondra Engineering Limited of Nanaimo.

## 5.0 EXPLORATION ADITING AND MINE DEVELOPMENT

RF Fry Limited of Surrey, British Columbia was retained as the prime contractor to drive the adit. After the appropriate government approvals had been obtained, work on the adit was commenced on June 20 1983. The first 15 meters of the adit was driven through glacial till material by driving spiling ahead of the face. The adit was advanced by drilling and blasting, and was mucked out using an Eimco 612 compressed air mucking machine. The roof was supported using 25 by 25 centimeter Douglas fir posts and beams set approximately one meter apart and fully lagged. The adit was driven 5 meters wide and 2.6 meters high. After an advance of approximately 12 meters, mucking out became inefficient due to an excessive tramming time. Work on the adit was stopped on July 20 1983 after the adit had been advanced 16 meters through the glacial till to the outcrop. Approximately 1.8 meters of coal was exposed at the end of the adit with approximately .3 meters of rock showing above. This rock later proved to be a rock band in the seam, not the true roof. Samples of the coal were taken and analysed.

Work to this point had been conducted under an exploration permit. It was decided that the exploration results were promising enough to justify the further development of an experimental mine, and a limited production permit was applied for and obtained. A Schopf diesel scoop with a 2 cubic meter bucket was acquired and a 10 by 20 meter maintenance building was constructed at the minesite in November and December 1983. For mine power, a 75 kilowatt Deutz generator and an Atlas Copco air compressor of 20 cubic meters per second capacity were installed. A well was drilled to supply water for the mine and an Atco wash house facility.

Work on the adit was resumed on January 2 1984. After advancing underground a total of 25 meters, the rock band in the floor of the adit thinned down and drilling into the roof indicated a further .5 meters of coal above this rock band. After 30 meters advance, the rock band had thinned enough to allow the adit to be driven to the full seam height, at this point approximately 4 meters. The true roof proved to be a hard, planar sandstone, and roof bolts were substituted as the means of roof support. As the adit was advanced to 65 meters, the rock band thinned to approximately .25 meters and the seam to approximately 2.2 meters. During a subsequent advance beyond this point, there were only minor variations in the total seam thickness, which correlated well with the seam thickness predicted by the exploration drilling. The thicknesses of the high ash bands did not, however, match those anticipated from the exploration drilling. While analyses of the coal bands revealed good thicknesses of coal with low ash and high heat values, it no longer appeared that the conventional selective mining system proposed could remove enough of the high ash material to yield the required product. More suitable mining and cleaning methods would thus be required.

Driving the adit had revealed the presence of a high quality coal and excellent mining conditions, and left litte doubt that the mine was economically viable. A decision was made in late January 1984 to proceed with the initial development of the mine, pending the final selection of a mining and cleaning system.

Since a second means of egress would soon be required if the initial adit was advanced further, it was decided that a second portal and entry should be developed and connected to the first adit via a crosscut. This entry was to have a cross section and azimuth suitable for the later installation of a mine conveyor. Work on this entry was begun in early February 1984. This entry is shown in Figure 4, a plan of the underground workings to the end of May 1984.

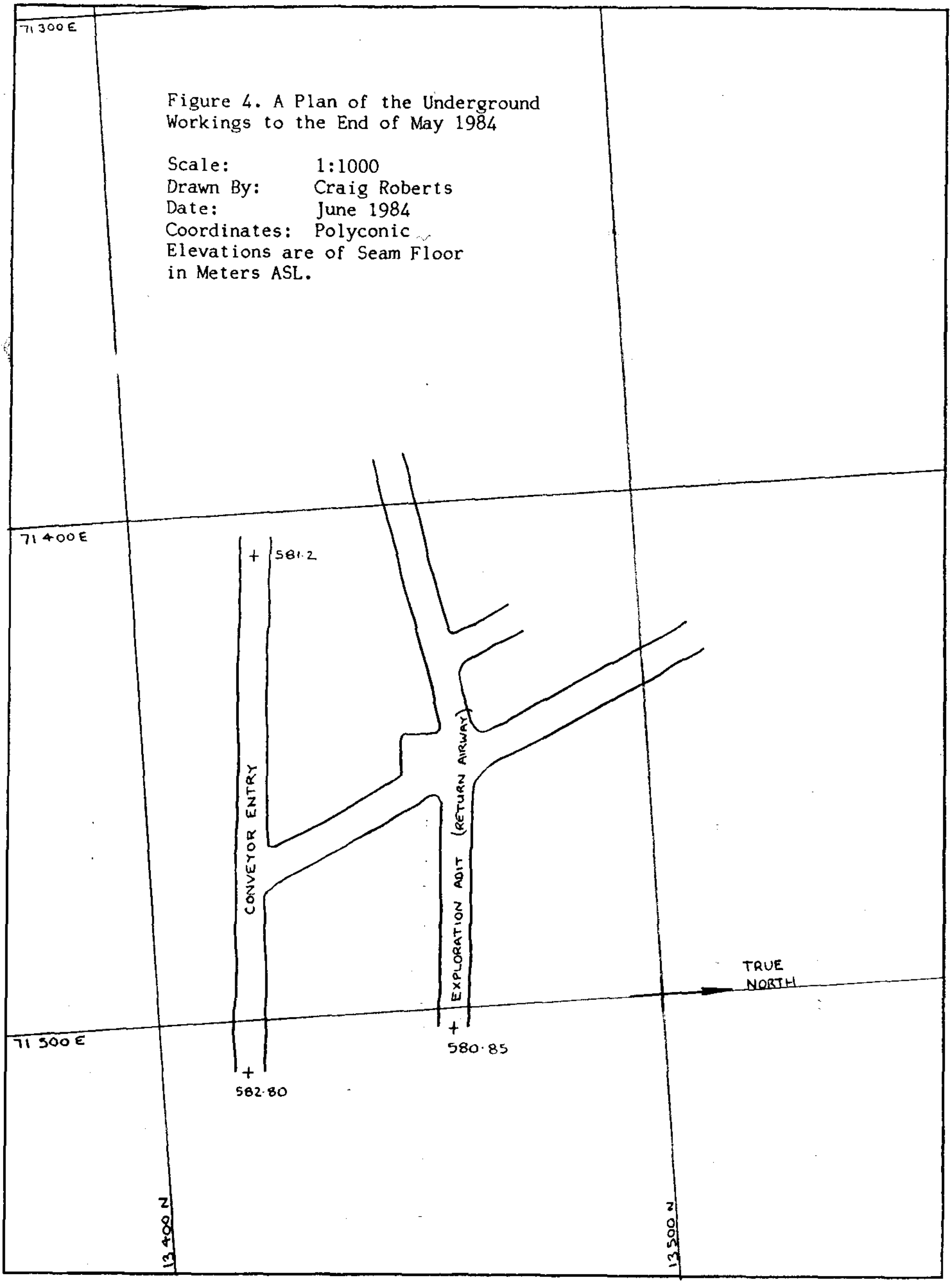



Figure 4. A Plan of the Underground Workings to the End of May 1984

Scale: 1:1000
Drawn By: Craig Roberts
Date: June 1984
Coordinates: Polyconic
Elevations are of Seam Floor in Meters ASL.

