MOUNT KLAPPAN COAL PROJECT
HOBBIT - BROATCH AREA
GEOLOGICAL REPORT
1984

GULF CANADA RESOURCES INC.
COAL DIVISION

GULF CANADA RESOURCES INC.

Mount Klappan Project Geological Report
Hobbit-Broatch Area
1984

Coal Project Licence Numbers
7118 to 7177
7381 to 7392
7416 to 7432
7487 to 7539
7559 to 7561
and
7714 to 7757

Cassiar Land District

NTS Map Number 104 H

Latitude Between 57° 06' and 57° 23'
Longitudes Between 128° 37' and 129° 15'

Gulf Canada Resources Inc.

January 1985

PREFACE

The Mount Klappan coal project is located in northwest British Columbia, and is wholly owned and operated by Gulf Canada Resources Inc.

The 1984 Hobbit-Broatch Area Geological Report combines current and previous exploration work to provide an assessment of the geology, coal quality, and resource potential of the Hobbit-Broatch area. Included as part of the initial coal licence acquisition in 1981 the Hobbit-Broatch area encompasses the northeastern portion of the Mount Klappan property.

Table of Contents

MOUNT KLAPPAN COAL PROJECT
HOBBIT-BROATCH AREA
1984 GEOLOGICAL REPORT

Table of Contents - cont'd

Page No.

Table of Contents - Cont'd

Table of Contents - Cont'd

Table of Contents - Cont'd

Table of Contents - Cont'd

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES cont'd

Page No.

Table No.

List of Appendices

- Appendices Within Text -

- Appendices External to Text -

APPENDIX I

1:50 000 Maps, Correlation Charts, Measured Sections

		Drawing No.
1:50 000 Maps:		
	1984 Coal Licence Map	KPN84B01
	1984 Traverse Location Map	KPN84B02
Correlation Charts:		
	Drill Hole Geophysical Log Correlation Chart	
	Sheet 1	KPN84HBC01
	Sheet 2	KPN84HBC02
Measured Sections		
	OTC 82005	KPN82129
	OTC 82007	KPN82131

APPENDIX II

Geology Maps and Cross-Sections

	Drawing No.
Volume I	
1:2500 Maps:	
J6-SW	KPN84HB-21
J7-SE	KPN84HB-22
J7-SW	KPN84HB-23
I6-NW	KPN84HB-24
I6-SW	KPN84HB-25
I7-NW	KPN84HB-26
I7-NE	KPN84HB-27
I6-NE	KPN84HB-28
I7-SE	KPN84HB-29
I8-NE	KPN84HB-30
J7-NE	KPN84HB-31
J8-SE	KPN84HB-32
I6-SE	KPN84HB-33
1:2500 Cross-Sections	
1000 SE	KPN84HB-41
1250 SE	KPN84HB-42
1500 SE	KPN84HB-43
1750 SE	KPN84HB-44
2000 SE	KPN84HB-45

	Drawing No.
1:2500 Cross-Sections	
2250 SE	KPN84HB-46
2500 SE	KPN84HB-47
2750 SE	KPN84HB-48
3000 SE	KPN84HB-49
3250 SE	KPN84HB-50
3500 SE	KPN84HB-51
3750 SE	KPN84HB-52
4000 SE	KPN84HB-53
4250 SE	KPN84HB-54
4500 SE	KPN84HB-55
4750 SE	KPN84HB-56
5000 SE	KPN84HB-57
5250 SE	KPN84HB-58
5500 SE	KPN84HB-59
1:5000 Maps:	
H-4	KPN84HB-61
H-5	KPN84HB-62
H-6	KPN84HB-63
H-7	KPN84HB-64
I-4	KPN84HB-65

APPENDIX II - Cont'd

	Drawing No.
1:5000 Maps:	
I-5	KPN84HB-66
I-6	KPN84HB-67
I-7	KPN84HB-68
J-5	KPN84HB-69
J-6	KPN84HB-70
J-7	KPN84HB-71
1:5000 Cross-Sections	
1000 NE	KPN84HB-81
1000 SE	KPN84HB-82
3000 SE	KPN84HB-83
5000 SE	KPN84HB-84
7000 SE	KPN84HB-85
9000 SE	KPN84HB-86
11000 SE	KPN84HB-87
13000 SE	KPN84HB-88
1:10 000 Map	
104H/2J	KPN84HB-91

APPENDIX II - Cont'd

	Drawing No.
1:10 000 Cross-Sections	
11000 SE	KPN84HB-92
13000 SE	KPN84HB-93

APPENDIX III

1981, 1982, 1983, 1984 Coal Trench Data

Data Source Summaries

Descriptive Logs

Coal Quality Analysis

1981 Reflectance Data

1:10 000 Trench and Drill Hole Location Map

APPENDIX IV

Diamond Drill Hole Data

Volume I

1982 Diamond Drill Hole Data (5 holes)

KPNHCDDH82001

KPNHCDDH82002

KPNHCDDH82003

KPNHCDDH82004

KPNHCDDH82006

- Data Source Summaries
- Coal Seam Data Sheets
- Sample Summaries
- Descriptive Logs
- Stratigraphic Logs
- Geophysical Logs
- Deviation Surveys

1:10 000 Trench and Drill Hole Location Map

APPENDIX IV cont'd

Diamond Drill Hole Data

Volume II

1984 Diamond Drill Hole Data (4 Holes)

KPNHCDDH84001

KPNHCDDH84002

KPNHCDDH84003

KPNHCDDH84004

- Data Source Summaries
- Coal Seam Data Sheets
- Sample Summaries
- Descriptive Logs
- Stratigraphic Logs
- Geophysical Logs
- Deviations Surveys

1:10 000 Trench and Drill Hole Location Map

APPENDIX V

Diamond Drill Hole

Coal Quality Data

Volume I

1982 Diamond Drill Hole Coal Quality Data (CONFIDENTIAL DATA)
& 1984

KPNHCDDH82001

KPNHCDDH82002

KPNHCDDH82003

KPNBCDDH82004

KPNBCDDH82006

KPNHC84001
KPNHC84002
KPNHC84003
KPNHC84004

~~Data Source Summaries~~

~~Sample Summaries~~

~~Coal Seam Data Sheets~~

Coal Quality Data

Volume II

1982 AND
1984 Diamond Drill Hole Coal Quality Data (OPEN FILE DATA)

KPNHCDDH84001

KPNHCDDH84002

KPNHCDDH84003

KPNHCDDH84004

KPNHC82001
KPNHC82002
KPNHC82003
KPNBC82004
KPNBC82006

APPENDIX V cont'd

Diamond Drill Hole

Coal Quality Data

Volune II cont'd

- Data Source Summaries
- Sample Summaries
- Coal Seam Data Sheets
- ~~Coal Quality Data~~

1.0 SUMMARY

Gulf Canada Resources' Mount Klappan property, is composed of 189 crown licences, comprising 50 014 hectares of land. The property is located in the Bowser Basin of Northwest British Columbia, some 150 kilometres northeast of Stewart, British Columbia.

The Mount Klappan property was divided into three separate areas in 1984 to facilitate exploration activities and logistics. These areas include the "Hobbit-Broatch Area", "the Lost-Fox Area" and the "Summit-Nass-Skeena Area". The Hobbit-Broacth Area is the focus of this report.

Combined exploration activity, during 1984, of all three areas comprised 8 diamond drill holes for 1 507 metres; 17 rotary drill holes totalling 897 metres; and the excavation of 223 trenches. In addition the property was mapped at scales of 1:2500 and 1:5000, and new air photo coverage was produced for the Hobbit-Broatch and Lost-Fox Areas at scales of 1:8000 and 1:20 000

The Mount Klappan property and the Hobbit-Broatch Area within it, covers sedimentary strata ranging from Middle - Upper Jurassic to Lower Cretaceous in age. Structurally, it consists of strata which is characterized by two phases of deformation. This has resulted in folds of the first phase trending NW-SE with minor thrusts. The second phase folding has resulted in generally broad, open NE to SW trending folds.

The sediments are subdivided into four sequences which, in ascending order, are labelled the Spatsizi, Klappan, Malloch and Rhondda Sequences. The Klappan Sequence, which is presently interpreted to comprise up to 900 metres of minor conglomerates, sandstones, claystones, siltstones and coals, is the main coal-bearing unit. Within the Hobbit-Broatch Area, sediments are found only within the Spatsizi, Klappan and Malloch Sequences.

The Mount Klappan property contains a total resource of 5.3 billion tonnes of coal, with each resource category contributing as indicated below. These coal resources are contained in 16 seams ranging in thickness up to 8 metres.

The Hobbit-Broatch Area contributes 1019.0 tonnes to the total resource of the Mount Klappan property, with each resource category contributing as indicated below. In the Hobbit-Broatch Area, there are 15 seams with an aggregate true thickness ranging up to 25 metres interpreted to exist within the coal-bearing Klappan Sequence.

Coal Resources

	Mount Klappan Property	Hobbit-Broatch	
Measured	44.2	12.1	m tonnes
Indicated	70.8	24.5	m tonnes
Inferred	604.6	369.1	m tonnes
Speculative	4622.4	613.3	m tonnes
Total	5342.0	1019.0	m tonnes

The coal, which is of anthracite rank, can be cleaned to simultaneously produce a variety of sized products, ranging in ash content from 5% ash premium coals to briquetting coals of 25% ash or greater. The anthracite products are characterized by low sulphur values (less than 1% and usually 0.5%), high calorific values, and only traces of chlorine.

2.0 RECOMMENDATIONS

Compilation and interpretation of geologic information over several exploration seasons has outlined a portion of the Hobbit-Broatch Area with potential surface mineable coal resources. The following recommendations are based on these interpretations:

1. Acquire additional geologic data through drilling, trenching and detailed geological mapping surrounding the Hobbit and Broatch Creek areas (Hobbit-Broatch Resource Area).

2. Extend the Hobbit-Broatch Resource Area north and west of Broatch Creek utilizing drilling and detailed geological mapping.

3. Continue delineation of the Klappan coal-bearing sequence through geologic mapping to the north along the Didene Creek and Spatsizi River, east along Ellis Ridge and to the west along Grizzley Ridge, and Knooph Hill.

3.0 INTRODUCTION

3.1 Mount Klappan Coal Project

3.1.1 Location

The Mount Klappan coal licences are situated in northwest British Columbia approximately 930 kilometres north of Vancouver, 150 kilometres northeast of Stewart and 530 kilometres northwest of Prince George (Figure 3.1; Appendix F).

Geographically the coal licences are at the northern extremity of the Skeena Mountains between 57° 06' and 57° 23' north latitude, and 128° 37' and 129° 15' west longitude, and cover the headwaters of the Klappan, Little Klappan, Spatsizi and Nass Rivers.

The nearest community to the property is the community of Iskut (population 500) located 100 kilometres to the northwest on the Stewart-Cassier Highway (Hwy. 37).

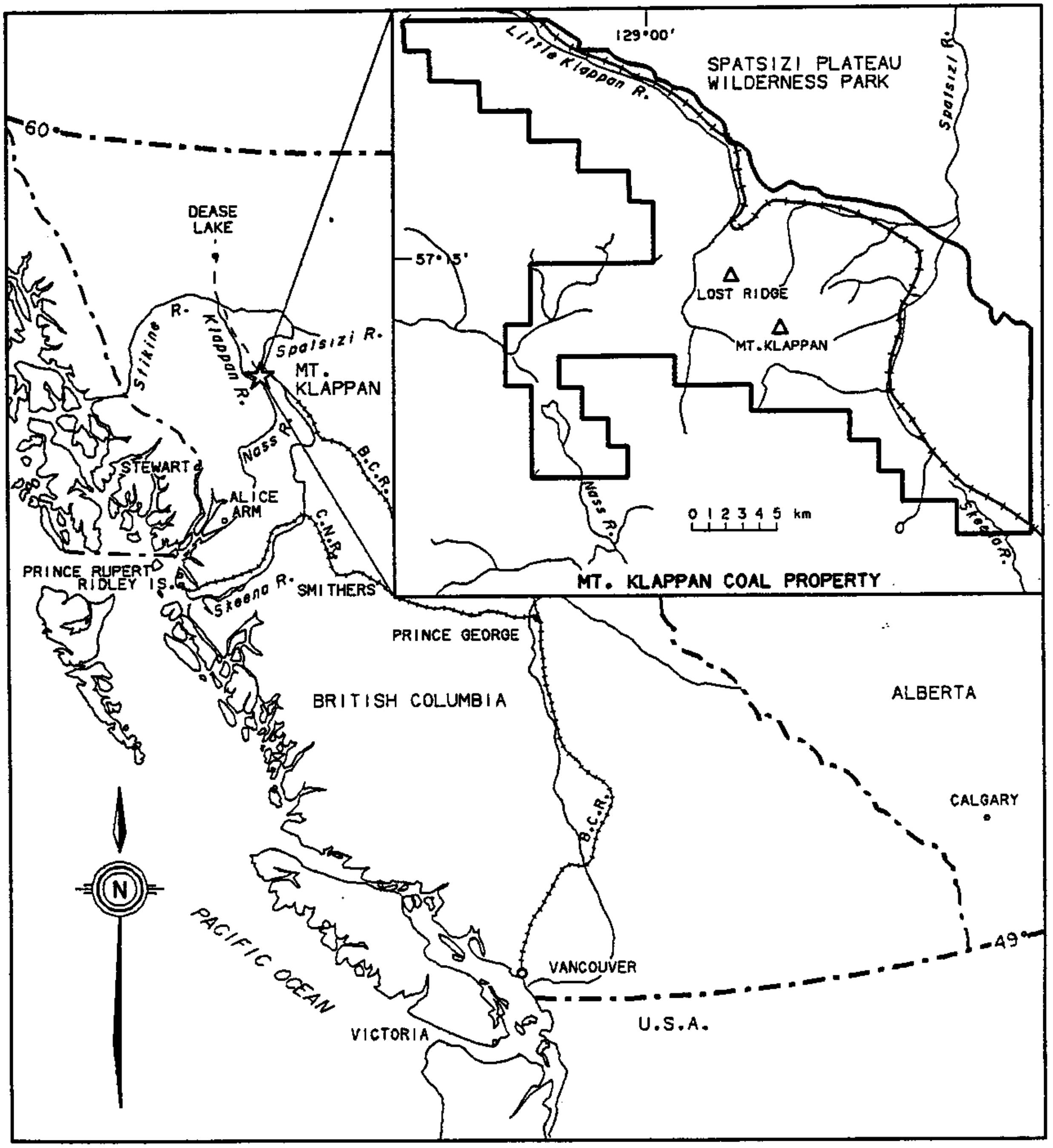
3.1.2 Access

The Mount Klappan property straddles the partially completed British Columbia Railway line between Prince George and Dease Lake (Figure 3.2). Prior to cessation of work on the construction of the line, steel was laid to within 80 kilometres soth of the property. With the exception of a 24 kilometre stretch north of the Kluatantan River, the railway

FIGURE 3.1

MOUNT KLAPPAN COAL PROPERTY

LOCATION MAP

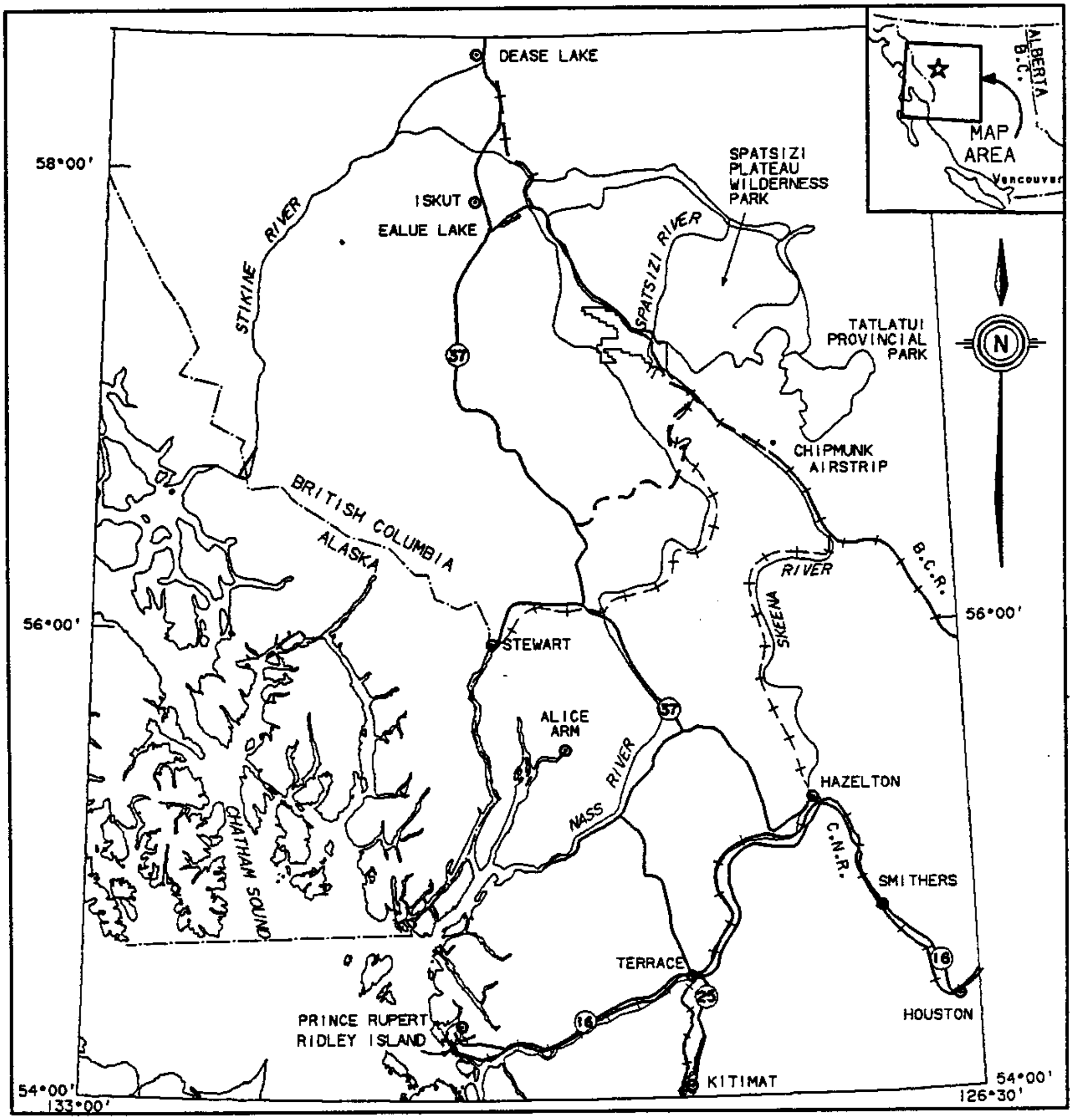


MT. KLAPPAN LICENCE AREA

GULF CANADA RESOURCES INC.
10/01/85

FILE NAME [205,57]831024018.LOC

FIGURE 3.2
MOUNT KLAPPAN COAL PROPERTY
PROPERTY ACCESS



LEGEND

————	ROAD ACCESS
— — — —	PROPOSED ROAD ACCESS
—+—+—+—	EXISTING RAILWAY
—+— —+—	EXISTING RAILWAY SUBGRADE
—+— —+—	POSSIBLE RAILWAY ROUTES
————	MT. KLAPPAN LICENCE AREA

SCALE

0 20 40 60 80 100 km

GULF CANADA RESOURCES INC.
10/01/85

QSO:[205,57]840564001.LOC

subgrade was constructed through and beyond the property to the Stikine River just south of Dease Lake.

Road access to the property from Highway 37 via Ealue Lake road, is provided along the British Columbia railway subgrade. Three bridges were constructed along the subgrade early in 1984 to permit surface access to the property. Road distances from Terrace and Stewart to the property are 575 kilometres and 426 kilometres respectively. Fixed wing aircraft provides access by air and use the 1000 metre Summit Airstrip located along the railway subgrade in the central region of the property.

3.1.3 Property Description

The Mount Klappan property comprises 189 coal licences totalling 50 014 hectares of land (Appendix B). The property was acquired in four separate applications from 1981 to 1984 (Figure 3.3).

3.1.4 Ownership

Gulf Canada Resources Inc., wholly owns the coal licences comprising the Mount Klappan property.

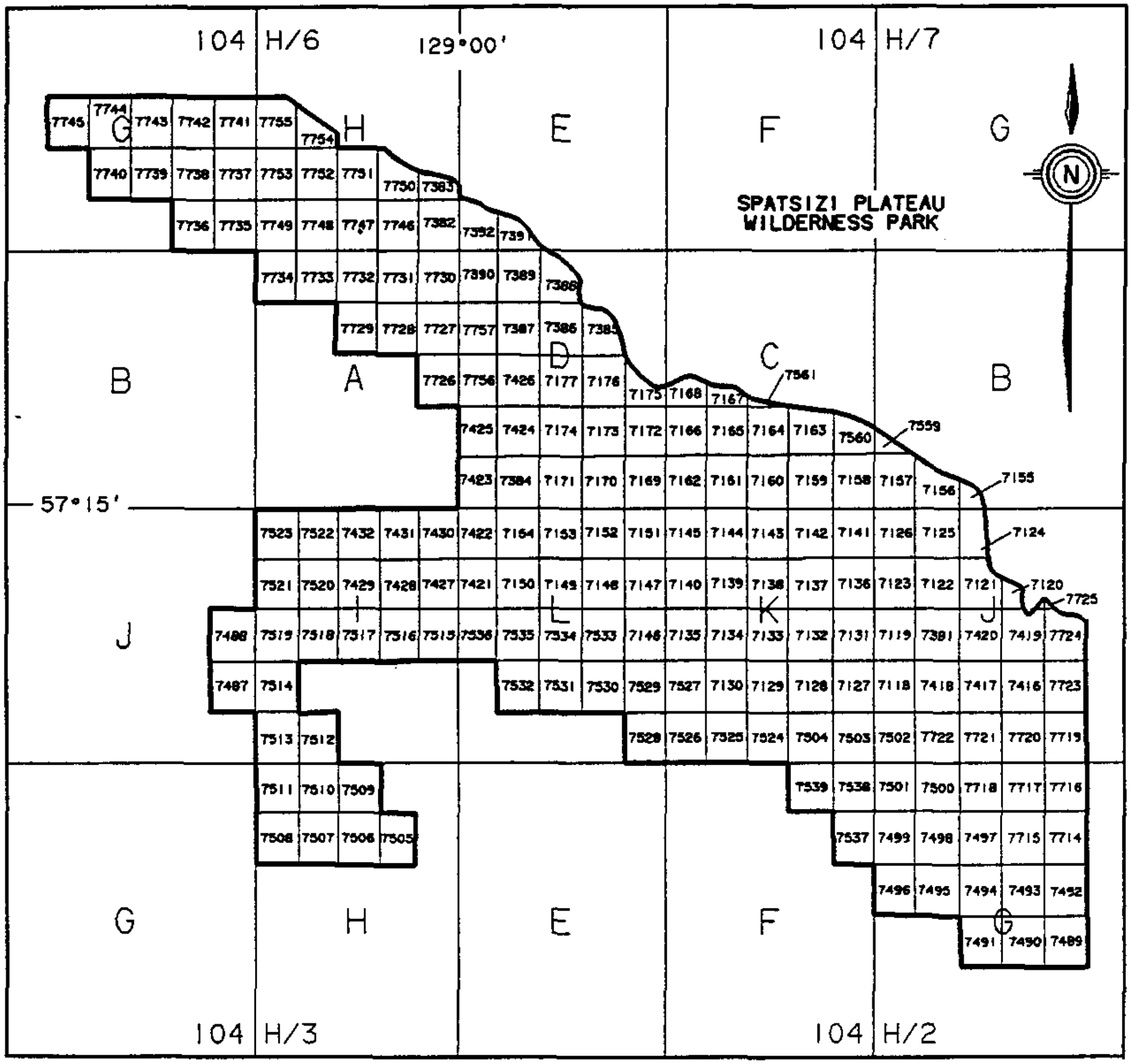
3.1.5 Property Geography and Biophysical Environment

The Mount Klappan property is located at the headwaters of the Little Klappan, Klappan, Nass, Skeena, and Spatsizi Rivers (Figure 3.1). This area is within the

FIGURE 3.3

MOUNT KLAPPAN COAL PROPERTY

LICENCES



LEGEND	
———	LICENCE AREA
7386	LICENCE NUMBER

SCALE

0 1 2 3 4 5 km

GULF CANADA RESOURCES INC.
05/12/84

FILE NAME [205,57]831024020.LOC

northern extremity of the Skeena Mountains physiographic region. The regional physiography is of mountainous terrain with broad northwest to southeast trending river valleys of the Little Klappan, Klappan, Nass, Spatsizi and Skeena Rivers, and Didene Creek.

Elevations on the property range from 1127 metres in the Spatsizi River Valley to over 2000 metres on Mount Klappan and the adjacent ridge tops.

The climatic regime of the area is in the Northern and Central Plateau and Mountain Zone. Precipitation values average 300 to 400 mm per year with the mean daily temperatures comparable to Fort Nelson and Prince George. This information is derived from weather station located on the northeastern edge of the property which have been monitored monthly since their installation three years ago.

Tree line in the area is at approximately 1500 metres. Valley bottoms are partially covered with scattered coniferous forests, grasses, shrubs, meadows, and bogs. The higher elevations are characterized by alpine tundra.

