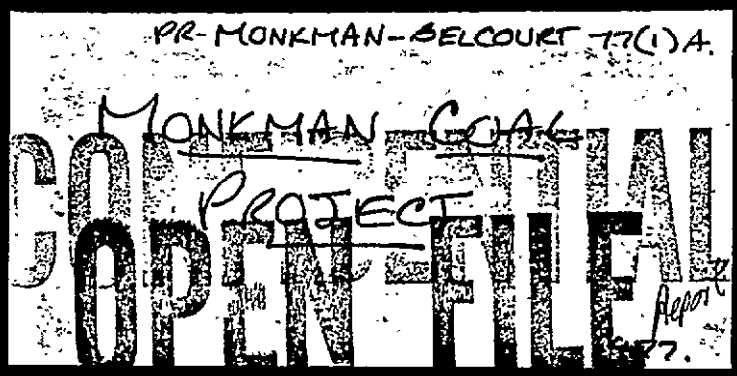

1977 Exploration Report

542

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VOL I

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Pacific Petroleums Ltd.

MONKMAN COAL PROJECT

1977

Location: N.T.S. 93I/7, 8, 10, 15

Coal Licence Nos:

3131-3135	3170-3174
3138-3139	3177-3184
3141-3149	3187-3190
3151-3155	3193
3157-3164	3195-3207
3166-3168	3209-3264

Authors: L. A. Smith, A. E. Bienia and J. Y. Wright
Date Submitted: January 13, 1978

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 542

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TABLE OF CONTENTS

Volume I	Page
Location and Means of Access	1
Tenure of Mineral Rights	1
Previous Work	1
1977 Field Program	2
Geology	12
Coal Quality	19

Volume II

Diamond Drill Logs
Trench Logs

Volume III

Geophysical Logs

List of Figures

		Page
1.	Location Map	2
2.	Index Map	Pocket 1
3.	Survey Control Data	Pocket 1
4.	Geological Map, Duke Mountain Block	Pocket 2
5.	Geological Map, Five Cabin Block	Pocket 2
6.	Surface Disturbance Map	Pocket 1
7.	Correlation Chart	16
8-23.	Geological Sections, Duke Mountain Block	33
24-27.	Geological Sections, Five Cabin Block	49
28.	M.O.F. Diagram	32

List of Tables

		Page
1.	Licence Groupings and Expenditures	3
2.	1977 Cost Breakdown	5
3.	Coal Seam Data	6
4.	Pacific Personnel Employed	8
5.	Principal Contractors	9
6.	Trench Analyses	13
7.	Table of Formations	14
8-15.	Summaries of Analytical Data, by Seam	22
16.	Summary of Rheological Data	30
17.	Summary of Petrographic Data	31

LOCATION AND MEANS OF ACCESS

The Monkman Coal Project is located in the southern part of the Peace River Coalfield, approximately 630 km by air north-northeast of Vancouver, British Columbia. (Fig. 1)

The most convenient access route is by the Kinuseo Falls road which connects the property with Beaverlodge, Alberta. There is also road access from Dawson Creek, B.C. The 1977 campsite was located adjacent to the Kinuseo Falls road where it crosses Kinuseo Creek, 11 km west of Stony Lake.

TENURE OF MINERAL RIGHTS

The property is comprised of one hundred and nineteen coal licences registered jointly in the names of Canadian Superior Exploration Limited and McIntyre Mines Limited. Pacific Petroleums Ltd. is carrying out exploratory work under an agreement with the above companies.

These licences cover 66,211 acres (26,795 hectares).

Grouping of Licences

The licence groupings for assessment purposes which were in effect at the time of the 1976 assessment report were seen to be a hindrance to the planning of effective exploration in the areas of current interest, in that lands with obvious future potential might be lost for lack of attention in the current season. An application to regroup was, therefore, submitted to the Chief Gold Commissioner on December 13, 1977. The new groupings are tabulated in Table 1.

Due Date for Assessment Work

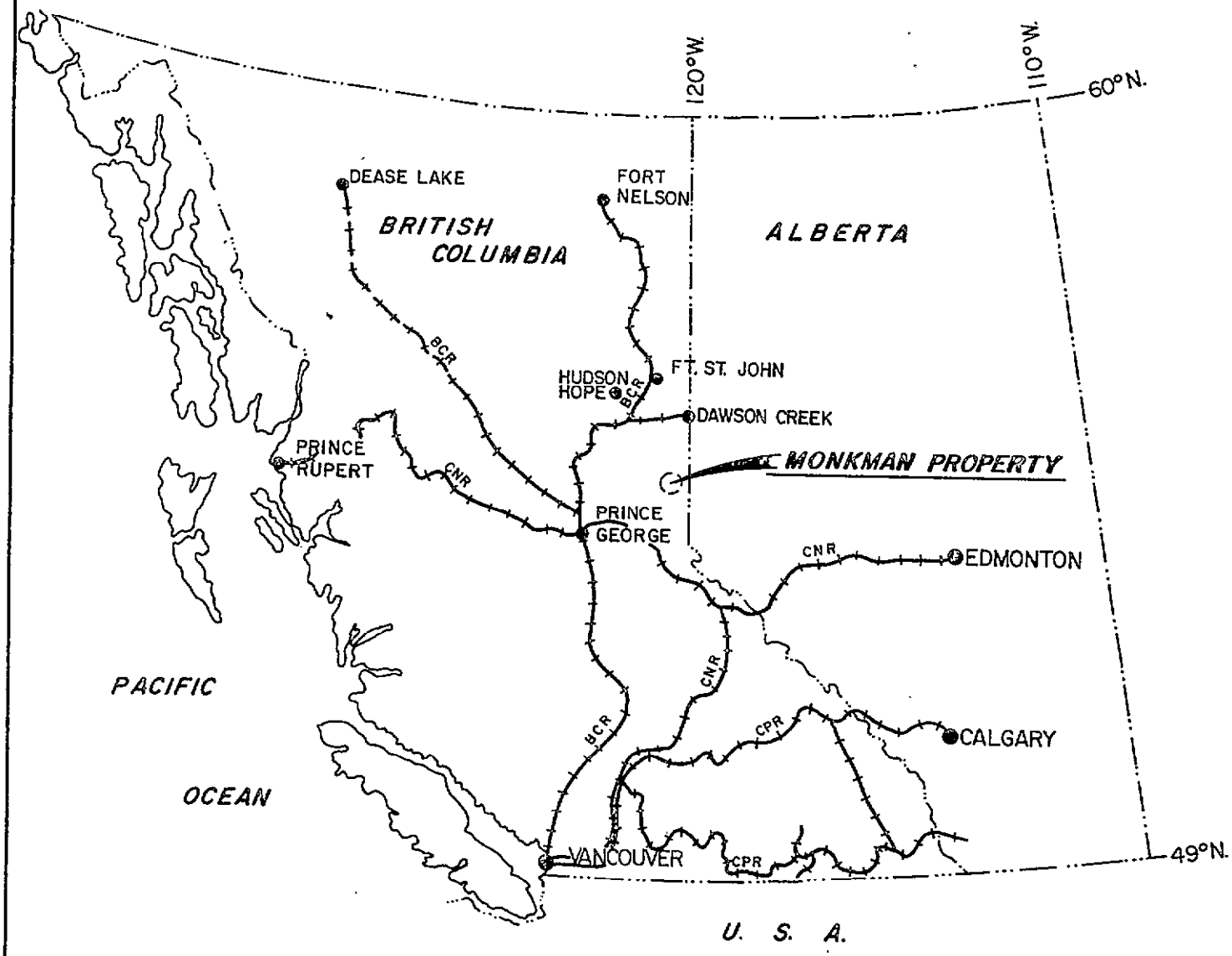
The uniform date for submission of assessment work is December 16th. The Administrator for Coal has kindly granted an extension of one month for the preparation of this geological report.

PREVIOUS WORK

Work was done previously in this area by the Geological Survey of Canada (1), McIntyre Porcupine Mines Ltd. (2,3), Canadian Superior Oil Ltd. (4), and Pacific Petroleums Limited (5). The 1977 program completes the Phase I exploration program started by Pacific Petroleums in 1976. The 1976 program was comprised of reconnaissance mapping and diamond drilling to determine the geological structure of the Lower Cretaceous exposures on the property, to gain preliminary indications of coal quality in the coal measures, and thus to identify areas with mining potential.

---

1 Stott, D.F.
1968: Lower Cretaceous Bullhead and Fort St. John Groups, Between Smoky and Peace Rivers, Rocky Mountain Foothills, Alberta and British Columbia. G.S.C. Bulletin 152.



PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

LOCATION MAP

Date	November 1977
Revised	
Author	
Drafted	R.P.B.
Scale	1:10,000,000

FIGURE 1

MONKMAN COAL PROJECT

Groupings as of 16 December, 1977

Group	Licences	Acreage	Work Acreage	1977 Expenditures	Expenditures Per Acre
A	3239, 3242, 3258, 3259, 3260 3261, 3262, 3263, 3264	4,791.36	4796	38,985.95	8.12
B	3238, 3240, 3241, 3243, 3244 3246, 3247, 3249, 3250, 3251	5,528.46	5531	32, 035.82	5.79
C	3233, 3245, 3234, 3248, 3254 3255, 3256, 3257	3,879.87	3883	25,220.68	6.49
D	3228, 3229, 3230, 3231, 3232	1,812.66	1815	15,194.73	8.37
E	3214, 3215, 3216, 3219, 3220 3221, 3222, 3226, 3227, 3252	7,381.32	7387	87,148.23	11.79
F	3213, 3217, 3218, 3223, 3224 3225, 3235, 3236, 3237, 3253	5,166.14	5171	31,577.41	6.10
G	3199, 3200, 3202, 3203, 3204 3205, 3209, 3210, 3211, 3212	5,169.08	5176	59,347.72	11.46
H	3183, 3184, 3187, 3188, 3189 3190, 3198, 3201, 3206, 3207	5,176.62	5182	42,098.62	8.12
I	3177, 3178, 3179, 3180, 3181 3182, 3193, 3195, 3196, 3197	7,031.46	7036	57,987.94	8.24
J	3131, 3166, 3167, 3168, 3170 3171, 3172, 3173, 3174	5,008.72	5013	-	-
11	3154, 3155, 3157, 3158, 3159 3160, 3161, 3162, 3163, 3164	5,576.98	5582	-	-
12	3145, 3148, 3149	2,233.76	2235	-	-
13	3139, 3141, 3142, 3143, 3144 3146, 3147, 3151, 3152, 3153	5,215.47	5222	-	-
14	3132, 3133, 3134, 3135, 3138	2,239.08	2242	-	-

TABLE 1

389,597.10

1977 FIELD PROGRAM

A. General Statement

The 1977 exploration program was designed to complete the reconnaissance exploration of the property. Accordingly, the majority of the work was concentrated on the Duke Mountain Block (see Figure 2) which had previously been neglected because of lack of mapping control and paucity of exposures. Further attention was also given to the Five Cabin Block. The expenditures incurred are listed in Table 2, and the personnel employed and contractor services are listed in Tables 4 and 5.

B. Surveying and Photogrammetry

Thick forest cover and poor outcrop exposure in the Duke Mountain Block cause difficulty in location of points in the field. To overcome this problem, survey control was established on Duke Mountain and Five Cabin Blocks (see Figure 3). Using this control and existing 1:25,000 scale photography, 1:5000 scale topographic maps with 5 metre contours were prepared by R. M. Hardy and Associates. These maps provided the base for the geological maps.

A mining base line was drawn on the map using the point 54° 40' N, 120° 36' E as 1000 m north. The baseline trends on an azimuth of 322° from this point and parallels the regional geology. Cross sections drawn for geological or other purposes are referred to this base line which is designated "Mine North".

C. Geological Mapping

A four-man crew commenced geological mapping on the Duke Mountain Block in early June. The 1:5000 scale maps and 1:2500 scale enlargements were used in the field for locating and plotting the geology.

---

2 Lidgett, W. D.
1970: Report on Monkman Pass Coal Project; McIntyre Porcupine Mines Ltd., Vancouver, B.C.

3 McKelvie, D. L.
1973: Geological Report on Monkman Pass Coal Licences; McIntyre Porcupine Mines Ltd., Vancouver, B.C.

4 Paul Dyson Consultants
1975: Geology and Coal Potential of Belcourt-Monkman Area, British Columbia; Prepared for Canadian Superior Oil Ltd., Calgary.

5 Smith, L. A. and Rowe, R. B.
1976: Report on 1976 Exploration Program, Monkman Coal Property, Peace River Coalfield, Pacific Petroleums Ltd., Calgary.

MONKMAN COAL PROJECT

1977 COST BREAKDOWN

GROUP	DISTRICT AND ADMIN.	CONTROL & NON-CONT. FIELD EQUIPT.	VEHICLE RENTAL & MAINT.	CATWORK AND SLASHING	CAMP & CATERING	DIAMOND DRILLING	GEOPHYS. LOGGING	COAL TESTS AND ANALYSIS	TRUCKING	TRENCH-ING	TOPO-GRAPHIC SURVEYS	AIRCRAFT CHARTER	SALARY AND TRAVEL	SUB TOTAL	WORK ACREAGE	WORK DONE/ ACRE **
A	1926.32	1221.21	1611.18	4812.70	1038.78	14,435.54	1193.17	595.17	787.75	348.69	2973.72	4297.20	3744.52	38,985.95	4796	8.12
B	3065.18	1912.62	2563.70	5567.00	2201.59				1411.22	703.34	4439.80	4839.97	5331.40	32,035.82	5531	5.79
C	2404.11	1492.24	2009.08	5910.32	844.01				1140.05	283.31	3416.15	3678.98	4042.43	25,220.68	3883	6.49
D	732.81	463.83	611.94	1827.90	394.54	5475.56	452.58		299.19	132.44	1129.44	1252.30	2422.20	15,194.73	1815	8.37
E	481.34	387.00	389.58	2436.55	605.12	65,395.49	5405.22	7142.11	217.23	238.80	1594.97	1068.82	1786.00	87,148.23	7387	11.79
F	2920.46	1821.02	2442.86	8206.05	1123.68				852.14	377.19	4216.77	4566.68	5050.56	31,577.41	5171	6.10
G	2088.98	1322.20	1744.41	5210.68	1124.68	30,302.20	2504.62	2975.87	852.90	377.53	3219.63	3569.85	4054.17	59,347.72	5176	11.46
H	2092.69	1324.55	1747.50	5219.94	1126.68	17,079.98	1411.75		854.42	378.20	3225.35	3576.19	4061.37	42,098.62	5182	8.12
I	2840.35	1797.77	2371.84	7084.86	1529.21	22,866.64	1890.04	1190.35	1159.67	513.32	4377.66	4853.86	5512.37	57,987.94	7036	8.24
TOTALS	18552.24	11742.44	15492.09	46276.00	9988.29	155,555.41	12857.38	11903.50	7574.57	3352.82	28593.49	31703.85	36005.02	389,597.12	45977	

10

** 1977 Only

Table 2

MONKMAN COAL PROJECT

1977 COAL SEAM DATA

Coal Seam	Interval (metres)	Thickness Recovered (metres)	Log Thickness (metres)	Dip	True Thickness (metres)	Recovery (%)
Drill Hole MDD 77 - 2B						
B11	40.29 - 41.49	1.20	1.20	23°	1.10	100
B10(U)	57.56 - 58.14	0.58	0.79	23°	0.74	73.4
B10(L)	59.79 - 61.27	1.48	1.52	23°	1.40	97.4
B9	78.66 - 81.56	2.90	2.90	23°	2.67	100
B8	95.09 - 95.85	0.86	0.86	24°	0.79	100
B7	111.52 - 112.58	0.66	0.66	22°	0.62	100
B5	145.00 - 145.89	0.89	1.80	21°	0.83	49.4
B4	195.88 - 203.32	7.44	8.56	20°	7.99	86.9
B3	209.40 - 214.49	5.09	5.35	25°	4.85	95.0
B1	250.56 - 253.68	3.12	3.44	21°	3.21	90.7
					Average	89.4
Drill Hole MDD 77 - 3						
A3	38.10 - 38.53	0.32	0.43	20°	0.30	74.4
A2	65.74 - 68.70	2.33	2.96	21°	2.76	80.3
A1	155.26 - 156.42	0.73	1.16	20°	0.69	62.9
					Average	85.05
Drill Hole MDD 77 - 4						
B11	41.07 - 41.91	0.84	0.84	15°	0.81	100
B9	93.84 - 99.47	5.63	5.63	13°	5.49	100
B6	137.95 - 139.02	0.92	1.07	15°	1.03	86.0
B5	155.05 - 156.11	1.02	1.06	15°	1.02	96.2
B4	199.00 - 203.30	3.60	5.52	18°	5.25	65.3
B4	205.80 - 208.18	2.19	2.38	19°	2.25	92.0
B3	223.71 - 224.96	1.00	1.25	13°	1.22	80.0
B3	225.98 - 226.90	0.92	0.89	13°	0.87	100
B3	228.29 - 229.64	0.65	1.35	13°	1.32	48.2
B2	256.90 - 257.76	0.86	0.86	15°	0.83	100
B1(U)	264.82 - 267.31	2.49	2.74	14°	2.66	90.9
B1(L)	271.58 - 273.73	1.66	2.83	17°	2.71	58.7
					Average	82.44
Drill Hole MUD 77 - 5						
B11	85.14 - 86.26	1.12	1.12	78° *	1.10	100
B9	126.77 - 133.24	6.26	6.47	78°	6.33	96.8
B6	163.21 - 166.37	3.16	2.96	78°	2.89	100.0
B5	184.00 - 184.77	0.77	0.83	78°	0.81	92.8
					Average	97.7

* BCA

TABLE 3

TABLE 3 (cont'd.)

Coal Seam	Interval (metres)	Thickness Recovered (metres)	Log Thickness (metres)	Dip	True Thickness (metres)	Recovery (%)
Drill Hole MDD 77 - 7						
B10	8.65 - 12.03	3.38	3.38	19°	3.20	100
B9	30.92 - 33.76	2.74	2.80	19°	2.65	97.9
B7	55.17 - 58.67	3.50	3.50	18°	3.33	100
B6	69.49 - 70.14	0.65	0.76	18°	0.72	85.5
B5	87.78 - 89.53	1.75	2.10	18°	2.00	83.3
B4	131.64 - 140.96	9.02	9.10	20°	8.55	99.1
B3	152.71 - 158.80	6.00	6.10	16°	5.86	98.4
B2	174.66 - 175.29	0.63	0.63	16°	0.61	100
B1	187.93 - 191.11	2.83	2.90	15°	2.80	97.6
					Average	97.5
Drill Hole MDD 77 - 8						
B5	21.00 - 23.20	0.32	2.20	29°	1.92	14.5
B4	58.83 - 69.03	8.93	9.60	25°	8.70	93.0
B3	87.58 - 93.47	5.69	5.40	27°	4.81	100
					Average	85.2

TABLE 4

Pacific Personnel Employed, 1977

Field

L. A. Smith	-	Senior Geologist
J. D. van der Lee	-	Geologist
A. E. Bienia	-	Geologist
B. Klappstein	-	Geological Assistant
C. Gretener	-	Field Assistant
M. Zeindler	-	Field Assistant
A. G. Speed	-	Engineering Supervisor

Office

L. A. Smith	-	Senior Geologist
A. E. Bienia	-	Geologist
R. P. Balabas	-	Senior Technician
J. Y. Wright	-	Geological Supervisor

TABLE 5

Principal Contractors, 1977

Diamond Drilling:	D. W. Coates Enterprises Vancouver, B.C.
Geophysical Logging:	Roke Oil Enterprises Ltd. Calgary, Alberta
Photogrammetry:	R. M. Hardy and Associates Calgary, Alberta
Bulldozers:	Grizzly Valley Contractors Fort Assiniboine, Alberta
	L. I. Adams Contractors Ltd. Grande Prairie, Alberta
Slashing:	Grizzly Valley Contractors Fort Assiniboine, Alberta
Helicopters:	Highland Helicopters Ltd. Vancouver, B.C.
	Ed Darvill Copters Grande Prairie, Alberta
Camp:	G.I.C. Industries Ltd. Edmonton, Alberta
	Jim Clay Rentals Ltd. Strathmore, Alberta
Catering:	Crown Caterers Edmonton, Alberta
Analyses:	Loring Laboratories Ltd. Calgary, Alberta
	Warnock Hersey Professional Services Ltd. Calgary, Alberta
	Cascade Coal Petrography Ltd. Calgary, Alberta
Trucks:	Edgar and Sissel Trucking Ltd. Grande Prairie, Alberta
	Hillbrand Industries Edmonton, Alberta
	W. M. Kosik Hauling Ltd. Valleyview, Alberta
	Wally's Trucking Service Ltd. Grande Prairie, Alberta
Backhoe:	Dale's Trenching Service Valleyview, Alberta

A modified plane table system using map board, chain and compass was used for ground control. Once an outcrop was located, its outline, accompanied by all relevant geological information, was plotted directly on the field maps. This information was later transferred to maps in the field office so that a permanent record was kept. Initial traverses supplied a framework of information and fill-in traverses were carried out as required in order to obtain sufficient information for compilation of the geological map. The information was transferred to the 1:25,000 scale compilation map which appears as Figure 4. Geological mapping continued on the Duke Mountain Block throughout the season. In addition, a number of traverses were carried out on the Five Cabin Block. This work is shown in Figure 5.

D. Diamond Drilling

Once the geological mapping had delineated several promising mining prospects, drill sites were located and diamond drilling commenced in early August. D. W. Coates Enterprises of Vancouver carried out the drilling on a contract basis using a Longyear Super 38 diamond drill equipped with an HQ core barrel. The skid-mounted rig was moved from site to site with a D6-C Caterpillar tractor. A total of 2045 metres was drilled at eight separate locations. (See Figure 6 - "77" series holes.) Serious difficulties were encountered at only one location, MDD-77-2, where three holes were required to complete the section. The casing slipped down the hole on the first attempt (MDD-77-2), the rods stuck and had to be blasted on the second attempt (MDD-77-2A), and the third attempt (MDD-77-2B) was successful. Six of the eight drilling locations proved successful in penetrating the coal measures. Table 2 shows the coal seams intersected and the recovery of the coal sections. The coal recovery was good, although difficulties were encountered occasionally. The overall average recovery was over 85%, which was a significant improvement over the previous year.

E. Road Construction

Initially, one and later two, D6-C Caterpillar tractors were contracted to build, upgrade and maintain drill sites and access roads. Figure 6 shows all construction on the Duke Mountain Block. The pre-existing Duke Mountain access road was upgraded to provide access to drill sites MDD-77-2, MDD-77-3, MDD-77-7 and MDD-77-8. Approximately 1.2 km of new road was built from drill site MDD-77-8 to MDD-77-2. This road is 16 feet wide and, with the exception of one switchback and one hill, maintains a grade of less than 10%. Drill site MQD-77-1 required 0.3 km of new road construction.

The majority of the road construction was carried out in the Duchess Mountain area to provide access to drill sites MUD-77-4, MUD-77-5 and MUD-77-6. This road leaves the Wapiti River road just south of the Fearless Creek crossing and winds southeast toward drill site MUD-77-5. It comprises 11.8 km of new road and 2.7 km of seismic line. Inordinately wet conditions did not readily permit the installation of culverts so several small water crossings were bladed out. This road was wet and sloppy at all times and was not upgraded for 4 x 4 access. The Duchess Mountain drill sites were serviced by a Hillbrand K-4 all-terrain vehicle. This allowed minimal road construction, decreased road construction costs and minimized environmental damage. The Hillbrand proved versatile, reliable and rugged and did not make large ruts.

F. Reclamation

Reclamation work commenced in mid-August and was carried out on a part-time basis until late September by Grizzly Valley Contractors. Heavy rainfall in late September forced the slashing and erosion control crews to stop work. Other commitments kept them from returning to complete the work. Winter had set in by the time it was realized that Grizzly Valley Contractors had no intention of carrying out the remaining work, which will be done early in the 1978 field season.

The following reclamation was carried out:

Trenches - Thirty of the thirty-one trenches were filled in and levelled. No seeding was done.

Drill sites - No slashing was done around any of the 8 drill sites cleared, and only drill sites MDD-77-3, MDD-77-7 and MDD-77-8 were levelled and bladed. No seeding was done.

Campsite - Both the Pacific campsite at Kinuseo Creek and the driller's camp at Honeymoon Creek were cleaned of all debris and levelled. The loading site at Honeymoon Creek was not levelled and neither of the areas was re-seeded.

Roads - Slashing of the access road to Duchess Mountain was completed on 2.3 km of the 11.8 km of new road. The steeper slopes were cross-ditched to provide erosion control. The brush along the access road to drill site MQD-77-1 was totally disposed of by burial. No slashing was done on the access road to MDD-77-2; however, all the grades on the Duke Mountain access road and the road to MDD-77-2 were cross-ditched.

G. Geophysical Logging

All six drill holes that successfully intersected the projected coal measures were logged with an array of down-hole geophysical tools which included gamma ray, neutron, density, caliper and focused beam resistivity logs and a directional dipmeter tool. Roke Oil Enterprises of Calgary provided these services on a contract basis. Copies of the logs are enclosed in the file folder (Volume III) which accompanies this report.

H. Core Logging, Sampling and Analytical Work

The core descriptions for the drill holes were carried out by A. E. Bienia, J. D. van der Lee and L. A. Smith, and are enclosed in Volume II of this report. The cores were delivered to the core shack daily and the major coal intervals logged and sampled as soon as possible, ahead of the logging of the intervening rock intervals. The rock units were logged lithologically with no restriction as to unit size. The coal intervals were logged on a detailed basis and notes were taken on visual ash content, brightness, friability and core recovery. The seams

were sampled lithologically, generally based on visual ash content. Maximum length of core included in any one sample was 2 metres. The samples were bagged in plastic bags, much of the air was squeezed out, the tops were twisted to exclude air and the tops were taped. The samples were flown to Calgary weekly and delivered to Loring Laboratories.

The remainder of the cores were left in the core boxes and delivered to the Charlie Lake core storage facility at the end of the season.

I. Trenching

A program of hand trenching and backhoe trenching was carried out to determine coal thickness and quality for those seams which outcrop.

The tracked backhoe proved to be a very valuable trenching machine, with the ability to ascend steep slopes and cross mudholes. The small neat trench and neatly piled dirt made reclamation very easy.

The seams were dug out to expose roof and floor strata and logged. All seams over 1.5 metres thick were channel sampled and sent for analysis. The trench logs are to be found in Volume II of this report, and the analyses in Table 6. The trench locations appear on the geological maps, Figures 4 and 5.

Five backhoe trenches were excavated on the Five Cabin Block, one hand trench on Quintette Mountain and twenty-five trenches on the north slope of Duke Mountain.

GEOLOGY

A. General Statement

The regional geology of the northeast B.C. Foothills was discussed by Stott (1968) and in more specific terms relative to the Monkman Coal Property by Smith and Rowe (1976). The outcrop pattern of the Lower Cretaceous rocks is shown on the index map (Figure 2) which also indicates the structural units into which the property has been divided. This report is concerned only with the geology of the Duke Mountain Block and the Five Cabin Block.

The Table of Formations (Table 7) outlines the stratigraphy of the Lower Cretaceous section exposed on the property. Information collected for this report has not substantially added to our knowledge of the stratigraphy; however, an expanded discussion of the coal measures is now possible. All of the potentially economic coal seams occur within the Gething Formation and the Gates Member of the Commotion Formation.

TABLE 6

ANALYSES OF TRENCH SAMPLES

TRENCH NUMBER	WIDTH (METRES)	% H_2O	% VOL MATTER	% ASH	% FIXED CARBON	% S	CALORIFIC VALUE kJ/kg
STB-1	0.65	10.55	23.51	20.60	45.34	.55	20,322
STB-2	2.75	18.14	25.25	14.77	41.84	.27	18,063
STB-3	1.15	10.86	26.87	9.87	52.40	.47	23,011
STB-4	2.80	13.13	22.44	28.02	36.41	.40	16,171
STB-5	1.41	9.33	26.01	7.48	57.18	.31	24,237
STB-6	2.88	14.57	24.94	14.59	45.90	.37	19,893
STB-8	1.72	17.26	23.85	16.67	42.22	.36	17,968
STB-9	1.76	12.61	26.73	7.77	52.89	.45	22,981
STB-10	1.84	17.87	24.23	13.92	43.98	.38	19,041
STB-11	2.90	9.85	18.62	43.22	28.31	.29	12,371
STB-12	1.22	13.50	25.48	16.38	44.64	.50	20,036
STB-13	1.50	9.60	25.04	15.62	49.74	.38	20,995
STB-16	1.58	10.87	23.94	17.37	47.82	.35	19,778
STB-18	2.34	14.00	23.66	21.70	40.64	.28	17,438
STB-19	2.30	14.24	23.11	22.21	40.44	.29	17,345
STB-23	6.00	17.07	24.08	14.58	44.27	.26	19,126
STB-25	2.29	4.53	23.90	19.57	52.00	.26	23,865
STB-26	5.15	14.97	25.13	15.58	44.32	.15	19,638
STB-27	1.66	6.00	22.39	31.94	39.67	.27	16,912
STB-28	2.90	5.83	28.03	9.49	56.65	.24	24,777
STA-1	4.32	10.90	24.96	18.93	45.21	.22	19,599
STA-29	1.86	17.11	23.13	15.69	44.07	.22	18,424
HTB-1	3.45	14.40	23.30	19.59	42.71	.24	17,817

Analyses are reported on an air-dried basis. Trenches STB 7, 14, 15, 17, 20, 21, 22, 24 and 30 were not sampled.

TABLE 7 - TABLE OF FORMATIONS (after Stott)

Series	Group	Formation		Thickness (metres)	Lithology
Upper and Lower Cretaceous	Fort St. John	Shaftesbury			Dark grey marine shale and silty marine shale with sideritic concretions; sandstone; siltstone; mudstone; minor conglomerate in lower part.
Lower Cretaceous		Commotion	Boulder Creek Member		Fine-grained, well-sorted sandstone; massive conglomerate; non-marine sandstone and mudstone.
			Hulcross Member	65-95	Dark grey marine shale with sideritic concretions.
			Gates Member	295-400	Fine-grained, marine and non-marine sandstones; conglomerate; coal; shale and mudstone.
		Moosebar		40-80	Dark grey marine shale with sideritic concretions; glauconitic sandstone and pebbles at base.
	Bullhead	Gething		30-150	Fine- to coarse-grained, brown, calcareous, carbonaceous sandstone; coal; carbonaceous shale and conglomerate.
		Cadomin		75-200	Massive conglomerate containing chert and quartzite pebbles.
Lower Cretaceous and Earlier	Minnes				Fine-grained sandstone and carbonaceous shale.

In the Duke Mountain and Five Cabin areas the Gething Formation consists of 150 metres of fine to very coarse grained continental sediments which lie unconformably on the Cadomin Conglomerate.

The Lower Gething is comprised of interbedded mudstone, siltstone and sandstone with numerous thin coal seams, usually less than 1 metre thick, but occasionally reaching 3 metres in thickness. The coal seams are commonly underlain and overlain by mudstones which contain large amounts of plant leaf and plant stem fossil fragments. Conglomerate does not commonly occur in this section.

Conglomeratic horizons up to 8 metres thick occur within the upper half of the Gething; however, the bulk of the unit is comprised of sandstone and siltstone. This unit contains at least one coal seam of economic interest. A seam varying from 2.5 to 4 metres in thickness (the A2 seam) occurs persistently within this zone. The contact between the Gething Formation and the overlying Moosebar shales is sharp and well-defined.

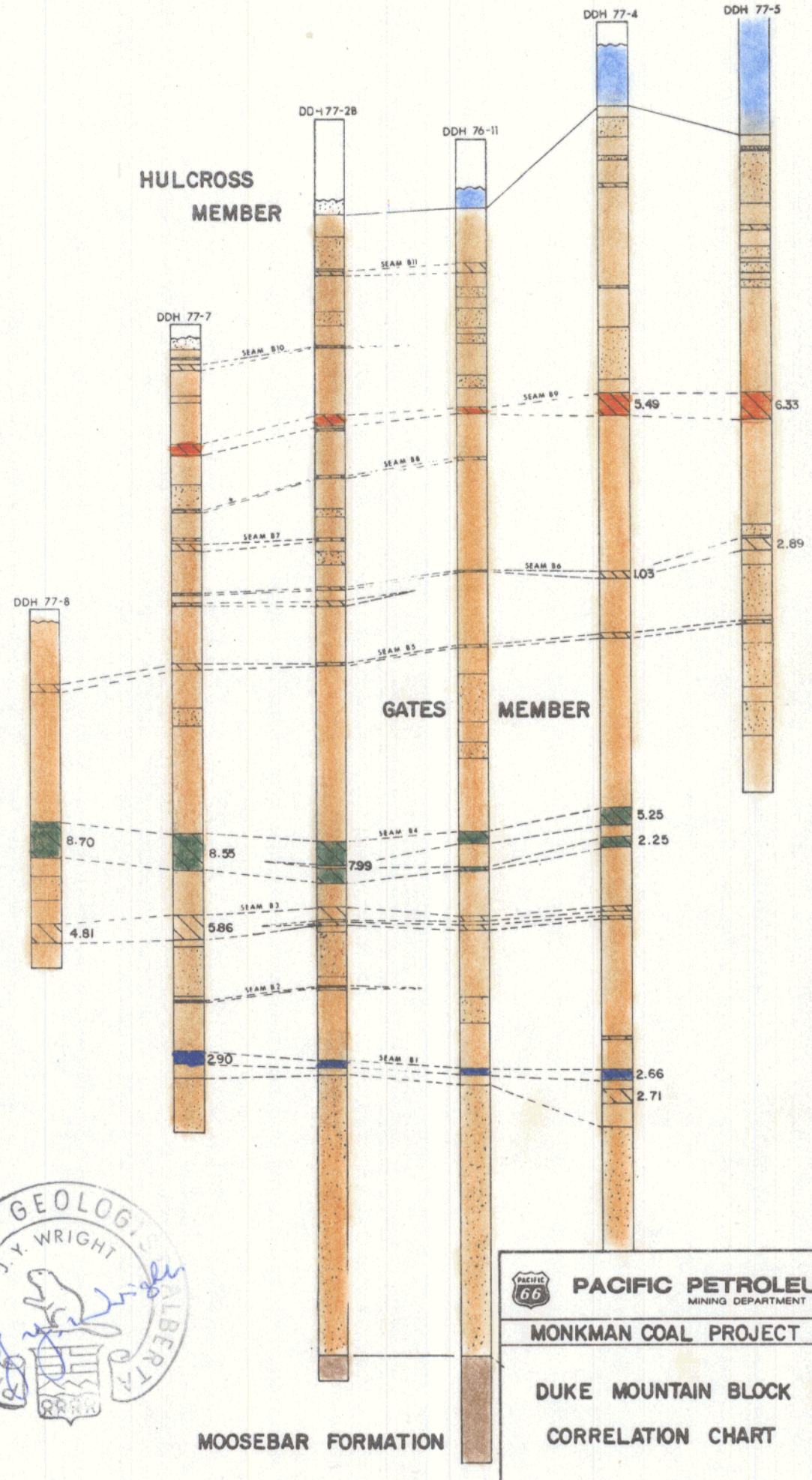
The Moosebar Formation is 40 to 60 metres thick, grading upwards from shale to siltstone and finally into the sandstone which forms the Basal Sandstone Unit of the Gates Member.

The Gates Member of the Commotion Formation is about 300 metres thick and contains lower, middle and upper units.

The lower unit, the Basal Sandstone, consists of approximately 70 metres of fine grained, cross bedded, worm burrowed, quartz sandstone. This unit is well sorted, laterally extensive, and is commonly a resistant ridge-forming unit.

The Middle Unit is finer-grained, containing more siltstone and mudstone, and all of the economic coal seams. This unit is commonly 170 metres thick and contains five coal seams greater than 2 metres thick. The coal seams have an aggregate thickness varying from 17 to 22 metres of coal. The floor and roof are usually carbonaceous siltstone or mudstone. Figure 7 shows the stratigraphic location of the major coal seams. Coal seams B1 to B9 (numbered chronologically) occur within this unit; however, only seams B1, B3, B4, B6 and B9 are of economic interest.

The upper unit, also known as the Babcock Unit, is a silty and sandy sequence of continental sediments containing only two thin coal seams, B10 and B11, neither of which is laterally continuous or attains significant thickness. It is this lack of coal development that differentiates this unit from the underlying unit. The upper contact of the Babcock Unit with the marine shales of the Hulcross Member is gradational over a thickness of 10 metres.



PROFESSIONAL GEOLOGIST J. Y. WRIGHT ALBERTA

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

DUKE MOUNTAIN BLOCK
CORRELATION CHART

Date	December 1977
Revised	
Author	J.Y.W.
Drafted	
Vert. Scale	1:1400

FIGURE 7.

B. Duke Mountain Block

The geology of the Duke Mountain Block is illustrated by a map (Figure 4) and sixteen sections (Figures 8 - 23). The sequence of Lower Cretaceous rocks has been deformed into a series of en echelon folds which run nearly parallel to the Inner Foothills trend. In general, the rocks exposed are younger from west to east, with strata of the Minnes Group of Jura-Cretaceous age on the west side and Shaftesbury strata of Lower and Upper Cretaceous age on the eastern boundary.

Undulating fold axes are characteristic of the block; however the net plunge is to the southeast. Commonly the anticlines are broad open folds and some are box anticlines. The synclines tend to be tighter, and some are of the steep chevron type.

The Quintette Anticline is a broad southeasterly-plunging anticline whose flat nose is tilted to the northeast at 20° - 25°. The nose broadens to the southeast but is deformed by secondary folding in the vicinity of drill hole MQD-77-1. (Figures 17 - 22).

The Duke structure consists of a steep chevron syncline and a broad box anticline whose tilted flat nose broadens to the northwest, exposing extensive areas of Gates strata. (Figures 16 - 18).

Immediately south of Duke Mountain the Fearless anticline-syncline pair forms a broad shallow structure (Figures 12 - 14). However, on Duchess Mountain folding becomes more intense and the Dokken Anticline complicates the structure. Steep folds, often of the chevron type, continue and intensify southwards into the Dokken Ridge area.

Evidence of faulting is displayed on the north face of Duke Mountain where minor shallow-angle thrusting has dislocated outcrops of Cadomin conglomerate and Gates sediments on the Duke Anticline. Displacements are minor (generally less than 20 m). The thrusts are known to intersect Boulder Creek strata up-section. Down-section, they appear to die out in Minnes Group strata. They are considered to be compression faults.

Two high-angle faults which outcrop on Dokken Creek appear to result from failure of competent sandstone units subjected to tight folding. The extent and displacement of these faults are unknown.

There is some evidence that a fault occurs at the north end of Quintette Syncline, causing dislocation of the synclined axis. However, there is insufficient information for the fault to be shown on the geological map.

C. Five Cabin Block

The geology of the Five Cabin Block is shown on a map (Figure 5) and four cross-sections (Figures 24 - 27). The major geological feature of the area is the Five Cabin Syncline. The syncline is asymmetrical. The west limb dimps steeply (70-85°) to the east, whereas the east limb dips shallowly (15-40°) to the west.

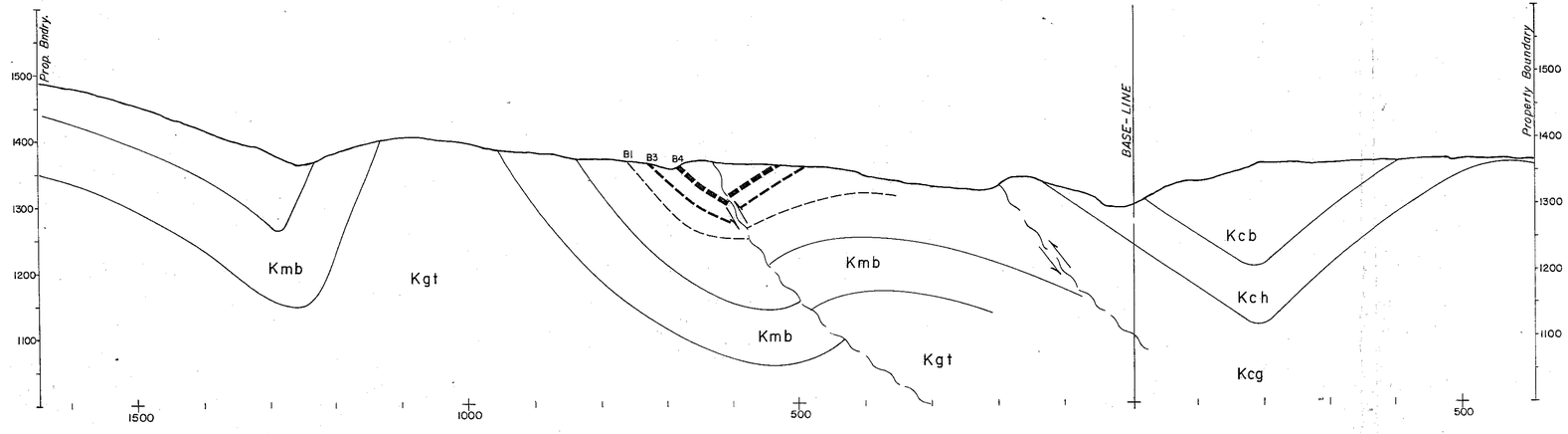
The west limb is more complex as it has some anomalous dips which have been represented simply as small-scale folds. These anomalous dips may be symptoms of faulting but data is insufficient to interpret it as such.

The low dips on the east limb of the syncline result in large dip slope areas of both the Gates Member of the Commotion Formation and the Gething Formation.

Lower Cretaceous formations, from Cadomin through Commotion, are exposed in the map area, the Cadomin visibly delineating the west limb of the syncline. Minnes Group strata flank both limbs.

The extent of coal development in the Gething Formation in the area is unclear. Two exposures of coal were discovered on the east side of the syncline. The coal at both locations appeared to be in the region of 2 m thick. Only one other significant exposure of Gething coal was located. It was trenched (STA-29) and found to be 1.86 m thick.

Four trenches in Gates Member coals (STB-25 - STB-29) indicated the presence of four seams, 2.90 m, 1.66 m, 5.15 m and 2.29 m thick respectively. This compares with seams of 0.9 m, 2.1 m, 2.8 m and 3.3 m intersected in the Canadian Superior hole, 75-3.



00542

PR-MONKMAN-BELCOURT 77(2) A. A. Smith

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

DUKE MOUNTAIN BLOCK

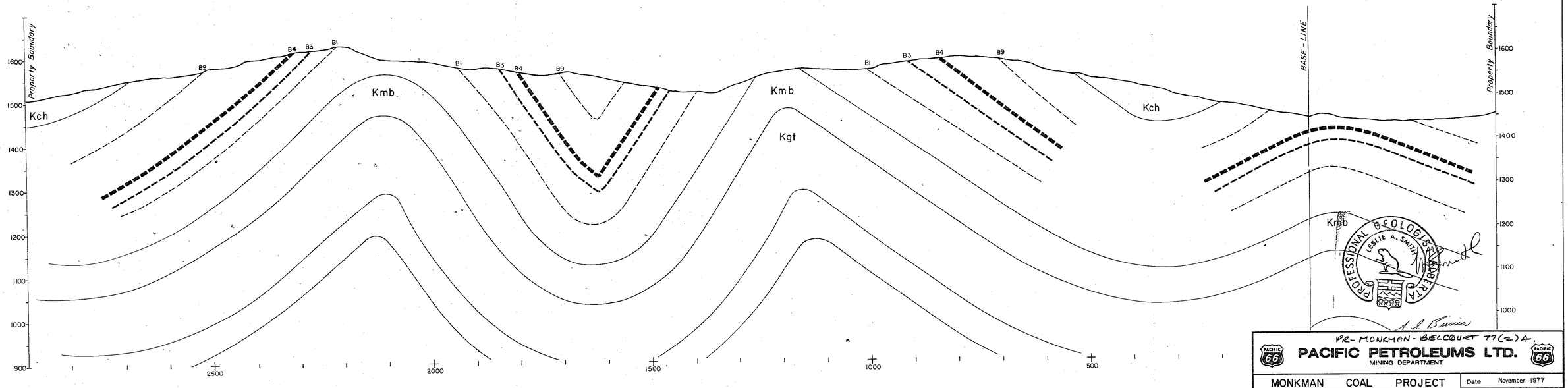
GEOLOGICAL SECTION

7,000 N.

Date	November 1977
Revised	
Author	LAS/AEB
Drafted	RPB
Scale	1:5000

FIGURE 8

022 N22



PROFESSIONAL GEOLOGIST LESLIE A. SMITH

PR - MONKMAN - BELCOURT 77(2) A.

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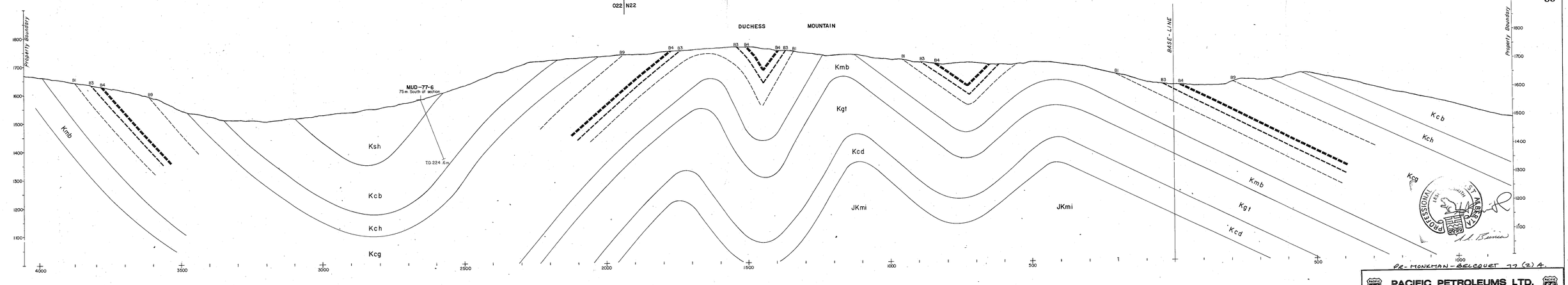
MINING DEPARTMENT

MONKMAN COAL PROJECT	Date November 1977
DUKE MOUNTAIN BLOCK	Revised
GEOLOGICAL SECTION	Author LAS/AEB
8,000 N.	Drafted RPB
	Scale 1:5000
	FIGURE 9



RE-MONKMAN-BELCOURT 77(2)A.

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DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

9,000 N.

Date	November 1977
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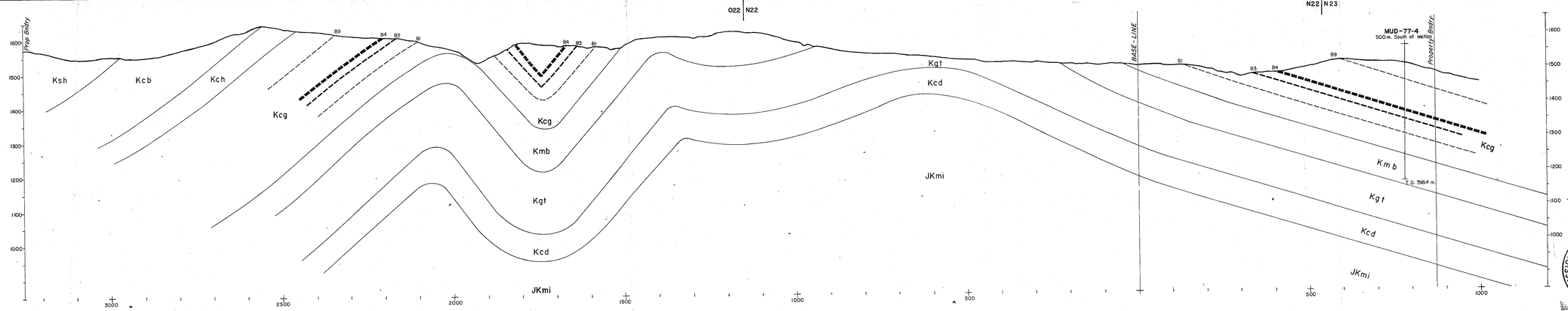
Drafted	RPB
Scale	1:5000

FIGURE 10



PR-MONKMAN-BELCOURT 77(2)4.

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DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

10, 000 N.

Date	November 1977
Revised	
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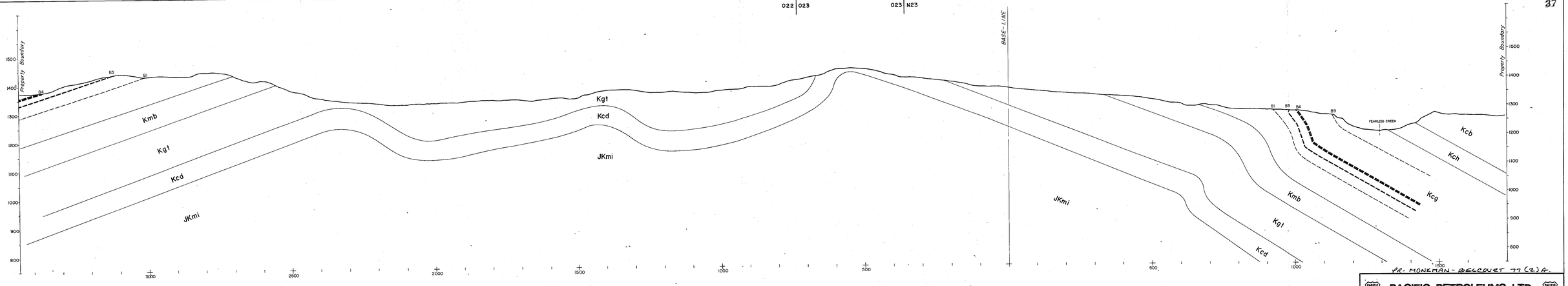
Drafted	RPB
Scale	1:5000

FIGURE 11



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MONKMAN COAL PROJECT

DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

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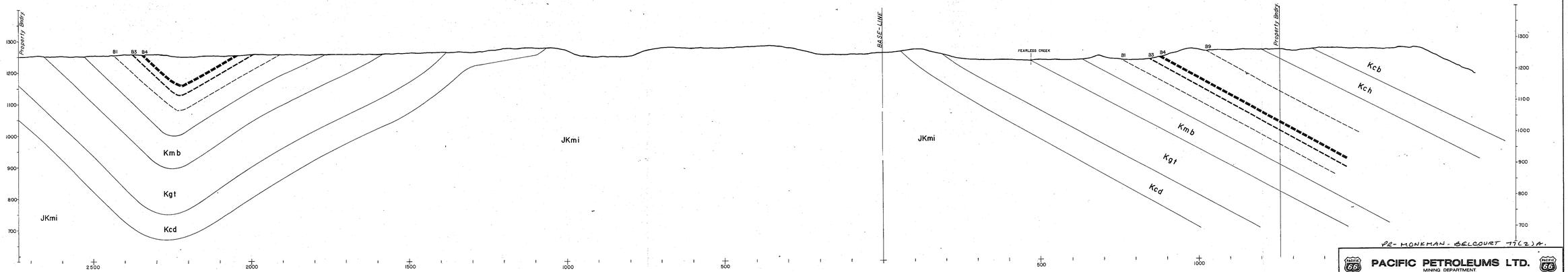
Scale	1:5000

FIGURE 12

022 | 023

023 | N23



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MONKMAN COAL PROJECT

DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

12, 000 N.

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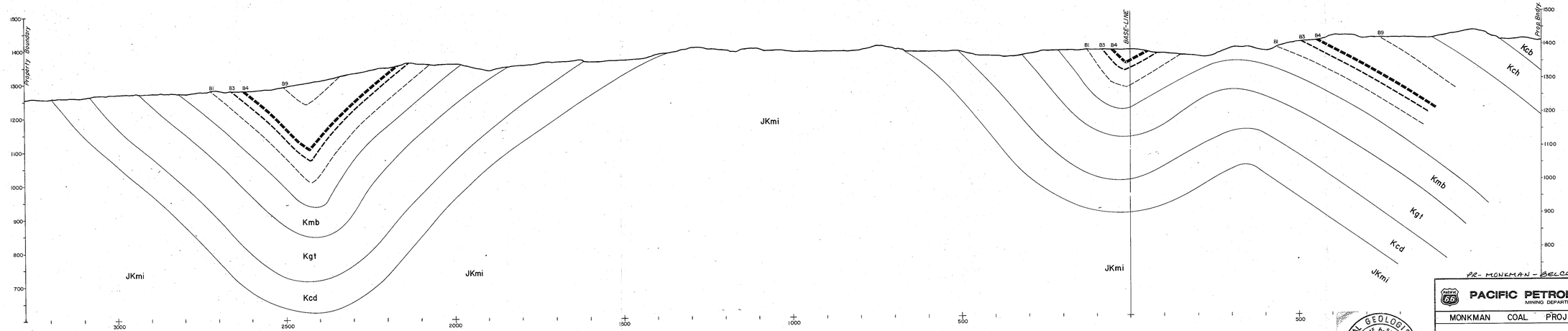
FIGURE 13

PROFESSIONAL GEOLOGIST — L. A. R. Smith — ALBERTA

A. L. Brown

P23 023



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DUKE MOUNTAIN BLOCK

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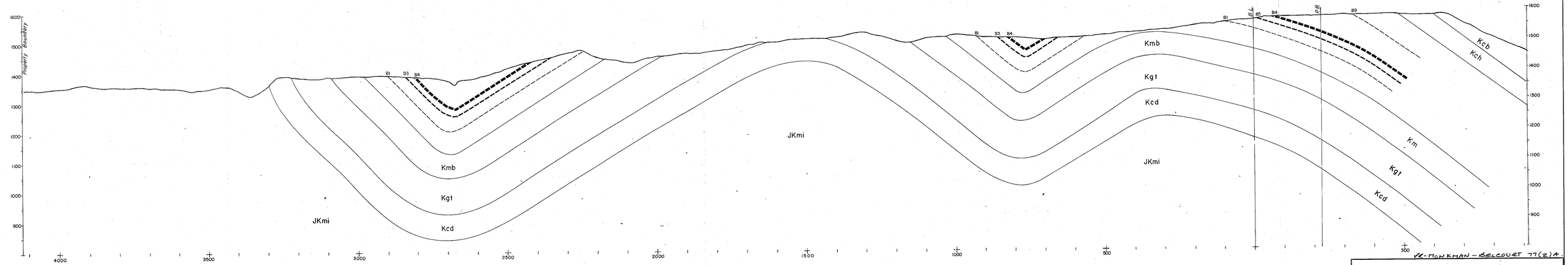
FIGURE 14

PROFESSIONAL GEOLOGIST ALBERTA LESLIE A. SMITH



VE-MONKMAN-BELCOURT 77(2)A

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DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

14, 000 N.

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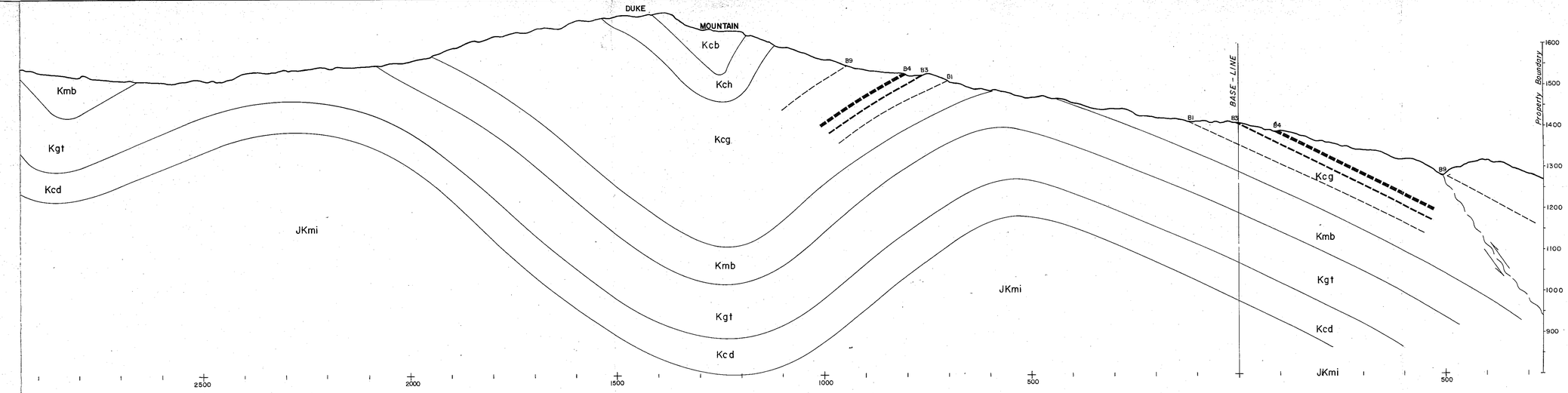
Drafted	RPB
Scale	1:5000

FIGURE 15

PROFESSIONAL GEOLOGIST LESLIE A. SMITH



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DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

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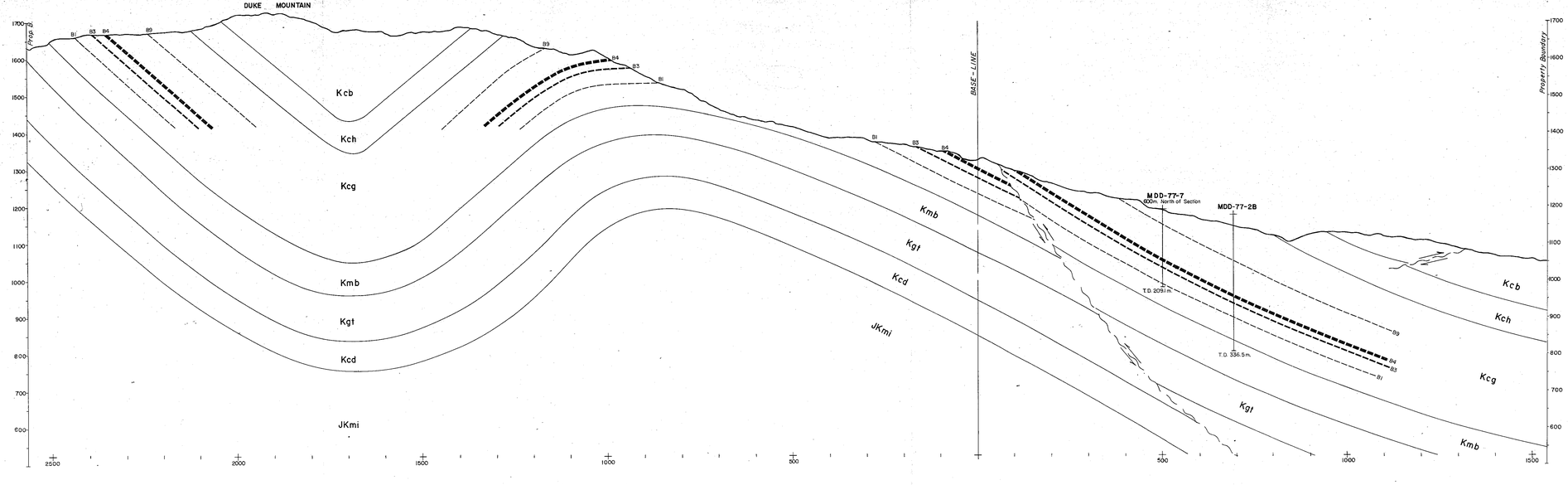
Drafted	RPB
Scale	1:5000

FIGURE 16

PROFESSIONAL GEOLOGIST ALBERTA
LESLIE A. SMITH



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MONKMAN COAL PROJECT

DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

16, 000 N.