A decision was also made to try an experimental mining system employing an Alpine F6-A continuous miner and the Schopf scoop. The Alpine miner and a 175 kilowatt generator were acquired on a rental basis and the switch from drilling and blasting to continuous mining was made in late February 1984. While a reasonably good separation of the high and low ash coal was achieved with this system (the low ash production averaged approximately 25 percent ash at 6 percent moisture, while the high ash production averaged approximately 42 percent ash at 6 percent moisture, each representing approximately 50 percent of production ), it was not possible to get the ash content low enough for market requirements and still maintain an acceptable production rate. This was not because the Alpine miner could not cut the high ash bands out with the required selectivity, but that the high ash coal once cut could not be cleaned up quickly and efficiently enough to maintain an acceptable production rate. High ash coal that was not picked up before the low ash bands were cut thus raised the ash content of the low ash coal above an acceptable level. Experience gathered over three months of experimenting with various selective mining techniques indicated that major purchases of equipment for selective mining could not be justified: the risk of a product too high in ash at a low yield and a low production rate was too great. The continuous mining equipment was therefore returned in late May 1984 and plans for the implementation of a non selective continouus mining system and for the design and permiting of a suitable coal cleaning plant were initiated.

## 6.0 RECLAMATION

All marketable timber cut during road construction and minesite preparation was sawn and used in the mine under Forestry permit number VAL 337. Smaller timber and brush along the access road and around the perimeter of the minesite was bucked into lengths of approximately one meter to reduce any fire hazard and to expediate the decomposition of the wood. Other brush was burned in several slash piles.

During excavation, topsoil was stockpiled separately for use in later reclamation. A small area cleared at the top of the minesite that was not required for future development was resloped to conform with the surrounding topography, covered with topsoil and seeded.

Both the access road and the minesite were well ditched and culveted to prevent erosion and contamination of surface water. Several other slopes were also seeded to prevent erosion.

## 7.0 SURVEYING

Duncan Kondra Engineering Limited of Nanaimo surveyed and mapped the access road, the minesite and the exploration adit. They also established bench marks at the minesite for future reference. Figures 3 and 4 are based on data provided by this survey.

## 8.0 GEOLOGIC MAPPING AND SAMPLING

The geology of the Wolf Mountain property, including the lithology the stratigraphy, and structural geology, was described in detail by Perry (1982). This description is included in the following pages: references in this excerpt are to sections of the 1982 Wolf Mountain Exploration Report.