3.2 Hobbit-Broatch Area

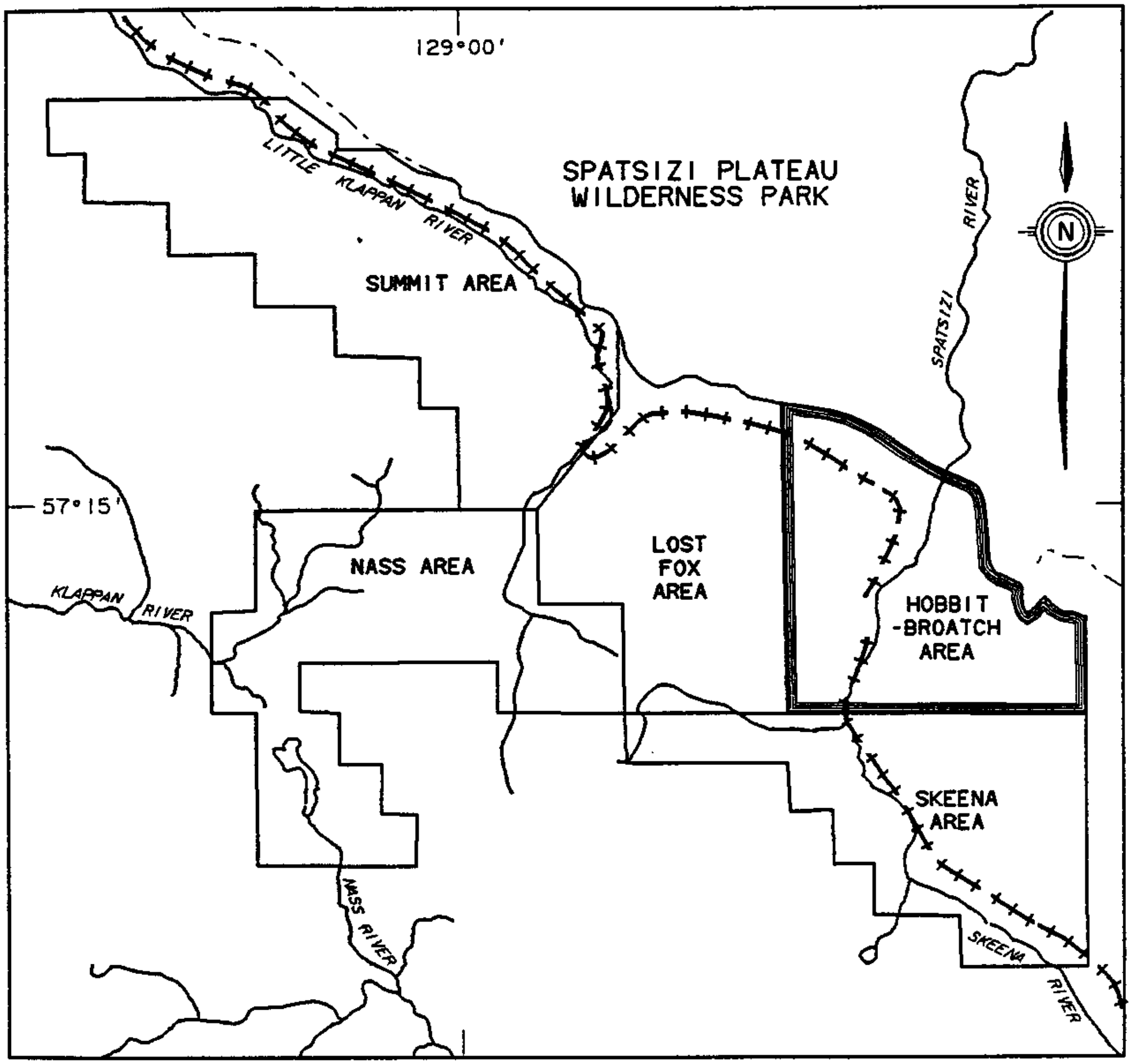
3.2.1 Location

The Hobbit-Broatch Area is located within the northeastern quadrant of the Mount Klappan property (Figure 3.4).

FIGURE 3.4

MOUNT KLAPPAN COAL PROPERTY

HOBBIT - BROATCH 1984 EXPLORATION AREA



LEGEND

- PREPARED RAIL BED
- PROVINCIAL PARK BOUNDARY
- LICENCE AREA

SCALE

0 1 2 3 km

GULF CANADA RESOURCES INC.
10/12/84

FILE NAME [205,57]841165014.LOC

Size and position of the area was based upon geological trends. Borders were applied along existing licences.

3.2.2 Access

The British Columbia Railway subgrade provides the main access as it transects the Hobbit-Broatch Area. This is further enhanced by small construction and service roads branching off the subgrade. Helicopter transport is limited mainly to the highlands of the Hobbit-Broatch Area.

3.2.3 Area Description

The Hobbit-Broatch Area consists of 34 coal licences, totalling 7 996 hectares of land. The majority of the licences date to the initial acquisition in 1981, the remainder covering the eastern margin of the area, were granted in early 1984.

3.2.4 Biophysical Environment

Dominated by the Spatsizi River Valley the Hobbit-Broatch Area is covered mainly by scattered coniferous forests, bogs, shrubs, meadows and grasses. Highlands to the southwest and eastern portions of the area exibit the alpine tundra found above treeline. Elevations range from 1270 metres in the Spatsizi River Valley to 1 950 metres on the adjacent ridge tops.

4.0 EXPLORATION HISTORY

4.1 Mount Klappan Property

4.1.1 Exploration Prior to Gulf's Acquisition

V.H. Dupont made the first published description of coal in the Northern Bowser Basin in 1900 for the Canadian Department of Railways and Canals (Figure 6.1). In his report, he describes a coal outcrop near the confluence of Didene Creek and the Spatsizi River. This outcrop is now recognized as part of the Klappan coal occurrences.

The Geological Survey of Canada has initiated five exploration programs into the area. The first, in 1911, was led by G.S. Malloch (Malloch, 1914) who undertook a geological evaluation of the Bowser Basin concentrating 55 miles to the south of Mount Klappan in the Groundhog Coal Measures. The second, in 1948, was led by Buckham and Latour (Buckham and Latour, 1950) which also concentrated in the Groundhog area. The third study in 1957 was called "Operation Stikine". The fourth and fifth programs, which broadly covered the Klappan coal measures, were led by Eisbacher in 1974 and in 1981. These studies resulted in some of the first stratigraphic and structural studies of the area. In addition, Eisbacher tried to relate the depositional history of the Bowser Basin to the tectonic history of the area.

In 1979, Richards and Gilchrist from the B.C. Department of Mines published stratigraphic studies primarily in the Groundhog area. However, they also included reference to the coal sequences of the Northern Bowser Basin.

Further interest in the Klappan coal occurrences during the late 1970's resulted in both Esso Minerals and Petrofina acquiring licences in the area. These licences were allowed to lapse in 1980 following minimal geological exploration of the area.

Initially, Gulf entered the Bowser Basin in 1979 concentrating in the Panorama-Groundhog Coal Measures. This was followed in 1981 by the acquisition of the Mount Klappan property.

4.1.2 Summary of Exploration 1981-1983

Prior to 1984, Gulf undertook three separate exploration programs on the Mount Klappan property. The exploration included geological mapping, hand trenching, diamond drilling, and adit driveage, as summarized in Table 4.1. The results of these exploration activities have been documented in three separate reports: Mount Klappan Coal Project - Geological Report 1981, 1982 and 1983.

Table 4.1

MOUNT KLAPPAN COAL PROJECT

EXPLORATION SUMMARY 1981 TO 1983

	1981	1982	1983	Total
Adits				
Number	--	--	1	1
Tonnes	--	--	39.2	39.2
Diamond Drill Holes				
Number (HQ)	--	7	3	10
Total Metres	--	1223	603	1 826
Number (AIX)	--	--	6	6
Total Metres	--	--	126	126
Hand Trenching				
Number	24	50	93	167
Total Metres	130	284	339	753
Geological Mapping				
Scales:	1:10 000	1:10 000	1:5 000 1:10 000	

4.2 Hobbit-Broatch Area

4.2.1 Summary of Exploration 1981-1983

Exploration work in the Hobbit-Broatch Area prior to 1984 included programs in 1981 and 1982. These programs comprised hand trenching, mapping, and diamond drilling (Table 4.2). Emphasis on other areas of the Mount Klappan property shifted exploration activities away from the Hobbit-Broatch Area in 1983. Results of the areas exploration work can be found in the Mount Klappan Coal Project Geological Report 1981 and 1982.

Table 4.2

HOBBIT-BROATCH AREA

EXPLORATION SUMMARY 1981-1983

	1981	1982	1983
Diamond Drill Holes			
Number (HQ):	--	5	--
Total Metres:	--	849	--
Hand Trenching			
Number:	13	32	2
Total Metres:	49	164	17
Geological Mapping			
Scales:	1:10 000	1:10 000	--

5.0 1984 EXPLORATION PROGRAM

5.1 Program Objectives

The objectives of the 1984 exploration program for the Hobbit-Broatch Area are as follows:

1. To increase level of confidence in the resource tonnage of the Hobbit-Broatch Area.
2. To locate a test pit of low stripping ratio for removal of a trial cargo.
3. To refine geological mapping in priority sequence at a 1:2500 scale.
4. To delineate coal measures in periferal regions of the area.

To accomplish these objectives, an explortion program was designed in the spring of 1984. This program consisted of diamond drilling, detailed geological mapping and trenching.

The first objective was met by drilling four diamond drill holes in two phases, during the months of April and August. The second objective required extensive mechanical trenching during the summer. Objectives 3 and 4 were accomplished by detailed geological mapping in priority sequence during July, August and early September.

5.2 Summary of Exploration

5.2.1 Mount Klappan Coal Project

In four years of exploration programs on the Mount Klappan property, Gulf has advanced through regional investigations to seam tracing, drilling, and adit driveage (Table 5.1). While new areas are constantly being investigated, exploration is proceeding on those areas which have immediate economic interest. During 1984, geological mapping and hand trenching were undertaken on all areas of the property. In addition, diamond and rotary drilling, mechanical trenching, and seam tracing were undertaken on areas in more advanced exploration stages, the Lost-Fox and Hobbit-Broatch Areas.

During the first three years, the exploration programs were supported by air transport and personnel were accomodated in tent camps. In early 1984, Gulf constructed three bridges along the British Columbia Railway subgrade, providing road access to the property from Highway 37. Gulf subsequently purchased and erected a trailer camp along the subgrade 10 kilometres south of the Summit Airstrip, next to Didene Creek. Didene Creek Camp (Figure 3.4), provided lodging and working space for up to 50 Gulf and support personnel throughout the exploration program.

An exploration road was built in late 1984 to provide surface access to the central region of the Lost-Fox Area. Construction commenced in mid-November and was completed in December. The construction and support personnel utilized the Didene Creek Camp.

During the 1984 exploration program, geological as well as drilling and support crews were transported to their work stations from camp by helicopter where road access was

Table 5.1

MOUNT KLAPPAN COAL PROJECT
EXPLORATION SUMMARY 1981 TO 1984

	1981	1982	1983	1984	Total
Adits					
Number	--	--	1	--	1
Tonnes	--	--	39.2	--	39.2
Diamond Drill Holes					
Number (HQ)	--	7	3	8	18
Total Metres	--	1223	603	1507	3333
Number (AIX)	--	--	6	--	6
Total Metres	--	--	126	--	126
Rotary Drill Holes					
Number	--	--	--	17	17
Total Metres	--	--	--	897	897
Mechanical Trenches (Seam Tracing)					
Number	--	--	--	128	128
Total Metres	--	--	--	1041	1041
Hand Trenches					
Number	24	51	93	95	263
Total Metres	84	289	527	416	1321
Geological Mapping					
Scales	1:10 000	1:10 000	1:5 000 1:10 000	1:2 500 1:5 000 1:10 000	

not available. A Hughes 500D, as well as a Bell 206B on occasion, were used for crew transport within the property area. A larger Bell 204 or 205 helicopter was utilized for transporting heavy equipment and drilling rigs. At all times a helicopter was available on site equipped with a stretcher carrying kit for medical emergencies. Four-wheel-drive trucks were used where road access was available. The British Columbia Railway subgrade provided an excellent roadway through the property, and joined with Highway 37 via the Ealue Lake Road (Figure 3.2). A four-wheel-drive Emergency Transportation Vehicle was on standby at all times for use in a medical emergency.

Commercial as well as charter fixed wing aircraft linked the Summit Airstrip on the property to major centres and provided convenient air transportation for personnel and cargo throughout the exploration program.

5.2.2 Hobbit-Broatch Area

The 1984 Hobbit-Broatch Area Geological Report contains all the exploration information collected to date. The geologic interpretations as presented in this report utilizes all this data. A summary of the Hobbit-Broatch Area exploration activities is provided in Table 5.2.

Table 5.2

HOBBIT-BROATCH AREA

EXPLORATION SUMMARY 1981 TO 1984

	1981	**1982**	**1983**	**1984**	**Total**
Diamond Drill Holes					
Number (HQ)		5		4	9
Total Metres		849		490	1339
Hand Trenching					
Number	13	32	2	8	55
Total Metres	49	164	17	22	252
Mechanical Trenches					
Number				40	40
Total Metres				490	490
Geological Mapping					
Scales	1:10 000	1:10 000	1:10 000	1:5000	
			1: 5 000	1:2500	

5.3 Cartography

The topographic maps used for geological interpretation were at scales of 1:2500 and 1:5000. The 1:5000 map was photographically enlarged to produce the 1:2500 scale maps. These maps were produced from 1:30 000 British Columbia Government airphotos flown before the subgrade construction. In the fall of 1982, Gulf Canada Resources Inc. had the Mount Klappan Property reflown at a scale of 1:30 000. These airphotos were subsequently used in 1984 to produce new 1:2500 scale maps for a small segment of the Hobbit-Broatch Area. A survey crew brought control into the area in 1984, and a new set of airphotos at a scale of 1:8000 and 1:20 000 were made of the Hobbit-Broatch Area.

5.4 Geological Mapping

Detailed geological mapping was carried out at scales of 1:2500 and 1:5000 scales (Geology maps, Appendix II). The Hobbit-Broatch Area was mapped on a priority bases starting with Hobbit Creek; Broatch Creek, and the intervening area. Periferal and highland areas were designated as lower priority. Two crews consisting of a geologist and geological assistant were responsible for the area. Transportation to the field was provided by either truck or helicopter. Position location in the field was determined by theodolite and stadia rod, or modified plane table method, in conjunction with airphotos. Cairns were built on known topographic features and traverses tied into them. Survey control was brought into the area, to which all airphoto targeted mapping cairns, drill holes, and distinctive topographic features will be tied into.

5.5 Trenching

Forty-eight trenches were excavated for a total of 511.5 metres. Of this total forty trenches for 489.9 metres were excavated by the use of a John Deer backhoe. The remaining eight trenches were hand dug for 21.6 metres. All trenched seams were measured in true thickness and described in detail, safety permitting.

Sampling of the coal was done with seams demonstrating thicknesses in excess of 0.5 metres. In many cases, the mechanically dug trenches could not be sampled or logged due to hazardous sloughing conditions. In such cases, samples were taken from the excavated material on a representative basis.

Position of the trenches were surveyed in by theodolite and stadia rod or by the modified plane table method. The coal trench data is contained in Appendix III.

5.6 Trial Cargo

In late November, 1984, Gulf Canada Resources Inc. completed negotiations of a trial cargo consisting of 20 000 tonnes of anthracite coal. The coal will be obtained from a test pit area located just off the British Columbia subgrade immediately south of Hobbit Creek.

In preparation for this test pit, preliminary trenching and sampling was carried out in early September, 1984. Further data on this testing is provided in the coal quality Section 8.2.

5.7 Diamond Drilling

A Longyear Super 38 diamond drill capable of being broken down for transportation by helicopter was utilized for the core drilling. The rig was mobilized from the Summit airstrip, where it was stored for the winter, to the Hobbit-Broatch Area via a Hughes 500D helicopter.

A total of 244.1 metres of drilling was completed in 4 holes during a 3 week span in April of 1984. A further deepening of one of these holes in August brought the total to 489.9 metres for the 1984 exploration program.

In addition, 5 holes were drilled in the summer of 1982 for a total of 849.1 metres. (Table 5.3 summarizes drilling to date). The rig was operated on a two-shift, 24 hour-a-day basis, with a driller and a helper on each shift. All 1982 drill holes were surveyed in using the modified plane table method, 1984 holes were located by theodolite and stadia rod survey.

At the completion of the drilling program the rig was moved by helicopter to the Lost-Fox Area.

5.8 Geophysical Logging

All diamond drill holes, except DDH82001, were geophysically logged at a general scale of 1:200. Detailed logs were produced at a scale of 1:40 over the coal seams utilizing the density, resistivity, gamma, and caliper responses.

Table 5.3

HOBBIT-BROATCH AREA

DIAMOND DRILL HOLE SUMMARY

Drill Hole	Easting (m)	Northing (m)	Elevation (m)	Length (m)	Inclination (°)	Azimuth (°)
KPNHCDDH82001	514375.0	6343645.0	1400.0	124.1	90.0	0.0
KPNHCDDH82002	515445.0	6345134.0	1342.0	179.0	90.0	0.0
KPNHCDDH82003	515540.0	6343325.0	1271.0	215.5	90.0	0.0
KPNBCDDH82004	513515.0	6344510.0	1470.0	157.6	60.0	040.0
KPNBCDDH82006	512650.0	6344865.0	1489.0	173.0	60.0	345.0
KPNHCDDH84001	515125.0	6343197.0	1305.0	57.0	80.0	054.1
KPNHCDDH84002	514717.0	6343493.0	1368.0	67.05	90.0	0.0
KPNHCDDH84003	514895.0	6343228.0	1347.0	53.95	90.0	0.0
KPNHCDDH84004	515230.0	6342717.0	1295.0	311.93	90.0	0.0

A digital geophysical logging system was employed with the information from probe readings being recorded directly onto magnetic tape. Paper prints of the logs were produced in the field to assist in core logging and correlation. Appendix IV, Volume II contains a complete set of geophysical logs.

The following is a list of the full suite of logs run during the program:

a) Gamma Ray
b) Neutron
c) Sidewall Density
d) Focused Beam Resistivity
e) Caliper
f) Direction Deviation

5.9 Data Management

During the 1984 field season, a HP 9816 computer was used in the field for budget purposes and for the storage of trench and drill hole data. This data was then transferred in Calgary to Gulfs Coal Data Base. All data stored to date in Calgary is on Gulf's AMDAHL V6 computer. The data stored includes all drill core descriptions, detailed records of each drill hole and trench, complete descriptions of all samples collected and all coal quality and washability data. The coal data base utilizes the System 2000 data base management system and Act 1 software to provide easy on-line data entry and screen retrieval of stored data.

5.10 Reclamation

The drilling program, undertaken with helicopter support, resulted in minor disturbances to the four diamond drill sites. All equipment and garbage has been removed from the sites. Coal seam hand trenches remain open for further inspection. The backhoe trenches were infilled for safety.

The permenant trailor camp was fully permitted and constructed on a site near Didene Creek. Garbage which was not incinerated was back-filled in a designated area.

5.11 Exploration and Camp Permits

Approvals for the 1984 exploration programs on the Mount Klappan property were received in April, 1984, following submission of Coal Exploration Forms 6 and 7 to the Government of British Columbia. Subsequently, the following permits/approvals were issued to Gulf Canada Resources Inc. with respect to the Mount Klappan Coal Project 1984 exploration program:

Name	B.C. Ministry of
Reclamation Permit C-160	Energy, Mines and Petroleum Resources
Free Use Permit 12565	Forests
Water Use Approval No. 610012	Environment
Operating Permit No. 15286	Health
Class B Burning Permit B23675	Forests
Inspection Report 16227	Forests
Water Analysis Report 23298	Health

5.12 Depositional Environments Study

Data and samples collected in the Hobbit-broatch Area and throughout the Mount Klappan Property, are currently undergoing analysis. The resultant depositional environments, interpreted from this data, will be published in a separate volume.

5.13 Project Management and Contractors

The 1984 exploration program was managed by B.P. Flynn of Gulf Canada Resources Inc. Field operations in the Hobbit-Broatch Area were supervised by G.E. Seve and E. LeGresley. Coal quality analysis were interpreted by J. Innis with assistance from K. Fujita of Norwest Resoruce Consultants Ltd. Coal petrology studies were performed by N.E. Pearson and Associates Ltd.

The following additional personnel contributed to the exploration in the Hobbit-Broatch Area.

B.M. Leece	Senior Engineer, Mining
E.M. LeGresley	Geologist
S. Rowe	Geologist
A.T. Sali	Administrator
G.E. Seve	Geologist
G. MacFarlane	Geological Assistant
G. Murray	Geological Assistant
B. Van Den Bussche	Geological Assistant

D. Ferguson	Helicopter Pilot
G. Gillik	Helicopter Pilot
J. Goats	Helicopter Pilot
S. Hannah	Helicopter Pilot
D. McCrae	Helicopter Pilot
C. Earle	Field Accountant
T. Sampietro	Expeditor/Camp Manager
C. Jacobs	Camp Maintenance
R. Bonang	Cook
D. Anderson	Cook's Helper
S. Bregazzi	Computer Operator
K. Scarbo	Geophysical Engineer
G. Barclay	First Aid Attendant
D. Fedderly	First Air Attendant
G. Dennis	Slasher/Trencher
F. Louie	Slasher/Trencher

The following is a list of the service companies and suppliers used during the project.

Services

AGT	Calgary
Avcon Aviation Consulting Ltd.	Calgary
Aero Expediting	Smithers
Birtley Coal & Minerals Testing	Calgary
B.C. Tel	Vancouver
Canadian Freightways Ltd.	Calgary/Terrace
Century Geophysical	Calgary
Commercial Testing & Engineering	Chicago
Calgary Shoe Hospital	Calgary
Central Mountain Air Services Ltd.	Smithers
Cullen Detroit Diesel	Houston
Dease Lake Contractors Ltd.	Dease Lake
Dowell Welding	Dease Lake
Dieterich Post	Calgary
Don Davidson Trucking	Smithers
Forty Mile Flats	Iskut
Glacier Helicopters	Smithers
Higgins Lake Contractors	Dawson Creek
Hudson Bay Taxidermy	Smithers
Hudson Bay Lodge	Smithers
Hardy Associates Ltd.	Calgary
Iskut Band Council	Iskut
Loring Laboratories Ltd.	Calgary
Lindsay's Cartage & Storage	Terrace
McElhanney Surveying & Engineering	Vancouver
Northern Mountain Helicopters	Prince George
Northwestel Inc.	Whitehorse
Northmount Camp Services Ltd.	Prince George
Park Ambulance Service Ltd.	Calgary
Pacific Western Airlines	Vancouver

Starr Industries Ltd.	
Southern Frontier Airlines	Calgary
Smithers Transport	Smithers
Tatogga Triangle Service Ltd.	Iskut
Trans Provincial Airlines	Terrace
Tenajon Lodge & Motel	Iskut
J.T. Thomas Diamond Drilling	Smithers
Tanzilla Transport	Dease Lake
T & R Services LTd.	Dease Lake
Viking Helicopters Ltd.	Prince George
Western Photogrammetry	Edmonton
Yukon Airways Ltd.	Whitehorse
B.C. Yukon Air Service Ltd.	Watson Lake

<u>**Suppliers**</u>

Alpine Wiring & Plumbing Ltd.	Smithers
Aqua North Plumbing Ltd.	Smithers
Apollo Automotive Parts	Smithers
Able Electric	Terrace
Best Caps & Sportswear Ltd.	Calgary
Chevron Canada Ltd.	Smithers
Fleck Brothers	Kitimat
Gulf Canada Ltd.	Terrace
HGL Data Systems Ltd.	Calgary
Helicom Avionics	Prince George
Iskut Coop	Iskut
ICG Liquid Gas Ltd.	Terrace
Monroe Systems for Business	Calgary
Mountain Equipment Coop	Calgary
Mr. Rentals	Smithers

N.R. Enterprises	Smithers
Northland Communications	Terrace
Neville Crosby Inc.	Vancouver
Omineca Building Supples	Terrace
Permasteel Construction	Vancouver
Profession Computer Centre	Calgary
Petrocraft Products Ltd.	Calgary
Ribtor Sales	Calgary
Smithers Lumber	Smithers
Terrace Builders Centre Ltd.	Terrace
Territorial Trailers Ltd.	Prince George
Terrace Coop Association	Terrace
Terrace Totem Ford	Terrace
Wayside Industrial Supply Ltd.	Smithers
Westcan Electronic Services Ltd.	Calgary

6.0 GEOLOGY

6.1 Introduction

Geological mapping and hand trenching activities were undertaken in all of the three areas of the Mount Klappan property during the 1984 exploration program. In addition, mechanical trenching and drilling operations proceeded in the Lost-Fox and Hobbit-Broatch Areas. The results of this exploration program combined with previous years' work provided the basis for geological interpretations presented in this report.

The Mount Klappan property is underlain by upper Jurassic to Lower Cretaceous strata which consist of marine to non-marine sediments deposited in Bowser Basin of northcentral British Columbia. The strata have been subjected regionally to two successive non-coaxial phases of deformation, F_1 and F_2, which resulted in folding and faulting trending in NW-SE (F_1) and E-W (F_2) directions generally. (See 1:50 000 Regional Geology Map located in Appendix D with this text).

The coal seams of the Mount Klappan property occur primarily in the Klappan Sequence; in addition, some minor seams have been trenched in the Malloch Sequence. Coal seams range up to over 7 metres in thickness in the Hobbit-Broatch Area.

6.2 Regional Geologic Setting

The coal measures of the Mount Klappan property are contained within a series of sediments ranging in age from Upper Jurassic to Lower Cretaceous. These sediments were deposited in the Bowser Basin, a successor basin to the volcanogenic Hazelton Trough (Tipper and Richards 1976). The Bowser Basin is bounded to the north and south by the Stikine and Skeena Arches respectively, and to the east by the Columbia Orogen (Omineca Crystalline Belt). The western margin is thought to have been open to the sea at the time of Bowser sediment deposition (Figure 6.1).