Date	November 1977
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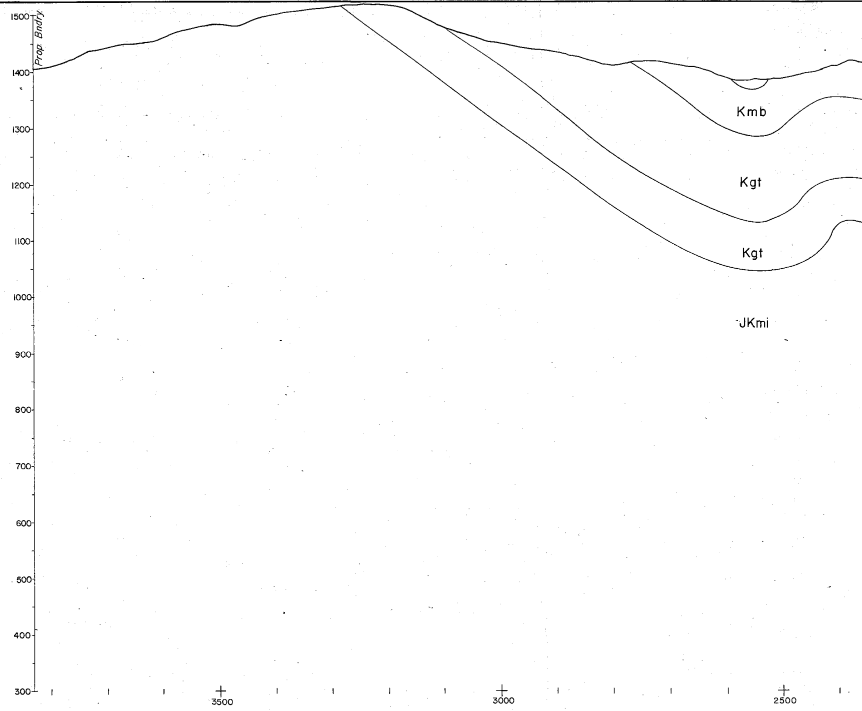
Drafted	R P B
Scale	1:5000

FIGURE 17

PROFESSIONAL GEOLOGIST LESLIE A. SMITH

A. E. Bonnis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1400
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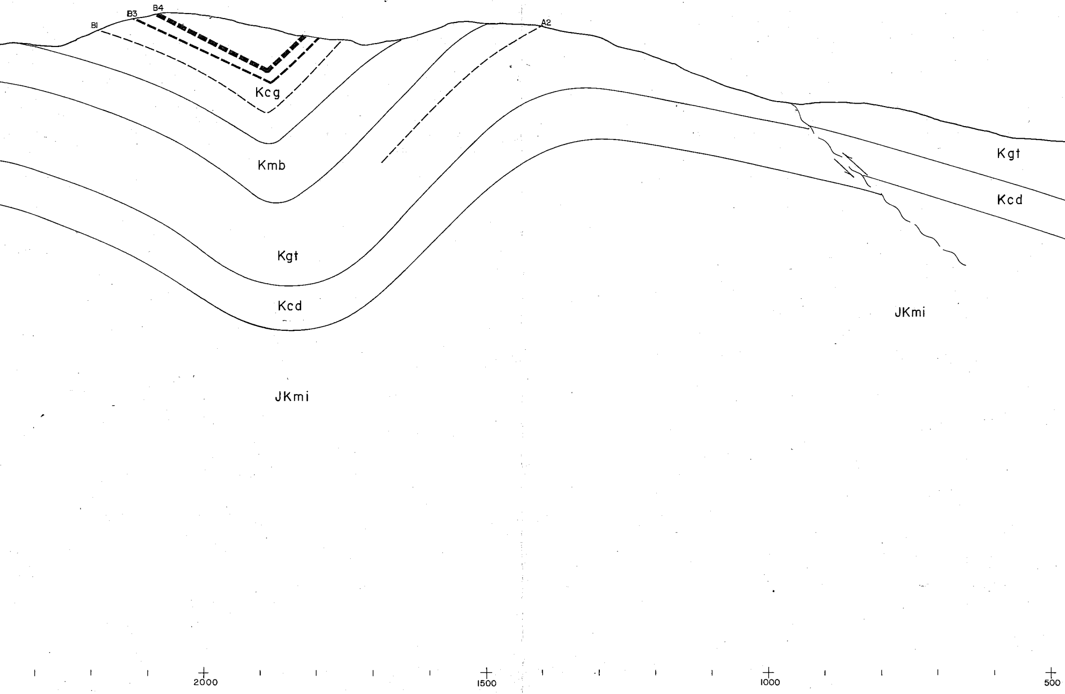
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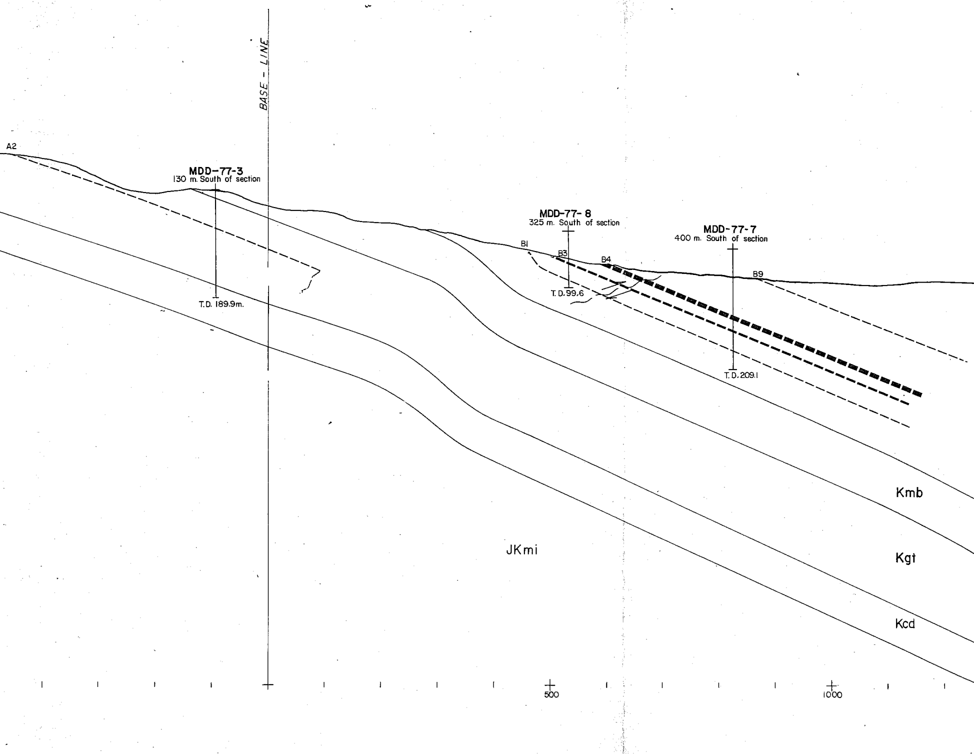
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130 m. South of section
T.D. 189.9m.
MDD-77-8
325 m. South of section
B1
B3
B4
T.D. 99.6
MDD-77-7
400 m. South of section
B9
T.D. 209.1
Kmb
Kgt
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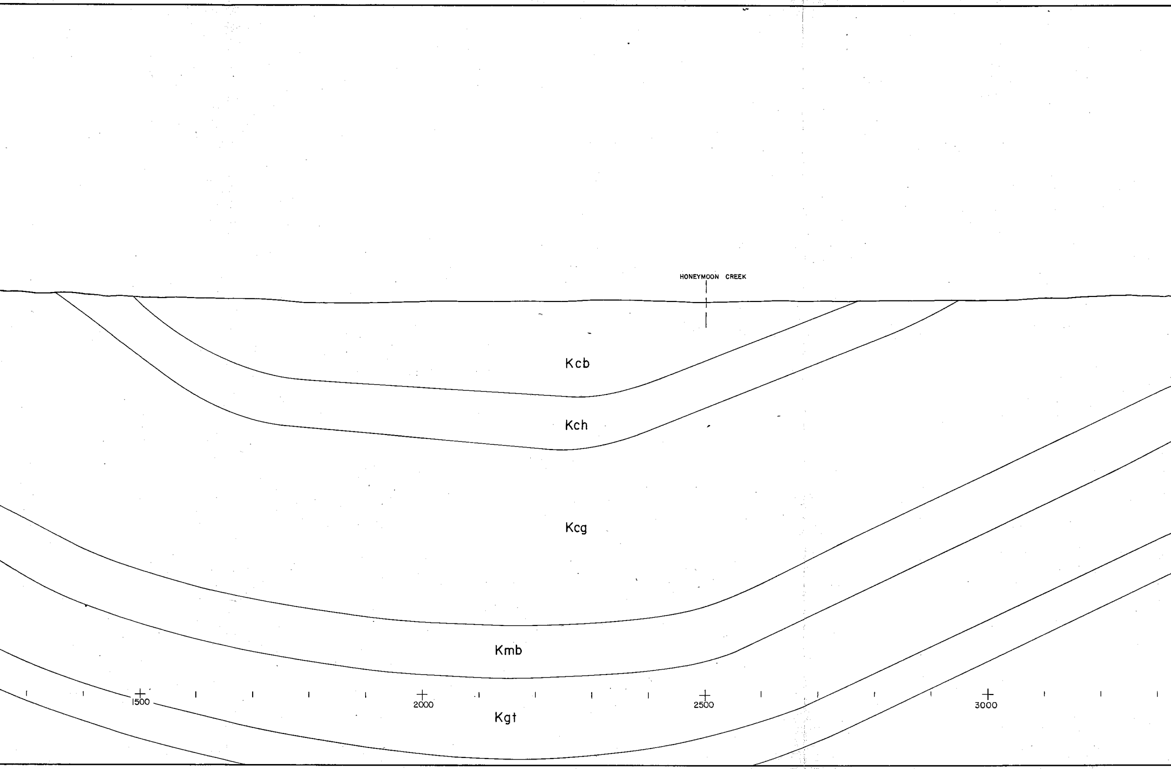
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Kcb
Kch
Kcg
Kmb
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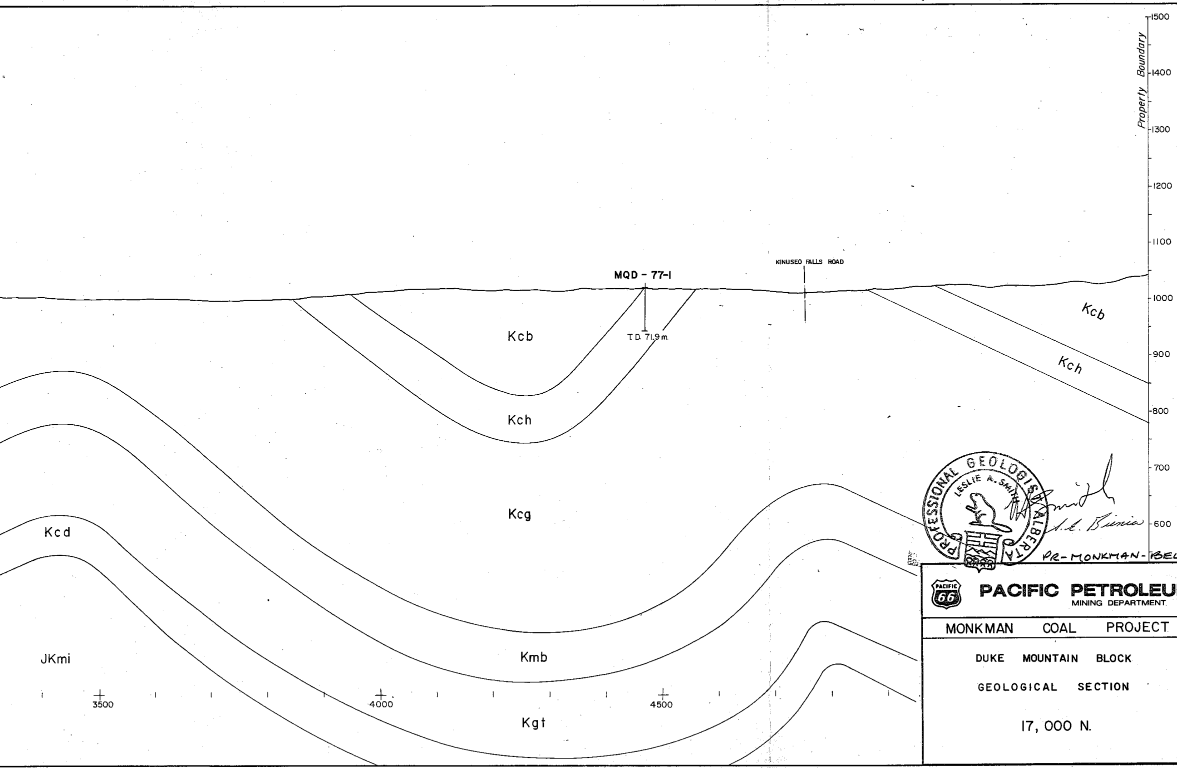
Kgt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1400
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Property Boundary
MQD - 77-1
T.D. 71.9 m.
KINUSEO FALLS ROAD
Kcb
Kch
Kcg
Kcd
JKmi
Kmb
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Kcb
Kch
3500
4000
4500

PROFESSIONAL GEOLOGIST ALBERTA
LESLIE A. SMITH

A.E. Bienia

PR-MONKMAN-BELCOURT 77(2)A.

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DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

17, 000 N.

Date	November 1977
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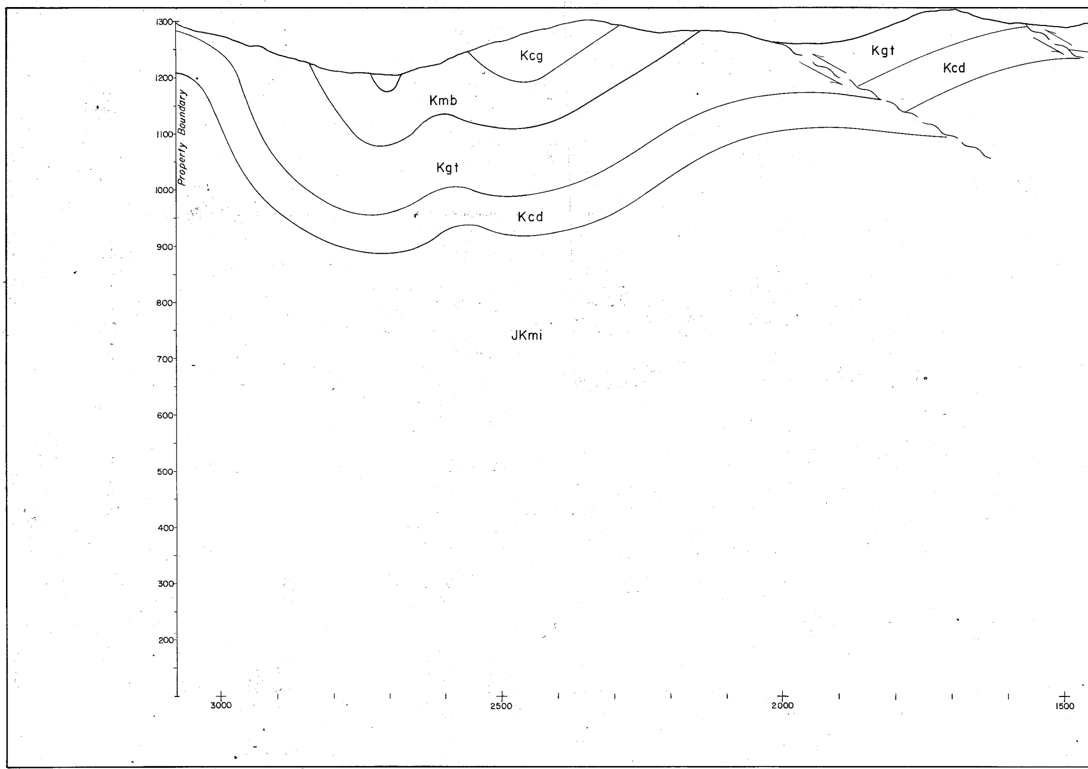
Author	LAS/AEB
Drafted	RPB
Scale	1:5000

FIGURE 18


1300
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300
200
Property Boundary
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Kmb
Kgt
Kcd
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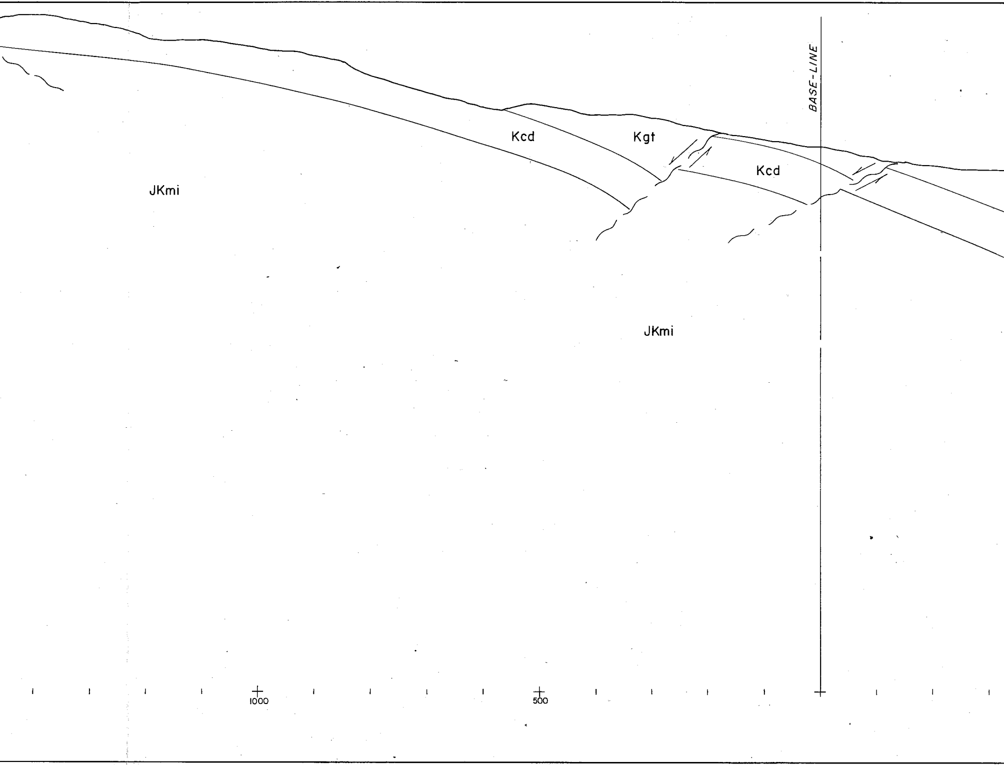
Kgt
Kcd
3000
2500
2000
1500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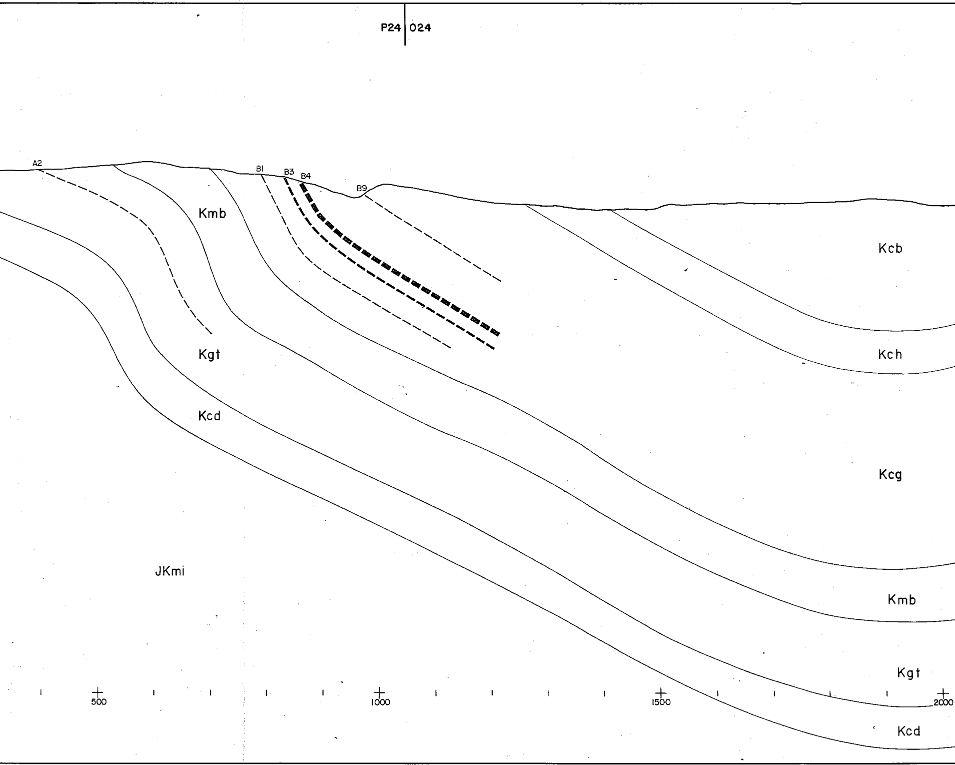
Kcd
Kgt
Kcd
JKmi
JKmi
1000
500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B1
B3
B4
B9
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Kgt
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Kcb
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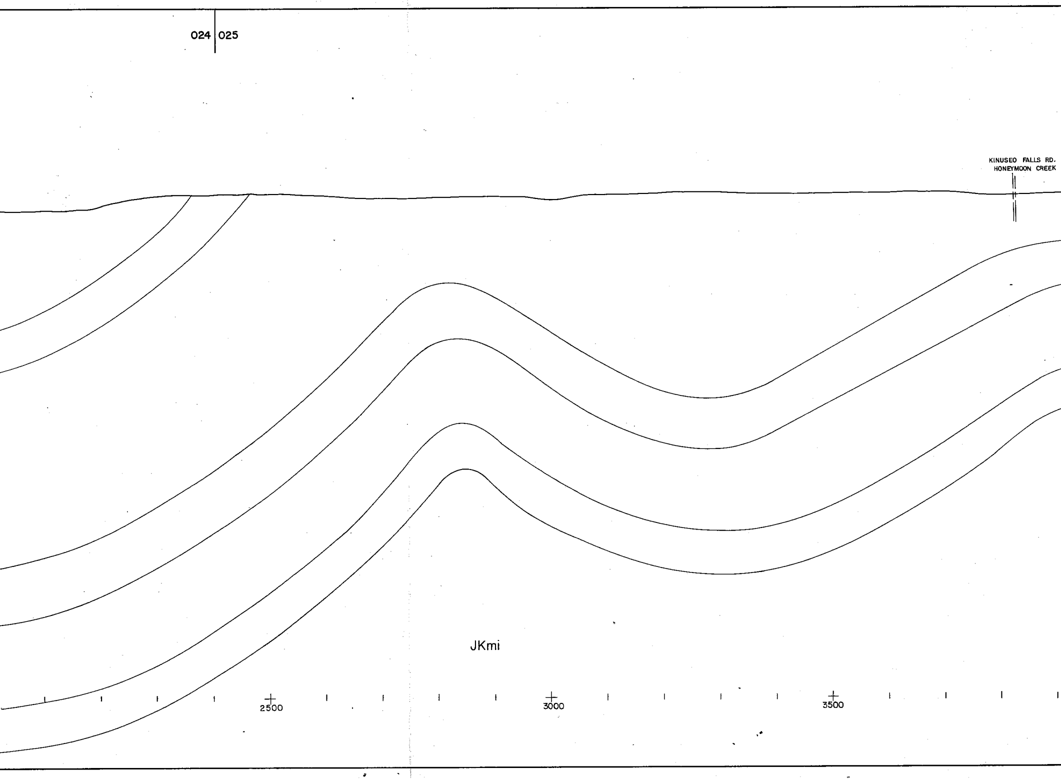
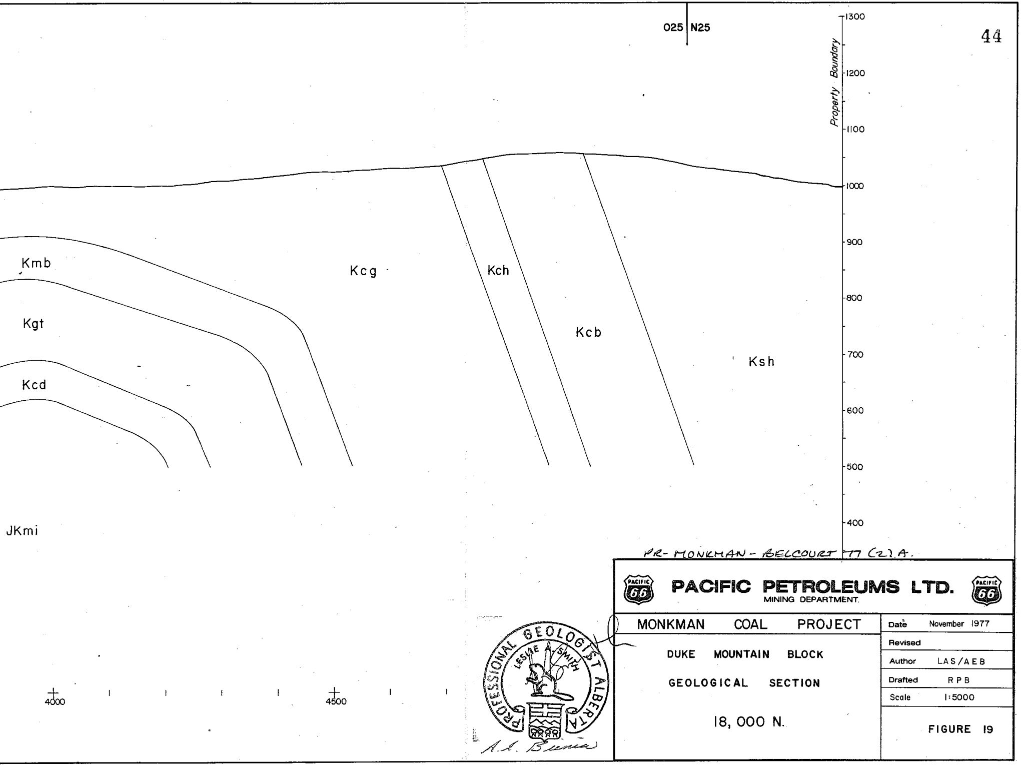

024
025
KINUSEO FALLS RD.
HONEYMOON CREEK
JKmi
2500
3000
3500


025
N25
Property Boundary
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600
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Kmb
Kgt
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Kcg
Kch
Kcb
Ksh
JKmi
4000
4500

PR- MONKMAN - BELCOURT 77 (2) A.

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT.

MONKMAN COAL PROJECT

DUKE MOUNTAIN BLOCK

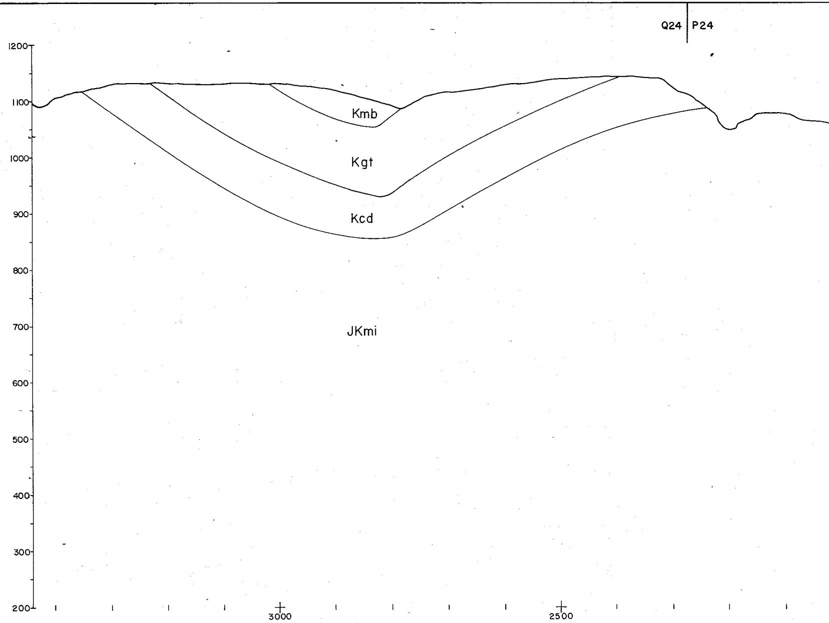
GEOLOGICAL SECTION

18, 000 N.

Date	November 1977
Revised	
Author	LAS/AEB
Drafted	RPB
Scale	1:5000

FIGURE 19

PROFESSIONAL GEOLOGIST ALBERTA
LESLIE A. SMITH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JKmi
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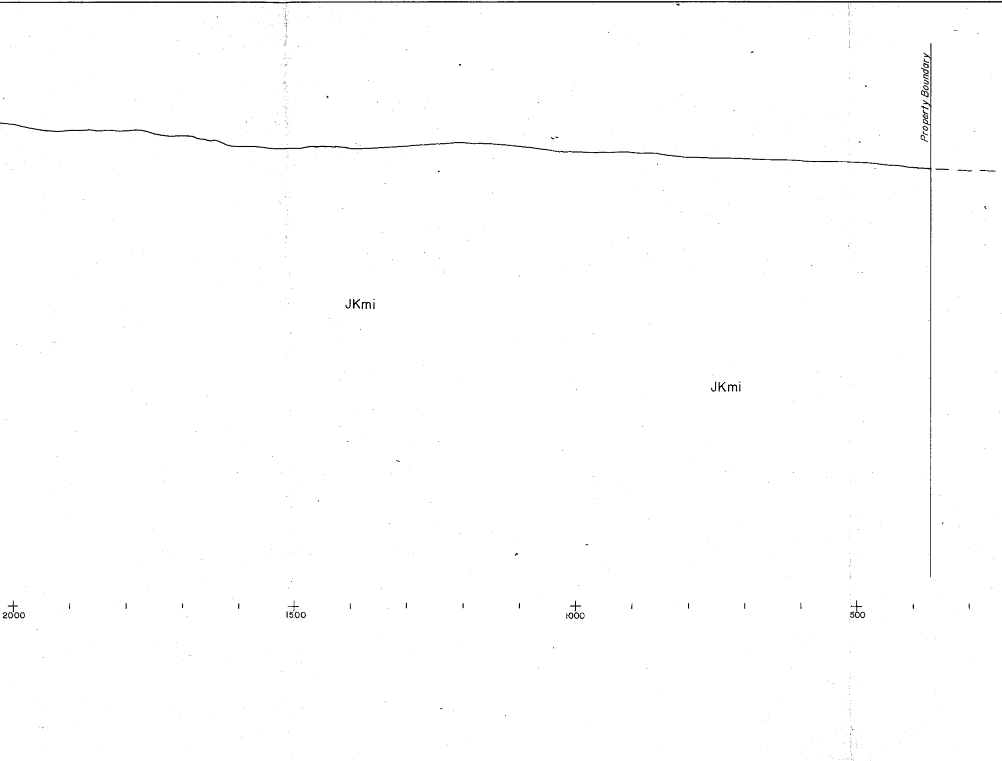
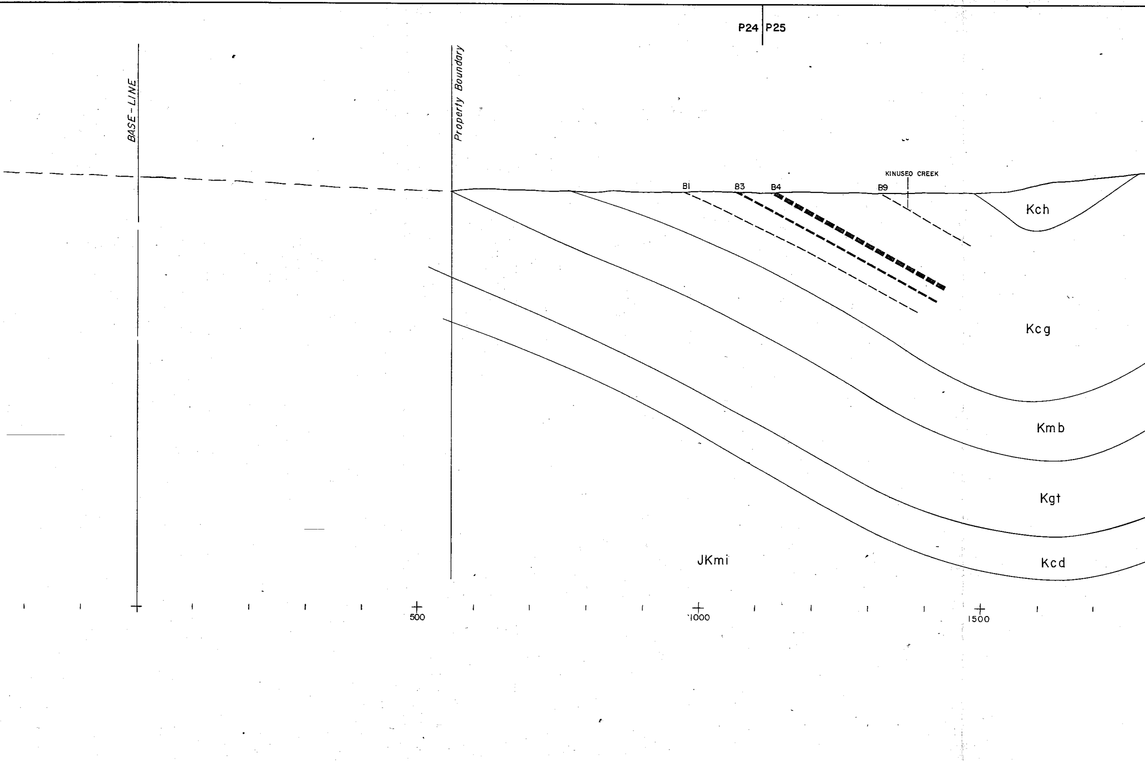
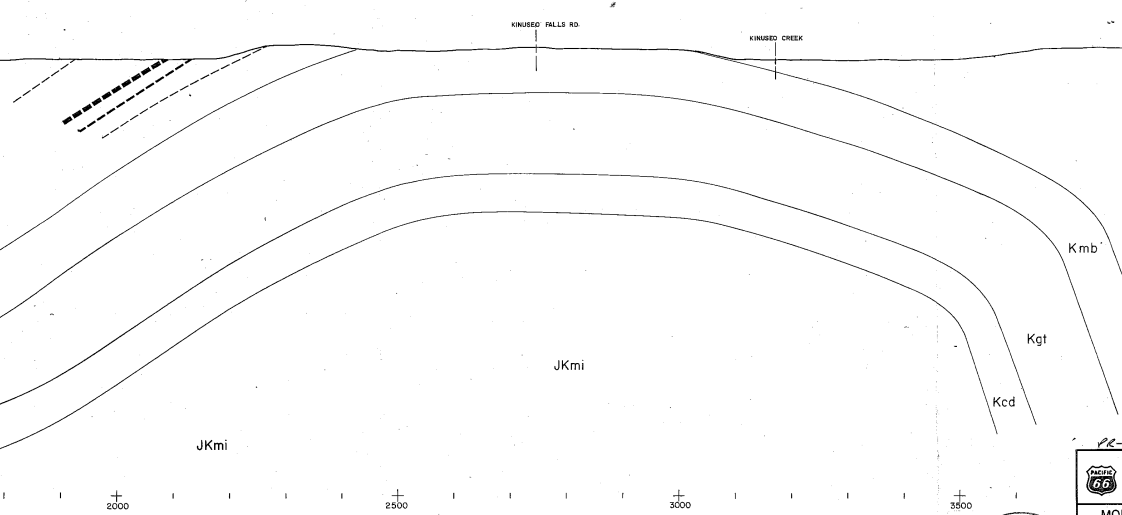
2500


Property Boundary
JKmi
JKmi
2000
1500
1000
500


P24
P25
BASE-LINE
Property Boundary
KINUSEO CREEK
B1
B3
B4
B9
Kch
Kcg
Kmb
Kgt
Kcd
JKmi
500
1000
1500

P25 | 025

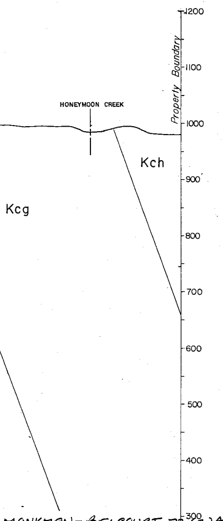

KINUSEO FALLS RD.
KINUSEO CREEK
Kmb
Kgt
Kcd
JKmi
JKmi
2000
2500
3000
3500

PR-

PACIFIC 66

MO

PROFESSIONAL GEOLOGIST ALBERTA
LESLIE A. SMITH


HONEYMOON CREEK
Property Boundary
Kch
Kcg
1200
1100
1000
900
800
700
600
500
400
300

MONKMAN-BELCOURT 77(2)A.

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

NKMAN COAL PROJECT

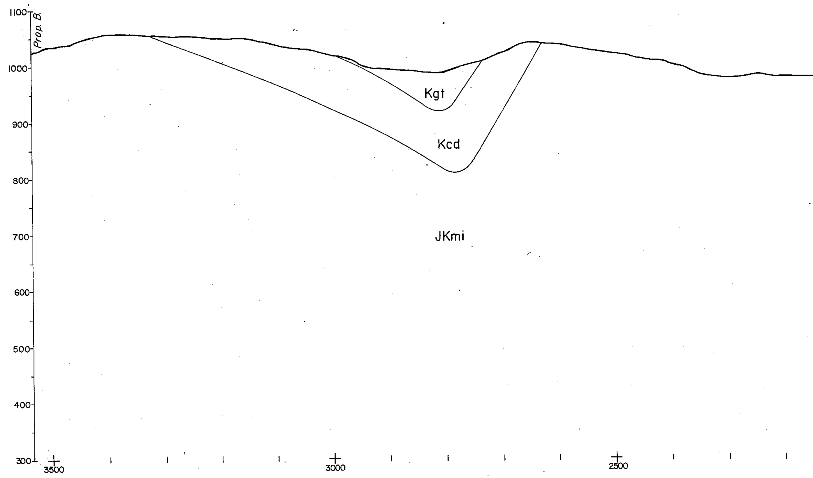
DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

19, 000 N.

Date	November 1977
Revised	
Author	LAS/AEB
Drafted	RPB
Scale	1:5000

FIGURE 20


Prop. B.
1100
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Kgt
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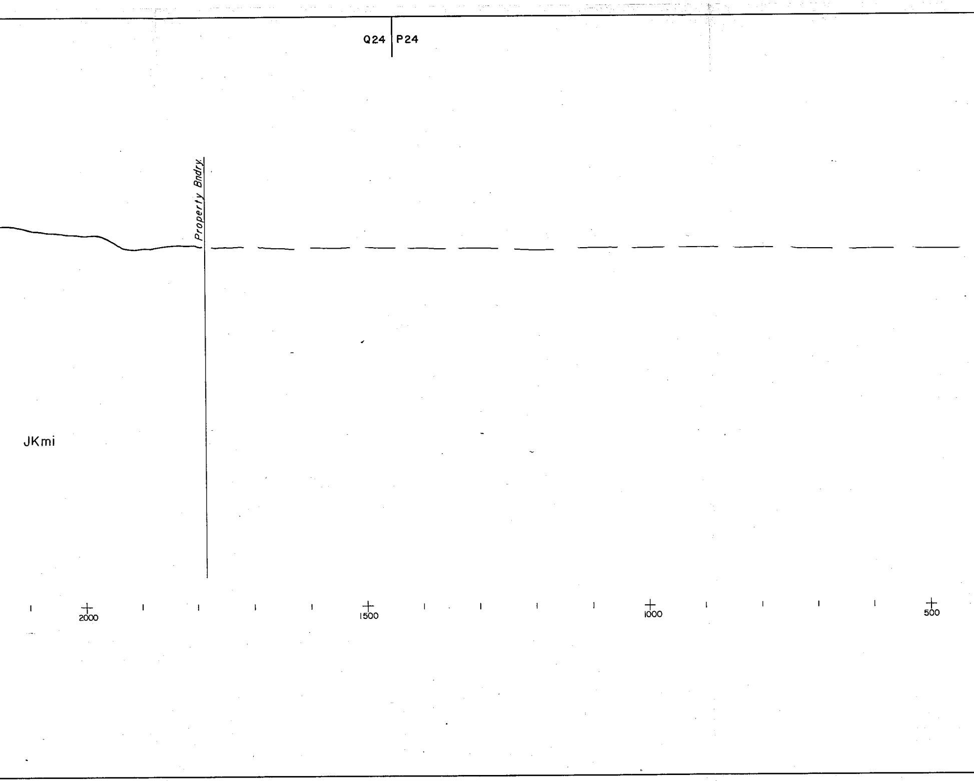
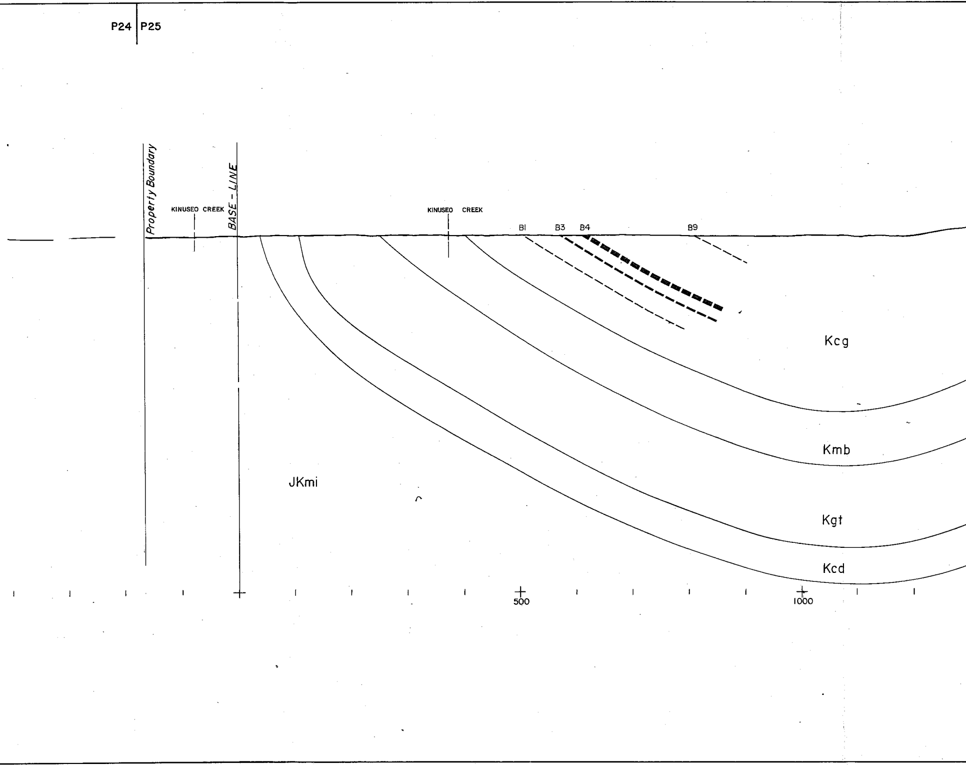
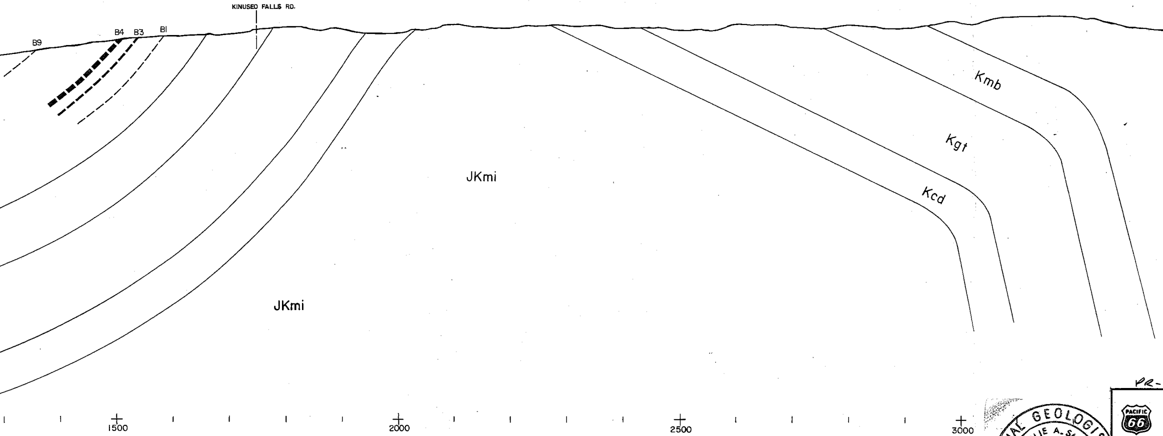
3500
3000
2500


Q24
P24
Property Bndry.
JKmi
2000
1500
1000
500



P24
P25
Property Boundary
KINUSEO CREEK
BASE - LINE
KINUSEO CREEK
B1
B3
B4
B9
Kcg
Kmb
JKmi
Kgt
Kcd
500
1000

P25 | 025

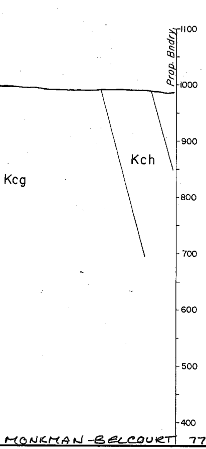

KINUSEO FALLS RD.
B9
B4
B3
BI
JKmi
JKmi
Kmb
Kgt
Kcd
1500
2000
2500
3000

LESLIE A. SMITH

A. L. Bienia

PR-

MON


Prop. Bndry.
1100
1000
900
800
700
600
500
400
Kch
Kcg

MONKMAN-BELCOURT 77 (2) A.

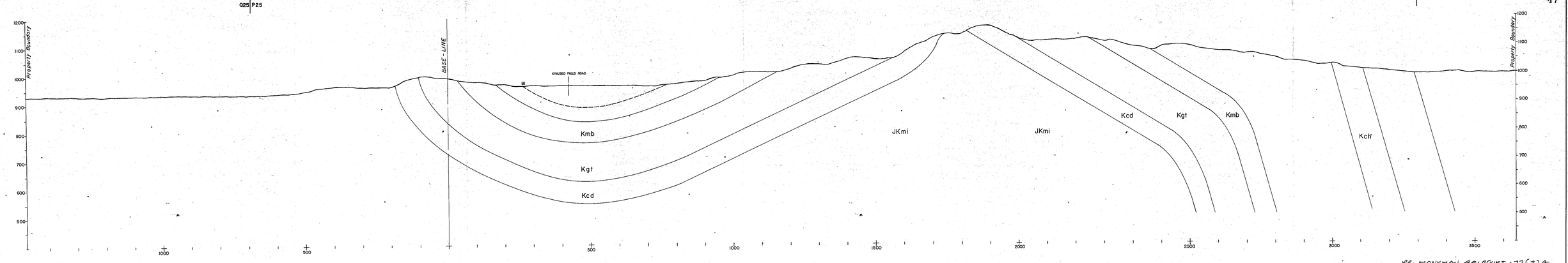
PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT.

KMAN COAL PROJECT

DUKE MOUNTAIN BLOCK
GEOLOGICAL SECTION
20,000 N.

Date November 1977
Revised
Author LAS/AEB
Drafted RPB
Scale 1:5000

FIGURE 21



PR- MONKMAN-BELCOURT - 77(2) A.

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

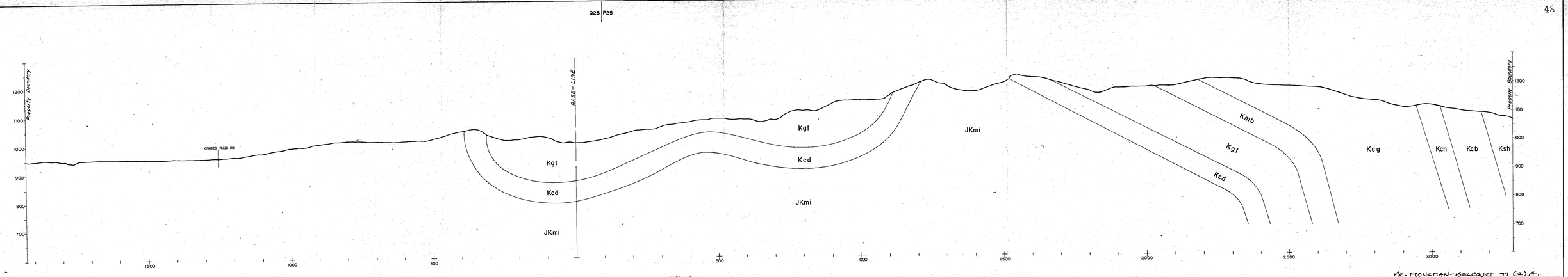
DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

21, 000 N.

Date	November 1977
Revised	
Author	LAS/AEB
Drafted	RPB
Scale	1:5000

FIGURE 22



PR-MONKMAN-BELCOURT 77 (2) A..

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

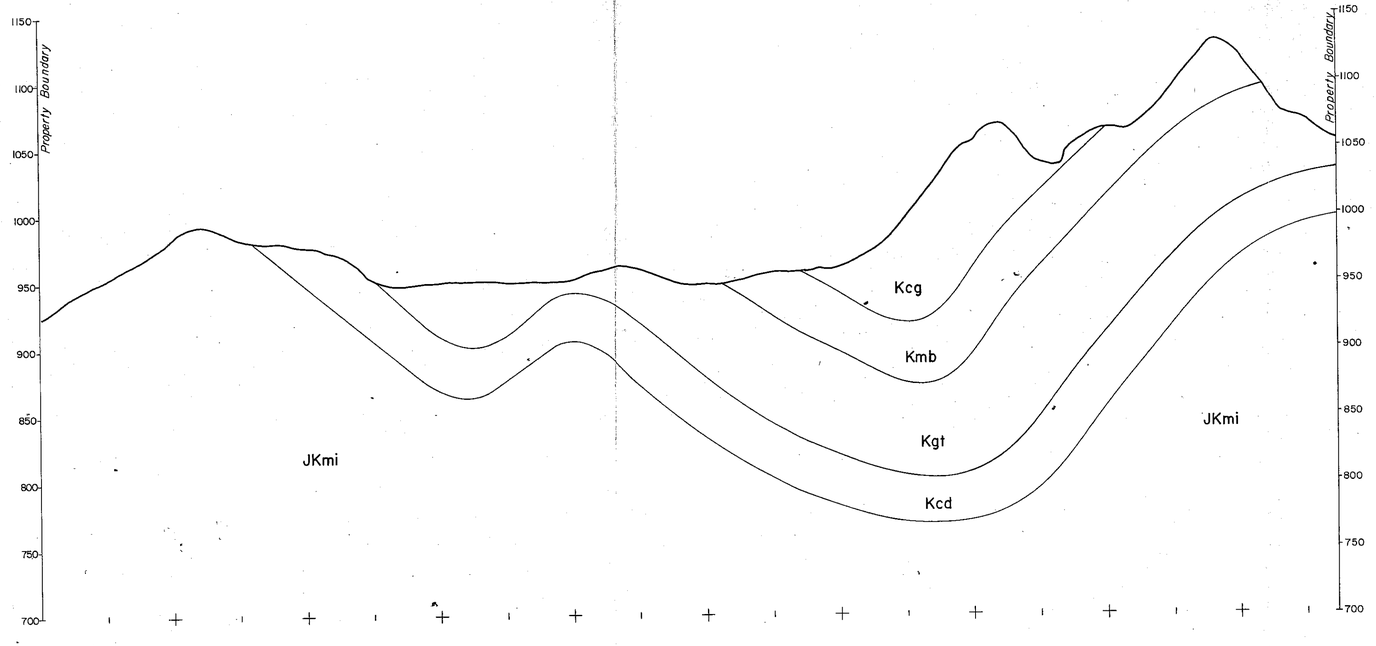
DUKE MOUNTAIN BLOCK

GEOLOGICAL SECTION

22,000 N.

Date	November 1977
Revised	
Author	LAS/AEB
Drafted	RPB
Scale	1:5000

FIGURE 23



PR-MONKMAN-BELCOURT 77(2)A.

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

FIVE CABIN BLOCK

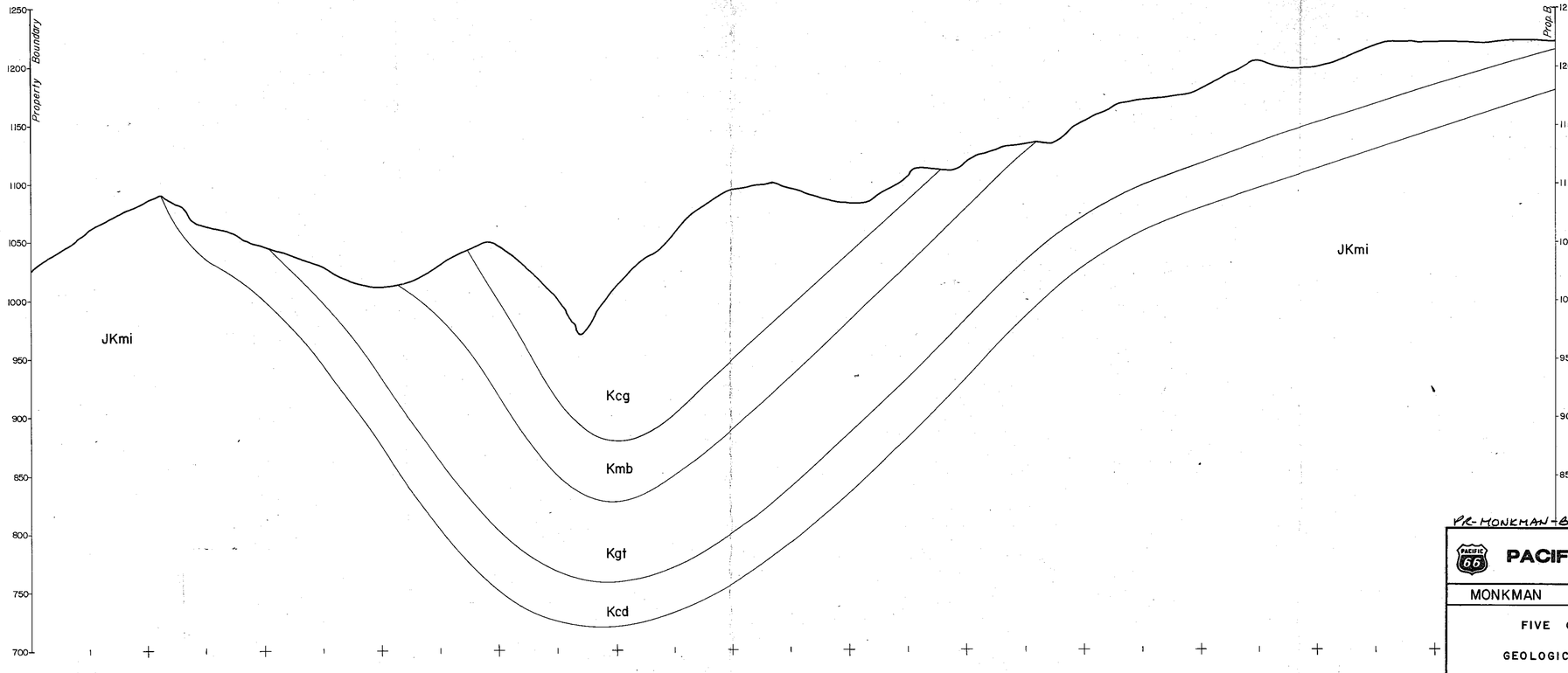
GEOLOGICAL SECTION

26,000 N.

Date	December 1977
Revised	
Author	LAS/AEB
Drafted	RPB
Scale	1:2500

FIGURE 24

PROFESSIONAL GEOLOGIST ALBERTA
DOUGLAS E. SMITH
A. E. Bunia



PR-MONKMAN-BELCOURT 71(2)A

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT.

MONKMAN COAL PROJECT

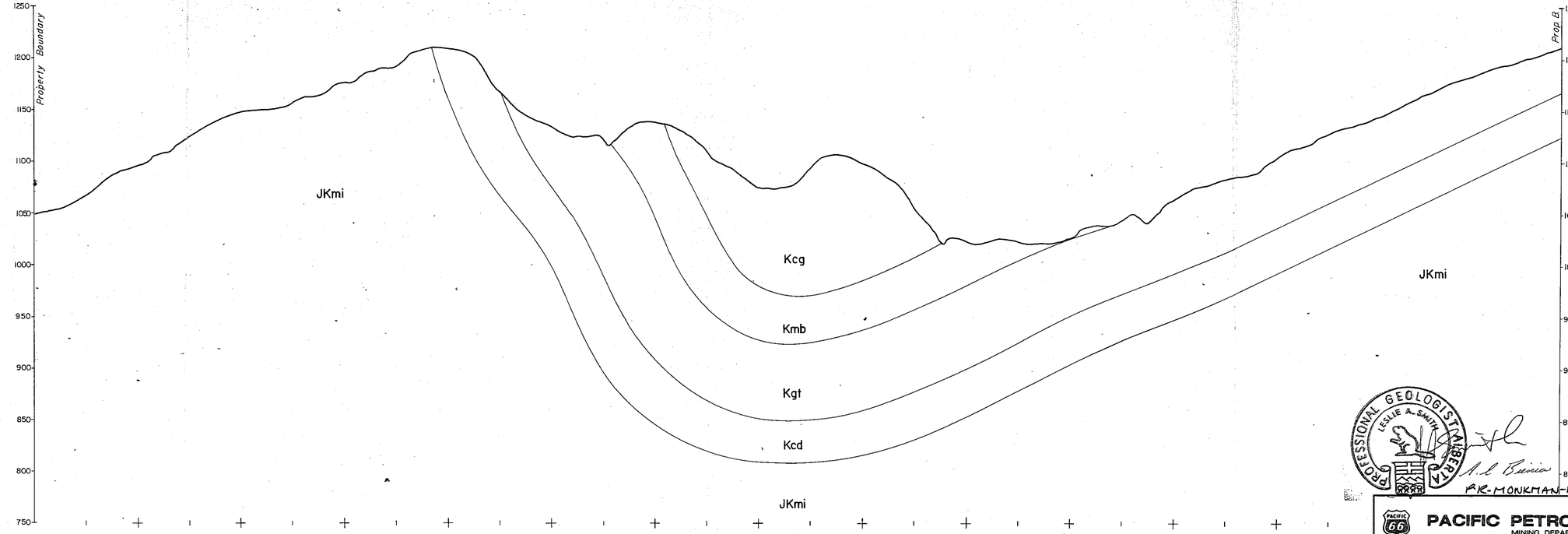
FIVE CABIN BLOCK

GEOLOGICAL SECTION

27, 000 N.

Date	December 1977
Revised	
Author	LAS/AEB
Drafted	RPB
Scale	1:2500

FIGURE 25



PROFESSIONAL GEOLOGIST ALBERTA LESLIE A. SMITH

A. L. Bania

RR-MONKMAN-BELCOURT 77(2)A.