# GEOLOGY

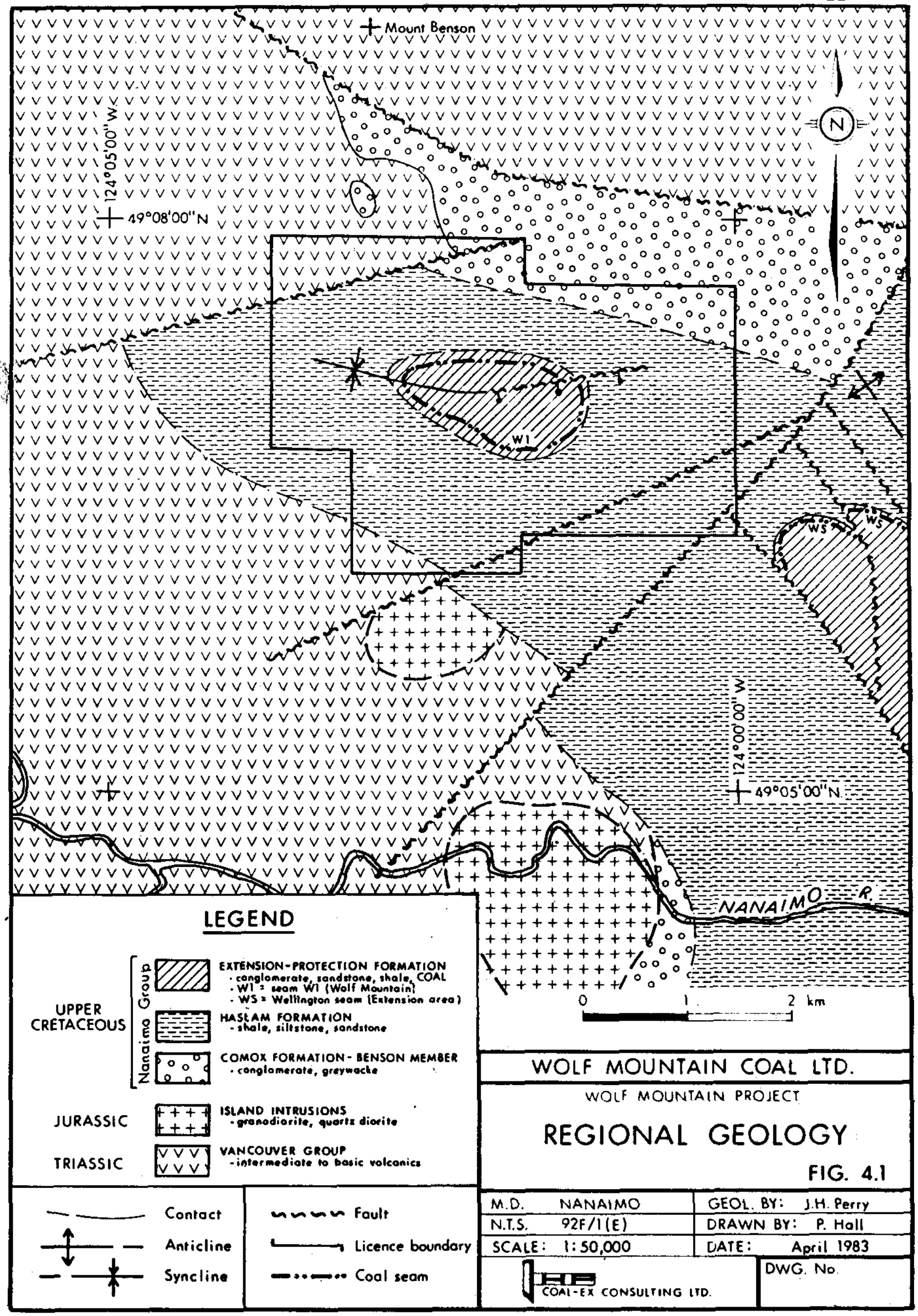
## Stratigraphy

### General Stratigraphy

The Wolf Mountain Coal Property is located to cover coal-bearing strata within the Extension-Protection Formation of the Upper Cretaceous Nanaimo Group. Strata of the Nanaimo Group unconformably overlie metasediments and igneous rocks of the Sicker and Vancouver Groups and Island Intrusions. The regional geology is outlined in Figure 4.1 while the distribution of the Nanaimo Group lithologies contained within the property is shown on the Geology Map and Structural Cross-Sections (Figures 4.2 and 4.3). Stratigraphic correlations of the rock units penetrated by the drill holes are presented in Figures 4.4 and 4.5.

Various formational names have been applied to the stratigraphy of the Upper Cretaceous strata of the eastern coastal plain of Vancouver Island. The first formational subdivisions and nomenclatures were established by Clapp (1912 a, b; 1917) while more recent revisions have been made by Muller and Jeletzky (1970) and Ward (1978). A comparison of the systems of nomenclature put forward by these authors is shown in Figure 4.6. As the formational subdivisions proposed by Ward (op.cit.) are not generally accepted for the Nanaimo area (J. Muller, pers. comm., 1983) the nomenclature used in this report is taken from Muller & Jeletzky (op.cit.).

The sediments that comprise the Nanaimo Group represent five sedimentary cycles. Four of the cycles are transgressive, each grading upwards from fluvial to deltaic and/or lagoonal, through nearshore to offshore marine. The fifth cycle is only deltaic.



Mount Benson
124°05'00"W
49°08'00"N
W1
WS
WS
124°00'00"W
49°05'00"N
NANAIMO R.
0
1
2 km
LEGEND
UPPER CRETACEOUS
Nanaimo Group
EXTENSION-PROTECTION FORMATION
· conglomerate, sandstone, shale, COAL
· W1 = seam W1 (Wolf Mountain)
· WS = Wellington seam (Extension area)
HASLAM FORMATION
· shale, siltstone, sandstone
COMOX FORMATION - BENSON MEMBER
· conglomerate, greywacke
JURASSIC
ISLAND INTRUSIONS
· granodiorite, quartz diorite
TRIASSIC
VANCOUVER GROUP
· intermediate to basic volcanics
Contact
Anticline
Syncline
Fault
Licence boundary
Coal seam
WOLF MOUNTAIN COAL LTD.
WOLF MOUNTAIN PROJECT
REGIONAL GEOLOGY
FIG. 4.1
M.D. NANAIMO
N.T.S. 92F/1(E)
SCALE: 1:50,000
GEOL. BY: J.H. Perry
DRAWN BY: P. Hall
DATE: April 1983
DWG. No.
COAL-EX CONSULTING LTD.

| FORMATION NAMES | CLAPP (1914) | MULLER & JELETZKY (1970) and THIS STUDY | WARD (1978) | MAJOR COAL SEAMS |
|---|---|---|---|---|
| | PROTECTION | EXTENSION-PROTECTION | PROTECTION | |
| | NEWCASTLE | | PENDER | DOUGLAS |
| | | | | NEWCASTLE |
| | CRANBERRY | | | |
| | EXTENSION | | EXTENSION | WELLINGTON |
| | EAST WELLINGTON | (EAST WELLINGTON MEMBER) | | (W-1) |
| | HASLAM | HASLAM | HASLAM; (North) HASLAM CREEK MEMBER / (South) COWICHAN MEMBER | |
| | COMOX | COMOX (BENSON MEMBER) | COMOX (BENSON MEMBER) | |
| | BENSON | | | |

FIGURE 4.6 - Upper Cretaceous Nanaimo Group Stratigraphic Nomenclature.

Each of the first four cycles is comprised of two formations: the first is a non-marine sandstone-conglomerate sequence which may contain lagoonal shale and coal; the second is an overlying, mainly marine, siltstone-shale sequence. Within the Nanaimo region only the lagoonal Extension-Protection Formation is coal-bearing. Of the Nanaimo Group, only sediments of the Comox, Haslam and Extension-Protection Formations are present within the Wolf Mountain Coal Property; these are discussed below. A general description of the stratigraphy of these formations is presented in Table 4.1.

TABLE 4.1

TABLE OF FORMATIONS -
LOWER PORTION OF THE UPPER CRETACEOUS
NANAIMO GROUP

| Formation | Lithology | Regional Variation in Thickness (metres) |
|---|---|---|
| Extension-Protection | Sandstone, conglomerate shale, coal | 0-580 |
| Haslam | Shale, siltstone, fine-grained sandstone | 0-305 |
| Comox (Benson Member) | Sandstone, shale (conglomerate) | 0-410 |

Nanaimo Group

Comox Formation

The Comox Formation forms the lower part of the first depositional cycle. Rocks of this formation are generally represented by the basal conglomerate of the Benson Member, a sequence of massive conglomerate of considerable lateral and vertical variation. Finer grained lithologies are present, but their thickness and extent are even more variable than that of the conglomerates. It is not known whether Comox Formation strata exist at depth throughout the property, but they are present in the southeast (as pebbly sandstones in drill holes GBS-RDH-81-02 and 81-14) and in the northeast (as outcroppings of the conglomeratic Benson Member). To the west, however, lithologies of the Haslam Formation directy overlie the basement volcanics. No significant coal seams have been found in the Comox Formation of the Nanaimo region (Perry, 1981).

Haslam Formation

The Haslam Formation represents the upper part of the first depositional cycle and is composed of a monotonous sequence of marine shales, siltstones, and fine-grained sandstones. The fine-grained lithologies of the upper portions of the Comox Formation are considered to be transitional with those of the overlying Haslam Formation. The Haslam shales are recessive and, hence, usually drift covered; exposures are largely confined to streams and occasional road-cuts. The shales and siltstones are commonly thin-bedded, dark grey to black when fresh, and often highly fossiliferous. They weather to a reddish-brown colour and appear in outcrop as oval, concentrically weathered masses, varying in size up to one metre in length. In drill hole GBS-RDH-81-05, the Haslam Formation is at least 260 metres thick.