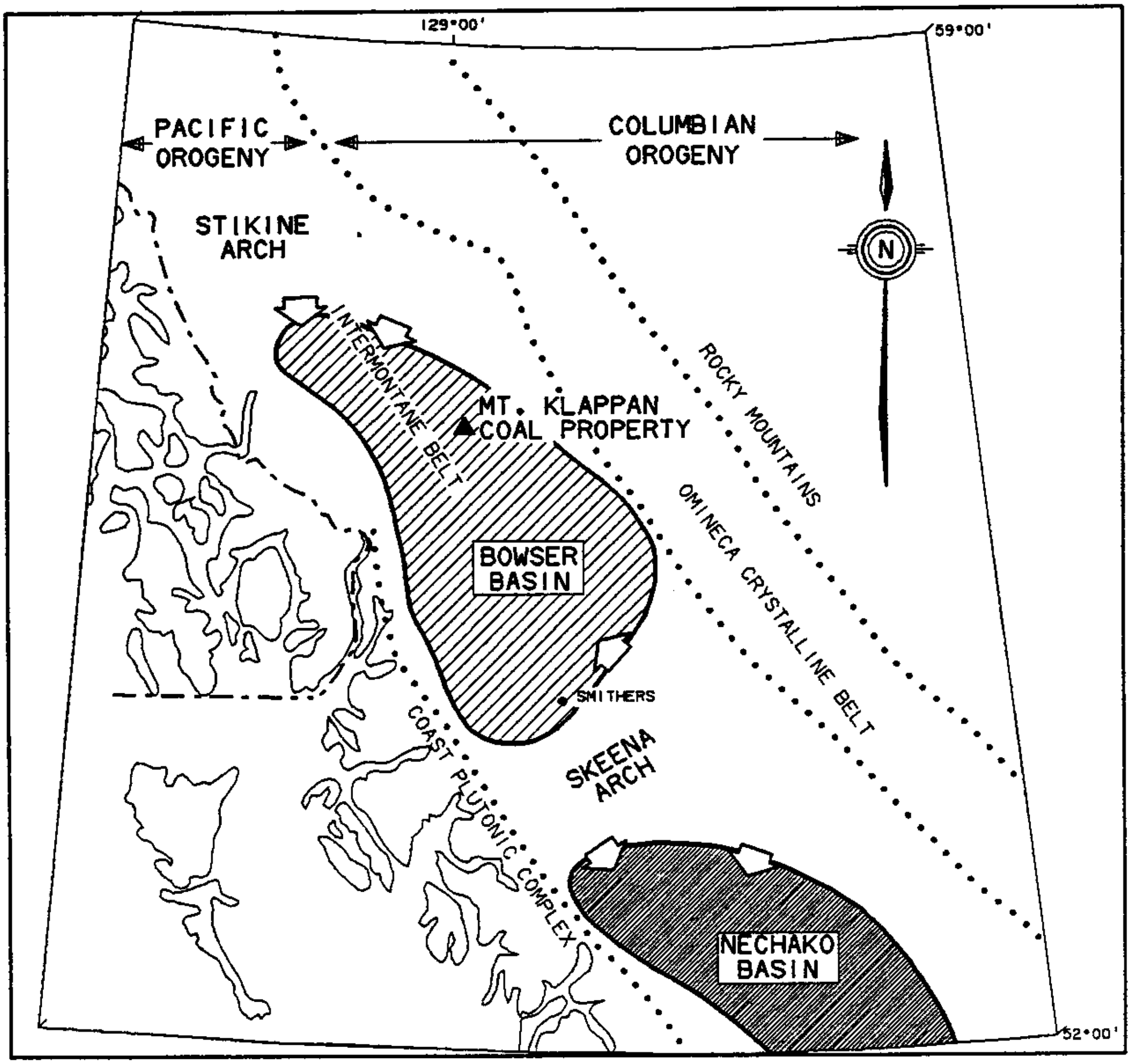
The formation and development of the Bowser Basin was controlled by the "collision and subsequent isostatic uplift of several crustal blocks in the Cordilleron Orogen of western Canada" (Eisbacher, 1981). These crustal blocks include the Stikine Terrane (volcanic arc complex) which directly underlies the Bowser sediments, the Atlin Terrane (remnant oceanic crust) and the Omineca Crystalline Belt (western margin of the North American Craton).

During the Middle Jurassic, the Skeena arch was uplifted and the subsidence of the Stikine Terrane divided the Hazelton Trough into the Bowser Basin to the north and the Nechako Basin to the south. Uplift of the Atlin Terrane to the north and northeast of the Bowser Basin, coupled with continued subsidence of the Stikine Terrane and collision and suturing of both these terranes with the Omineca Crystalline Belt (Eisbacher, 1981) resulted in a progradation of non-marine over marine sediments within the basin.

FIGURE 6.1

MOUNT KLAPPAN COAL PROPERTY

JURASSIC-CRETACEOUS BOWSER BASIN



LEGEND

BOWSER BASIN

NECHAKO BASIN

(AFTER TIPPER AND RICHARDS, 1976)

SCALE

0 100 200 km

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Paleocurrent measurements indicate a centripetal flow into the Bowser Basin from highlands to the north, northeast, and south.

Bowser sediment source rocks originate within the Atlin Terrane (high chert; low volcanic content) for the north and northeastern margins of the Basin, and from the remnant volcanic arc assemblage of the Stikine Terrane, (high volcanic; low chert content) for the southern portion of the Basin. Sediments from the Lower Cretaceous (youngest marine succession of the Bowser Basin) through to the Paleocene are found only on the eastern, and in part, the southern margins of the Basin.

In the southern portion of the Bowser Basin, the assemblage has been subdivided into three groups by Tipper and Richards (1976). These groups, in ascending order are: the Early Jurassic to Middle Jurassic Hazelton Groups, the Upper Jurassic Bowser Lake Group, and the Early Cretaceous Skeena Group. In the area discussed by Tipper and Richards (1976), the Skeena Group contains the major coal occurrences with some coal occurring at the top of the Bowser Lake Group.

In the Northern Bowser Basin comprehensive work has not been done and the sedimentary package associated with the coal in the Klappan Area has been variously named: the Skeena Series (Malloch, 1914); Upper Hazelton (Buckham and Latour, 1950); Groundhog-Gunanoot (Eisbacher, 1974a), and has been dated as Lower Cretaceous (Malloch, 1914; Buckham and Latour, 1950) and Upper Jurassic to Lower Cretaceous (Eisbacher, 1984a). (Table 6.1).

TABLE 6.1

MOUNT KLAPPAN COAL PROPERTY

REGIONAL STRATIGRAPHY - TABLE OF FORMATIONS

AGE	SUBDIVISION OF AGE	GROUP	LITHOLOGY
TERTIARY	LOWER		QUARTZ PEBBLE CONGLOMERATE, TO PEBBLY SANDSTONE, SANDSTONE SUB QUARTZOSE FELDSPATHIC, DARK GREY TO REDDISH MUDSTONE, THIN COAL SEAMS, SHALE, AND ASH FALL TUFFS IN UPPER PORTION OF UNIT.
CRETACEOUS	UPPER		
	MIDDLE		
	LOWER	SKEENA	CHERT PEBBLE RICH;BROWN-GREY CONGLOMERATE, BLACK, BROWN, AND ORANGEY CLAYSTONE, SILICEOUS AND CLAYEY SANDSTONE, WITH SILTSTONE, CLAYSTONE AND COAL INTERBEDS. BASE OF UNIT DARK GREY TO BLACK TUFFS, TUFFACEOUS SANDSTONE AND CARBONACEOUS SHALE.
JURASSIC	UPPER	BOWSER BASIN	FELDSPATHIC TO QUARTZOSE SANDSTONE, DARK GREY TO BLACK SHALE, SILTSTONE, GREYWACKE, CHERT PEBBLE CONGLOMERATE AND MINOR COAL SEAMS.
	MIDDLE		
	LOWER	HAZELTON	REDDISH, PURPLE, GREY AND GREEN PYROCLASTIC AND FLOW VOLCANICS, WITH CALC-ALKALINE CHEMICAL AFFINITIES, REDDISH SANDSTONE, SILTSTONE, MUDSTONE, MINOR CONGLOMERATE, AND LIMESTONE AND THEIR TUFFACEOUS EQUIVALENTS.
TRIASSIC	UPPER	TAKLA	GREY-GREEN TO DARK GREEN FLOW AND PYROCLASTIC, BASALTIC AND ANDESITIC VOLCANIC ROCKS,PELITIC SEDIMENTARY ROCKS AND MINOR CARBONATE ROCKS.
	MIDDLE		

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10/01/85

Structural deformation of Bowser Basin sediments resulted from intermittent tectonic stresses at the western cratonic margin from Cretaceous to recent time. The deformation caused an extensive, shallow decollement, recumbent folds, and local thrust faults extending a few kilometers along strike (Eisbacher, 1976).

The large scale forces resulting from collision of a remnant volcanic arc and cratonic margin subjected the area to northeast-southwest compression (F_1) creating the general structural trend of northwest-southeast.

Later position of the former volcanic arc terrain northwards along interlaced right lateral high angle faults (Eisbacher, 1981) may account for the later north-south compressional (F_2) event. This deformation event resulted in generally broad, open NE to SW trending folds with relatively rare, flat lying thrusts expressed in several Klippen fault structures.

The final deformational event which produced strike-slip and some dip-slip faulting may have resulted from a change in the rotational component of the western crustal block, terminating compression.

6.3 Mount Klappan Coal Project Geology

6.3.1 Stratigraphy

The Upper Jurassic to Lower Cretaceous sedimentary package underlying the Mount Klappan property has been subdivided into four sequences which, in ascending order are the Spatsizi, Klappan, Malloch, and Rhondda Sequences. (Figure 6.2). These conformable sequences have a combined estimated thickness of about 3400 metres and together represent a gradual overall marine regression. Table 6.2 briefly outlines the lithologies and sedimentary features observed within each sequence.

6.3.1.1 Spatsizi Sequence

The Spatsizi Sequence, which represents the lowest stratigraphic sequence within the Mount Klappan property, is generally comprised of sediments deposited under open marine conditions with minor coastal environment influences. Strata consist of mudstones, siltstones, sandstones, and discontinuous massive conglomerates in the upper portion of the sequence. Exposures of the Spatsizi Sequence are located in the northern Summit Area and the south-western Nass Area of the Mount Klappan property (Figure 3.4; Appendix D).

6.3.1.2 Klappan Sequence

The Klappan Sequence, the main coal-bearing unit on the property, was deposited in a coastal marine environment in which extensive peat marshes had developed. Evidence of marine influxes increase toward the base of the sequence. Strata consist of fine to coarse-grained sandstones interbedded with

FIGURE 6.2
MOUNT KLAPPAN COAL PROPERTY
SCHEMATIC STRATIGRAPHIC COLUMN

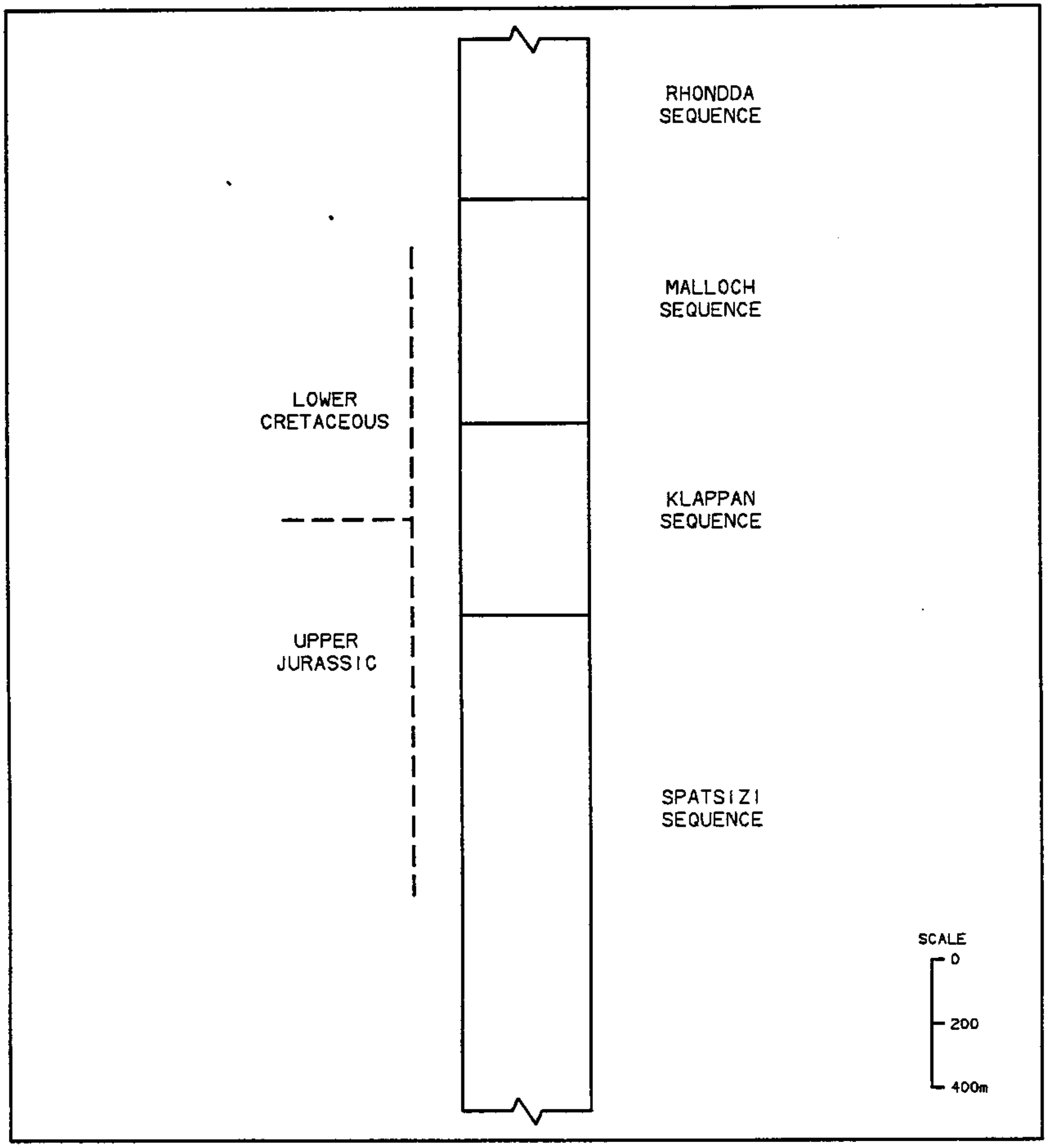

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TABLE 6.2
MOUNT KLAPPAN COAL PROPERTY
TABLE OF FORMATIONS

JKr **RHONDDA SEQUENCE**

SEQUENCE OF THICK MASSIVE CONGLOMERATES AND MINOR GRITTY SANDSTONES INTERBEDDED WITH AN INCREASING ABUNDANCE OF SILTSTONES AND MUDSTONES TOWARDS THE BASAL CONTACT.

JKm **MALLOCH SEQUENCE**

THICK INTERBEDS OF MUDSTONES, ARGILLACEOUS SILTSTONES, FINE GRAINED ARGILLACEOUS SANDSTONES AND THIN BEDS OF ORANGE WEATHERING SILICEOUS NODULAR SILTSTONES. CONGLOMERATE BEDS TEND TO BE LATERALLY DISCONTINUOUS. THICK CLEAN SANDSTONE BEDS AND THIN COAL SEAMS INCREASE IN ABUNDANCE TOWARDS THE BASAL GRADATIONAL CONTACT. SEQUENCE CAN CONTAIN PETRIFIED WOOD AND PLANT FOSSILS. BIVALVES ARE RARE.

JKk **KLAPPAN SEQUENCE (MAIN COAL-BEARING UNIT)**

SEQUENCE OF FINE TO COARSE GRAINED SANDSTONES INTERBEDDED WITH MUDSTONES, SILTSTONES, OCCASIONAL THIN BANDS OF ORANGE WEATHERING CALCAREOUS SILTSTONES, CONGLOMERATES AND ABUNDANT COAL SEAMS. CONGLOMERATE BEDS GRADE LATERALLY INTO SANDSTONE. SANDSTONES OFTEN DISPLAY TABULAR OR TROUGH CROSS-BEDDING. SEVERAL SPECIES OF PELECYPODS AND PLANTS ARE COMMON. BELEMNITES AND AMMONITES ARE RARE.

Js **SPATSIZI SEQUENCE**

PREDOMINANTLY A MARINE SEQUENCE COMPRISED OF BEDS OF MUDSTONES, SILTSTONES AND LESSER AMOUNTS OF SANDSTONES AND CONGLOMERATES. THE UPPER CONTACT IS DEFINED AS THE FIRST OCCURRENCE OF A NON-MARINE BED. DISCONTINUOUS MASSIVE CONGLOMERATE BEDS LIE IN THE UPPER PORTION OF THE SEQUENCE. BIVALVES ARE ABUNDANT AND BELEMNITES ARE RARE.

mudstones, siltstones, congomerates, and abundant coal seams. The Klappan Sequence attains thicknesses of approximately 400 to 900 metres and is exposed throughout the Mount Klappan property. At least 16 coal seams, ranging in thickness up to over 8 metres, are interpreted to exist in the coal-bearing Klappan Sequence.

6.3.1.3 Malloch Sequence

The Malloch Sequence is exposed in the Nass, Skeena, Hobbit-Broatch, and Lost-Fox Areas of the Mount Klappan property. The strata consist of interbedded argillaceous sandstone, siltstone, mudstone, thick bedded to massive lenticular chert pebble conglomerates and minor coal increasing towards the base of the sequence. The sequence is interpreted to be approximately 700 metres in thickness.

6.3.1.4 Rhondda Sequence

The Rhondda Sequence is exposed in the Skeena Area only and consists primarily of thick and laterally extensive chert pebble conglomerates interbedded with lesser amounts of sandstone, siltstone, and mudstone; the finer sediments increase in abundance towards the base of the sequence. The sediments were deposited in an alluvial environment and the sequence attains a thickness of about 500 metres.

6.3.2 Structure

The fold style of the Mount Klappan property is the result of two phases of non-coaxial deformation, both of which postdate the youngest sediments in the area.

The original, and major, compressional event resulted in the development of first phase folds (F_1) trending in a northeast to southeast direction. The result of this was the formation of two major folds that transect the property; the Beirnes Synclinorium (Richards and Gilchrist 1979) and the Nass River Anticlinorium (Moffat and Bustin 1983, (Appendix D). Parasitic folds within these structures are upright to overturned to the northeast on the eastern limb of the synclinorium and to the southwest o the western limb. Fold vergence swings back to the northeast on the western limb of the anticlinorium. It is the vergence of these folds that has determined the approximate positioning of the major fold axial traces. The majority of the Mount Klappan property lies to the northeast of the Beirnes Synclinorium. Southwest dipping thrust faults have also developed from this stage and display varying displacements in the order of tens to hundreds of metres.

A second, less intense, deformational period resulted in broad open second phase folds (F_2) that trend in a northeast to southwest direction. The imprint of these folds on the F_1 folds is seen as a series of plunge changes approaching maximum values of between 14 degrees northeast and 22 degrees south. Low angle north dipping thrust faults, of undetermined displacement, are associated with this event as are north of northeast trending high angle strike slip faults. These strike slip faults formed either during the F_2 event or were the result of post F_2 relaxation and suggest minimal displacement.

6.4 Hobbit-Broatch Area Geology

6.4.1 Introduction

The Hobbit-Broatch Area comprises 7 996 hectares of land located in the northeast portion of the Mount Klappan property. Resource potential, as defined by drill hole and outcrop control, is at an optimum within a specified area and is termed the Hobbit-Broatch resource area. The resource area is bounded on the southeast by the Spatsizi River, the covered areas on the upper reaches of Hobbit Creek and Broatch Creek to the southwest by Broatch Creek to the northwest and the B.C.R. subgrade to the northeast. (Appendix D 1:50 000 Regional Geology Map)

The Hobbit-Broatch Area is underlain by the Spatsizi, Klappan, and Malloch sequences. The Klappan sequence, the main coal-bearing unit, underlies the Hobbit-Broatch resource area exclusively, and to date has been interpreted to exceed 400 metres in thickness.

The Hobbit-Broatch resource area contains at least 15 seams with a total aggregate thickness of over 26 metres. The seams average 1.73 metres in thickness and range up to over 7 metres.

Detailed geological maps and cross-sections pertaining to the Hobbit-Broatch area and the resource area within it are contained in Appendix II.

6.4.2 Spatsizi Sequence

The Spatsizi Sequence is thought to outcrop in the extreme northeast portion of the Hobbit-Broatch Area, near the confluence of the Spatsizi River and Didene Creek. Characterized by predominantly marine sequences of mudstone, siltstone, and sandstone, this sequence has been found locally to comprise coarsening upward sequences on the order of 50 metres thick. The contact with the overlying Klappan unit is based upon the first occurrence of a non-marine unit. The Spatsizi Sequence is not recognized at any other point within the Hobbit-Broatch Area.

6.4.3 Klappan Sequence

The Klappan Sequence, the main coal-bearing unit, is comprised of interbedded sandstones, mudstones, siltstones, conglomerates, and coal. Within the Hobbit-Broatch Area the Klappan sequence is found at lower elevations and is exposed best along stream and river cuts.

Sandstones, varying in grain size from very fine-grained to a grit, may exhibit ripple marks, planar tabular and trough cross-stratification, contain minor amounts of carbonate cement, and in many cases is found to contain varying amounts of hematite. Petrographic analyses of the sandstones undertaken in 1982, indicate detrital chert as the dominant constituent with some quartz and minor feldspar, and virtually no muscovite. X-ray diffraction reveals ankerite (calcium, iron, magnesium, and manganese carbonate ($CaCO_3$, $(Mg, Fe, Mn)CO_3$) as the predominant cement.

Interbedded siltstones and mudstones are generally dark grey to brown weathering, display low angle cross laminations, ripple marks, and occasional varved bedding. Orange weathering siltstone or chert nodules have been found in these sediments. Chert pebble conglomerates may locally exceed ten metres in thickness, and are often found as a cliff forming unit. The conglomerate beds generally exhibit sharp bases and grade laterally and vertically into sandstone. The total thickness of the Klappan Sequence is interpreted to exceed 400 metres, however the entire thickness of the unit has not been intersected in exploration to date in the Hobbit-Broatch Area.

6.4.4 Malloch Sequence

The majority of this sequence is comprised of interbedded siltstone and mudstone, thick bedded to massive conglomerates, sandstone, and coal. The upper portion of the Malloch is predominantly dark grey weathering siltstones and mudstones, interbedded with sandstone and occasional conglomerate beds. These units may contain orange weathering siliceous nodules. Petrified wood fragments and plant fossils are locally abundant. The abundance of sandstone, conglomerates, and minor coal seams increases towards the base of the unit. No contact, with the underlying Klappan Sequence has been found within the Hobbit-Broatch Area. Mapped contacts are tentative at this time. The Malloch Sequence outcrops on the ridges bordering the eastern and western limits of the Hobbit-Broatch Area.

6.4.5 Coal Seam Development

6.4.5.1 Klappan Sequence

The Klappan Sequence within the Hobbit-Broatch resource area is interpreted to contain up to fifteen seams over a 200 - 250 metre interval. Information on the fifteen seams is derived from drill hole and trench data. The seams are labelled in ascending order; A to K which includes upper and lower splits of some seams. Average thicknesses range from a minimum of 0.48 metres to a maximum average thickness of 3.68 metres (Table 6.3). The cumulative average of all seams combined is 26.4. Trenches where the roof and floor of the coal seam were defined were included with drilled data to provide accurate coal seam thickness (Table 6.4). Laterally, seam thickness remain fairly constant although structural thickening and stratigraphic thinning of the coals were observed. (Table 6.5)

6.4.5.2 Malloch Sequence

Coals within the Malloch Sequence in the Hobbit-Broatch Area are generally thinner and occur less frequently than the underlying Klappan Sequence.

Table 6.3

HOBBIT-BROATCH AREA COAL SEAM SUMMARY

Seam	Number Vallid Data Points	Average True Thickness (m)	Approximate True Interseam Thickness (m)
K	6	3.13	
			10
J	4	3.68	
			33
I upper	1	2.76	
			1
I	12	2.95	
			28
H	9	1.48	
			26
G	7	2.40	
			4
G lower	1	1.13	
			17
F	6	0.68	
			22
New	1	0.70	
			9
E upper	2	0.88	
			3
E	6	1.41	
			20
D	6	1.50	
			22
C	3	0.48	
			16
B	1	1.50	
			33
A	1	1.68	

Table 6.4
Hobbit-Broatch Area Data Source Coal Seam Summary

Data Source	A	B	C	D	E	E upper	New Seam	F	G lower	G	H	I	I upper	J	K
DDH82001										1.68	1.73	3.21	2.76	0.93	3.45
DDH82002			0.67	0.53	2.24	0.91		0.35	1.13	3.25					
DDH82003					2.27	0.85		2.15		3.92	2.56	4.29		2.32	2.40
DDH82004				0.43*	0.60*			0.04		2.88					
DDH82006	1.68	1.50	0.19	0.59	0.62			0.16		2.45	1.99				
DDH84001											1.37	2.27			
DDH84002											1.61	2.22			
DDH84003											1.03	4.14			
DDH84004				3.43	2.30†		0.70	1.05		2.03	1.41				
TRC82001														5.79	
TRC82002															6.17
TRC82003														5.66	
TRC82005										0.60					
TRC82006												1.25			
TRC82010												2.91			
TRC82011			0.57												
TRC82012				2.53											
TRC82013												3.42			
TRC82014															1.40
TRC82015											0.81				
TRC82018								0.32							
TRC82019												1.17			
TRC82024															2.90
TRC82025															2.43
TRC82026												2.51			
TRC82027												7.43			
TRC84140											0.85				
TRC84142												0.57			
Average True Seam Thickness	1.68	1.50	0.48	1.50	1.41	0.88	0.70	0.68	1.13	2.40	1.48	2.95	2.76	3.68	3.13

Aggregate Average True Thickness - 26.36

*Average thickness of repeated seam.
†High ash value used as 0 value in Resource Calculations.