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

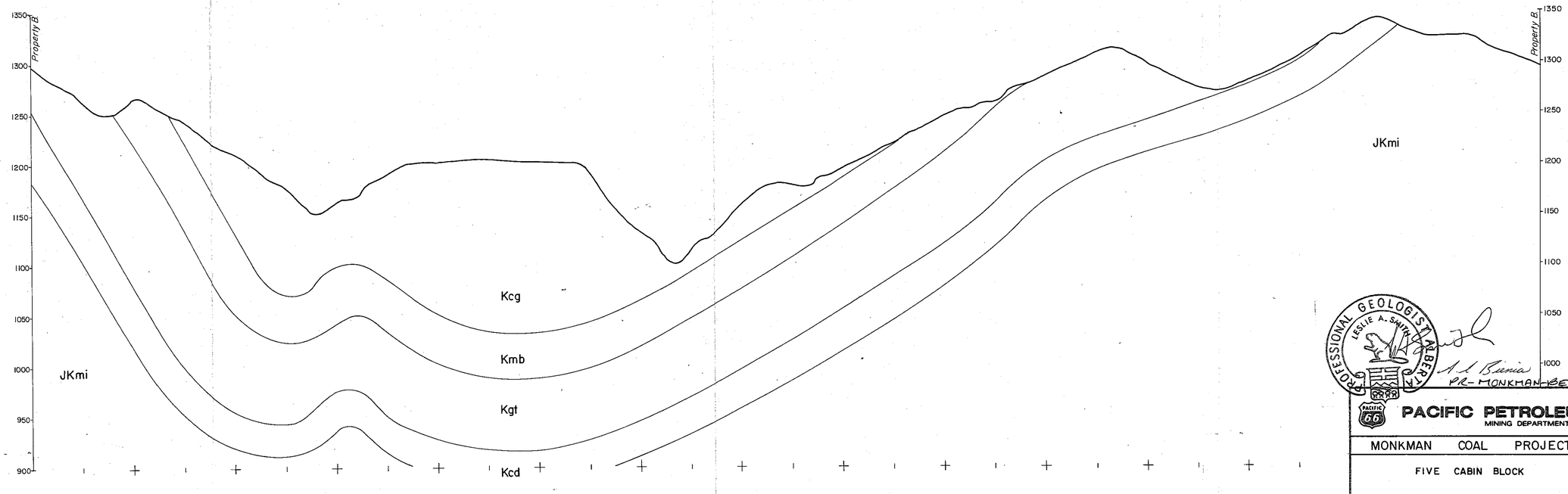
FIVE CABIN BLOCK

GEOLOGICAL SECTION

28,000 N.

Date	December 1977
Revised	
Author	LAS/AEB
Drafted	RPB
Scale	1:2500

FIGURE 26



PROFESSIONAL GEOLOGIST ALBERTA
LESLIE A. SMITH

A. L. Bienia
PR-MONKMAN-BELCOURT 77(2)A.

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT.

MONKMAN COAL PROJECT

FIVE CABIN BLOCK

GEOLOGICAL SECTION

29, 000 N.

Date	December 1977
Revised	
Author	LAS/AEB
Drafted	RPB
Scale	1:2500

FIGURE 27

121°30'
121°00'
120°30'
120°00'
55°00'
54°45'
54°30'
54°15'
54°00'

93-I-14
93-I-15
93-I-16
93-I-11
93-I-10
93-I-9
93-I-7
93-I-8
93-I-2
3-I-1

TO DAWSON CREEK
TO DAWSON CREEK
TO BEAVERLODGE 35MILES

QUINTETTE COAL (DENISON)

Flatbed Creek
Redwillow River
Kinuseo Creek
Stony Lake
Wapiti River
Wapiti Lake
Deer Creek
Red Creek
Belcourt Creek

FIVE CABIN BLOCK
CAMP
DUKE MTN. BLOCK
KINUSEO FALLS
ONION SYNCLINE
FIG 4
WAPITI DIP SLOPE
BELCOURT COAL (DENISON)
BELCOURT DIP SLOPE
SECUS DIP SLOPE
NEKIK DIP SLOPE
SAXON SYNCLINE
SAXON COAL

N

4 3 2 1 0 4 8 MILES
SCALE

LEGEND

- OUTCROP OF LOWER CRETACEOUS COAL MEASURES
- 93-I-8 COAL TITLE REFERENCE MAP, MAP No. SCALE = 1:50,000
- COAL LICENCE, BOUNDARY, MONKMAN COAL PROJECT
- COAL LICENCE, DENISON PROPERTY
- SYNCLINE
- ANTICLINE
- FAULT (THRUST)
- ROAD

PROFESSIONAL GEOLOGIST ALBERTA

FIGURE 2

INDEX MAP OF MONKMAN COAL PROJECT

542

MAP SHEET 93-I

PR-MONKMAN-BELCORT 77(2) A

PR-MONKMAN-BELCOURT 77(2)A.

542

PACIFIC PETROLEUMS LIMITED

PLAN SHOWING PHOTOGRAMMETRIC SURVEY CONTROL ON THE MONKMAN COAL PROJECT

Scale: 1:50000

Legend: Bearings are derived from Provincial Triangulation stations and are referred to the 123° Meridian.

STATION	CONTROL POINTS	ELEVATIONS	NORTHINGS	EASTINGS
MAMIE		1915.058	58616.111	46522.177
HAWK		1791.005	65394.922	48281.876
MARCIA		1742.237	69491.119	43056.023
	MARCIA (SATELITE)	1731.95	69658.47	42997.24
QUIN. E.		1842.211	80886.178	36257.542
	OLD PHOTO TARGET	1840.14	80875.86	36262.49
QUIN S.W.		1730.654	78279.013	26459.728
KINUSOE		1762.963	69470.940	27646.770
	HAWK (BRIDGE PT. - PT. OF SHRUB)	1786.13	65313.16	48250.74
HV#1	IP#340	1702.65	60210.18	54777.08
	OLD PIPE POST	1696.64	60162.85	54811.42
	BT#341 (6" SPRUCE)	1699.55	60187.37	54785.29
HV#2	IP#327	1815.73	59385.20	52574.43
	IP#328	1816.91	59332.13	52618.01
	HV#2	1815.20	59358.96	52616.25
HV#3	IP#342	1688.15	61391.27	53841.19
	BT#343 (2"SPRUCE)	1686.13	61388.88	53859.96
HV#4	IP#338	1693.06	61922.91	52708.94
	BT#339 (6" SPRUCE)	1682.88	61896.12	52694.21
HV#5	IP#329	1729.31	64066.77	46187.45
HV#6	IP#330	1525.62	65814.99	46332.21
	(TOP CORNER OF LEDGE)	1525.94	65819.67	46346.18
	(HEIGHT OF LAND)	1525.82	65816.00	46352.61
	BT#331 (3"SPRUCE)	1525.12	65800.37	46354.83
HV#7	IP#349	1664.93	66661.72	49909.50
	BT#350	1661.56	66692.73	49925.15
HV#8	IP#333	1598.75	67815.22	41647.09
	BT#332 (3" SPRUCE)	1584.21	67807.79	41674.26
HV#9	IP#335	1703.94	67911.86	44811.50
	BT#334 (2" SPRUCE)	1701.52	67896.22	44824.34
	(MAIN POINT OF SHRUBS)		67823.71	44802.94
HV#10	IP#	1297.31	70283.29	49609.12
	REF. IP (ON LINE FROM HAWK)	1298.84	70296.08	49612.66
	EDGE OF TREES	1297.44	70281.45	49545.59
	BT#347	1297.57	70284.28	49611.95
	BT#348 (20" SPRUCE)	1297.16	70283.69	49643.76
HV#11	IP#371	1336.85	63706.12	50741.41
	BT#372 (18" SPRUCE)	1336.17	63726.05	50748.62
	BT#373 (18" SPRUCE)	1336.81	63709.02	50749.13
HV#12	IP#351	1531.53	70044.79	39868.11
	BT#353 (POINT OF TREES)	1518.58	69974.50	39937.34
HV#13	IP#336	1579.33	70524.02	46868.43
	BT#337 (1" SPRUCE)	1575.93	70501.36	46868.94
HV#14	IP#358	1055.57	72577.75	40074.97
	BT#357 (4" PINE)	1061.27	72524.15	40105.19
HV#15	IP#356	1300.71	72524.35	42547.79
	BT#354 (4" FIR) (EDGE OF CLEARING)	1299.36	72512.97	42595.71
	BT#355 (4" SPRUCE) "	1299.94	72505.69	42562.13
HV#16	IP#359	1023.89	72960.14	45988.63
	BT#360 (18" SPRUCE)	1024.30	72942.76	45986.26
	BT#385 (16" SPRUCE)	1023.72	72951.76	45997.44
	(NORTH CORNER OF CABIN ROOF)	1024.66	72974.90	45998.58
	(NORTH CORNER OF CABIN GROUND)	1022.53	72974.90	45998.58
HV#17	IP#382	1192.79	71927.54	50325.24
	NAIL (ROAD INTERSECTION)	1190.86	71925.44	50302.91
	BT#380 (4" SPRUCE)	1193.53	71920.82	50322.14
	BT#381 (8" PINE)	1195.28	71954.56	50343.81
HV#18	IP#368	951.58	75136.03	39963.55
	BT#370 (8" POPLAR)	952.44	75143.34	39998.48
	BT#369 (6" POPLAR)	950.12	75115.32	39957.46
HV#19	IP#404	992.82	75135.63	45423.22
	NAIL (ROAD INTERSECTION)	993.38	75158.46	45410.47
	BT#383	994.14	75150.08	45426.13
	BT#384	993.61	75133.72	45430.76
HV#20	IP#389	1086.81	76133.00	50933.79
	BT#390 (4" SPRUCE)	1077.56	76143.34	50907.79
	NAIL (ROAD INTERSECTION)	1088.25	76136.48	50978.04
	BT#391 (8" PINE)	1086.81	76109.86	50951.60
HV#21	IP#368	1292.99	76948.96	39573.33
	BT#387 (2"SPRUCE)	1292.99	76955.43	39576.71
	NAIL (POINT OF OLD SIGNAL)	1292.99	76945.87	39577.30
	BT#388 (2" SPRUCE)	1294.24	76991.08	39528.24
HV#22	IP#392	1252.96	77006.75	42768.40
	BT#393 (5" SPRUCE)	1247.20	76984.27	42764.91
	BT#394 (5" FIR)	1249.91	76996.67	42738.01
HV#23	IP#403	1090.83	80488.78	44128.76
	BT#406 (4" POPLAR)	1091.86	80489.05	44122.99
	BT#405 (5" POPLAR)	1090.13	80436.11	44134.56
HV#24	NAIL IN BRIDGE	914.87	73064.08	31432.99
	IP#400	914.23	73034.56	31528.35

HV#12	IP#352 (SATELITE)	1530.54	70107.26	39803.53

HV#26	IP#395	1291.56	76083.79	32769.89
	BT#397 (8" PINE)	1289.75	76097.47	32779.00
	BT#398 (5" FIR)	1289.26	76069.09	32779.05
HV#27	IP#374	1566.11	76876.00	27742.63
	BT#375 (6" SPRUCE)	1559.33	76862.03	27737.68
	BT#376 (4" SPRUCE)	1560.62	76889.78	27721.16
HV#29	IP#378	1689.61	79089.81	31406.01
	IP#379 (FACE PT.)	1690.72	79143.48	31396.77
	PHOTO PT. (POINT OF SHRUBS)	1688.85	79087.91	31407.67
	PHOTO PT. (POINT OF SHRUBS)	1689.79	79114.18	31408.53
HV2	HIGH POINT (SMALL ROCK KNOLL)	1815.55	59388.72	52565.07
	HIGH POINT (SMALL ROCK KNOLL)	1818.95	59191.98	52733.07

HV#18	946.86	75145.61	39926.26

Note: All coordinates and elevations are derived from 1956 triangulation control monuments.

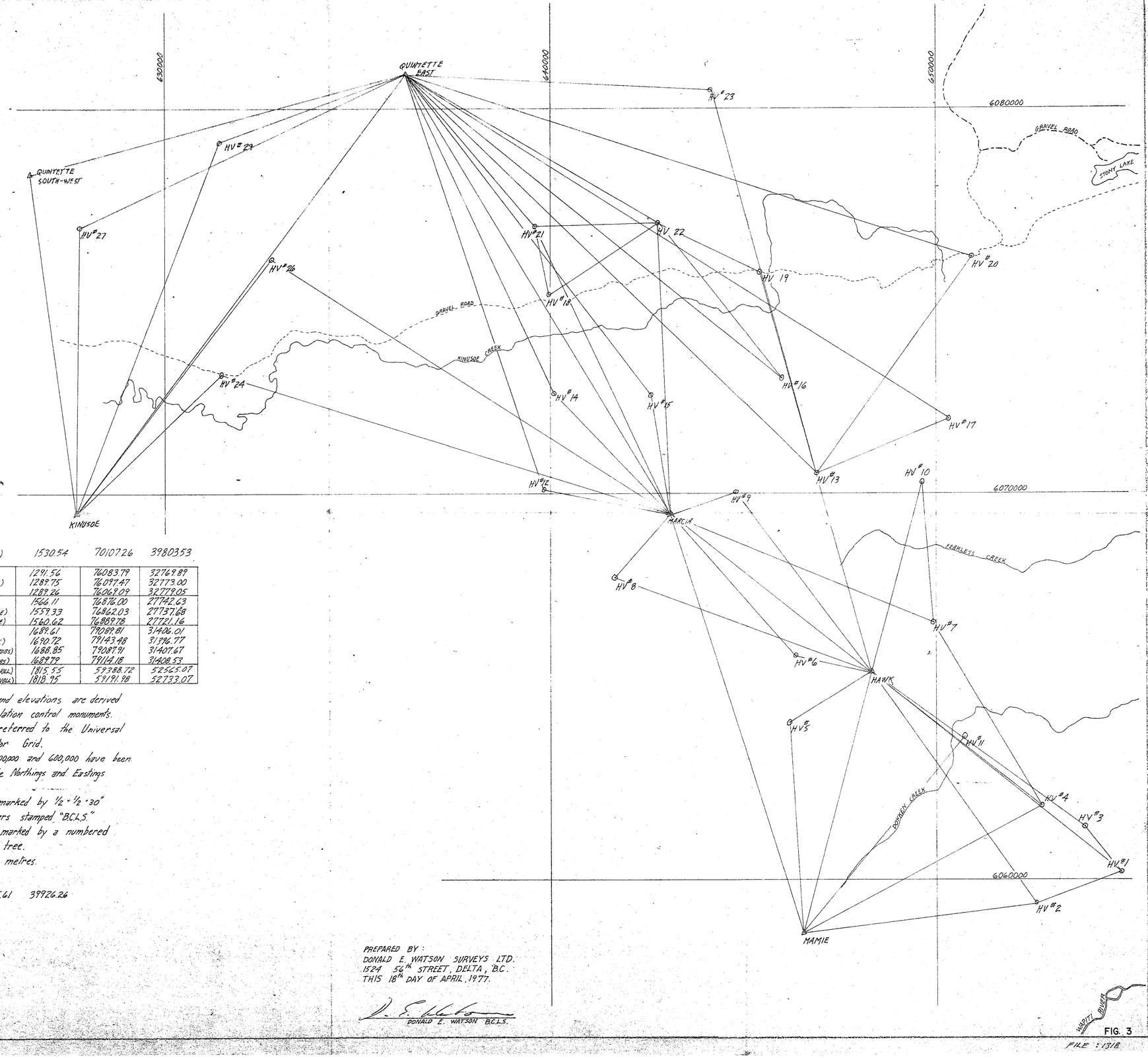
Note: All coordinates referred to the Universal Transverse Mercator Grid.

Note: Constants of 6000000 and 600,000 have been subtracted from the Northings and Eastings respectively.

Note: Stations set are marked by ½"·½"·30" galvanized iron bars stamped "B.C.L.S."

Note: Bearing trees are marked by a numbered tag nailed to the tree.

Note: Elevations are in metres.



PREPARED BY:
DONALD E. WATSON SURVEYS LTD.
1524 54th STREET, DELTA, B.C.
THIS 18th DAY OF APRIL, 1977.

DONALD E. WATSON B.C.L.S.

FIG. 3

FILE: 1318

Q P O N M

120° 51' 00" 120° 48' 00" 120° 45' 00" 120° 42' 00" 120° 39' 00" 120° 36' 00"

54° 50' 54° 48' 54° 46' 54° 44' 54° 42' 54° 40'

25 24 23 22 21

MQD-76-10 MQD-76-12 MQD-76-2 MQD-76-11 MQD-76-9 MQD-75-1 MQD-77-1 MQD-77-3 MQD-77-4 MQD-77-5 MQD-77-6 MQD-77-7 MQD-77-8 MQD-77-28

1977 CAMP 1977 DRILL CAMP

KINUSEO FALLS ROAD KINUSEO CREEK KINUSEO CREEK HONEYMOON CREEK FEARLESS CREEK DOOKEN CREEK FEARLESS MTN. ACCESS ROAD

STR-1 STR-2 STR-3 STR-4 STR-5 STR-6 STR-7 STR-8 STR-9 STR-10 STR-11 STR-12 STR-13 STR-14 STR-15 STR-16 STR-17 STR-18 STR-19 STR-20 STR-21 STR-22 STR-23 STR-24

1791

TOPOGRAPHIC LEGEND

- MAIN ACCESS ROAD — DRY WEATHER
- EXPLORATION ROAD
- EXPLORATION TRAIL
- AIR STRIP
- SEISMIC LINE, CUT LINE
- POWER TRANSMISSION LINE
- RIVER
- STREAM
- LAKE
- SWAMP
- CONTOURS (1625, 1500)
- DEPRESSION CONTOUR

GEOLOGICAL LEGEND

LOWER CRETACEOUS

- Ksh SHAFTESBURY FORMATION
- Kcb COMMOTION FORMATION (Boulder Creek Member)
- Kch COMMOTION FORMATION (Hulcross Member)
- Kcg COMMOTION FORMATION (Gates Member)

FORT ST. JOHN GROUP

- Kmb MOOSEBAR FORMATION
- Kgt GETHING FORMATION
- Kcd CADOMIN FORMATION

BULLHEAD GROUP

JURASSIC — CRETACEOUS

- JKmi MINNES GROUP

PALEOZOIC

- P DEVONIAN, MISSISSIPPIAN

SYMBOLS

- GEOLOGICAL CONTACT
- DIP AND STRIKE: REGULAR
- VERTICAL
- HORIZONTAL
- OVERTURNED
- THRUST: FLAGS SHOW DIP DIRECTION
- NORMAL FAULT
- ANTICLINE, SYNCLINE
- DRILL HOLE COLLAR
- TRENCH
- ADIT

SURVEY NOTE

Control Survey was carried out for Photogrammetric Mapping to cover MONKMAN COAL PROJECT COAL LEASES. Mapping outside of the Coal Leases was taken from existing N.T.S. maps, and 25 metre contour intervals were interpolated.

CONTOUR INTERVAL 25 m

R.M. HARDY & ASSOCIATES LTD.

1977

PROFESSIONAL GEOLOGIST ALBERTA LESLIE A. SMITH

PR-MONKMAN-BELCOURT 77(2)A.

542

PACIFIC PETROLEUMS LTD.

MINING DEPARTMENT

MONKMAN COAL PROJECT

SURFACE DISTURBANCE MAP

(1977 WORK IS IN RED)

Date	December 1977
Revised	
Author	L.A.S.
Drafted	R.P.B.
Scale	1 : 25,000

FIGURE 6

121°00'
54°50'
120°57'
54°50'
6,077,000 N
6,076,000 N
6,075,000 N
54°48'
121°00'
629,000 E
28,000 E
75,000 E
29,000N
28,000N
27,000N
T25 NW12
T25 NW11
T25 NE10
T25 NE9
T25 NW5
T25 NW4
T25 NE3
T25 NE2
T25 SW12
T25 SW11
T25 SE10
T25 SE9
T25 SW5
T25 SW4
T25 SE3
T25 SE2
Kch
Kcb
Kcg
Kmb
Kgt
Kcd
JKmi
STB-25
STB-26
STB 27
STB 28
STA-29
COAL AND SHALE
COAL
PR-MONKMAN-BELCOURT 77(2)A.

LEGEND

- Improved road
- Secondary road
- Track or trail
- Cut line
- Tree area
- River
- Steam
- Intermittent stream
- Swamp
- Contours 1300
- Horizontal control △ 390
- Vertical control ○ V 1372 I
- Spot elevation 1247.9
- Iron Pin ◇ IP

CONTOUR INTERVAL 5 METRES
DATE OF PHOTOGRAPHY SEPTEMBER 1975
DATE OF SURVEY APRIL 1977
DATE OF MAPPING MAY 1977

SURVEY NOTE

The Horizontal and Vertical Co-ordinates were established by D. W. Watson, B.C.L.S. using conventional and E.D.M. survey equipment. Horizontal and vertical co-ordinates and elevations are derived from Trig. Stations Quintette E, Quintette S.W., Mamie, Hawk, Marcia, Kinuseo. All co-ordinates referred to Universal Traverse Mercator Grid Zone 10. Elevations are above Mean Sea Level were established by trig. levelling, vertical angles being read at both ends of each course simultaneously.

GEOLOGICAL LEGEND

LOWER CRETACEOUS

- Ksh — SHAFTESBURY FORMATION
- Kcb — COMMOTION FORMATION (Boulder Creek Member)
- Kch — COMMOTION FORMATION (Hulcross Member)
- Kcg — COMMOTION FORMATION (Gates Member)

FORT ST. JOHN GROUP

- Kmb — MOOSEBAR FORMATION
- Kgt — GETHING FORMATION
- Kcd — CADOMIN FORMATION

BULLHEAD GROUP

JURASSIC — CRETACEOUS

- JKmi — MINNES GROUP

PALEOZOIC

- P — DEVONIAN, MISSISSIPPIAN

- — CONGLOMERATE
- — SANDSTONE
- — SILTSTONE
- — MUDSTONE

KEY MAP
SCALE 1:250,000

542

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

FIVE CABIN BLOCK
GEOLOGICAL MAP

Date	December 1977
Revised	
Author	AEB
Drafted	RPB
Scale	1:5,000

FIGURE 5
T 25

542

PROFESSIONAL GEOLOGIST ALBERTA
LESLIE A. SMITH

R.M. HARDY & ASSOCIATES LTD.

Q P O N M

120° 51' 00" 120° 48' 00" 120° 45' 00" 120° 42' 00" 120° 39' 00" 120° 36' 00"

54° 50' 54° 48' 54° 46' 54° 44' 54° 42' 54° 40'

25 24 23 22 21

22,000 N. 21,000 N. 20,000 N. 19,000 N. 18,000 N. 17,000 N. 16,000 N. 15,000 N. 14,000 N. 13,000 N. 12,000 N. 11,000 N. 10,000 N. 9,000 N. 8,000 N. 7,000 N.

22,000 W. 21,000 N. 20,000 N. 19,000 N. 18,000 N. 17,000 N. 16,000 N. 15,000 N. 14,000 N. 13,000 N. 12,000 N. 11,000 N. 10,000 N. 9,000 N.

BASE LINE

KINUSEO CREEK

HONEYMOON CREEK

FEARLESS CREEK

DUKE MOUNTAIN

DUCHESS MOUNTAIN

DOKKEN RIDGE

QUINTETTE ANTICLINE

DUKE ANTICLINE

DUKE SYNCLINE

FEARLESS ANTICLINE

FEARLESS SYNCLINE

DOKKEN ANTICLINE

DOKKEN SYNCLINE

MQD-76-10 MQD-76-12 MQD-75-2 MQD-75-1 MQD-77-1 MQD-77-7 MQD-77-8 MQD-77-2B MQD-76-11 MQD-76-9 MQD-77-4 MQD-77-5 MQD-77-6

HTB-1 STA-1 STB-1 STB-2 STB-3 STB-4 STB-5 STB-6 STB-7 STB-8 STB-9 STB-10 STB-11 STB-12 STB-13 STB-14 STB-15 STB-16 STB-17 STB-18 STB-19 STB-20 STB-21 STB-22 STB-23 STB-24 STB-25

641656.1 6067123.0

641993.9 6063516.9

652984.9 6065636.9

649297.6 6061920.9

PR-MONKMAN-BELCOURT 77 (2) A.

542

TOPOGRAPHIC LEGEND

- MAIN ACCESS ROAD — DRY WEATHER
- EXPLORATION ROAD
- EXPLORATION TRAIL
- AIR STRIP
- SEISMIC LINE, CUT LINE
- POWER TRANSMISSION LINE
- RIVER
- STREAM
- LAKE
- SWAMP
- CONTOURS (1625, 1500)
- DEPRESSION CONTOUR

GEOLOGICAL LEGEND

LOWER CRETACEOUS

- Ksh SHAFTESBURY FORMATION
- Kcb COMMOTION FORMATION (Boulder Creek Member) — FORT ST. JOHN GROUP
- Kch COMMOTION FORMATION (Hulcross Member) — FORT ST. JOHN GROUP
- Kcg COMMOTION FORMATION (Gates Member) — FORT ST. JOHN GROUP
- Kmb MOOSEBAR FORMATION — BULLHEAD GROUP
- Kgt GETHING FORMATION — BULLHEAD GROUP
- Kcd CADOMIN FORMATION — BULLHEAD GROUP

JURASSIC — CRETACEOUS

- JKmi MINNES GROUP

PALEOZOIC

- P DEVONIAN, MISSISSIPPIAN

SYMBOLS

- GEOLOGICAL CONTACT
- DIP AND STRIKE: REGULAR
- VERTICAL
- HORIZONTAL
- OVERTURNED
- THRUST: FLAGS SHOW DIP DIRECTION
- NORMAL FAULT
- ANTICLINE, SYNCLINE
- DRILL HOLE COLLAR
- TRENCH
- ADIT

SURVEY NOTE

Control Survey was carried out for Photogrammetric Mapping to cover MONKMAN COAL PROJECT COAL LEASES. Mapping outside of the Coal Leases was taken from existing N.T.S. maps, and 25 metre contour intervals were interpolated.

CONTOUR INTERVAL 25 m

R.M. HARDY & ASSOCIATES LTD.

1977

PROFESSIONAL GEOLOGIST ALBERTA LESLIE A. SMITH

PACIFIC PETROLEUMS LTD.

MINING DEPARTMENT

MONKMAN COAL PROJECT

Dec 10/92 outcrops South of 54°45' 542DUKEFM
JC
Sum92064

DUKE MOUNTAIN BLOCK GEOLOGICAL MAP

Date	NOV. 1977
Revised	
Author	LAS / AEB
Drafted	
Scale	1 : 25.000

FIGURE 4

PR-MONKMAN 77(3)A.

VOL II

MINING RECORDER
RECEIVED and RECORDED
DEC 13 1977
M.R. #.....
VICTORIA, B. C.

Pacific Petroleums Ltd.

MONKMAN COAL PROJECT

1977

Location: N.T.S. 93I/7, 8, 10, 15

Coal Licence Nos:

3131-3135	3170-3174
3138-3139	3177-3184
3141-3149	3187-3190
3151-3155	3193
3157-3164	3195-3207
3166-3168	3209-3264

OPEN FILE

Authors: L. A. Smith, A. E. Bienia and J. Y. Wright
Date Submitted: January 13, 1978

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 542

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J. Y. WRIGHT

J. Y. Wright, P.Geol.

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MQD 77-1

Location:
(a) Coal Licence: 3231
(b) N.T.S. : c-66-B, 93-I-15
(c) Coal Grid :
(d) Mine Grid :

Azimuth & Inclination: Vertical

Core Size: HQ (63.5 mm)

Date Drilled: August 6 - 8, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Hole was plugged, casing was pulled. Hole abandoned

Logged by: A. E. Bienia

Formation Tested: Hulcross Member

Coal Seams Intersected: None

Total Depth: 71.9 m

Geophysical Logs: None run.

Interval (metres)	Width (metres)	Description
0 - 3.66	3.66	Overburden
3.66 - 5.18	1.52	HULCROSS MEMBER, COMMOTION FORMATION Sandstone, f.g., interbedded with siltstone; minor flow features, ferruginous staining.
5.18 - 5.79	0.61	Sandstone, v.f.g. to f.g., medium grey.
5.79 - 8.23	2.44	Sandstone, v.f.g., with interbedded siltstones, medium grey, flow features, ferruginous stain. Dip 56°.
8.23 - 11.00	2.77	Siltstone and f.g. sandstone, interbedded, medium grey with flow structures and minute disseminated specks and blebs of pyrite.
11.00 - 12.50	1.50	Siltstone, medium to dark grey, with occasional interbedded, light grey , f.g. sandstone; flow features, worm burrow at ca. 12.0 m, carbonaceous specks.
12.50 - 17.40	4.90	Siltstone, occasionally interbedded with fine sandstone, carbonaceous or coaly parting at ca. 13.0 m; minor carbonaceous specks, flow features, with very fine sandstone, medium to dark grey; pyrite blebs and specks at approximately 15.3 m. Dip 49°. Slickensides (minor fault approximately parallel to bedding plane) 16.5 m - 17.4 m.
17.40 - 17.80	0.40	Siltstone, dark grey, slickensided.
17.80 - 19.00	1.20	Siltstone interbedded with very fine sandstone; slickensides, flow features, occasional minute pyrite blebs and specks.
19.00 - 21.80	2.80	Siltstone, dark grey, occasionally interbedded with very fine sandstone, dark grey; minor flow features, pyrite blebs up to 0.5 cm. Dip 47°.
21.80 - 23.47	1.67	Siltstone, some intervals (20%) interbedded with fine sandstone; pyrite blebs, minor amounts of carbonaceous material, minor flow features.
23.47 - 29.50	6.03	Siltstone, interbedded with fine sandstone; pyrite blebs, carbonaceous specks, occasional slickensides, flow features.
29.50 - 31.57	2.07	Siltstone, dark grey, interbedded with small amounts of fine sandstone; rare pyrite blebs and specks.
31.57 - 31.67	0.10	Mudstone, broken and crushed.

Interval (metres)	Width (metres)	Description
31.67 - 31.70	0.03	Carbonate band, white, calcite-rich, fine, soft, fairly crumbly.
31.70 - 32.61	0.91	Siltstone, dark grey, in places interbedded with fine sandstone; minor slickensides, minor flow features, pyrite blebs and minute stringers.
32.61 - 35.66	3.05	Siltstone, dark grey, small interval of siltstone interbedded with fine sandstone; minor flow (structure) features, slickensides; pyrite stringer at 32.65 m, 5 mm wide. Dip 52°.
35.66 - 38.10	2.44	Siltstone, dark grey, interbedded with fine sandstone (light grey); slickensides, minor flow features.
38.10 - 40.23	2.13	Siltstone, dark grey, some interbeds of f.g., light grey sandstone, slickensides.
40.23 - 47.85	7.62	Siltstone, dark grey, very compact and uniform, with rare sandstone interbeds; pyrite stringer at 40.50 m approximately 10 mm wide, slickensides. Dip 45° at 42 m. Dip 52° at 45 m.
47.85 - 55.47	7.62	Siltstone, dark grey, rare or minor amounts of light grey sandstone (thin), minor flow features, slickensides, trace amounts of pyrite.
55.47 - 60.26	4.79	Siltstone, dark grey, minor amounts of interbedded very fine sandstone, flow features, slickensides, minor specks white ash. Dip 54° at 57 m.
60.26 - 60.76	0.50	Mudstone (broken).
60.76 - 63.40	2.64	Siltstone, dark grey, rare very fine sandstone interbeds, minor (less than 10 mm) bands of mudstone, slickensides, flow features.
63.40 - 67.06	3.66	Siltstone, dark grey, (rare, light, very fine sandstone) (at 63.40 - 63.50 band of mudstone); slickensides, minute fractures filled with calcite.
67.06 - 71.02	3.96	Siltstone, dark grey, with occasional very fine sandstone, slickensides, flow features, plant fossils, carbonaceous specks and minor specks of white ash. Dip 55°.
71.02 - 71.93	0.91	Siltstone, dark grey; minor amounts of interbedded very fine sandstone, slickensides, minor flow features.

T.D. 71.93 m

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MDD 77-2

Location:

(a) Coal Licence: 3226
(b) N.T.S. : b-39-B, 93-I-15
(c) Coal Grid :
(d) Mine Grid :

Azimuth & Inclination: Vertical

Core Size: HQ (63.5 mm)

Date Drilled: August 13 - 14, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Casing and one rod lost down hole
Hole abandoned

Logged by: A. E. Bienia

Formation Tested: Gates Member

Coal Seams Intersected: B7, B9, B10, B11

Total Depth: 114.9 m

Geophysical Logs: None run

Interval (metres)	Width (metres)	Description
0 - 20.72	20.72	OVERBURDEN
20.72 - 24.08	3.36	GATES MEMBER, COMMOTION FORMATION Sandstone, f.g. to m.g., light grey, some siltstone bands, carbonaceous specks and stringers, flow features.
24.08 - 26.15	2.07	Siltstone, dark grey, carbonaceous specks and coaly partings, plant fossils, some flow features; occasional interval interbedded with f.g. to m.g. sandstone.
26.15 - 29.57	3.42	Sandstone, f.g. to m.g., light grey, grain size coarsening downwards, carbonaceous and coaly stringers; 6 cm coal band at 28.12 4 cm coal band at 27.62
29.57 - 38.71	9.14	Sandstone, m.g. to c.g., light grey, grain size coarsening downwards, carbonaceous specks and stringers, occasional coal band 1 cm in width. Dip = 19°.
38.71 - 39.01	0.30	Siltstone, dark grey, fractured, plant fossils.
39.01 - 39.11	0.10	COAL, clean, broken, intermediate lustre, with 10% vitreous bands. Recovered 7 cm.
39.11 - 39.49	0.38	COAL 39.11 - 39.16 - Siltstone, carbonaceous, 10% coal bands, pyrite blebs and disseminations 39.16 - 39.23 - COAL, dirty, pyrite blebs. 39.23 - 39.29 - COAL, very dirty (50% coal) pyrite disseminations. 39.29 - 39.33 - COAL, fairly clean, intermediate lustre with 20% vitreous coal bands, pyrite disseminations. 39.33 - 39.49 - COAL, intermediate lustre with 40% dull coal, one 4 mm silt band at 39.48, pyrite. (Recovery 100%)
39.49 - 39.63	0.14	COAL, clean, minute fractures, with vitreous coal along fractures, intermediate lustre with 30% dull coal.
39.63 - 39.64	0.01	Siltstone parting.
39.64 - 39.67	0.03	COAL, dirty, intermediate lustre, 30% dull coal.
39.67 - 39.93	0.26	COAL, clean, broken, 60% intermediate lustre, 40% dull coal, fractured, traces of pyrite. Recovered 9 cm.

Interval (metres)	Width (metres)	Description
39.93 - 39.98	0.05	COAL, broken, 60% dull coal, 40% intermediate lustre. Sample: 7004 : 39.01 - 39.98 0.97
39.98 - 41.52	1.54	Mudstone, carbonaceous, with some carbonaceous siltstone intervals, plant fossils, solid. Dips = 22° - 24°.
41.52 - 42.06	0.54	Sandstone, v.f.g. to f.g., light to medium grey, carbonaceous partings.
42.06 - 42.67	0.61	Siltstone, with v.f.g. sandstone interbeds, carbonaceous partings, plant fossils, pyrite disseminations and stringers.
42.67 - 46.94	4.27	Siltstone, dark grey, carbonaceous partings and coaly stringers with one 5 cm vitreous coal band at 46.64.
46.94 - 49.51	2.57	Siltstone, dark grey, with minor f.g. sandstone bands or interbeds, carbonaceous partings and coaly stringers, plant fossils. Dips = 22° - 25°.
49.51 - 51.11	1.60	Sandstone, f.g., with minor siltstone interbeds, carbonaceous stringers, flow features, calcite filled fractures.
51.11 - 51.76	0.65	Sandstone, f.g., medium grey, carbonaceous partings, and coal stringers, occasional fracture filled with calcite.
51.76 - 56.22	4.46	Siltstone, dark grey, with some f.g. sandstone interbeds, carbonaceous specks, coaly stringers and partings, plant fossils, minute fractures, flow features. Dip = 21°.
56.22 - 56.31	0.09	COAL, clean, 80% dull coal with 20% vitreous bands, pyrite blebs and disseminations.
56.31 - 56.42	0.11	COAL, clean, fairly solid, 80% dull coal with 20% vitreous bands.
56.42 - 56.52	0.10	COAL, clean, crushed and ground, dull coal with 30% vitreous coal.
56.52 - 56.53	0.01	COAL, dirty.
56.53 - 56.62	0.09	COAL, clean, fractured, dull coal with 20% vitreous coal bands.
56.62 - 56.72	0.10	COAL, clean, intermediate lustre with 40% dull coal, pyrite disseminations.
56.72 - 56.84	0.12	COAL, clean, dull coal with 35 - 40% vitreous coal bands, pyrite disseminations.

Interval (metres)	Width (metres)	Description
56.84 - 56.89	0.05	COAL, clean, broken and crushed, dull coal with 40% vitreous coal. Sample: 7005 : 56.22 - 56.89 0.67
56.89 - 58.24	1.35	Siltstone, carbonaceous, coal stringers. Dip = 22°.
58.24 - 58.29	0.05	COAL, dull coal with 20% vitreous coal bands.
58.29 - 58.33	0.04	COAL, dirty, 80% dirty dull coal with 20% vitreous, brittle coal, highly fractured.
58.33 - 58.37	0.04	COAL, clean, dull coal with 20% vitreous bands.
58.37 - 58.51	0.14	Mudstone, carbonaceous.
58.51 - 58.57	0.06	COAL, dirty, with 10% vitreous (1 mm) bands.
58.57 - 58.59	0.02	Siltstone, carbonaceous.
58.59 - 58.70	0.11	COAL, fairly clean, dull coal with small bands of vitreous coal (15%), broken.
58.70 - 58.80	0.10	COAL, dirty; alternating coal bands (dull) and silty bands.
58.80 - 58.89	0.09	COAL, clean, broken; intermediate lustre with 30% - 40% vitreous bands.
58.89 - 58.92	0.03	Mudstone, coaly.
58.92 - 59.05	0.13	COAL, clean; dull with 30% vitreous bands.
59.05 - 59.21	0.16	COAL, very dirty, hard, 10% vitreous bands.
59.21 - 59.23	0.02	COAL, crushed and ground; dull coal.
59.23 - 59.38	0.15	COAL, very dirty, crushed and broken.
59.38 - 59.44	0.06	COAL, clean, dull coal with up to 40% vitreous coal bands.
59.44 - 59.74	0.30	COAL, very crushed and ground.
59.74 - 59.76	0.02	COAL, dirty, very crushed and ground, coal and carbonaceous mudstone chips. Sample: 7006 : 58.24 - 59.76 1.52
59.76 - 61.64	1.88	Siltstone, dark grey, occasional f.g. sandstone band, carbonaceous stringers, plant fossils, fractured.

Interval (metres)	Width (metres)	Description
61.64 - 62.04	0.40	Sandstone, f.g., medium grey, carbonaceous specks, minor flow features.
62.04 - 63.70	1.66	Siltstone, dark grey, carbonaceous specks and stringers, plant fossils, occasional coal stringer.
63.70 - 69.19	5.49	Siltstone, dark grey, with v.f.g. sandstone interbeds, carbonaceous specks, plant fossils, minor flow features, minute fractures filled with calcite. Dips = 24° - 26°.
69.19 - 69.69	0.50	Sandstone, v.f.g., medium grey.
69.69 - 72.24	2.55	Siltstone, dark grey, with occasional v.f.g. sandstone interbed, carbonaceous specks, plant fossils, occasional coal stringer up to 0.5 cm in width, fractured.
72.24 - 76.95	4.71	Siltstone, dark grey, with occasional v.f.g. sandstone interbed, carbonaceous specks, plant fossils, occasional minute fracture filled with calcite, minor slickensides. Dip = 23°.
76.95 - 77.32	0.37	COAL, clean, solid, some fractures; vitreous coal with 20% dull coal bands.
77.32 - 77.45	0.13	COAL, clean, solid; intermediate lustre with 20% vitreous coal bands.
77.45 - 77.49	0.04	Mudstone.
77.49 - 77.55	0.06	COAL, clean, broken; intermediate lustre with ca. 5% vitreous coal bands.
77.55 - 77.83	0.28	COAL, clean, hard; intermediate lustre with 20% vitreous coal bands.
77.83 - 79.08	1.25	COAL, clean, fairly brittle; 70% vitreous coal, with 5% dull, soft, peaty coal.
79.08 - 79.12	0.04	Mudstone, carbonaceous
79.12 - 79.40	0.28	COAL, clean, brittle, vitreous coal (80%) with 20% bands of intermediate lustre.
79.40 - 79.76	0.36	COAL, clean, brittle, 60% vitreous coal, 40% intermediate lustre.
79.76 - 79.82	0.06	Mudstone, carbonaceous.

Interval (metres)	Width (metres)	Description
79.82 - 79.86	0.04	COAL, clean, broken, intermediate lustre. Samples: 7007 : 76.95 - 77.83 0.88 7008 : 77.83 - 79.12 1.29 7009 : 79.12 - 79.86 0.74
79.86 - 80.92	1.06	Siltstone interbedded with f.g. sandstone, carbonaceous specks, plant fossils, flow features.
80.92 - 81.48	0.56	Sandstone, f.g., interbedded with occasional siltstone, carbonaceous stringers, plant fossils, flow features. Dips = 20° - 23°.
81.48 - 84.16	2.68	Siltstone, coal partings and stringers (2 mm), fractured, slickensided.
84.16 - 84.53	0.37	Siltstones alternating with vitreous coal bands up to 4 cm in width.
84.53 - 85.04	0.51	Siltstone, carbonaceous.
85.04 - 89.92	4.88	Siltstone, with v.f.g. sandstone interbeds, carbonaceous partings, plant fossils, minute fractures, flow features.
89.92 - 91.47	1.55	Sandstone, f.g., carbonaceous partings and stringers, plant fossils, flow features.
91.47 - 93.85	2.38	Siltstone, dark grey, with v.f.g. sandstone interbeds, carbonaceous stringers, coal bands up to 0.5 cm in width, minute fractures. 93.63 - 93.85 - Coal, clean, fairly solid, intermediate lustre with 40% vitreous bands. Dips = 19° - 22°.
93.85 - 95.43	1.58	Siltstone, with some f.g. sandstone interbeds, carbonaceous stringers and partings, plant fossils.
95.43 - 98.55	3.12	Siltstone interbedded with v.f.g. sandstone, specks and partings, plant fossils, minute fractures, minor flow features and occasional slickensides.
98.55 - 98.60	0.05	COAL band, dull coal, 30% vitreous.
98.60 - 101.92	3.32	Siltstone, dark grey, carbonaceous partings, plant fossils, coal bands up to 1 cm in width.
101.92 - 102.54	0.62	Sandstone, f.g. with occasional siltstone bands, carbonaceous stringers and partings, flow features, calcite filled fractures, some slickensides.

Interval	Width	Description
102.54 - 103.12	0.58	Siltstone with v.f.g. sandstone interbeds, coaly partings and stringers, slickensided. Dip = 20°.
103.12 - 104.27	1.15	Sandstone, f.g. to m.g., with occasional silt band, carbonaceous stringers, fractures filled with calcite.
104.27 - 106.52	2.25	Siltstone with occasional interbed of v.f.g. sandstone, carbonaceous and coaly stringers and partings, plant fossils, minute fractures filled with calcite, slickensides.
106.52 - 106.62	0.10	COAL, broken, intermediate lustre, 20% vitreous bands.
106.62 - 106.85	0.23	Siltstone, carbonaceous.
106.85 - 107.15	0.30	COAL, broken, intermediate lustre, 20% vitreous bands.
107.15 - 108.81	1.66	Siltstone, coal bands and stringers up to 1 cm in width, plant fossils, carbonaceous, slickensides.
108.81 - 108.85	0.04	Mudstone, coaly, with 20% vitreous bands.
108.85 - 109.11	0.26	COAL, clean, broken, 60% vitreous, 40% dull.
109.11 - 109.42	0.31	Mudstone, carbonaceous with thin bands of coal (4 mm widths).
109.42 - 109.52	0.10	COAL, clean, vitreous, crushed and ground.
109.52 - 109.60	0.08	COAL, solid, dull.
109.60 - 109.94	0.34	COAL, clean, brittle, fairly solid; dull coal with 30% vitreous bands.
109.94 - 110.20	0.26	COAL, clean, brittle, vitreous; crushed and ground.
110.20 - 110.22	0.02	Mudstone, carbonaceous.
110.22 - 110.37	0.15	COAL, clean, fairly solid, vitreous (greater than 80%).
110.37 - 110.56	0.19	COAL, clean, intermediate lustre.
110.56 - 110.64	0.08	Core lost.
110.64 - 110.84	0.20	COAL, clean, broken; dull coal with 30% vitreous bands.
110.84 - 110.95	0.11	COAL, dirty, hard, solid.
110.95 - 111.05	0.10	COAL, clean, brittle; 90% dull coal with 10% vitreous bands.

Interval	Width	Description
111.05 - 111.40	0.35	COAL, clean, crushed and ground, dull coal with 20% vitreous coal bands. Recovered 15 cm.
111.40 - 111.52	0.12	Mudstone, carbonaceous, hard, solid.
111.52 - 111.86	0.34	Mudstone, carbonaceous, with vitreous coal stringers, and coal along fractures, broken; recovered 10 cm. Samples: 7010 : 108.81 - 109.42 0.61 7011 : 109.42 - 110.56 1.14 7012 : 110.56 - 111.86 1.30
111.86 - 114.91	3.05	Siltstone interbedded with sandstone, carbonaceous and coaly stringers, flow features, minute fractures.

T.D. 114.91 m

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MDD 77-2A

Location:

(a)	Coal Licence:		3226
(b)	N.T.S.	:	b-39-B, 93-I-15
(c)	Coal Grid	:	
(d)	Mine Grid	:	

Azimuth & Inclination: Vertical

Core Size: HQ (63.5 mm)

Date Drilled: August 15 - 18, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Lost two rods and accessories down hole casing pulled and abandoned

Logged by: J. D. van der Lee

Formation Tested: Gates Member

Coal Seams Intersected: B9, B10, B11

Total Depth: 99.7 m

Geophysical Logs: None run

Interval (metres)	Width (metres)	Description
0 - 21.64	21.64	Overburden
21.64 - 23.63	1.99	GATES MEMBER COMMOTION FORMATION Sandstone, m.g., light grey, carbonaceous specks and stringers, plant fossils, occasional fracture, ferruginous straining common.
23.63 - 23.98	0.35	Siltstone, carbonaceous specks and stringers, plant fossils
23.98 - 25.10	1.12	Sandstone, f.g. to m.g. wtih occasional siltstone interbed, carbonaceous stringers and partings, plant fossils, flow features Dip 23°.
25.10 - 25.62	0.52	Siltstone, carbonaceous stringers, plant fossils, flow features.
25.62 - 29.57	3.95	Sandstone, f.g. to m.g., light grey, carbonaceous stringers and partings, some coal bands (0.5 cm in width) occasional fracture, ferruginous stain.
29.57 - 34.35	4.78	Sandstone, f.g. to m.g., light grey, carbonaceous strings and partings, ferruginous stain along minute fractures, some low angle cross bedding.
34.35 - 34.57	0.22	Sandstone, m.g., soft and broken with ferruginous staining.
34.57 - 37.62	3.05	Sandstone, m.g., light grey, a few carbonaceous stringers and partings, fractures with ferruginous stain, minor cross bedding.
37.62 - 37.97	0.35	Sandstone, v.f.g., with siltstone interbeds, carbonaceous partings, flow features, Dip 25°.
37.97 - 38.32	0.35	Siltstone with v.f.g. ss interbeds, carbonaceous partings, flow features, thinly bedded, laminated.
38.32 - 38.71	9.39	Coal, clean, broken, intermediate to vitreous lustre, highly fractured. Recovered 10 cm.
38.71 - 38.76	0.05	Coal, fairly clean, dull, broken coal with thin (1 mm) vitreous stringers (10%); one cm. of mudstone, traces of pyrite.
38.76 - 38.91	0.15	Coal, clean, fairly brittle, 30% vitreous bands, 70% dull coal, traces of pyrite, poor recovery.

Interval (metres)	Width (metres)	Description
38.91 - 39.35	0.44	Coal, clean, hard, 40% nitreous bands (bands usually 1 cm in width), 60% dull coal, good recovery - (785%)
39.35 - 39.45	0.10	Coal, clean, very brittle, broken; highly fractured, 50% vitreous, 50% dull coal.
39.45 - 39.47	0.02	Coal, very dirty, broken Sample: 7013: 38.32 - 39.47 1.15
39.47 - 39.72	0.25	Mudstone, carbonaceous, some thin vitreous partings, interval broken.
39.72 - 40.39	0167	Siltstone 1 Mudstone, some coaly partings (2 cm) of broken coal at 40.07), flow features.
40.39 - 41:41	1.02	Siltstone with some v.f.g. ss interbeds, some carbonaceous specks and coal stringers, flow features.
41.41 - 43.44	2.03	Mudstone, carbonaceous, plant fossils, some vitreous strings (1-2 mm).
43.44 - 43.55	0.11	Coal, hard, broken; vitreous, poor recovery
43.55 - 46.75	3.20	Mudstone 1 Silstone, carbonaceous, some vitreouscoal stringers and partings, plant fossils.
46.75 - 47.85	1.10	Siltstone, dark grey, with v.f.g. ss interbeds, some flow features. Dips 22° - 24°.
47.85 - 49.03	1.18	Mudstone, carbonaceous, plant fossils
49.03 - 51.26	2.23	Sandstone, f.g. to m.g. with dark grey siltstone interbeds, some carbonaceous partings, flow features.
51.26 - 53.58	2.32	Sandstone, v.f.g. to m.g., light grey, fining downwards, occasional dark grey siltstone interbeds, some plant fossils. Dips 23^{0} - 25°.
53.58 - 55.56	1.98	Mudstone, carbonaceous, with some small siltstone bands, some flow features and ripple cross laminations.
55.56 - 55.68	0.12	Coal, clean, fairly hard, solid; banded coal, 30% vitreous, 40% dull and 30% of intermediate lustre.
55.68 - 56.08	0.40	Coal, clean, broken; vitreous coal. Recovered 30 cm.
56.08 - 56.17	0.09	Coal, clean, vitreous, broken and crushed.

MDD 77 - 2A (cont'd)

Interval (metres)	Width (metres)	Description
56.17 - 56.45	0.28	Silstone, carbonaceous
56.45 - 56.49	0.04	Coal, broken and crushed; 10% vitreous bands Sample: 7014: 55.56 - 56.49 0.93
56.49 - 57.83	1.34	Mudstone, carbonaceous, solid, plant fossils.
57.83 - 57.95	0.12	Coal, dirty, 10% vitreous bands.
57.95 - 58.22	0.27	Coal, clean, fairly brittle, 30% vitreous.
58.22 - 58.50	0.28	Siltstone, carbonaceous, slickensided.
58.50 - 58.84	0.34	Coal, fairly hard, solid, 10% vitreous, 40% dull, 50% intermediate lustre, banded.
58.85 = 58.85	0.01	Silstone. Dip 23°.
58.85 - 59.15	0.30	Coal, crushed and broken, 10% vitreous, 90% intermediate lustre, Sample: 7015: 57.95 - 59.15 1.20
59.15 - 59.59	0.44	Mudstone, carbonaceous, plant fossils, some vitreous coal stringers.
59.59 - 61.15	1.56	Siltstone,carbonaceous specks and stringers, flow features.
61.15 - 61.45	0.30	Siltstone with v.f.g. ss interbeds, some carbonaceous material, flow features.
61.45 - 62.77	1.32	Siltstone, dark grey, some carbonaceous material, minor flow features.
62.77 - 63.35	0.58	Mudstone, coaly and carbonaceous intervals, some vitreous coal stringers, plant fossils
63.35 - 66.20	2.85	Siltstone, dark grey, with minor v.f.g, light grey, ss interbeds, carbonaceous partings, some calcite filled fractures, minor flow features.
66.20 - 66.66	0.46	Sandstone, f.g., light grey, with some siltstone bands, some carbonaceous partings and flow features.
66.66 - 67.73	1.07	Silstone with occasional v.f.g. ss interbeds.
67.73 - 69.19	1.46	Sandstone, f.g., medium grey, interbeded with siltstone, flow features, calcite filled fractures, some slickensides.

Interval (metres)	Width (metres)	Description
69.19 - 73.29	4.10	Siltstone, dark grey, carbonaceous partings, some calcite filled fractures.
73.29 - 75.80	2.51	Sandstone, v.f.g., light to medium grey, with siltstone interbeds, carbonaceous specks and partings, flow features. Dips 21° - 23°.
75.80 - 76.31	0.51	Siltstone, dark grey, with minor interbeds of v.f.g., ss.
76.31 - 76.41	0.10	Coal, clean, brittle, fractured; 40% vitreous, 60% intermediate lustre.
76.41 - 76.49	0.08	Coal, clean, 40% intermediate lustre, 60% dull coal.
76.49 - 76.51	0.02	Siltstone, carbonaceous
76.51 - 76.80	0.29	Coal, clean, hard, solid; intermediate lustre with 10-15% vitreous bands.
76.80 - 76.88	0.08	Siltstone, carbonaceous.
76.88 - 77.11	0.23	Coal, clean, fairly hard, broken and crushed, 90% intermediate lustre, 10% vitreous bands.
77.11 - 77.43	0.32	Coal, clean, brittle, intermediate lustre with 10% vitreous bands and 10% dull coal.
77.43 - 77.67	0.24	Coal, clean, 60% intermediate lustre with 40% vitreous bands; last 10 cm very broken andcrushed.
77.67 - 78.20	0.53	Coal, clean, solid, intermediate lustre with vitreous bands up to 10%.
78.20 - 78.38	0.18	Coal, clean solid; intermediate lustre, 20% dull coal and 30% vitreous coal bands. Siltstone parting from 78.34 - 78.38, slickensided.
78.38 - 78.95	0.57	Coal, clean, slightly broken; intermediate lustre, 20% dull coal and 30% vitreous .
78.95 - 78.98	0.03	Siltstone, carbonaceous.
78.98 - 79.00	0.02	Coal, clean, crushed and ground, intermediate lustre, 10% vitreous.

Samples:

7016:	76.31 - 77.11	0.80
7017:	77.11 - 78.38	1.27
7018:	78.38 - 79:00	0.62

MDD 77 - 2A (cont'd)

Interval (metres)	Width (metres)	Description
79.00 - 79.40	0.40	Mudstone, with some coal bands.
79.40 - 79.51	0.11	Siltstone, carbonaceous, plant fossils.
79.51 - 82.30	2.79	Sandstone, f.g., medium grey, wtih siltstone interbeds, plant fossils, flow features. Dip 23°.
82.30 - 83.24	0.94	Mudstone, carbonaceous, plant fossils, occasional coal stringer, slickensided, minor fractures filled with calcite.
83.24 - 83.71	0.47	Silstone, carbonaceous, plant fossils.
83.71 - 83.96	0.25	Mudstone, carbonaceous, with vitreous coal bands up to 2 cm in width, sime slickensides.
83.96 - 84.83	0.87	Siltstone, carbonaceous, with plant fossils.
84.83 - 88.53	3.70	Siltstone, some intervals interbedded with v.f.g. ss, carbonaceous partings, plant fossils, minor flow features, some slickensides.
88.53 - 88.92	0.39	Mudstone, carbonaceous, occasional coal stringer, slickensided.
88.92 - 88.96	0.04	Coal band, 20% vitreous.
88.96 - 89.13	0.17	Mudstone, carbonaceous.
89.13 - 90.60	1.47	Sandstone, f.g., with some siltstone interbeds, carbonaceous partings, plant fossils, some minute coal stringers (1mm).
90.60 - 91.32	0.72	Siltstone, carbonaceous, minor slickensides
91.32 - 91.46	0.14	Coal, dirty.
91.46 - 92.40	0.94	Siltstone, carbonaceous, plant fossils, coal stringers up to 3mm in width.
92.40 - 92.48	0.08	Coal, 20% vitreous.
92.48 - 92.60	0.12	Siltstone, carbonaceous with minor coal stringers.
92.60 - 93.32	0.72	Coal, solid, 60% dull, 40% vitreous; one mudstone parting (3 cm in width) at 93.02.
93.32 - 93.71	0.39	Mudstone, carbonaceous, plant fossils, some slickensides.
93.71 - 95.11	1.40	Siltstone, carbonaceous, occasional v.f.g. ss band, plant fossils. Dips 20° - 24°.

MDD 77 - 2A - (Cont'd)

Interval (metres)	Width (metres)	Description
95.11 - 96.62	1.51	Sandstone, f.g., medium grey, with siltstone interbeds, plant fossils, flow features.
96.62 - 97.69	1.07	Siltstone, carbonaceous, plant fossils, slickensided.
97.69 - 98.26	0.57	Mudstone, coaly, with up to 30% coal bands, slickensides, dissiminated pyrite.
98.26 - 98.45	0.19	Siltstone, carbonaceous, occasional coaly stringers, slickensides.
98.45 - 99.30	0.85	Mudstone, coaly,some coaly bands up to 1 cm. in width, slickensided.
99.30 - 99.67	0.37	Mudstone, carbonaceous, some coaly stringers, plant fossils.

TD 99.67 m

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MDD 77-2B

Location:
(a) Coal Licence: 3226
(b) N.T.S. : b-39-B, 93-I-15
(c) Coal Grid :
(d) Mine Grid :

Azimuth & Inclination: Vertical

Core Size: HQ (63.5 mm)

Date Drilled: August 19 - 23, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Casing capped and left in hole

Logged by: A. E. Bienia

Formation Tested: Gates Member

Coal Seams Intersected: B1 to B11

Total Depth: 336.5 m

Geophysical Log: GRN, FBL, CAL-DENS, DIRECTIONAL

Avg Dip 23°

MDD - 77 - 2B

Interval (metres)	Width (metres)	Description
0 - 21.52	21.52	Overburden.
21.52 - 21.90	0.38	GATES MEMBER, COMMOTION FORMATION Sandstone, f.g., medium grey, with minor siltstone interbeds, carbonaceous partings, plant fossils.
21.90 - 25.30	3.40	Sandstone, f.g. to m.g., thin carbonaceous stringers (1 mm widths), some mud clasts, plant fossils, Dip - 23°.
25.30 - 25.47	0.17	Mudstone, carbonaceous, broken and crushed.
25.47 -25.66	0.19	Siltstone.
25.66 - 25.80	0.14	Sandstone, f.g. to m.g. with rip-up (mud) clasts
15.80 - 27.25	1.45	Siltstone interbedded with m.g. ss, flow features, carbonaceous stringers, plant fossils, disseminated pyrite.
27.25 - 29.84	2.59	Sandstone, f.g. to m.g., light grey, carbonaceous stringers and partings, plant fossils.
29.84 - 29.95	0.11	Siltstone, carbonaceous, plant fossils.
29.95 - 39.79	9.84	Sandstone, f.g. to m.g., light grey, carbonaceous stringers and partings, plant fossils, occasional calcite filled fracture, minor ferruginous stain; grain size in this interval fines upwards.
39.70 - 40.29	0.50	Sandstone, v.f.g., interbedded with siltstones, carbonaceous partings and plant fossils. Dip 23°
40.29 - 40.66	0.37	Coal, broken, 30% vitreous, 60% dull coal, with 10% carbonaceous mudstone chips.
40.66 - 41.13	0.47	Coal, clean, solid, 90% dull coal with 10% vitreous bands.
41.13 41.19	0.06	Coal, dirty, solid
41.19 - 41.49	0.30	Coal, fairly dirty, crushed; 70% dull coal, some carbonaceous mudstone chips. Sample: 7022 40.29 - 41.49 1.20 m.
41.49 - 42.64	1.15	Siltstone, carbonaceous, occasional v.f.g. ss band, plant fossils, slickensides, minor flow features.
42.64 - 43.30	0.66	Sandstone, v.f.g. to f.g., medium grey, with occasional siltstone bands, carbonaceous stringers, plant fossils, flow features.