Extension-Protection Formation

The Extension-Protection Formation conformably overlies the Haslam Formation and represents the lower part of the second depositional cycle. This formation contains the only coal seams of economic interest in the Nanaimo region. They are found in the lower half of the formation and were extensively mined between 1852 and 1953. The major seams are named Wellington, Newcastle and Douglas; most of the production came from the Wellington and Douglas seams.

The Extension-Protection Formation is a sequence of coarse clastic sediments composed mainly of interbedded conglomerates and sandstones with occasional horizons of shale and coal. The conglomerates are generally massive and clast size ranges from small pebble to cobble. The clasts vary from rounded to subrounded and are composed predominantly of cherts, although granitic and volcanic clasts are quite common. Sandstone interbeds are common; the sandstone is generally medium to coarse grained, yellow weathering but olive grey when fresh and consists of quartz, feldspar, volcanic and chert grains. At the base of the formation is a thick sandstone referred to as the East Wellington Member. This sandstone is approximately 40 metres thick and commonly forms the floor of the Wellington seam. On Wolf Mountain the thick conglomerate-sandstone horizons form cliffs and bluffs with shales and coal at their base. The prominent "benched" topography developed around the upper southern and eastern flanks of the mountain results from the recessive weathering of the coals and shales. Only the lowermost portions of the Extension-Protection Formation are represented on the property. Consequently, only the lowermost coal seams, (that is, the Wellington and associated minor seams), are present. A discussion of the coal seam stratigraphy is presented below.

Coal Seam Stratigraphy

A total of six coal seams have been identified on the Wolf Mountain Property (see Figure 4.5, drill hole GBS-RDH-81-05). However, because of thickness and quality considerations, only one of these is presently considered to be economically mineable. This seam is referred to as seam W.1 and is correlated with the Wellington seam. Throughout most of the reserve area seam W.1 is the lowermost coal seam within the Extension-Protection Formation. A thin coal seam (referred to as seam Wx) does, however, underlie seam W.1 in drill hole GBS-RDH-81-05. As seam Wx has not been intersected in any of the other drill holes, its development is obviously very limited. The main coal seams are numbered in ascending order, seam W.5 being the topmost coal seam. The areal extent of these coal seams diminishes rapidly from seam W.1 to seam W.5 due to the shape of the topography.

As a result of the drill programme it has been possible to establish positive correlation of the coal seams throughout the property. This correlation is readily apparent from the signatures each seam makes on the geophysical logs (see Figures 4.4 and 4.5). Some of the more pertinent characteristics of seam W.1 are summarized below and illustrated in Figure 4.7, the correlation chart for seam W.1.

Seam W.1 averages approximately 2.4 metres in true thickness and ranges between 0.84 metres and 2.76 metres. Throughout most of the property, however, the range in thickness is from 1.69 to 2.76 metres. Only hole WM-RDH-82-01 exhibits a seam thickness of less than 1.69 metres. Seam W.1 generally possesses good lateral and vertical continuity, except in the immediate vicinity of drill hole WM-RDH-82-01. Here the upper part of the seam is replaced by shale while shales and thin coal splits comprise the interseam strata between seams W.1 and W.2. The variation in the thickness of seam W.1 across the reserve area is illustrated by the Isopach Map (Figure 4.8). The pattern generated by the isopachs is quite simple. There is a small but steady decrease in the thickness of seam W.1 from north to south across the reserve area up to a line which would connect drill holes WM-RDH-82-05, GBS-RDH-81-05 and WM-RDH-82-08. South of this line there is a rapid but regular decrease in thickness towards drill hole WM-RDH-82-01.

As can be seen from Figure 4.7, several rock and/or poor coal bands are characteristically developed at specific horizons within seam W.1. One of these is located some 0.20 to 0.50 metres above the floor of the seam. Generally, this poor coal/rock band is 0.05 to 0.10 metres thick but in drill holes WM-RDH-82-03, 07 and 09 it ranges between 0.20 and 0.40 metres in thickness and is comprised mainly of carbonaceous mudstone. Two rock bands are present within the top half of the seam in drill holes WM-RDH-82-02, 03, 07, 08, and GBS-RDH-81-05. Again, these bands are between 0.10 to 0.15 metres in thickness. In the southwestern portions of the reserve area, however, only one band is present in the upper portions of the seam. This band reaches a thickness of approximately 0.35 metres in WM-RDH-82-09 but is approximately 0.10 metres thick in the rest of the drill holes. Other rock and poor coal bands may be present within seam W.1, but they are quite thin (0.01-0.03 metres) and mainly restricted to the upper half of the coal seam. The rock bands are comprised of highly carbonaceous, almost coaly, shales and mudstones and are difficult to distinguish in structurally deformed portions of the seam.

The floor of seam W.1 is usually a medium to coarse grained sandstone. In the core samples the sandstone is highly carbonaceous and even coaly at the contact with the seam. This sandstone, known as the East Wellington sandstone, is very thick and forms the floor in the old workings nearby.

Roof lithologies of seam W.1 range from carbonaceous claystone through interbedded shale and siltstone to medium grained silty sandstone. The shales are restricted to the south and eastern portions of the reserve area (WM-RDH-82-01, 02, and 08) while a predominantly sandstone roof is present in the north, central and western portions (WM-RDH-82-04, 06, 07, 09, and GBS-RDH-81-05). Shale and siltstone interbeds form the roof of seam W.1 in drill holes WM-RDH-82-03 and 05. The shale which forms the roof in WM-RDH-82-02A is quite competent, generally massive, with only a slight fissility and provides a sharp contact with the underlying coal. The sandstone roof exhibited in drill holes WM-RDH-82-06A and 07A is fine to medium grained, silty and interlayered with very thin coal bands and pods for the first 0.10 to 0.20 metres above the seam. Although no geotechnical work has been undertaken it is anticipated that roof conditions will be better in the areas where the roof is comprised of shale or siltstone and shale than where it is formed by sandstone. This observation is drawn from the fact that the thin coal bands and pods which are found within the sandstone provide planes of weakness within the immediate roof. These coal bands and pods were not present in the shale roof examined from hole WM-RDH-82-02A.