Table 6.5 cont'd

HOBBIT-BROATCH AREA
SUMMARY OF DIAMOND DRILL INTERSECTIONS

Diamond Drill Hole	Seam	Drilled Interval (m)	True Seam Thickness (m)	True Interseam Thickness (m)	Coal (m)/ Coal + Rock (m)
KPNBCDDH82006	H	26.09 - 28.10	1.99		1.29/1.99
				22.58	
	G	51.15 - 53.60	2.45		1.84/2.45
				16.09	
	*F	69.75 - 69.91	0.16		0.16/0.16
				15.87	
	E	85.88 - 86.51	0.62		0.60/0.62
				12.77	
	D	99.38 - 99.97	0.59		0.52/0.59
				17.02	
	*C	117.15 - 117.34	0.19		0.19/0.19
				14.37	
	B	132.35 - 133.85	1.50		1.26/1.50
				14.61	
	A	166.31 - 168.37	1.68		1.63/1.68

Table 6.5 cont'd

HOBBIT-BROATCH AREA
SUMMARY OF DIAMOND DRILL INTERSECTIONS

Diamond Drill Hole	Seam	Drilled Interval (m)	True Seam Thickness (m)	True Interseam Thickness (m)	Coal (m)/ Coal + Rock (m)
KPNHCDDH84001	I	22.73 - 25.16	2.27		1.69/2.27
				24.09	
	H	50.73 - 52.14	1.37		1.11/1.37
KPNHCDDH84002	I	24.15 - 26.37	2.22		2.10/2.22
				28.37	
	H	54.93 - 56.58	1.61		1.18/1.61
KPNHCDDH84003	I	18.99 - 23.37	4.14		3.61/4.14
				25.02	
	H	48.38 - 49.41	1.03		0.69/1.03
KPNHCDDH84004	H	32.86 - 34.27	1.41		1.25/1.41
				24.04	
	G	57.68 - 59.71	2.03		1.73/2.03
				19.67	
	F	79.95 - 80.80	1.05		0.91/1.05
				22.95	
	New	103.10 - 103.80	0.70		0.70/0.70
				9.55	
	E	113.32 - 115.62	2.30		1.16/2.30
				27.13	
	†D	143.65 - 159.21 structurally thickened	8.88		5.87/8.88

Table 6.5 cont'd

HOBBIT-BROATCH AREA
SUMMARY OF DIAMOND DRILL INTERSECTIONS

Diamond Drill Hole	Seam	Drilled Interval (m)	True Seam Thickness (m)	True Interseam Thickness (m)	Coal (m)/ Coal + Rock (m)
KPNDDHHC84004	D repeat	251.22 - 255.09	3.43		3.16/3.43
	+D repeat	301.17 - 306.97 (structurally thickened)	4.57		4.14/4.57

To date no coal seam correlation has been developed for these seams.

6.4.6 Structure

Structural deformation within the Hobbit-Broatch Area is very intense due to the predominance of incompetent siltstones and coals. Two district, roughly normal phases of deformation are evident.

The first and most dominant deformational phase, F1, is expressed by assymetrical folds trending approximately 135° with long shallowly dipping southwest limbs, and short, overturned northeast limbs. These folds become progressively more overturned towards the southeast portion of the Hobbit-Broatch resource area. Folds have been shown to be overturned by as much as 76°. F1 fold hinges tend to be very tight with substantial structural thickening and/or minor thrusting in the fold cores. Wavelengths of 350 to 500 metres, amplitudes of 75 to 150 metres, and dihedral angles of about 80° are common. Associated with these folds are minor, open, upright parasitic folds with amplitudes of approximately 20 metres. Parasitic folds exist especially near the hinge area on the long limbs of overturned folds.

Deformational style within a single fold pair varies along strike. Folds emerge and develop from open upright folds into larger amplitude acute overturned folds and then progressively die out along strike with a transfer of displacement to the adjacent fold pair. This entire sequence progression occurs over a strike length of about 3 to 5 kilometers (see Figure 6.3). Major overturned folds on Hobbit Creek can be traced into more minor upright structures on Broatch Creek.

The second deformational phase, F2, consists of broad, open, upright folds with wavelengths of approximately 1200 metres and amplitudes of approximately 300 metres. Fold trend is roughly 045°. F2 folds are observed as plunge changes in F1 structures. Plunges vary between 5° and 22° towards both the northwest and southeast.

Mesoscopic deformational features consist of two fracture sets, one parallel and one normal to the F1 deformational trend, and a well developed F1 axial planar cleavage in incompetent lithologies.

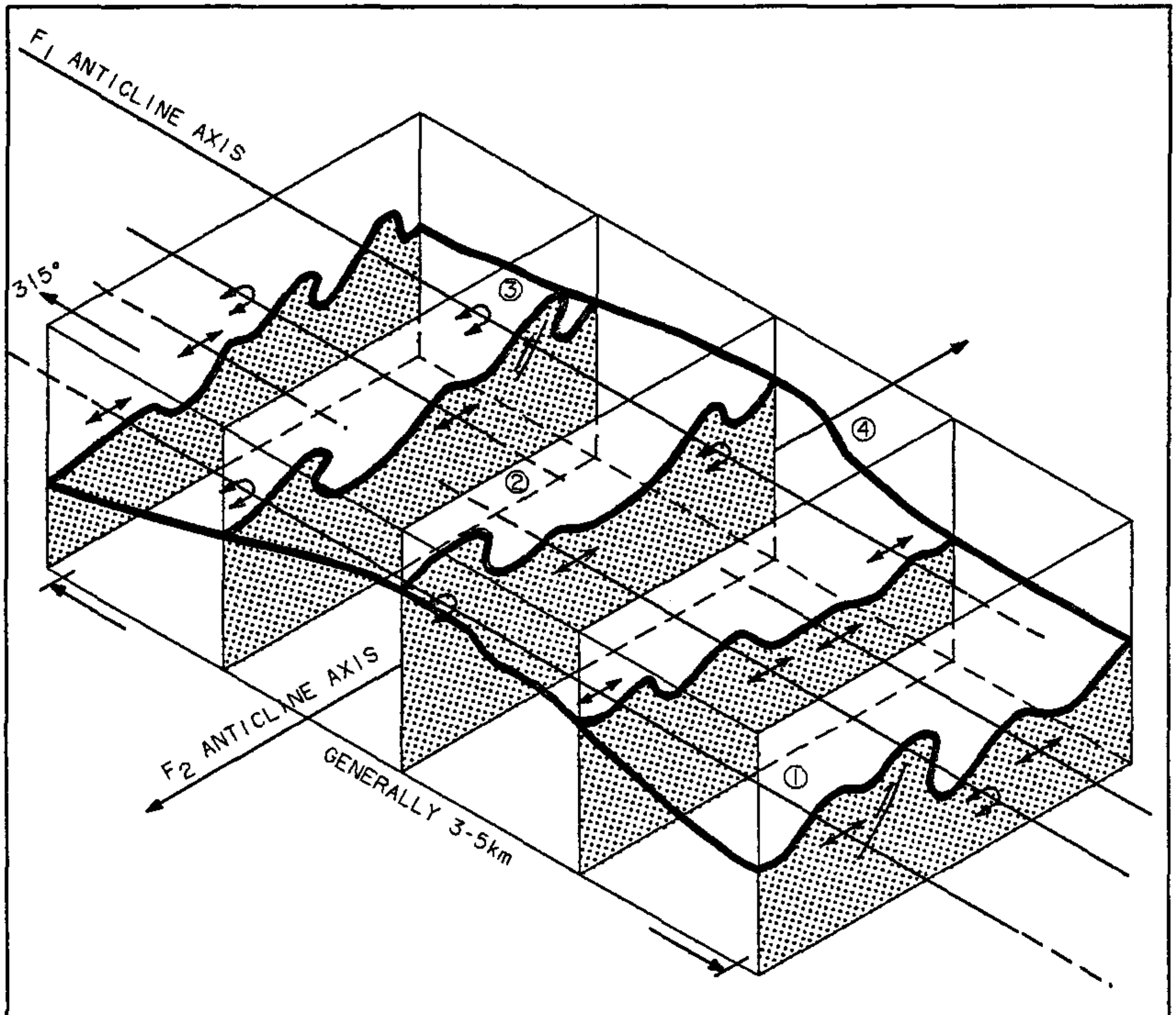
The trace of the Klappan Thrust crosses the southwest corner of the Hobbit-Broatch map area. Interpreted displacement is approximately 100 metres.

No other major faults have been documented in the Hobbit-Broatch map area.

FIGURE 6.3

MOUNT KLAPPAN COAL PROPERTY

HOBBIT - BROATCH GEOLOGICAL SCHEMATIC



① FLAT-UPRIGHT-OVERTURNED-UPRIGHT-FLAT FOLD PROGRESSION ALONG STRIKE
② TRANSFER OF DISPLACEMENT FROM ONE FOLD TO ANOTHER ADJACENT FOLD
③ THRUSTING IN CORE OF OVERTURNED FOLDS
④ STEEP "STEPS" AT F_1-F_2 INTERSECTIONS

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Table 6.4
Hobbit-Broatch Area Data Source Coal Seam Summary

Data Source	A	B	C	D	E	E upper	New Seam	F	G lower	G	H	I	I upper	J	K
DDH82001										1.68	1.73	3.21	2.76	0.93	3.45
DDH82002			0.67	0.53	2.24	0.91		0.35	1.13	3.25					
DDH82003					2.27	0.85		2.15		3.92	2.56	4.29		2.32	2.40
DDH82004				0.43*	0.60*			0.04		2.88					
DDH82006	1.68	1.50	0.19	0.59	0.62			0.16		2.45	1.99				
DDH84001											1.37	2.27			
DDH84002											1.61	2.22			
DDH84003											1.03	4.14			
DDH84004				3.43	2.30†		0.70	1.05		2.03	1.41				
TRC82001														5.79	
TRC82002															6.17
TRC82003														5.66	
TRC82005										0.60					
TRC82006												1.25			
TRC82010												2.91			
TRC82011			0.57												
TRC82012				2.53											
TRC82013												3.42			
TRC82014															1.40
TRC82015											0.81				
TRC82018								0.32							
TRC82019												1.17			
TRC82024															2.90
TRC82025															2.43
TRC82026												2.51			
TRC82027												7.43			
TRC84140											0.85				
TRC84142												0.57			
Average True Seam Thickness	1.68	1.50	0.48	1.50	1.41	0.88	0.70	0.68	1.13	2.40	1.48	2.95	2.76	3.68	3.13

Aggregate Average True Thickness - 26.36

*Average thickness of repeated seam.
†High ash value used as 0 value in Resource Calculations.

Table 6.5

HOBBIT-BROATCH AREA
SUMMARY OF DIAMOND DRILL INTERSECTIONS

Diamond Drill Hole	Seam	Drilled Interval (m)	True Seam Thickness (m)	True Interseam Thickness (m)	Coal (m)/ Coal + Rock (m)
KPNHCDDH82001	K	19.39 - 22.84	3.45		1.63/3.45
				7.19	
	J	30.08 - 31.02	0.93		0.85/0.93
				25.02	
	I upper	57.25 - 60.14	2.76		1.93/2.76
				1.0	
	I	61.18 - 64.51	3.21		2.41/3.21
				27.34	
	H	93.95 - 95.86	1.73		0.94/1.73
				20.31	
	G	118.44 - 120.12	1.68		1.16/1.68
KPNHCDDH82002	G	35.93 - 40.08	3.25		2.36/3.25
				3.34	
	G lower	43.42 - 44.55	1.13		0.56/1.13
				7.79	
	*F	52.54 - 52.89	0.35		0.35/0.35
				27.12	
	E upper	81.07 - 82.06	0.91		0.72/0.91
				4.05	
	E	86.51 - 89.00	2.24		1.64/2.24
				37.17	
	D	138.38 - 138.92	0.53		0.53/0.53
				25.59	
	C	165.97 - 166.66	0.67		0.67/0.67

*Seam Intersections less than 0.50 metres but applied to weighted average seam thickness
†Not applied to any resource calculations due to structural thickening

Table 6.5 cont'd

HOBBIT-BROATCH AREA
SUMMARY OF DIAMOND DRILL INTERSECTIONS

Diamond Drill Hole	Seam	Drilled Interval (m)	True Seam Thickness (m)	True Interseam Thickness (m)	Coal (m)/ Coal + Rock (m)
KPNHCDDH82003	K	27.87 - 32.79	2.40		2.15/2.40
				9.84	
	J	44.06 - 46.62	2.32		2.20/2.32
				33.58	
	I	94.14 - 98.94	4.29		3.35/4.29
				27.80	
	H	127.24 - 129.81	2.56		2.22/2.56
				25.21	
	G	155.24 - 159.46	3.92		2.98/3.92
				22.75	
	F	182.38 - 184.56	2.15		1.69/2.15
				20.31	
	E upper	205.28 - 206.14	0.85		0.85/0.85
				2.01	
	E	208.17 - 209.45	1.27		1.15/1.27
KPNBCDDH82004	G	24.73 - 29.60	2.88		2.62/2.88
				16.39	
	*F	58.10 - 58.17	0.04		0.04/0.04
				16.85	
	E	90.39 - 91.67	0.75		0.68/0.75
				15.18	
	*D	114.46 - 114.96	0.35		0.35/0.35
	D repeat	139.84 - 140.34	0.50		0.41/0.50
	E repeat	150.36 - 150.81	0.45		0.45/0.45

7.0 RESOURCES

7.1 Mount Klappan Coal Project

7.1.1 Summary

The coal resources of the Mount Klappan Coal Project total 5.3 billion tonnes in seams greater than 0.5 metres in thickness to a maximum depth of 500 metres below surface. The following table summarizes the resource contributions from the areas of the property as well as the representation by resource category. A 1:50 000 Coal Resource Map (Appendix E) presents the distribution of resources over the Mount Klappan property.

Table 7.1

MOUNT KLAPPAN COAL PROJECT
COAL RESOURCES (MT)

	Category			
Area	**Measured**	**Indicated**	**Inferred**	**Speculative**
Lost-Fox	32.1	46.3	194.1	794.9
Hobbit-Broatch	12.1	24.5	369.1	613.3
Summit			41.4	1860.1
Nass				1121.8
Skeena				232.3
Total	44.2	70.8	604.6	4622.4

Mount Klappan Coal Project Total Coal Resources: 5342.0

The coal seams are contained within the strata of the Klappan Sequence. There are also coal measures in the Malloch Sequence; however, they are not presently considered of economic importance.

The parameters within which the coal resources were classified and the procedures utilized in resource calculations are outlined in Section 7.3.

7.2 Hobbit-Broatch Area

7.2.1 Summary

The coal resources of the Hobbit-Broatch Area are contained within 15 seams and total 1019.0 million tonnes in seams greater than 0.5 metre in true thickness to a depth of 500 metres below surface. Table 7.2 summarizes the resource contributions by seam in the Hobbit-Broatch resource area.

Increased density of data points resulting from continued exploration in 1984 has provided an area which now contains measured and indicated resources. The 1:50 000 Coal Resource Map (Appendix E) highlights the resource areas. All resource data for the Hobbit-Broatch Area is located in Appendix C.

Table 7.2

HOBBIT-BROATCH AREA

COAL RESOURCES (MT)

Seam	Measured	Indicated	Inferred	Total
K	0.9	1.6	19.4	21.9
J	1.3	1.4	16.1	18.8
I Upper	0.2	0.1		0.3
I	3.5	5.7	37.7	46.9
H	1.2	2.5	39.6	43.3
G	1.7	6.0		7.7
G Lower	0.1	0.1	59.9	60.1
F	0.3	1.0	19.3	20.6
New	0.1	0.1		0.2
E Upper	0.2	0.1		0.3
E	0.6	1.8	37.0	39.4
D	1.2	2.2	40.2	43.6
C	0.1	0.2	15.0	15.3
B	0.3	0.8	40.1	41.2
A	0.4	0.9	44.8	46.1
Total	12.1	24.5	369.1	405.7
Total Speculative Resources				613.3
			Total	1019.0 mt

7.3 Procedures and Parameters

7.3.1 Introduction

In-situ coal resources are defined as the in place coal (coal and partings) that is contained in seams occurring within specified limits of thickness and depth from surface. Resources are further defined through classification into "measured", "indicated", "inferred", and "speculative" categories based on the existence and relative spacing of coal seam exploration data.

The procedures for the resource calculations include standard methods utilizing geological cross-sections and maps as described in Section 7.3.2.

The parameters for resource categorization generally follow those set out for the Cordillera Region by Energy, Mines and Resources Canada in Report ER79-9: Coal Resources and Reserves of Canada. The parameters utilized for the 1984 Mount Klappan Coal Project are described in Section 7.3.3.

7.3.2 Procedures

Utilizing valid data points (drill holes, trenches, measurable seams in outcrops), a distribution of data points for each seam was established. Subsequently, based on maximum allowable data point spacing (Section 7.3.3), resources were calculated for a specific category.

For each of the measured and indicated categories, the seam thickness used for tonnage calculations was a weight averaged thickness derived using the "polygon method": polygons were constructed horizontally around each data point in the resource area. (In some cases they may have been circles if there was only one data point in the resource area.) Polygon boundaries were defined by the midpoints between data points; at the maximum, the distance limit from the data point was one-half the allowable data point spacing for the category under consideration. The areas of the polygons provided the basis for the weight-averaging factors.

An area of coalescing polygons defined one specific resource area for the category under consideration. The limits to this area were projected perpendicularly onto the cross- section(s) passing through the area. The seam length was then measured within these limits.

The third dimension required for the coal volume calculation, after the seam thickness and length were determined, was the "influence" or "strike length" of the seam. This measurement was usually the cross-section spacing, as this should have been less than or equal to the required data point spacing for the resource category under consideration. In some cases, where a seam projected to surface before the assumed influence limit was reached, the influence was measured to the seam subcrop (or outcrop).

For comparison with 1982 inferred resources calculated for the Hobbit-Broatch Resource Area, the 1984 inferred resources were generated utilizing all procedures and parameters from 1982.

Polygons were again constructed horizontally around each data point. The polygon boundaries were defined by midpoints between data points and the boundary of the Hobbit-Broatch Resource Area itself.

Seam length was measured from the cross-sections contained within the "resource area" boundary, and "influence" or "strike length" was equal to the cross-section spacing.

To calculate coal tonnage in all categories, a weight-average specific gravity for each seam was used. It was calculated using the polygon method and available coal quality data. A review of the Mount Klappan Coal Project coal quality data demonstrated that, in general, specific gravity data provided a weight-average specific gravity of 1.70 tonnes per cubic metre.

The following equation summarizes the resource calculation procedure:

$$\text{Tonnes of Coal} = \underset{(m)}{\text{Seam Thickness}} \times \underset{(m)}{\text{Seam Length}} \times \underset{(m)}{\text{Influence}} \times \underset{(t/m^3)}{\text{Specific Gravity}}$$

Speculative resources were calculated using a slightly different procedure. The area indicated on the 1:50 000 Regional Geology Map (Appendix D) to be Klappan Sequence within the Hobbit-Broatch Area but outside the 1:2500 map area, was planimetered. The seam thickness applied to this area was 25% of the average total aggregate coal thickness for the Lost-Fox and Hobbit-Broatch Areas, as this figure appeared to be a reasonable estimate of the proportionate coverage of coal-bearing section within the area. The specific gravity of 1.70 tonnes per cubic metre was used for this category also. The following equation summarizes the Speculative Resource calculation:

Speculative Resource Tonnes of Coal =

Area (m^2) x .25 x Seam Thk (m) x Specific Gravity (t/m_3)

7.3.3 Parameters

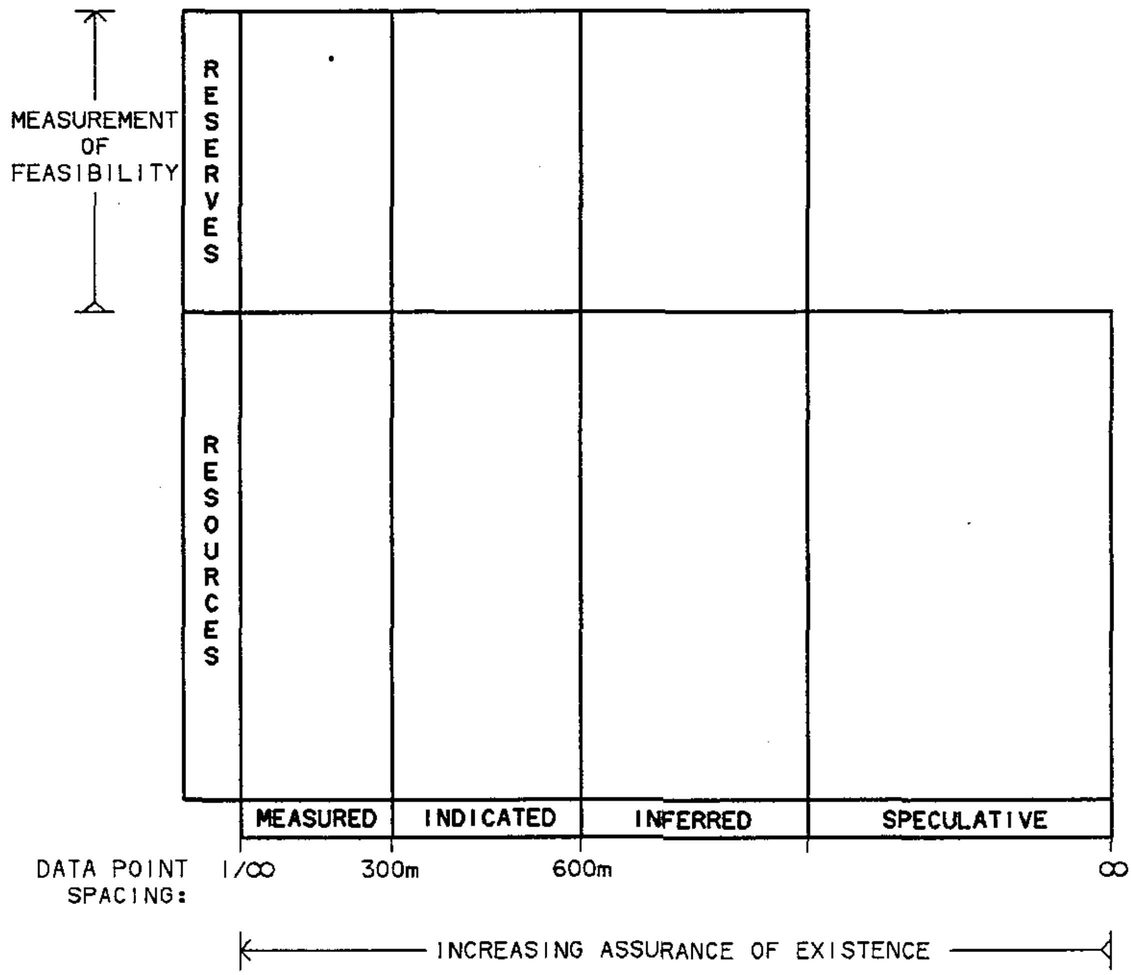
For "Measured" and "Indicated" resource categories, minimum seam thickness used for the 1984 Hobbit-Broatch Area was 0.5 metres where the dip of the seam was less than or equal to 30° and 1 metre where the dip was in excess of 30°. Seams were included to a maximum depth of 500 metres from surface. Seams were defined as containing 50% coal.

Coal intersections which were correlatable but did not meet parameters defining them as a seam, were included as zero values when determining weight averaged thickness by the polygon method.

FIGURE 7.1

MOUNT KLAPPAN COAL PROPERTY

1984 RESOURCE CLASSIFICATION SCHEME



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The following resource category parameters were used for the calculations. The classification scheme is illustrated in Figure 7.1.

7.3.3.1 Measured Resources

Measured Resources include those resources delineated through establishment of exploration data points and therefore reported with confidence as to the character and continuity of the coal seams. The maximum distance between data points, which may include adits, drill holes, trenches and outcrops, is 300 metres.

7.3.3.2 Indicated Resources

Indicated Resources include resources which are delineated using established data points as well as reasonable geological projections. The maximum distance between data points is 600 metres.

7.3.3.3 Inferred Resources

Inferred Resources include resources which are delineated utilizing regional geological data including data points which predict the continuity of coal seams. Report ER79-9 does not state a data point spacing for this category. Inferred resources within the Hobbit-Broatch Resource Area were based on coal seams defined as a coal and inseam rock interval which contained greater than approximately 60% coal. Correlatable coal intersections not meeting these parametres were included as zero values in weight averaging. Where a coal zone contained two distinct seams the thicknesses were summed. Seam intersections less than 0.5 metres thick were included in the weight averaged thickness for each seam, however seams with weight average thickness less than 0.5 metres were excluded from resource calculations. Resources were calculated to a depth of 500 metres. Resources contained within measured and indicated categories within the Hobbit- Broatch Resource Area are subtracted from the total inferred resource.

7.3.3.4 Speculative Resources

Speculative Resources include those resources which are calculated from a few scattered coal occurrences in areas of little or no exploration data where the coal-bearing sequence(s) is/are interpreted to exist. There is no maximum spacing in this category.