Interval (metres)	Width (metres)	Description
43.30 - 43.99	0.69	Siltstone, with occasional f.g. ss bands, carbonaceous stringers, plant fossils, slickensides.
43.99 - 44.81	0.82	Mudstone, coaly, some coal bands up to 2 cm in width.
44.81 - 45.12	0.31	Siltstone, carbonaceous, occasional v.f.g. ss interbeds, plant fossils. Dip (23°).
45.12 45.18	0.06	Mudstone, coaly, plant fossils.
45.18 - 47.01	1.83	Siltstone, with occasional f.g. ss interbeds, some coal bands up to 0.5 cm in width, flow features, minor slickensides.
47.01 - 47.23	0.22	Mudstone, coaly, with coal stringers up to 2-3 mm wide, plant fossils.
47.23 - 51.28	4.05	Siltstone with occasional f.g. ss band, some carbonaceous specks and stringers, minor flow features.
51.28 - 53.80	2.52	Sandstone, f.g., light to medium grey, carbonaceous specks and stringers, minor flow features filled with calcite.
53.80 - 54.90	1.10	Sandstone, f.g., light grey, interbedded with siltstones, carbonaceous specks and stringers.
54.90 - 57.66	2.76	Siltstone interbedded with v.f.g., light grey ss, carbonaceous stringers and specks, minor flow features.
57.66 - 58.14	0.48	Coal, dull with 10% vitreous bands.
58.14 - 59.79	1.65	Siltstone/Mudstone, carbonaceous, occasional coal band up to 1 cm in width.
59.79 - 59.84	0.05	Coal, 90% dull with 10% vitreous coal bands.
59.84 - 60.05	0.21	Mudstone, carbonaceous, some coal stringers.
60.05 - 60.44	0.39	Coal, some minor mudstone partings (1 cm wide).
60.44 - 60.75	0.31	Mudstone, carbonaceous, some coal stringers (2-3 mm wide), plant fossils, minor slickensides.
60.75 - 61.27	0.52	Coal, dull, with 10% vitreous bands. Sample: 0113: 60.05 - 61.40 1.35
61.27 - 61.74	0.47	Mudstone, coaly, carbonaceous.

Interval (metres)	Width (metres)	Description
61.74 - 63.49	1.75	Siltstone, interbedded with v.f.g. ss, minor flow features. Dip 22° - 24°.
63.49 - 64.62	1.13	Siltstone, dark grey, pyrite blebs up to 1 cm.
64.92 - 65.15	0.53	Mudstone, coaly, vitreous coal bands up to 1 cm in width, plant fossils.
65.15 - 65.21	0.06	Mudstone, carbonaceous, plant fossils.
65.21 - 65.56	0.35	Siltstone, dark grey.
65.56 - 66.62	1.06	Sandstone, v.f.g., with some siltstone bands, minor flow features.
66.62 - 67.14	0.52	Siltstone with minor interbeds of f.g. ss, carbonaceous stringers and plant fossils.
67.14 - 67.62	0.48	Sandstone, f.g., interbedded with siltstone, carbonaceous specks, minor flow features.
67.62 - 68.28	0.66	Siltstone, carbonaceous stringers and partings.
68.28 - 68.81	0.53	Sandstone, f.g., light grey, with siltstone interbeds, some flow features.
68.81 - 71.67	2.86	Siltstone, with minor v.f.g. ss bands, carbonaceous specks and stringers, some flow features, occasional calcite filled fractures. Dip 23°.
71.67 - 72.17	0.50	Siltstone, some carbonaceous stringers and partings, plant fossils.
72.17 - 72-24	0.07	Mudstone, carbonaceous, crushed and broken, poor recovery (50%).
72.24 - 72.41	0.17	Mudstone, carbonaceous with occasional coal bend up to 1 cm in width.
72.41 - 75.71	3.30	Siltstone, dark grey, carbonaceous and coaly stringers, plant fossils.
75.71 - 77.77	2.06	Sandstone, v.f.g., with occasional siltstone bands, carbonaceous specks and stringers, flow features. Dips 22° - 24°.
77.77 - 78.01	0.24	Siltstone.
78.01 - 78.08	0.07	Sandstone, m.g.

Interval (metres)	Width (metres)	Description
78.08 - 78.61	0.53	Siltstone, dark grey, rare f.g. ss band, few carbonaceous specks. Dip 26°.
78.61 - 78.66	0.05	Siltstone, carbonaceous.
78.66 - 78.93	0.27	COAL, hard, slightly broken, 15% vitreous bands.
78.93 - 78.95	0.02	COAL, very dirty.
78.95 - 79.12	0.17	COAL, hard, solid, intermediate lustre with 10% vitreous bands.
79.12 - 79.17	0.05	Mudstone, coaly.
79.17 - 79.44	0.27	COAL, very hard, solid, intermediate lustre, 10% vitreous coal.
79.44 - 79.76	0.32	COAL, clean, soft, solid, 20 - 25% vitreous coal bands.
79.76 - 79.92	0.16	COAL, fairly clean, dull, 15% soft dull, peaty coal, crushed and ground.
79.92 - 81.83	1.46	COAL, clean, solid, 30% vitreous, (3 cm mudstone parting at 80.75 m), slickensides, (2 cm mudstone parting at 81.27 m). 81.29 - 81.39 coal is broken, fairly soft.
81.38 - 81.51	0.13	Coal, hard, 10% vitreous.
81.51 - 81.52	0.01	Mudstone parting.
81.52 - 81.56	0.04	Coal, fairly clean, hard, 10% vitreous bands, minor slickensides.
81.56 - 81.69	0.13	Mudstone, coaly with coal bands up to 2cm in width, broken. Samples: 7023: 78.66 - 79.17 0.51 7024: 79.17 - 80.75 1.58 7025: 80.75 - 81.69 0.94
81.69 - 82.14	0.45	Siltstone, carbonaceous, plant fossils.
82.14 - 82.36	0.22	Sandstone, f.g., occasional thin silt bands, flow features, some coaly specks. Dip 22° - 24°.

Interval (metres)	Width (metres)	Description
82.36 - 82.71	0.35	COAL, fairly clean, vitreous coal 30%, a few mudstone chips, very broken and crushed.
82.71 - 83.03	0.32	Sandstone, v.f.g., with interbeds of siltstone, vitreous coal stringers, minor slickensides.
83.03 - 83.49	0.46	Mudstone, carbonaceous, some coaly stringers.
83.49 - 83.67	0.18	COAL, crushed and ground.
83.67 - 84.81	1.14	Mudstone, carbonaceous, some coal stringers, plant fossils.
84.81 - 85.68	0.87	Mudstone, carbonaceous, with some siltstone bands, coaly specks and stringers, plant fossils, slickensides, some flow features.
85.68 - 85.95	0.27	Mudstone, carbonaceous, some coal stringers, plant fossils, occasional calcite-filled fracture.
85.95 - 87.45	1.50	Siltstone interbedded with occasional f.g. sandstone, few carbonaceous specks. Dip 23°.
87.45 - 87.91	0.46	Sandstone, v.f.g., interbedded with siltstone, carbonaceous specks, few plant fossils, flow features.
87.91 - 88.75	0.84	Mudstone, occasional coaly stringer, minor slickensides.
88.75 - 91.08	2.33	Siltstone, interbedded with some v.f.g. sandstone, rare carbonaceous speck, minor flow features.
91.08 - 91.32	0.24	Mudstone, carbonaceous, plant fossils, coal stringers and bands up to 5 mm in width, calcite-filled fractures.
91.32 - 93.57	2.25	Siltstone interbedded with f.g. sandstone, carbonaceous specks and partings, plant fossils, flow features.
93.57 - 93.65	0.08	Mudstone, coaly, minute vitreous bands.
93.65 - 93.69	0.04	Mudstone, carbonaceous, plant fossils, coaly specks, minor slickensides.
93.69 - 94.11	0.42	Siltstone with occasional sandstone band; carbonaceous specks, plant fossils.
94.11 - 94.36	0.25	Mudstone, coaly, minute vitreous coal stringers, plant fossils.

Interval (metres)	Width (metres)	Description
94.36 - 95.09	0.73	Siltstone
95.09 - 95.10	0.01	COAL, vitreous
95.10 - 95.85	0.75	COAL (50%) and carbonaceous and coaly mudstone (50%), banded. Sample: 0114 : 95.10 - 95.96 0.86
95.85 - 96.29	0.44	Mudstone, carbonaceous, vitreous coal stringers up to 5 mm wide, minor slickensides.
96.29 - 97.30	1.01	Siltstone, carbonaceous, coal stringers, plant fossils.
97.30 - 99.81	2.51	Sandstone, f.g. with siltstone interbeds, carbonaceous partings, flow features. Dip 24°.
99.81 - 103.06	3.25	Siltstone, carbonaceous, vitreous coal stringers up to 1 cm wide, plant fossils, minute fractures.
103.06 - 103.79	0.73	Siltstone with occasional f.g. sandstone interbed, coaly and carbonaceous stringers, plant fossils, minor flow features, calcite-filled fractures.
103.79 - 105.87	2.08	Sandstone, f.g., with some siltstone interbeds, carbonaceous stringers and partings, plant fossils, flow features, minute fractures: 104.20 - 104.44 mudstone with coal bands up to 1 cm in width, minor slickensides. Dip 22°.
105.87 - 110.88	5.01	Siltstone, carbonaceous, coal stringers (minute), plant fossil, minute fractures, rare 2 cm coal band, rare slickensides.
110.88 - 110.95	0.07	Mudstone, carbonaceous.
110.95 - 111.18	0.23	COAL, dirty, numerous small mudstone partings.
111.18 - 111.52	0.34	Mudstone, carbonaceous, some vitreous coal stringers, plant fossils.
111.52 - 112.18	0.66	COAL, 20% vitreous bands.
112.18 - 112.44	0.26	Mudstone, carbonaceous, plant fossils, coal stringers and one 4 cm coal band at 112.28.
112.44 - 112.67	0.23	Siltstone, carbonaceous, occasional coal stringer, minute fractures filled with calcite.
112.67 - 114.45	1.78	Sandstone, v.f.g., interbedded with siltstone, carbonaceous partings and stringers, plant fossils, flow features, minute fractures, minor slickensides.

Interval (metres)	Width (metres)	Description
114.45 - 115.06	0.61	Siltstone, occasional carbonaceous speck or stringer.
115.06 - 118.61	3.55	Sandstone, f.g., with some siltstone interbeds, rare carbonaceous specks and partings, calcite-filled fractures, flow features.
118.61 - 124.47	5.86	Siltstone, carbonaceous, rare coal stringers, fractures filled with calcite, slickensides. Dip 24°
124.47 - 124.67	0.20	Mudstone, carbonaceous with one 2 cm vitreous coal band.
124.67 - 124.86	0.19	COAL, hard, broken, 10% vitreous.
124.86 - 124.90	0.04	Mudstone, carbonaceous.
124.90 - 125.28	0.38	COAL, clean, brittle, fairly broken, 30% vitreous. Sample: 7026 : 124.67 - 125.28 0.61
125.28 - 125.58	0.30	Mudstone, carbonaceous, coaly specks and stringers, plant fossils.
125.58 - 127.10	1.52	Siltstone, carbonaceous, with occasional v.f.g. sandstone band, plant fossils, minor flow features.
127.10 - 127.28	0.18	COAL, solid, 20% vitreous.
127.28 - 127.39	0.11	Mudstone, carbonaceous, vitreous stringers, plant fossils, minute fractures.
127.39 - 127.78	0.39	Siltstone, carbonaceous, plant fossils, slickensides.
127.78 - 127.88	0.10	Mudstone, carbonaceous, plant fossils.
127.88 - 127.93	0.05	COAL band.
127.93 - 128.10	0.17	Mudstone, carbonaceous, minute coal stringers, plant fossils.
128.10 - 129.59	1.49	COAL, less than 10% vitreous, crushed and ground, 2 cm band of dirty coal.
129.59 - 129.81	0.22	Siltstone, with occasional f.g. sandstone band, occasional carbonaceous specks and partings, plant fossils, minor flow features, minute fractures.
129.81 - 130.05	0.24	Siltstone, carbonaceous, plant fossils, slickensides.
130.05 - 131.55	1.50	Siltstone, with occasional f.g. sandstone interbed, carbonaceous specks and stringers, plant fossils, minor flow features, pyrite blebs and stringers, minute fractures. Dips 21° - 23°.

Interval (metres)	Width (metres)	Description
131.55 - 132.19	0.64	Mudstone, carbonaceous, coaly, vitreous coal bands up to 1 cm in width, plant fossils, slickensides.
132.19 - 132.39	0.20	Siltstone, coal bands and stringers (5 mm wide).
132.39 - 132.77	0.38	Mudstone, coaly, minute vitreous coal stringers and occasional band (5 mm wide), plant fossils.
132.77 - 135.26	2.49	Siltstone, carbonaceous, coal stringers (1 - 2 mm), plant fossils, minute fractures filled with calcite, pyrite disseminations, blebs and stringers, minor slickensides.
135.26 - 135.65	0.39	Sandstone, f.g., carbonaceous specks and stringers, plant fossils, pyrite specks and blebs, flow features.
135.65 - 137.73	2.08	Siltstone, carbonaceous, some minor sandstone bands, coal stringers (2 mm), slickensides, plant fossils, pyrite specks and blebs, highly fractured with calcite filling fractures.
137.73 - 138.07	0.34	Siltstone with occasional f.g. sandstone band, carbonaceous stringers and partings, minute fractures, minor flow features.
138.07 - 141.49	3.42	Sandstone, v.f.g., with occasional siltstone interbed, carbonaceous specks, plant fossils, some minute coal stringers, minor flow features. Dip 21°.
141.49 - 145.00	3.51	Siltstone with occasional or rare sandstone band, carbonaceous specks, stringers and partings, minute coaly stringers (1 mm), plant fossils.
145.00 - 145.20	0.20	COAL, 10% vitreous, broken and crushed.
145.20 - 145.32	0.12	Siltstone, carbonaceous, with minute coaly stringers, plant fossils, slickensides.
145.32 - 145.89	0.57	COAL, crushed and broken, 10% vitreous, some carbonaceous siltstone chips.
145.89 - 146.91	1.02	Siltstone, carbonaceous, with some sandstone bands, carbonaceous stringers and partings, plant fossils, minute fractures.
146.91 - 156.06	9.15	Siltstone, carbonaceous, coal stringers and bands up to 2 cm in width, plant fossils, fractures filled with calcite, some slickensides.
156.06 - 157.13	1.07	Siltstone, carbonaceous specks and stringers, minute fractures.

Interval (metres)	Width (metres)	Description
157.13 - 160.42	3.29	Siltstone, carbonaceous specks and stringers, occasional coal band up to 5 mm in width, plant fossils, some calcite-filled fractures. Dips 22° - 24°.
160.42 - 177.39	16.97	Siltstone, with some interbeds of v.f.g. sandstone, carbonaceous specks and stringers, abundant plant fossils, minute calcite-filled fractures, minor flow features, pyrite disseminations and specks.
177.39 - 187.84	10.45	Siltstone, with some interbeds of v.f.g. sandstone, carbonaceous specks and partings, some coal stringers (1 mm), plant fossils, fractures filled with calcite, minor flow features. Dip 23°.
187.84 - 188.21	0.37	Siltstone, carbonaceous, coaly stringers, plant fossils.
188.21 - 191.11	2.90	Sandstone, f.g., with siltstone interbeds, carbonaceous specks and partings, plant fossils, flow features, fractures filled with calcite.
191.11 - 192.21	1.10	Siltstone, carbonaceous, occasional coal band 2 cm in width, plant fossils, slickensides.
192.21 - 192.33	0.12	Mudstone, coaly.
192.33 - 192.46	0.13	COAL, dirty, broken, slickensides.
192.46 - 192.68	0.22	COAL, broken, 10% vitreous.
192.68 - 192.85	0.17	Mudstone, carbonaceous.
192.85 - 193.11	0.26	COAL, clean, broken, 10-15% vitreous
193.11 - 193.16	0.05	Mudstone, coaly.
193.16 - 193.58	0.42	COAL, clean, fairly hard, 10-15% vitreous bands.
193.58 - 193.76	0.18	Siltstone, carbonaceous.
193.76 - 194.26	0.50	COAL, clean, solid, 10% vitreous coal bands.
194.26 - 194.59	0.33	Siltstone, carbonaceous with coaly stringers.
194.59 - 195.53	0.94	COAL, clean, fairly hard, solid, less than 10% vitreous coal bands, 60% intermediate lustre, 30% dull coal.
195.53 - 195.88	0.35	Mudstone, carbonaceous.
195.88 - 195.96	0.08	COAL, fairly hard but broken, dull coal with 10% minute vitreous bands.

Interval (metres)	Width (metres)	Description
195.96 - 196.11	0.15	COAL, dirty, hard, broken, 10% vitreous stringers.
196.11 - 196.34	0.23	COAL, brittle, broken, 30% vitreous.
	Note:	(According to core box marker 0.91 m was ground and lost here.)
196.34 - 196.94	0.60	COAL, clean, hard and solid, 20% vitreous, trace of pyrite.
196.94 - 196.95	0.01	Mudstone, coaly.
196.95 - 198.63	1.68	COAL, hard, solid.
198.63 - 199.43	0.80	Lost core, chiefly mudstone?
199.43 - 199.59	0.16	COAL, clean, solid, 20% vitreous.
199.59 - 199.69	0.10	Mudstone, coaly.
199.69 - 199.78	0.09	COAL, clean, hard, 10% vitreous.
199.78 - 199.80	0.02	Mudstone, carbonaceous.
199.80 - 200.25	0.45	COAL, clean, hard, solid, 20% vitreous.
200.25 - 200.50	0.25	COAL, clean, fairly hard, solid, 20% vitreous, 5% soft, dull, peaty coal.
200.50 - 201.78	1.28	COAL, clean, hard, solid, 20% vitreous banding.
201.78 - 201.87	0.09	COAL, clean, brittle, broken and crushed, 30% vitreous
201.87 - 203.32	1.45	COAL, clean, fairly brittle, solid, up to 40% vitreous Samples: 7027 : 192.33 - 194.26 1.93 7028 : 194.26 - 195.88 1.62 7029 : 195.88 - 199.59 3.71 7030 : 199.59 - 200.50 0.91 7031 : 200.50 - 201.78 1.28 7032 : 201.78 - 203.32 1.54
203.32 - 203.45	0.13	Mudstone, carbonaceous, solid.
203.45 - 204.82	1.37	Siltstone with some interbeds of f.g. sandstone, carbonaceous specks and stringers, abundant plant fossils. Dip 20°.
204.82 - 205.80	0.98	Sandstone, f.g., with some silt interbeds, carbonaceous specks, plant fossils, minute fractures filled with calcite, minor flow features.

Interval (metres)	Width (metres)	Description
205.80 - 209.09	3.29	Siltstone, carbonaceous, plant fossils, vitreous coal bands up to 1 cm in width, fractures filled with calcite, minor flow features, one worm burrow at 208.84.
209.09 - 209.40	0.31	Mudstone, carbonaceous with coal stringers and bands.
209.40 - 210.65	1.25	COAL, clean, fairly hard, solid, 20-25% vitreous bands, good recovery.
210.65 - 210.72	0.07	Mudstone, carbonaceous.
210.72 - 212.23	1.51	COAL, clean, solid with alternating intervals of brittle and fairly hard coal, vitreous bands up to 20-25%.
212.23 - 212.25	0.02	Mudstone, carbonaceous.
212.25 - 212.27	0.02	COAL, vitreous.
212.27 - 212.45	0.18	Mudstone, carbonaceous, plant fossils.
212.45 - 212.63	0.18	COAL, clean, broken, 30% vitreous.
212.63 - 213.03	0.40	COAL, very clean, fairly brittle, solid, 35% vitreous.
213.03 - 213.66	0.63	Mudstone, carbonaceous, plant fossils, coal bands up to 1 cm in width.
213.66 - 214.26	0.60	COAL, clean, very hard, solid, 20% vitreous.
214.26 - 214.31	0.05	Mudstone, carbonaceous.
214.31 - 214.49	0.18	COAL, broken and crushed, 20% vitreous. Samples: 7033 : 209.40 - 210.72 1.32 7034 : 210.72 - 212.23 1.51 7035 : 212.23 - 213.03 0.80 0115 : 213.03 - 213.66 0.63 7036 : 213.66 - 214.49 0.83
214.49 - 214.67	0.18	Mudstone, carbonaceous, plant fossils.
214.67 - 215.02	0.35	Sandstone, v.f.g., with some siltstone bands, minor flow features, minute fractures. Dips 24° - 26°.
215.02 - 215.15	0.13	Siltstone, laminated.
215.15 - 215.48	0.33	Mudstone, carbonaceous, coal bands up to 5 mm in width.
215.48 - 215.59	0.11	COAL, dirty, hard, broken.

Interval (metres)	Width (metres)	Description
215.59 - 216.39	0.80	Siltstone, carbonaceous, plant fossils, a few coal stringers (minute).
216.39 - 218.24	1.85	Sandstone, m.g., light grey, some carbonaceous stringers.
218.24 - 227.53	9.29	Sandstone, f.g. to m.g., light grey, occasional bands about 1 cm in width containing fine pebbles, worm burrows about every 30 cm, fairly massive (no definite bedding).
227.53 - 229.25	1.72	Sandstone, f.g., medium grey. Dip 20°.
229.25 - 229.39	0.14	Siltstone, carbonaceous, plant fossils, occasional band of v.f.g. sandstone.
229.39 - 229.44	0.05	Conglomerate band, fine pebbles, high sand matrix, slickensides.
229.44 - 229.93	0.49	Siltstone/Mudstone, carbonaceous, plant fossils, coal stringers, slickensides.
229.93 - 230.73	0.80	Siltstone with v.f.g. sandstone interbeds, carbonaceous stringers and specks, flow features. Dip 20°.
230.73 - 230.83	0.10	COAL, dirty.
230.83 - 231.05	0.22	COAL, clean, broken, 10% vitreous.
231.05 - 231.33	0.28	Siltstone, some coaly and carbonaceous stringers.
231.33 - 232.81	1.48	Sandstone, m.g., medium grey, carbonaceous specks, coal stringers (2 mm), occasional fine pebble.
232.81 - 232.92	0.11	COAL, dirty.
232.92 - 233.14	0.22	Sandstone, m.g. with carbonaceous and coaly stringers up to 5 mm in width, some fractures filled with calcite.
233.14 - 233.23	0.09	COAL, bands of dirty coal alternating with vitreous coal bands.
233.23 - 235.61	2.38	Sandstone, v.f.g., with siltstone interbeds, carbonaceous stringers and partings, plant fossils, minor flow features, fractures filled with calcite. Dips 20° - 22°.
235.61 - 237.45	1.84	Siltstone/Mudstone, carbonaceous, plant fossils, coal bands up to 2 cm in width, minor flow features, some slickensides.

Interval (metres)	Width (metres)	Description
237.45 - 239.88	2.43	Siltstone, carbonaceous, plant fossils, some coaly stringers, fractures filled with calcite, slickensides.
239.88 - 241.28	1.40	Siltstone with v.f.g. sandstone interbeds, carbonaceous specks and stringers, plant fossils, minor specks and stringers, plant fossils, minor flow features, calcite-filled fractures.
241.28 - 242.93	1.65	Sandstone, v.f.g., medium grey, with some siltstone bands, minute fractures, carbonaceous specks and stringers, worm burrows.
242.93 - 244.14	1.21	Siltstone with f.g. sandstone interbeds, carbonaceous partings and coal stringers, plant fossils, minute fractures filled with calcite.
244.14 - 245.67	1.53	Siltstone, carbonaceous, minute coal stringers (1 mm), fractures filled with calcite.
245.67 - 247.17	1.50	Sandstone, v.f.g., with minor siltstone interbeds, some cross-bedding, carbonaceous stringers and partings, fractures filled with calcite, slickensides. Dip 21°.
247.17 - 249.02	1.85	Sandstone, v.f.g., with siltstone interbeds, carbonaceous stringers and partings, plant fossils, minor flow features.
249.02 - 250.56	1.54	Siltstone, carbonaceous, coaly stringers (5 mm), plant fossils, minute fractures.
250.56 - 250.88	0.32	COAL, clean, fairly solid, 10% vitreous.
250.88 - 250.90	0.02	Mudstone, carbonaceous.
250.90 - 251.27	0.37	COAL, clean, fairly solid, 10% vitreous.
251.27 - 251.70	0.43	Siltstone/Mudstone, carbonaceous, hard and solid, coal bands up to 2 cm in width.
251.70 - 251.80	0.10	COAL, dull, crushed and broken.
251.80 - 251.81	0.01	Mudstone, carbonaceous.
251.81 - 252.00	0.19	COAL, clean, 10% vitreous. Recovered 9 cm.
252.00 - 252.32	0.32	COAL, clean, fairly solid, 20% vitreous bands.
252.32 - 252.34	0.02	Mudstone, carbonaceous.
252.34 - 252.83	0.49	COAL, hard, solid, 5-10% vitreous bands.

Interval (metres)	Width (metres)	Description
63.08 - 63.97	0.89	Siltstone, dark grey, carbonaceous specks, some coaly stringers (1-2 mm), minor slickensides.
63.97 - 64.03	0.06	COAL, intermediate lustre, soft, platy.
64.03 - 64.53	0.50	Siltstone, medium grey, minute fractures, carbonaceous and coaly specks and stringers.
64.53 - 66.14	1.61	Siltstone, light grey, minute fractures, some carbonaceous specks and stringers, massive.
66.14 - 67.07	0.93	Mudstone, fairly soft, abundant slickensides.
67.07 - 69.19	2.12	Siltstone, light to medium grey, blebs and small stringers of carbonaceous material.
69.19 - 70.41	1.22	Sandstone, f.g., occasional siltstone interbed.
70.41 - 74.68	4.27	Sandstone, f.g. to m.g., carbonaceous specks, stringers and partings, well sorted, some minor slickensides in the last 1 m which is also broken. BCA 58°.
74.68 - 75.12	0.44	Sandstone, m.g., with 5-6 cm intervals of coarse grained sandstone, occasional carbonaceous speck, rare calcite-filled fracture, clean.
75.12 - 75.78	0.66	Sandstone, v.f.g. to f.g., medium grey, well sorted.
75.78 - 76.56	0.78	Sandstone, alternating f.g., m.g. and c.g. zones, occasional carbonaceous speck, stringer or parting.
76.56 - 79.08	2.52	Sandstone, c.g. to v.c.g., clean, some carbonaceous specks and stringers. BCA 59° - 61°.
79.08 - 81.26	2.18	Sandstone, m.g. to c.g., with 5-10 cm bands of fine pebble conglomerate.
81.26 - 81.83	0.57	Mudstone
81.83 - 82.91	1.08	Siltstone, medium grey, massive, uniform.
82.91 - 83.51	0.60	Mudstone, slickensides.
83.51 - 86.00	2.49	Siltstone/Mudstone, light grey, massive.
86.00 - 87.17	1.17	Siltstone, medium grey, massive.
87.17 - 87.64	0.47	Sandstone, v.f.g. to f.g., well sorted. BCA 39°.
87.64 - 88.29	0.65	Siltstone with 20% v.f.g. sandstone interbeds, carbonaceous specks and stringers, slickensides.

Interval (metres)	Width (metres)	Description
321.87 - 325.53	3.66	Sandstone, f.g., with siltstone interbeds (30%), carbonaceous stringers and partings, plant fossils, calcite-filled fractures, minor flow features, slickensides.
325.53 - 331.62	6.09	Sandstone, f.g., interbedded with siltstone (50%-50%), carbonaceous stringers and partings, plant fossils, calcite-filled fractures, minor flow features.
331.62 - 336.50	4.88	MOOSEBAR FORMATION Siltstone with v.f.g. sandstone interbeds (30-40%), carbonaceous stringers and partings, plant fossils, calcite-filled fractures, flow features, slickensides, rip-up clasts, pyrite specks and blebs. Dips 18° - 22°.

T.D. 336.50 m

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MDD 77-3

Location:

(a) Coal Licence: 3239
(b) N.T.S. : a-31-C, 93-I-15
(c) Coal Grid :
(d) Mine Grid :

Azimuth & Inclination: Vertical

Core Size: HQ (63.5 mm)

Date Drilled: August 9 - 12, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Casing Left in Hole and Capped

Logged by: A. E. Bienia, L. A. Smith

Formation Tested: Gething

Coal Seams Intersected: A1, A2, A3

Total Depth: 189.9 m

Geophysical Logs: FBL, GRN, CAL-DENS, DIR.

Interval (metres)	Width (metres)	Description
0 - 4.57	4.57	Overburden
4.57 - 5.18	0.61	MOOSEBAR FORMATION Mudstone (crushed and broken), minute carbonaceous specks.
5.18 - 7.37	2.19	Mudstone (fairly broken), minute carbonaceous specks are abundant, minute fractures with ferruginous stain.
7.37 - 11.28	3.91	Mudstone (unbroken) uniform, occasional speck of white ash.
11.28 - 17.57	6.29	Mudstone, uniform, occasional speck of white ash, pyrite disseminations and blebs. Dips 12° - 18°.
17.57 - 17.66	0.09	Mudstone (very soft, broken) ferruginous stain.
17.66 - 19.04	1.38	GETHING FORMATION Conglomerate, quartz, chert pebbles, (rare green chert) medium grained cementing quartz.
19.04 - 19.72	0.68	Sandstone, m.g., light to medium grey, clean - well sorted.
19.72 - 20.52	0.80	Conglomerate, quartz, chert, green chert pebbles, m.g. cementing quartz, blebs of pyrite up to 0.5 cm width, carbonaceous specks.
20.52 - 20.67	0.15	Sandstone, m.g., medium grey, coaly bands from 1 mm to 7 mm widths.
20.67 - 22.17	1.50	Conglomerate, pebbles, high matrix of m.g. sand.
22.17 - 22.67	0.50	Sandstone, m.g.
22.67 - 24.69	2.02	Conglomerate, quartz, chert, green chert pebbles, high m.g. sand matrix, some coaly stringers (1 mm widths).
24.69 - 28.96	4.27	Conglomerate, quartz, chert, and rare green chert pebbles, m.g. sand matrix, fractures abundant, fractures filled with calcite, ferruginous staining. At 26.82 - 26.87 sandstone band with 3 cm of vitreous coal. 28.45 - 28.56 m.g. sandstone bands.
28.96 - 29.56	0.60	Conglomerate, pebbles with high, m.g. sand matrix.
29.56 - 29.88	0.32	Sandstone, m.g., ferruginous staining, vitreous coal bands - 1 cm in width.
29.88 - 30.03	0.15	Conglomerate, pebbles, quartz and chert, fractured, ferruginous staining.

Interval (metres)	Width (metres)	Description
30.03 - 30.18	0.15	Sandstone (crumbly, broken) with approximately 30% coaly stringers, some slickensides, ferruginous staining.
30.18 - 35.66	5.48	Sandstone, m.g., medium grey, with occasional fine pebble band, some fractures, few carbonaceous bands and stringers throughout 30.18 - 32.50. 32.50 - 35.66 - Sandstone cleaner, rare pebble band, occasional carbonaceous stringer.
35.66 - 36.92	1.26	Sandstone, m.g., medium grey, vitreous coal stringers 1 mm in width.
36.92 - 38.58	1.66	Sandstone, m.g., medium grey, some pebbly bands, minor fractures filled with calcite, vitreous coaly stringers (1 mm widths) common.
38.58 - 38.90	0.32	Coal, intermediate brightness or lustre, 10-15% vitreous bands, pyrite blebs and stringers.
38.90 - 41.45	2.55	Sandstone, v.f.g., medium to dark grey, plant fossils, coaly bands or stringers up to 3 mm in width (common) pyrite disseminations, blebs and minute stringers.
41.45 - 49.68	8.23	Siltstone, dark grey, carbonaceous specks, plant fossils, blebs and stringers of pyrite (up to 7 mm) flow features, trace amounts of white ash. Dips 18° - 22°.
49.68 - 52.00	2.32	Siltstone, minor flow features, trace white ash.
52.00 - 58.62	6.62	Sandstone, m.g. to c.g., light to medium grey, some pebbles and pebble bands, coaly stringers (1 mm widths) common, pyrite blebs and stringers common. 54.80 - 58.62 - finer grained sandstone, clean, minor flow features, some cross-bedding. Dips 18° - 22°.
58.62 - 59.00	0.38	Sandstone, m.g., small pebble bands, coaly stringers.
59.00 - 60.05	1.05	Conglomerate, pebble, high sand matrix, rare interval of m.g. ss.
60.05 - 60.45	0.40	Sandstone, fine to medium grained, occasional pebble.
60.45 - 66.14	5.69	Siltstone, very carbonaceous, coaly bands and stringers up to 1 cm widths, plant fossils abundant, pyrite disseminations and blebs, minute fractures filled with calcite.

Interval (metres)	Width (metres)	Description
66.14 - 66.22	0.08	Mudstone, massive, very competent
66.22 - 66.26	0.04	Mudstone, carbonaceous, partially ground, recovery 0.02 m
66.26 - 66.32	0.06	COAL, dirty, dull, recovery 0.02 m
66.32 - 67.06	0.74	COAL, clean. Recovery 0.69 m 66.32 - 66.37 - Coal, very clean, dull with one 0.04 m bright band (vitreous), fairly competent, unbroken. 66.37 - 66.55 - Dull, very clean, core solid. Contains occasional band (3 mm wide) of vitreous coal. Specks of pyrite are common. 66.55 - 66.67 - Clean, dull coal, vitreous coal insignificant, contains specks of pyrite, core somewhat broken. 66.67 - 66.85 - Clean coal, 70% dull, 30% vitreous bands, rare speck of pyrite, massive, vitreous bands, brittle. 66.85 - 67.06 - Dull coal, massive, fractured but with no definite pattern.
67.06 - 68.16	1.10	COAL, very clean, dull. Recovery 100%. 67.06 - 67.61 - Dull coal with less than 10% vitreous bands (up to .75 cm width). Contains minor flecks of white ash, interval competent. 67.61 - 67.85 - Clean coal, intermediate lustre with 20% vitreous bands. Coal interval brittle and breaks fairly easily. 67.85 - 68.16 - Clean coal, dull with 30-40% vitreous bands (1 cm in width). Specks of pyrite and some ash. Blocky.
68.16 - 68.70	0.54	COAL, clean, vitreous, traces of pyrite, crushed and ground, some slickensides. Recovery 30%.
68.70 - 69.00	0.30	COAL, clean, lustre intermediate to vitreous (50% - 50%) (Recovery 100%). Competent but breaks easily.
69.00 - 69.08	0.08	COAL, crushed and ground. Recovered 0.06 m. Very sharp contact with floor rock. Samples: 7001 : 66.22 - 68.16 1.94 7002 : 68.16 - 68.70 0.54 7003 : 68.70 - 69.08 0.38
69.08 - 69.19	0.11	Mudstone, plant fossils, very competent floor rock.

Interval (metres)	Width (metres)	Description
69.19 - 69.92	0.73	Siltstone, carbonaceous, coaly bands and stringers, plant fossils, fractured, with coal along fractures, trace white ash.
69.92 - 70.22	0.30	COAL, vitreous
70.22 - 71.32	1.10	Mudstone, carbonaceous
71.32 - 71.52	0.20	Mudstone
71.52 - 72.24	0.72	Siltstone, coal stringers less than 1 mm wide, fractured, ferruginous stain, plant fossil fragments and carbonaceous specks.
72.24 - 72.84	0.60	Siltstone, some minor f.g., sandstone interbeds, carbonaceous specks and stingers, flow features.
72.84 - 73.94	1.10	Sandstone, m.g., minor carbonaceous specks and coaly stringers.
73.94 - 74.24	0.30	Siltstone with f.g. ss interbeds, carbonaceous specks, flow features.
74.24 - 78.33	4.09	Sandstone, m.g., coaly bands and stringers, minute fractures, rare chert pebble, grain size fines downward. Dip 24°.
78.33 - 86.83	8.50	Sandstone, m.g. to f.g., planar bedd g, some cross-bedding, carbonaceous specks. Dips - 15°.
86.83 - 89.00	2.17	Siltstone with v.f.g. ss interbeds, minor carbonaceous stringers, flow features, pyrite. Dips 18° - 19°.
89.00 - 89.30	0.30	Sandstone, v.f.g. to f.g., occasional siltstone band.
89.30 - 89.48	0.18	Pebble conglomerate band
89.48 - 90.65	1.17	Sandstone, v.f.g. to f.g., carbonaceous specks and stringers, minute fractures
90.65 - 94.97	4.32	Sandstone, f.g. to v.f.g. with siltstone interbeds, some cross bedding, minor fractures, carbonaceous specks, stringers, plant fossils. Dips 18°.
94.97 - 96.82	1.85	Sandstone, f.g. to c.g., occasional fine pebble band, coaly stringers, minute fractures filled with calcite, slickensides.
96.82 - 101.48	4.66	Sandstone, f.g. to m.g., abundant carbonaceous specks and stringers, plant fossils, minor flow features, minute fracture, some slickensides, occasional pebbl

Interval (metres)	Width (metres)	Description
101.48 - 103.22	1.74	Conglomerate, fine pebbles, cementing sand m.g. to c.g., coaly sands and stringers (up to 1 cm widths).
103.22 - 105.04	1.82	Sandstone, m.g. to c.g., some fine pebble conglomerate bands, coaly bands and stringers.
105.04 - 105.19	0.15	Coal band, crushed and broken, intermediate lustre.
105.19 - 105.30	0.11	Siltstone, very carbonaceous (crushed and ground).
105.30 - 105.77	0.47	Siltstone, carbonaceous specks, plant fossils, pyrite blebs and stringers, some slickensides.
105.77 - 106.16	0.39	Siltstone, (crushed and ground) very carbonaceous.
106.16 - 106.54	0.38	Siltstone, carbonaceous specks, plant fossils, pyrite disseminations.
106.54 - 108.40	1.86	Sandstone, f.g., with occasional siltstone interbed, cross-bedding, fractures filled with calcite, slickensides.
108.40 - 112.06	3.66	Siltstone, minute fractures, ferruginous stain, plant fossils, carbonaceous specks, slickensides common, calcite filling fractures.
112.06 - 114.61	2.55	Sandstone, v.f.g. to f.g., some interbeds of slst., carbonaceous specks and stringers, ferruginous stain, flow features, fractures filled with calcite, slickensides.
114.61 - 119.81	5.20	Siltstone, carbonaceous specks and partings, minute fractures, slickensides.
119.81 - 121.90	2.09	Siltstone, with v.f.g. ss interbeds, plant fossils, some carbonaceous stringers, minor flow features.
121.90 - 123.95	2.05	Sandstone, v.f.g. to f.g., cross-bedding, flow features, carbonaceous specks, calcite filling fractures, slightly carbonaceous cement.
123.95 - 124.20	0.25	Siltstone, carbonaceous, coaly bands and stringers.
124.20 - 124.70	0.50	COAL, vitreous (80%) dull coal (20%), occasional 1 cm parting of carbonaceous siltstone, pyrite disseminations.
124.70 - 126.79	2.09	Siltstone with v.f.g. ss interbeds, carbonaceous specks, plant fossils, minor flow features.

Interval (metres)	Width (metres)	Description
126.79 - 129.33	2.54	Sandstone, v.f.g. to f.g. with minor silt interbeds, flow features, some cross-bedding, carbonaceous specks and stringers, calcite filled fractures, slickensides. Dip 19°.
129.33 - 129.84	0.51	Siltstone, carbonaceous, plant fossils, occasional vitreous coal band up to 2 cm in width.
129.84 - 131.20	1.36	Sandstone, v.f.g. to f.g., cross-bedding, flow features, carbonaceous partings, plant fossils, fractures filled with calcite, some pyrite blebs, some slickensides.
131.20 - 132.18	0.98	Siltstone, very carbonaceous, some coaly bands (1 cm width) minute fractures, slickensides.
132.18 - 133.32	1.14	Sandstone, v.f.g. to f.g., carbonaceous stringers, cross-bedding, calcite filled fractures, slickensides.
133.32 - 133.62	0.30	Siltstone, carbonaceous specks and partings, plant fossils, calcite specks, pyrite disseminations and minute pyrite blebs.
133.62 - 142.04	8.42	Sandstone, v.f.g., minute fractures filled with calcite, flow features, some slump features, carbonaceous partings, plant fossils, slickensides. 135.45 - 142.04 - v.f.g. to f.g. ss with some siltstone interbeds, otherwise same as above.
142.04 - 145.39	3.35	Siltstone, carbonaceous specks and stringers, occasional f.g. ss interbed, minor fractures filled with calcite.
145.39 - 145.75	0.36	Mudstone, carbonaceous, coaly bands (40%)
145.75 - 146.30	0.55	Siltstone, carbonaceous
146.30 - 147.70	1.40	Siltstone, carbonaceous stringers, coaly bands (2 mm widths) calcite filled fractures.
147.70 - 148.44	0.74	Sandstone, v.f.g., mud chips or rip-up clasts.
148.44 - 149.93	1.49	Siltstone, coaly partings, fractures filled with calcite, slickensides.

Interval (metres)	Width (metres)	Description
149.93 - 150.88	0.95	Sandstone v.f.g. to f.g., some rip-up clasts, few siltstone interbeds, carbonaceous specks, calcite filled fractures.
150.88 - 151.33	0.45	Siltstone, carbonaceous with up to 30% coaly partings and bands.
151.33 - 151.49	0.16	COAL, dull, with 20% vitreous bands
151.49 - 155.68	4.19	Siltstone, carbonaceous, coal bands, stringers and partings, fractures filled with calcite.
155.68 - 156.41	0.73	COAL (broken and crushed), 80% dull, 20% vitreous.
156.41 - 156.76	0.35	Siltstone alternating with coal bands (3 cm width)
156.76 - 160.11	3.35	Siltstone with v.f.g. ss interbeds, plant fossils, carbonaceous partings, calcite filled fractures. At 157.90 - some slickensides, fewer ss interbeds.
160.11 - 162.84	2.71	Sandstone, v.f.g. to f.g., some silt interbeds, carbonaceous specks, flow features, quartz veinlet. Coaly bands and stringers up to 1 cm widths.
162.84 - 166.73	3.89	Sandstone, v.f.g. to f.g., uniform, carbonaceous specks.
166.73 - 169.29	2.56	Sandstone, v.f.g. to f.g., minor flow features, carbonaceous specks and stringers, fractures filled with calcite, occasional blebs of pyrite. Dip 19°.
169.29 - 172.10	2.81	Sandstone, m.g. to c.g., abundant coaly partings, calcite filled fractures, pyrite blebs, some fine pebble conglomerate intervals (up to 30 cm)
172.10 - 173.37	1.27	Sandstone, m.g. to c.g., carbonaceous parting and coaly stringers, fractures filled with calcite.
173.37 - 174.00	0.63	Siltstone, carbonaceous with some f.g. ss interbeds, coaly stringers, flow features.
174.00 - 175.75	1.75	Sandstone, v.f.g., some silt interbeds, flow features, plant fossils, fractures filled with calcite.
175.75 - 189.89	14.14	CADOMIN FORMATION Conglomerate, pebble/cobble, quartz, chert, green chert.

TD 189.89 m

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MUD 77-4

Location:
(a) Coal Licence: 3199
(b) N.T.S. : c-74-J, 93-I-10
(c) Coal Grid :
(d) Mine Grid :

Azimuth & Inclination: Vertical

Core Size: HQ (63.5 mm)

Date Drilled: August 24 - 31, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Casing capped and left in hole

Logged by: A. E. Bienia, J. D. van der Lee

Formation Tested: Gates Member

Coal Seams Intersected: B1 to B12

Total Depth: 398.4 m

Geophysical Logs: GRN, FBL, CAL, DENS, DIR.

Interval (metres)	Width (metres)	Description
0 - 5.79	5.79	Overburden
5.79 - 6.99	1.20	HULCROSS MEMBER, COMMOTION FORMATION Mudstone, very soft, highly weathered, fissile - breaks into plates, heavily fractured, abundant ferruginous staining.
6.99 - 13.41	6.42	Siltstones/Mudstones, very broken, soft, highly weathered, heavily fractured, abundant ferruginous staining, fissile - breaks into thin (1 cm) plates.
13.41 - 16.61	3.20	Mudstone, dark grey, with thin bands or interbeds of siltstones, minor small-scale cross-bedding, ferruginous stain common.
16.61 - 17.22	0.61	Siltstone, dark grey, hard, massive.
17.22 - 21.34	4.12	Siltstone, interbedded with v.f.g. sandstone (40%) and mudstone (10%), some cross-bedding, minor fractures. Dip 16°.
21.34 - 21.94	0.60	GATES MEMBER, COMMOTION FORMATION Siltstone, interbedded with mudstone and occasional v.f.g. sandstone, rare coaly stringer, pyrite disseminations.
21.94 - 22.11	0.17	COAL, clean, solid, brittle, 30-40% vitreous.
22.11 - 22.60	0.49	Mudstone, carbonaceous, fairly soft, plant fossils, coaly stringers (1 mm widths), some slickensides, abundant pyrite disseminations, blebs and stringers, minute fractures filled with coal.
22.60 - 23.78	1.18	Sandstone, v.f.g. to f.g., medium grey, occasional siltstone interbed, minor flow features, plant fossils, carbonaceous specks, pyrite disseminations, blebs, and stringers. Dips 12° - 13°.
23.78 - 24.34	0.56	Siltstone, first 15 cm very carbonaceous then becoming massive, some carbonaceous specks.
24.34 - 27.21	2.87	Sandstone, v.f.g. to f.g., medium grey, occasional siltstone interbed, minor flow features, carbonaceous specks and stringers, occasional plant fossil. Dip 12°.
27.21 - 29.22	2.01	Sandstone, v.f.g., interbedded with siltstone, carbonaceous specks, stringers, and partings, plant fossils, minute fractures, flow features, slickensides, pyrite disseminations, blebs and stringers.

Interval (metres)	Width (metres)	Description
29.22 - 29.94	0.72	Siltstone with v.f.g. sandstone interbeds, carbonaceous specks and stringers. Dip 14°.
29.94 - 32.48	2.54	Sandstone, v.f.g. to f.g., with siltstone interbeds, minor flow features, carbonaceous specks and stringers.
32.48 - 32.81	0.33	COAL, clean, solid, 50% vitreous, pyrite specks.
32.81 - 33.58	0.77	Mudstone, carbonaceous specks and stringers, coal stringers (1 mm widths), plant fossils, pyrite specks and stringers, slickensides, fractures filled with calcite.
33.58 - 33.83	0.25	COAL, clean, solid, 25% vitreous bands.
33.83 - 34.26	0.43	Mudstone, carbonaceous, plant fossils, pyrite blebs. 33.95 - 34.01 - Coal band, clean, fairly soft, 30% vitreous, pyrite specks. 34.01 - 34.26 - Mudstone, carbonaceous, fairly broke
34.26 - 35.28	1.02	Sandstone, v.f.g. to f.g., medium grey, plant fossil carbonaceous specks and stringers, pyrite specks and stringers, minute fractures filled with carbonaceous material.
35.28 - 35.56	0.28	Siltstone, medium grey, carbonaceous stringers and partings, pyrite stringers.
35.56 - 35.87	0.31	Sandstone, v.f.g., minor flow features, carbonaceous specks and stringers. Dips 14° - 16°.
35.87 - 36.55	0.68	Mudstone, carbonaceous, coal bands and stringers up to 5 mm width, pyrite specks and stringers (common), plant fossils, minor slickensides.
36.55 - 40.31	3.76	Siltstone, with v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers, pyrite blebs and stringers common, minor flow features.
40.31 - 41.07	0.76	Siltstone, carbonaceous, plant fossils, abundant pyrite, minor slickensides.
41.07 - 41.76	0.69	COAL, clean, fairly broken, 10% vitreous, pyrite specks.
41.76 - 41.79	0.03	Mudstone, carbonaceous.
41.79 - 41.91	0.12	COAL, clean, fairly broken, 10% vitreous, pyrite specks.
41.91 - 42.21	0.30	Mudstone, very carbonaceous, abundant plant fossils, coaly stringers, pyrite specks and blebs.

Interval (metres)	Width (metres)	Description
42.21 - 42.91	0.70	Siltstone with some v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers, pyrite specks and stringers common, coal stringers (1 - 2 mm), minute fractures, flow features.
42.91 - 43.46	0.55	Sandstone, v.f.g., carbonaceous specks and stringers.
43.46 - 44.34	0.88	Siltstone, carbonaceous specks, stringers and partings, coal stringers, pyrite specks and stringers common, plant fossils, minor slickensides.
44.34 - 45.40	1.06	Sandstone, v.f.g. to m.g., calcareous cement, carbonaceous specks and stringers, pyrite disseminations and blebs, rare siltstone band. Dips 14° - 16°.
45.40 - 45.80	0.40	Siltstone, carbonaceous specks and stringers.
45.80 - 47.18	1.38	Mudstone, carbonaceous, plant fossils, coal stringers.
47.18 - 47.96	0.78	Siltstone, dark grey, rare v.f.g. sandstone interbed, carbonaceous specks, minute fractures filled with calcite.
47.96 - 55.85	7.89	Sandstone, f.g., interbedded with siltstones, carbonaceous specks and stringers, plant fossils, calcite filled fractures, minor slickensides, flow features, swirls of sandstone in siltstone.
55.85 - 57.48	1.63	Sandstone, f.g., light grey, with up to 20% siltstone bands, carbonaceous specks and stringers, minor flow features. Dip 16°.
57.48 - 59.40	1.92	Sandstone, f.g. to m.g., light grey, clean, well sorted, occasional pebble or rip-up clast.
59.40 - 59.67	0.27	Siltstone.
59.67 - 60.05	0.38	Sandstone, f.g. with siltstone interbeds, carbonaceous specks and stringers.
60.05 - 65.94	5.89	Siltstone, dark grey, with occasional interbed (less than 10%) of v.f.g. sandstone, plant fossils, carbonaceous stringers and partings, some fractures filled with calcite, occasional blebs and stringers of pyrite.
65.94 - 66.45	0.51	Sandstone, f.g. to m.g., light grey, one fracture (5 mm) filled with coarse calcite grains.

Interval (metres)	Width (metres)	Description
66.45 - 67.67	1.22	Siltstone, dark grey, with less than 10% v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers, minute fractures filled with calcite, trace of pyrite. Dip 16°.
67.67 - 67.75	0.08	Siltstone, carbonaceous, plant fossils, pyrite blebs and stringers common.
67.75 - 68.07	0.32	COAL, clean, broken, 30% vitreous, banded.
68.07 - 69.19	1.12	Sandstone, with siltstone interbeds (50%-50%), carbonaceous specks, stringers and partings.
69.19 - 71.23	2.04	Siltstone, carbonaceous, some small zones of carbonaceous mudstone, plant fossils, coaly stringers up to 5 mm in width, some slickensides, pyrite common.
71.23 - 72.51	1.28	Sandstone, v.f.g., with occasional interbed of siltstone, carbonaceous specks and stringers, some pyrite.
72.51 - 73.27	0.76	Siltstone/Mudstone, coaly stringers up to 4 mm in width, carbonaceous partings and bands, plant fossils, pyrite common, minute fractures filled with carbonaceous material and calcite.
73.27 - 73.43	0.16	Mudstone, coaly, pyrite.
73.43 - 75.09	1.66	Siltstone, medium grey, carbonaceous specks and stringers, minute fractures filled with calcite.
75.09 - 77.35	2.26	Siltstone with occasional interbed of sandstone, carbonaceous specks, minor flow features.
77.35 - 82.41	5.06	Sandstone, v.f.g. to f.g., light grey, with occasional interval (up to 10 cm) of siltstone, flow features generally associated with the siltstones; carbonaceous specks and stringers, minute fractures filled with calcite. Dips 16° - 17°.
82.41 - 83.61	1.20	Sandstone, m.g., well sorted, carbonaceous specks and stringers.
83.61 - 84.58	0.97	Sandstone, f.g., plant fossils, carbonaceous stringers and partings, calcite-filled fractures, white ash.
84.58 - 90.53	5.95	Sandstone, f.g. to m.g., light grey, well sorted, occasional carbonaceous specks and stringers, some minor flow features, occasional interval - interbedded with minor amounts of siltstone. Dip 15°.

Interval (metres)	Width (metres)	Description
90.53 - 92.37	1.84	Sandstone, f.g. with siltstone interbeds, carbonaceous partings and stringers, coaly specks, plant fossils, flow features, minute fractures.
92.37 - 93.84	1.47	Siltstone, with v.f.g. sandstone interbeds, carbonaceous specks and stringers, abundant pyrite disseminations. Dip 13°.
93.84 - 94.20	0.36	COAL, clean, hard, solid, brittle; up to 70% vitreous coal, 10% dull, soft, peaty coal, pyrite specks.
94.20 - 94.36	0.16	COAL, clean, hard, solid, 20 - 30% vitreous, pyrite.
94.36 - 94.56	0.20	Mudstone parting, carbonaceous, coaly stringers.
94.56 - 94.67	0.11	COAL, very dirty with approximately 40% mudstone, pyrite.
94.67 - 95.49	0.82	COAL, clean, hard, less than 10% vitreous bands, 10% dull, soft, peaty coal, 80% intermediate lustre, hard, silvery grey, traces of pyrite.
95.49 - 95.55	0.06	COAL, dirty, pyrite.
95.55 - 96.15	0.60	COAL, fairly hard, solid, 10% vitreous bands, 30% dull, rare dirty coal band (less than 1 cm in width), pyrite.
96.15 - 96.23	0.08	COAL, clean, 40% vitreous, 60% intermediate lustre.
96.23 - 96.30	0.07	COAL, dirty, pyrite.
96.30 - 96.62	0.32	COAL, fairly hard, solid, 10% vitreous bands, 30% dull coal, pyrite.
96.62 - 96.72	0.10	COAL, hard, solid, 10% vitreous bands, 10% dull, 70% intermediate lustre, 10% very dirty coal bands up to 1 cm widths.
96.72 - 96.93	0.21	COAL, clean, hard and solid, 10% vitreous bands, 10% dull coal, 80% intermediate lustre.
96.93 - 97.00	0.07	Mudstone, carbonaceous.
97.00 - 97.20	0.20	COAL, very dirty - coaly mudstone, pyrite.
97.20 - 98.70	1.50	COAL, clean, hard, solid, banded coal - up to 30% vitreous, 50 - 60% silvery grey, hard coal, 10% dull, soft, peaty coal, traces of pyrite.
98.70 - 98.86	0.16	Mudstone, carbonaceous, pyrite.

Interval (metres)	Width (metres)	Description
98.86 - 99.40	0.54	COAL, clean, hard, up to 25% vitreous bands; 70 - 75% coal of intermediate lustre, pyrite.
99.40 - 99.47	0.07	COAL, dirty, pyrite. Samples: 0005 93.84 - 94.67 0.83 0006 94.67 - 96.30 1.63 0007 96.30 - 97.20 0.90 0008 97.20 - 98.70 1.50 0009 98.70 - 99.47 0.77
99.47 - 99.67	0.20	Mudstone, carbonaceous.
99.67 - 101.60	1.93	Siltstone, carbonaceous, plant fossils, carbonaceous and coaly stringers and partings. Dips 14° - 15°.
101.60 - 101.70	0.10	COAL, dirty, crushed and ground.
101.70 - 101.80	0.10	Mudstone, very carbonaceous, plant fossils.
101.80 - 102.42	0.62	Sandstone, with siltstone interbeds, plant fossils, carbonaceous specks and stringers, minute fractures filled with calcite, flow features.
102.42 - 106.80	4.38	Siltstone, dark grey, with occasional v.f.g. sandstone interbed, plant fossils, carbonaceous and coaly stringers and partings, minute fractures filled with carbonaceous material and calcite, occasional mud clast.
106.80 - 106.96	0.16	Mudstone, with approximately 30% coal (vitreous) occuring as minute stringers (1 mm widths).
106.96 - 107.30	0.34	Mudstone, carbonaceous, plant fossils, and coaly bands up to 5 mm in width.
107.30 - 107.61	0.31	COAL, fairly clean, broken, dull, with 10 - 30% vitreous bands.
107.61 - 107.71	0.10	Mudstone, carbonaceous, slickensides.
107.71 - 107.77	0.06	COAL, very clean, vitreous.
107.77 - 107.81	0.04	Mudstone, carbonaceous, slickensides.
107.81 - 107.89	0.08	COAL, clean, solid, 60% vitreous.
107.89 - 110.91	3.02	Mudstone, very carbonaceous, plant fossils, vitreous coal bands up to 1 cm in width, some slickensides, minute fractures.
110.91 - 111.86	0.95	Sandstone, f.g., carbonaceous specks and stringers.

Interval (metres)	Width (metres)	Description
111.86 - 119.83	7.97	Siltstone, carbonaceous, plant fossils, coal stringers (1 cm widths), carbonaceous stringers and partings, minute fractures filled with calcite. Dip 16°.
119.83 - 122.70	2.87	Siltstone, dark grey, with occasional v.f.g. sandstone interbed, plant fossils, carbonaceous specks and stringers.
122.70 - 124.00	1.30	Sandstone, f.g. to m.g., carbonaceous partings, coaly specks and stringers, fractures filled with coarse calcite crystals, occasional rip-up clasts.
124.00 - 128.17	4.17	Siltstone, with some v.f.g. sandstone interbeds, carbonaceous specks, stringers and partings, plant fossils.
128.17 - 129.25	1.08	Siltstone, carbonaceous specks, stringers and partings, plant fossils.
129.25 - 130.00	0.75	Mudstone, carbonaceous
130.00 - 130.03	0.03	COAL, dirty.
130.03 - 130.15	0.12	COAL, clean, fairly solid, 15% vitreous, 10% dull, soft, peaty coal.
130.15 - 130.57	0.42	Mudstone, carbonaceous, plant fossils, coal stringers 1 - 2 mm in width.
130.57 - 132.28	1.71	Siltstone, plant fossils, carbonaceous specks and stringers.
132.28 - 135.44	3.16	Siltstone with v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers, flow features, minor fractures filled with calcite.
135.44 - 136.85	1.41	Sandstone, f.g., plant fossils, carbonaceous specks, stringers and partings, minor slickensides.
136.85 - 138.05	1.20	Sandstone, f.g., dark grey, occasional siltstone band, carbonaceous stringers and partings, plant fossils, minute fractures filled with vitreous coal and calcite.
138.05 - 138.37	0.32	Siltstone, plant fossils, carbonaceous specks.
138.37 - 139.29	0.92	COAL, clean, slightly broken, fairly solid, brittle, up to 35% vitreous bands. Sample: 0010 138.37 - 139.29 . 0.92
139.29 - 139.47	0.18	Mudstone, carbonaceous.

Interval (metres)	Width (metres)	Description
139.47 - 139.61	0.14	COAL, clean, 10 - 20% vitreous.
139.61 - 139.77	0.16	Mudstone, carbonaceous.
139.77 - 142.32	2.55	Sandstone, v.f.g., with siltstone interbeds, carbonaceous specks, stringers, and partings, plant fossils, minor flow features, minute fractures.
142.32 - 147.04	4.72	Siltstone, with v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers. Dips 10° - 12°.
147.04 - 147.26	0.22	Mudstone, carbonaceous.
147.26 - 148.06	0.80	Siltstone, with v.f.g. sandstone interbeds, carbonaceous specks, flow features.
148.06 - 149.46	1.40	Mudstone/Siltstone, carbonaceous, vitreous coal stringers up to 1 cm in width, plant fossils, minute fractures.
149.46 - 151.29	1.83	Siltstone, interbedded with v.f.g. sandstone, plant fossils, carbonaceous specks and stringers, flow features, minute fractures filled with calcite.
151.29 - 151.97	0.68	Siltstone, carbonaceous, plant fossils, coal stringers up to 5 mm in width, slickensides.
151.97 - 152.37	0.40	Sandstone, v.f.g., with occasional siltstone interbed plant fossils, carbonaceous stringers.
152.37 - 152.94	0.57	Siltstone, carbonaceous, plant fossils.
152.94 - 153.34	0.40	COAL, fairly hard, solid, 15% vitreous bands, 10% soft, dull, peaty coal.
153.34 - 153.57	0.23	Mudstone, coaly stringers (1 mm), carbonaceous.
153.57 - 153.61	0.04	COAL, mudstone, siltstone chips, crushed and ground.
153.61 - 153.81	0.20	COAL, fairly hard, solid, 10% vitreous bands.
153.81 - 154.03	0.22	Mudstone, carbonaceous.
154.03 - 154.23	0.20	COAL, clean, solid, 30% vitreous.
154.23 - 154.35	0.12	Mudstone, carbonaceous.
154.35 - 154.53	0.18	Mudstone, coaly, recovered 8 cm.
154.53 - 155.05	0.52	Mudstone, carbonaceous, abundant vitreous coal stringers (1 mm widths), plant fossils, some slickensides.