The outcrop trace of the Wellington seam as presented on the Geology Map (Figure 4.2) has been projected using drill hole and strike and dip data. The coal seam has not yet been located on the ground due, mainly, to the amount of talus and overburden in the areas of projected seam outcrop.

As the other coal seams are not, as yet, considered to possess any economic potential, they have not been studied in any detail. Seam W.3 is usually over two metres in thickness but is composed mainly of highly carbonaceous, coaly shale with only thin coal splits throughout. Although it is of a mineable thickness it could not provide an economical product for marketing (see Appendix A.III). Seam W.4 has been intersected only in drill hole GBS-RDH-81-05 where it is approximately 0.83 metres thick and appears to be free of rock bands. Although it is of very limited areal extent this seam might warrant further study if an economical extraction method could be devised.

These minor coal seams may also be correlated with seams described from other parts of the Nanaimo coalfield. Seam W.2 is believed to correlate with the Little Wellington seam, while seam W.3 probably correlates with a seam exposed at "Jack's Prospect" on the north bank of the Nanaimo River, south of Extension (see Dowling, 1915 b).

Structural Geology

The general geological structure of the region is illustrated in Figure 4.1 while the detailed structure of Wolf Mountain itself is presented in Figures 4.2, 4.3, and 4.9, the Geology Map. Structural Cross-Sections and Structure Contour Map (Seam W.1), respectively.

Analysis of the data indicates that the coal-bearing strata are contained within a faulted syncline. This syncline exhibits a gentle ($\simeq 2^{o}$) plunge to the east over most of the reserve area but noses sharply in the west where it plunges at approximately $20^{o}$ to the southeast. The syncline is disrupted by a high-angle reverse fault contained within the hinge zone of the fold. This fault trends east-northeast across the central and eastern portions of the reserve area, is downthrown to the south and is hinged at its western extremity. The displacement associated with the fault increases to the east and on seam W.1 it reaches a maximum of approximately 20 metres. The displacement increases at higher stratigraphic levels.

The strike of the beds throughout most of the reserve area is to the east or southeast. On the north flank of the syncline the strata dip between $20^{o}$-$26^{o}$ to the south while the south flank dips gently to the north (from $2^{o}$ to $7^{o}$). In the nose of the syncline the dips on the south flank steepen to approximately $20^{o}$.

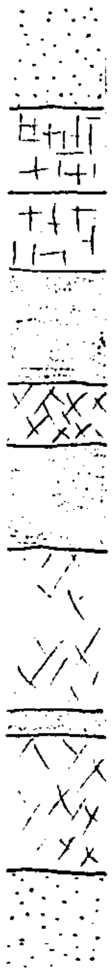
Geological mapping to date has largely been on a reconnaissance basis and, as a result, detailed analysis of the structural geology has been hampered by the lack of seam W.1 outcrop and reliable bedding measurements. The conglomerates and sandstones on Wolf Mountain show extensive cross-bedding and, as the shales and coals are recessive and covered with till, the dip and strike of true bedding is difficult to obtain. Consequently, the structure contours of seam W.1 (Figure 4.9) are based primarily on the drill hole data. The interpreted presence of a reverse fault is based on the development of the structure contours of seam W.1, particularly in the area between WM-RDH-82-09 and GBS-RDH-81-05. No mapping which could confirm this structure (in the area where the fault is projected to intersect the seam W.1 outcrop) has yet been carried out. Examination of air-photographs does not indicate any obvious displacement so further work will be necessary to properly define the nature of the transition from the south to north flank, where the fault is now proposed to exist.

Very little data is available on the small-scale structures which may affect seam W.1. Examination of core from WM-RDH-82-02A indicates that the amount of disturbance within, above and below seam W.1 is very slight in the eastern portions of the reserve area. Tectonic disturbance of the seam increases to the west in proximity to the nose of the syncline, as is indicated by intense shearing of the coal in hole WM-RDH-82-07A. Small scale roof structures which will be found in the underground operations of the proposed mine will be more prevalent in the western half than in the eastern half of the reserve area.

The primary objective of all mapping and sampling performed during 1983 was to determine the ash content of easily identifiable bands in the Wellington seam so that the coal could be mined selectively. With the mine in production, the bands in the seam would have to be identified by the miners at the face to allow them to separate the high and low ash coals. Table 1 shows a typical seam cross section based on measurements of band thicknesses and ash analyses at approximately 25 locations. This mapping was done in laymans terms for the reasons described above: see the excerpt from Perry (1982) for a comprehensive and detailed geologic description of the Wellington seam. The overall seam ash content calculated from this data is approximately 33 percent, correcting for the different specific gravities of the individual bands. Corrected for 6 percent moisture, the overall calculated ash content is 31 percent. The overall run of mine coal has averaged approximately 34 percent ash to date, but part of this ash has come from the roof and floor.

Table 2 summarises the analyses of the samples taken from the high and low ash coal produced by selective mining. These data are on an as received basis: the moisture content is typically 6 percent.

Production records show the split between low and high ash



| Band Number | Typical Band Thickness (cm) | Observed Thickness Range (cm) | Typical Ash Content* (%) |
|---|---|---|---|
| Sandstone Roof | | | |
| 1A | 25 | 20-36 | 12 |
| 1B | 26 | 20-33 | 18 |
| 2 | 50 | 30-? | 80 |
| 3 | 15 | 13-33 | 18 |
| 4 | 38 | 15-69 | 40 |
| 5A | 50 | 48-98 | 9 |
| 5B | 18 | 1-43 | 40 |
| 5C | 42 | 41-58 | 6 |
| Sandstone Floor | | | |

*Air Dried Basis

Table 1. A Typical Seam Cross Section

| LOW ASH PRODUCTION SAMPLES | | HIGH ASH PRODUCTION SAMPLES | |
|---|---|---|---|
| Sample Number | Ash Content (%) | Sample Number | Ash Content (%) |
| C1 | 34.7 | D1 | 51.1 |
| C2 | 18.1 | D2 | 41.3 |
| C3 | 19.2 | D3 | 32.8 |
| C4 | 22.8 | D4 | 47.6 |
| C5 | 28.9 | D5 | 43.5 |
| C6 | 27.4 | D6 | 37.9 |
| C7 | 24.7 | D7 | 40.4 |
| C8 | 26.1 | | |
| C9 | 23.0 | | |
| C10 | 29.0 | | |
| C11 | 23.1 | | |
| C12 | 23.9 | | |
| C13 | 30.1 | | |
| Mean | 25.5 | Mean | 42.1 |