7.4 Discussion

Comparison of inferred resource figures within the Hobbit-Broatch Resource Area from 1982 to 1984 indicate a drop in total tonnage (Table 7.3 and 7.4). Several factors have contributed to this decline, all of which can be attributed to additional geological information or refinement of such data since 1982. The single most important factor in this decline of resource has

Table 7.3
SUMMARY OF HOBBIT-BROATCH RESOURCES
1982

Seam Name	A	B	C	D	E	F	G	H	I	J	K	Section Total Tonnages (10^6)
Wt. Average Seam Thickness (metres)*	1.67	1.50	0.48+	0.40+	1.66	0.87	3.32	2.12	6.07	1.41	3.13	
Cross-Section												
500S	4.90	2.81			1.25		1.11	0.20				10.27
1000S	6.20	5.18			4.62		5.70	2.26	3.56	0.37	0.63	28.52
1500S	5.29	4.86			5.43		10.78	6.50	16.61	3.24	6.84	59.55
2000S	5.90	5.28			5.75		10.70	6.57	16.15	3.43	7.37	61.15
2500S	5.42	4.74			5.04		8.78	4.72	10.65	2.04	4.04	45.43
3000S	4.93	4.77			5.46	2.82	10.48	6.39	16.56	3.33	6.96	61.70
3500S	4.76	3.98			5.43	2.84	10.96	6.96	19.27	3.87	8.15	66.22
4000S	6.08	5.78			6.66	3.49	13.32	8.66	23.01	5.03	10.38	82.41
4500S	4.98	4.97			5.59	2.84	11.13	7.07	20.38	4.39	9.31	70.66
5000S	5.37	4.84			5.69	2.95	11.64	7.42	19.22	4.28	8.87	70.28
5500S	5.72	5.39			6.10	3.24	11.61	6.72	16.85	2.83	5.39	63.85
Seam Total Tonnages (10^6)	59.55	52.60			57.02	18.18	106.21	63.47	162.26	32.81	67.94	620.04

* Weighted average aggregate thickness is 21.75 m
\+ Weight averaged thicknesses <0.5 m excluded from resource calculation

Table 7.4
SUMMARY OF HOBBIT-BROATCH RESOURCES
1984

Seam Name	A	B	C	D	E	New	F	G	H	I	J	K	Section Total Tonnages (mt)
Wt. Average Seam Thickness (metres)	1.68	1.50	0.56	1.62	1.46	0.70	0.78	2.63	1.86	2.84	1.89	3.07	
Cross-Section													
1000SE	2.20	1.64	0.50	1.30	1.01		0.38	0.94	0.41	0.21			8.59
1250SE	2.48	2.01	0.68	1.55	1.09		0.49	1.52	0.92	0.89	0.21	0.23	12.07
1500SE	2.52	2.28	0.85	2.59	2.32		1.15	3.33	1.78	1.84	1.05	1.63	21.34
1750SE	2.43	2.26	0.86	2.56	2.39		1.23	3.98	2.49	3.13	1.57	2.28	25.19
2000SE	2.48	2.26	0.86	2.51	2.23		1.17	3.67	2.20	2.65	1.27	1.89	23.19
2250SE	2.60	2.30	0.85	2.37	2.12		1.10	3.39	2.04	2.32	0.89	1.12	21.10
2500SE	2.53	2.20	0.82	2.35	2.08		1.03	3.38	2.17	2.62	1.15	1.19	21.52
2750SE	2.50	2.29	0.87	2.60	2.34		1.19	3.97	2.66	3.74	1.83	2.65	26.64
3000SE	2.41	2.20	0.84	2.46	2.33		1.29	4.48	2.94	3.67	1.59	1.98	26.19
3250SE	2.48	2.31	0.86	2.59	2.36		1.27	4.35	2.81	3.54	1.25	1.17	24.99
3500SE	2.38	2.19	0.83	2.43	2.20		1.23	4.22	3.05	0.65	1.38	1.69	22.25
3750SE	2.40	2.18	0.82	2.40	2.18		1.23	4.18	2.80	3.50	1.34	1.78	24.81
4000SE	2.39	2.15	0.82	2.36	2.14		1.20	4.08	2.74	3.56	1.34	1.78	24.56
4250SE	2.41	2.18	0.84	1.55	2.22		1.18	3.98	2.66	3.12	0.75	0.61	21.50
4500SE	2.41	2.18	0.83	2.41	2.14		1.10	3.78	2.59	2.69	0.35	0.16	20.64
4750SE	2.41	2.18	0.81	2.51	2.21	0.19	1.16	3.96	2.59	2.97	0.89	0.72	22.60
5000SE	2.40	2.17	0.81	2.41	2.16		1.10	3.78	2.27	2.03	0.41		19.54
5250SE	2.35	2.12	0.80	2.33	2.11		1.08	3.63	2.27	1.90	0.82	0.75	20.16
5500SE	2.32	2.10	0.79	2.32	2.07		1.02	3.18	1.91	2.17	0.66	0.23	18.77
Subtract Resources:													
Measured	0.40	0.30	0.10	1.20	0.80	0.10	0.30	1.80	1.20	3.70	1.30	0.90	12.10
Indicated	0.90	0.80	0.20	2.20	1.90	0.10	1.00	6.10	2.50	5.80	1.40	1.60	24.50
Seam Total Tonnage (mt)	44.80	40.10	15.04	40.20	37.00	0.00	19.30	59.90	39.60	37.70	16.05	19.36	369.05

occurred due to reduced thickness values on specific seams. This was brought about by incorporation of data from additional drilling intersections in 1984 and the expanded geological interpretation in 1984 to correlate all seam outcrops considered valid data points. Another minor factor contributing to the reduction in resource is the diminished size of the Hobbit-Broatch Resource Area brought about by refinement of the geological interpretation. The significance of this reduction is small, however, amounting to a decrease in the order of 1% from the 1982 resource figures.

8.0 COAL QUALITY

8.1 Summary

The 1984 program for coal quality examination has broadened the spectrum of information available on the quality and production potential of the Mount Klappan anthracite resource (Table 8.1).

Trenching in the Hobbit Creek Area has expanded the area of good control of the distribution of seam I. A micro stripping and trenching operation produced several large samples of seam I coal for detailed washability and size analysis.

Four drill holes at close spacing (within 1 km.) allowed tracing of seams, establishing the presence of a reasonably shallow, extensive resource. Drilling to depth in core holes demonstrated the variety of structural style in the area and emphasized the requirement for detailed interpretation and collection of representative structural data. Seam D, intersection at depth, is of quite acceptable quality and appears to be subject to considerable structural thickening.

Size analysis of drill core has provided the first step toward a systematic treatment of the natural behavior of Mount Klappan coal in the circumstances of preparation of sized products. The extensive suite of size distributions available taken from every drill core sample analyzed demonstrates that there is an average size distribution to which all coals on the property can be compared.

Table 8.1

HOBBIT CREEK
AVERAGE COAL QUALITY

	Raw Coal	5% Ash Product	10% Ash Product	Briquetting Product
PROXIMATE ANALYSIS				
Residual Moisture	1.38	1.12	1.28	1.81
Ash	28.43	5.00	10.00	25.00
Volatiles	8.84	6.42	7.70	7.92
Fixed Carbon	61.35	87.46	81.02	65.27
H.G.I.				
Specific Gravity	1.66			
Carbon Dioxide				
Chlorine (ppa)				
Phosphorous In Coal				
Total Sulphur	0.65	0.54	0.51	0.45
Combustible Sulphur	0.27			
Gross C.V. (MJ/KG)	23.68	33.21	31.20	26.41
Gross C.V. (cal/gm)	5660	7937	7457	6312
ULTIMATE ANALYSIS				
Carbon	64.08	87.70	81.68	
Hydrogen	2.08	2.72	2.58	
Nitrogen	0.72	0.96	0.88	
Oxygen	2.66	1.96	3.07	
ASH FUSION (Deg. C.)				
OXIDIZING Initial	1255			
Softening	1295			
Hemispherical	1330			
Fluid	1375			
REDUCING Initial	1200			
Softening	1240			
Hemispherical	1275			
Fluid	1325			
ASH ANALYSIS				
SiO2	56.17			
Al2O3	17.10			
Fe2O3	6.61			
TiO2	0.89			
P2O5	1.17			
CaO	5.74			
MgO	4.26			
SO3	3.37			
Na2O	1.52			
K2O	0.82			

8.2 Procedures and Parameters

8.2.1 Introduction

The 1984 Hobbit Creek exploration program concentrated on geological interpretation of a zone surrounding an area identified as having potential for exploitation of coal resources by low ratio stripping. Mapping and geological investigation ranged some distance from the designated pit site, but drilling, trench sampling and quality analysis centred on a fairly restricted area. The following discussion is based on the trench, drill core and modest bulk sampling programs that provided coal samples for quality analysis in 1984.

Four diamond drill holes were spudded in April, 1984 with the objective of intersecting seam I and successive or preceding seams (if present) at shallow depths. The exploration program proper did not begin until July, and in August drilling recommenced in the Hobbit Creek Area with a continuation of DDH84004. Several additional seams were intersected in the lower part of the hole, the completion of which marked the end of drilling activity in the area for 1984.

Several trenches were excavated along the B.C.R. subgrade and nearby, both by backhoe and by hand. As the region around Hobbit Creek is heavily treed, areas inaccessible to the backhoe were also unlikely to have significant outcrop. Most trenches, therefore, were dug by backhoe.

In September, interest in establishing a pit location intensified and a large trench was excavated by bulldozer and backhoe across the proposed pit location. This trench yielded several samples comprising up to three barrels of coal apiece, which in turn, were analyzed in depth of size distribution and ash level.

8.2.2 Trenching Program

8.2.2.1 Objectives

The objectives of the 1984 Hobbit Creek trenching program were as follows:

1. To establish the continuity of identified seams through areas lacking detailed control.
2. Through sampling, to detect variation in seam character and add to the accumulated data on average seam quality.

8.2.2.2 Methodology

Because of the vegetation covering the Hobbit Creek Area, and the general development of a relatively thick soil horizon, successful trenching with the possibility of a highly representative sample was difficult. Some well established surface seam intersections were developed, but on occasion seams exposed by hand trenching were not sufficiently thick, or contained too many rock partings to warrant sampling.

In some cases, due to erosion, soil creep or excessive overburden, it was impossible to make a full transect of the seam with sharp definition of the roof and floor. Sampling and analyses were not carried out for these trenches either.

A different set of conditions were encountered in excavating trenches with the backhoe. Movement of volumes of cover was facilitated with the backhoe, but the depth reached in some of the trenches was such that they could not be safely entered. Samples could be taken in these circumstances but the seam intersections could not be logged and there was therefore no guarantee of sample representation.

Where there were no encumbrances to executing the routine procedure for trench sampling, a small channel of constant dimensions was incised perpendicular to the strike and dip of the seam. The seam was logged in detail (down to 1 centimeter intervals) prior to trenching, and the sampling intervals chosen were guided by the seam log. Substantial partings or changes in coal character were cause for sampling of the seam by ply, so that the nature of variations across the seam could be traced. For the most part, however, a single sample was taken to transect and represent the whole seam.

8.2.2.3 Analytical Procedure

Among the samples taken there was considerable duplication and some areas of closely spaced samples due to the intent of tracing seam subcrops. From the collection of samples four were chosen from seams in the pit area judged to be most representative of the seam character. Much additional information was gathered from the major trench excavated in September (TRC 84143).

The analytical program applied to trench samples is outlined in Figure 8.1. A more elaborate program applied to samples from TRC 84143. All analyses were completed at Loring Laboratories Ltd. of Calgary, Alberta. Trenches were analyzed on a raw basis with some washability studies performed on samples from TRC 84143.

8.2.3 Diamond Drilling Program

8.2.3.1 Objectives

The objectives of the 1984 Hobbit-Broatch diamond drilling program were as follows:

1. To broaden control on the current understanding of coal seam stratigraphy through intersection of the established section of interest in new areas.

FIGURE 8.1

Trench Sample Analysis

CRUSH SAMPLE TO
3/8 INCH

RIFFLE 3 TIMES

RAW HEAD ANALYSIS
Proximate, Total Sulphur
Calorific Value
Vitrinite Reflectance

2. To contribute to the growing data base on quality characteristics and variation in each identified seam.

8.2.3.2 Methodology

The drill core consisting of coal derived from the intersection of each seam was logged in detail prior to sampling. The sample increments were determined by the internal stratigraphy of the seam, guided by seam partings and changes in coal character. Samples were subjected to a comprehensive series of analyses as outlined in Figure 8.2.

Due to evolving priorities, the samples taken from drill core bored in April were not subjected to quite as complete a suite of analyses as those taken in August. The variation can be seen on the tabulation of raw coal quality (Table 8.2).

All analyses except vitrinite reflectance determinations were carried out by Cyclone Engineering Sales Ltd. of Edmonton, Alberta.

Vitrinite reflectance measurements were performed by David E. Pearson and Associates of Victoria, British Columbia.

FIGURE 8.2
DIAMOND DRILL CORE ANALYSIS
FLOW SHEET

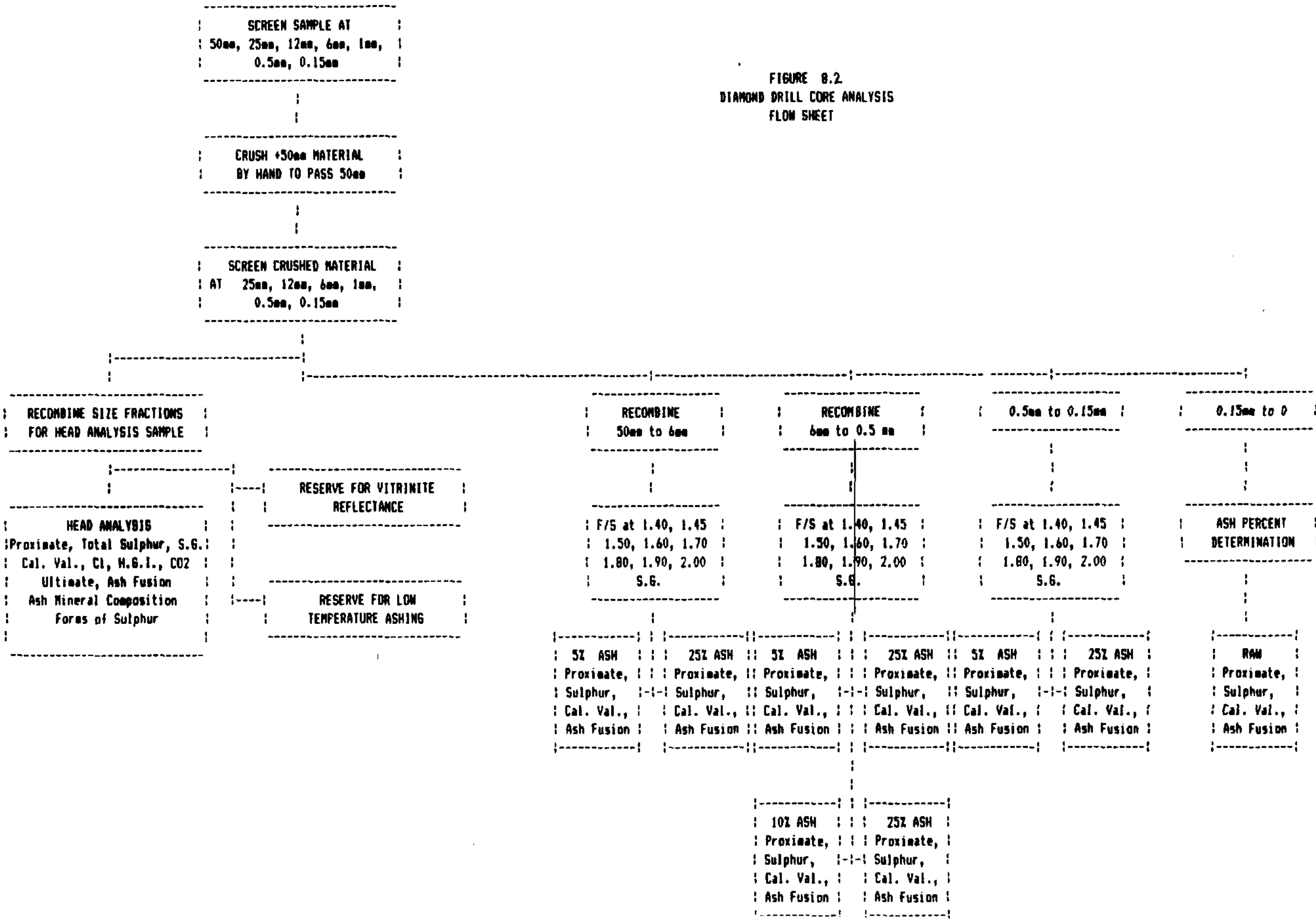


Table 8.2

HOBBIT CREEK AREA
RAW COAL QUALITY

	Seam	I	I lower	H	G	F	D
	No. of Occurrences	2	2	4	1	1	2
PROX. ANALYSIS	Residual Moisture	1.45	1.38	1.76	1.40	1.64	1.20
	Ash	20.34	15.47	38.26	32.85	59.49	29.29
	Volatiles	9.84	9.83	9.43	10.09	9.06	7.22
	Fixed Carbon	68.38	73.33	50.56	55.66	29.81	62.30
H.G.I.	Specific Gravity	1.60	1.54	1.76	1.73	1.86	1.63
	Carbon Dioxide					5.46	2.64
	Chlorine (ppm)					472	625
	Phosphorous	0.225	0.211	0.072	0.176	0.106	0.039
	Total Sulphur	0.42	0.47	0.73	1.55	0.22	0.34
	Combustible Sulphur	0.17	0.27	0.35	0.89	0.10	0.00
GROSS C.V. (MJ/Kg)		26.45	28.42	19.73	21.56	11.77	23.89
GROSS C.V. (Cal/g)		6322	6791	4714	5153	2813	5709
ULT. ANALYSIS	Carbon	70.27	75.03	53.66	60.12	33.14	63.60
	Hydrogen	2.23	2.30	1.74	1.84	1.63	2.18
	Nitrogen	0.86	0.91	0.60	0.66	0.34	0.68
	Oxygen	4.10	4.23	2.57	1.09	3.54	2.30
ASH FUSION (°C)	OXIDIZING						
	Initial	1245	1245	1285	1300	1230	1225
	Softening	1265	1265	1320	1325	1285	1290
	Hemispherical	1290	1285	1355	1340	1305	1345
	Fluid	1325	1315	1400	1375	1450	1405
	REDUCING						
	Initial	1165	1155	1235	1220	1230	1205
	Softening	1200	1195	1275	1255	1280	1260
	Hemispherical	1230	1225	1315	1280	1305	1290
	Fluid	1255	1240	1375	1325	1340	1370
ASH ANALYSIS	SiO_2	49.33	46.87	59.58	49.98	63.95	63.61
	Al_2O_3	17.54	18.07	19.06	18.58	18.14	15.34
	Fe_2O_3	8.51	9.13	4.71	5.14	4.62	6.48
	TiO_2	1.08	1.15	1.05	1.38	0.45	0.43
	P_2O_5	2.53	3.13	0.43	1.23	0.41	0.31
	CaO	8.69	9.20	4.72	8.49	5.13	2.34
	MgO	5.09	5.25	3.28	4.68	2.39	3.72
	SO_3	3.12	3.16	2.51	5.04	0.90	3.01
	Na_2O	1.49	1.44	1.82	2.02	0.97	1.20
	K_2O	0.64	0.56	0.89	0.96	2.11	0.88
SiO_2/Al_2O_3 Ratio		2.81	2.59	3.13	2.69	3.53	4.15
Fouling Factor		0.54	0.56	0.35	0.61	0.18	0.22
Base/Acid Ratio		0.36	0.39	0.19	0.30	0.18	0.18

8.2.3.3 Analytical Procedures

The flow sheet may be divided into four main sections:

1. Size Analysis
2. Head Analysis
3. Washability Studies
4. Product Analysis

8.2.3.3.1 Size Analysis

A more in-depth program of size analysis has been undertaken in 1984 than in previous years. This is in response to the growing need for information on the characteristics of sized coal required by Gulf Canada Resources Inc.'s marketing studies. Each sample was screened at several sizes (50 mm, 25 mm, 12 mm, 6 mm, 1 mm, 0.5 mm, 0.25 mm, 0.15 mm) both in its natural state, and after crushing the coarsest material (larger than 50 mm) to less than 50 mm. (Table 8.3)

8.2.3.3.2 Head Analysis

A complete analysis of the raw coal from each sample was undertaken. The number of samples involved and their relatively small size precluded the

Table 8.3

HOBBIT CREEK AREA

SIZE CONSIST

Seam	Drill Hole	Slope	Intercept	% + 6 mm	Correlation Coefficient
D	84004	0.57	-0.91	44.15	0.997
D	84004	0.59	-1.12	58.77	0.998
D	84004	0.62	-1.15	60.49	0.998
F	84004	0.68	-1.63	81.45	0.998
G	84004	0.79	-1.62	80.44	0.999
H	84001	0.83	-1.41	65.57	0.999
H	84002	0.71	-1.17	57.67	0.999
H	84003	0.62	-1.00	49.66	0.999
H	84004	0.66	-1.52	81.82	0.997
I	84001	0.59	-1.24	70.36	0.999
I	84002	0.66	-1.01	50.32	0.999
I	84003	0.66	-0.98	44.04	0.999
I	A1	0.65	-1.16	66.98	0.994
I	A2	0.57	-0.79	42.83	0.995
I	A3	0.66	-0.87	40.90	0.998
I	A4	0.45	-0.62	36.83	0.988

possibility of head analysis on each size fraction.

8.2.3.3.3 Float/Sink Data

Limitations on sample quantity also prevented the performance of complete washability studies on each size fraction. A compromise measure included the combination of the size fractions between 50 mm and 6 mm, (2 inches x 1/4 inch) and between 6 mm and 0.5 mm into two single samples for each seam. Less sample was required for representative analysis of the 0.5 mm x 0.15 mm fraction so this material was floated separately. Previous studies indicated that virtually all pertinent information could be gleaned from flotation at 0.10 S.G. intervals between 1.40 and 2.00 S.G. with one extra flotation point at 1.45 S.G. The 0.15 mm x 0 (100 mesh x 0) fraction was not frothed, but an ash determination was made.

8.3 Coal Quality - Trenching Program

8.3.1 Introduction

Due to the emphasis in the Hobbit Creek exploration program on delineation of resources that are surface strippable at low stripping ratios, there was a restriction in the number of surface coal exposures that were of interest. Seam I, as the seam of highest quality and best continuity in the area, was the target for most operations. Exploration, therefore, centred on the areas where seam I was close to surface with the result that the majority of trenches excavated intersect seam I. The following discussion concentrates exclusively on various samples of this particular seam.

For all trench samples, analytical investigations are subject to a degree of interference from oxidation of coal and rock. Moisture and volatiles are slightly elevated relative to what they would be for the same coal in drill core (unoxidized) intersection. Ash levels, because they are linked to moisture and ash, appear slightly depressed in a proximate analysis with fixed carbon levels even more so. These effects are of relatively little concern in this comparison of trench sample analyses as all samples, being from the same seam, can be assumed to be subject to comparable effects.

8.3.2 Discussion

Two different intervals within seam I were investigated at various times in the Hobbit Creek area depending upon the current emphasis in exploration. In general, it has been found that a lower section of the seam approximately two metres thick has a markedly low ash level (9% to 15%). The actual thickness of this lower zone varies in thickness from 1.9 to 2.3 metres but it maintains its character through all substantiated intervals of the seam to date, from Hobbit Creek to Lost Ridge. The top of this zone is marked by a thin lenticular clay parting in most occurrences. A series of rock partings and bands over a 0.5 to 1.5 metre interval separate the lower part of seam I from the upper part, though occasionally (DDH 84002 for example) the upper part is absent entirely and the total thickness of the seam is comprised of the 2 metres of low ash coal.

Depending on whether the lower part of the seam has been recognized and sampled, ash levels reported for sections of seam I range from 9 to 12% (for the lower part only) to just over 20% for the seam as a whole. The "V.I.P." trench on Hobbit Creek just below the rail grade has been sampled repeatedly (this year as TRC 84127) and analyzed as having a total ash content of 18.1%. Close by, in TRC 84109, the lower 1.28 metres of seam I was sampled and yielded coal with an ash level of 11.7%.

The most substantial trenches samples of seam I came from TRC 84143 which transected the pit created by bulldozer in September. These samples consist of 10 barrels of coal (approximately 1800 kg) from four different locations. Over a 35 metre length covered by the samples the ash level of the lower 1.9 metres (or less) of the seam varied, though not linearly, from 12.3% to 15.4%. In cases where part of the seam was missing due to erosion the sampled thickness was reduced to as little as 1.2 metres, though the ash level remained essentially the same. A complication associated with sampling coal from immediately beneath overburden, apart from oxidation, is the possibility of contamination of the sample during sampling by loose surficial material. It is worth noting that the sample site with the best cover (even some of the upper seam was present), yielded the sample with the lowest ash level.

Several other trenches, located around the perimeter of the area designated for pit excavation, were analyzed as a means of monitoring the consistency of ash levels. Three trenches were dug by backhoe along the west side of the B.C.R. subgrade (east side of the pit). These were numbered TRC 84001, 84002, and 84003 (north to south). As these were backhoe trenches and quite deep, there was relatively little control on exactly what portion of the seam had been sampled, particularly as the floor of the seam was not reached in some cases. In TRC 84001, a 0.5 metre sample from near the bottom of the trench (and the seam?) contains 17.5% ash. TRC 84002 and 84003 are quite close together and produced samples of similar ash level (22.9% and 22.7%) even though the thicknesses are somewhat different (1.5 and 2.4 metres).