Interval (metres)	Width (metres)	Description
155.05 - 155.35	0.30	COAL, clean, hard, solid, 70% vitreous.
155.35 - 155.65	0.30	COAL, hard, solid, 10% vitreous bands, 80% intermediate lustre, silvery grey, 10% dirty coal.
155.65 - 156.07	0.42	COAL, hard, solid, 10% vitreous bands, 90% intermediate lustre. Sample: 0011 155.05 - 156.07 1.02
156.07 - 156.30	0.23	Mudstone, carbonaceous, coal bands up to 2 cm widths.
156.30 - 156.55	0.25	Mudstone, carbonaceous.
156.55 - 159.59	3.04	Siltstone, carbonaceous specks and stringers, plant fossils, minute fractures.
159.59 - 160.73	1.14	Sandstone, v.f.g. to f.g., medium grey, rare siltstone interbed, coal stringers and blebs, carbonaceous specks and stringers, calcite-filled fractures, flow features, swirls of brown mud in the siltstones.
160.73 - 166.80	6.07	Siltstone, rare, v.f.g, sandstone interbed, some carbonaceous specks and stringers, minute fractures filled with calcite.
166.80 - 179.53	12.73	Siltstone, dark grey, with up to 10% v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers. Dip 20°.
179.53 - 183.79	4.26	Siltstone, with 30% v.f.g. sandstone interbeds, flow features, plant fossils, carbonaceous specks and stringers, coal stringers up to 2 mm width.
183.79 - 185.00	1.21	Siltstone, interbedded with v.f.g. sandstone (50% - 50%), plant fossils, carbonaceous stringers and partings, coaly stringers, minor flow features, minor slickensides.
185.00 - 188.06	3.06	Siltstone, some v.f.g. sandstone interbeds, plant fossils, coaly stringers, carbonaceous partings, fractures filled with calcite, minor flow features. Dip 23°.
188.06 - 192.33	4.27	Siltstone, rare, v.f.g. sandstone band, plant fossils, carbonaceous specks and stringers, minor flow features.
192.33 - 196.60	4.27	Siltstone, carbonaceous, plant fossils, minor flow features, coal bands up to 5 mm in width.

Interval (metres)	Width (metres)	Description
196.60 - 199.00	2.40	Siltstone/Mudstone, carbonaceous, coal bands up to 3 mm in width, plant fossils, minute fractures. Dip 18°
199.00 - 199.15	0.15	COAL, crushed and broken, vitreous.
199.15 - 199.30	0.15	COAL, fairly soft, solid, 60% vitreous.
199.30 - 199.77	0.47	COAL, clean, fairly soft, broken and crushed, 60% vitreous.
199.77 - 200.22	0.45	COAL, clean, fairly soft, solid, 20 - 30% vitreous, 10% soft, dull, peaty coal.
200.22 - 200.37	0.15	COAL, clean, crushed and broken, 30% vitreous.
200.37 - 200.51	0.14	Mudstone, carbonaceous, slickensides.
200.51 - 200.61	0.10	COAL, highly broken, 20% vitreous, 10% dull soft peaty coal.
200.61 - 201.09	0.48	COAL, clean, fairly hard, solid, 25% dull soft, peaty coal.
201.09 - 201.39	0.30	COAL, clean, broken, 25% vitreous bands, 10% dull peaty coal.
201.39 - 201.43	0.04	COAL, dirty.
201.43 - 201.61	0.18	Mudstone, carbonaceous.
201.61 - 203.30	1.69	COAL, crushed and broken, 10% vitreous bands, some dirty coal, one 3 cm carbonaceous. Note: 1.22m not accounted for. Likely is mostly dirt bands. Mudstone parting. Recovered 99 cm. Samples: 0012 199.00 - 200.37 1.37 0013 200.37 - 201.61 1.24 0014 201.61 - 203.30 1.69
203.30 - 203.52	0.22	Mudstone, coaly.
203.52 - 203.57	0.05	COAL - band.
203.57 - 206.35	2.78	Siltstone, carbonaceous, plant fossils, coaly stringers (0.5 cm width), slickensides. Dip 19°
206.35 - 208.54	2.19	COAL
208.54 - 208.69	0.15	Mudstone, carbonaceous.

Interval (metres)	Width (metres)	Description
208.69 - 208.93	0.24	Siltstone, carbonaceous.
208.93 - 213.60	4.67	Siltstone, interbedded with v.f.g. sandstone, plant fossils, carbonaceous stringers and partings, some coal stringers, calcite in fractures. Dip 13°.
213.60 - 215.19	1.59	Sandstone, f.g., medium grey, carbonaceous stringers and partings, coal stringers, plant fossils, some slickensides, fractures filled with calcite.
215.19 - 222.66	7.47	Sandstone, v.f.g., interbedded with siltstone, carbonaceous stringers and specks, cross-bedding (rare), fractures filled with calcite.
222.66 - 223.71	1.05	Siltstone, carbonaceous, plant fossils, coaly bands up to 5 mm, some slickensides.
223.71 - 224.96	1.25	COAL, badly broken, approximately 10% vitreous, 90% intermediate lustre. Recovered 70 cm. Sample: 0015 : 223.71 - 224.96 1.25
224.96 - 225.98	1.02	Siltstone, carbonaceous, heavily fractured, some plant fossils, some slickensides, calcite-filled fractures.
225.98 - 226.90	0.92	COAL, fairly soft, very broken and crushed, up to 40% vitreous. Sample: 0016 : 225.98 - 226.90 0.92
226.90 - 227.99	1.09	Sandstone, f.g., carbonaceous specks and stringers, highly fractured, fractures filled with calcite, plant fossils, minor slickensides.
227.99 - 228.29	0.30	Mudstone, very carbonaceous, coaly bands up to 2 mm in width, slickensides.
228.29 - 228.94	0.65	COAL, solid, 20% vitreous bands, 10-15% duli, soft peaty coal.
228.94 - 230.53	1.59	Sandstone, v.f.g., occasional siltstone band, carbonaceous specks, minute fractures. Dip 13°.
230.53 - 230.91	0.38	Mudstone, carbonaceous, slickensides.
230.91 - 230.97	0.06	COAL with mudstone chips, very ground.
230.97 - 233.63	2.66	Sandstone, v.f.g., carbonaceous specks and stringers, slickensides, calcite-filled fractures, flow features.
233.63 - 233.78	0.15	Mudstone, carbonaceous.

Interval (metres)	Width (metres)	Description
233.78 - 241.10	7.32	Siltstone, with some v.f.g. sandstone bands, carbonaceous, minute fractures filled with calcite, coaly stringers up to 2 mm, minor slickensides.
241.10 - 244.40	3.30	Siltstone, interbedded with f.g. sandstone, occasional carbonaceous stringer or parting, minute fracture filled with calcite.
244.40 - 245.36	0.96	Siltstone, badly broken, calcite-filled fractures.
245.36 - 248.60	3.24	Sandstone, v.f.g., interbedded with siltstones, carbonaceous stringers and partings, flow features, fractures filled with calcite.
248.60 - 251.46	2.86	Siltstone with occasional v.f.g. sandstone band, plant fossils, minute fractures filled with calcite.
251.46 - 256.34	4.88	Sandstone, v.f.g., with some siltstone interbeds, flow features, carbonaceous specks and stringers, fractures filled with calcite, abundant jointing
256.34 - 256.90	0.56	Mudstone, carbonaceous, plant fossils, slickensides.
256.90 - 257.26	0.36	COAL, fairly hard, broken, 30% vitreous, poor recovery.
257.26 - 262.13	4.87	Siltstone, carbonaceous, plant fossils, coal stringers up to 5 mm width, minute fractures filled with calcite, occasional v.f.g. sandstone band. Dip 14°.
262.13 - 263.43	1.30	Sandstone, v.f.g., with some siltstone interbeds, carbonaceous stringers and partings, minor flow features, minute fractures.
263.43 - 263.91	0.48	Siltstone, plant fossils, carbonaceous stringers and partings, some coaly stringers.
263.91 - 264.01	0.10	Mudstone, carbonaceous, broken.
264.01 - 264.27	0.26	COAL, 10% vitreous.
264.27 - 264.82	0.55	Mudstone, carbonaceous, some coaly stringers (3 mm in width), slickensides.
264.82 - 266.70	1.88	COAL, very clean, solid, 10% vitreous, 15% dull, soft peaty coal.
266.70 - 267.05	0.35	COAL, clean, broken and crushed, 20% vitreous
267.05 - 267.31	0.26	COAL, fairly soft but solid, 10% vitreous. Samples: 0017 : 264.82 - 266.70 1.88 0018 : 266.70 - 267.31 0.61

Interval (metres)	Width (metres)	Description
267.31 - 270.16	2.85	Mudstone, carbonaceous, coal bands up to 5 mm, minute fractures filled with calcite.
270.16 - 270.36	0.20	COAL, broken, less than 10% vitreous.
270.36 - 270.78	0.42	Mudstone, carbonaceous.
270.78 - 270.89	0.11	COAL, fairly hard, solid, 20% vitreous.
270.89 - 270.95	0.06	Mudstone, carbonaceous.
270.95 - 271.00	0.05	COAL, dirty.
271.00 - 271.58	0.58	Mudstone, carbonaceous. Recovered 20 cm.
271.58 - 272.38	0.80	COAL, broken and crushed, 10% vitreous.
272.38 - 272.58	0.20	Mudstone, carbonaceous, slickensides.
272.58 - 273.41	0.83	COAL and mudstone, highly ground. Recovered 34 cm.
273.41 - 273.73	0.32	COAL, fairly solid, 15% vitreous.
273.73 - 276.15	2.42	Siltstone, carbonaceous, coal stringers 2-3 mm, slickensides. Dip 17°.
276.15 - 276.46	0.31	Siltstone, carbonaceous, calcite-filled fractures.
276.46 - 277.30	0.84	Siltstone/Mudstone, carbonaceous, coal stringers 2 mm, plant fossils, calcite-filled fractures, some slickensides.
277.30 - 278.91	1.61	Sandstone, v.f.g., with siltstone interbeds, plant fossils, carbonaceous stringers and partings.
278.91 - 279.09	0.18	Mudstone, coaly.
279.09 - 285.65	6.56	Sandstone, f.g., medium grey, carbonaceous stringers and partings, calcite-filled fractures, some cross-bedding, well sorted.
285.65 - 289.56	3.91	Sandstone, f.g., medium grey, carbonaceous stringers and partings, calcite-filled fractures. Worm burrows 285.65 - 286.00 287.20 - 287.43
289.56 - 294.14	4.58	Sandstone, f.g., light grey, carbonaceous specks and stringers, well sorted. Dips 16° - 18°.
294.14 - 306.63	12.49	Sandstone, v.f.g. to f.g., light grey, carbonaceous specks and stringers, rare worm burrow, rip-up clasts (occasional 1 cm band)

Interval (metres)	Width (metres)	Description
306.63 - 309.40	2.77	Sandstone, v.f.g. to f.g., occasional siltstone band, occasional carbonaceous speck, fractures filled with calcite.
309.40 - 311.21	1.81	Sandstone, f.g., with siltstone interbeds (30%), carbonaceous specks and stringers, flow features.
311.21 - 318.00	6.79	Sandstone, f.g., with siltstone interbeds (20%), flow features, some carbonaceous stringers, calcite-filled fractures, pyrite blebs and stringers worm burrows, occasional rip-up clast.
318.00 - 319.28	1.28	Sandstone, f.g., light grey, plant fossils, carbonaceous specks and stringers, occasional mud clast.
319.28 - 326.23	6.95	Sandstone, f.g., light grey, with occasional siltstone band, flow features associated with siltstone bands, plant fossils, carbonaceous specks and stringers, pyrite blebs and stringers.
326.23 - 327.97	1.74	Sandstone, f.g., carbonaceous specks, well sorted.
327.97 - 345.34	17.37	Sandstone, f.g., medium grey, occasional silt band, plant fossils, carbonaceous specks and stringers, flow features, occasional rip-up clasts, calcite-filled fractures, pyrite blebs and stringers (occasional), siltstone bands increase downwards up to 20%.
345.34 - 359.77	14.43	Sandstone, v.f.g., with siltstone interbeds (50%-50%) flow features common, small worm burrows; siltstone content increases downwards.
359.77 - 368.49	8.72	Siltstone, with 20% v.f.g. sandstone interbeds, flow features common, occasional calcite-filled fracture, pyrite blebs common.
368.49 - 368.56	0.07	Mud, medium grey.
368.56 - 373.75	5.19	Siltstone, with 20% v.f.g. sandstone interbeds, rare calcite-filled fracture, flow features common, occasional pyrite specks and blebs.
373.75 - 373.83	0.08	Calcite, medium grey, solid, but easily broken.
373.83 - 383.47	9.64	Shale with less than 30% siltstone bands, flow features, pyrite blebs common.
383.47 - 398.37	14.90	Shale, with thin siltstone bands (less than 10 cm), flow features associated with siltstones, pyrite blebs and stringers common.

T.D. 398.37 m

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MUD 77-5

Location:

(a) Coal Licence: 3196
(b) N.T.S. : a-54-J, 93-I-10
(c) Coal Grid :
(d) Mine Grid :

Azimuth & Inclination: 218°; -70°

Core Size: HQ (63.5 mm)

Date Drilled: September 1 - 7, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Casing capped and left in hole.

Logged by: A. E. Bienia, L. A. Smith

Formation Tested: Gates Member

Coal Seams Intersected: B5, B6, B9, B11

Total Depth: 300.8 m

Geophysical Logs: FBL, GRN, CAL-DENS, DIR.

Interval (metres)	Width (metres)	Description
0 - 3.05	3.05	Overburden
3.05 - 6.00	2.95	HULCROSS MEMBER COMMOTION FORMATION Sandstone, v.f.g., medium grey, with siltstone interbeds, highly fractured, ferruginous staining abundant.
6.00 - 8.62	2.62	Sandstone, v.f.g. with siltstone interbeds, highly fractured, ferruginous stain ing common. This interval is highly broken, with mud and ground chips, poor recovery - 60%.
8.62 - 9.47	0.85	Sandstone chips, highly broken, ferruginous stain.
9.47 - 11.28	1.81	Sandstone, v.f.g., with siltstone interbeds, highly fractured, ferruginous staining, flow features.
11.28 - 16.16	4.88	Sandstone and siltstone chips mixed with mud and clay. Only 34 cm. recovered.
16.16 - 17.07	0.91	Siltstone, dark grey, with approximately 10% v.f.g. sandstone interbeds, ferruginous stain.
17.07 - 26.21	9.14	Siltstone, dark grey, with approximately 25% v.f.g. sandstone interbeds, minute fractures, ferruginous staining, minor flow features (interval fairly broken).
26.21 - 32.61	6.40	Siltstone, dark grey, minute fractures common, fissil.
32.61 - 36.88	4.27	Siltstone, dark grey, with v.f.g. sandstone interbeds, minute fractures, minor flow features, small scale cross-beds, occasional plant fossil. B.C.A. = 80°.
36.88 - 45.28	8.40	Siltstone, dark grey, with approximately 25% v.f.g. sandstone interbeds, minute fractures, flow features, Calcite band 40.45 - 40.50 . B.C.A. 79°.
45.28 - 62.79	17.51	Siltstone, dark grey, with approximately 30% v.f.g. sandstone interbeds, minute fractures abundant, fractures filled with calcite, flow features, small scale cross-bedding (rare) B.C.A. 79°.
62.79 - 65.10	2.31	GATES MEMBER COMMOTION FORMATION Siltstone interbedded with v.f.g. sandstone (50% - 50%) minute fractures filled with calcite, flow features, occasional plant fossil.

Interval (metres)	Width (metres)	Description
65.10 - 66.14	1.04	Conglomerate, fine pebble, (maximum pebble size 0.5 cm.) quartzitic cement with traces of calcite, fractured, some ferruginous staining, pyrite blebs.
66.14 - 66.34	0.20	Siltstone, dark grey, carbonaceous, plant fossils abundant, vitreous coal stringers common, highly fractured.
66.34 - 67.88	1.54	Sandstone, m.g. medium grey, numerous coaly partings and stringers (up to 0.5 cm. in width) highly fractured, with carbonaceous material along fractures, plant fossils, slickensides, pyrite blebs and stringers.
67.88 - 68.00	0.12	Siltstone, dark grey, highly fractured, plant fossils common, some coaly stringers (1 - 2 mm. widths).
68.00 - 72.24	4.24	Sandstone, f.g. with minor siltstone interbeds (10%), minute fractures filled with calcite, coaly stringers and partings, plant fossils, flow features, pyrite blebs. B.C.A. 66° - 68°.
72.24 - 74.37	2.13	Sandstone, f.g. to m.g., rare siltstone interbed, rip up clasts, plant fossils fractures filled with calcite, minor slickensides.
74.37 - 79.54	5.17	Sandstone, f.g. to m.g., medium grey, calcareous cement. Calcite filled fractures, some carbonaceous stringers and partings, occasional coal stringer, plant fossils, minor flow features. B.C.A. 72°.
79.54 - 79.80	0.26	Coal, clean, broken, 10 - 20% vitreous bands, 80% intermediate lustre.
79.80 - 81.18	1.38	Siltstone, carbonaceous, plant fossils, vitreous coal stringers of 2 - 3 mm. widths.
81.18 - 81.53	0.35	Coal, clean, 20% vitreous bands, pyrite common.
81.53 - 81.73	0.20	Siltstone, carbonaceous, plant fossils, coal stringers 0.5 cm. in width, pyrite common.
81.73 - 83.21	1.48	Siltstone, dark grey, some carbonaceous intervals, minute fractures, plant fossils abundant, coal stringers 2 - 3 mm. in width, pyrite blebs and stringers common.

Interval (metres)	Width (metres)	Description
83.21 - 84.85	1.64	Siltstone, dark grey, plant fossils, rare coal stringer, pyrite.
84.85 - 84.93	0.08	Coal, dirty, slickensides.
84.93 - 85.14	0.21	Mudstone, carbonaceous.
85.14 - 85.29	0.15	Coal, dirty, dull. 5% vitreous bands, fairly hard, solid.
85.29 - 85.63	0.34	Coal, clean, solid, intermediate lustre, 5% dull peaty coal, pyrite blebs and disseminations.
85.63 - 85.84	0.21	Mudstone, carbonaceous, vitreous coal stringers (1mm. widths), plant fossils, pyrite specks and stringers.
85.84 - 86.26	0.42	Coal, clean, fairly hard, solid, 10% vitreous bands, some white ash specks and stringers, pyrite specks and blebs. Last 4 cm. broken and crushed. Recovered 36 cm. Sample: 0019 : 85.14 - 86.26 1.12
86.26 - 86.96	0.70	Siltstone, carbonaceous specks and stringers, plant fossils, minute fractures.
86.96 - 87.48	0.52	Coal, very dirty grading to a coaly mudstone.
87.48 - 88.88	1.40	Siltstone, plant fossils, carbonaceous stringers and partings, minor interbeds of v.f.g. sandstone fractures filled with calcite, jointing common.
88.88 - 90.23	1.35	Siltstone, dark grey, highly fractured, abundant minute fractures filled with calcite, plant fossils, minor slickensides.
90.23 - 91.44	1.21	Sandstone, with some siltstone interbeds, flow features, calcite filled fractures, plant fossils, carbonaceous specks. B.C.A. 78°.
91.44 - 92.04	0.60	Sandstone, f.g. to m.g., coaly stringers and partings, calcite cement and calcite filled fractures.
92.04 - 93.27	1.23	Siltstone, plant fossils, coaly stringers and partings, minute fractures filled with calcite.
93.27 - 94.31	1.04	Siltstone, with v.f.g. sandstone interbeds, fractures filled with calcite, minor flow features. B.C.A. 82°.

Interval (metres)	Width (metres)	Description
94.31 - 96.62	2.31	Sandstone, v.f.g. to f.g., occasional interbed of siltstone, carbonaceous specks, plant fossils, calcite filled fractures, minor flow features, rip-up clasts.
96.62 - 98.67	2.05	Siltstone, interbedded with v.f.g. sandstone, plant fossils, some fractures filled with calcite.
98.67 - 100.58	1.91	Sandstone, f.g. to m.g., light grey, rare siltstone band (usually 1 cm width) plant fossils calcite cement and calcite filled fractures, occasional rip-up clasts.
100.58 - 100.98	0.40	Siltstone, interbedded with v.f.g. sandstone plant fossils.
100.98 - 104.09	3.11	Siltstone, dark grey, occasional brown mud band, minute fractures filled with calcite, occasional carbonaceous specks.
104.09 - 105.21	1.12	Sandstone, f.g. medium grey, some siltstone bands, plant fossils, carbonaceous specks and stringers associated with the silts, minor flow features, ferrugenous stain. B.C.A. 79°.
105.21 - 108.81	3.60	Siltstone, dark grey, with occasional v.f.g. sandstone interbeds, plant fossils, carbonaceous stringers and coaly specks, minute fractures, ferruginous stain and calcite along fractures.
108.81 - 108.97	0.16	Sandstone, v.f.g., medium grey, carbonaceous stringers and partings, flow features.
108.97 - 109.63	0.66	Siltstone, dark grey, minute fractures, ferruginous stain and calcite along fractures, carbonaceous stringers and coaly specks.
109.63 - 109.75	0.12	Siltstone/Mudstone, carbonaceous, coaly stringers and bands up to 2 mm. in width.
109.75 - 109.90	0.15	Coal, 10 - 20% vitreous, 15% duel, soft, peaty coal.
109.90 - 110.08	0.18	Mudstone, coaly, carbonaceous, pyrite stringers.
110.08 - 111.02	0.94	Siltstone/Mudstone, carbonaceous, plant fossils abundant, vitreous coal bands 2 - 4 mm in width (common), fractures filled with calcite, minor slickensides, pyrite blebs.
111.02 - 111.24	0.22	Mudstone, coaly, pyrite.

Interval (metres)	Width (metres)	Description
111.24 - 111.27	0.03	Coal band, vitreous.
111.27 - 111.36	0.09	Mudstone, carbonaceous, slickensides.
111.36 - 112.62	1.26	Siltstone, with interbeds of v.f.g., sandstone plant fossils abundant, coaly bands and stringers, calcite filled fractures.
112.62 - 112.87	0.25	Sandstone, f.g. abundant coaly specks and stringers, slickensides, pyrite blebs and stringes, fractures filled with calcite and large (0.5 cm) amber crystals.
112.87 - 115.36	2.49	Siltstone, plant fossils abundant, coaly stringers and bands up to 0.5 cm. in width.
115.36 - 116.68	1.32	Sandstone, v.f.g., interbedded with siltstones, flow features, plant fossils, coaly specks and stringers. B.C.A. 78°.
116.68 - 117.52	0.84	Siltstone, carbonaceous, occasional v.f.g. Sandstone band, minute fractures, plant fossils, coaly stringers and bands.
117.52 - 117.70	0.18	Coal band, vitreous.
117.70 - 117.90	0.20	Siltstone, carbonaceous, some coal bands up to 1 cm. in width, pyrite common.
117.90 - 119.02	1.12	Sandstone, v.f.g. with siltstone interbeds, plant fossils, carbonaceous specks and stringers, rare fracture filled with calcite, flow features.
119.02 - 121.00	1.98	Sandstone, f.g., medium grey, abundant carbonaceous stringers and partings, minor slickensides, calcite filled fractures.
121.00 - 122.84	1.84	Siltstone, with v.f.g. Sandstone interbeds, some slickensides, plant fossils, coaly stringers and vitreous coal bands up to 0.5 cm. widths, minute fractures filled with calcite, pyrite.
122.84 - 123.40	0.56	Siltstone, dark grey, rare plant fossil, minute fractures filled with calcite.
123.40 - 125.00	1.60	Siltstone interbedded with v.f.g. sandstone, plant fossils, slickensides, calcite along fractures and slickensided surfaces. B.C.A. 80°.
125.00 - 125.27	0.27	Mudstone, carbonaceous, come slickensides and minute fractures.

Interval (metres)	Width (metres)	Description
125.27 - 126.47	1.20	Siltstone, dark grey, plant fossils, coaly bands and stringers, abundant calcite along fractures and joint surfaces, massive.
126.47 - 126.77	0.30	Siltstone, carbonaceous, plant fossils, minor slickensides.
126.77 - 127.10	0.33	Coal 50%, Mudstone 50%, highly crushed and ground.
127.10 - 127.32	0.22	Coal, fairly clean, solid, 20% vitreous bands, 80% intermediate lustre, pyrite specks.
127.32 - 127.38	0.06	Mudstone, carbonaceous, pyrite.
127.38 - 127.48	0.10	Coal, very dirty - grading to a mudstone, pyrite.
127.48 - 128.93	1.45	Coal, clean, fairly hard, solid, 20 - 30% vitreous, 65% intermediate lustre, with approximately 5% dull, soft peaty coal, pyrite specks.
128.93 - 130.00	1.07	Coal, fairly clean, solid, 10% vitreous bands, up to 25% dull, soft peaty coal, 65% intermediate lustre.
130.00 - 130.05	0.05	Coal, dirty.
130.05 - 130.15	0.10	Mudstone, carbonaceous.
130.15 - 130.57	0.42	Coal, appears fairly clean, soft, crushed and ground (poor recovery).
130.57 - 130.63	0.06	Coal, dirty, broken, 10% vitreous bands.
130.63 - 130.77	0.14	Coal, soft, crushed and ground.
130.77 - 131.25	0.48	Coal, fairly clean, hard, intermediate lustre with 20% dull coal, 5% dull soft peaty coal, minor slickensides, specks and blebs of white ask along slickensided surfaces.
131.25 - 133.24	1.99	Coal, appears fairly clean, crushed and ground, intermediate lustre with 20 - 30% dull coal and 10 - 15% vitreous coal bands. Recovered 1.37 m. Samples: 0020 : 126.77 - 127.48 0.71 0021 : 127.48 - 128.93 1.45 0022 : 128.93 - 130.15 1.22 0023 : 130.15 - 131.25 1.10 0024 : 131.25 - 133.24 1.99

Interval (metres)	Width (metres)	Description
133.24 - 133.88	0.64	Siltstone with v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers.
133.88 - 135.98	2.10	Sandstone, v.f.g. to f.g., with some siltstone interbeds, occasional fractures filled with calcite, carbonaceous specks and stringers, minor flow features.
135.98 - 136.13	0.15	COAL, broken
136.13 - 136.25	0.12	Mudstone, carbonaceous
136.25 - 138.07	1.82	Siltstone, dark grey, carbonaceous specks and stringers, minute fractures.
138.07 - 141.23	3.16	Siltstone, medium grey, plant fossils, carbonaceous specks and stringers, calcite filled fractures. BCA = 84°.
141.23 - 142.39	1.16	Sandstone, v.f.g. to f.g., medium grey, calcite cement, carbonaceous specks.
142.39 - 144.36	1.97	Siltstone, dark grey, plant fossils, carbonaceous specks and stringers, minute fractures filled with calcite.
144.36 - 144.47	0.11	COAL, dirty.
144.47 - 144.55	0.08	COAL, hard, solid, 10% vitreous bands, 90% intermediate lustre.
144.55 - 146.91	2.36	Siltstone, carbonaceous, plant fossils, carbonaceous stringers and partings, vitreous coal bands up to 1 cm in width, minute fractures filled with calcite.
146.91 - 149.77	2.86	Siltstone (with some mudstone intervals), carbonaceous, plant fossils, coal bands and stringers up to 1 cm in width, fractures filled with calcite, minor slickensides.
149.77 - 151.70	1.93	Siltstone, interbedded with v.f.g. sandstone, occasional coaly stringers and bands up to 0.5 cm in width, plant fossils, minute fractures filled with calcite.
151.70 - 154.23	2.53	Sandstone, v.f.g. to f.g., with some siltstone interbeds, occasional carbonaceous parting, minor slickensides, minor flow features, calcite veinlets, calcite filled fractures, calcite along slickensided surfaces.
154.23 - 155.75	1.52	Siltstone with some v.f.g. sandstone interbeds, occasional plant fossil.

Interval (metres)	Width (metres)	Description
155.75 - 157.58	1.83	Sandstone, v.f.g., with siltstone interbeds, minute fractures filled with calcite, plant fossils, carbonaceous specks and stringers, flow features. BCA = 78° - 82°.
157.58 - 158.18	0.60	Siltstone, with v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers, flow features, slump features.
158.18 - 159.87	1.69	Sandstone, v.f.g., occasional siltstone band, plant fossils, carbonaceous stringers and partings, minor slickensides, flow features, calcite filled fractures.
159.87 - 162.69	2.82	Sandstone, m.g., medium grey, carbonaceous stringers and partings, coal stringers (2 mm width) rare slickensides, fractured, calcite and pyrite crystals along fractures. BCA 78° - 82°.
162.69 - 163.21	0.52	Siltstone, carbonaceous.
163.21 - 163.94	0.73	COAL, clean, fairly brittle, broken and crushed, recovery 80-85%, 30-40% vitreous coal.
163.94 - 164.09	0.15	Mudstone, carbonaceous.
164.09 - 164.84	0.75	COAL, clean, fairly brittle, solid, 30% vitreous coal bands, 20% dull peaty coal, 50% intermediate lustre.
164.84 - 165.24	0.40	COAL, hard, some dirty coal stringers (1 - 2 mm width) 10-15%, 10% vitreous bands, 60-70% very hard coal, intermediate lustre, steely grey.
165.24 - 166.17	0.93	COAL, fairly clean, fairly soft but solid, 20% vitreous bands, 20% dull, peaty coal.
166.17 - 166.37	0.20	COAL, clean, soft, broken, 10% vitreous. Samples: 0025 : 163.21 - 164.09 0.88 0026 : 164.09 - 164.84 0.75 0027 : 164.84 - 166.37 1.53
166.37 - 168.59	2.22	Siltstone, carbonaceous, plant fossils, coaly stringers and specks, slickensides with white ash, trace pyrite.
168.59 - 169.77	1.18	Siltstone interbedded with v.f.g. sandstone (50%-50%), plant fossils, carbonaceous specks, stringers and partings, calcite filled fractures.

Interval (metres)	Width (metres)	Description
169.77 - 174.58	4.81	Sandstone, v.f.g., light to medium grey, carbonaceous specks and stringers, occasional minute fracture filled with calcite, some plant fossils, minor flow features.
174.58 - 176.48	1.90	Sandstone, m.g. to c.g., light grey, carbonaceous specks, stringers and partings, plant fossils, coal stringers, calcite filled fractures and calcareous cement, pyrite disseminations and blebs.
176.48 - 178.92	2.44	Sandstone, f.g. to m.g., some carbonaceous partings, fractures filled with calcite, well sorted.
178.92 - 182.56	3.64	Sandstone, m.g. to c.g., occasional stringers of coal (3 mm width), calcareous cementing material, well sorted sandstone. BCA = 80°.
182.56 - 182.66	0.10	COAL, clean, fairly solid, vitreous (80%).
182.66 - 182.86	0.20	COAL, fairly solid, 40% vitreous, 20% dull, peaty coal.
182.86 - 183.60	0.74	Mudstone, carbonaceous, with vitreous coal stringers up to 5 mm in width.
183.60 - 183.63	0.03	COAL, vitreous.
183.63 - 183.68	0.05	COAL, clean, 20% vitreous. Recovery ca. 80%.
183.68 - 184.00	0.32	Mudstone, carbonaceous.
184.00 - 184.36	0.36	COAL, clean, fairly soft but solid, intermediate lustre, brittle.
184.36 - 184.77	0.41	COAL, dirty, slickensides, specks of white ash along slickensided surfaces. Sample: 0028 : 184.00 - 184.77 0.77
184.77 - 185.31	0.54	Mudstone, carbonaceous, slickensides. BCA = 78°.
185.31 - 185.77	0.46	Siltstone, dark grey, plant fossils, minor carbonaceous specks, minute fractures, some slickensides. BCA = 78°.
185.77 - 186.13	0.36	Mudstone, coaly, slickensides.
186.13 - 188.07	1.94	Siltstone, carbonaceous, plant fossils, slickensides with white ash, minute fractures filled with calcite.

Interval (metres)	Width (metres)	Description
188.07 - 192.05	3.98	Siltstone, dark grey, occasional plant fossils, some carbonaceous specks and stringers, calcite along fractures and slickensides. BCA = 60°.
192.05 - 193.09	1.04	Sandstone, f.g., with siltstone interbeds, carbonaceous stringers, coal specks, flow features, calcite filled fractures, slickensides. BCA = 41°.
193.09 - 198.95	5.86	Sandstone, f.g. to m.g., coaly specks, stringers and partings, intervals of m.g. sandstone, highly fractured, fractures filled with calcite. BCA = 42°.
198.95 - 199.95	1.00	Sandstone, f.g. to m.g., coaly partings and stringers. fractured. BCA = 45°.
199.95 - 201.47	1.52	Sandstone, f.g. with c.g. bands, highly fractured, coaly specks, stringers and bands, slickensided.
201.47 - 205.13	3.66	Sandstone, f.g. to m.g., some siltstone interbeds, highly fractured, coal specks, stringers, calcite along fractures and slickensided surfaces. BCA = 57°.
205.13 - 206.95	1.82	Sandstone, f.g. to m.g., some siltstone interbeds, coaly blebs, stringers and partings, calcite along fractures and slickensides, highly fractured, highly crushed and broken, some ferruginous staining.
206.95 - 216.32	9.37	Siltstone, dark grey, rare plant fossils, fractures filled with calcite, slickensides. BCA = 23°.
216.32 - 221.59	5.27	Sandstone, v.f.g., medium grey, carbonaceous specks and stringers, some plant fossils; abundant calcite filled fractures and calcareous cement. BCA = 20°.
221.59 - 225.60	4.01	Sandstone, v.f.g., dark grey, well sorted, slightly foliated, rare plant fossils, fairly porous, coarsening downward, calcite filled fractures. BCA = 32°.
225.60 - 226.19	0.59	Sandstone, m.g., light grey, contains numerous coaly fragments and stringers, fractures filled with coaly material.
226.19 - 226.29	0.10	Conglomerate, fine pebble, pebbles appear angular, well cemented.
226.29 - 227.79	1.50	Sandstone, m.g., with occasional siltstone band, calcite filled fractures common, some calcite blebs. BCA = 32°

Interval (metres)	Width (metres)	Description
227.79 - 229.80	2.01	Conglomerate, fine pebbles, with up to 20% sandstone bands, pebbles angular, matrix 30%, well cemented.
229.80 - 235.61	5.81	Sandstone, m.g., highly fractured, fractures filled with calcite and coaly material, minor flow features, last 2 m highly fractured and badly broken. BCA = 25°.
235.61 - 236.00	0.39	Conglomerate, fine pebbles (0.5 cm), conglomerate lies on a mudstone with a thin coal band (10 mm width) separating them - evidence of a low angle plane fault: rocks are crushed and contain numerous slickensides. BCA = 5° - 8°.
236.00 - 237.53	1.53	Mudstone, with coaly mudstone intervals, badly fractured and broken, slickensides common. BCA = 20° - 25°.
237.53 - 258.44	20.91	Mudstone, numerous minute fractures, occasional coal specks and stringers, some brown mud blobs and bands, massive.
258.44 - 261.24	2.80	Mudstone, fractures filled with coal, total coal content 15%. BCA = 20°.
261.24 - 265.05	3.81	Sandstone, v.f.g., grading downwards to a siltstone, rare plant fossils, rare fractures are calcite filled.
265.05 - 300.84	35.79	Siltstone, dark grey, some fractured intervals, with calcite filling, massive. BCA = 5°.

T.D. 300.84

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MUD 77-5

Location:

(a) Coal Licence: 3196
(b) N.T.S. : a-54-J, 93-I-10
(c) Coal Grid :
(d) Mine Grid :

Azimuth & Inclination: 218°; -70°

Core Size: HQ (63.5 mm)

Date Drilled: September 1 - 7, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Casing capped and left in hole.

Logged by: A. E. Bienia, L. A. Smith

Formation Tested: Gates Member

Coal Seams Intersected: B5, B6, B9, B11

Total Depth: 300.8 m

Geophysical Logs: FBL, GRN, CAL-DENS, DIR.

Interval (metres)	Width (metres)	Description
0 - 3.05	3.05	Overburden
3.05 - 6.00	2.95	HULCROSS MEMBER COMMOTION FORMATION Sandstone, v.f.g., medium grey, with siltstone interbeds, highly fractured, ferruginous staining abundant.
6.00 - 8.62	2.62	Sandstone, v.f.g. with siltstone interbeds, highly fractured, ferruginous stain ing common. This interval is highly broken, with mud and ground chips, poor recovery - 60%.
8.62 - 9.47	0.85	Sandstone chips, highly broken, ferruginous stain.
9.47 - 11.28	1.81	Sandstone, v.f.g., with siltstone interbeds, highly fractured, ferruginous staining, flow features.
11.28 - 16.16	4.88	Sandstone and siltstone chips mixed with mud and clay. Only 34 cm. recovered.
16.16 - 17.07	0.91	Siltstone, dark grey, with approximately 10% v.f.g. sandstone interbeds, ferruginous stain.
17.07 - 26.21	9.14	Siltstone, dark grey, with approximately 25% v.f.g. sandstone interbeds, minute fractures, ferruginous staining, minor flow features (interval fairly broken).
26.21 - 32.61	6.40	Siltstone, dark grey, minute fractures common, fissil.
32.61 - 36.88	4.27	Siltstone, dark grey, with v.f.g. sandstone interbeds, minute fractures, minor flow features, small scale cross-beds, occasional plant fossil. B.C.A. = 80°.
36.88 - 45.28	8.40	Siltstone, dark grey, with approximately 25% v.f.g. sandstone interbeds, minute fractures, flow features, Calcite band 40.45 - 40.50 . B.C.A. 79°.
45.28 - 62.79	17.51	Siltstone, dark grey, with approximately 30% v.f.g. sandstone interbeds, minute fractures abundant, fractures filled with calcite, flow features, small scale cross-bedding (rare) B.C.A. 79°.
62.79 - 65.10	2.31	GATES MEMBER COMMOTION FORMATION Siltstone interbedded with v.f.g. sandstone (50% - 50%) minute fractures filled with calcite, flow features, occasional plant fossil.

Interval (metres)	Width (metres)	Description
65.10 - 66.14	1.04	Conglomerate, fine pebble, (maximum pebble size 0.5 cm.) quartzitic cement with traces of calcite, fractured, some ferruginous staining, pyrite blebs.
66.14 - 66.34	0.20	Siltstone, dark grey, carbonaceous, plant fossils abundant, vitreous coal stringers common, highly fractured.
66.34 - 67.88	1.54	Sandstone, m.g. medium grey, numerous coaly partings and stringers (up to 0.5 cm. in width) highly fractured, with carbonaceous material along fractures, plant fossils, slickensides, pyrite blebs and stringers.
67.88 - 68.00	0.12	Siltstone, dark grey, highly fractured, plant fossils common, some coaly stringers (1 - 2 mm. widths).
68.00 - 72.24	4.24	Sandstone, f.g. with minor siltstone interbeds (10%), minute fractures filled with calcite, coaly stringers and partings, plant fossils, flow features, pyrite blebs. B.C.A. 66° - 68°.
72.24 - 74.37	2.13	Sandstone, f.g. to m.g., rare siltstone interbed, rip up clasts, plant fossils fractures filled with calcite, minor slickensides.
74.37 - 79.54	5.17	Sandstone, f.g. to m.g., medium grey, calcareous cement. Calcite filled fractures, some carbonaceous stringers and partings, occasional coal stringer, plant fossils, minor flow features. B.C.A. 72°.
79.54 - 79.80	0.26	Coal, clean, broken, 10 - 20% vitreous bands, 80% intermediate lustre.
79.80 - 81.18	1.38	Siltstone, carbonaceous, plant fossils, vitreous coal stringers of 2 - 3 mm. widths.
81.18 - 81.53	0.35	Coal, clean, 20% vitreous bands, pyrite common.
81.53 - 81.73	0.20	Siltstone, carbonaceous, plant fossils, coal stringers 0.5 cm. in width, pyrite common.
81.73 - 83.21	1.48	Siltstone, dark grey, some carbonaceous intervals, minute fractures, plant fossils abundant, coal stringers 2 - 3 mm. in width, pyrite blebs and stringers common.

Interval (metres)	Width (metres)	Description
83.21 - 84.85	1.64	Siltstone, dark grey, plant fossils, rare coal stringer, pyrite.
84.85 - 84.93	0.08	Coal, dirty, slickensides.
84.93 - 85.14	0.21	Mudstone, carbonaceous.
85.14 - 85.29	0.15	Coal, dirty, dull 5% vitreous bands, fairly hard, solid.
85.29 - 85.63	0.34	Coal, clean, solid, intermediate lustre, 5% dull peaty coal, pyrite blebs and disseminations.
85.63 - 85.84	0.21	Mudstone, carbonaceous, vitreous coal stringers (1mm. widths), plant fossils, pyrite specks and stringers.
85.84 - 86.26	0.42	Coal, clean, fairly hard, solid, 10% vitreous bands, some white ash specks and stringers, pyrite specks and blebs. Last 4 cm. broken and crushed. Recovered 36 cm. Sample: 0019 : 85.14 - 86.26 1.12
86.26 - 86.96	0.70	Siltstone, carbonaceous specks and stringers, plant fossils, minute fractures.
86.96 - 87.48	0.52	Coal, very dirty grading to a coaly mudstone.
87.48 - 88.88	1.40	Siltstone, plant fossils, carbonaceous stringers and partings, minor interbeds of v.f.g. sandstone fractures filled with calcite, jointing common.
88.88 - 90.23	1.35	Siltstone, dark grey, highly fractured, abundant minute fractures filled with calcite, plant fossils, minor slickensides.
90.23 - 91.44	1.21	Sandstone, with some siltstone interbeds, flow features, calcite filled fractures, plant fossils, carbonaceous specks. B.C.A. 78°.
91.44 - 92.04	0.60	Sandstone, f.g. to m.g., coaly stringers and partings, calcite cement and calcite filled fractures.
92.04 - 93.27	1.23	Siltstone, plant fossils, coaly stringers and partings, minute fractures filled with calcite.
93.27 - 94.31	1.04	Siltstone, with v.f.g. sandstone interbeds, fractures filled with calcite, minor flow features. B.C.A. 82°.

Interval (metres)	Width (metres)	Description
94.31 - 96.62	2.31	Sandstone, v.f.g. to f.g., occasional interbed of siltstone, carbonaceous specks, plant fossils, calcite filled fractures, minor flow features, rip-up clasts.
96.62 - 98.67	2.05	Siltstone, interbedded with v.f.g. sandstone, plant fossils, some fractures filled with calcite.
98.67 - 100.58	1.91	Sandstone, f.g. to m.g., light grey, rare siltstone band (usually 1 cm width) plant fossils calcite cement and calcite filled fractures, occasional rip-up clasts.
100.58 - 100.98	0.40	Siltstone, interbedded with v.f.g. sandstone plant fossils.
100.98 - 104.09	3.11	Siltstone, dark grey, occasional brown mud band, minute fractures filled with calcite, occasional carbonaceous specks.
104.09 - 105.21	1.12	Sandstone, f.g. medium grey, some siltstone bands, plant fossils, carbonaceous specks and stringers associated with the silts, minor flow features, ferrugenous stain. B.C.A. 79°.
105.21 - 108.81	3.60	Siltstone, dark grey, with occasional v.f.g. sandstone interbeds, plant fossils, carbonaceous stringers and coaly specks, minute fractures, ferruginous stain and calcite along fractures.
108.81 - 108.97	0.16	Sandstone, v.f.g., medium grey, carbonaceous stringers and partings, flow features.
108.97 - 109.63	0.66	Siltstone, dark grey, minute fractures, ferruginous stain and calcite along fractures, carbonaceous stringers and coaly specks.
109.63 - 109.75	0.12	Siltstone/Mudstone, carbonaceous, coaly stringers and bands up to 2 mm. in width.
109.75 - 109.90	0.15	Coal, 10 - 20% vitreous, 15% duel, soft, peaty coal.
109.90 - 110.08	0.18	Mudstone, coaly, carbonaceous, pyrite stringers.
110.08 - 111.02	0.94	Siltstone/Mudstone, carbonaceous, plant fossils abundant, vitreous coal bands 2 - 4 mm in width (common), fractures filled with calcite, minor slickensides, pyrite blebs.
111.02 - 111.24	0.22	Mudstone, coaly, pyrite.

Interval (metres)	Width (metres)	Description
111.24 - 111.27	0.03	Coal band, vitreous.
111.27 - 111.36	0.09	Mudstone, carbonaceous, slickensides.
111.36 - 112.62	1.26	Siltstone, with interbeds of v.f.g., sandstone plant fossils abundant, coaly bands and stringers, calcite filled fractures.
112.62 - 112.87	0.25	Sandstone, f.g. abundant coaly specks and stringers, slickensides, pyrite blebs and stringes, fractures filled with calcite and large (0.5 cm) amber crystals.
112.87 - 115.36	2.49	Siltstone, plant fossils abundant, coaly stringers and bands up to 0.5 cm. in width.
115.36 - 116.68	1.32	Sandstone, v.f.g., interbedded with siltstones, flow features, plant fossils, coaly specks and stringers. B.C.A. 78°.
116.68 - 117.52	0.84	Siltstone, carbonaceous, occasional v.f.g. Sandstone band, minute fractures, plant fossils, coaly stringers and bands.
117.52 - 117.70	0.18	Coal band, vitreous.
117.70 - 117.90	0.20	Siltstone, carbonaceous, some coal bands up to 1 cm. in width, pyrite common.
117.90 - 119.02	1.12	Sandstone, v.f.g. with siltstone interbeds, plant fossils, carbonaceous specks and stringers, rare fracture filled with calcite, flow features.
119.02 - 121.00	1.98	Sandstone, f.g., medium grey, abundant carbonaceous stringers and partings, minor slickensides, calcite filled fractures.
121.00 - 122.84	1.84	Siltstone, with v.f.g. Sandstone interbeds, some slickensides, plant fossils, coaly stringers and vitreous coal bands up to 0.5 cm. widths, minute fractures filled with calcite, pyrite.
122.84 - 123.40	0.56	Siltstone, dark grey, rare plant fossil, minute fractures filled with calcite.
123.40 - 125.00	1.60	Siltstone interbedded with v.f.g. sandstone, plant fossils, slickensides, calcite along fractures and slickensided surfaces. B.C.A. 80°.
125.00 - 125.27	0.27	Mudstone, carbonaceous, come slickensides and minute fractures.

Interval (metres)	Width (metres)	Description
125.27 - 126.47	1.20	Siltstone, dark grey, plant fossils, coaly bands and stringers, abundant calcite along fractures and joint surfaces, massive.
126.47 - 126.77	0.30	Siltstone, carbonaceous, plant fossils, minor slickensides.
126.77 - 127.10	0.33	Coal 50%, Mudstone 50%, highly crushed and ground.
127.10 - 127.32	0.22	Coal, fairly clean, solid, 20% vitreous bands, 80% intermediate lustre, pyrite specks.
127.32 - 127.38	0.06	Mudstone, carbonaceous, pyrite.
127.38 - 127.48	0.10	Coal, very dirty - grading to a mudstone, pyrite.
127.48 - 128.93	1.45	Coal, clean, fairly hard, solid, 20 - 30% vitreous, 65% intermediate lustre, with approximately 5% dull, soft peaty coal, pyrite specks.
128.93 - 130.00	1.07	Coal, fairly clean, solid, 10% vitreous bands, up to 25% dull, soft peaty coal, 65% intermediate lustre.
130.00 - 130.05	0.05	Coal, dirty.
130.05 - 130.15	0.10	Mudstone, carbonaceous.
130.15 - 130.57	0.42	Coal, appears fairly clean, soft, crushed and ground (poor recovery).
130.57 - 130.63	0.06	Coal, dirty, broken, 10% vitreous bands.
130.63 - 130.77	0.14	Coal, soft, crushed and ground.
130.77 - 131.25	0.48	Coal, fairly clean, hard, intermediate lustre with 20% dull coal, 5% dull soft peaty coal, minor slickensides, specks and blebs of white ask along slickensided surfaces.
131.25 - 133.24	1.99	Coal, appears fairly clean, crushed and ground, intermediate lustre with 20 - 30% dull coal and 10 - 15% vitreous coal bands. Recovered 1.37 m. Samples: 0020 : 126.77 - 127.48 0.71 0021 : 127.48 - 128.93 1.45 0022 : 128.93 - 130.15 1.22 0023 : 130.15 - 131.25 1.10 0024 : 131.25 - 133.24 1.99

Interval (metres)	Width (metres)	Description
133.24 - 133.88	0.64	Siltstone with v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers.
133.88 - 135.98	2.10	Sandstone, v.f.g. to f.g., with some siltstone interbeds, occasional fractures filled with calcite, carbonaceous specks and stringers, minor flow features.
135.98 - 136.13	0.15	COAL, broken
136.13 - 136.25	0.12	Mudstone, carbonaceous
136.25 - 138.07	1.82	Siltstone, dark grey, carbonaceous specks and stringers, minute fractures.
138.07 - 141.23	3.16	Siltstone, medium grey, plant fossils, carbonaceous specks and stringers, calcite filled fractures. BCA = 84°.
141.23 - 142.39	1.16	Sandstone, v.f.g. to f.g., medium grey, calcite cement, carbonaceous specks.
142.39 - 144.36	1.97	Siltstone, dark grey, plant fossils, carbonaceous specks and stringers, minute fractures filled with calcite.
144.36 - 144.47	0.11	COAL, dirty.
144.47 - 144.55	0.08	COAL, hard, solid, 10% vitreous bands, 90% intermediate lustre.
144.55 - 146.91	2.36	Siltstone, carbonaceous, plant fossils, carbonaceous stringers and partings, vitreous coal bands up to 1 cm in width, minute fractures filled with calcite.
146.91 - 149.77	2.86	Siltstone (with some mudstone intervals), carbonaceous, plant fossils, coal bands and stringers up to 1 cm in width, fractures filled with calcite, minor slickensides.
149.77 - 151.70	1.93	Siltstone, interbedded with v.f.g. sandstone, occasional coaly stringers and bands up to 0.5 cm in width, plant fossils, minute fractures filled with calcite.
151.70 - 154.23	2.53	Sandstone, v.f.g. to f.g., with some siltstone interbeds, occasional carbonaceous parting, minor slickensides, minor flow features, calcite veinlets, calcite filled fractures, calcite along slickensided surfaces.
154.23 - 155.75	1.52	Siltstone with some v.f.g. sandstone interbeds, occasional plant fossil.

Interval (metres)	Width (metres)	Description
155.75 - 157.58	1.83	Sandstone, v.f.g., with siltstone interbeds, minute fractures filled with calcite, plant fossils, carbonaceous specks and stringers, flow features. BCA = 78° - 82°.
157.58 - 158.18	0.60	Siltstone, with v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers, flow features, slump features.
158.18 - 159.87	1.69	Sandstone, v.f.g., occasional siltstone band, plant fossils, carbonaceous stringers and partings, minor slickensides, flow features, calcite filled fractures.
159.87 - 162.69	2.82	Sandstone, m.g., medium grey, carbonaceous stringers and partings, coal stringers (2 mm width) rare slickensides, fractured, calcite and pyrite crystals along fractures. BCA 78° - 82°.
162.69 - 163.21	0.52	Siltstone, carbonaceous.
163.21 - 163.94	0.73	COAL, clean, fairly brittle, broken and crushed, recovery 80-85%, 30-40% vitreous coal.
163.94 - 164.09	0.15	Mudstone, carbonaceous.
164.09 - 164.84	0.75	COAL, clean, fairly brittle, solid, 30% vitreous coal bands, 20% dull peaty coal, 50% intermediate lustre.
164.84 - 165.24	0.40	COAL, hard, some dirty coal stringers (1 - 2 mm width) 10-15%, 10% vitreous bands, 60-70% very hard coal, intermediate lustre, steely grey.
165.24 - 166.17	0.93	COAL, fairly clean, fairly soft but solid, 20% vitreous bands, 20% dull, peaty coal.
166.17 - 166.37	0.20	COAL, clean, soft, broken, 10% vitreous. Samples: 0025 : 163.21 - 164.09 0.88 0026 : 164.09 - 164.84 0.75 0027 : 164.84 - 166.37 1.53
166.37 - 168.59	2.22	Siltstone, carbonaceous, plant fossils, coaly stringers and specks, slickensides with white ash, trace pyrite.
168.59 - 169.77	1.18	Siltstone interbedded with v.f.g. sandstone (50%-50%), plant fossils, carbonaceous specks, stringers and partings, calcite filled fractures.

Interval (metres)	Width (metres)	Description
169.77 - 174.58	4.81	Sandstone, v.f.g., light to medium grey, carbonaceous specks and stringers, occasional minute fracture filled with calcite, some plant fossils, minor flow features.
174.58 - 176.48	1.90	Sandstone, m.g. to c.g., light grey, carbonaceous specks, stringers and partings, plant fossils, coal stringers, calcite filled fractures and calcareous cement, pyrite disseminations and blebs.
176.48 - 178.92	2.44	Sandstone, f.g. to m.g., some carbonaceous partings, fractures filled with calcite, well sorted.
178.92 - 182.56	3.64	Sandstone, m.g. to c.g., occasional stringers of coal (3 mm width), calcareous cementing material, well sorted sandstone. BCA = 80°.
182.56 - 182.66	0.10	COAL, clean, fairly solid, vitreous (80%).
182.66 - 182.86	0.20	COAL, fairly solid, 40% vitreous, 20% dull, peaty coal.
182.86 - 183.60	0.74	Mudstone, carbonaceous, with vitreous coal stringers up to 5 mm in width.
183.60 - 183.63	0.03	COAL, vitreous.
183.63 - 183.68	0.05	COAL, clean, 20% vitreous. Recovery ca. 80%.
183.68 - 184.00	0.32	Mudstone, carbonaceous.
184.00 - 184.36	0.36	COAL, clean, fairly soft but solid, intermediate lustre, brittle.
184.36 - 184.77	0.41	COAL, dirty, slickensides, specks of white ash along slickensided surfaces. Sample: 0028 : 184.00 - 184.77 0.77
184.77 - 185.31	0.54	Mudstone, carbonaceous, slickensides. BCA = 78°.
185.31 - 185.77	0.46	Siltstone, dark grey, plant fossils, minor carbonaceous specks, minute fractures, some slickensides. BCA = 78°.
185.77 - 186.13	0.36	Mudstone, coaly, slickensides.
186.13 - 188.07	1.94	Siltstone, carbonaceous, plant fossils, slickensides with white ash, minute fractures filled with calcite.

Interval (metres)	Width (metres)	Description
188.07 - 192.05	3.98	Siltstone, dark grey, occasional plant fossils, some carbonaceous specks and stringers, calcite along fractures and slickensides. BCA = 60°.
192.05 - 193.09	1.04	Sandstone, f.g., with siltstone interbeds, carbonaceous stringers, coal specks, flow features, calcite filled fractures, slickensides. BCA = 41°.
193.09 - 198.95	5.86	Sandstone, f.g. to m.g., coaly specks, stringers and partings, intervals of m.g. sandstone, highly fractured, fractures filled with calcite. BCA = 42°.
198.95 - 199.95	1.00	Sandstone, f.g. to m.g., coaly partings and stringers, fractured. BCA = 45°.
199.95 - 201.47	1.52	Sandstone, f.g. with c.g. bands, highly fractured, coaly specks, stringers and bands, slickensided.
201.47 - 205.13	3.66	Sandstone, f.g. to m.g., some siltstone interbeds, highly fractured, coal specks, stringers, calcite along fractures and slickensided surfaces. BCA = 57°.
205.13 - 206.95	1.82	Sandstone, f.g. to m.g., some siltstone interbeds, coaly blebs, stringers and partings, calcite along fractures and slickensides, highly fractured, highly crushed and broken, some ferruginous staining.
206.95 - 216.32	9.37	Siltstone, dark grey, rare plant fossils, fractures filled with calcite, slickensides. BCA = 23°.
216.32 - 221.59	5.27	Sandstone, v.f.g., medium grey, carbonaceous specks and stringers, some plant fossils; abundant calcite filled fractures and calcareous cement. BCA = 20°.
221.59 - 225.60	4.01	Sandstone, v.f.g., dark grey, well sorted, slightly foliated, rare plant fossils, fairly porous, coarsening downward, calcite filled fractures. BCA = 32°.
225.60 - 226.19	0.59	Sandstone, m.g., light grey, contains numerous coaly fragments and stringers, fractures filled with coaly material.
226.19 - 226.29	0.10	Conglomerate, fine pebble, pebbles appear angular, well cemented.
226.29 - 227.79	1.50	Sandstone, m.g., with occasional siltstone band, calcite filled fractures common, some calcite blebs. BCA = 32°

Interval (metres)	Width (metres)	Description
227.79 - 229.80	2.01	Conglomerate, fine pebbles, with up to 20% sandstone bands, pebbles angular, matrix 30%, well cemented.
229.80 - 235.61	5.81	Sandstone, m.g., highly fractured, fractures filled with calcite and coaly material, minor flow features, last 2 m highly fractured and badly broken. BCA = 25°.
235.61 - 236.00	0.39	Conglomerate, fine pebbles (0.5 cm), conglomerate lies on a mudstone with a thin coal band (10 mm width) separating them - evidence of a low angle plane fault: rocks are crushed and contain numerous slickensides. BCA = 5° - 8°.
236.00 - 237.53	1.53	Mudstone, with coaly mudstone intervals, badly fractured and broken, slickensides common. BCA = 20° - 25°.
237.53 - 258.44	20.91	Mudstone, numerous minute fractures, occasional coal specks and stringers, some brown mud blobs and bands, massive.
258.44 - 261.24	2.80	Mudstone, fractures filled with coal, total coal content 15%. BCA = 20°.
261.24 - 265.05	3.81	Sandstone, v.f.g., grading downwards to a siltstone, rare plant fossils, rare fractures are calcite filled.
265.05 - 300.84	35.79	Siltstone, dark grey, some fractured intervals, with calcite filling, massive. BCA = 5°.

T.D. 300.84

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MUD 77-6

Location:

(a)	Coal Licence:	3198
(b)	N.T.S. :	b-57-J, 93-I-15
(c)	Coal Grid :	
(d)	Mine Grid :	

Azimuth & Inclination: 045°; -70°

Core Size: HQ (63.5 mm)

Date Drilled: September 8 - 14, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Hole was plugged, casing was pulled.

Logged by: A. E. Bienia, L. A. Smith

Formation Tested: Boulder Creek Member

Coal Seams Intersected: None

Total Depth: 224.6 m

Geophysical Logs: None run.