Table 2. Summary of Ash Content of Coal Produced by Selective Mining

NOTE: Only ash determinations were made on these samples: the purpose of these analyses was to determine the saleability of the coal. The saleability depends primarily on the heat content of the coal which can be determined from the ash content (see Figure 7).

coal to be approximately 50–50. The mean overall ash content of the coal produced by selective mining to the end of May 1984 is thus approximately 34 percent at 6 percent moisture. Approximately 4,000 tonnes were produced by selective mining. Several size distribution analyses were done on the coal selectively mined by the Alpine F6–A continuous miner. The average size distribution for the full seam is shown in Figure 5: the size distribution for the full seam conforms well to the Rosin–Rammler equation:

$$Y = 100(1-\exp(-(X/9)^{.75}))$$

where: Y = the weight percent of material
passing size X in millimeters

Data were also gathered to determine the variation of ash content with particle size. Figure 6 shows the percent ash in the material passing size X in millimeters. The percent ash for the full seam in the fraction finer than a top size of 100 millimeters is 33.5 percent, which matches other calculated full seam values.

Figure 7 from Perry (1982) shows a plot of heat content versus ash content. Analyses performed during 1983 confirmed the accuracy of this plot. All laboratory analyses were performed by Chemex Labs Limited of North Vancouver.

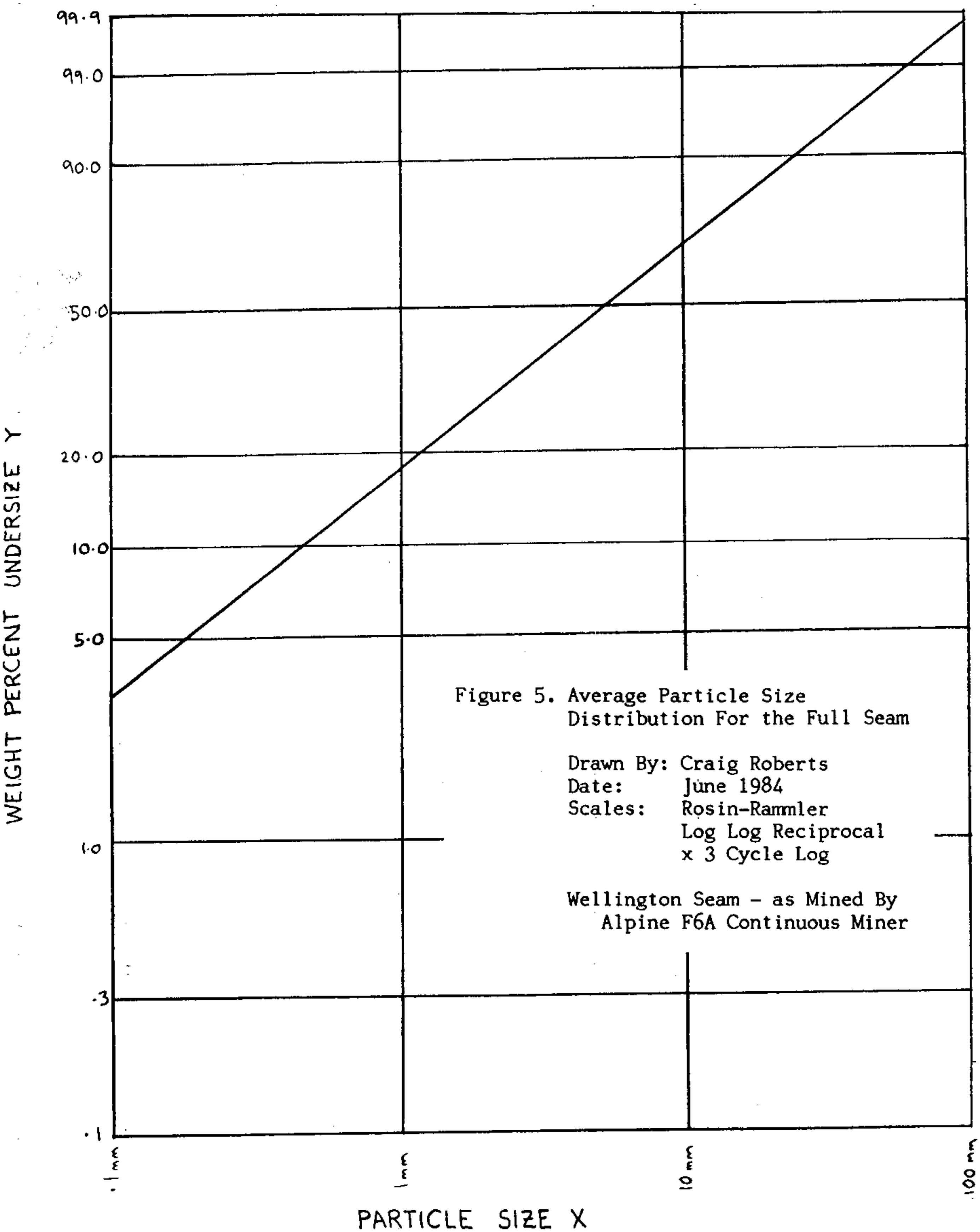



Figure 5. Average Particle Size Distribution For the Full Seam

Drawn By: Craig Roberts
Date: June 1984
Scales: Rosin-Rammler Log Log Reciprocal x 3 Cycle Log