A further trench along the western perimeter of the pit area (TRC 84019) also intersected coal from seam I. A 2.3 metre section of coal was noted and an ash level of 14% was recorded from the analyzed sample. None of the latter four trenches discussed were sampled under ideal conditions but the analyses do indicate consistency in the character of surface expressions of seam I. Moisture levels after air drying range generally between 3.0% and 5.5% and volatiles are most often measured between 3.4 and 6%. This value is low relative to previous experience on the Mount Klappan property but appears to be a feature of the Hobbit Creek Area.

8.4 Size Analysis - Diamond Drilling Program

8.4.1 Introduction

Due to an increasing interest in establishing a data base on the size consist of Mount Klappan coal, 1984 marked a departure from the previous procedures of drill core analysis. Previously, crushing of coal to 3/8" and screening at 0.5 mm and 0.15 mm was based on considerations of the limits imposed by preparation plant equipment. Information is now required on the quality of coarse coal and therefore, after determination of the natural size distribution, the coal is crushed no finer than two inches (50 mm) and then screened to a series of diminishing sizes (as described in 8.2.3.3.1).

8.4.2 Discussion

Studies of the size distributions of Appalachian coals (Frumerman and Baetens, 1984) have yielded several noteworthy observations. The study was based on channel samples taken from the face of seams exploited at 159 mines through Pennsylvania, West Virginia, and Wyoming. As size distribution data is usually presented graphically with log scales along both axes, it follows that a linear regression for size data could be calculated using the logs of both size and weight percent data. In practice, for each single sample the correlation coefficient (r) is generally very high (greater than 0.99) indicating a very strong relationship between the populations.

The linear regression formula is expressed as:

$$\log(\log(100/R(x))) = n \log(x) + b$$

In this expression "x"is the screen size expressed in millimetres (or any constant unit of convenience) and R(x) is the cumulative amount of sample by percentage - retained on the screen of that size. The letter "n" is described as the distribution constant and represents the slope of the line that would appear on a graphical representation. The letter "b" is the intercept along the ordinate (vertical axis). Both "n" and "b" have numerical values when the regression is calculated for an actual population of size distribution points. By examining these values a significance for the whole population can be derived.

When the slope (n) is a larger value the line on the graph appears steeper. As size distribution graphs are usually drawn with large sizes to the right and zero to the left, and with 0% retained at the top and 100% at the bottom, a steeper line means that as the size of the screen is reduced (a move from right to left), the amount retained increases quickly (the move downward on the graph is rapid). This situation would occur in a material with a high proportion of coarse material. By contrast, if the slope is a low number, the graphed line has a shallow slope, and there is a relatively more fine material.

The same relationship exists with the intercept value. The intercept is determined through eliminating the function n log (x) by setting log (x) equal to zero. This occurs when x equals 1 (1 millimetre), and the intercept can therefore be evaluated to provide the weight percent retained when the screen size is 1 mm. A small number as the intercept means that less material is retained at 1 mm because more material is finer than this size.

In the cited study, it was found that coals from all mines visited, if handled in a similar manner, had comparable size distributions, particularly with regard to slope. In fact, an average equation could be generated that expressed representative size distribution for all coals from all mines.

Identical treated was applied to the size distributions measured from 1984 Mount Klappan drill core. The numbers derived from linear regression calculations were, of course, different from those found in the Appalachian study, but a fairly close relationship was discovered, not only within each seam, but also among all seams. For all drill core samples representing whole, unoxidized seams, the slope of the regression line varied between 0.57 and 0.83 with an average expression being:

$$\log \left(\log \frac{100}{\text{weight}}\right) = 0.67 \quad \log (\text{size}) \quad - 1.12$$

(where the weight is cumulative weight of sample retained at the respective screen size).

The intercept for the same group of samples varies generally from -0.91 to -1.63. (See Table 8.2).

Not only has this regression formula established that there is a general property wide correspondence in the size distribution of Mount Klappan coal seams (which extends through the Hobbit Creek Area), it also provides a yardstick with which new samples can be easily compared.

The Hobbit Creek suite of size analyses provides a lesson in the necessity of consideration of all the values available from a linear regression. There is not a particularly close correspondence among the whole group of samples from drill holes in the Hobbit Creek Area, but review of all available data can indicate the reasons for deviation of some samples from the average.

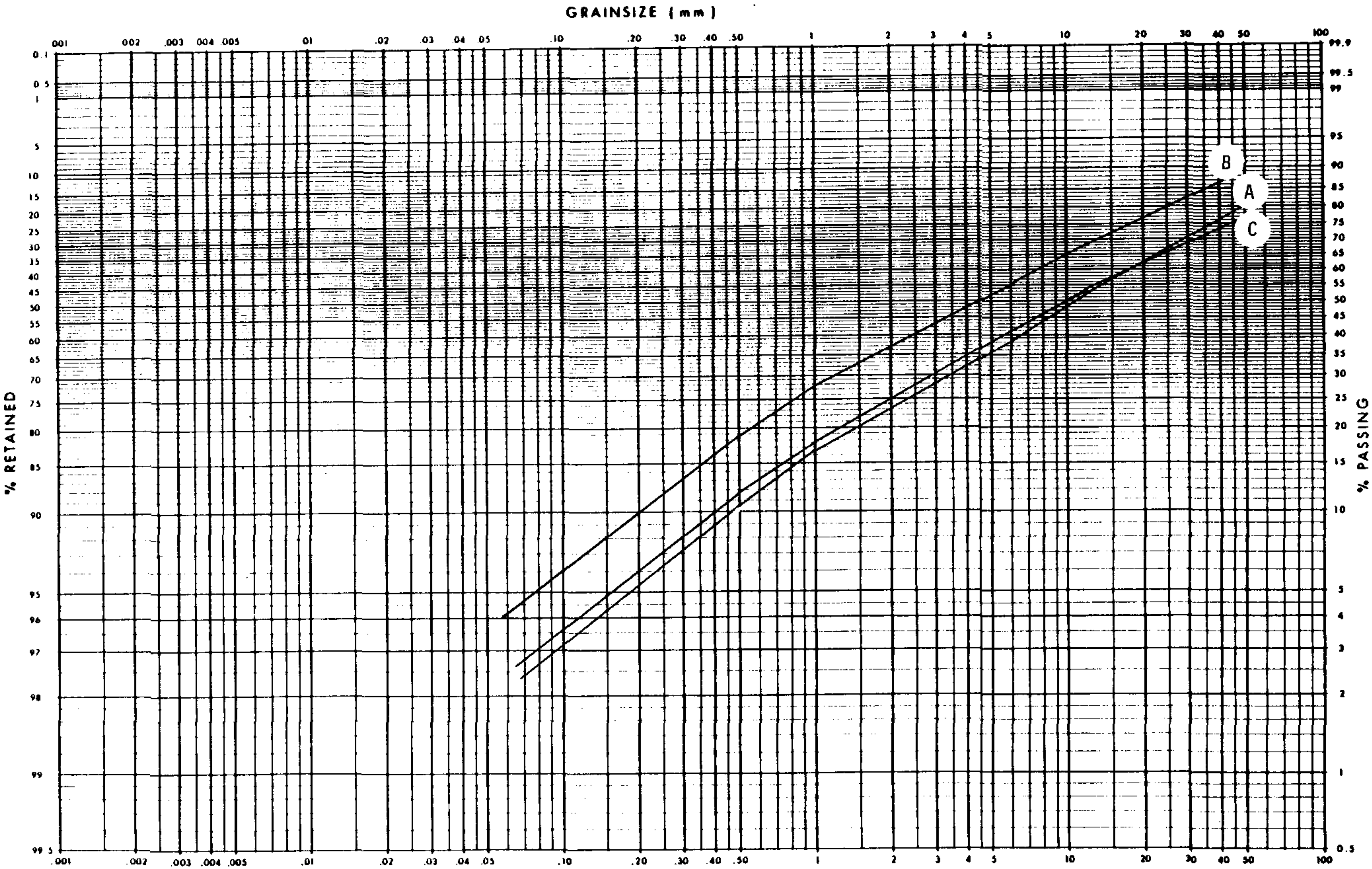
Seam D, in three intersections has a generally lower than average slope and intercept, indicating a somewhat fine size distribution. In addition, the correlation coefficient is, while still extremely high, a little lower than most others. Graphing of these size populations illustrates the reason (Figure 8.3). Three slightly concave downward, parallel lines are produced which suggests a slight degree of attrition within the sample. Indeed, structural disturbance has not only repeated the same seam three times in the same

Figure 8.3

SIZE DISTRIBUTION CURVE

Seam D

A Seam D 143.81 m DDH84004
B Seam D 251.22 m DDH84004
C Seam D 301.17 m DDH84004



drill hole, but, in the highest occurrence (last on the list in Table 8.2) also folded the seam on itself multiple times in a single band of coal. The coal in this seam has been crushed prior to extraction in the drill core.

Seams F and G, may have benefitted from the careful crushing which has preserved the absolute maximum possible quantity of coarse material. Both seams have extremely high values for all parameters of the linear regression. Seam F contains a very high proportion of ash (59.5%, see Table 8.1) which would make the sample in total less brittle compared with coal, and able to fracture gently rather than shattering on careful breakage and maintain a high percentage of coarse material. The H.G.I of seam F, which is measured on smaller pieces (as a standard procedure) and is not subject to procedural bases, is 56 as would be expected in a coal containing this much ash in Mount Klappan. Seam G has a much lower ash level (32.9%) but when graphed displays an unnatural concave upward kink (Figure 8.4). This is likely the result of having been crushed just enough to have every piece pass 50 mm, leaving an abnormally high percentage of coarse material. Unfortunately a Hardgrove measurement is not available for seam G, but it should be relatively low.

Seam H is unusual in that each occurrence has a slightly different size distribution, however, all occurrences averaged together produce a result not too different from the regional average. The slopes and intercepts from DDH 84001, 84002 and 84003 imply gently diverging but almost parallel trends (Figure 8.5). In 84004, the very high

Figure 8.4

SIZE DISTRIBUTION CURVE

Seams F and G

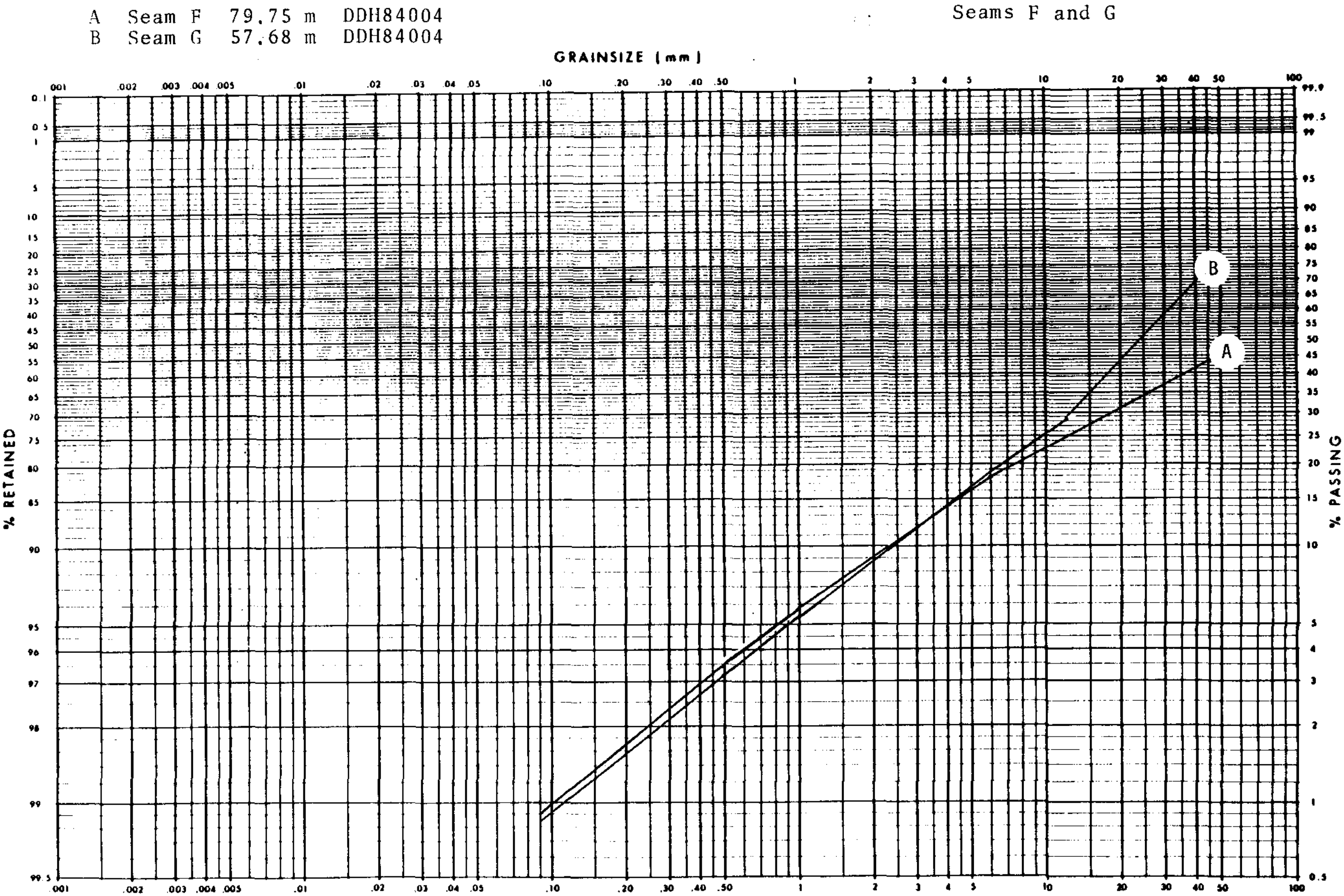
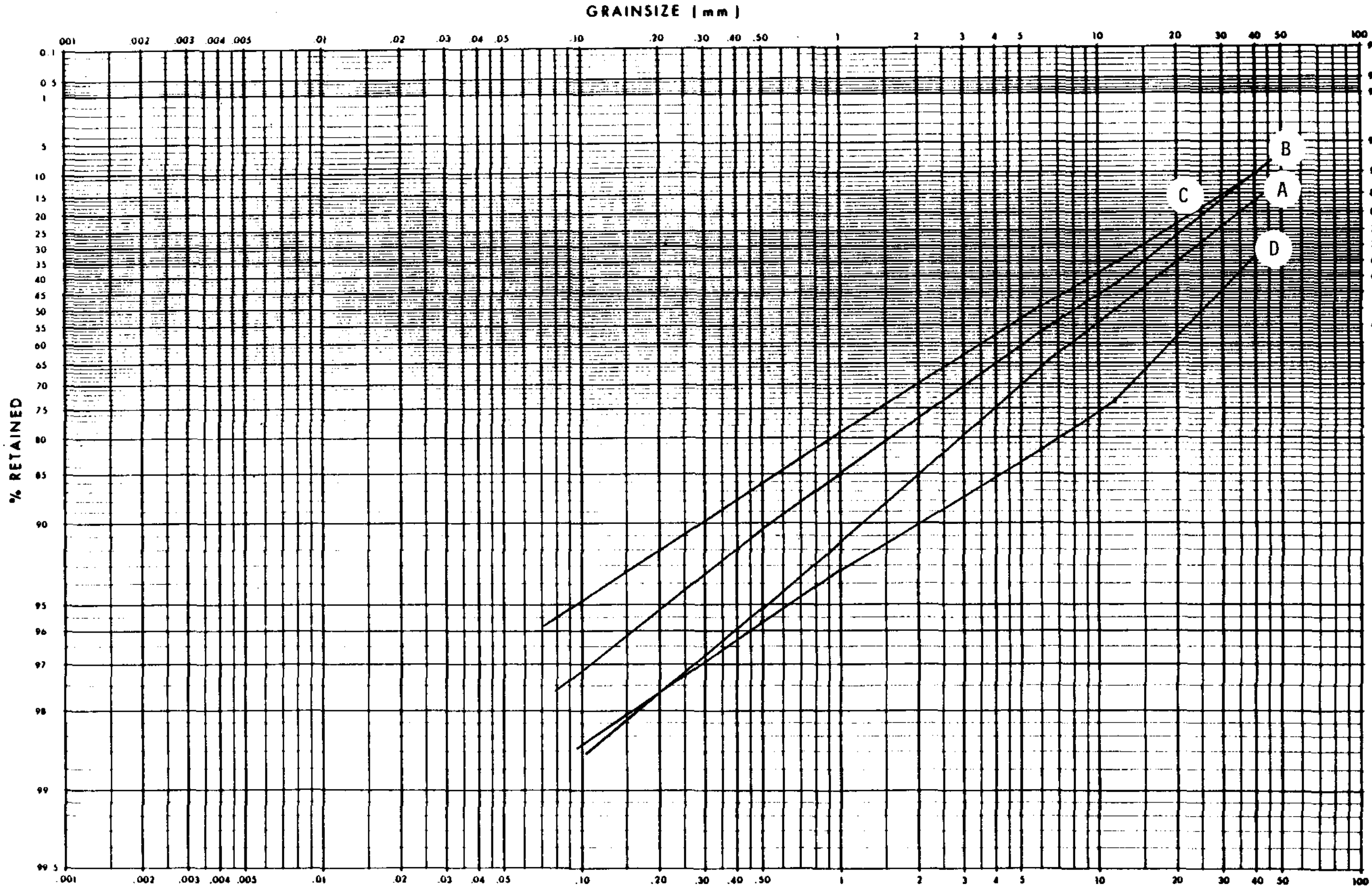


Figure 8.5

SIZE DISTRIBUTION CURVE

Seam H

A Seam H 50.73 m DDH84001
B Seam H 54.93 m DDH84002
C Seam H 48.38 m DDH84003
D Seam H 32.86 m DDH84004



percentage of + 6 mm material and the low correlation coefficient are again symptomatic of an unnatural distribution. As with G there is a concave upward bend in the line pointing to the unusually high preservation of coarse particules. The lesser variance exhibited by the first three samples is caused by differences in oxidation and structural disturbance. All these occurrences are in a somewhat disturbed area and are fairly close to the surface.

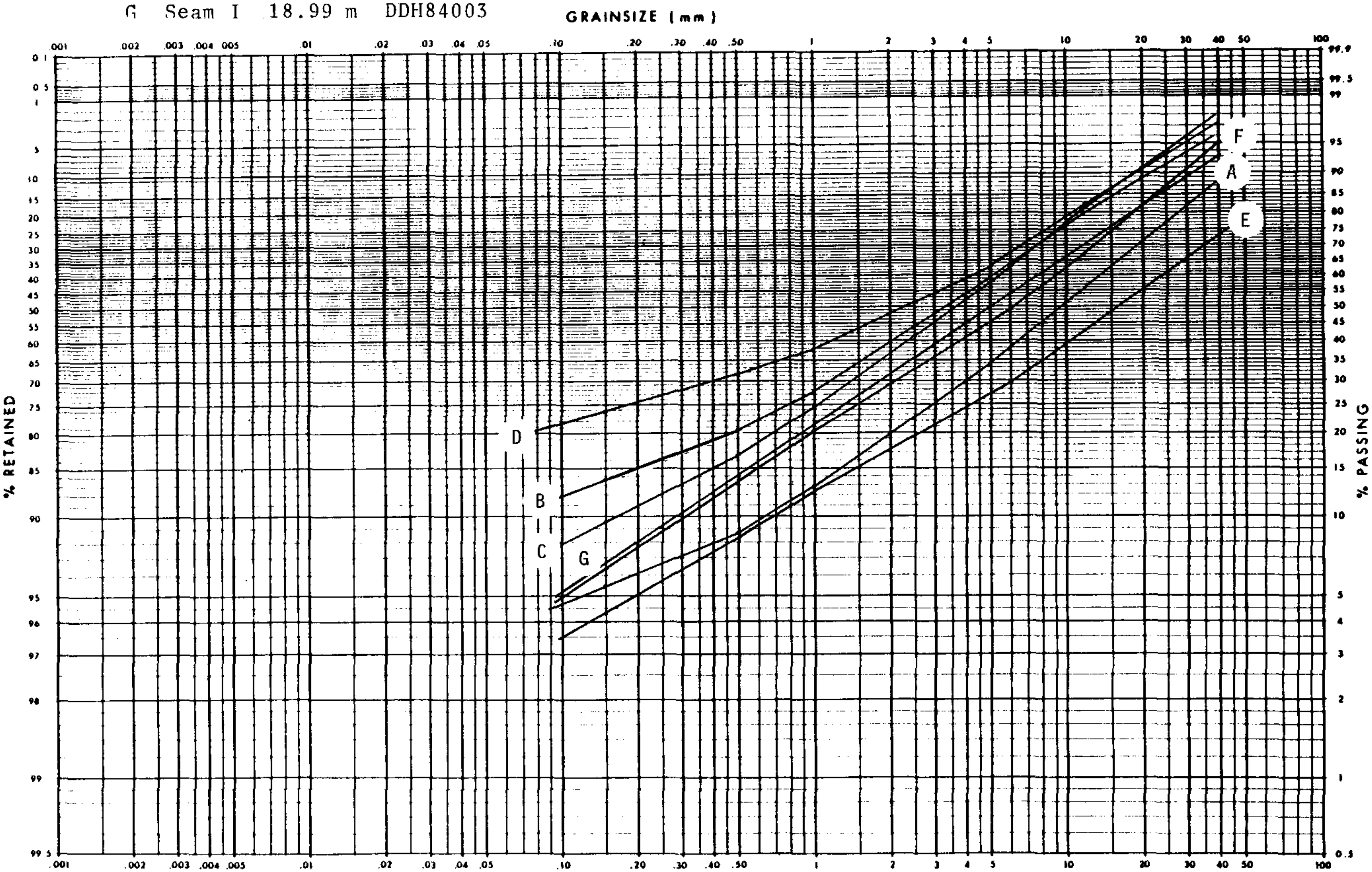
Most intersections of seam I show fairly normal size distributions with minor variation, but most notable are the distributions of samples A2 through A4. These are trench samples from TRC 84143 and all show rather low intercept values and values for % +6 mm (Figure 8.6). The explanation for this is very straightforward, the decrease in coarse material is a function of weathering. A1 has a normal distribution and the greatest amount of cover (see discussion in Section 8.3.2) while A2 and A3 are much more weathered, having been considerably more exposed. A4 is a ply sample from immediately above A1 and shows the result of having absorbed the bulk of oxidation effects. The size consist of A4 particle is very degraded with much higher quantities of fines.

A Seam I A1 TRC84143
B Seam I A2 TRC84143
C Seam I A3 TRC84143
D Seam I A4 TRC84143
E Seam I 22.73 m DDH84001
F Seam I 24.15 m DDH84002
G Seam I 18.99 m DDH84003

Figure 8.6

SIZE DISTRIBUTION CURVE

Seam I



8.5 Raw Coal Quality - Diamond Drilling Program

8.5.1 Introduction

The strategy of concentrating on the surface mineable resource at this time in the Hobbit Creek area is well advised, as some work is yet required to resolve the structural complexities that appear to be dominant at depth. Through the initial 100 metres of strata, structures on a regional scale appears fairly simple and seams I and H are easily traceable from drill hole to drill hole over distances of over 1 kilometer. Beneath 100 metres (and seam F) the situation is quite different and, as mentioned previously, seam D is interpreted to reoccur several times in DDH 84004. Because of the shallow depth of most of the drilling in 1984 and the structure that affects the one hole that does penetrate to deeper levels, only a limited number of seams are represented by samples for drill core coal quality.

8.5.2 Seam D

8.5.2.1 Occurrence

Both samples of seam D are taken from DDH 84004, one occurring at 251 metre depth and the other at 301 metres. A third occurrence between 143 and 161 metres is severely contorted by structure and cannot be reliably considered in terms of coal quality.

8.5.2.2 Coal Quality

The two occurrences of seam D are very similar in all respects of coal quality and the average is therefore quite representative. The seam is fairly low in ash (29.3%) and quite low in sulphur. Volatiles and oxygen levels indicate that it is one of the few seams intersected in the area that is most likely unoxidized. The thickness of the seam varies from one occurrence to the other (3.43 metres at the higher level and 4.57 metres below) but this is not surprising considering the structure in which it is involved. The high H.G.I. also suggests a degree of fracturing has taken place. At shallow depth, this seam, with its thickness and quality would be a worthwhile prospect.

8.5.3 Seam F

8.5.3.1 Occurrence

There is only one intersection of seam F, in the immediate vicinity, at 80 metres depth in 84004. Its thickness here is 1.05 metres.

8.5.3.2 Coal Quality

Seam F is barely worthy of inclusion in a discussion of potential coal resources as it is quite thin and has a very high (59.5%) ash level. This, however, is the only local coal occurrence at this stratigraphic level and is reported for possible future correlation.

8.5.4 Seam G

8.5.4.1 Occurrence

Seam G occurs at a depth of 58 metres in DDH 84004 with a thickness of 1.94 metres. A mark of its continuity is that it also occurs at 118 metres depth in DDH 82001 at a distance of 1.2 kilometers from 84004. Its thickness here is approximately 1.7 metres (determined without geophysical logs).

8.5.4.2 Coal Quality

Seam G has acceptable but not exceptional raw coal quality with an ash level of 32.9%. Volatiles are elevated (at 10.1%), suggesting some degree of weathering. Several factors points to the possibility of secondary mineralization contaminating the seam. Sulphur levels are quite high (1.55%) and only half of this content is combustible, indicating the presence of pyrite. Calcium and magnesium oxide levels are also elevated which offers evidence (in the absence of a carbon dioxide measurement) of the source of the excess volatiles.