Interval (metres)	Width (metres)	Description
0 - 4.57	4.57	Overburden
4.57 - 5.18	0.61	SHAFTESBURY FORMATION Mudstone, mud, broken and ground.
5.18 - 8.23	3.05	Mudstone (fairly broken), dark grey, highly weathered, highly fractured, ferruginous stain along fractures is very common.
8.23 - 15.69	7.46	Siltstone and Mudstone intervals, highly weathered, fairly broken, ferruginous staining common, some flow features. BCA 45°.
15.69 - 22.47	6.78	Siltstone, dark grey, with up to 10% v.f.g. sandstone interbeds, rare carbonaceous specks, some flow features, minute fractures common, ferruginous stain. BCA 44°.
22.47 - 28.04	5.57	Siltstone, dark grey, with approximately 15% v.f.g. sandstone interbeds, uniform, some minute fractures, minor flow features, occasional pyrite bleb.
28.04 - 32.38	4.34	Siltstone, with 15-20% v.f.g. sandstone interbeds, minor flow features, occasional carbonaceous speck, pyrite blebs and stringers (up to 5 mm). 32.21 - 32.31 Mudstone interval, slickensides. BCA 56°.
32.38 - 32.44	0.06	Mudstone, coaly material and mud, highly ground (mush).
32.44 - 33.28	0.84	BOULDER CREEK MEMBER, COMMOTION FORMATION Conglomerate, pebbles, average 5 mm.
33.28 - 36.85	3.57	Sandstone, v.f.g. to f.g., light to medium grey, occasional pyrite bleb, rare plant fossil, clean, well sorted.
36.85 - 38.79	1.94	Sandstone, f.g., light to medium grey, carbonaceous specks and stringers, occasional (rare) coaly band up to 1 cm, minor slickensides, ferruginous stain along fractures, some rip-up clasts. BCA 58°.
38.79 - 40.54	1.75	Sandstone, v.f.g., carbonaceous specks and stringers, coaly specks and stringers, occasional fracture with ferruginous stain.
40.54 - 44.00	3.46	Siltstone, light to medium grey, occasional carbonaceous speck, minute fractures, ferruginous stain.
44.00 - 45.69	1.69	Sandstone, light grey, v.f.g., massive, no obvious bedding; occasional carbonaceous speck, solid but soft.

Interval (metres)	Width (metres)	Description
45.69 - 46.35	0.66	Sandstone, f.g. to m.g., carbonaceous specks and occasional stringer, rare pebble, some slickensides, minor ferruginous staining.
46.35 - 47.75	1.40	Siltstone, interbedded with v.f.g. sandstone, flow features, occasional carbonaceous speck and plant fossil fragment, minute fractures, ferruginous staining.
47.75 - 48.33	0.58	Sandstone, f.g., well sorted (clean), some slickensides with calcite along slickensided surface some rip-up clasts in interval 48.20 - 48.33.
48.33 - 49.37	1.04	Siltstone, dark grey, plant fossils, carbonaceous specks and stringers, vitreous coal stringers and bands up to 3 mm in width, massive.
49.37 - 49.43	0.06	Mudstone, carbonaceous, slickensided, ground.
49.43 - 50.85	1.42	Siltstone with some mudstone intervals, massive, fairly soft, rare slickenside with calcite along slickensided surface.
50.85 - 54.35	3.50	Siltstone/Mudstone, light grey, massive, rare carbonaceous speck, some calcite along fractures.
54.35 - 54.65	0.30	Siltstone, medium grey, massive, uniform.
54.65 - 54.99	0.34	Sandstone, f.g., well sorted.
54.99 - 55.81	0.82	Siltstone, medium to dark grey, massive.
55.81 - 57.00	1.19	Sandstone/Siltstone, v.f.g., light grey, one 10 cm interval with large fractures (3 mm widths) filled with calcite.
57.00 - 57.62	0.62	Siltstone, minor slickensides, massive.
57.62 - 59.05	1.43	Siltstone/Mudstone, light grey, fairly soft, massive, rare carbonaceous speck, calcite-filled fractures.
59.05 - 60.45	1.40	Sandstone, f.g., medium to dark grey, fairly soft, reddish blebs and stringers (see sample MUD 77-6-2).
60.45 - 61.85	1.40	Siltstone, medium grey, minute fractures, occasional carbonaceous speck, rare slickenside.
61.85 - 63.08	1.23	Mudstone, grading into a siltstone near end of interval, fairly soft, consolidated.

Interval (metres)	Width (metres)	Description
63.08 - 63.97	0.89	Siltstone, dark grey, carbonaceous specks, some coaly stringers (1-2 mm), minor slickensides.
63.97 - 64.03	0.06	COAL, intermediate lustre, soft, platy.
64.03 - 64.53	0.50	Siltstone, medium grey, minute fractures, carbonaceous and coaly specks and stringers.
64.53 - 66.14	1.61	Siltstone, light grey, minute fractures, some carbonaceous specks and stringers, massive.
66.14 - 67.07	0.93	Mudstone, fairly soft, abundant slickensides.
67.07 - 69.19	2.12	Siltstone, light to medium grey, blebs and small stringers of carbonaceous material.
69.19 - 70.41	1.22	Sandstone, f.g., occasional siltstone interbed.
70.41 - 74.68	4.27	Sandstone, f.g. to m.g., carbonaceous specks, stringers and partings, well sorted, some minor slickensides in the last 1 m which is also broken. BCA 58°.
74.68 - 75.12	0.44	Sandstone, m.g., with 5-6 cm intervals of coarse grained sandstone, occasional carbonaceous speck, rare calcite-filled fracture, clean.
75.12 - 75.78	0.66	Sandstone, v.f.g. to f.g., medium grey, well sorted.
75.78 - 76.56	0.78	Sandstone, alternating f.g., m.g. and c.g. zones, occasional carbonaceous speck, stringer or parting.
76.56 - 79.08	2.52	Sandstone, c.g. to v.c.g., clean, some carbonaceous specks and stringers. BCA 59° - 61°.
79.08 - 81.26	2.18	Sandstone, m.g. to c.g., with 5-10 cm bands of fine pebble conglomerate.
81.26 - 81.83	0.57	Mudstone
81.83 - 82.91	1.08	Siltstone, medium grey, massive, uniform.
82.91 - 83.51	0.60	Mudstone, slickensides.
83.51 - 86.00	2.49	Siltstone/Mudstone, light grey, massive.
86.00 - 87.17	1.17	Siltstone, medium grey, massive.
87.17 - 87.64	0.47	Sandstone, v.f.g. to f.g., well sorted. BCA 39°.
87.64 - 88.29	0.65	Siltstone with 20% v.f.g. sandstone interbeds, carbonaceous specks and stringers, slickensides.

Interval (metres)	Width (metres)	Description
88.29 - 90.98	2.69	Sandstone, v.f.g., with some siltstone interbeds, flow features, minute fractures filled with calcite.
90.98 - 92.38	1.40	Siltstone, medium grey, plant fossils, carbonaceous specks and stringers, some coaly stringers, pelecypod mould at 92.16.
92.38 - 94.79	2.41	Siltstone, with approximately 20% v.f.g. sandstone interbeds, occasional carbonaceous specks and stringers, plant fossil fragments.
94.79 - 95.40	0.61	Sandstone, v.f.g., with siltstone interbeds, flow features.
95.40 - 96.26	0.86	Mudstone, slickensided.
96.26 - 99.06	2.80	Siltstone, medium to dark grey, occasional v.f.g. sandstone interbeds, carbonaceous specks and stringers, plant fossils, minute fractures filled with calcite.
99.06 - 100.66	1.60	Siltstone/Mudstone, massive, occasional carbonaceous bleb or minute stringer.
100.66 - 102.61	1.95	Sandstone, f.g., rare siltstone band, slickensides, calcite along fractures and slickensided surfaces, occasional carbonaceous speck or stringer.
102.61 - 105.88	3.27	Siltstone, medium grey, minute fractures, occasional carbonaceous specks and stringers, minor slickensides.
105.88 - 106.65	0.77	Sandstone, f.g., light grey, slickensides with calcite along slickensided surfaces.
106.65 - 107.49	0.84	Mudstone, coaly, minor slickensides, broken.
107.49 - 108.20	0.71	Siltstone, slickensides.
108.20 - 109.59	1.39	Siltstone, massive, minute fractures - calcite.
109.59 - 110.39	0.80	Sandstone, f.g., medium grey, clean.
110.39 - 111.56	1.17	Siltstone/Mudstone, light grey, massive.
111.56 - 112.96	1.40	Sandstone, v.f.g., medium grey, some siltstone interbeds, occasional carbonaceous speck.
112.96 - 116.60	3.64	Siltstone, with v.f.g. sandstone interbeds, occasional carbonaceous speck or stringer, occasional slickenside, flow features, minute fractures. BCA 60°.

Interval (metres)	Width (metres)	Description
116.60 - 121.38	4.78	Sandstone, v.f.g., medium grey, rare carbonaceous speck, clean.
121.38 - 124.20	2.82	Sandstone, f.g. to m.g., carbonaceous stringers and partings up to 1 cm widths, minute fractures filled with calcite, rare slickenside.
124.20 - 125.60	1.40	Sandstone, c.g., clean, rare carbonaceous speck. BCA 52°.
125.60 - 128.50	2.90	Sandstone, c.g., grading to a fine pebble conglomerate, slickensides, some calcite along slickensided surfaces.
128.50 - 130.15	1.65	Sandstone, f.g. to m.g., occasional pebble band (5 cm widths), carbonaceous stringers and partings, minute fractures.
130.15 - 130.79	0.64	Sandstone, Siltstone, and carbonaceous mudstone chips, slickensides, highly broken.
130.79 - 131.23	0.44	Siltstone, carbonaceous, plant fossils.
131.23 - 133.60	2.37	Mudstone, coaly stringers, slickensides common.
133.60 - 135.02	1.42	Siltstone, plant fossils, carbonaceous stringers and specks, occasional coaly bands (1-2 mm widths), minute fractures, abundant slickensides.
135.02 - 136.85	1.83	Mudstone, slickensides, crushed and ground, recovery (60%).
136.85 - 141.06	4.21	Siltstone, fractures filled with calcite, rare carbonaceous speck, slickensides, massive.
141.06 - 141.95	0.89	Mudstone, carbonaceous, with some vitreous coal bands, slickensides, broken and crushed.
141.95 - 143.35	1.40	Siltstone/Mudstone, carbonaceous, slickensides, minute fractures.
143.35 - 144.62	1.27	Siltstone, medium grey, slickensides, rare carbonaceous specks, minute fractures filled with calcite.
144.62 - 146.60	1.98	Mudstone, coaly and carbonaceous, with approximately 20% vitreous coal, 10% dirty coal, crushed and ground. Recovery 65%.
146.60 - 148.14	1.54	Mudstone/Siltstone, fairly solid, carbonaceous specks and stringers, minute fractures, minor flow features.

Interval (metres)	Width (metres)	Description
148.14 - 148.44	0.30	Mudstone and coal, crushed and ground.
148.44 - 149.16	0.72	COAL, very soft, intermediate lustre.
149.16 - 153.01	3.85	Sandstone, f.g. to m.g., medium grey, with occasional 5-10 cm band of v.c.g. sandstone, rare carbonaceous stringer. BCA 58° - 60°.
153.01 - 153.57	0.56	Conglomerate, pebble.
153.57 - 153.72	0.15	Sandstone, m.g., well sorted.
153.72 - 154.63	0.91	Conglomerate, fine pebbles, with occasional m.g. sandstone interval, clean.
154.63 - 157.28	2.65	Sandstone, m.g., with occasional pebble band (1-2 cm width).
157.28 - 161.24	3.96	Sandstone, f.g. to m.g., medium grey, occasional v.f. pebble band, rare slickenside.
161.24 - 174.04	12.80	Sandstone, f.g. to m.g., carbonaceous partings and stringers (1 mm widths), some minute fractures, minor slickensides, occasional (rare) pebble or very fine pebble band. BCA 60° - 62°.
174.04 - 177.27	3.23	Sandstone, v.f.g., medium grey, well sorted. BCA 61°.
177.27 - 178.51	1.24	Sandstone, v.f.g., with some siltstone intervals, carbonaceous stringers and partings, minute fractures, slickensides.
178.51 - 183.67	5.16	Sandstone, v.f.g., with 10-15% siltstone intervals (5-10 cm width), carbonaceous stringers and partings, coaly stringers 1-2 mm width, slickensides associated with silt intervals, flow features, pyrite blebs and stringers; mud (grey-brown) blobs.
183.67 - 188.06	4.39	Sandstone, v.f.g., medium grey, with 20-30% siltstone interbeds, occasional coaly parting or stringer, minor slickensides.
188.06 - 199.03	10.97	Sandstone, v.f.g., with siltstone interbeds (50%-50%), minor flow features, carbonaceous specks and stringers, calcite along slickensided surfaces. BCA 62°.
199.03 - 210.92	11.89	HULCROSS MEMBER, COMMOTION FORMATION Siltstone, dark grey, with v.f.g. sandstone interbeds (up to 20-25%), slickensides, some intervals fairly broken, minute fractures filled with calcite, minor flow features, pyrite specks and blebs. BCA at 203.30 62°. BCA at 206.96 42°.

Interval (metres)	Width (metres)	Description
210.92 - 219.46	8.54	Siltstone, with v.f.g. sandstone interbeds (25%), pyrite blebs and stringers common, minute fractures filled with calcite, slickensides, minor flow features, rare carbonaceous speck. BCA at 215.34 58° - 60°. BCA at 219.46 54°.
219.46 - 223.42	3.96	Siltstone, same as above but highly fractured. BCA 28° - 32°.
223.42 - 224.64	1.22	Siltstone with v.f.g. sandstone interbeds (35%), minute fractures filled with calcite, slickensides, rare carbonaceous speck, minor flow features, pyrite blebs and stringers. BCA 28° - 32°.

T.D. 224.64 m

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MDD 77-7

Location:

(a)	Coal Licence	:	3226
(b)	N.T.S.	:	d-40-B, 93-I-15
(c)	Coal Grid	:	
(d)	Mine Grid	:	

Azimuth & Inclination: Vertical

Core Size: HQ (63.5 mm)

Date Drilled: September 15 - 17, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Casing capped and left in hole.
Small water flow outside casing is flowing.

Logged by: A. E. Bienia

Formation Tested: Gates Member

Coal Seams Intersected: B1 to B10

Total Depth: 209.1 m

Geophysical Logs: FBL, GRN, CAL-DENS, DIR.

MDD 77 - 7

Interval (metres)	Width (metres)	Description
0 - 3.66	3.66	Overburden.
3.66 - 6.76	3.10	GATES MEMBER, COMMOTION FORMATION Sandstone, f.g., medium grey, solid, minute fractures, ferruginous stain common, carbonaceous specks and stringers. Worm burrows throughout interval.
6.76 - 8.23	1.47	Sandstone, v.f.g., with some siltstone interbeds, ferruginous stain, carbonaceous specks, stringers and partings, flow features. Dips 15°-17°.
8.23 - 8.65	0.42	Siltstone, solid, ferruginous stain, carbonaceous specks and stringers, plant fossil fragments.
8.65 - 9.17	0.52	COAL, fairly clean, one 2 cm band of dirty coal, solid, 20-30% vitreous.
9.17 - 9.22	0.05	COAL, dirty.
9.22 - 10.27	1.05	Mudstone, carbonaceous, brown mud blobs and bands.
10.27 - 10.57	0.30	COAL, fairly clean, intermediate lustre, steely grey, hard coal with 10-15% vitreous bands.
10.57 - 10.77	0.20	COAL, fairly dirty, solid, 1 cm mudstone parting at 10.61 m. Coal of intermediate lustre with 10% vitreous bands.
10.77 - 10.92	0.15	COAL, solid, hard, intermediate lustre with 10% vitreous bands, some thin (less than 1cm) bands of dirty coal.
10.92 - 11.04	0.12	COAL, clean, solid, 60% vitreous.
11.04 - 11.28	0.24	COAL, dirty, fairly broken. Recovered 0.12 m.
11.28 - 11.62	0.34	COAL, clean, hard, solid, 40-50% vitreous, 25% dull coal, 5-10% dull soft, peaty coal, 45-55% intermediate lustre.
11.62 - 12.03	0.26	COAL broken. 11.77 - 11.87 - Mudstone, carbonaceous. 11.87 - 12.03 - Coal, dirty, broken. Samples: 0029 : 8.65 - 9.22 - 0.57 0030 : 9.22 - 10.27 - 1.05 0051 ; 10.27 - 11.28 - 1.01 0052 : 11.28 - 12.03 - 0.75

Interval (metres)	Width (metres)	Description
12.03 - 14.33	2.30	Siltstone, with v.f.g. ss interbeds, carbonaceous and coaly specks and stringers, minute fractures abundant, flow features, occasional pyrite speck.
14.33 - 14.99	0.66	Siltstone, dark grey, massive, occasional carbonaceous speck.
14.99 - 15.43	0.44	Sandstone, v.f.g. with some siltstone bands, carbonaceous and coaly specks and stringers, calcite filled fractures, pyrite.
15.43 - 15.52	0.09	COAL, solid, intermediate lustre, 40% vitreous bands, pyrite specks.
15.52 - 15.73	0.21	Siltstone, coal bands, up to 3 mm width, carbonaceous specks and stringers, slickensided, specks of white ash.
15.73 - 15.94	0.21	Sandstone, v.f.g., coaly bands, stringers and specks, minute fractures filled with calcite and carbonaceous material, pyrite specks.
15.94 - 16.64	0.70	Siltstone, occasional carbonaceous speck, massive.
16.64 - 17.37	0.73	Siltstone, interbedded with v.f.g. ss, some minute fractures, occasional carbonaceous speck or stringer, plant fossil fragments.
17.37 - 17.97	0.60	Sandstone, v.f.g. with siltstone bands, carbonaceous specks and stringers, minor flow features, some rip-up (mud) clasts.
17.97 - 18.57	0.60	Siltstone, with rare band of v.f.g. ss, plant fossil fragments, occasional carbonaceous speck.
18.57 - 20.32	1.75	Sandstone, f.g., medium grey, carbonaceous specks, stringers and partings, calcite filled fractures. Dip 19°.
20.32 - 21.72	1.40	Siltstone, occasional plant fossil, carbonaceous specks, massive.
21.72 - 23.77	2.05	Siltstone, with 10-15% v.f.g. ss bands, brown mud bands, plant fossil fragments, occasional carbonaceous specks.
23.77 - 28.76	4.99	Siltstone, carbonaceous specks and stringers, plant fossils, coaly specks and stringers common.
28.76 - 29.30	0.54	Sandstone, f.g. with siltstone interbeds, carbonaceous specks and stringers, minute fractures filled with calcite and carbonaceous material, flow features. Dip 18°

MDD 77 - 7 (cont'd)

Interval (metres)	Width (metres)	Description
29.30 - 29.57	0.27	Sandstone, f.g. to m.g., rare carbonaceous speck, some rip-up clasts, clean.
29.57 - 30.32	0.75	Siltstone interbedded with v.f.g. ss (40%).
30.32 - 30.92	0.60	Siltstone, rare carbonaceous speck, massive.
30.92 - 31.10	0.18	COAL, clean, solid; 70% vitreous.
31.10 - 31.25	0.15	COAL, fairly clean, well consolidated, 40% vitreous coal.
31.25 - 31.34	0.09	Mudstone, carbonaceous.
31.34 - 31.61	0.27	COAL, fairly dirty, very hard, intermediate lustre, steel grey, 15% vitreous bands.
31.61 - 31.74	0.13	COAL, clean, fairly hard, solid; 70% vitreous.
31.74 - 31.86	0.12	COAL, fairly clean, hard, solid; 20% vitreous bands, 60% dull coal.
31.86 - 31.94	0.08	COAL, clean, brittle, broken and crushed; recovery 95%.
31.94 - 32.10	0.16	COAL, fairly clean, hard, solid; 40% vitreous, 60% intermediate lustre, steely grey.
32.10 - 32.61	0.51	COAL, fairly clean, hard, solid; 80% intermediate lustre, steely grey, with 20% vitreous bands. Last 16 cm more brittle, broken; recovery 80%.
32.61 - 32.67	0.06	Siltstone.
32.67 - 32.74	0.07	COAL, very dirty - to a coaly mudstone.
32.74 - 32.97	0.23	COAL, clean, solid; 60% vitreous, 10% soft dull, peaty coal.
32.97 - 33.19	0.22	COAL, clean, brittle, solid; 40% vitreous, 40% dull.
33.19 - 33.22	0.03	Mudstone, carbonaceous.
33.22 - 33.60	0.38	COAL, clean, fairly brittle, slightly broken, 60% vitreou slickensides, traces of pyrite.
33.60 - 33.64	0.04	COAL, dirty.
33.64 - 33.76	0.12	COAL, dirty, and coaly mudstone, solid; traces of pyrite. Samples: 0053 : 30.92 - 31.61 - 0.69 0054 : 31.61 - 32.61 - 1.00 0055 : 32.61 - 33.76 - 1.15

Interval (metres)	Width (metres)	Description
33.76 - 34.75	0.99	Siltstone, carbonaceous, solid.
34.75 - 35.05	0.30	Siltstone, carbonaceous specks, plant fossil fragments.
35.05 - 35.66	0.61	Sandstone, f.g., carbonaceous specks, stringers and partings, minute fractures filled with calcite, some slickensides. Dip 18°.
35.66 - 37.69	2.03	Siltstone, carbonaceous, plant fossils, carbonaceous specks and stringers, coal stringers (2 mm in width).
37.69 - 37.85	0.16	Mudstone, carbonaceous, coaly.
37.85 - 41.50	3.65	Siltstone, minute fractures, some carbonaceous specks and stringers; last 1.4 m interbedded with v.f.g. ss (20-30%), pyrite disseminations.
41.50 - 47.55	6.05	Sandstone, v.f.g. to f.g., medium grey, some siltstone interbeds, carbonaceous specks, stringers and partings, minute calcite filled fractures, minor flow features, occasional worm burrow. Dip 19°.
47.55 - 47.93	0.38	Siltstone, carbonaceous, plant fossils.
47.93 - 48.00	0.07	COAL, dirty.
48.00 - 48.15	0.15	COAL, clean, broken and crushed, 20% vitreous.
48.15 - 48.32	0.17	COAL, clean, solid, 40% vitreous.
48.32 - 51.20	2.88	Siltstone, carbonaceous, plant fossils, coal stringers 1-2 mm width, brown mud bands.
51.20 - 52.13	0.93	Mudstone, coaly, plant fossils.
52.13 - 53.95	1.82	Siltstone, carbonaceous, plant fossils, minute fractures occasional coal band up to 5 mm in width. Dip 20°.
53.95 - 55.17	1.22	Mudstone, very carbonaceous, numerous vitreous coal stringers and bands (5 mm), minute fractures filled with calcite, some slickensides.
55.17 - 55.25	0.08	COAL, dirty, fairly broken.
55.25 - 55.37	0.12	Mudstone coaly.
55.37 - 55.43	0.06	COAL, dirty.
55.43 - 55.52	0.09	Mudstone, carbonaceous.
55.52 - 55.57	0.05	COAL, vitreous.

MDD 77 - 7 (cont'd)

Interval (metres)	Width (metres)		Description
55.57 - 55.62	0.05		Siltstone.
55.62 - 55.72	0.10		COAL, fairly clean, solid, 20% minute vitreous bands.
55.72 - 56.75	1.03		Mudstone, carbonaceous, occasional 1 cm vitreous coal band, minor slickensides.
56.75 - 57.00	0.25		COAL, fairly clean, hard, broken; 20-30% vitreous, 50% dull coal.
57.00 - 57.30	0.30		Mudstone, coaly with up to 1 cm wide vitreous coal bands.
57.30 - 57.46	0.16		Mudstone, carbonaceous, rare coal stringer.
57.46 - 57.52	0.06		COAL, dirty, broken.
57.52 - 57.61	0.09		COAL, clean, solid; 30-40% vitreous, 20% dull.
57.61 - 57.70	0.09		COAL, hard, intermediate lustre, steely grey.
57.70 - 57.87	0.17		COAL, fairly clean, broken, 20% vitreous bands.
57.87 - 57.99	0.12	✓	COAL, fairly clean, brittle but core solid, 70% vitreous.
57.99 - 58.11	0.12	✓	COAL, fairly clean, brittle, solid, 70% vitreous.
58.11 - 58.67	0.56		COAL 30%, broken and crushed dirty coal 40%, carbonaceous and coaly mudstone 30%. Samples: 0056 : 55.17 - 55.72 - 0.55 0057 : 55.72 - 56.75 - 1.03 0058 : 56.75 - 57.46 - 0.71 0059 : 57.46 - 58.67 - 1.21
58.67 - 59.13	0.46		Mudstone, very carbonaceous, abundant vitreous coal bands and stringers, minute fractures filled with calcite, some slickensides.
59.13 - 60.35	1.22		Siltstone, dark grey, plant fossils, carbonaceous specks, massive.
60.35 - 61.75	1.40		Siltstone, interbedded with f.g. ss (35%), minor flow features, some cross-beds, occasional carbonaceous stringer, some brown mud bands. Dip 18°.
61.75 - 63.40	1.65		Siltstone, occasional interbed of v.f.g. ss, carbonaceous specks and stringers, plant fossils, coaly specks.

MDD 77 - 7 (cont'd)

Interval (metres)	Width (metres)	Description
63.40 - 69.49	6.09	Siltstone, occasional v.f.g. ss band, rare brown mud band, plant fossils, carbonaceous and coaly specks and stringers, minute fractures filled with calcite. Dip 18°.
69.49 - 69.57	0.08	COAL, dirty.
69.57 - 69.67	0.10	Mudstone, carbonaceous.
69.67 - 69.71	0.04	COAL, hard, solid, steely grey.
69.71 - 69.83	0.12	COAL, clean, solid, 80% vitreous.
69.83 - 70.14	0.31	COAL, fairly clean, brittle; 30% vitreous, 50% dull, peaty coal, last 10 cm ground and crushed. Recovered 25 cm. Sample: 0060 : 69.49 - 70.14 - 0.65
70.14 - 70.34	0.20	Mudstone, carbonaceous, solid, minor slickensides.
70.34 - 72.17	1.83	Siltstone, carbonaceous, abundant plant fossils, minute fractures filled with coal, brown mud bands, minor slickensides, trace pyrite.
72.17 - 72.21	0.04	COAL, vitreous.
72.21 - 72.55	0.34	Mudstone, carbonaceous, plant fossils, minor slickenside.
72.55 - 72.90	0.35	COAL, dirty, broken.
72.90 - 75.29	2.39	Siltstone interbedded with v.f.g. ss (40%), abundant plant fossils, carbonaceous specks and stringers, coal bands up to 5 mm in width, fractures filled with coal, flow features.
75.29 - 75.81	0.52	Sandstone, v.f.g. with siltstone interbeds (30%), some carbonaceous specks and stringers.
75.81 - 76.08	0.27	COAL, fairly clean, broken and crushed; recovered 15 cm.
76.08 - 76.13	0.05	Mudstone, coaly.
76.13 - 76.46	0.33	COAL, dirty, broken. Recovered 25 cm.
76.46 - 76.81	0.35	Mudstone, carbonaceous, plant fossils, coaly specks and stringers; recovered 31 cm.
76.81 - 81.23	4.42	Siltstone, plant fossil fragments, carbonaceous specks and stringers, rare coal band (5 mm wide), calcite and coal filled minute fractures, occasional brown mud band, massive. Dip 19°.

Interval (metres)	Width (metres)	Description
81.23 - 85.34	4.11	Siltstone, with 40% v.f.g. ss interbeds, occasional plant fossil and carbonaceous stringer, some brown mud bands, fractures filled with calcite, massive.
85.34 - 87.48	2.14	Siltstone, carbonaceous, plant fossils, coaly stringers, brown mud bands, calcite and coal filled fractures. Dips 18°-19°.
87.48 - 87.78	0.30	Mudstone, carbonaceous.
87.78 - 87.87	0.09	COAL, clean, fairly soft, broken; 40% dull coal, 60% intermediate lustre.
87.87 - 89.53	1.66	COAL, broken, crushed and ground (mush), poor recovery (40%), Recovered 30 cm. Sample: 0061 : 87.78 - 89.53 - 1.75
89.53 - 95.10	5.57	Sandstone, v.f.g., light grey, carbonaceous specks and stringers, rare plant fossil, rare minute fracture fille with calcite.
95.10 - 99.36	4.26	Sandstone, v.f.g., medium grey, occasional carbonaceous specks or stringer, traces of pyrite. Dip 20°.
99.36 - 100.00	0.64	Sandstone, f.g., carbonaceous specks, stringers and partings.
100.00 - 103.90	3.90	Sandstone, f.g. to m.g., coarsens downwards, occasional siltstone interbed, highly fractured, fractures filled with coal, stringers, and bands of coal up to 1 cm wide, more coaly downwards, flow features. Dip 27°.
103.90 - 107.90	4.00	Siltstone, with brown mud blobs and bands, abundant plant fossils, carbonaceous specks and stringers, coal stringers and bands (2-3 mm), minute fractures filled with coal and calcite.
107.90 - 112.17	4.27	Siltstone, dark grey, some brown mud bands, occasional carbonaceous stringer, occasional fracture. Dip 18°.
112.17 - 120.70	8.53	Siltstone, dark grey, occasional brown mud band, plant fossils, carbonaceous and coaly specks and stringers, rare coal band up to 1 cm in width, fractures filled with coal.
120.70 - 122.20	1.50	Siltstone, with v.f.g. ss interbeds (30%), carbonaceous and coaly specks and stringers, flow features. Dips 18°-24°.
122.20 - 128.53	6.33	Siltstone with v.f.g ss interbeds (40%), carbonaceous and coaly specks and stringers, minute fractures (common) filled with coal, flow features, minor slickensides.

MDD 77 - 7 (cont'd)

Interval (metres)	Width (metres)	Description
128.53 - 129.33	0.80	Mudstone, carbonaceous.
129.33 - 131.64	2.31	Mudstone, carbonaceous, coal bands abundant.
131.64 - 132.00	0.36	Mudstone carbonaceous, with abundant coal stringers, grading to a dirty coal.
132.00 - 132.15	0.15	COAL, dirty.
132.15 - 132.21	0.06	COAL, dirty, broken.
132.21 - 132.30	0.09	COAL, clean, solid; 20% vitreous bands, 10% dull, soft peaty coal.
132.30 - 132.42	0.12	COAL, clean, brittle, broken, 50% vitreous.
132.42 - 132.47	0.05	COAL, clean, hard, solid; 15% vitreous bands, 20% dull coal.
132.47 - 132.52	0.05	COAL, dirty, minor slickensides.
132.52 - 132.57	0.05	COAL, fairly clean, broken.
132.57 - 132.61	0.04	COAL, fairly clean, 10% vitreous, 60% dull; minor slickensides, trace white ash.
132.61 - 132.66	0.05	Mudstone, carbonaceous.
132.66 - 132.74	0.08	COAL, fairly clean, fairly hard, intermediate lustre, 40% vitreous bands, 40% dull; minor slickensides, trace of white ash.
132.74 - 132.95	0.21	COAL, clean, solid; 30% vitreous, 40% dull, peaty coal.
132.95 - 133.20	0.25	COAL, fairly clean, fairly hard, broken, 20% vitreous, 60% intermediate lustre, steel grey; recovered 19 cm.
133.20 - 133.65	0.45	Mudstone, solid, carbonaceous, some coaly bands, and stringers, minor slickensides.
133.65 - 133.69	0.04	Mudstone, coaly.
133.69 - 133.77	0.08	COAL, dirty, broken and crushed; 70% recovery.
133.77 - 133.93	0.16	COAL, fairly clean, broken, 10% vitreous bands, 90% intermediate lustre, steely grey, hard; minor slickensides.
133.93 - 134.38	0.45	COAL, very hard, solid; intermediate lustre with 10% vitreous bands (10 cm). 134.03 - 134.38 - Coal very clean, brittle, solid; 60% vitreous, 10% dull, peaty coal.

MDD 77 - 7 (cont'd)

Interval (metres)	Width (metres)	Description
134.38 - 134.56	0.18	Mudstone, carbonaceous.
134.56 - 134.60	0.04	COAL, dirty, minor slickensides.
134.60 - 134.82	0.22	COAL, clean, core solid; vitreous 40%.
134.82 - 135.12	0.30	COAL, fairly clean, fairly broken, vitreous coal 60%.
135.12 - 135.92	0.80	COAL, appears clean, ground and crushed (mush), recovery 65%; recovered 65 cm.
135.92 - 136.25	0.33	COAL, clean, broken, 30% vitreous.
136.25 - 136.37	0.12	COAL, fairly clean, broken, 60% recovery.
136.37 - 136.57	0.20	Clean, fairly brittle, solid; 30% vitreous bands, 70% intermediate lustre.
136.57 - 136.69	0.12	COAL, dirty.
136.69 - 137.17	0.48	COAL, clean, brittle, fairly broken, 40-50% vitreous, 10 dull.
137.17 - 137.50	0.33	COAL, appears fairly clean, crushed and ground (mush). Recovered 30 cm.
137.50 - 137.77	0.27	COAL, fairly clean, solid; intermediate lustre, steely grey, with 15% vitreous bands.
137.77 - 137.92	0.15	COAL, dirty, core solid.
137.92 - 138.12	0.20	COAL, clean, brittle, solid, 60% vitreous.
138.12 - 138.72	0.60	COAL, clean, hard, solid; intermediate lustre, steely grey with 15% vitreous bands.
138.72 - 138.97	0.25	COAL, clean, brittle, broken, 40% vitreous bands.
138.97 - 139.11	0.14	COAL, clean, broken, 15% vitreous bands.
139.11 - 139.29	0.18	COAL, clean, broken, 20% vitreous bands; recovery 70%.
139.29 - 139.45	0.16	COAL, clean, brittle, solid, 30% vitreous.
139.45 - 139.47	0.02	COAL, very dirty.
139.47 - 140.47	1.00	COAL, very clean, brittle but very solid; intermediate lustre 25%, less than 5% dull coal, 70% vitreous.
140.47 - 140.82	0.35	COAL, very clean, brittle, 70% vitreous, less than 5% dull coal.

MDD 77 - 7 (cont'd)

Interval (metres)	Width (metres)	Description
140.82 - 140.96	0.14	COAL, very clean, solid; vitreous coal (greater than 90%). Samples: 0065 : 131.64 - 132.15 - 0.51 0062 : 132.15 - 133.20 - 1.05 0063 : 133.20 - 133.69 - 0.49 0064 : 133.69 - 134.38 - 0.69 0066 : 134.38 - 135.12 - 0.74 0067 : 135.12 - 136.37 - 1.25 0068 : 136.37 - 137.77 - 1.40 0069 : 137.77 - 138.72 - 0.95 0070 : 138.72 - 139.29 - 0.57 0071 : 139.29 - 140.47 - 1.18 0072 : 140.47 - 140.96 - 0.49
140.96 - 141.88	0.92	Siltstone, dark grey, occasional carbonaceous speck, - forms abrupt contact with coal interval, core solid.
141.88 - 148.44	6.56	Sandstone, v.f.g., carbonaceous specks, stringers and partings, minute fractures filled with coal. Dips 21°-23
148.44 - 150.72	2.28	Siltstone, plant fossils abundant, carbonaceous specks an stringers, minute fractures filled with coaly material, some brown mud bands. Dip 21°.
150.72 - 150.81	0.09	Mudstone coaly.
150.81 - 152.61	1.80	Siltstone, carbonaceous, plant fossils, fractures filled with vitreous coal. Dip 20°.
152.61 - 152.71	0.10	Mudstone, carbonaceous, slickensided.
152.71 - 152.83	0.12	COAL, clean, core solid; 40% dull, peaty coal, 10% vitreous bands.
152.83 - 152.91	0.08	COAL, clean, solid; 20% dull peaty coal, 20% vitreous bands, 60% intermediate lustre.
152.91 - 153.02	0.11	COAL, dirty, hard.
153.02 - 153.40	0.38	COAL, clean, 65% intermediate lustre, 30% vitreous, 5% soft dull, peaty coal; broken, brittle.
153.40 - 153.72	0.32	COAL, very clean, core solid, fairly brittle; 60% vitreous, less than 5% soft dull peaty coal (specks).
153.72 - 154.32	0.60	COAL, very clean, core solid, fairly brittle; 60% vitreous, less than 5% soft dull peaty coal (specks).
154.32 - 154.52	0.20	Mudstone, carbonaceous.

MDD 77 - 7 (cont'd)

Interval (metres)	Width (metres)	Description
154.52 - 155.72	1.20	COAL, clean, hard, solid; 20% dull peaty coal, 20% vitreous bands (1-2 cm wide), 60% intermediate lustre; steely grey.
155.72 - 155.79	0.07	COAL, clean, hard, 10% vitreous, 80-90% intermediate lustre; steely grey.
155.79 - 156.01	0.22	Mudstone, carbonaceous, coal stringers.
156.01 - 156.83	0.82	COAL, very clean, brittle, solid; 40% vitreous bands, 60% soft dull, peaty coal.
156.83 - 156.93	0.10	COAL, dirty.
156.93 - 157.15	0.22	Mudstone, carbonaceous.
157.15 - 157.37	0.22	COAL, fairly clean, broken, 20% vitreous bands, 80% intermediate lustre.
157.37 - 157.58	0.21	COAL, fairly clean, solid; 20% vitreous bands, 20% dull coal.
157.58 - 157.61	0.03	COAL, dirty.
157.61 - 157.68	0.07	COAL, clean, vitreous.
157.68 - 157.70	0.02	Mudstone, carbonaceous.
157.70 - 157.81	0.11	COAL, clean, brittle, core solid, vitreous (greater than 80%).
157.81 - 158.37	0.56	Mudstone, carbonaceous.
158.37 - 158.80	0.43	COAL, appears fairly clean, vitreous, ground and crushed. Recovered 32 cm. Samples: 0073 : 152.71 - 153.72 - 1.01 0074 : 153.72 - 154.32 - 0.60 0081 : 154.32 - 154.52 - 0.20 0075 : 154.52 - 155.72 - 1.20 0076 : 155.72 - 156.01 - 0.29 0077 : 156.01 - 156.83 - 0.82 0078 : 156.83 - 157.81 - 0.98 0079 : 157.81 - 158.37 - 0.56 0080 : 158.37 - 158.80 - 0.43
158.80 - 160.73	1.93	Siltstone, carbonaceous.
160.73 - 163.37	2.64	Sandstone, f.g. to m.g., occasional carbonaceous specks and stringer, rare pebbles (2 mm). Well sorted. Dip 20°
163.37 - 165.41	2.04	Sandstone, m.g., occasional carbonaceous specks, minute fractures filled with calcite, occasional pebble (5 mm) and rip- up clasts. Dip 16°.

Interval (metres)	Width (metres)	Description
165.41 - 167.33	1.92	Sandstone, m.g., light grey, well sorted, rare pebble, worm burrowed intervals at 167.00 m and 165.76 m. Dip 16°.
167.33 - 171.60	4.27	Sandstone, f.g. to m.g., rare carbonaceous specks, occasional pebble band 1-2 cm wide.
171.60 - 173.88	2.28	Sandstone, f.g., medium grey, well sorted. Dip 16°.
173.88 - 173.97	0.09	Siltstone, carbonaceous specks and stringers.
173.97 - 174.08	0.11	COAL, broken.
174.08 - 174.14	0.06	Mudstone, coaly.
174.14 - 174.66	0.52	Mudstone, very carbonaceous, plant fossils, core solid. Dip 16°.
174.66 - 174.68	0.02	COAL, dirty. Sample: 0082 : 174.66 - 175.33 - 0.67
174.68 - 175.29	0.61	COAL, very clean, fairly hard, solid; intermediate lustre with 40% vitreous bands.
175.29 - 175.33	0.04	Mudstone, coaly.
175.33 - 175.80	0.47	Siltstone, dark grey, occasional carbonaceous specks, massive.
175.80 - 175.87	0.07	Sandstone, f.g., well sorted.
175.87 - 179.56	3.69	Sandstone, m.g. to c.g., some carbonaceous and coaly specks and stringers, well sorted, clean.
179.56 - 180.44	0.88	Sandstone, v.f.g., carbonaceous specks, stringers and partings. Dips 15°-21°.
180.44 - 180.50	0.06	COAL.
180.50 - 180.58	0.08	Mudstone, carbonaceous.
180.58 - 180.63	0.05	COAL, vitreous.
180.63 - 180.70	0.07	Mudstone, carbonaceous.
180.70 - 181.34	0.64	Siltstone, plant fossils, carbonaceous and coaly specks and stringers, minute calcite filled fractures.
181.34 - 182.97	1.63	Sandstone, v.f.g., minor siltstone bands (40%), plant fossils, carbonaceous specks and stringers, fractures filled with carbonaceous material.

MDD 77 - 7 (cont'd)

Interval (metres)	Width (metres)	Description
182.97 - 183.13	0.16	COAL, solid, vitreous.
183.13 - 183.73	0.60	Mudstone, carbonaceous, with vitreous coal bands up to 1 cm in width.
183.73 - 183.91	0.18	Mudstone, carbonaceous.
183.91 - 184.01	0.10	COAL, crushed and ground.
184.01 - 184.71	0.70	Siltstone, carbonaceous, minute fractures filled with calcite and coal.
184.71 - 187.61	2.90	Mudstone, carbonaceous, coal bands up to 1 cm in width, minute fractures filled with calcite and coal, minor slickensides. Dips 14°-16°.
187.61 - 187.93	0.32	Mudstone, carbonaceous, coal stringers.
187.93 - 188.06	0.13	COAL, fairly clean, hard, solid; intermediate lustre, steely grey, with 10-20% vitreous bands.
188.06 - 188.11	0.05	Mudstone, carbonaceous.
188.11 - 188.57	0.46	COAL, fairly clean, hard, solid; intermediate lustre, steely grey, 20% vitreous bands.
188.57 - 188.67	0.10	Siltstone, carbonaceous.
188.67 - 188.77	0.10	COAL, dirty.
188.77 - 188.81	0.04	Siltstone, carbonaceous.
188.81 - 189.63	0.82	COAL, clean, hard, slightly broken; 20% dull, peaty coal, 20% vitreous bands.
189.63 - 189.93	0.30	COAL and mudstone chips, highly crushed and ground (mush) recovery 80%.
189.93 - 189.96	0.03	Mudstone, carbonaceous.
189.96 - 190.77	0.81	COAL, appears clean, fairly broken, 20% vitreous; Recovery 75%.
190.77 - 191.03	0.26	Mudstone, carbonaceous.
191.03 - 191.11	0.08	COAL, fairly clean, crushed and ground; recovery 40%. Samples: 0083 : 187.93 - 188.81 - 0.88 0084 : 188.81 - 189.63 - 0.82 0085 : 189.63 - 190.77 - 1.14 0086 : 190.77 - 191.03 - 0.26 0087 : 191.03 - 191.11 - 0.08

Interval (metres)	Width (metres)	Description
191.11 - 191.34	0.23	Mudstone, carbonaceous, coal stringers.
191.34 - 194.86	3.52	Siltstone, carbonaceous, abundant plant fossils, v.f.g. ss interbeds (40%), coal specks and stringers.
194.86 - 196.90	2.04	Sandstone, m.g., occasional carbonaceous speck or stringer, minor cross bedding, well sorted. Dip 12°.
196.90 - 201.17	4.27	Sandstone, m.g., medium grey, occasional f.g. ss band, carbonaceous specks, stringers and partings, one pebble band 3 cm in width (at 199 mm). Dip 17°.
201.17 - 205.85	4.68	Sandstone, m.g., light grey, occasional carbonaceous speck, fractures filled with calcite and carbonaceous material, worm burrowed intervals common. Dip 18°.
205.85 - 209.10	3.25	Sandstone, f.g., medium grey, carbonaceous specks and stringers, slickensides, abundant fractures filled with calcite (2-4 mm in width), calcite along slickensided surfaces. Dip 16°.

T.D. 209.10 m

PACIFIC PETROLEUMS LTD.

MONKMAN COAL PROJECT

DIAMOND DRILL HOLE NO: MDD 77-8

Location:

(a)	Coal Licence:	3226
(b)	N.T.S. :	c-40-B, 93-I-15
(c)	Coal Grid :	
(d)	Mine Grid :	

Azimuth & Inclination: Vertical

Core Size: HQ (63.5 mm)

Date Drilled: September 18 - 20, 1977

Drilled by: D. W. Coates Enterprises

Abandonment Procedure: Casing capped and left in hole

Logged by: A. E. Bienia

Formation Tested: Lower Gates Member

Coal Seams Intersected: B3, B4, B5

Total Depth: 99.7 m

Geophysical Logs: FBL, GRN, CAL-DENS

Interval (metres)	Width (metres)	Description
0 - 3.66	3.66	Overburden
3.66 - 3.86	0.20	GATES MEMBER, COMMOTION FORMATION Pebbles, rounded, quartz, sandstone, (overburden).
3.86 - 4.11	0.25	Mudstone, carbonaceous, abundant plant fossils.
4.11 - 4.98	0.87	Mudstone, siltstone chips, ground and crushed. Recovered 56 cm.
4.98 - 5.81	0.83	Sandstone, v.f.g. with siltstone interbeds, flow features, plant fossils, carbonaceous and coaly specks and stringers, minute fractures filled with coal and calcite.
5.81 - 8.23	2.42	Siltstone (fairly broken), carbonaceous specks and stringers, plant fossils, minute fractures filled with carbonaceous material, occasional brown mud band, some ferruginous staining.
8.23 - 8.53	0.30	Siltstone, carbonaceous specks and stringers, some plant fossils, last 10 cm highly fractured, fractures filled with calcite and quartz crystals (3 - 4 mm) Dip 28°.
8.53 - 10.24	1.71	Siltstone, carbonaceous specks and stringers, occasional plant fossil, minute fractures filled with calcite and carbonaceous material, occasional brown mud blobs.
10.24 - 11.28	1.04	Siltstone/Mudstone, carbonaceous, plant fossils.
11.28 - 12.80	1.52	Siltstone, medium grey, carbonaceous and coaly specks and stringers, some plant fossils, minute fractures filled with coaly material and calcite, occasional brown mud blobs.
12.80 - 14.33	1.53	Siltstone, with 10% v.f.g. sandstone interbeds, some carbonaceous and coaly specks and stringers, minute fractures filled with calcite and coal, traces of pyrite. Dip 28°.
14.33 - 15.63	1.30	Sandstone, v.f.g. to f.g., minor flow features and small scale cross-bedding, abundant plant fossils, carbonaceous and coaly specks, stringers and partings (less than 1 mm widths), highly fractured, fractures filled with calcite and coaly material.
15.63 - 20.88	5.25	Siltstone, medium to dark grey, with up to 15% v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers, minute fractures (1 mm)

Interval (metres)	Width (metres)	Description
20.88 - 21.03	0.15	Mudstone, very carbonaceous, slickensided.
21.03 - 23.41	2.38	COAL, appears fairly clean with 1 band (4 cm width) of coaly mudstone, very crushed and ground. Recovered 32 cm.
23.41 - 27.13	3.72	Siltstone, medium grey, massive, some plant fossils, some coaly and carbonaceous specks and stringers. Dip = 28°.
27.13 - 32.31	5.18	Siltstone, medium grey, some plant fossils, carbonaceous specks and occasional stringer, minute fractures filled with calcite and coaly material, massive. Dip = 29°.
32.31 - 36.27	3.96	Siltstone with approx. 30% v.f.g. sandstone interbeds, plant fossils, carbonaceous specks and stringers, minute fractures filled with calcite and coaly material.
36.27 - 38.41	2.14	Sandstone, f.g., coaly specks and stringers, fractures common - filled with carbonaceous material and calcite, pyrite specks and blebs.
38.41 - 42.06	3.65	Siltstone, dark grey, coaly and carbonaceous specks and stringers, occasional plant fossil, minute fractures filled with carbonaceous material, massive, some brown mud bands. Dips 22° - 28°.
42.06 - 46.33	4.27	Siltstone with 10% v.f.g. sandstone interbeds, carbonaceous specks and stringers, some plant fossils, minor flow features, brown mud blobs and bands common. Dip = 28°.
46.33 - 50.60	4.27	Siltstone, medium grey, carbonaceous specks and stringers, plant fossils, occasional minute fracture filled with calcite, massive. Dip = 30°.
50.60 - 54.86	4.26	Siltstone/Mudstone, carbonaceous, coaly specks and stringers common, plant fossils, minute fractures common. 53.00 - 54.86 - coal bands up to 1 cm widths, fractures filled with calcite. Dip = 34°.
54.86 - 56.96	2.10	Mudstone, carbonaceous, minute fractures common, fractures filled with calcite and coal, plant fossils, coaly bands and stringers up to 0.5 cm width. Dips = 22° - 28°.
56.96 - 57.52	0.56	Mudstone, coaly, broken, vitreous bands 1 cm in width.

Interval (metres)	Width (metres)	Description
57.52 - 57.76	0.24	COAL, dirty, broken and crushed, trace pyrite.
57.76 - 58.83	1.07	Mudstone, carbonaceous, minute fractures filled with calcite and coal, plant fossils, coal stringers and bands up to 0.5 cm in width, minor slickensides.
58.83 - 59.63	0.80	Mudstone, coaly.
59.63 - 60.05	0.42	COAL, 59.63 - 59.72 - dirty coal 59.72 - 59.87 - coal, fairly clean, broken and ground, recovery 50%. 59.87 - 60.05 - coal, dirty, fairly hard, broken.
60.05 - 60.11	0.06	COAL, clean, fairly soft but core solid, 40% vitreous.
60.11 - 60.15	0.04	COAL, dirty.
60.15 - 60.41	0.26	Mudstone, carbonaceous, slickensides.
60.41 - 60.89	0.48	COAL, very hard, well consolidated, 20% dull coal, 5% dull, soft, peaty coal, 10% vitreous bands, 65% hard coal, intermediate lustre, silvery grey, (appears fairly clean but is slightly heavy).
60.89 - 61.19	0.30	Mudstone, carbonaceous, slickensides.
61.19 - 61.63	0.44	COAL, crushed and ground coal with mudstone chips - recovery 70%
61.63 - 62.02	0.39	Mudstone, carbonaceous, slickensides.
62.02 - 63.09	1.07	COAL, dirty coal and coaly mudstone, broken, crushed, ground. Recovered 84 cm. Recovery ca. 60%.
63.09 - 63.20	0.11	COAL, dirty
63.20 - 63.36	0.16	COAL, fairly dirty, hard, broken, intermediate lustre, less than 10% vitreous bands.
63.36 - 63.66	0.30	COAL, clean, fairly soft, core solid, 20% vitreous, less than 5% dull coal.
63.66 - 63.81	0.15	COAL, clean, fairly soft but core solid, 20 - 25% vitreous bands.
63.81 - 64.50	0.69	COAL, fairly clean, broken, crushed and ground. Recovered 20 cm - with 75% recovery.
64.50 - 64.84	0.34	Mudstone, carbonaceous, coaly bands, broken, recovery 40%.
64.84 - 64.92	0.08	COAL, dirty, ground and crushed.

Interval (metres)	Width (metres)	Description
64.92 - 65.02	0.10	Mudstone, coaly
65.02 - 65.13	0.11	COAL, fairly dirty, crushed, and ground coal with some mudstone chips, recovery 60%.
65.13 - 65.28	0.15	COAL, dirty, hard, core solid.
65.28 - 65.36	0.08	COAL, clean, core solid, less than 10% vitreous bands, 90% intermediate lustre, silvery grey.
65.36 - 65.48	0.12	COAL, fairly clean, hard, intermediate lustre, broken; recovered 10 cm.
65.48 - 65.58	0.10	COAL, fairly soft, core solid, fairly clean, 60% intermediate lustre, 40% dull coal.
65.58 - 65.96	0.38	COAL, fairly clean, broken and crushed; recovered 18 cm.
65.96 - 66.14	0.18	COAL, fairly clean, hard, core solid, less than 10% vitreous bands, 50% dull coal, 40% intermediate lustre.
66.14 - 66.49	0.35	COAL, clean, hard, core solid, intermediate lustre, silvery grey, with less than 10% vitreous bands.
66.49 - 66.85	0.36	COAL, clean, fairly hard, core solid, 20% vitreous, 20% dull, trace pyrite.
66.85 - 66.87	0.02	Mudstone, carbonaceous.
66.87 - 66.92	0.05	COAL, dirty.
66.92 - 67.67	0.75	COAL, clean, fairly soft, brittle, core solid, 30% vitreous, 20% dull coal.
67.67 - 68.27	0.60	COAL, clean, core solid, 10 - 15% vitreous bands, 5 - 10% dull.
68.27 - 68.91	0.64	COAL, clean, core solid, 20 - 30% dull coal with 10% dull, soft, peaty coal, 40% vitreous.
68.91 - 69.03	0.12	COAL, very crushed and ground. Samples: 0088 : 56.96 - 57.76 0.80 0089 : 58.83 - 59.63 0.80 0090 : 59.63 - 60.05 0.42 0091 : 60.05 - 60.41 0.36 0092 : 60.41 - 60.89 0.48 0093 : 60.89 - 61.19 0.30 0094 : 61.19 - 61.63 0.44 0095 : 61.63 - 62.02 0.39

Interval (metres)	Width (metres)	Description
		0096 : 62.02 - 63.09 1.07 0097 : 63.09 - 63.36 0.27 0098 : 63.36 - 64.50 1.14 0099 : 64.50 - 65.28 0.78 0100 : 65.28 - 66.14 0.86 0101 : 66.14 - 66.92 0.78 0102 : 66.92 - 67.67 0.75 0103 : 67.67 - 69.03 1.36
69.03 - 69.19	0.16	Mudstone, carbonaceous.
69.19 - 71.93	2.74	Siltstone with 30 - 50% v.f.g. sandstone interbeds, minute fractures filled with carbonaceous material, some carbonaceous specks and stringers. Dip = 26°.
71.93 - 75.29	3.36	Sandstone, v.f.g., with approx. 10% siltstone interbeds, carbonaceous specks and stringers, minute fractures filled with calcite, slickensides with calcite along surfaces. Dip = 30°.
75.29 - 76.50	1.21	Sandstone, f.g., well sorted, minute carbonaceous stringers and partings. Dip = 28°.
76.50 - 82.28	5.78	Sandstone, f.g., well sorted, some carbonaceous specks, stringers and partings, occasional fracture filled with calcite. Dip = 30°.
82.28 - 84.75	2.47	Sandstone, v.f.g, with up to 20% siltstone interbeds, flow features, minute cross-beds, carbonaceous stringers and partings, some minute fractures filled with calcite.
84.75 - 87.48	2.73	Siltstone, carbonaceous, plant fossils, carbonaceous specks and stringers common, brown mud bands common, minor slickensides, rare fracture filled with calcite, massive. Dips 22° - 38°.
87.48 - 87.58	0.10	Siltstone, carbonaceous.
87.58 - 87.88	0.30	Mudstone, coaly, slickensides.
87.88 - 88.18	0.30	COAL, very clean, soft, brittle, 60% vitreous, 40% intermediate lustre.
88.18 - 89.30	1.12	COAL, clean, soft but core solid, 20% dull, soft, peaty coal, up to 25% vitreous bands, 55% intermediate lustre.
89.30 - 89.54	0.24	Mudstone, coaly, carbonaceous.
89.54 - 89.90	0.36	COAL, clean, soft, core solid, 10% dull, 10% vitreous bands.

Interval (metres)	Width (metres)	Description
89.90 - 90.05	0.15	COAL, clean, hard, core solid, intermediate lustre, silvery grey.
90.05 - 90.53	0.48	COAL, clean, brittle, core solid, 60% vitreous, 10% dull, soft, peaty coal.
90.53 - 90.85	0.32	COAL, clean, brittle, broken, 20% dull, soft, peaty coal, 50% vitreous coal.
90.85 - 91.10	0.25	Mudstone, coaly.
91.10 - 91.40	0.30	COAL, very clean, brittle, core solid, 90% vitreous coal, 10% intermediate lustre.
91.40 - 91.46	0.06	COAL, clean, brittle, fairly broken, vitreous.
91.46 - 91.76	0.30	COAL, clean, fairly soft, core solid, 20% dull, soft peaty coal, 40% vitreous bands.
91.76 - 92.06	0.30	Mudstone, carbonaceous, coal bands 2 - 3 mm in width slickensides.
92.06 - 92.62	0.56	92.06 - 92.10 - Coal, fairly clean, dull; 92.10 - 92.13 - Carbonaceous mudstone; 92.13 - 92.62 - Coal, clean, core solid, 40% vitreous, 20 - 30% dull coal.
92.62 - 92.92	0.30	COAL, dirty.
92.92 - 93.37	0.45	COAL, fairly clean, broken and crushed, vitreous; recovered 26 cm.
93.37 - 93.47	0.10	COAL, dirty, vitreous bands 2 - 3 mm in width, trace pyrite. Samples: 0104 : 87.58 - 87.88 0.30 0105 : 87.88 - 89.30 1.42 0106 : 89.30 - 89.54 0.24 0107 : 89.54 - 90.85 1.31 0108 : 90.85 - 91.10 0.25 0109 : 91.10 - 91.76 0.66 0110 : 91.76 - 92.06 0.30 0111 : 92.06 - 92.62 0.56 0112 : 92.62 - 93.47 0.85
93.47 - 93.57	0.10	Siltstone, carbonaceous
93.57 - 94.19	0.62	Mudstone, very carbonaceous, coal stringers and bands common, up to 3 mm in width.
94.19 - 94.34	0.15	COAL, core solid, intermediate lustre, 10% vitreous bands.

Interval (metres)	Width (metres)	Description
94.34 - 94.91	0.57	Mudstone, carbonaceous.
94.91 - 96.62	1.71	Siltstone, carbonaceous. Dips = 26° - 28°.
96.62 - 97.00	0.38	Siltstone, carbonaceous with approximately 40% v.f.g. sandstone interbeds. Dip = 27°.
97.00 - 99.67	0.67	Sandstone, m.g., light grey, well sorted, some coaly stringers up to 0.5 cm in width. 98.24 - 99.67 - occasional carbonaceous specks.

T.D. 99.67 m

TRENCHES

Interval (metres)	Width (metres)	Description
STB - 1		
HW		Siltstone/Mudstone, medium grey
0 - 0.25	0.25	COAL, highly weathered, soft, crumbly.
0.25 - 0.30	0.05	Siltstone, carbonaceous.
0.30 - 0.33	0.03	COAL, weathered, soft, crumbly; banded coal, dull with vitreous bands.
0.33 - 0.60	0.27	COAL, weathered, soft, broken.
0.60 - 0.65	0.05	COAL, weathered, soft, crumbly; dull coal with vitreous bands. Sample: 7040 : 0 - 0.65 0.65
FW		Siltstone, medium grey.
STB - 2		
HW		Siltstone, medium grey
0 - 2.00	2.00	COAL, weathered, soft, crumbly; banded coal, dull with minute (less than 5 mm) vitreous bands.
2.00 - 2.15	0.15	Siltstone parting.
2.15 - 2.90	0.75	COAL, weathered, soft and crumbly. Samples: 7041 : 0 - 2.00 2.00 7042 : 2.15 - 2.90 0.75
FW		Siltstone, medium grey.
STB - 3		
HW		Sandstone, v.f.g., with some intervals of mudstone; weathered.
0 - 1.15	1.15	COAL, weathered, soft, crumbly; dull coal with numerous 1 - 2 cm vitreous bands. Sample: 7039 : 0 - 1.15 1.15
FW		Siltstone, soft, weathered.

Interval (metres)	Width (metres)	Description
STB - 4		
HW		Siltstone, medium grey
0 - 1.10	1.10	COAL, weathered, soft.
1.10 - 2.80	1.70	COAL, weathered, soft, crumbly, with abundant 5 cm wide siltstone bands or partings.
2.80 - 2.95	0.15	Siltstone, medium grey, carbonaceous; some coaly bands.
2.95 - 3.25	0.30	COAL, weathered; some siltstone bands. Samples: 7043 : 0 - 1.10 1.10 7044 : 1.10 - 2.80 1.70
FW		Siltstone, medium grey.
STB - 5		
HW		Siltstone, medium grey.
0 - 0.60	0.60	COAL, dull; some carbonaceous siltstone bands (up to 5 cm in width).
0.60 - 1.75	1.15	COAL, banded; dull with vitreous coal bands; some minor (less than 5 mm) siltstone bands.
1.75 - 1.81	0.06	Siltstone, very carbonaceous.
1.81 - 2.01	0.20	COAL, banded; dull with vitreous bands.
2.01 - 2.35	0.34	COAL, dull; abundant siltstone bands. Sample: 7045 : 0.60 - 2.01 1.41
FW		Siltstone, medium grey.