Wellington Seam - as Mined By Alpine F6A Continuous Miner

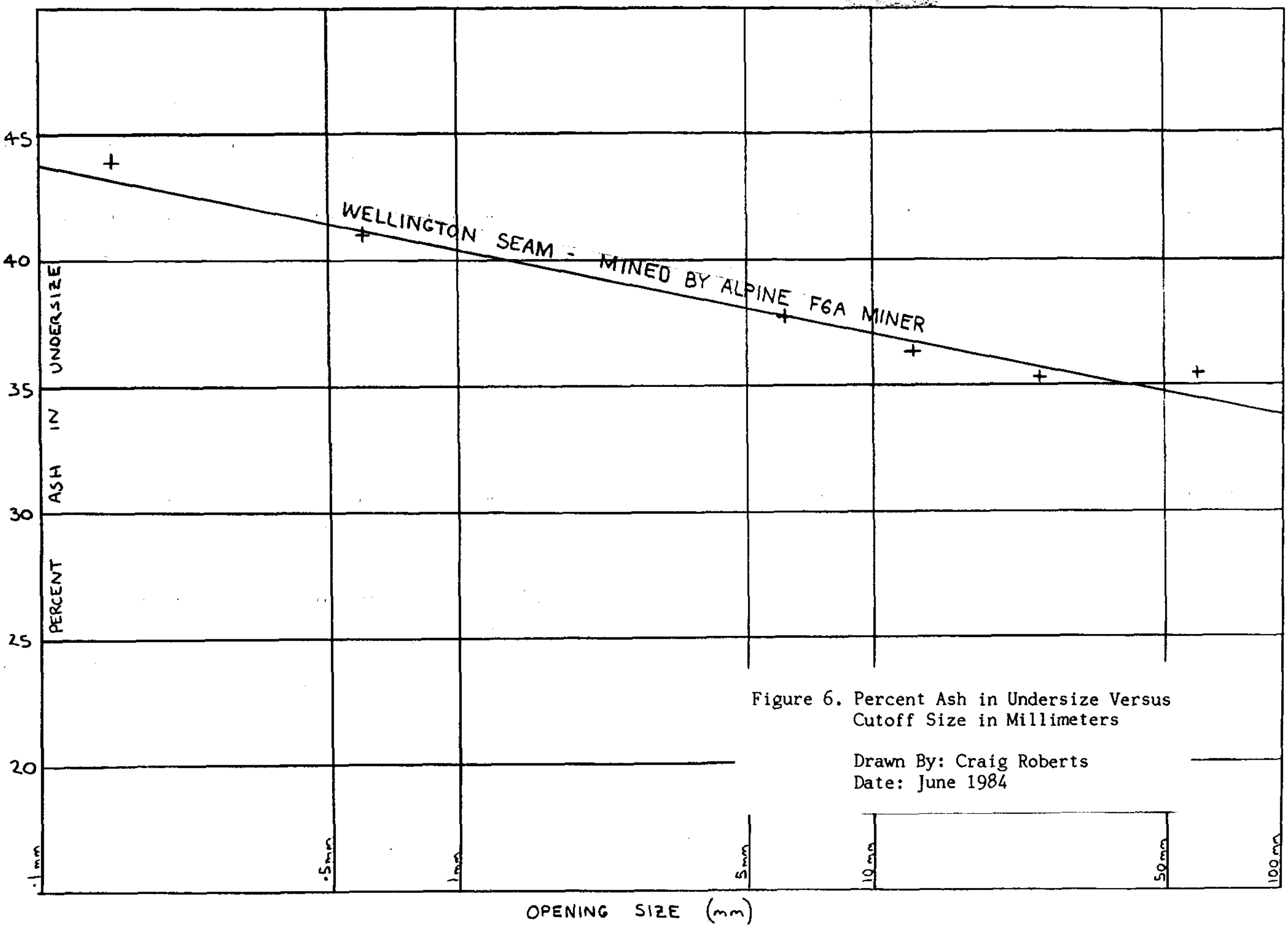



Figure 6. Percent Ash in Undersize Versus Cutoff Size in Millimeters

Drawn By: Craig Roberts
Date: June 1984

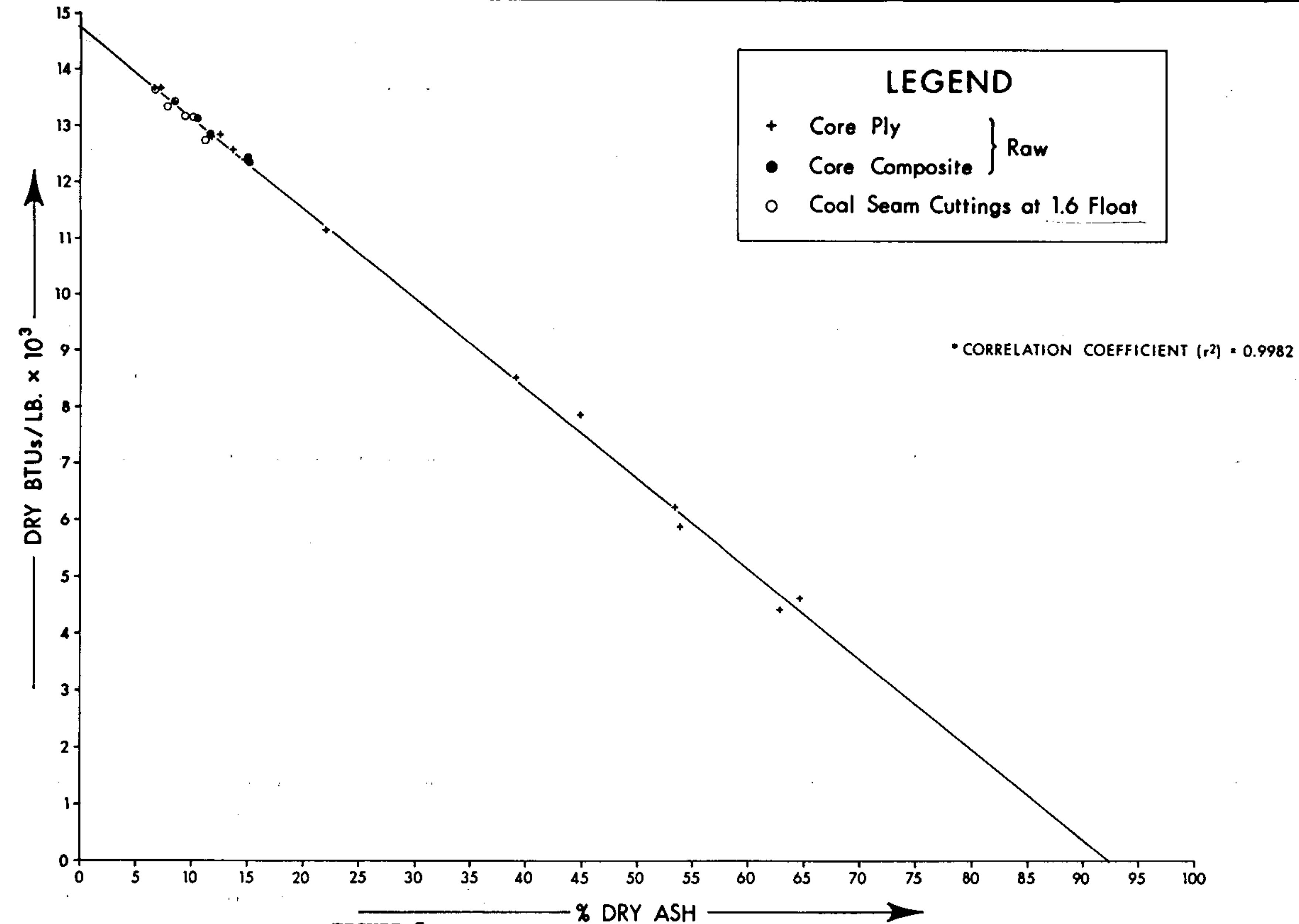



FIGURE 7.