8.5.5 Seam H

8.5.5.1 Occurrence

Seam H occurs at shallow depths in all four of the 1984 Hobbit Creek diamond drill holes. It appears as a 1.62 metre seam at 30.3 metres depth in DDH 84001; a 1.65 metre seam at 55 metres depth in DDH 84002; a 1.03 metre seam at 48 metres depth in DDH 84003; a 1.70 metre seam at 33 metres depth in DDH 84004; and, also as a 1.54 metre seam at 94 metres depth in 82001.

8.5.5.2 Coal Quality

As consistent as seam H is in thickness, it also varies little in quality. With slight fluctuation each occurrence of seam H has a quality quite similar to the reported average. The volatile level is raised due to most occurrences of the seam being quite shallow. Sulphur levels are slightly higher than average, but the average value is misleading, as it is actually the product of several normal values at around 0.5% and one high value (1.25%) from an intersection containing pyrite. The thinness of seam H combined with its ash level do not make large contributions to the resource but seam H finds its use in this area as a consistent stratigraphic marker.

8.5.6 Seam I

8.5.6.1 Occurrence

Seam I was the target of drilling in all holes but was so close to the surface at some locations that it was lost in overburden and could not be cored. Samples were taken from 24 metres in DDH 84002 (2.22 metres thick); 19 metres in DDH 84003 (at 4.16 metres thickness); and from 57 metres in DDH 82001 with a 6.97 metre thickness including a 1 metre mid seam rock parting.

8.5.6.2 Coal Quality

Two different quality listings are given for seam I, representing the whole seam and the lower two metres (see discussion of Section 8.3). Apart from ash level, most aspects of the quality of these two intervals of the seam are entirely comparable. There is, surprisingly, very little affect on ash mineral composition through the addition of the extra rock material in the upper part of the seam. Volatiles also are unaffected by the presence or absence of the extra ash, but are uniformly inflated by oxidation. All intersections of seam I are at quite shallow depths. Oxygen levels also appear elevated and the contents of calcium and magnesium, as in seam G, suggest that some secondary mineralization may have taken place.

8.6 PRODUCT YIELDS

8.6.1 Introduction

As discussed in Section 8.2, the coal quality analysis program for 1984 differs from the procedures of previous years in several respects, including the design of washability testing. Four size fractions were subjected to separate washabilites to provide product yield information directly relatable to the specifications of demands for sized product. All samples discussed here, taken in 1984 from the pit area, have received essentially the same treatment and can be readily compared.

The results of yield calculation are reported on Table 8.4. Yield figures were generated using a computerized washplant simulation. Cleaning efficiency for all coal down to 0.13 mm were those of drum equipment (heavy metal vessels). The 0.15 mm coal was not washed but directed in raw state to the 25% ash product. The three products tested for the size fractions of each soon are successive products, extraction of high ash products follows that of low ash products. The seam samples included in these calculations and averaging for this table are exactly the same as those for which raw coal quality is reported in Table 8.3.

Product coal analyses are not indicated in this discussion as, in general, they are not available. Product analysis was not a part of the analytical program performed in April and the low yields of some of the seams intersected

Table 8.4

CLEAN COAL YIELDS
HOBBIT CREEK AREA

Seam	Ash	50 x 6 mm	6 x 0.5 mm	0.5 x 0.15 mm	0.15 mm x 0	Total
D	5	2.65	9.59	4.52	--	16.76
	10	1.86	2.37	0.40	--	4.63
	25	20.44	13.48	2.43	6.49	42.84
Total		24.95	25.44	7.35	6.49	64.23
F	5	0.63	1.97	0.26	--	2.86
	10	0.16	0.51	0.06	--	0.73
	25	0.99	1.03	0.17	1.32	3.51
Total		1.78	3.51	0.49	1.32	7.10
G	5	0.34	3.46	0.60	--	4.40
	10	5.53	3.46	0.10	--	9.09
	25	45.53	4.66	0.48	1.21	51.88
Total		51.40	11.58	1.18	1.21	65.37
H	5	0.17	4.62	1.65	--	6.44
	10	1.30	0.82	0.02	--	2.14
	25	10.76	7.03	1.04	3.59	22.41
Total		12.23	12.47	2.71	3.59	31.00
I	5	1.90	18.80	5.68	--	26.38
	10	16.80	6.34	0.12	--	23.26
	25	9.72	10.43	1.14	6.27	27.56
Total		28.42	35.57	6.94	6.27	77.20
I	5	2.79	22.88	5.74	--	31.41
Lower	10	20.10	4.05	0.08	--	24.23
	25	11.75	10.43	1.08	6.10	29.36
Total		34.64	37.36	6.90	6.10	85.00

in the continuation of DDH 84-004 did not warrant product quality analysis. At any rate, typical product quality can be expected to conform with that seen generally across the Mt. Klappan property (See Table 8.1).

8.6.2 5% Ash Product Yield

Yields of 5% ash product coal expressed seam by seam (Table 8.4) are very much as might be expected from looking at the average head analyses of each seam. Seams D and I, with the lowest head ash are by a considerable margin, capable of production of the most 5% ash product. For all seams, there is a clear tendency, due to the liberation effect, towards higher yields in coal sized to middle ranges (6 x 0.3 mm) then in coarse coal (50 x 6 mm). Of the seams of lower capacity seam G, with a head ash only slightly greater than D produces relatively little 5% ash product. Seam H has a head ash even higher than seam G but can produce more fine (less than 6 mm) 5% ash product. Seam F is very high in ash and has correspondingly poor yields of all products.

The reason for separate consideration of the lower 2 m interval of seam I, compared with the whole of seam I is clear on Table 8.4. Yields of 5% ash product in all sizes are higher for the cleaner interval than for the entire seam (including those central high ash portion).

8.6.3 10% Ash Product Yield

In general, seams with substantial potential for 5% ash coal, can produce lesser amounts of 10% ash interest as a second product. This is noted in both seams D and I, although 10% ash yields for seam I are very nearly as high as for 5% ash coal. Seams F and H also follow three tendency, but the washability of seam G is such that, in coarser coals, better separation is achieved at an ash level of 10% than at 5%.

The peaking of product yield in the middle size ranges is not noted in the 10% ash production from most seams. Where liberation has acted to release 5% ash product (in the 6 x 0.5 mm fraction) little additional low ash (10%) production is possible. In the 50 x 6 mm fraction a substantial quantity of high quality coal interval that just failed to float at the 5% point, readly reported to the 10% ash product. (See seams G, H and I), yields for seam F are too low to be significant, and the yields of low ash coal (less than 10%) in the coarse functions of seam D are also quite low).

8.6.4 Briquetting Coal Product Yield

Yields of briquetting coal (around 25% ash) are quite high for must seams, with the exceptions of seam I, where most coal has already gave to 5% and 10% ash products and seam F, where coal quality is generally very poor. Seam D, G, and H have yields of briquetting coal high than the 5% and 10% ash products combined. The favourable yields expected

9.0 LIST OF REFERENCES

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APPENDIX A

STATEMENTS OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

GLENN E. SEVE

This is to certify that I obtained my Bachelor of Science Degree in Geology at the University of Alberta in 1979.

I have gained my geological experience through coal property evaluations and exploration mapping and drilling programs situated in Alberta and British Columbia. I have been employed as a Geologist with the Coal Division of Gulf Canada Resources Inc. since 1979 and have participated in the evaluation of Gulf's Mount Klappan, Panorama, Chip Lake, Wapiti, and Goodrich properties.

STATEMENT OF QUALIFICATIONS

ERIC M. LEGRESLEY

This is to certify that I obtained my Bachelor of Science Degree in Geology from McMaster University in 1982.

My geological experience, in chronological order, includes field mapping in northern Ontairo, Vancouver Island, and northwest British Columbia, sedimentological studies in the Cretaceous oil sands of Alberta, structural mapping in the front ranges of the Rocky Mountains of Alberta, petroleum exploration in northern Alberta, and presently coal exploration in the Bowser Basin of northwest British Columbia.

I have been employed as a geologist with Gulf Canada Resources Inc. since May, 1982, and have been working in the Coal Division since April, 1984.

APPENDIX B

LEGAL DESCRIPTION AND LISTING OF LICENCES

Appendix B

MOUNT KLAPPAN COAL PROJECT LICENCES
1984

SUMMIT-NASS-SKEENA AREA

Summit Area

Licence	Effective Date	Hectares	Series	Block
7171*	Dec. 31/82	140.5	104-H-7	D
7173*	Dec. 31/82	140.0	104-H-7	D
7174	Dec. 31/82	280.0	104-H-7	D
7176	Dec. 31/82	277.0	104-H-7	D
7177	Sept. 1/81	280.0	104-H-7	D
7382	Mar. 15/82	280.0	104-H-6	H
7383	Mar. 15/82	108.0	104-H-6	H
7384	Mar. 15/82	281.0	104-H-7	D
7385	Mar. 15/82	204.0	104-H-7	D
7386	Mar. 15/82	280.0	104-H-7	D
7387	Mar. 15/82	280.0	104-H-7	D
7388	Mar. 15/82	172.0	104-H-7	D
7389	Mar. 15/82	275.0	104-H-7	D
7390	Mar. 15/82	280.0	104-H-7	D
7391	Mar. 15/82	115.0	104-H-7	E
7392	Mar. 15/82	260.0	104-H-7	E
7423	Mar. 15/83	281.0	104-H-7	D
7424	Mar. 15/83	280.0	104-H-7	D
7425	Mar. 15/83	280.0	104-H-7	D
7426	Mar. 15/83	280.0	104-H-7	D
7726	Jan. 10/84	280.0	104-H-6	A
7727	Jan. 10/84	280.0	104-H-6	A
7728	Jan. 10/84	280.0	104-H-6	A
7729	Jan. 10/84	280.0	104-H-6	A
7730	Jan. 10/84	280.0	104-H-6	A

Summit Area (cont'd)

Licence	Effective Date	Hectares	Series	Block
7731	Jan. 10/84	280.0	104-H-6	A
7732	Jan. 10/84	280.0	104-H-6	A
7733	Jan. 10/84	280.0	104-H-6	A
7734	Jan. 10/84	280.0	104-H-6	A
7735	Jan. 10/84	280.0	104-H-6	G
7736	Jan. 10/84	280.0	104-H-6	G
7737	Jan. 10/84	280.0	104-H-6	G
7738	Jan. 10/84	280.0	104-H-6	G
7739	Jan. 10/84	280.0	104-H-6	G
7740	Jan. 10/84	280.0	104-H-6	G
7741	Jan. 10/84	280.0	104-H-6	G
7742	Jan. 10/84	280.0	104-H-6	G
7743	Jan. 10/84	280.0	104-H-6	G
7744	Jan. 10/84	280.0	104-H-6	G
7745	Jan. 10/84	280.0	104-H-6	G
7746	Jan. 10/84	280.0	104-H-6	H
7747	Jan. 10/84	280.0	104-H-6	H
7748	Jan. 10/84	280.0	104-H-6	H
7749	Jan. 10/84	280.0	104-H-6	H
7750	Jan. 10/84	261.0	104-H-6	H
7751	Jan. 10/84	280.0	104-H-6	H
7752	Jan. 10/84	280.0	104-H-6	H
7753	Jan. 10/84	280.0	104-H-6	H
7754	Jan. 10/84	154.0	104-H-6	H
7755	Jan. 10/84	274.0	104-H-6	H
7756	Jan. 10/84	280.0	104-H-6	D
7757	Jan. 10/84	280.0	104-H-6	D

* Licence split between Summit-Nass-Skeena and Lost-Fox Areas.

Summit Area Total Hectares = 13 582.5

Nass Area Licence	Effective Date	Hectares	Series	Block
7150	Sept. 1/81	281	104-H-2	L
7154	Sept. 1/81	281	104-H-2	L
7421	Mar. 15/83	281	104-H-2	L
7422	Mar. 15/83	281	104-H-2	L
7427	Mar. 15/83	281	104-H-3	I
7428	Mar. 15/83	281	104-H-3	I
7429	Mar. 15/83	281	104-H-3	I
7430	Mar. 15/83	281	104-H-3	I
7431	Mar. 15/83	281	104-H-3	I
7432	Mar. 15/83	281	104-H-3	I
7487	Oct. 21/82	281	104-H-3	J
7488	Oct. 21/82	281	104-H-3	J
7505	Oct. 21/82	281	104-H-3	H
7506	Oct. 21/82	281	104-H-3	H
7507	Oct. 21/82	281	104-H-3	H
7508	Oct. 21/82	281	104-H-3	H
7509	Oct. 21/82	281	104-H-3	H
7510	Oct. 21/82	281	104-H-3	H
7511	Oct. 21/82	281	104-H-3	H
7512	Oct. 21/82	281	104-H-3	I
7513	Oct. 21/82	281	104-H-3	I
7514	Oct. 21/82	281	104-H-3	I
7515	Oct. 21/82	281	104-H-3	I
7516	Oct. 21/82	281	104-H-3	I
7517	Oct. 21/82	281	104-H-3	I
7518	Oct. 21/82	281	104-H-3	I
7519	Oct. 21/82	281	104-H-3	I
7520	Oct. 21/82	281	104-H-3	I

Nass Area (cont'd)

Licence	Effective Date	Hectares	Series	Block
7521	Oct. 21/82	281	104-H-3	I
7522	Oct. 21/82	281	104-H-3	I
7523	Oct. 21/82	281	104-H-3	I
7530	Oct. 21/82	281	104-H-2	L
7531	Oct. 21/82	281	104-H-2	L
7532	Oct. 21/82	281	104-H-2	L
7533	Oct. 21/82	281	104-H-2	L
7534	Oct. 21/82	281	104-H-2	L
7535	Oct. 21/82	281	104-H-2	L
7536	Oct. 21/82	281	104-H-2	L

Nass Area Total Hectares = 10 678

Skeena Area

7489	Oct. 21/82	282	104-H-2	G
7490	Oct. 21/82	282	104-H-2	G
7491	Oct. 21/82	282	104-H-2	G
7492	Oct. 21/82	282	104-H-2	G
7493	Oct. 21/82	282	104-H-2	G
7494	Oct. 21/82	282	104-H-2	G
7495	Oct. 21/82	282	104-H-2	G
7496	Oct. 21/82	282	104-H-2	G
7497	Oct. 21/82	281	104-H-2	G
7498	Oct. 21/82	281	104-H-2	G
7499	Oct. 21/82	281	104-H-2	G
7500	Oct. 21/82	281	104-H-2	G

Skeena Area (cont'd)

Licence	Effective Date	Hectares	Series	Block
7501	Oct. 21/82	281	104-H-2	G
7502	Oct. 21/82	281	104-H-2	J
7503	Oct. 21/82	281	104-H-3	K
7504	Oct. 21/82	281	104-H-3	K
7524	Oct. 21/82	281	104-H-2	K
7525	Oct. 21/82	281	104-H-2	K
7526	Oct. 21/82	281	104-H-2	K
7528	Oct. 21/82	281	104-H-2	L
7537	Oct. 21/82	281	104-H-2	F
7538	Oct. 21/82	281	104-H-2	F
7539	Oct. 21/82	281	104-H-2	F
7714	Jan. 10/84	281	104-H-2	G
7715	Jan. 10/84	281	104-H-2	G
7716	Jan. 10/84	281	104-H-2	G
7717	Jan. 10/84	281	104-H-2	G
7718	Jan. 10/84	281	104-H-2	G
7719	Jan. 10/84	281	104-H-2	G
7720	Jan. 10/84	281	104-H-2	G
7721	Jan. 10/84	281	104-H-2	G
7722	Jan. 10/84	281	104-H-2	G

Skeena Area Total Hectares = 9000

Summit-Nass-Skeena Area Total Hectares = 33 260.5

Appendix B

MOUNT KLAPPAN COAL PROJECT LICENCES
1984

Hobbit-Broatch Area

Licence	Effective Date	Hectares	Series	Block
7118	Sept. 1/81	281	104-H-2	J
7119	Sept. 1/81	281	104-H-2	J
7120	Sept. 1/81	32	104-H-2	J
7121	Sept. 1/81	224	104-H-2	J
7122	Dec. 31/82	281	104-H-2	J
7123	Dec. 31/82	281	104-H-2	J
7124	Sept. 1/81	98	104-H-2	J
7125	Dec. 31/82	281	104-H-2	J
7126	Dec. 31/82	281	104-H-2	J
7127	Sept. 1/81	281	104-H-2	K
7128	Sept. 1/81	281	104-H-2	K
7131	Sept. 1/81	281	104-H-2	K
7132	Sept. 1/81	281	104-H-2	K
7136	Dec. 31/82	281	104-H-2	K
7137	Sept. 1/84	281	104-H-2	K
7141	Dec. 31/82	281	104-H-2	K
7142	Dec. 31/82	281	104-H-2	K
7155	Sept. 1/81	61	104-H-7	B
7156	Sept. 1/81	167	104-H-7	B
7157	Sept. 1/81	265	104-H-7	B
7158	Dec. 31/82	281	104-H-7	C
7159	Dec. 31/82	281	104-H-7	C
7163	Dec. 31/82	257	104-H-7	C
7381	Mar. 18/82	281	104-H-2	J
7416	Mar. 15/83	281	104-H-2	J
7417	Mar. 15/83	281	104-H-2	J
7418	Mar. 15/83	281	104-H-2	J
7419	Mar. 15/83	278	104-H-2	J
7420	Mar. 15/83	281	104-H-2	J

Hobbit-Broatch Area (cont'd)

Licence	Effective Date	Hectares	Series	Block
7559	June 30/83	22	104-H-7	B
7560	June 30/83	153	104-H-7	C
7723	Jan. 10/84	281	104-H-2	J
7724	Jan. 10/84	250	104-H-2	J
7725	Jan. 10/84	7	104-H-2	J

Hobbit-Broatch Area Total Hectares = 7 996

Appendix B

MOUNT KLAPPAN COAL PROJECT LICENCES
1984

Lost-Fox Area

Licence	Effective Date	Hectares	Series	Block
7129	Sept. 1/81	281	104-H-2	K
7130	Sept. 1/81	281	104-H-2	K
7133	Sept. 1/81	281	104-H-2	K
7134	Sept. 1/81	281	104-H-2	K
7135	Sept. 1/81	281	104-H-2	K
7138	Sept. 1/81	281	104-H-2	K
7139	Sept. 1/81	281	104-H-2	K
7140	Dec. 31/82	281	104-H-2	K
7143	Dec. 31/82	281	104-H-2	K
7144	Dec. 31/82	281	104-H-2	K
7145	Dec. 31/82	281	104-H-2	K
7146	Sept. 1/81	281	104-H-2	L
7147	Dec. 31/82	281	104-H-2	L
7148	Sept. 1/81	281	104-H-2	L
7149	Sept. 1/81	281	104-H-2	L
7151	Dec. 31/82	281	104-H-2	L
7152	Dec. 31/82	281	104-H-2	L
7153	Sept. 1/81	281	104-H-2	L
7160	Dec. 31/82	281	104-H-7	C
7161	Dec. 31/82	281	104-H-7	C
7162	Dec. 31/82	281	104-H-7	C
7164	Dec. 31/82	280	104-H-7	C
7165	Dec. 31/82	280	104-H-7	C
7166	Dec. 31/82	280	104-H-7	C
7167	Sept. 1/81	75	104-H-7	C
7168	Sept. 1/81	142	104-H-7	C
7169	Dec. 31/82	281	104-H-7	D

Lost-Fox Area (cont'd)

Licence	Effective Date	Hectares	Series	Block
7170	Dec. 31/82	281	104-H-7	D
7171*	Dec. 31/82	140.5	104-H-7	D
7172	Dec. 31/82	280	104-H-7	D
7173*	Dec. 31/82	140	104-H-7	D
7175	Sept. 1/81	94	104-H-7	D
7527	Oct. 21/82	281	104-H-2	K
7529	Oct. 21/82	281	104-H-2	L
7561	June 30/83	21	104-H-7	C

* Licence split between Lost-Fox and Summit-Nass-Skeena Areas

Lost-Fox Area Total Hectares = 8 757.5

APPENDIX C

RESOURCE DATA AND CALCULATIONS

MEASURED RESOURCE TABLES

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES1000

SECTION: 1000
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	0.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES1250

SECTION: 1250
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70		250			
J	0.00	1.70		250			
I	2.90	1.70	273	250	336472.5	336472.5	336472.5
H	0.00	1.70		250			
G	0.00	1.70		250			
F	0.00	1.70		250			
E	0.00	1.70		250			
D	0.00	1.70		250			
C	0.57	1.70	125	250	30281.3		
B	0.00	1.70		250			
A	0.00	1.70		250			
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					366753.8	336472.5	336472.5

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES1750

SECTION: 1750
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	0.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES1500

SECTION: 1500
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	1.40	1.70	343	250	204085.0	204085.0	
J	0.00	1.70	0	250			
I	1.25	1.70	475	105	105984.4	105984.4	
H	1.40	1.70	590	250	351050.0	351050.0	
G	2.45	1.70	300	250	312375.0	312375.0	312375.0
F	0.00	1.70	0	250			
E	0.62	1.70	298	250	78523.0		
D	1.56	1.70	300	250	198900.0	198900.0	
C	0.00	1.70	0	250			
B	1.50	1.70	500	250	318750.0	318750.0	
A	1.68	1.70	500	250	357000.0	357000.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	1926667.4	1848144.4	312375.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES2000

SECTION: 2000
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	0.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES2250

SECTION: 2250
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	2.88	1.70	163	165	131677.9	131677.9	131677.9
F	0.00	1.70	0	250			
E	0.75	1.70	158	170	34246.5		
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	165924.4	131677.9	131677.9

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES2500

SECTION: 2500
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	2.88	1.70	75	135	49572.0	49572.0	49572.0
F	0.00	1.70	0	250			
E	0.75	1.70	75	130	12431.3		
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	62003.3	49572.0	49572.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES2750

SECTION: 2750
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	0.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES3000

SECTION: 3000
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.57	1.70	140	250	33915.0		
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	33915.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES3250

SECTION: 3250
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.85	1.70	200	250	72250.0		
G	3.25	1.70	275	250	379843.8	379843.8	379843.8
GI	1.13	1.70	275	250	132068.8	132068.8	
F	0.00	1.70	0	250			
Eu	0.91	1.70	323	250	124920.3		
E	2.24	1.70	413	250	393176.0	393176.0	393176.0
D	0.53	1.70	400	250	90100.0		
C	0.67	1.70	275	250	78306.3		
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	1270665.0	905088.5	773019.8

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES3500

SECTION: 3500
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	2.87	1.70	95	250	115876.3	115876.3	115876.3
J	0.93	1.70	150	250	59287.5		
Iu	2.76	1.70	203	250	238119.0	238119.0	238119.0
I	2.86	1.70	275	250	334262.5	334262.5	334262.5
H	0.00	1.70	0	250			
G	1.68	1.70	295	250	210630.0	210630.0	
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	958175.3	898887.8	688257.8

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES3750

SECTION: 3750
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	2.22	1.70	123	135	62667.3	62667.3	62667.3
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	62667.3	62667.3	62667.3

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES4000

SECTION: 4000
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	6.17	1.70	150	250	393337.5	393337.5	393337.5
J	5.66	1.70	115	135	149381.6	149381.6	149381.6
I	2.22	1.70	202.5	165	126098.8	126098.8	126098.8
I	2.91	1.70	237.5	250	293728.1	293728.1	293728.1
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	962546.0	962546.0	962546.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES4250

SECTION: 4250
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	5.66	1.70	250	165	396907.5	396907.5	396907.5
I	3.21	1.70	322.5	250	439970.6	439970.6	439970.6
H	1.20	1.70	375	250	191250.0	191250.0	
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	1028128.1	1028128.1	836878.1

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES4500

SECTION: 4500
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	2.44	1.70	87.5	145	52627.8	52627.8	52627.8
J	4.06	1.70	200	250	345100.0	345100.0	345100.0
I	3.21	1.70	275	250	375168.8	375168.8	375168.8
I	5.86	1.70	162.5	270	437082.8	437082.8	437082.8
H	2.56	1.70	227.5	150	148512.0	148512.0	148512.0
H	1.20	1.70	382.5	200	156060.0	156060.0	
G	3.92	1.70	150	140	139944.0	139944.0	139944.0
F	2.15	1.70	157.5	140	80592.8	80592.8	80592.8
E	1.27	1.70	150	145	46958.3	46958.3	
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	1782046.3	1782046.3	1579028.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES4750

SECTION: 4750
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	2.44	1.70	210	155	135017.4	135017.4	135017.4
J	4.06	1.70	322.5	155	345013.7	345013.7	345013.7
I	5.86	1.70	427.5	230	979513.7	979513.7	979513.7
H	1.41	1.70	285	250	170786.3	170786.3	
H	2.56	1.70	170	150	110976.0	110976.0	110976.0
G	3.92	1.70	172.5	160	183926.4	183926.4	183926.4
G	2.03	1.70	282.5	250	243726.9	243726.9	243726.9
F	1.05	1.70	282.5	160	80682.0	80682.0	
F	2.15	1.70	172.5	250	157621.9	157621.9	157621.9
NEW	0.70	1.70	312.5	250	92968.8		
Eu	0.85	1.70	175	155	39195.6		
E	1.27	1.70	175	155	58562.9	58562.9	
D	3.43	1.70	625	250	911093.8	911093.8	911093.8
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	3509085.2	3376920.8	3066889.7

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES5000

SECTION: 5000
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	0.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES5250

SECTION: 5250
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	0.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: MES5500

SECTION: 5500
RESOURCE TYPE: MEASURED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	0.0	0.0	0.0

INDICATED RESOURCE TABLES

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND1000

SECTION: 1000
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	2.97	1.70	32.5	250	41023.1	41023.1	41023.1
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	41023.1	41023.1	41023.1