Interval (metres)	Width (metres)	Description
STB - 6		
HW		Siltstone/Mudstone.
0 - 0.40	0.40	COAL, weathered, dirty.
0.40 - 0.90	0.50	Siltstone, medium grey.
0.90 - 1.70	0.80	COAL, weathered, soft, crumbly.
1.70 - 1.90	0.20	Siltstone, alternating with thin bands of coal and carbonaceous siltstone.
1.90 - 2.95	1.05	COAL, weathered, soft, crumbly.
2.95 - 3.57	0.62	Siltstone, carbonaceous.
3.57 - 4.40	0.83	COAL, weathered, soft, crumbly. Samples: 7046 : 0.90 - 2.95 2.05 7047 : 3.57 - 4.40 0.83
FW		Sandstone, v.f.g., with some intervals of siltstone.
STB - 7		
HW		Mudstone
0 - 0.42	0.42	COAL, dirty.
0.42 - 0.46	0.04	Mudstone.
0.46 - 0.71	0.25	COAL, fairly clean.
FW		Mudstone, highly fractured.
STB - 8		
HW		Mudstone
0 - 0.30	0.30	COAL, fairly clean, dull.
0.30 - 0.48	0.18	COAL, dirty, intermediate lustre with ca. 20% dirty coal bands.
0.48 - 0.51	0.03	Clay band.
0.51 - 1.51	1.00	COAL, fairly clean, intermediate lustre.
1.51 - 1.72	0.21	COAL, clean, dull

Interval (metres)	Width (metres)	Description
STB - 9		
HW		Mudstone
0 - 1.06	1.06	Mudstone, coaly.
1.06 - 2.13	1.07	Mudstone with highly weathered coal bands.
2.13 - 2.33	0.20	COAL, fairly clean.
2.33 - 2.86	0.53	Mudstone with some coal bands.
2.86 - 3.12	0.26	COAL, fairly clean, soft.
3.12 - 3.15	0.03	Mudstone.
3.15 - 3.43	0.28	COAL.
3.43 - 3.61	0.18	Mudstone.
3.61 - 3.89	0.28	COAL, dirty. Sample: 0034 : 2.13 - 3.89
FW		Unexposed.
STB - 10		
HW		Siltstone.
0 - 0.60	0.60	COAL, clean, fairly hard, 20% vitreous bands.
0.60 - 0.64	0.04	Siltstone.
0.64 - 1.84	1.20	COAL, fairly clean with one 4 cm siltstone band at 0.90 m. Sample: 0035 : 0 - 1.84 1.84
FW		Mudstone.

Interval (metres)	Width (metres)	Description
STB - 11		
HW		Siltstone/Mudstone
0 - 0.09	0.09	COAL
0.09 - 0.24	0.15	Mudstone.
0.24 - 0.74	0.50	COAL, clean.
0.74 - 0.76	0.02	COAL, dirty.
0.76 - 0.98	0.22	COAL, fairly clean, intermediate lustre.
0.98 - 1.01	0.03	Siltstone.
1.01 - 1.70	0.69	COAL.
1.70 - 2.31	0.61	COAL, clean, intermediate lustre with vitreous bands up to 1 cm in width.
2.31 - 2.38	0.07	COAL, dull, dirty, highly weathered.
2.38 - 2.63	0.25	COAL, clean, dull; soft, peaty coal.
2.63 - 2.68	0.05	Siltstone.
2.68 - 2.90	0.22	COAL, fairly clean, dull. Samples: 0036 : 0 - 2.31 2.31 0037 : 2.31 - 2.90 0.61
FW		Siltstone.
STB - 12		
HW		Sandstone, v.f.g.
0 - 1.22	1.22	COAL, clean, intermediate lustre with some vitreous bands up to 2 - 3 cm in width. Sample: 0038 : 0 - 1.22 1.22
FW		Mudstone
STB - 13		
HW		Siltstone
0 - 1.50	1.50	COAL, very clean, fairly hard, fairly solid, vitreous bands common; one 2 cm mudstone band at .5 m. Sample: 0039 : 0 - 1.50 1.50
FW		Mudstone

Interval (metres)	Width (metres)	Description
STB - 14		
HW		Sandstone.
0 - 0.90	0.90	COAL, fairly clean.
FW		Mudstone, coaly partings with occasional vitreous coal bands.
STB - 15		
HW		Siltstone with v.f.g. sandstone interbeds.
0 - 0.90	0.90	COAL, fairly clean, occasional vitreous band, intermediate to dull, highly weathered, soft, crumbly.
FW		Mudstone.
STB - 16		
HW		Mudstone
0 - 1.32	1.32	COAL, fairly clean, dull with occasional 1 cm vitreous bands.
1.32 - 1.38	0.06	COAL, dirty.
1.38 - 1.58	0.20	COAL, fairly clean, dull. Sample: 0040 : 0 - 1.58 1.58
FW		Mudstone.
STB - 17		
HW		Siltstone
0 - 0.90	0.90	COAL, dirty, numerous siltstone and mudstone bands.
FW		Mudstone.

Interval (metres)	Width (metres)	Description
STB - 18		
HW		Mudstone
0 - 1.82	1.82	COAL, clean, intermediate lustre with up to 10% vitreous bands.
1.82 - 2.34	0.52	COAL, dirty, banded; alternating bands of coal and clay. Sample: 0041 : 0 - 2.34 2.34
FW		Unexposed.
STB - 19		
HW		Mudstone
0 - 0.27	0.27	COAL, dirty.
0.27 - 2.30	2.03	COAL, clean, intermediate lustre with occasional vitreous coal bands. Sample: 0042 : 0 - 2.30 2.30
FW		Unexposed.
STB - 20		
		Less than one (1) metre of coal (dirty) was intersected. Trench not logged or sampled.
STB - 21		
HW		Mudstone.
0 - 0.80	0.80	COAL, clean.
FW		Mudstone with some coal bands and stringers.
STB - 22		
		Trench not logged or sampled. Less than 1 metre of dirty coal was intersected.

Interval (metres)	Width (metres)	Description
STB - 23		
HW		Mudstone.
0 - 1.15	1.15	COAL, clean, fairly hard, some vitreous bands.
1.15 - 2.25	1.10	Siltstone with v.f.g. sandstone interbeds.
2.25 - 3.55	1.30	COAL, fairly clean, some soil creep.
3.55 - 4.35	0.80	Siltstone.
4.35 - 5.50	1.15	COAL, clean, vitreous bands common.
5.50 - 5.70	0.20	Clay band.
5.70 - 6.00	0.30	COAL, dull. Samples: 0043 : 0 - 2.25 2.25 0044 : 2.25 - 4.35 2.10 0045 : 4.35 - 6.00 1.65
FW		Unexposed.
STB - 24		
HW		Siltstone
0 - 0.80	0.80	COAL, dirty.
0.80 - 1.40	0.60	COAL, fairly clean, weathered, soft.
FW		Mudstone.
STB - 25		
HW		Mudstone with a 16 cm interval of gradational contact into coal, ferruginous staining.
0 - 1.12	1.12	COAL, clean, vitreous, minor specks of white ash.
1.12 - 1.23	0.11	Clay, white to light grey; very irregular - 3 to 11 cm in width.
1.23 - 1.60	0.37	COAL, very clean, dull.
1.60 - 1.68	0.08	Mudstone band.
1.68 - 1.97	0.29	COAL, fairly clean; intermediate lustre with some vitreous bands, minor ash (specks and blebs).
1.97 - 2.20	0.23	Mudstone, carbonaceous.
2.20 - 2.29	0.09	COAL, dirty, fairly dull. Sample: 0046 : 0 - 2.29 2.29
FW		Mudstone

Interval (metres)	Width (metres)	Description
STB - 26		
HW		Mudstone.
0 - 0.12	0.12	COAL, dull.
0.12 - 0.16	0.04	COAL, dirty.
0.16 - 0.94	0.78	COAL, dull with some bands of dirty coal.
0.94 - 1.14	0.20	COAL, dirty.
1.14 - 2.01	0.87	COAL, dirty, dull, with up to 30% light brown clay.
2.01 - 2.52	0.51	COAL, fairly dirty; dull coal with up to 20% vitreous bands; ca. 20% light brown to grey clay.
2.52 - 3.30	0.78	COAL, clean, banded, dull coal (50%) with vitreous bands (50%).
3.30 - 3.81	0.51	COAL, clean, vitreous with minor ash bands.
3.81 - 4.19	0.38	COAL, with a high content of rusty coatings (ferruginous staining).
4.19 - 4.76	0.57	COAL, clean, fairly hard; intermediate lustre.
4.76 - 4.97	0.21	Siltstone.
4.97 - 5.15	0.18	COAL, clean, vitreous. Sample: 0047 : 0 - 5.15 5.15
FW		Siltstone, hard, solid.
STB - 27		
HW		Sandstone, v.f.g.
0 - 0.61	0.61	COAL and mudstone, alternating bands (50%-50%).
0.61 - 1.22	0.61	COAL, fairly clean, dull.
1.22 - 1.34	0.12	COAL, dirty.
1.34 - 1.43	0.09	COAL, clean.
1.43 - 1.47	0.04	COAL, abundant ferruginous staining.
1.47 - 1.66	0.19	COAL, dirty. Sample: 0048 : 0 - 1.66 1.66
FW		Mudstone

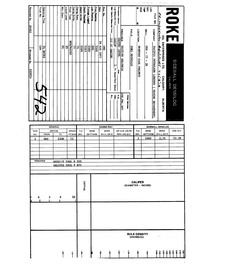
Interval (metres)	Width (metres)	Description
STB - 28		
HW		Siltstone with v.f.g. sandstone interbeds.
0 - 0.07	0.07	Mudstone.
0.07 - 0.97	0.90	COAL, intermediate to vitreous lustre.
0.97 - 1.02	0.05	COAL, dull.
1.02 - 1.23	0.21	COAL, clean, vitreous.
1.23 - 1.60	0.37	COAL, very clean, dull.
1.60 - 2.49	0.89	COAL, clean, dull with vitreous bands.
2.49 - 2.90	0.41	COAL, very dirty. Sample: 0049 : 0 - 2.90 2.90
FW		Mudstone, soft.
STA - 1		
HW		Siltstone, dark grey.
0 - 0.10	0.10	COAL, dirty.
0.10 - 0.25	0.15	COAL, weathered, soft, crumbly.
0.25 - 0.35	0.10	Siltstone band.
0.35 - 1.90	1.55	COAL, weathered, soft; banded, dull coal with abundant vitreous bands.
1.90 - 2.05	0.15	Siltstone, coaly.
2.05 - 3.40	1.35	COAL, alternating dull and vitreous coal bands.
3.40 - 3.52	0.12	Siltstone, medium grey.
3.52 - 4.32	0.80	COAL, weathered, with minor siltstone partings. Samples: 7048 : 0 - 2.05 2.05 7049 : 2.05 - 4.32 2.27
FW		Siltstone, medium grey, carbonaceous specks, plant fossils.

TRENCHES (cont'd.)

Interval (metres)	Width (metres)	Description
STA - 29		
HW		Siltstone/Mudstone
0 - 1.08	1.08	COAL, fairly clean.
1.08 - 1.86	0.78	COAL, dull, dirty, with increasing siltstone/mudstone bands towards FW. Sample: 0050 : 0 - 1.86 1.86
FW		Siltstone.
STB - 30		
HW		Siltstone
0 - 0.40	0.40	COAL, fairly clean, weathered.
0.40 - 0.80	0.40	Siltstone
0.80 - 1.10	0.30	COAL, clean.
1.10 - 2.70	1.60	Mudstone.
2.70 - 3.40	0.70	COAL, fairly clean.
FW		Mudstone

TRENCHES

Interval (metres)	Width (metres)	Description
HTB - 1		
HW		Mudstone, carbonaceous.
0 - 0.08	0.08	COAL, with coaly mudstone bands up to 5 mm wide.
0.08 - 0.18	0.10	Mudstone, coaly.
0.18 - 0.55	0.37	COAL, with one 2 cm mudstone band at 0.20 m.
0.55 - 0.80	0.25	Mudstone.
0.80 - 1.90	1.10	COAL, weathered, very soft, crumbly, occasional clay stringer.
1.90 - 1.93	0.03	Siltstone band or parting.
1.93 - 2.08	0.15	COAL, 20% vitreous bands.
2.08 - 2.10	0.02	Clay.
2.10 - 2.55	0.45	COAL, soft, weathered; banded coal, 20% vitreous, a few disseminated rusty specks (weathered-out pyrite).
2.55 - 3.45	0.90	COAL, weathered, soft; dull coal with 10% vitreous bands.
3.45 - 3.85	0.40	Shale, carbonaceous, with occasional coal band or stringer. Samples: 7019 : 0 - 0.80 0.80 7020 : 0.80 - 2.55 1.75 7021 : 2.55 - 3.45 0.90
FW		Siltstone.


ROXE
Roxe Oil Company, Inc.
Sidney, Texas
Lease: [illegible]
Well No. 1
Field: [illegible]
County: [illegible]
State: [illegible]
Elevation: [illegible]
Location: [illegible]
Date: [illegible]
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Depth Logger: [illegible]
Bottom Log Interval: [illegible]
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Type Fluid in Hole: [illegible]
Density: [illegible]
Viscosity: [illegible]
Fluid Loss: [illegible]
Source of Sample: [illegible]
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Rm @ BHT: [illegible]
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Depth Logger: [illegible]
Bottom Log Interval: [illegible]
Top Log Interval: [illegible]
Casing Driller: [illegible]
Casing Logger: [illegible]
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Source of Rmf & Rmc: [illegible]
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Max. Rec. Temp.: [illegible]
Equip. No. & Location: [illegible]
Recorded By: [illegible]
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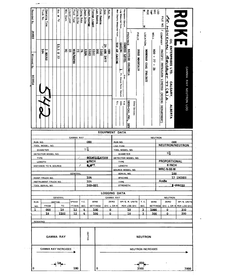
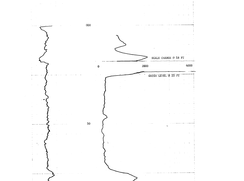
DUAL INDUCTION-LATEROLOG
SIDEWALL NEUTRON-GAMMA RAY
SIDEWALL NEUTRON-FORMATION DENSITY

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DRILLER
LOGGER
TYPE FLUID IN HOLE
DENSITY
VISCOSITY
PH
FLUID LOSS
SOURCE OF SAMPLE
RM @ MEAS. TEMP.
RMF @ MEAS. TEMP.
RMC @ MEAS. TEMP.
SOURCE RMF & RMC
RM @ BHT
TIME CIRC. ENDED
TIME LOGGER ON BOTTOM
MAX. REC. TEMP.
EQUIP. LOCATION
RECORDED BY
WITNESSED BY
LITHOLOGY DATA
DENSITY
NEUTRON
GAMMA RAY
CALIPER
GAMMA RAY NEUTRON
DELTA-T
GAMMA RAY DELTA-T
BOREHOLE CORRECTIONS
CASING
MUD
MUD WEIGHT
BIT
FLUID IN HOLE
SALINITY
MATRIX
SALINITY
FLUID LEVEL
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CALIPER
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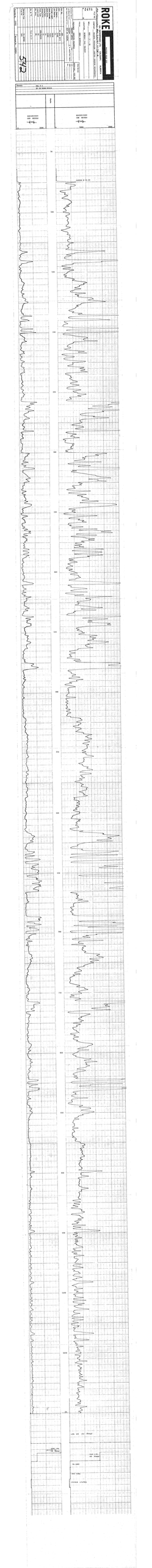
GAMMA RAY DELTA-T


ROKE
542

ROKE

OIL ENTERPRISES LTD. CALGARY ALBERTA

RIGGED RIGHT

Phil No.

Company: ROKE OIL ENTERPRISES LTD. CALGARY ALBERTA

Well: WELL NO. 2-3

Field: NORMAN CANAL TERRITORY

Location: NORMAN CANAL TERRITORY

Province: BRITISH COLUMBIA

Country: CANADA

Other Services: DUAL INDUCTION LOG SFL

Permanent Datum: GROUND LEVEL

Log Measured From: KELLY BUSHING

Drilling Measured From: KELLY BUSHING

Elev.: K.B. 1000 G.L. 990

Date: 23 JUNE 1977

Run No.: ONE

Depth-Driller: 5500

Depth-Logger: 5502

Bottom Logged Interval: 5500

Top Logged Interval: 1000

Type Fluid in Hole: GEL CHEM

Salinity PPM Cl: 2500

Density: 9.6

Viscosity: 45

Fluid Loss: 8.0

Source of Sample: FLOWLINE

Rm @ Meas. Temp.: 2.0 @ 77

Rmf @ Meas. Temp.: 1.5 @ 77

Rmc @ Meas. Temp.: 3.0 @ 77

Source: Rmf Rmc

Rm @ BHT: 1.5 @ 150°F

Time Since Circ.: 12 HOURS

Max. Rec. Temp.: 150

Equipment No.: 10554

Recorded By: KOSTER

Witnessed By: KOSTER

542

Remarks: FBL @ 5
20 CM HEAVY WEIGHT

Depths

RESISTIVITY OHM METERS 0 — 5000

RESISTIVITY OHM METERS 10 — 1000 — 1000

73

100

150

200

250

300

350

400

450

500

550

600

FB

LOGGED ON 100 RANGE

CAL 5000 LATCHED 100 RANGE

1000 CAL 100 RANGE

CAL ZERO

REC ZERO

SYSTEM STOP

ROKE

OIL ENTERPRISES LTD.

CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

COMPANY ROKE OIL ENTERPRISES LTD. WELL No. 5-12-47-4 W4M FIELD WILDWOOD SOUTH COUNTY PARISH STATE ALBERTA

LOCATION 5-12-47-4 W4M OTHER SERVICES

PERMANENT DATUM GROUND LEVEL Elev. 2,400 ft. ELEV. K.B. 2,410 ft. D.F. 2,409 ft. G.L. 2,400 ft.

LOG MEASURED FROM K.B. 10 ft. ABOVE PERM. DATUM

DRILLING MEASURED FROM K.B.

DATE 2-8-77 RUN No. ONE TYPE LOG GAMMA RAY NEUTRON DEPTH—DRILLER 1,000 DEPTH—LOGGER 1,000 BTM. LOG INTERVAL 1,000 TOP LOG INTERVAL 100 CASING—DRILLER 8 5/8" @ 100 CASING—LOGGER 100 BIT SIZE 7 7/8" TYPE FLUID IN HOLE GEL CHEM DENS. 9.0 VISC. 40 PH 9.0 FLUID LOSS 10 cc SOURCE OF SAMPLE FLOWLINE RM @ MEAS. TEMP. 1.4 @ 60 °F RMF @ MEAS. TEMP. .98 @ 60 °F RMC @ MEAS. TEMP. 1.8 @ 60 °F SOURCE OF RMF & RMC MEAS RM @ BHT 1.0 @ 80 °F TIME SINCE CIRC. 12 HRS MAX. REC. TEMP. 80 °F EQUIP. LOCATION 5-12 EQUIP. No. 5-12 RECORDED BY R. PEARSON WITNESSED BY MR. SMITH

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.	11	LOG TYPE	NEUTRON/NEUTRON
DIAMETER		TOOL MODEL NO.	
DETECTION MODEL NO.		DIAMETER	11
TYPE	SCINTILLATION	DETECTION MODEL NO.	
LENGTH	6'-7" INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6.8 FT.	LENGTH	6 INCH
GENERAL		SOURCE MODEL NO.	MRC/N-SS-W
HOIST TRUCK NO.	105	SERIAL NO.	105
INSTRUMENT TRUCK NO.	105	DEPTHS	17 SPACED
TOOL DETAIL NO.	105-015	TYPE	Am-Be
		STRENGTH	20 CURIES

LOGGING DATA

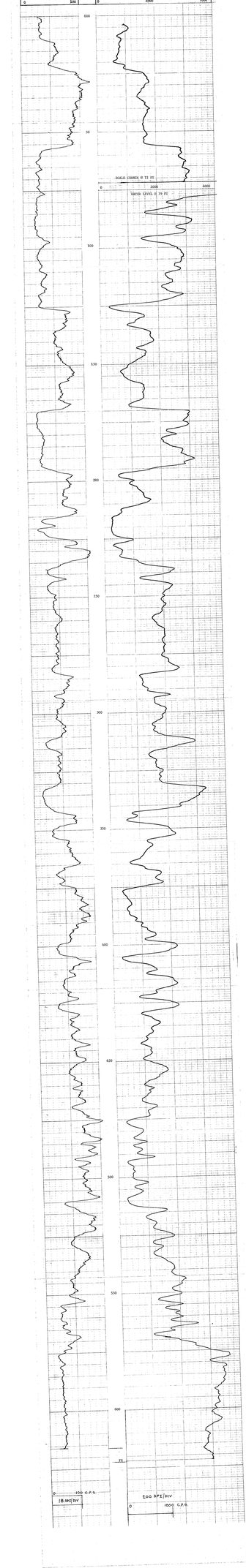
GENERAL					GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	TO	SPEED FT/MIN	T.C. SEC.	SENS DEFLECTION	ZERO DIV.	API, B. K. UNITS PER 1.00 API	T. C. SEC.	SENS DEFLECTION	ZERO DIV.	API, B. UNITS PER 1.00 API	
1	0	72	11	4	100	0	18	3	1000	0	230	
	72	102	11	4	100	0	18	3	500	0	200	

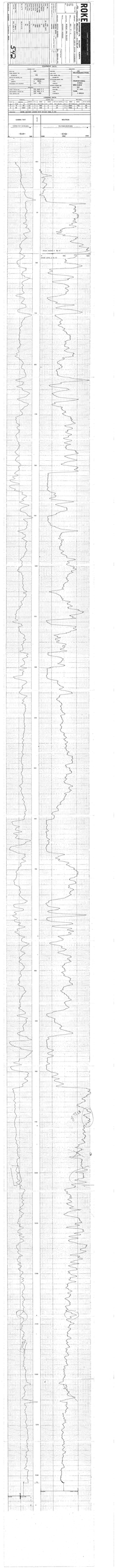
REMARKS

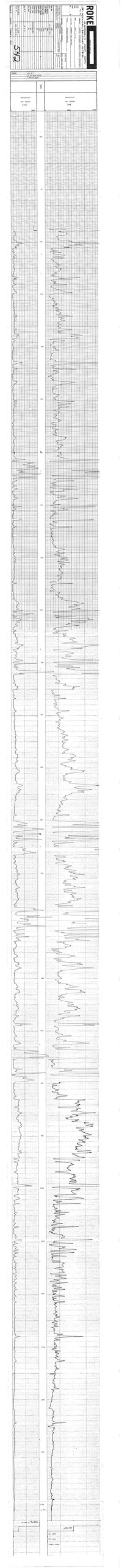
GAMMA RAY | SCALE | NEUTRON

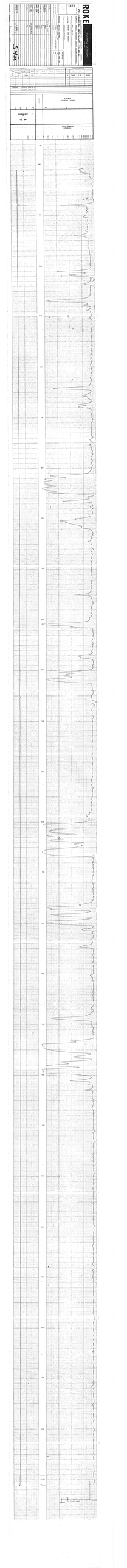
GAMMA RAY INCREASES → | - | NEUTRON INCREASES →

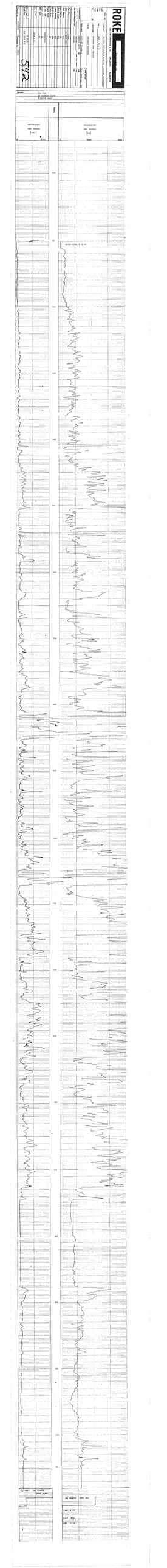
0 — 100 — 200 — 3000 — 7000

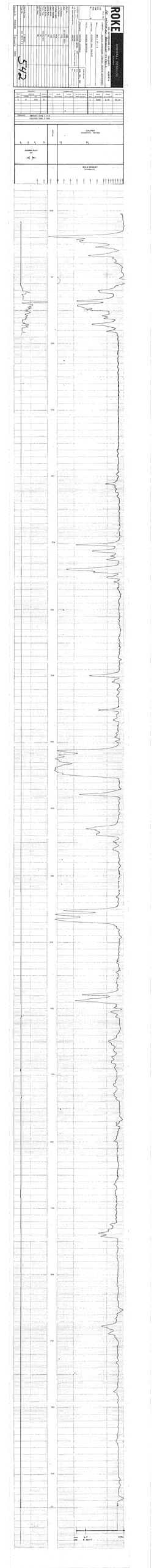



ROKE
572
RUN 1
RUN 2
RUN 3
RUN 4
RUN 5
RUN 6
RUN 7
RUN 8
RUN 9
RUN 10
RUN 11
RUN 12
RUN 13
RUN 14
RUN 15
RUN 16
RUN 17
RUN 18
RUN 19
RUN 20
RUN






ROKE
5472
Company
Well
Field
County
Location
Elevation
Permanent Datum
Log Measured From
Drilling Measured From
Date
Run No.
Depth-Driller
Depth-Logger
Bottom Logged Interval
Top Logged Interval
Type Fluid in Hole
Salinity
Density
Level
Max. Rec. Temp.
Equip. No. & Location
Recorded By
Witnessed By
RUN NO. 1
RUN NO. 2
RUN NO. 3
CASING RECORD
SIZE
WGT.
DEPTH
TYPE FLUID IN HOLE
DENSITY
VISCOSITY
PH
FLUID LOSS
SOURCE OF SAMPLE
RM @ MEAS. TEMP.
RMF @ MEAS. TEMP.
RMC @ MEAS. TEMP.
SOURCE RMF
SOURCE RMC
RM @ BHT
TIME SINCE CIRC.
MAX. REC. TEMP.
EQUIP. LOCATION
RECORDED BY
WITNESSED BY
DUAL INDUCTION LATEROLOG
MICROLATEROLOG
GAMMA RAY-NEUTRON
Other Services
Remarks
RUN NO. 1
RUN NO. 2
RUN NO. 3
GAMMA RAY-NEUTRON
(API)
RESISTIVITY
(OHMS)
SHALLOW RESISTIVITY
(OHMS)
DEEP RESISTIVITY
(OHMS)
SPONTANEOUS POTENTIAL
(MV)
CALIPER
(INCHES)
BOTTOM LOGGED INTERVAL
TOP LOGGED INTERVAL
LOG MEASURED FROM
DRILLING MEASURED FROM
ELEVATION
PERMANENT DATUM
ELEVATIONS
K.B.
D.F.
G.L.
LOG MEASURED FROM
DRILLING MEASURED FROM
ELEVATION
PERMANENT DATUM
ELEVATIONS
K.B.
D.F.
G.L.
LOG MEASURED FROM
DRILLING MEASURED FROM
ELEVATION
PERMANENT DATUM
ELEVATIONS
K.B.
D.F.
G.L.
SECTION
TOWNSHIP
RANGE
API SERIAL NO.
PERMANENT DATUM
ELEVATIONS
K.B.
D.F.
G.L.
LOG MEASURED FROM
DRILLING MEASURED FROM
ELEVATION


ROKE
SPECTRAL DENSITY DUAL SPACED NEUTRON
CALIPER
GAMMA RAY
BULK DENSITY
5412

ROKE

SCHLUMBERGER WELL SURVEYING CORPORATION

COMPANY

WELL

FIELD

COUNTY

STATE

Other Services

Sec. Twp. Rge.

Permanent Datum

Elev.: K.B.

D.F.

G.L.

Log Measured From

Drilling Measured From

Date

Run No.

Depth-Driller

Depth-Logger

Bottom Logged Interval

Top Logged Interval

Type Fluid in Hole

Salinity, PPM Cl

Density

Level

Max. Rec. Temp. Deg. F

Operating Rig Time

Recorded By

Witnessed By

BOREHOLE RECORD

No.	Bit From	To	Size	Type Fluid in Hole	Density	Viscosity	pH	Fluid Loss

CASING RECORD

No.	Size	Wgt.	Grade	Type Joint	Top	Bottom

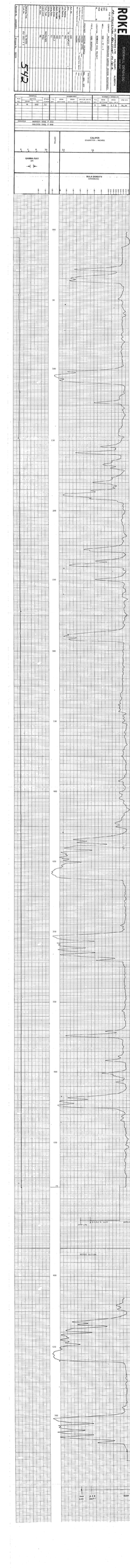
5412

EQUIPMENT DATA

GAMMA RAY	NEUTRON
RUN NO.	RUN NO.
GAMMA RAY NO.	NEUTRON INSTRUMENT NO.
DETECTOR MODEL NO.	16
6 SPS	PROFESSIONAL
GENERAL PURPOSE	TYPE
SPECIAL	NEUTRON MODEL NO.
SPECIAL	MN-C-N-M
SPECIAL	SPACING
CALIBRATION NO.	17 CNS
CALIBRATION TRUCK NO.	Radio
CABLE SPEED NO.	CYCLING
	4 CYCLES

LOGGING DATA

| GENERAL | | | | | | | |


ROKE
GENERAL LITHOLOGY
5-42
CALIPER
GAMMA RAY
BULK DENSITY

ROKE

Date Time Zero
Recorder No.
Test Before
Test After
Calibration Signal
Reference Signal
Gain Setting
Filter Setting
Chart Speed
Antenna
Probe
Probe Angle
Probe Index
Search Unit
Couplant
Material Ident.
Material Thickness
Material Velocity
Material Attenuation
Scanning Surface
Scanning Method
Scanning Sensitivity
Remarks

Date
Time
Location
Weld No.
Weld Identification
Weld Thickness
Weld Configuration
Weld Process
Weld Material
Weld Material Spec.
Weld Material Grade
Weld Material Class
Weld Material Type
Weld Material Form
Weld Material Size
Weld Material Heat No.
Weld Material Lot No.
Weld Material Batch No.
Weld Material Supplier
Weld Material Manufacturer
Weld Material Certification
Weld Material Traceability
Weld Material Storage
Weld Material Handling
Weld Material Preheat
Weld Material Interpass Temperature
Weld Material Postheat
Weld Material Hydrogen Control
Weld Material Shielding Gas
Weld Material Flux
Weld Material Electrode
Weld Material Filler Wire
Weld Material Backing
Weld Material Backing Gas
Weld Material Backing Flux
Weld Material Backing Electrode
Weld Material Backing Filler Wire
Weld Material Backing Ring
Weld Material Backing Strip
Weld Material Backing Tape
Weld Material Backing Paste
Weld Material Backing Powder
Weld Material Backing Other
Weld Material Backing Remarks

542

Remarks: FIG. 8.1
AS-US SCAN PLATE
1 METER AWAY

PLOTTING AXIS

SENSITIVITY
0000 MICRONS
[000]

SENSITIVITY
0000 MICRONS
[000]

ROKE

GAMMA RAY NEUTRON LOG

Company: ROKE OIL, INC.
Well: #1 GEARHART-OWEN
Field: WILDCAT
County: HEMPHILL
State: TEXAS
Location: 1980' FSL & 1980' FEL
Sec. 14 Twp. 7N Rge. 27E
Other Services: DUAL INDUCTION SFL, BOREHOLE COMPENSATED SONIC
Permanent Datum: GROUND LEVEL
Elev.: 2,977
Log Measured From: KELLY BUSHING
Elev.: 2,987
Drilling Measured From: KELLY BUSHING
Elev.: 2,987
Date: 3-19-77
Run No.: ONE
Depth-Driller: 6,000
Depth-Logger: 6,000
Bottom Logged Interval: 6,000
Top Logged Interval: 2,500
Type Fluid in Hole: CHEMICAL
Salinity, PPM Cl: 1,000
Density: 9.1
Level: FULL
Max. Rec. Temp. Deg. F: 120
Operating Rig Time: 12 HRS
Recorded By: J. ZITO
Witnessed By: MR. ROKE

EQUIPMENT DATA

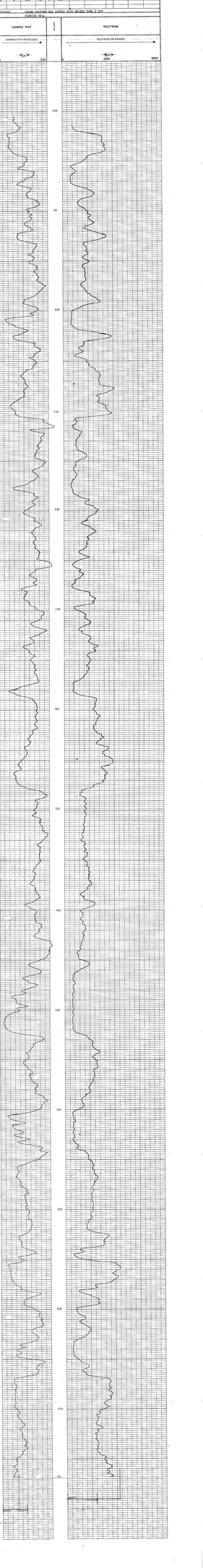
Gamma Ray		Neutron	
Run No.	ONE	Run No.	ONE
Detector, No.		Type	NEUTRON/NEUTRON
Diameter	1 5/8	Total Count, No.	
Detector Model No.		Diameter	1 5/8
Type	SCINTILLATION	Source Model, No.	
Length	6 INCH	Type	PROPORTIONAL
Distance to Source	9.8 FT.	Length	6 INCH
		Source	MICRO CURIES
General		Source Model, No.	
Sonde Truck No.	FLA 3322 F 2	Serial No.	181
Instrument Truck No.	FLA 3322 F 2	Volume	17 MCI
Total Serial No.	181 - 202	Type	AM-BE
		Assembly	3 CURIES

LOGGING DATA

Run	General				Gamma Ray				Neutron				
	Casing		Speed	T.C.	Speed	API & N. Units		T.C.	Gate	Speed	6 INCH SPACING	
	From	To				Left	Right		Sec.	Sec./Min.	Left	Right
ONE	0	2500	12	6	120	0	150	6	1000	6	500	

REMARKS: CASING SHUTTING OFF LOGGING WITH GR-NEU TOOL @ 2375

RECORDED MODE



ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

Pc-Tonkenstn-Belcourt 77(8)A

COMPANY PACIFIC PETROLEUMS LIMITED (OPERATOR FOR ITSELF AND OTHERS)

WELL NO. 77 - 8

FIELD BEDEL MERIDIAN

LOCATION NORMAL COAL PROJECT

PROVINCE BRITISH COLUMBIA

Other Services: BHC - SONIC - GR.

Permanent Datum: GROUND LEVEL

Log Measured From: K.B.

Drilling Measured From: K.B.

Elev.: K.B. 3825 ft. D.F. G.L.

Date: 19 SEPT 1977

Run No.: ONE

Depth-Driller: 325

Depth-Logger: 325

Bottom Logged Interval: 325

Top Logged Interval: SURFACE

Type Fluid in Hole: AIR/WATER/MIST

Salinity, PPM Cl: 5

Density: 0.13

Level: FULL

Max. Rec. Temp. Deg. F.: 80

Equip. No. and Location: 1 UNION

Recorded By: SCHEIDER

Witnessed By: SMITH

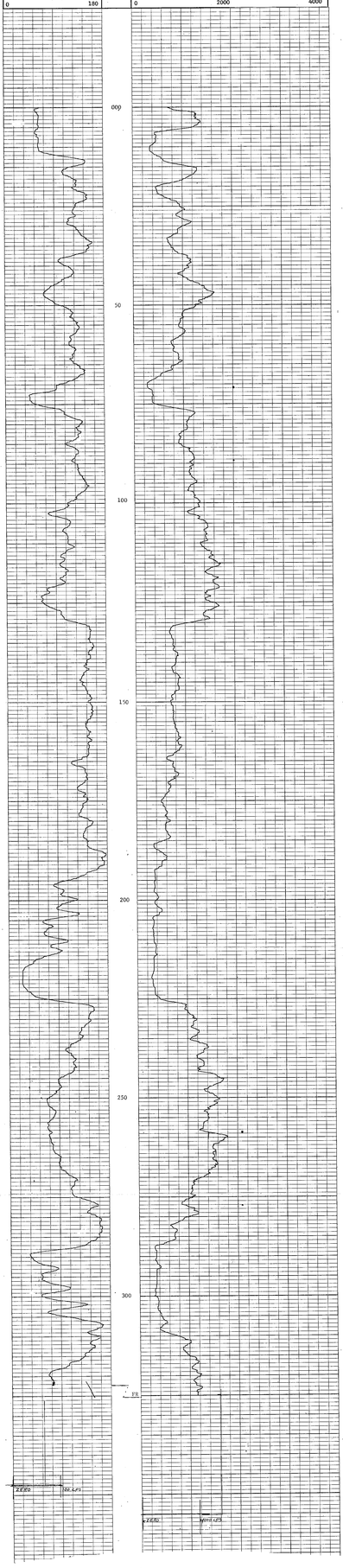
EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	1 11/16
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	4 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6,8 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRCN-SS-W
GENERAL		SERIAL NO.	127
HOIST TRUCK NO.	FLY UNIT # 2	SPACING	17 INCH
INSTRUMENT TRUCK NO.	FLY UNIT # 2	TYPE	AmBe
TOOL SERIAL NO.	169 - 002	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTH FROM	DEPTH TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG D/V.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG D/V.
1	0	325	12					3	1000	0	200

REMARKS GAMMA SECTION WAS LOGGED WITH GR-288 TOOL # 278



ROKE

OIL ENTERPRISES LTD.

CALGARY, ALBERTA

ENGINEERED BY ROKE

File No.

Company: PACIFIC PETROLEUMS LIMITED (OPERATING DEPARTMENT)

Well: DDH - 77 - 8

Location: NORMAN COAL PROJECT

Field: DEKE MEDITATER

Province: BRITISH COLUMBIA

Logged Interval: 1000 FT. To 0 FT.

Other Services: DIPOLE-DIPOLE

Permanent Datum: GROUND LEVEL Elev.: 0

Log Measured from: GROUND LEVEL 0 Ft. Above Perm. Datum

Drl. Measured from: GROUND LEVEL 0 Ft.

Run No.	ONE	
Date	19 - OCT - 1977	
First Reading	1000	
Last Reading	0	
Footage Logged	1000	
Logging Speed	3327	
Depth Driller	1000	
Depth Logger	1000	
Casing Driller	0	
Casing Logger	0	
Fluid Type	AIR/MONITORED	
Fluid Level		
Mfr. Cable	ROKE	
Rec. @ °F	12.8 @ 77	
Operating Time	1/2 DOUBLE	
Truck No.	FLY UNIT # 2	

Recorded By: SCHIMMER

Witnessed By: SMITH

Remarks: FULL # 4
20 CM BEAM WIDTH
1 METER ARRAY

Depths	RESISTIVITY OHM METERS 500 (0 – 5000)	RESISTIVITY OHM METERS 100 (0 – 1000 – 2000)
000		WATER LEVEL @ 5 FT.
50		
100		
150		
200		
250		
300		
FS		

5995 CAL
LATERAL ON
103 RANGE

1000 CAL
109 RANGE

CALZERO

REC. ZERO

SYSTEM STARTED

542

ROKE OIL ENTERPRISES LTD.

SIDEWALL DENSLOG
CALIPER

CALGARY, ALBERTA

Re-logged when recover tools fr.

LSD SEC TWP RGE W.....M

FILE NO.

COMPANY TRACTEC PETROLEUMS LIMITED (OPERATING DEPARTMENT)

WELL 1000 - 77 - 8

LOCATION MORKHAM COAL PROJECT

FIELD DERE MOUNTAIN

PROVINCE BRITISH COLUMBIA

Permanent Datum: GROUND LEVEL Elev. ____
Log Measured From: CASING FT. Above Perm. Datum
Drilling Measured From: KB

Other Services: GRS, FDL

Rec. No.	03
Date	13 SEPT 1977
First Reading	323
Last Reading	0
Feet Logged	323
Depth Driller	323
Depth Logger	323
Bottom Logged Interval	-
Casing Driller	13
Casing Logger	-
Bit Size	ASSUMED 12
Type Fluid in Hole	WATER
Density	5
Level	FULL
Max. Temp.	HQ

Operating Time	1 WEEK
Truck No.	FIX DATE # 2

Recorded By: BOB BARRETT

Witnessed By: PETE

5412

GENERAL				GAMMA RAY			SIDEWALL DENSLOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/ DIV
1	0	313	12					3	1000	2.78	70.38

REMARKS: DENSITY TOOL # 553
CALIPER TOOL # 460

DEPTHS

CALIPER (DIAMETER – INCHES)
4 6 8 10 12 14

GAMMA RAY API

BULK DENSITY (GRAMS/CC)
1.95 2.00 2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00

000
50
100
150
200
250
300

FR

1000 CPS
2.7 DIV. R. SHIFT
1685

542

DIRECTIONAL SURVEY

ROKE OIL ENTERPRISES LIMITED

COMPANY: PACIFIC PETROLEUM LIMITED (MINING DEPT.) GRID

DRILL HOLE MDD-77-2B LATITUDE

LOCATION MCNKMAN COAL PROJECT DEPARTURE

FIELD DUKE MOUNTAIN ELEVATION

MAGNETIC DECLINATION CORRECTION OF

DATE SURVEYED 24 AUGUST 1977

SURVEY BY JONES

WITNESSED BY BIENIA

CALCULATIONS BY

FOR GRID

Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing
0	000	1·65		11	311	1·66	264·0	22	473	1·51	253·0
1	50	1·88		12	314	1·66	271·4	23	480	1·83	251·9
2	100	1·86	273·5	13	350	1·65	264·9	24	500	1·65	243·9
3	131	1·86	272·4	14	363	1·65	262·5	25	550	1·47	234·7
4	134	1·87	273·6	15	369	1·65	262·0	26	600	1·28	227·8
5	150	1·85	273·6	16	400	1·65	258·9	27	631	1·46	227·8
6	188	1·85	272·7	17	407	1·65	259·9	28	650	1·46	224·2
7	200	1·85	272·1	18	410	1·65	260·3	29	666	1·64	223·4
8	250	2·03	270·5	19	418	1·65	259·8	30	686	1·83	222·8
9	257	1·86	270·3	20	421	1·65	258·7	31	700	1·85	222·5
10	300	1·84	265·7	21	450	1·65	257·3	32	702	1·83	222·3

DIRECTIONAL SURVEY

ROKE OIL ENTERPRISES LIMITED

COMPANY: PACIFIC PETROLEUM LIMITED (MINING DEPT) GRID _____ DATE SURVEYED 24 AUGUST 1977

DRILL HOLE MDD-77-2B LATITUDE _____ SURVEY BY JONES

LOCATION MONKMAN COAL PROJECT DEPARTURE _____ WITNESSED BY BIENIA

FIELD DUKE MOUNTAIN ELEVATION _____ CALCULATIONS BY _____

MAGNETIC DECLINATION _____ CORRECTION OF _____ FOR _____ GRID _____

Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing
0	750	1·82	221·5	11				22			
1	756	1·82	220·9	12				23			
2	759	1·82	218·4	13				24			
3	800	1·83	220·3	14				25			
4	821	1·82	220·1	15				26			
5	831	1·82	221·0	16				27			
6	850	1·82	221·9	17				28			
7	900	2·01	222·5	18				29			
8	950	2·36	220·4	19				30			
9	1000	2·90	221·9	20				31			
10	1050	3·10	223·4.	21				32			

DIRECTIONAL SURVEY

ROKE OIL ENTERPRISES LIMITED

COMPANY: PACIFIC PETROLEUM LIMITED (MINING DEPT.) GRID _____ DATE SURVEYED 23 AUGUST 1977

DRILL HOLE MDD-77-3 LATITUDE _____ SURVEY BY JONES

LOCATION MONKMAN COAL PROJECT DEPARTURE _____ WITNESSED BY BIENIA

FIELD DUKE MOUNTAIN ELEVATION _____ CALCULATIONS BY _____

MAGNETIC DECLINATION _____ CORRECTION OF _____ FOR _____ GRID _____

Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing
0	000	2·04		11	250	3·13	150·8	22	550	4·52	170·0
1	50	2·78	144·7	12	300	2·93	158·0	23	600	5·07	174·1
2	100	2·59	145·8	13	350	3·65	161·6	24	609	5·06	175·2
3	125	2·59	141·7	14	400	3·48	164·0	25			
4	127	2·60	141·7	15	406	3·83	164·8	26			
5	150	2·96	144·8	16	450	4·19	169·3	27			
6	200	2·95	148·7	17	477	4·54	171·4	28			
7	216	2·95	146·9	18	479	4·36	168·4	29			
8	225	2·96	148·8	19	500	4·71	171·3	30			
9	228	3·13	148·3	20	510	4·72	171·1	31			
10	230	3·13	148·4	21	513	4·71	171·3	32			

DIRECTIONAL SURVEY

ROKE OIL ENTERPRISES LIMITED

COMPANY: PACIFIC PETROLEUMS | GRID | DATE SURVEYED 18 SEPT 1977

DRILL HOLE MUD-77-4 | LATITUDE | SURVEY BY SCRIBNER

LOCATION MONKMAN COAL PROJECT | DEPARTURE | WITNESSED BY SMITH

FIELD DUCHESS MOUNTAIN | ELEVATION | CALCULATIONS BY

MAGNETIC DECLINATION | CORRECTION OF | FOR GRID

Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing
0	00	0.19		11	450	0.97	249.7	22	800	1.13	258.9
1	50	0.75	241.9	12	460	0.98	247.4	23	840	1.12	256.8
2	105	0.77	238.7	13	500	0.97	255.4	24	860	0.94	255.5
3	150	0.77	232.2	14	515	0.97	252.5	25	882	1.12	250.6
4	200	0.97	241.2	15	550	0.97	253.4	26	900	1.12	250.0
5	256	0.79	239.6	16	600	0.96	258.3	27	950	0.94	245.2
6	305	0.80	237.4	17	650	0.97	256.3	28	1000	1.13	245.6
7	325	0.97	238.1	18	685	1.13	256.8	29	1050	1.50	235.6
8	360	0.97	245.2	19	700	1.13	260.8	30	1100	1.85	240.2
9	380	0.97	247.2	20	725	1.14	259.9	31	1150	1.86	242.8
10	400	0.98	245.3	21	750	.95	259.4	32	1200	1.66	241.7
									1250	1.68	238.9

DIRECTIONAL SURVEY

ROKE OIL ENTERPRISES LIMITED

COMPANY: PACIFIC PETROLEUMS LTD GRID _____ DATE SURVEYED 16 SEPT 1977

DRILL HOLE MUD-77-5 LATITUDE _____ SURVEY BY SCRIBNER

LOCATION MONKMAN COAL PROJECT DEPARTURE _____ WITNESSED BY SMITH

FIELD DUCHESS MOUNTAIN ELEVATION _____ CALCULATIONS BY _____

MAGNETIC DECLINATION _____ CORRECTION OF _____ FOR _____ GRID _____

Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing
0	00	19.00		11	500	17.60	180.9	22	950	15.54	183.4
1	50	18.62	345.0	12	525	17.56	181.3	23	962	15.39	181.9
2	100	17.98	182.0	13	535	17.53	181.7	24			
3	150	17.65	181.7	14	550	17.53	181.7	25			
4	200	17.55	181.5	15	600	17.52	181.1	26			
5	250	17.61	181.6	16	650	16.81	182.3	27			
6	300	17.90	181.0	17	700	16.80	181.7	28			
7	350	17.61	180.1	18	750	16.48	181.5	29			
8	400	17.54	182.5	19	800	16.26	181.8	30			
9	425	17.61	180.7	20	850	16.08	182.6	31			
10	450	17.54	180.7	21	900	15.58	183.2	32			

DIRECTIONAL SURVEY-

ROKE OIL ENTERPRISES LIMITED

COMPANY: PACIFIC PETROLEUMS LTD GRID _____ DATE SURVEYED 19 SEPT 1977

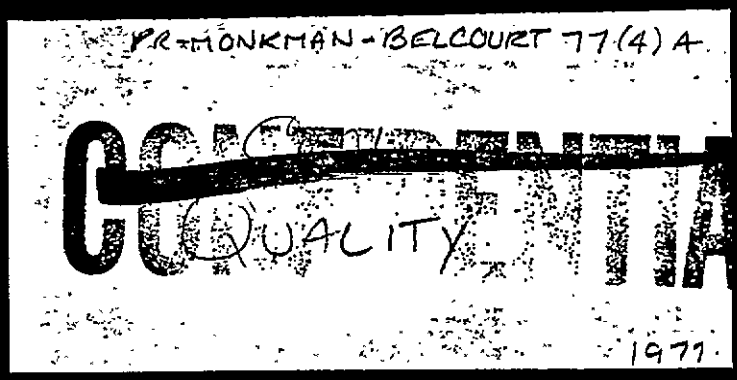
DRILL HOLE MDD-77-7 LATITUDE _____ SURVEY BY SCRIBNER

LOCATION MONKMAN COAL PROJECT DEPARTURE _____ WITNESSED BY SMITH

FIELD DUKE MOUNTAIN ELEVATION _____ CALCULATIONS BY _____

MAGNETIC DECLINATION _____ CORRECTION OF _____ FOR _____ GRID _____

Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing	Number	Cable Depth	Slant Angle	Slant Angle Bearing
0	00	.11		11	230	.60	200.4	22	500	1.68	239.0
1	50	.24	167.5	12	235	.60	191.9	23	520	1.86	232.6
2	100	.26	176.9	13	240	.64	192.5	24	550	2.05	234.3
3	110	.21	182.2	14	283	.61	202.1	25	568	2.04	238.3
4	150	.25	180.1	15	295	.60	207.6	26	577	2.04	238.5
5	160	.25	184.3	16	300	.78	205.4	27	600	1.96	231.0
6	175	.24	181.7	17	350	.98	213.1	28	615	2.04	233.9
7	185	.25	177.0	18	400	.96	211.6	29	625	2.21	232.8
8	195	.24	174.8	19	430	.96	219.3	30	650	2.39	236.4
9	200	.23	188.7	20	450	1.14	216.1	31	670	2.57	239.5
10	225	.24	189.0	21	465	1.13	225.7	32			



542

GEOLOGICAL BRANCH 77(4)
ASSESSMENT REPORT 19

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COAL QUALITY

General Statement

The analytical program was planned to make use of two laboratories, Lab. 1 to do the proximate analyses, sulphur, calorific value and FSI on the individual raw coal samples and to handle the washability tests on the composite samples. In addition, Lab. 2 was to run Gieseler plastometer and Ruhr dilatometer tests on the clean coal products from selected washed samples.

In actual practice, delays at Lab. 2 were such that the samples urgently required for early determination of the optimum specific gravity for washing were returned to Lab. 1 and the work carried out there. The remainder of the washability work was shared between the two laboratories.

It was understood that both laboratories were using a method of froth flotation which they had agreed upon the previous year. However, Lab. 1 continued to use two-stage reverse froth flotation while Lab. 2 reverted to standard two-stage froth flotation. The result was that the latter's flotation products report fairly consistently a little dirtier. The results from Lab. 1 can be identified by the letter "C" above the product analysis in Tables 8 to 15. Lab. 2's results can be identified by the letter "A".

Gieseler and Ruhr results also were delayed at Lab. 2, and some of the samples were over two months old before the tests were run. However, it was observed by the petrographic firm, which handled many of the same samples at the same time, that there was no significant oxidation.

Analytical Program

Samples were shipped weekly for proximate analysis and sulphur, calorific value and FSI determinations. As soon as results became available, suitable composite samples were selected and washability tests performed on them. The first seven such samples to become available were subjected to a full program of washability tests:

(a) Wet Screen at 28 mesh
(b) Sink-Float +28 mesh fraction at 1.3, 1.4, 1.5, 1.6 and 1.7 s.g.
(c) Froth Flotation -28 mesh fraction at 180, 135, 90 and 45 secs. (reverse two-stage)

From these tests a standard specific gravity of 1.6 was chosen for the remainder of the composite samples. It was also decided that the froth flotation would be standardised at 180 secs. The standards were set with a view to maximising clean coal recovery without exceeding 9% ash.

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On a few of the clean coal samples, phosphorus content was determined.

The results are summarised by seam in Tables 8 to 15. It can be seen that the Gates coals contain between 13% and 35% ash, the two major seams, B3 and B4, containing 21% and 26% ash respectively, on the basis of three or four holes. Washability varies over a wide range, from 57% recovery in the case of the dirtiest intersection to 82% in the case of the cleanest. It is expected that an average washability of at least 70% can be achieved for the deposit as a whole, for a product with less than 9% ash.

Free swelling indices of the clean coal products are in the 5½ - 7½ range for all the Gates seams apart from the uppermost pair, B9 and B10. B9's range (3-5½) is reflected in the dilatometer results, reported below.

Sulphur content of the washed coal is very low, the major seam, B4, containing about 0.25%. Phosphorus pentoxide content is insignificant at less than 0.2%.

Rheological Properties

Eleven samples of clean coal product were tested in the Ruhr Dilatometer and ten of these also in the Gieseler Plastometer. The eleventh sample was rejected because it had been crushed too fine for use in the plastometer.

The plastometer results indicate that the coal has the low plasticity to be expected in western Canadian coals. (Table 16)

The dilatometer results parallel the plastometer results and demonstrate that the uppermost seams, B9 and B10, show no dilatation.

Beside the observed dilatometer results are recorded "G Factors". The G Factor is a European measure of caking capacity, calculated from the co-ordinates of the plastic zone curve recorded by the dilatometer. In the European experience, most medium and strongly coking coals have G values in the range 0.95 - 1.15 (Gibson, 1971), and exhibit positive dilatation. However, coals below the lower end of this range can be made to coke satisfactorily by application of different heating rates, carbonisation times, etc.

J. Gibson: "Dilatometry and the Prediction of Coke Quality"; The Coke Oven Manager's Yearbook, 1971.

Petrographic Analysis

Fourteen clean coal samples were submitted for petrographic analysis. The samples were selected to cover the stratigraphic section at two locations, Duke Mountain and Duchess Mountain.

The samples were crushed to minus 20 mesh, coned and quartered to produce an 8 gm sample, then pelletised, using a thermo-setting plastic. Fifty reflectance readings were recorded on each pellet. Five hundred maceral readings were done on each of nine pellets. The results are summarised in Table 17, which also includes coke stability calculations. In calculating the Coke Stability Factor, the following standard figures were used: Ash 8%, Sulphur 0.40%.

The reflectance study showed steadily increasing reflectances with stratigraphic depth, with a small variation in ranges between Duke Mountain and Duchess Mountain, the former ranging from 1.19 in Seam B10 to 1.34 in Seam B1 and the latter from 1.12 in Seam B9 to 1.26 in Seam B1.

From the petrographic results alone, it would appear that all the Gates coals are capable of producing satisfactory cokes. (In the one instance where the Calculated Coke Stability Factor and the JIS Drum Index are out of line with the other figures, it is strongly suspected that the sample was contaminated.)

M.O.F. Diagram - Suitability for Japanese Market

The major Gates seams (B3 and B4) fall in Quadrant IV of the M.O.F. Diagram (Fig. 28), occupying a range below Fording's major seams and the Japanese optimum blend.

Seam B1, with a relatively high fluidity and moderately high reflectance, falls into Quadrant I with the American medium volatile coals.

The other major seam, B9, occupies a position straddling the boundary between Quadrants III and IV, intermediate between the Kootenay and the Australian medium volatile coals.

The net result of blending these coals in the proportions available at Monkman will no doubt be a product somewhat lower in reflectance than the Kootenay coals and with somewhat more fluidity but still falling into Quadrant IV.

There remains the possibility of adding Gething coal to the blend. Through some breakdown in communication with the laboratory it was not possible to have the single sample of Gething coal tested.

MONKMAN COAL PROJECT

Summary of Analytical Data - SEAM A2

TABLE 8

Source of Sample	77-3								
Interval (m) : from	66.2								
to	69.1								
True Seam Thickness (m)	2.73								
Core Recovery %	80.3								
True Sample Width (m)	2.19								
Weighted Average Analysis Raw Coal (Air Dried Basis) :									
Moisture %	0.53								
Ash %	11.59								
Volatiles %	19.51								
Fixed Carbon %	68.37								
FSI	4								
Sulphur %	0.40								
Calorific Value (kJ/kg)	31,347								
Screen Analysis									
¼ x 28 mesh Wt %	56.69								
- 28 mesh Wt %	43.31								
Flotation of + 28 mesh portion at 1.6 S.G. Rec %	86.70								
Analysis of washed + 28 mesh product :									
Moisture (a.d.) %	0.55								
Ash %	7.32								
Volatiles %	19.93								
Fixed Carbon %	72.20								
FSI	2½-8½								
Sulphur %	0.35								
P_2O_5 %	ND								
Froth flotation of - 28 mesh portion Rec %	57.12								
Analysis of froth product:									
Moisture (a.d.)	0.46								
Ash %	6.56								
Volatiles %	21.21								
Fixed Carbon %	71.77								
FSI	7								
Sulphur %	0.34								
P_2O_5 %	ND								
Analysis of total clean coal product *	C								
Moisture (a.d.) %	0.52								
Ash %	7.07								
Volatiles %	20.36								
Fixed Carbon %	72.05								
FSI	4½								
Sulphur %	0.35								
P_2O_5 %	ND								
Recovery of clean coal %	73.89								

* Actual analyses of product shown by "A", weighted average analyses of +28 mesh and -28 mesh components by "C".

MONKMAN COAL PROJECT

Summary of Analytical Data - SEAM B1

TABLE 9

Source of Sample	77-2B	77-7	77-4						
Interval (m) : from	250.6	187.9	264.8						
to	253.7	191.1	267.3						
True Seam Thickness (m)	3.21	2.80	2.66						
Core Recovery %	90.7	97.6	90.9						
True Sample Width (m)	2.91	2.73	2.42						
Weighted Average Analysis Raw Coal (Air Dried Basis) :			(upper only)						
Moisture %	0.48	0.57	0.60						
Ash %	34.11	32.59	8.88						
Volatiles %	18.10	18.29	23.37						
Fixed Carbon %	47.31	48.55	67.15						
FSI	1-7½	0-8	7						
Sulphur %	0.36	0.38	0.40						
Calorific Value (kJ/kg)	23,113	19,790	32,648						
Screen Analysis ¼ x 28 mesh Wt %	71.02	78.9	66.46						
- 28 mesh Wt %	28.98	21.1	33.54						
Flotation of + 28 mesh portion at 1.6 S.G. Rec %	52.52	61.9	94.08						
Analysis of washed + 28 mesh product :									
Moisture (a.d.) %	0.38	0.5	0.52						
Ash %	6.82	8.2	6.83						
Volatiles %	23.81	ND	22.92						
Fixed Carbon %	68.99	ND	69.73						
FSI	5½	7½	6-8½						
Sulphur %	0.45	ND	0.32						
P_2O_5 %									
Froth flotation of - 28 mesh portion Rec %	67.53	82.2	64.16						
Analysis of froth product: Moisture (a.d.)	0.57	0.5	0.26						
Ash %	9.18	12.8	6.49						
Volatiles %	23.81	ND	24.71						
Fixed Carbon %	66.44	ND	68.54						
FSI	7	1-8	8						
Sulphur %	0.47	ND	0.31						
P_2O_5 %									
Analysis of total clean coal product *	C	A	C						
Moisture (a.d.) %	0.45	0.5	0.45						
Ash %	7.63	9.0	6.74						
Volatiles %	23.81	21.5	23.38						
Fixed Carbon %	68.11	69.0	69.43						
FSI	5½-7	7½	7½						
Sulphur %	0.46	0.54	0.32						
P_2O_5 %	ND	0.07	ND						
Recovery of clean coal %	56.87	66.2	84.0						

* Actual analyses of product shown by "A", weighted average analyses of +28 mesh and -28 mesh components by "C".