PLOT OF DRY BTUs/LB. VS. % DRY ASH BY WEIGHT.

## 9.0 STATEMENT OF COSTS

A copy of the application to extend the term of licences CL 6084, CL 6085 and CL 6086 which was submitted April 18 1984 is included in the following 3 pages. A copy of the covering letter that was submitted with this application is also included for reference.

April 18, 1984

Mr. Paul Hagen
Coal Administrator
Province of British Colmmbia
Ministry of Energy, Mines &
Petroleum Resources
Room 412
617 Government Street
Victoria, B.C.

Dear Mr. Hagen:

Re; Coal Licence Nos. 6084, 6085 and 6086 Douglas District

During 1984 exploration work on the above coal licences has been carried out by Wolf Mountain Coal Limited Paethership under an agreement with Netherlands Pacific Mining Co. Inc. The report on this work is at present being compiled by Wolf Mountain Coal Limited Partnership. Although the report is expected to be completed shortly, it will mot be available to submit to you by the April 21st anniversary date. We would, therefore, request an extension of the deadline for data submission under Section 18 (4) of the Coal Act (1979).

We have enclosed the forms "Application to Extend Term of Licence" along with a cheque for $3,680.00 to cover our annual rental fee. We are allowing coal licence numbers 6083 and 7470 to forfeit.

Yours truly,
NETHERLANDS PACIFIC MINING CO. INC.

W. H. Owen
PRESIDENT

WHO/wm

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

# APPLICATION TO EXTEND TERM OF LICENCE

I, Mr. W. H. Owen (Name) agent for Netherlands Pacific Mining Co. Inc. (Name)

1409 Chartwell Drive
West Vancouver, B.C. V7S 2R7
(Address)

105-1285 West Pender Street
Vancouver, B.C. V6E 4B1
(Address)

Valid FMC No. 266332

hereby apply to the Minister to extend the term of Coal Licence(s) No(s). 6084, 6085, 6086

for a further period of one year.

2. Property name Wolf Mountain Coal Property

3. I am allowing the following Coal Licence(s) No(s). to forfeit 6083, 7470

4. I have performed, or caused to be performed, during the period April 21, 1983 to April 20, 1984, work to the value of at least $ 262,670.00 on the location of coal licence(s) as follows:

| CATEGORY OF WORK | Licence(s) No(s). | Apportioned Cost |
|---|---|---|
| Geological mapping | None | - |
| Surveys: Geophysical | None | - |
| Geochemical | None | - |
| Other: Road and minesite surveys | 6085, 6086 | 4,250.00 |
| Road construction | 6085, 6086 | 22,000.00 |
| Surface work | 6086 | 86,000.00 |
| Underground work | 6086 | 122,000.00 |
| Drilling | None | - |
| XXXXX sampling, and testing | 6086 | 1,100.00 |
| Reclamation | None | - |
| Other work (specify) Water Supply | 6084, 6085, 6086 | 4,320.00 |
| Off-property costs | | 23,000.00 |

5. I wish to apply $ 262,670 of this value of work on Coal Licence(s) No(s). 6084, 6085, 6086

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

7. The work performed on the location(s) is detailed in the attached report entitled Wolf Mountain Coal Property - 1984 Summary of Work. This report will be submitted by Wolf Mountain Coal Limited Partnership shortly.

April 18, 1984 (Date) ............................ (Signature)

W. H. Owen, President (Position)

(FORMS AND REPORT TO BE SUBMITTED IN DUPLICATE)

| | Area (Hectares) | Scale | Duration |
|---|---|---|---|
| Reconnaissance | | | |
| Detail: Surface | | | |
| Underground | | | |
| Other* (specify) | | | |

Total Cost $ Nil

**GEOPHYSICAL/GEOCHEMICAL SURVEYS** Yes ☒ No ☐

Method

Grid

Topographic

Other* (specify) Surveying for road and minesite

Total Cost $ 4,250.00

**ROAD CONSTRUCTION** Yes ☒ No ☐

Length 1,000 metres Width 9 metres (includes ditches)

On Licence(s) No.(s) 6085, 6086

Access to the minesite

Total Cost $ 22,000.00

**SURFACE WORK** Yes ☒ No ☐

| | Length | Width | Depth | Cost |
|---|---|---|---|---|
| Trenching | | | | |
| Seam Tracing | | | High-wall | |
| Crosscutting | | | | |
| Other* (specify) Face-up for underground workings, minesite work area, maintenance area | 120 m | 40 m | 5 m | |

Total Cost $ 86,000.00

**UNDERGROUND WORK** Yes ☒ No ☐

| | No. of Adits | Maximum Length | No. of Holes | Total Metres | Cost |
|---|---|---|---|---|---|
| Test Adits | | | | | |
| Other workings* Development adits | 2 | 150 m to date | no drilling done | | |

Total Cost $ 122,000.00

**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 $ Nil

**~~XXXXXXX~~, SAMPLING, AND TESTING** Yes ☒ No ☐

Lithology: Drill samples ☐ Core samples ☐ Bulk samples ☐

Logs: Gamma-neutron ☐ Density ☐

Other* (specify)

Testing: Proximate analysis ☒ FSI ☐ Washability ☐

Carbonization ☐ Petrographic ☐ Plasticity ☐

Other* (specify) Acid generation tests

Total Cost $ 1,100.00

**RECLAMATION** Yes ☐ No ☒

Details Total Cost $

**OTHER WORK (Specify details)** Yes ☒ No ☐ Cost

Water supply

Total Cost $ 4,320.00

**OFF-PROPERTY COSTS** Yes ☐ No ☐

Details Stage II preparation, Public Meetings Total Cost $ 23,000.00

Total Expenditures $262,670.00

April 18, 1984
(Date)

(Signature)

W. H. Owen, President
(Position)

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

## 10.0 BIBLIOGRAPHY AND REFERENCES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