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND1250

SECTION: 1250
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	1.40	1.70	100	250	59500.0	59500.0	
J	0.00	1.70	0	250			
I	2.97	1.70	25	250	31556.3	31556.3	31556.3
H	1.40	1.70	412.5	200	196350.0	196350.0	
G	2.45	1.70	200	195	162435.0	162435.0	162435.0
F	0.00	1.70	0	250			
E	0.62	1.70	255	200	53754.0		
D	1.56	1.70	325	195	168070.5	168070.5	
C	0.00	1.70	0	250			
B	1.50	1.70	537.5	250	342656.3	342656.3	
A	1.68	1.70	537.5	250	383775.0	383775.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					1398097.0	1344343.0	193991.3

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND1500

SECTION: 1500
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	1.40	1.70	125	250	74375.0	74375.0	
J	0.00	1.70	0	250			
I	1.25	1.70	70	250	37187.5	37187.5	
H	1.40	1.70	350	250	208250.0	208250.0	
G	2.45	1.70	525	250	546656.3	546656.3	546656.3
F	0.00	1.70	0	250			
E	0.62	1.70	325	250	85637.5		
D	1.56	1.70	225	250	149175.0	149175.0	
C	0.00	1.70	0	250			
B	1.50	1.70	337.5	250	215156.3	215156.3	
A	1.68	1.70	325	250	232050.0	232050.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	1548487.5	1462850.0	546656.3

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND1750

SECTION: 1750
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	1.25	1.70	500	200	212500.0	212500.0	
H	1.40	1.70	275	150	98175.0	98175.0	
G	2.45	1.70	275	155	177533.1	177533.1	177533.1
F	0.00	1.70	0	250			
E	0.62	1.70	237.5	150	37548.8		
D	1.56	1.70	225	155	92488.5	92488.5	
C	0.00	1.70	0	250			
B	1.50	1.70	377.5	250	240656.3	240656.3	
A	1.68	1.70	350	250	249900.0	249900.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	1108801.6	1071252.9	177533.1

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND2000

SECTION: 2000
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					0.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND2250

SECTION: 2250
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	2.88	1.70	337.5	250	413100.0	413100.0	413100.0
F	0.00	1.70	0	250			
E	0.75	1.70	322.5	250	102796.9		
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					515896.9	413100.0	413100.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND2500

SECTION: 2500
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	2.88	1.70	452.5	250	553860.0	553860.0	553860.0
F	0.00	1.70	0	250			
E	0.75	1.70	322.5	250	102796.9		
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					656656.9	553860.0	553860.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND2750

SECTION: 2750
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					0.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND3000

SECTION: 3000
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.57	1.70	220	250	53295.0		
H	0.85	1.70	182.5	155	40875.4		
G	3.25	1.70	372.5	150	308709.4	308709.4	308709.4
F	0.00	1.70	0	250			
E	2.24	1.70	325	155	191828.0	191828.0	191828.0
D	0.53	1.70	287.5	155	40150.8		
C	0.67	1.70	185	250	52678.8		
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	687537.4	500537.4	500537.4

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND3250

SECTION: 3250
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	4.25	1.70	100	250	180625.0	180625.0	180625.0
J	0.93	1.70	150	130	30829.5		
I	3.71	1.70	255	135	217118.5	217118.5	217118.5
I	0.57	1.70	202.5	195	38263.4		
H	0.85	1.70	312.5	250	112890.6		
G	3.25	1.70	125	130	89781.3	89781.3	89781.3
G	1.13	1.70	585	250	280946.3	280946.3	
G1	1.13	1.70	100	250	48025.0	48025.0	
F	0.00	1.70	0	250			
Eu	0.91	1.70	75	250	29006.3		
E	2.24	1.70	575	250	547400.0	547400.0	547400.0
D	0.53	1.70	437.5	250	98546.9		
C	0.67	1.70	200	250	56950.0		
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					1730382.6	1363896.0	1034924.7

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND3500

SECTION: 3500
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.93	1.70	50	250	19762.5		
Iu	2.76	1.70	37.5	250	43987.5	43987.5	43987.5
I	3.71	1.70	350	250	551862.5	551862.5	551862.5
H	0.85	1.70	425	195	119754.4		
G	3.15	1.70	462.5	200	495337.5	495337.5	495337.5
G	1.68	1.70	400	250	285600.0	285600.0	
F	0.00	1.70	0	250			
E	2.24	1.70	450	195	334152.0	334152.0	334152.0
D	0.53	1.70	427.5	195	75109.6		
C	0.67	1.70	337.5	250	96103.1		
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	2021669.1	1710939.5	1425339.5

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984   FILE NAME: IND3750

SECTION: 3750
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	4.25	1.70	380	250	686375.0	686375.0	686375.0
J	0.93	1.70	200	220	69564.0		
I	2.91	1.70	277.5	200	274558.5	274558.5	274558.5
I	3.71	1.70	475	250	748956.3	748956.3	748956.3
H	0.00	1.70	0	250			
G	1.68	1.70	447.5	220	281173.2	281173.2	
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	2060627.0	1991063.0	1709889.8

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND4000

SECTION: 4000
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	4.25	1.70	225	250	406406.3	406406.3	406406.3
J	0.00	1.70	0	250			
I	2.91	1.70	252.5	250	312279.4	312279.4	312279.4
I	3.71	1.70	555	250	875096.3	875096.3	875096.3
H	1.65	1.70	437.5	185	227029.7	227029.7	
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	1820811.6	1820811.6	1593781.9

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND4250

SECTION: 4250
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	4.64	1.70	302.5	250	596530.0	596530.0	596530.0
I	2.91	1.70	92.5	150	68639.6	68639.6	68639.6
I	3.71	1.70	372.5	250	587339.4	587339.4	587339.4
H	1.65	1.70	552.5	250	387440.6	387440.6	
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	1639949.6	1639949.6	1252509.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND4500

SECTION: 4500
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	2.44	1.70	30	250	31110.0	31110.0	31110.0
J	4.64	1.70	12.5	250	24650.0	24650.0	24650.0
I	3.71	1.70	350	250	551862.5	551862.5	551862.5
H	1.65	1.70	512.5	250	359390.6	359390.6	
G	2.98	1.70	575	250	728237.5	728237.5	728237.5
F	1.60	1.70	550	135	201960.0	201960.0	
E	0.76	1.70	522.5	130	87759.1		
D	3.43	1.70	300	135	236155.5	236155.5	236155.5
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	2221125.2	2133366.1	1572015.5

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND4750

SECTION: 4750
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	2.44	1.70	145	250	150365.0	150365.0	150365.0
J	4.64	1.70	345	250	680340.0	680340.0	680340.0
I	3.71	1.70	372.5	250	587339.4	587339.4	587339.4
H	1.65	1.70	847.5	250	594309.4	594309.4	
G	2.98	1.70	897.5	250	1136683.8	1136683.8	1136683.8
F	1.60	1.70	950	165	426360.0	426360.0	
NEW	0.70	1.70	125	250	37187.5		
E	0.64	1.70	775	250	210800.0		
D	3.43	1.70	322.5	250	470124.4	470124.4	470124.4
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	4293509.4	4045521.9	3024852.5

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND5000

SECTION: 5000
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	3.71	1.70	350	250	551862.5	551862.5	551862.5
H	1.65	1.70	322.5	250	226153.1	226153.1	
G	2.98	1.70	437.5	250	554093.8	554093.8	554093.8
F	1.60	1.70	575	250	391000.0	391000.0	
E	0.64	1.70	480	250	130560.0		
D	3.43	1.70	650	250	947537.5	947537.5	947537.5
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					2801206.9	2670646.9	2053493.6

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND5250

SECTION: 5250
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	0.0	0.0	0.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IND5500

SECTION: 5500
RESOURCE TYPE: INDICATED

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	0.00	1.70	0	250			
J	0.00	1.70	0	250			
I	0.00	1.70	0	250			
H	0.00	1.70	0	250			
G	0.00	1.70	0	250			
F	0.00	1.70	0	250			
E	0.00	1.70	0	250			
D	0.00	1.70	0	250			
C	0.00	1.70	0	250			
B	0.00	1.70	0	250			
A	0.00	1.70	0	250			

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	0.0	0.0	0.0

INFERRED RESOURCE TABLES

NOTE: All values are gross before measured and indicated resources have been deducted.

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF1000-2

SECTION: 1000
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
I	2.84	1.70	175	250	211225.0	211225.0	211225.0
H	1.86	1.70	512.5	250	405131.3	405131.3	
G	2.63	1.70	837.5	250	936115.6	936115.6	936115.6
F	0.78	1.70	1150	250	381225.0		
E	1.46	1.70	1620	250	1005210.0	1005210.0	
D	1.62	1.70	1892.5	250	1302986.3	1302986.3	
C	0.56	1.70	2100	250	499800.0		
B	1.50	1.70	2570	250	1638375.0	1638375.0	
A	1.68	1.70	3087.5	250	2204475.0	2204475.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
		TOTAL TONNES THIS SECTON:			8584543.1	7703518.1	1147340.6

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF1250-2

SECTION: 1250
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	177.5	250	231593.1	231593.1	231593.1
J	1.89	1.70	262.5	250	210853.1	210853.1	
I	2.84	1.70	737.5	250	890162.5	890162.5	890162.5
H	1.86	1.70	1162.5	250	918956.3	918956.3	
G	2.63	1.70	1362.5	250	1522934.4	1522934.4	1522934.4
F	0.78	1.70	1472.5	250	488133.8		
E	1.46	1.70	1762.5	250	1093631.3	1093631.3	
D	1.62	1.70	2255	250	1552567.5	1552567.5	
C	0.56	1.70	2857.5	250	680085.0		
B	1.50	1.70	3150	250	2008125.0	2008125.0	
A	1.68	1.70	3475	250	2481150.0	2481150.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	12078191.9	10909973.1	2644690.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF1500-2

SECTION: 1500
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	1247.5	250	1627675.6	1627675.6	1627675.6
J	1.89	1.70	1307.5	250	1050249.4	1050249.4	
I	2.84	1.70	1527.5	250	1843692.5	1843692.5	1843692.5
H	1.86	1.70	2247.5	250	1776648.8	1776648.8	
G	2.63	1.70	2975	250	3325306.3	3325306.3	3325306.3
F	0.78	1.70	3477.5	250	1152791.3		
E	1.46	1.70	3735	250	2317567.5	2317567.5	
D	1.62	1.70	3755	250	2585317.5	2585317.5	
C	0.56	1.70	3625	250	862750.0		
B	1.50	1.70	3577.5	250	2280656.3	2280656.3	
A	1.68	1.70	3522.5	250	2515065.0	2515065.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	21337720.0	19322178.8	6796674.4

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF1750-2

SECTION: 1750
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	1750	250	2283312.5	2283312.5	2283312.5
J	1.89	1.70	1952.5	250	1568345.6	1568345.6	
I	2.84	1.70	2595	250	3132165.0	3132165.0	3132165.0
H	1.86	1.70	3150	250	2490075.0	2490075.0	
G	2.63	1.70	3562.5	250	3981984.4	3981984.4	3981984.4
F	0.78	1.70	3720	250	1233180.0		
E	1.46	1.70	3852.5	250	2390476.3	2390476.3	
D	1.62	1.70	3717.5	250	2559498.8	2559498.8	
C	0.56	1.70	3620	250	861560.0		
B	1.50	1.70	3537.7	250	2255283.8	2255283.8	
A	1.68	1.70	3410	250	2434740.0	2434740.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					25190621.3	23095881.3	9397461.9

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF2000-2

SECTION: 2000
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	1450	250	1891887.5	1891887.5	1891887.5
J	1.89	1.70	1582.5	250	1271143.1	1271143.1	
I	2.84	1.70	2197.5	250	2652382.5	2652382.5	2652382.5
H	1.86	1.70	2777.5	250	2195613.8	2195613.8	
G	2.63	1.70	3282.5	250	3669014.4	3669014.4	3669014.4
F	0.78	1.70	3515	250	1165222.5		
E	1.46	1.70	3600	250	2233800.0	2233800.0	
D	1.62	1.70	3652.5	250	2514746.3	2514746.3	
C	0.56	1.70	3600	250	856800.0		
B	1.50	1.70	3552.5	250	2264718.8	2264718.8	
A	1.68	1.70	3472.5	250	2479365.0	2479365.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	23194693.8	21172671.3	8213284.4

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF2250-2

SECTION: 2250
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	860	250	1122085.0	1122085.0	1122085.0
J	1.89	1.70	1110	250	891607.5	891607.5	
I	2.84	1.70	1925	250	2323475.0	2323475.0	2323475.0
H	1.86	1.70	2585	250	2043442.5	2043442.5	
G	2.63	1.70	3032.5	250	3389576.9	3389576.9	3389576.9
F	0.78	1.70	3322.5	250	1101408.8		
E	1.46	1.70	3417.5	250	2120558.8	2120558.8	
D	1.62	1.70	3442.5	250	2370161.3	2370161.3	
C	0.56	1.70	3572.5	250	850255.0		
B	1.50	1.70	3607.5	250	2299781.3	2299781.3	
A	1.68	1.70	3635	250	2595390.0	2595390.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	21107741.9	19156078.1	6835136.9

File Name: IF2500-2

HOBBIT-BROATCH

RESOURCE CALCULATIONS

December, 1984

Section: 2500

Resource Type: Inferred Type 2

Seam Name	Seam Thk (m)	S.G. (t/m^3)	Seam Length (m)	Influence (m)	Total Tonnes Seams >=0.5 m	Total Tonnes Seams >=1.0 m	Total Tonnes Seams >=2.0 m
K	3.07	1.70	912.5	250	1190584.4	1190584.4	1190584.4
J	1.89	1.70	1427.5	250	1146639.4	1146639.4	
I	2.84	1.70	2167.5	250	2616172.5	2616172.5	2616172.5
H	1.86	1.70	2750	250	2173875.0	2173875.0	
G	2.63	1.70	3035	250	3392371.3	3392371.3	3392371.3
F	0.78	1.70	3100	250	1027650.0		
E	1.46	1.70	3370	250	2091085.0	2091085.0	
D	1.62	1.70	3407.5	250	2346063.8	2346063.8	
C	0.56	1.70	3432.5	250	816935.0		
B	1.50	1.70	3457.5	250	2204156.3	2204156.3	
A	1.68	1.70	3550	250	2534700.0	2534700.0	

Seams:	>=0.5 m	>=1.0 m	>=2.0 m
Total Tonnes This Section:	21540232.5	19695647.5	7199128.1

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF2750-2

SECTION: 2750
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	2025	250	2642118.8	2642118.8	2642118.8
J	1.89	1.70	2280	250	1831410.0	1831410.0	
I	2.84	1.70	3095	250	3735665.0	3735665.0	3735665.0
H	1.86	1.70	3370	250	2663985.0	2663985.0	
G	2.63	1.70	3555	250	3973601.3	3973601.3	3973601.3
F	0.78	1.70	3600	250	1193400.0		
E	1.46	1.70	3770	250	2339285.0	2339285.0	
D	1.62	1.70	3772.5	250	2597366.3	2597366.3	
C	0.56	1.70	3650	250	868700.0		
B	1.50	1.70	3595	250	2291812.5	2291812.5	
A	1.68	1.70	3507.5	250	2504355.0	2504355.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					26641698.8	24579598.8	10351385.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF3000-2

SECTION: 3000
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	1520	250	1983220.0	1983220.0	1983220.0
J	1.89	1.70	1975	250	1586418.8	1586418.8	
I	2.84	1.70	3040	250	3669280.0	3669280.0	3669280.0
H	1.86	1.70	3722.5	250	2942636.3	2942636.3	
G	2.63	1.70	4005	250	4476588.8	4476588.8	4476588.8
F	0.78	1.70	3895	250	1291192.5		
E	1.46	1.70	3752.5	250	2328426.3	2328426.3	
D	1.62	1.70	3577.5	250	2463108.8	2463108.8	
C	0.56	1.70	3522.5	250	838355.0		
B	1.50	1.70	3452.5	250	2200968.8	2200968.8	
A	1.68	1.70	3380	250	2413320.0	2413320.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					26193515.0	24063967.5	10129088.8

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF3250-2

SECTION: 3250
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	897.5	250	1171013.1	1171013.1	1171013.1
J	1.89	1.70	1552.5	250	1247045.6	1247045.6	
I	2.84	1.70	2930	250	3536510.0	3536510.0	3536510.0
H	1.86	1.70	3540	250	2798370.0	2798370.0	
G	2.63	1.70	3897.5	250	4356430.6	4356430.6	4356430.6
F	0.78	1.70	3835	250	1271302.5		
E	1.46	1.70	3810	250	2364105.0	2364105.0	
D	1.62	1.70	3762.5	250	2590481.3	2590481.3	
C	0.56	1.70	3675	250	874650.0		
B	1.50	1.70	3627.5	250	2312531.3	2312531.3	
A	1.68	1.70	3487.5	250	2490075.0	2490075.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					25012514.4	22866561.9	9063953.8

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF3500-2

SECTION: 3500
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	1297.5	250	1692913.1	1692913.1	1692913.1
J	1.89	1.70	1717.5	250	1379581.9	1379581.9	
I	2.84	1.70	535	250	645745.0	645745.0	645745.0
H	1.86	1.70	3852.5	250	3045401.3	3045401.3	
G	2.63	1.70	3775	250	4219506.3	4219506.3	4219506.3
F	0.78	1.70	3695	250	1224892.5		
E	1.46	1.70	3547.5	250	2201223.8	2201223.8	
D	1.62	1.70	3522.5	250	2425241.3	2425241.3	
C	0.56	1.70	3482.5	250	828835.0		
B	1.50	1.70	3437.5	250	2191406.3	2191406.3	
A	1.68	1.70	3337.5	250	2382975.0	2382975.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	22237721.3	20183993.8	6558164.4

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF3750-2

SECTION: 3750
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	1362.5	250	1777721.9	1777721.9	1777721.9
J	1.89	1.70	1672.5	250	1343435.6	1343435.6	
I	2.84	1.70	2902.5	250	3503317.5	3503317.5	3503317.5
H	1.86	1.70	3545	250	2802322.5	2802322.5	
G	2.63	1.70	3752.5	250	4194356.9	4194356.9	4194356.9
F	0.78	1.70	3695	250	1224892.5		
E	1.46	1.70	3535	250	2193467.5	2193467.5	
D	1.62	1.70	3480	250	2395980.0	2395980.0	
C	0.56	1.70	3445	250	819910.0		
B	1.50	1.70	3417.5	250	2178656.3	2178656.3	
A	1.68	1.70	3367.5	250	2404395.0	2404395.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
		TOTAL TONNES THIS SECTON:			24838455.6	22793653.1	9475396.3

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF4000-2

SECTION: 4000
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	1362.5	250	1777721.9	1777721.9	1777721.9
J	1.89	1.70	1672.5	250	1343435.6	1343435.6	
I	2.84	1.70	2947.5	250	3557632.5	3557632.5	3557632.5
H	1.86	1.70	3470	250	2743035.0	2743035.0	
G	2.63	1.70	3652.5	250	4082581.9	4082581.9	4082581.9
F	0.78	1.70	3620	250	1200030.0		
E	1.46	1.70	3450	250	2140725.0	2140725.0	
D	1.62	1.70	3427.5	250	2359833.8	2359833.8	
C	0.56	1.70	3425	250	815150.0		
B	1.50	1.70	3372.5	250	2149968.8	2149968.8	
A	1.68	1.70	3347.5	250	2390115.0	2390115.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	24560229.4	22545049.4	9417936.3

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF4250-2

SECTION: 4250
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	457.5	250	596923.1	596923.1	596923.1
J	1.89	1.70	935	250	751038.8	751038.8	
I	2.84	1.70	2587.5	250	3123112.5	3123112.5	3123112.5
H	1.86	1.70	3350	250	2648175.0	2648175.0	
G	2.63	1.70	3565	250	3984778.8	3984778.8	3984778.8
F	0.78	1.70	3580	250	1186770.0		
E	1.46	1.70	3575	250	2218287.5	2218287.5	
D	1.62	1.70	3525	160	1553256.0	1553256.0	
C	0.56	1.70	3527.5	250	839545.0		
B	1.50	1.70	3425	250	2183437.5	2183437.5	
A	1.68	1.70	3382.5	250	2415105.0	2415105.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	21500429.1	19474114.1	7704814.4

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF4500-2

SECTION: 4500
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	125	250	163093.8	163093.8	163093.8
J	1.89	1.70	430	250	345397.5	345397.5	
I	2.84	1.70	2225	250	2685575.0	2685575.0	2685575.0
H	1.86	1.70	3275	250	2588887.5	2588887.5	
G	2.63	1.70	3385	250	3783583.8	3783583.8	3783583.8
F	0.78	1.70	3307.5	250	1096436.3		
E	1.46	1.70	3455	250	2143827.5	2143827.5	
D	1.62	1.70	3502.5	250	2411471.3	2411471.3	
C	0.56	1.70	3475	250	827050.0		
B	1.50	1.70	3420	250	2180250.0	2180250.0	
A	1.68	1.70	3370	250	2406180.0	2406180.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					20631752.5	18708266.3	6632252.5

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF4750-2

SECTION: 4750
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	555	250	724136.3	724136.3	724136.3
J	1.89	1.70	1102.5	250	885583.1	885583.1	
I	2.84	1.70	2462.5	250	2972237.5	2972237.5	2972237.5
H	1.86	1.70	3275	250	2588887.5	2588887.5	
G	2.63	1.70	3545	250	3962423.8	3962423.8	3962423.8
F	0.78	1.70	3510	250	1163565.0		
New	0.70	1.70	527.5	250	156931.3		
E	1.46	1.70	3557.5	250	2207428.8	2207428.8	
D	1.62	1.70	3652.5	250	2514746.3	2514746.3	
C	0.56	1.70	3410	250	811580.0		
B	1.50	1.70	3422.5	250	2181843.8	2181843.8	
A	1.68	1.70	3375	250	2409750.0	2409750.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	22579113.1	20447036.9	7658797.5

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF5000-2

SECTION: 5000
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
J	1.89	1.70	515	250	413673.8	413673.8	
I	2.84	1.70	1680	250	2027760.0	2027760.0	2027760.0
H	1.86	1.70	2872.5	250	2270711.3	2270711.3	
G	2.63	1.70	3380	250	3777995.0	3777995.0	3777995.0
F	0.78	1.70	3320	250	1100580.0		
E	1.46	1.70	3477.5	250	2157788.8	2157788.8	
D	1.62	1.70	3500	250	2409750.0	2409750.0	
C	0.56	1.70	3387.5	250	806225.0		
B	1.50	1.70	3397.5	250	2165906.3	2165906.3	
A	1.68	1.70	3360	250	2399040.0	2399040.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					19529430.0	17622625.0	5805755.0

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF5250-2

SECTION: 5250
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	575	250	750231.3	750231.3	750231.3
J	1.89	1.70	1015	250	815298.8	815298.8	
I	2.84	1.70	1575	250	1901025.0	1901025.0	1901025.0
H	1.86	1.70	2872.5	250	2270711.3	2270711.3	
G	2.63	1.70	3247.5	250	3629893.1	3629893.1	3629893.1
F	0.78	1.70	3260	250	1080690.0		
E	1.46	1.70	3397.5	250	2108148.8	2108148.8	
D	1.62	1.70	3382.5	250	2328851.3	2328851.3	
C	0.56	1.70	3342.5	250	795515.0		
B	1.50	1.70	3322.5	250	2118093.8	2118093.8	
A	1.68	1.70	3285	250	2345490.0	2345490.0	

	SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:	20143948.1	18267743.1	6281149.4

HOBBIT BROATCH : RESOURCE CALCULATIONS December 1984 FILE NAME: IF5500-2

SECTION: 5500
RESOURCE TYPE: INFERRED TYPE 2

SEAM NAME	SEAM THK (m)	SPEC GRAV (t/m3)	SEAM LENGTH (m)	INFLUENCE (m)	TOTAL TONNES SEAMS >=0.5m	TOTAL TONNES SEAMS >=1.0m	TOTAL TONNES SEAMS >=2.0m
K	3.07	1.70	177.5	250	231593.1	231593.1	231593.1
J	1.89	1.70	822.5	250	660673.1	660673.1	
I	2.84	1.70	1795	250	2166565.0	2166565.0	2166565.0
H	1.86	1.70	2422.5	250	1914986.3	1914986.3	
G	2.63	1.70	2850	250	3185587.5	3185587.5	3185587.5
F	0.78	1.70	3062.5	250	1015218.8		
E	1.46	1.70	3330	250	2066265.0	2066265.0	
D	1.62	1.70	3365	250	2316802.5	2316802.5	
C	0.56	1.70	3322.5	250	790755.0		
B	1.50	1.70	3290	250	2097375.0	2097375.0	
A	1.68	1.70	3267.5	250	2332995.0	2332995.0	
					SEAMS >=0.5M:	SEAMS >=1.0M:	SEAMS >=2.0M:
TOTAL TONNES THIS SECTON:					18778816.3	16972842.5	5583745.6

SPECULATIVE RESOURCE CALCULATIONS

Hobbit-Broatch Area

SPECULATIVE RESOURCE CALCULATIONS

Coal = Area x (25% x Average Aggregate Seam Thickness) x Specific Gravity
((LF + HB)/2)

Area = 40,985,000 m^2

Average Aggregate Seam Thickness = (25.90 + 44.52/2 = 25.2/m

Specific Gravity 1.70 tonnes/m^3

Speculative Resource - 40,985,00 m^2 x (25% 35.2/m) x 1.70t/m^3

Hobbit-Broatch Total Speculative Resource 613,309,786 tonnes