MONKMAN COAL PROJECT
Summary of Analytical Data - SEAM B3

TABLE 10

Source of Sample	77-2B	77-7	77-8						
Interval (m) : from	209.4	152.7	87.9						
to	214.5	158.8	93.5						
True Seam Thickness (m)	4.85	5.86	4.81						
Core Recovery %	95.0	98.4	96.6						
True Sample Width (m)	4.61	5.77	4.65						
Weighted Average Analysis Raw Coal (Air Dried Basis) :									
Moisture %	0.84	0.60	0.81						
Ash %	27.36	29.26	20.58						
Volatiles %	18.82	18.42	19.70						
Fixed Carbon %	52.98	51.71	58.91						
FSI	5	0-9	0-7						
Sulphur %	0.40	0.39	0.46						
Calorific Value (kJ/kg)	24,487	24,539	27,625						
Screen Analysis									
¼ x 28 mesh Wt %	65.79	77.2	89.4						
- 28 mesh Wt %	34.21	22.8	10.6						
Flotation of + 28 mesh portion at 1.6 S.G. Rec %	65.31	58.1	78.06						
Analysis of washed + 28 mesh product :									
Moisture (a.d.) %	0.36	0.5	0.45						
Ash %	6.17	6.3	6.86						
Volatiles %	22.75	ND	22.57						
Fixed Carbon %	70.72	ND	70.12						
FSI	4½+	6½	7						
Sulphur %	0.39	ND	0.45						
P_2O_5 %	ND	ND	0.07						
Froth flotation of - 28 mesh portion Rec %	68.30	78.8	79.14						
Analysis of froth product:									
Moisture (a.d.)	0.30	0.5	0.28						
Ash %	8.29	14.4	7.59						
Volatiles %	23.49	ND	22.84						
Fixed Carbon %	67.92	ND	69.29						
FSI	8	1-7½	7						
Sulphur %	0.42	ND	0.47						
P_2O_5 %	ND	ND	0.07						
Analysis of total clean coal product *	C	A	C						
Moisture (a.d.) %	0.34	0.6	0.43						
Ash %	6.92	8.3	6.94						
Volatiles %	23.01	21.6	22.60						
Fixed Carbon %	69.73	69.5	70.03						
FSI	6½	7	7						
Sulphur %	0.40	0.37	0.45						
P_2O_5 %	ND	0.03	0.07						
Recovery of clean coal %	66.33	62.8	78.17						

* Actual analyses of product shown by "A", weighted average analyses of +28 mesh and -28 mesh components by "C".

MONKMAN COAL PROJECT
Summary of Analytical Data - SEAM B4

TABLE 11

Source of Sample	77-28	77-7	77-8	77-4					
Interval (m) : from	195.9	132.2	60.4	199.0					
to	203.3	141.0	69.0	203.3					
True Seam Thickness (m)	7.99	8.28	8.02	5.25					
Core Recovery %	86.9	99.1	93.0	65.2					
True Sample Width (m)	6.94	8.21	7.45	3.42					
Weighted Average Analysis Raw Coal (Air Dried Basis) :									
Moisture %	0.43	0.52	0.83	0.77					
Ash %	13.83	22.58	22.97	27.78					
Volatiles %	23.44	20.76	19.86	20.89					
Fixed Carbon %	62.30	56.14	56.34	50.56					
FSI	1½-8½	0-8½	0-7½	5					
Sulphur %	0.20	0.21	0.23	0.20					
Calorific Value (kJ/kg)	30,195	26,680	26,608	24,784					
Screen Analysis ¼ x 28 mesh Wt %	72.0	69.0	89.66	69.17					
- 28 mesh Wt %	28.0	31.0	10.34	30.83					
Flotation of + 28 mesh portion at 1.6 S.G. Rec %	84.31	72.3	77.74	62.11					
Analysis of washed + 28 mesh product :									
Moisture (a.d.) %	0.34	0.50	0.61	0.63					
Ash %	7.33	8.4	9.93	9.60					
Volatiles %	23.38	ND	21.83	23.38					
Fixed Carbon %	68.95	ND	67.63	66.39					
FSI	1-9	6	5½	3½-9					
Sulphur %	0.22	ND	0.25	0.30					
P_2O_5 %	0.14	ND	0.14	ND					
Froth flotation of - 28 mesh portion Rec %	75.49	90.8	79.73	78.94					
Analysis of froth product: Moisture (a.d.)	0.53	0.7	0.70	0.52					
Ash %	6.03	10.9	13.48	10.49					
Volatiles %	24.59	ND	21.72	24.54					
Fixed Carbon %	68.85	ND	64.10	64.45					
FSI	8½	1-7	5½	7					
Sulphur %	0.23	ND	0.28	0.23					
P_2O_5 %	0.13	ND	0.18	ND					
Analysis of total clean coal product *	C	A	C	C					
Moisture (a.d.) %	0.39	0.6	0.62	0.59					
Ash %	6.99	9.4	10.31	9.92					
Volatiles %	23.69	22.0	21.82	23.80					
Fixed Carbon %	68.93	68.0	67.25	65.69					
FSI	7½	6	5½	6½					
Sulphur %	0.22	0.22	0.25	0.27					
P_2O_5 %	0.14	0.10	0.14	ND					
Recovery of clean coal %	81.84	78.1	77.94	67.30					

* Actual analyses of product shown by "A", weighted average analyses of +28 mesh and -28 mesh components by "C".

MONKMAN COAL PROJECT
Summary of Analytical Data - SEAM B6

TABLE 12

Source of Sample	77-4	77-5	77-7						
Interval (m) : from	138.37	163.21	69.49						
to	139.29	166.37	70.14						
True Seam Thickness (m)	0.89	2.89	0.62						
Core Recovery %	100	100	91						
True Sample Width (m)	0.89	2.89	0.56						
Weighted Average Analysis Raw Coal (Air Dried Basis) :									
Moisture %	0.49	0.84	0.50						
Ash %	4.08	30.63	40.05						
Volatiles %	27.12	21.78	19.02						
Fixed Carbon %	68.31	46.75	40.43						
FSI	7	3-6	5						
Sulphur %	0.92	0.42	0.45						
Calorific Value (kJ/kg)	34,292	23,314	19,529						
Screen Analysis									
¼ x 28 mesh Wt %		85.6							
- 28 mesh Wt %		14.4							
Flotation of + 28 mesh portion at 1.6 S.G. Rec %		63.2							
Analysis of washed + 28 mesh product :									
Moisture (a.d.) %		0.7							
Ash %		5.9							
Volatiles %									
Fixed Carbon %									
FSI		7½							
Sulphur %									
P_2O_5 %	0.5		0.5						
Froth flotation of - 28 mesh portion Rec %	0 A	83.5	0 A						
Analysis of froth product: Moisture (a.d.)		0.7							
Ash %		13.3							
Volatiles %	1		1						
Fixed Carbon %	0 2		0 2						
FSI		1-6½							
Sulphur %									
P_2O_5 %									
Analysis of total clean coal product *									
Moisture (a.d.) %		0.7							
Ash %		6.5							
Volatiles %		26.0							
Fixed Carbon %		66.8							
FSI		7							
Sulphur %		0.56							
P_2O_5 %									
Recovery of clean coal %		66.1							

* Actual analyses of product shown by "A", weighted average analyses of +28 mesh and -28 mesh components by "C".

MONKMAN COAL PROJECT
Summary of Analytical Data - SEAM B7

TABLE 13

Source of Sample	77-2	77-7							
Interval (m) : from	109.4	55.2							
to	110.6	58.7							
True Seam Thickness (m)	1.13	3.33							
Core Recovery %	99	85.5							
True Sample Width (m)	1.12	2.85							
Weighted Average Analysis Raw Coal (Air Dried Basis) :									
Moisture %	0.60	0.64							
Ash %	20.52	59.58							
Volatiles %	22.14	15.33							
Fixed Carbon %	56.74	24.45							
FSI	7½	0-6							
Sulphur %	0.78	0.33							
Calorific Value (kJ/kg)	27,928	11,497							
Screen Analysis ¼ x 28 mesh Wt %	59.7								
- 28 mesh Wt %	40.3								
Flotation of + 28 mesh portion at 1.6 S.G. Rec %	65.5								
Analysis of washed + 28 mesh product :									
Moisture (a.d.) %	0.5								
Ash %	5.3								
Volatiles %	ND								
Fixed Carbon %	ND								
FSI	8½								
Sulphur %	ND								
P_2O_5 %	ND	W							
		7							
Froth flotation of - 28 mesh portion Rec %		0							
Analysis of froth product:		A							
Moisture (a.d.)	0.5								
Ash %	8.9								
Volatiles %	ND								
Fixed Carbon %	ND	1							
FSI	1-8½	0							
Sulphur %	ND								
P_2O_5 %	ND	2							
Analysis of total clean coal product *	A								
Moisture (a.d.) %	0.6								
Ash %	6.6								
Volatiles %	26.9								
Fixed Carbon %	65.9								
FSI	8½								
Sulphur %	0.72								
P_2O_5 %	0.17								
Recovery of clean coal %	75.2								

* Actual analyses of product shown by "A", weighted average analyses of +28 mesh and -28 mesh components by "C".

MONKMAN COAL PROJECT
Summary of Analytical Data - SEAM B9

TABLE 14

Source of Sample	77-28	77-2	77-2A	77-7	77-5	77-4			
Interval (m) : from	78.7	77.0	76.3	30.9	127.5	93.8			
to	81.7	79.9	79.0	33.8	133.2	99.5			
True Seam Thickness (m)	2.67	2.67	2.50	2.65	5.58	5.49			
Core Recovery %	100	100	100	97.9	96.8	100			
True Sample Width (m)	2.67	2.67	2.50	2.59	5.40	5.49			
Weighted Average Analysis Raw Coal (Air Dried Basis) :									
Moisture %		0.68	0.56	0.61	1.00	0.95			
Ash %		21.06	20.21	21.62	12.95	18.18			
Volatiles %		20.24	21.51	20.98	24.03	22.32			
Fixed Carbon %		58.02	57.72	56.79	62.02	58.55			
FSI		2-7½	1½-7½	5-6	2-3½	3½			
Sulphur %		0.38	0.36	0.37	0.29	0.34			
Calorific Value (kJ/kg)		27,306	27,619	27,510	29,580	28,025			
Hardgrove Index		74							
Screen Analysis ¼ x 28 mesh Wt %		79.0	70.30	78.8		69.20			
- 28 mesh Wt %		21.0	29.70	17.9		30.80			
Flotation of + 28 mesh portion at 1.6 S.G. Rec %		72.6	74.44	72.8		77.05			
Analysis of washed + 28 mesh product :									
Moisture (a.d.) %		0.5	0.44	0.5		0.75			
Ash %		8.9	7.92	8.7		7.53			
Volatiles %		ND	23.26	ND		23.76			
Fixed Carbon %		ND	68.38	ND		67.96			
FSI		5	1-9	3½		2-6½			
Sulphur %		ND	0.40	ND		0.36			
P_2O_5 %			0.09			ND			
Froth flotation of - 28 mesh portion Rec %		86.2	92.05	90.6		68.93			
Analysis of froth product: Moisture (a.d.)		0.5	0.62	0.5		0.60			
Ash %		11.8	9.35	12.3		7.90			
Volatiles %		ND	23.23	ND		24.59			
Fixed Carbon %		ND	66.80	ND		66.91			
FSI		1½-5	6-7½	1-5½		5-7			
Sulphur %		ND	0.40	ND		0.33			
P_2O_5 %			0.10			ND			
Analysis of total clean coal product *		A	C	A		C			
Moisture (a.d.) %		0.7	0.50	0.6		0.71			
Ash %		10.9	8.41	8.9		7.63			
Volatiles %		22.1	23.25	21.8		24.00			
Fixed Carbon %		66.3	67.84	68.7		67.66			
FSI		5	5½	3		4½			
Sulphur %		0.45	0.40	0.44		0.35			
P_2O_5 %		0.12	0.09	0.17		ND			
Recovery of clean coal %		75.5	79.67	76.6		74.55			

* Actual analyses of product shown by "A", weighted average analyses of +28 mesh and -28 mesh components by "C".

MONKMAN COAL PROJECT
Summary of Analytical Data - SEAM B10

TABLE 15

Source of Sample	77-7	77-28							
Interval (m) : from	10.27	60.05							
to	12.03	61.40							
True Seam Thickness (m)	1.66	1.35							
Core Recovery %	93	100							
True Sample Width (m)	1.55	1.24							
Weighted Average Analysis Raw Coal (Air Dried Basis) :									
Moisture %	0.62	1.06							
Ash %	32.35	35.76							
Volatiles %	18.56	17.46							
Fixed Carbon %	48.47	45.72							
FSI	1½-2½	1½							
Sulphur %	0.53	0.57							
Calorific Value (kJ/kg)	23,386	21,329							
Screen Analysis ¼ x 28 mesh Wt %	78.0								
- 28 mesh Wt %	22.0								
Flotation of + 28 mesh portion at 1.6 S.G. Rec %	58.9								
Analysis of washed + 28 mesh product :									
Moisture (a.d.) %	0.5								
Ash %	12.8								
Volatiles %									
Fixed Carbon %									
FSI	3½								
Sulphur %									
P_2O_5 %									
Froth flotation of - 28 mesh portion Rec %	79.7	2 5 0							
Analysis of froth product: Moisture (a.d.)	0.6	A							
Ash %	14.3								
Volatiles %									
Fixed Carbon %									
FSI	1-4	1							
Sulphur %		0							
P_2O_5 %		2							
Analysis of total clean coal product *	A								
Moisture (a.d.) %	0.6								
Ash %	12.9								
Volatiles %	21.5								
Fixed Carbon %	65.0								
FSI	3½								
Sulphur %	0.62								
P_2O_5 %									
Recovery of clean coal %	63.4								

* Actual analyses of product shown by "A", weighted average analyses of +28 mesh and -28 mesh components by "C".

Source of Sample	Gieseler Plasticity							Ruhr Dilatometer						
	Start °C	DDPM	Maximum °C	DDPM	Final °C	DDPM	Rge. °C	Start °C	Soft °C	Max. Dil. °C	Contr. %	Dil. %	G Factor	FSI
Seam B10 77-7	432	1	456	5	477	1	45	350	392	(468)	22	Nil	-	3½
Seam B9 77-2	432	1	459	5	483	1	51	340	395	NR	22	Nil	-	5
77-4	444	1	455	2	471	1	27	360	400	(466)	17	Nil	-	4½
77-5	450	1	456	1	465	1	15	340	405	(481)	20	Nil	-	1
77-7	432	1	459	6	483	1	51	350	397	(471)	24	Nil	-	3
Seam B6 77-5	411	1	456	55	483	1	72	340	380	475	28	32	1.007	7
Seam B4 77-2	ND	ND	ND	ND	ND	ND	ND	350	390	481	28	15	0.969	7½
77-4	423	1	468	36	495	1	72	360	394	477	24	-7	0.845	6½
77-7	429	1	462	11	486	1	57	340	396	487	26	-13	0.764	6
Seam B3 77-7	429	1	468	27	495	1	66	360	400	491	27	-1	0.901	7
Seam B1 77-7	414	1	465	298	504	1	90	360	385	468	29	44	1.020	7½

TABLE 16

SUMMARY OF RHEOLOGICAL DATA

	Mean Maximum Reflectance	Vitrinite	Exinite	Semifusinite	Macrinite	Micrinite	Fusinite	Mineral Matter	% Total Reactives	% Total Inerts	CBI	Strength Index	Coke Stability Factor	JIS Drum Index
Seam B10														
77-7	1.1910	44.44	2.05	22.95	9.79	3.51	9.79	7.46	55.93	44.07	2.26	4.27	42	90
Seam B9														
77-4	1.1296	47.62	3.43	26.29	8.19	2.48	9.14	2.86	58.84	41.16	1.93	4.17	45	90
77-5	1.1236	34.93	6.32	25.75	10.69	4.22	13.86	4.22	49.74	50.26	2.68	3.66	26	85
77-7	1.2180	47.33	0.09	23.04	9.46	2.33	10.42	6.44	57.19	42.81	2.37	4.34	42	90
77-2	1.2016													
Seam B6														
77-5	1.1356	57.41	4.37	13.49	8.17	2.28	11.02	3.32	65.48	34.52	1.40	4.24	53	92
77-4	1.1698													
Seam B5														
77-4	1.1984													
Seam B4														
77-4	1.1982	51.31	2.79	21.45	8.58	1.49	10.26	4.10	61.07	38.93	1.86	4.40	50	92
77-7	1.2660	49.09	0.06	23.56	8.21	3.65	11.70	3.19	56.81	43.19	2.65	4.39	41	90
Seam B3														
77-7	1.3158	52.71	0.02	7.92	7.08	5.00	11.04	6.04	59.90	40.10	1.97	5.42	56	92
77-4	1.2436													
Seam B1														
77-7	1.3480	51.44	Nil	17.49	8.82	7.98	8.99	5.26	57.80	42.20	2.94	5.54	50	92
77-4	1.2602													

TABLE 17

SUMMARY OF PETROGRAPHIC DATA

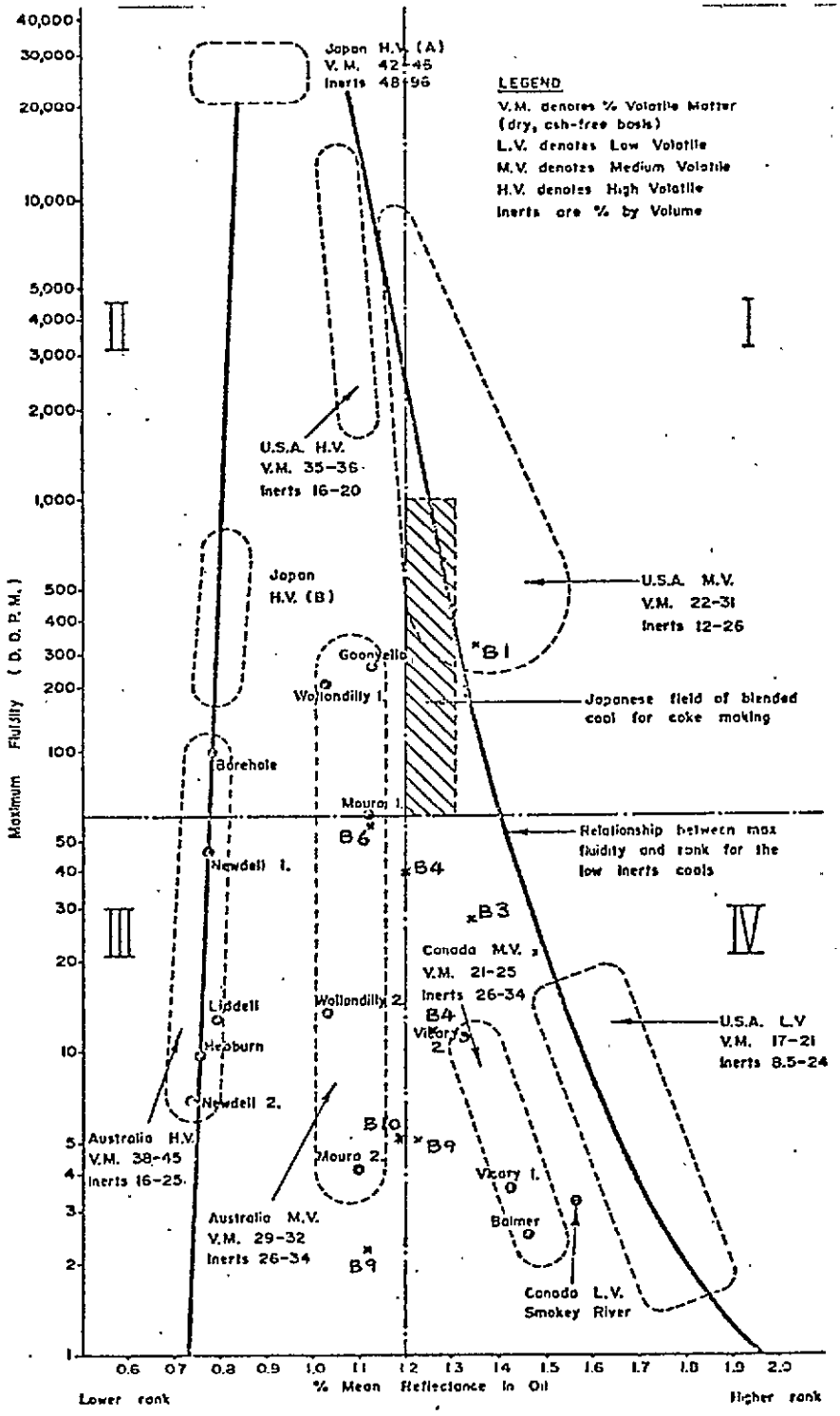


Figure 28

M.O.F. Diagram (after Miyazu)

PR - MONKMAN - BELCOURT 77 (4) B

NOTE: COAL ANALYSIS DATA HAS BEEN TAKEN FROM OPEN FILE 77 (7) B

MONKMAN COAL PROJECT

PROSPECTUS

JANUARY, 1978

CONFIDENTIAL

3. Coal Quality

The western part of the property, including the Wapiti Dip Slope, contains largely high-volatile bituminous coal. The deeper, Gething coal appears to be medium-volatile bituminous.

In the Duke Mountain Block the Gates coals are medium-volatile bituminous and the Gething coals low-volatile bituminous.

A summary of clean coal analyses is presented in Table II.
SEE NEXT PAGE -9-

TABLE II

ANALYSES OF WASHED COAL BY SEAM *

COAL SEAM	THICKNESS (meters)	LAB SCALE RECOVERY %	MOISTURE AIR DRIED %	ASH %	VOLATILE MATTER %	FIXED CARBON %	FSI	SULPHUR %
A2 **	2.7	74	0.5	7.1	20.4	72.1	4½	0.4
B1	2.9	69	0.5	7.8	22.9	68.9	5½ - 7½	0.4
B3	5.2	69	0.5	7.4	22.4	69.8	6½ - 7	0.4
B4	7.4	76	0.6	9.2	22.8	67.5	5½ - 7½	0.2
B6	1.5	66	0.7	6.5	26.0	66.8	7	0.6
B7	2.0	75	0.6	6.6	26.9	65.9	8½	0.7
B9	3.6	76	0.6	7.2	22.8	67.6	3 - 5½	0.4
B10	1.5	63	0.6	12.9	21.5	65.0	3½	0.6

* +28 Mesh Washed in Heavy Media at 1.6 S.G.
-28 Mesh Washed with Froth Flotation

** Gething Coal - remainder are Gates Coal

PR-MONKMAN-BELCOURT 77(7)B

MONKMAN COAL PROJECT

PROSPECTUS

JANUARY, 1978

OPEN FILE

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 542

OUR FILE _____

YOUR FILE _____

ADDRESS YOUR REPLY

TO _____

THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA

Reply to:
Coal Guidelines Steering Committee
c/o E.L.U.C. Secretariat,
Parliament Buildings,
Victoria, B.C.
V8V 1X4

1978-04-05.

MEMORANDUM TO:

All Reviewers - Coal Guidelines Process

Re: Monkman Coal Project Prospectus

I enclose a copy of the Prospectus for the Monkman Coal Project situated south of the Quintette property in the NE Coal Block.

You will note on Figure 5 (page 15) that the developer plans to complete a Stage I analysis for this project by the Spring of 1979. I understand the developer has selected consultants to complete this Stage I analysis and trust that you will co-operate in making all relevant data available to them.

As usual, this Prospectus is being sent to you as an informational item. If you should have any comments, please send them to Ray Crook (6387) who works for the Special Projects Unit, ELUC Secretariat, but presently has his office with the Resource Analysis Branch, Ministry of the Environment.

Thank you for your co-operation.

J. O'Riordan

Jon O'Riordan,
Chairman,
Coal Guidelines Steering Committee.

JO'R/sm
Encl.

cc - J. McDonald
- R. Crook
- B. Gates

PR- MONKMAN - BECCOURT 77(7) B

M O N K M A N P R O S P E C T U S

TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
GEOLOGY	3
CONSTRUCTION PHASE	12
PROPOSED COAL MINING OPERATION	14
INFRASTRUCTURE	21

LIST OF TABLES

		PAGE
1	COAL-BEARING FORMATIONS OF PEACE RIVER COALFIELD	7
2	ANALYSES OF WASHED COAL BY SEAM	10

REFER TO: PR - MONKMAN - BELCOURT 77(4)A CONFIDENTIAL ANALYSIS FILE

LIST OF FIGURES

1	LOCATION MAP	2
2	PROPERTY MAP SHOWING COAL LICENCES	4
3	POTENTIAL MINING AREAS	6
4	DUKE MTN. BLOCK CORRELATION CHART	9
5	CONSTRUCTION SCHEDULE	15
6	TENTATIVE PREPARATION PLANT FLOW DIAGRAM	19
7	REGIONAL MAP	23

I Introduction

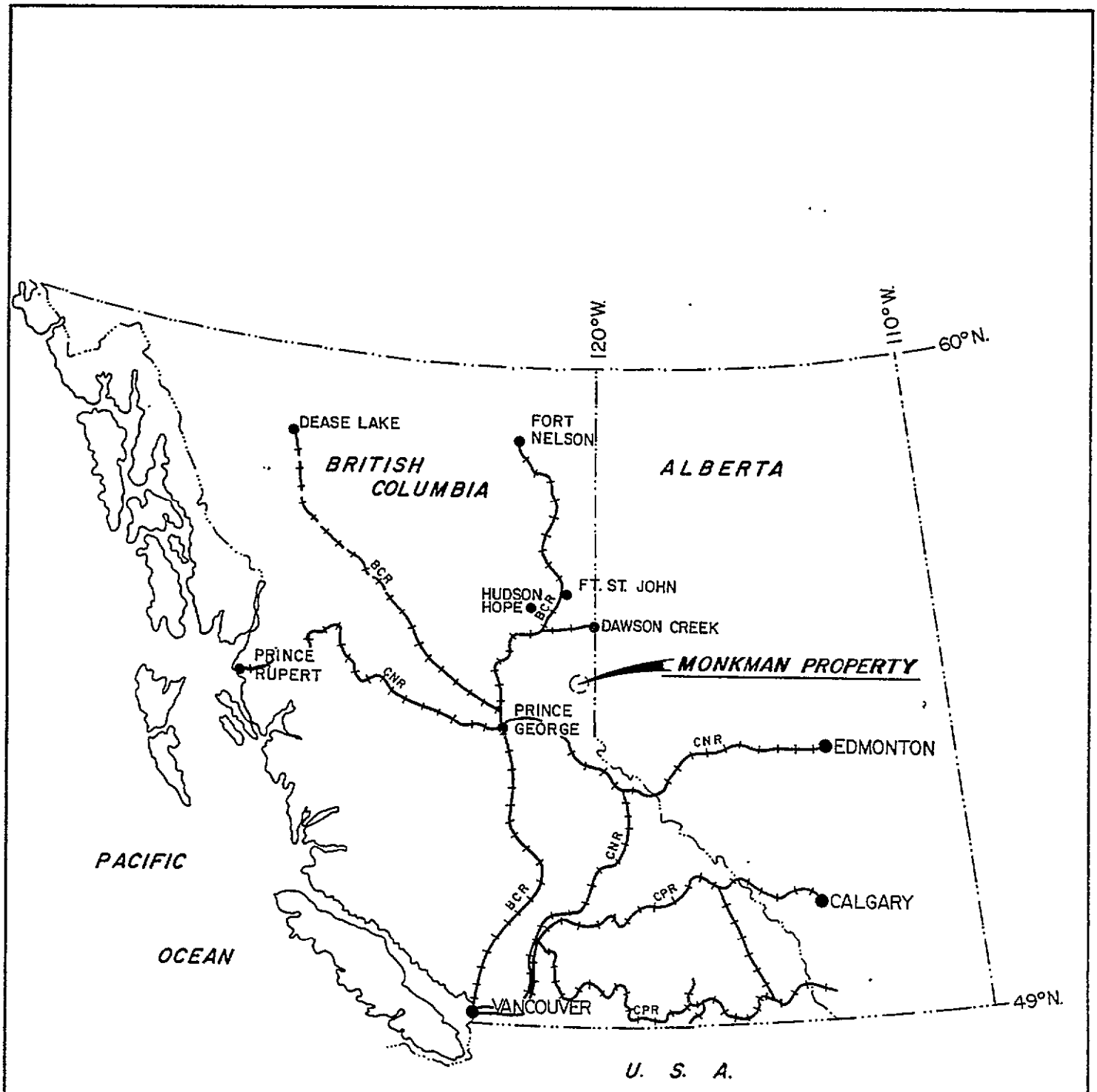
On May 18, 1976, Pacific Petroleums Ltd. acquired an option on the Monkman Coal Property, held jointly by Canadian Superior Exploration Ltd. and McIntyre Mines Limited. Since that time Pacific has been investigating the metallurgical coal potential of this property.

The Monkman Coal Project is located within the designated Northeastern Coal Block. With respect to existing communities, the property is 110 kilometres SSE of Chetwynd and 100 kilometres SSW of Dawson Creek (see figures 1 & 7). Geographically, the centre of the property is at Latitude $54^{\circ}30'$ and Longitude 120° 30'.

The area covered by the property is in the inner foothills of the Rocky Mountains. This area has been subject to prolonged glaciation, and is dissected by many creeks and rivers carrying runoff from the Rocky Mountains into the Prairies.

Since 1970, considerable geological work has been accomplished (Lidgett, 1970; McKelvie, 1973; Dyson, 1975; Smith & Rowe, 1976; Smith, Bienia & Wright, 1977). The work to date suggests that the reserves of coal are substantial and that both open pit and underground mining are applicable.

Initially it is proposed to develop an open pit on the north flank of Duke Mountain, where some 30 million tonnes of medium-volatile bituminous coal are indicated as a result of preliminary drilling.



PR - MONKMAN - BELCOURT - 77(7)13.

PACIFIC PETROLEUMS LTD. MINING DEPARTMENT		
MONKMAN COAL PROJECT	Date	November 1977
	Revised	
	Author	
LOCATION MAP	Drafted	R.P.B.
	Scale	1:10,000,000
	FIGURE 1	

Production is proposed to commence in 1982 at a nominal rate of 600,000 tonnes of clean coal per year, which would increase in stages to 2,000,000 tonnes of clean coal per year by 1985, however, the ultimate scale of magnitude will be determined by economic studies. This production schedule is predicated on a slow recovery from the present depressed world steel demand which implicitly regulates the demand for metallurgical coal. The majority of the coal will be destined for Japan, but other markets will be actively sought.

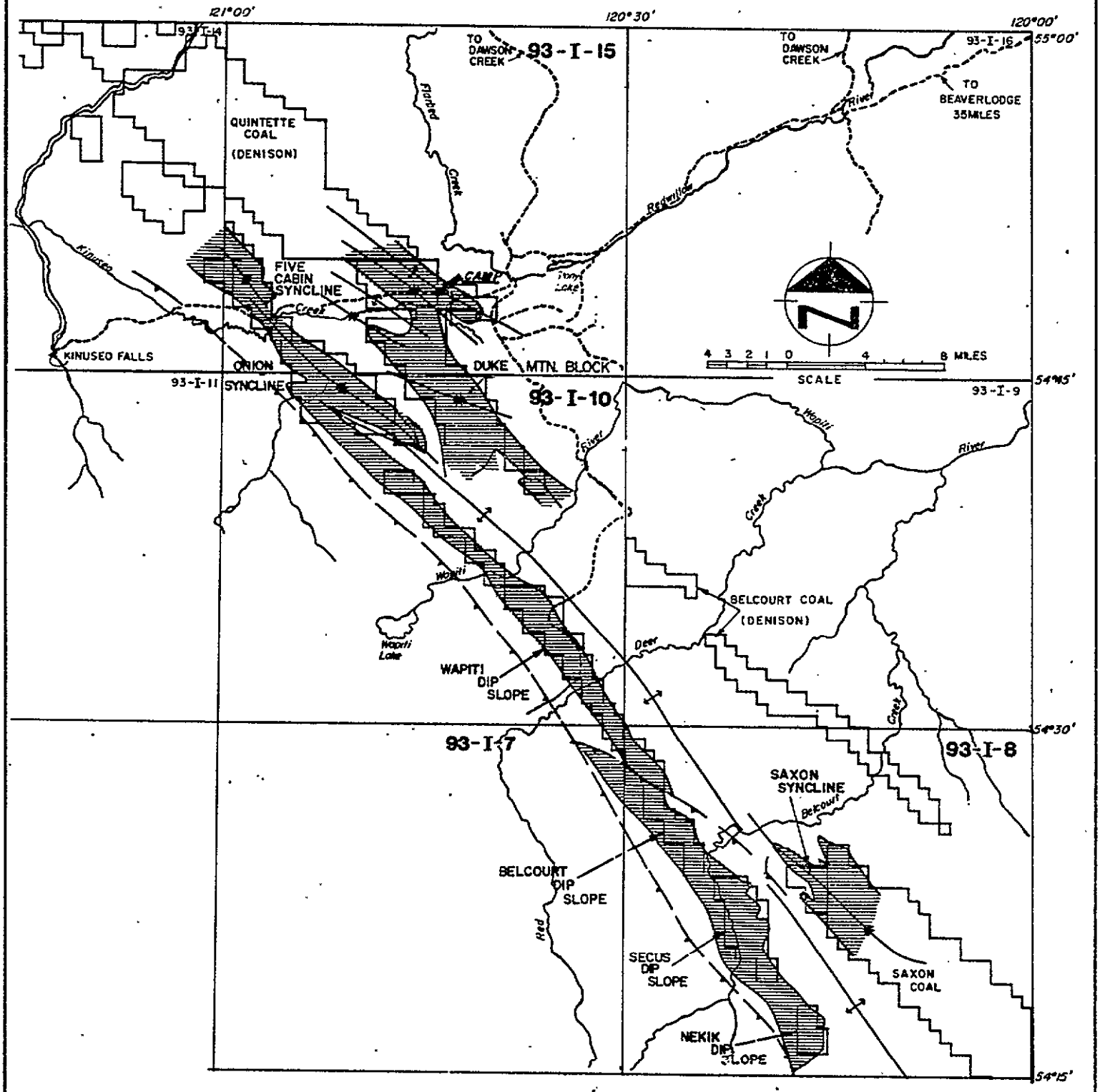
II Geology

A. Coal Licences

The property, licenced from the Province of British Columbia, covers 26,795 hectares (66,211 acres) and stretches in a northwesterly - southeasterly direction some 80 kilometres (see figure 2). The current holders of the coal licences are Canadian Superior Exploration Ltd. and McIntyre Mines Limited. Pacific Petroleums Ltd. is performing work on the property to earn a 50% interest and the right to operate any resulting mining venture.

B. Coal Reserves

The geological assessment of the property has not progressed to the stage of detailed reserve studies at the present time. A preliminary assessment of a promising area on the north flank of Duke Mountain indicated some 30 million tonnes of medium-volatile bituminous



PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

PROPERTY MAP SHOWING COAL LICENCES

Date	December/77
Revised	
Author	AGS
Drafted	RPB
Scale	as shown

FIGURE 2.

coal could be mined by open pit methods. Tentatively, the in-situ coal reserves in the Duke Mountain Block are estimated at 200 million tonnes. On the Wapiti Dip Slope, information is quite sparse, but at least 500 million tonnes of high-volatile bituminous coal are inferred presently. The location of potential reserves is illustrated in figure 3.

C. Geological Summary

1. Geology & Stratigraphy.

The Monkman Property lies within the Foothills belt, to the east of the main ranges of the Rocky Mountains. The rocks in this section of the foothills are typically folded into a series of en echelon northwesterly trending folds cut by south-west dipping strike-thrust faults. The coal-bearing formations are of Lower Cretaceous age (see table 1), the chief being the Gates Member of the Commotion Formation, which ranges in thickness from 295 m to 400 m. Some 80 m below the Gates Member, and separated from it by marine shales, is the Gething Formation which is also coal-bearing. The coal-bearing formations are generally poorly exposed, their location being deduced from the conglomeratic members which outcrop prominently.

The most regular structure on the property, described as the Wapiti Dip Slope, occurs in the westerly band of coal licences. This structure, the west limb of the Wapiti Anticline, stretches for some 40 km, dipping regularly southwestwards at 35° - 45°.

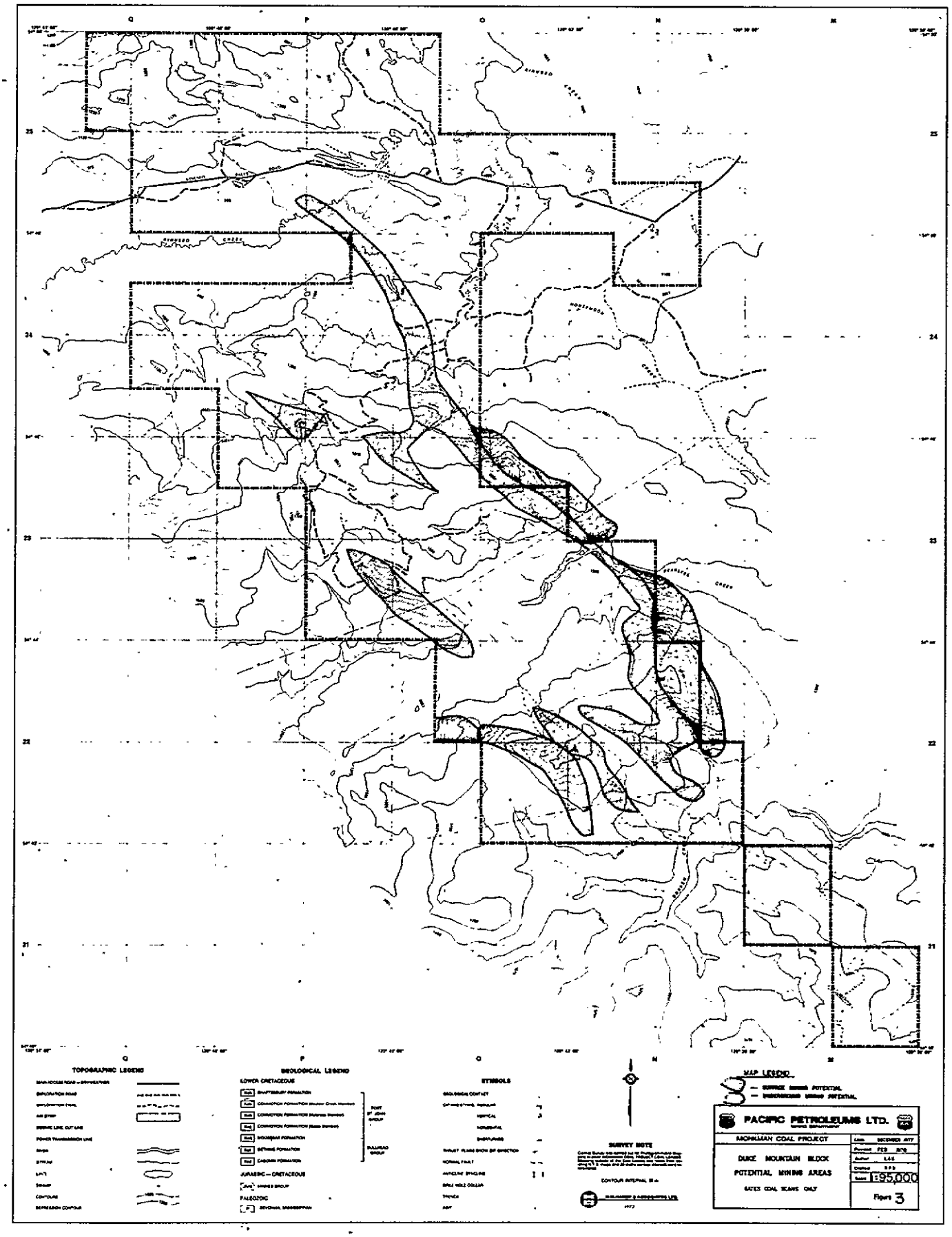

TOPOGRAPHIC LEGEND
GEOLOGICAL LEGEND
LOWER CRETACEOUS
JURASSIC — CRETACEOUS
PALEOZOIC
SYMBOLS
SURVEY NOTE
MAP LEGEND
PACIFIC PETROLEUMS LTD.
MONKMAN COAL PROJECT
DUKE MOUNTAIN BLOCK
POTENTIAL MINING AREAS
GATES COAL SEAMS ONLY
1:95,000
Figure 3

TABLE I - TABLE OF FORMATIONS (after Stott)

Series	Group	Formation		Thickness (metres)	Lithology
Upper and Lower Cretaceous	Fort St. John	Shaftesbury			Dark grey marine shale and silty marine shale with sideritic concretions; sandstone; siltstone; mudstone; minor conglomerate in lower part.
Lower Cretaceous		Commotion	Boulder Creek Member		Fine-grained, well-sorted sandstone; massive conglomerate; non-marine sandstone and mudstone.
			Hulcross Member	65-95	Dark grey marine shale with sideritic concretions.
			Gates Member	295-400	Fine-grained, marine and non-marine sandstones; conglomerate; coal; shale and mudstone.
		Moosebar		40-80	Dark grey marine shale with sideritic concretions; glauconitic sandstone and pebbles at base.
	Bullhead	Gething		30-125	Fine- to coarse-grained, brown, calcareous, carbonaceous sandstone; coal; carbonaceous shale and conglomerate.
		Cadomin		75-200	Massive conglomerate containing chert and quartzite pebbles.
Lower Cretaceous and Earlier	Minnes				Fine-grained sandstone and carbonaceous shale.

The area upon which most work has been conducted is the Duke Mountain Block which, although structurally complex, contains substantial areas of more or less regularly dipping coal-bearing strata. The most interesting area on Duke Mountain has a dip of less than 25°.

2. Coal Seams

On the Wapiti Dip Slope, coal occurs in the Gates Member in five persistent seams which range in thickness from 1.5 m to 6 m. In its best development, based on the results of three drill holes, the Gates Member here contains 16 m of coal in seams greater than 2 m thick. In the Gething Formation, one seam has been observed, 2.9 m thick.

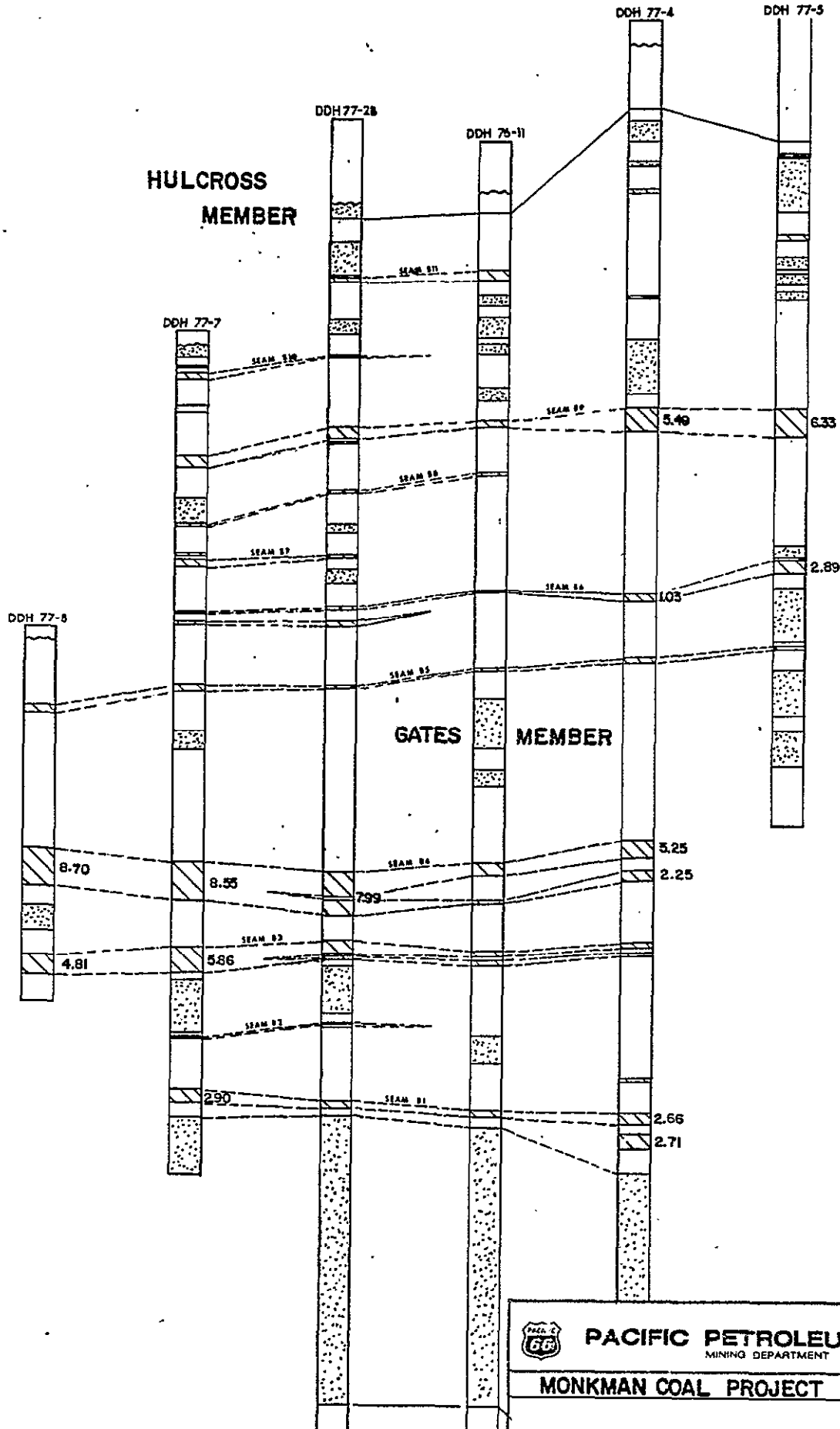
On Duke Mountain, there are four major seams in the Gates Member, for a total of 21 m of coal. The single Gething seam is 2.8 m thick. These seams are illustrated in the columnar sections (figure 4).

3. Coal Quality

The western part of the property, including the Wapiti Dip Slope, contains largely high-volatile bituminous coal. The deeper, Gething coal appears to be medium-volatile bituminous.

In the Duke Mountain Block the Gates coals are medium-volatile bituminous and the Gething coals low-volatile bituminous.

A summary of clean coal analyses is presented in Table II.
REFER TO: PR- MOLKMAN - BELCOURT 77(4)A
CONFIDENTIAL ANALYSIS FILE
page 9.



PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

DUKE MOUNTAIN BLOCK

CORRELATION CHART

Date	December 1977
Revised	
Author	J.Y.W.
Drafted	
Vert. Scale	1:1400

FIGURE 4.

D. Exploration Work

1. Completed Work

Exploration has been conducted on the licences during 1970 and 1973 by McIntyre; in 1975 by Canadian Superior; and in 1976 and 1977 by Pacific. The initial emphasis was on geological mapping. Trenching was also undertaken to expose the full stratigraphic sequence across the rock units of interest (W. D. Lidgett, 1970 and D. L. McKelvie, 1973). The exploration program conducted by Canadian Superior in 1975 was an extension of the work carried out by McIntyre in 1970 and 1973. The program covered the drilling of three HQ-size, diamond drill holes and additional field mapping of surface geology. In 1976 Pacific undertook further geological mapping, completed twelve widely spread, NQ-size, diamond drill holes to gain a knowledge of the number and thickness of the coal seams and conducted analysis and testing of drill-core samples to provide data for the preliminary estimation of coal quality and washability. Three hand trenches were also dug to enhance natural coal exposures. In 1977 Pacific completed eight HQ-size diamond drill holes, and twenty-nine backhoe trenches.

To recapitulate, some twenty-three diamond drill holes, with an aggregate length of 5754.8 metres, 60 kilometres of road and surface mapping have been completed on the property.

2. Proposed Work

A major exploration program will be undertaken in the 1978 field season. Further coal seam delineation on the north flank of Duke Mountain will be accomplished by closely-spaced rotary and diamond drill

holes, thus permitting accurate calculation of coal reserves and preliminary planning for mining. Additional diamond drilling in the Duchess Mountain area and environs will also be conducted to supplement the existing widely-spaced core drilling. Further geological mapping of the Wapiti Dip Slope structure and neighbouring structures is planned but additional drilling will be limited to the most promising areas.

Adit work is planned to permit acquisition of large samples of coal from the mineable coal seams on the north flank of Duke Mountain and the east flank of Duchess Mountain. These samples are required to confirm coal quality and permit pilot plant work to aid in wash plant design. Additional roads will be required for the planned drilling and adit work. These roads will follow regulations and guidelines currently established. Existing roads will not be upgraded with the exception of some remedial work on impassable sections.

Further trenching with a small track-mounted backhoe will also be performed in view of the excellent data acquired by this method during the 1977 exploration program.

Environmental studies will be initiated in co-ordination with the exploration program so that environmental resources can be documented.

III Construction Phase

The construction phase for the Monkman Coal Project will require the accommodation of some 300 to 500 construction workers.

Accommodation will consist primarily of bunkhouses at the minesite but some houses and trailers may be located at the community that Quasar Petroleum Ltd. will establish at its Grizzly Valley Gas Plant, near Thunder Mountain, some 15 kilometres NNE of the mine site. This gas plant will be constructed during 1978 and 1979 and present plans call for it to be operational in 1980. The community that will serve this gas plant is projected to have a population of 30.

The proposed camp facility at the minesite would be equipped with a modern sewage treatment plant. Domestic solid wastes and garbage will be disposed of according to guidelines provided by the Pollution Control Board. The community to be established by Quasar will have facilities for sewer and water as well as garbage disposal, so additional homes and trailers at that community will probably rely on these existing facilities and no major changes or additions are foreseen.

The proposed mine access road will follow the existing forestry road that runs west from Stony Lake to Kinuseo Falls. The present road will be upgraded to secondary highway standards. At Stony Lake this road will connect with the existing road system that Quasar is planning to upgrade during the summer of 1978. This road system will provide all-weather access to both Dawson Creek and Beaverlodge.

The mine industrial area site will be constructed close to the open pit, which is presently proposed for the north flank of Duke Mountain. However, further exploration may reveal that the bulk of the low to medium volatile coal reserves lie further south. In this instance, the

location of the mine industrial area will be revised so that it may more appropriately serve the immediate and long-term developments foreseen at this property. The mine industrial area will consist of a wash plant (coal preparation plant), mine shops, warehousing and offices. At the initial stage of mining, raw coal will be trucked directly to the wash plant from the open pit, but at a later date overland conveyors may be introduced to move the raw coal from the pit to the wash plant.

The loadout facility may be located immediately adjacent to the wash plant or at some distance if rail access is precluded by topography. In this instance, clean coal would be conveyed between the wash plant and the loadout by either truck or conveyor, dependent again upon topography, volume moved annually, and operating conditions peculiar to this geographic location. Unit trains will transport the coal from the load out facility to the port facilities.

Since the infrastructure and construction on neighbouring properties have a marked effect on the construction and operation of the Monkman Project, it would be futile to make any detailed estimates of construction schedules beyond those outlined previously (see figure 5).

IV Proposed Coal Mining Operation

A. Exploration

Closely spaced rotary and diamond drill holes, on a two hundred to five hundred metre grid, will be required for detailed delineation of coal seam location and assessment of coal reserves, quality and variability. Additional adits will be required to confirm coal quality and provide large samples of coal for further pilot plant testing.

PACIFIC PETROLEUMS LTD.
MONKMAN COAL PROJECT
— CONSTRUCTION SCHEDULE —

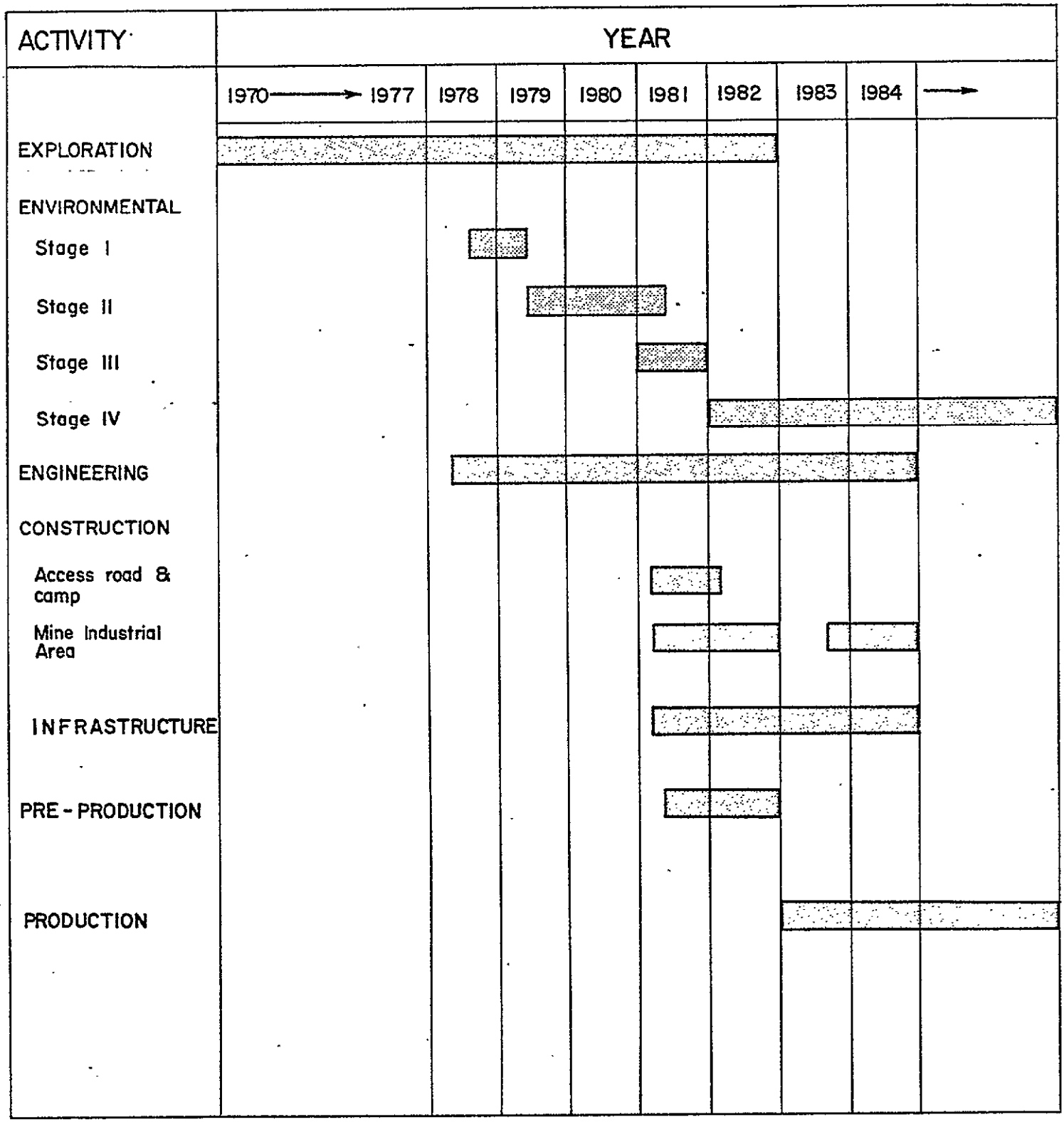


FIGURE 5

Additional roads will be necessary for access throughout those areas where development is certain. Environmental studies will be continued and revegetation studies initiated. Geotechnical investigations will be expanded to enhance previous preliminary data.

The expanded operations proposed will require an all-weather camp facility and suitable access roads.

B. Engineering

A more detailed engineering study will be initiated following accurate determination of coal reserves and quality, environmental impact, and operational restrictions imposed by geotechnical criteria.

Studies of the coal transportation and access routes will be conducted to determine those most suitable.

C. Mine Operations

Initial production is proposed in 1982 at a rate of 600,000 tonnes of clean coal per year, gradually increasing to 2,000,000 tonnes per year. This production will be derived initially from an open pit on the north flank of Duke Mountain. Overburden removal at this pit will begin in the latter stages of construction, probably in 1981, and sufficient coal will be exposed by the time the coal preparation plant is completed so that this plant can begin tune-up immediately. Trucks in the 100 to 160 tonne capacity range and electric shovels in the 8 to 12 cubic metre range will form the principal materials handling equipment

in the pit; however, coal will be excavated and loaded into trucks with either large backhoes or hydraulic excavators with shovel attachments in preference to rubber-tired, front-end loaders. Past experience with moderately-dipping seams (Kaiser Resources Ltd., Fording Coal Ltd.) indicates that excessive fines are created by bulldozers which push the coal into suitable piles for front-end loaders. The utilization of mining methods such as draglines, in-pit crushers and conveyor belts or bucket wheel excavators has not as yet been considered in view of the preliminary nature of the geological data available.

The average quantity of waste material moved annually will initially be in the 8 million bank cubic metre range. Three electric shovels and probably fifteen trucks will handle this volume of waste, whereas two large backhoes or hydraulic excavators and three trucks will handle the coal initially.

The operating labour force at the mine will initially consist of 200 people, increasing to 650 at full capacity. This includes both supervisory personnel and equipment operators.

The exploration conducted to date indicates additional reserves of low and medium volatile coal are to be found on Duchess Mountain, immediately to the south of Duke Mountain. The quantity of coal has not been delineated to the extent that definitive estimates can be made but, in all probability, additional reserves of coal will be proven up by subsequent exploration. At present, both open pit and underground operations are probable in the Duchess Mountain area.

D. Coal Preparation

A possible flow sheet of the coal preparation process is shown in Figure 6. Raw coal from the pit will be delivered to a breaker that scalps oversize material from the raw coal feed. Undersize will be stockpiled adjacent to the coal preparation plant. Coal will be reclaimed by front end loader from the stockpile and transferred to a conveyor that carries the coal into the crushing section of the plant. All coal will be sized with the plus 5 centimetre material going to double rolls crushers for crushing to 5 centimetre or less.

Once the incoming coal has been sized to minus 5 centimetre, a split will be made, so that plus 1 centimetre material goes to the heavy media section and any material, minus 1 centimetre to + 28 mesh goes to the cyclone section, whereas fines (minus 28 mesh) will report to the froth flotation section.

Clean coal from the heavy media section will report directly to the product storage whilst clean coal from the cyclone section will be centrifuged to reduce moisture to acceptable levels and then fed to a coal-fired thermal dryer before going to product storage. The clean coal from the froth flotation section will report to vacuum filters and the filter cake will then report to the coal-fired, thermal dryer before going to product storage.

The reject from the breaker and the heavy media section will be trucked back to the pit in the coal haulers for burial, whilst reject from the cyclones will be centrifuged and then trucked back to the pit.

Underflow from the froth flotation section will report to a large thickener. Underflow from the thickener will report to vacuum filters where entrained water will be decanted and returned as make up water for the various plant processes. Filter cake will then be hauled back to the pit.

Clean coal will be stored in clean coal silos at the rail head where coal will be loaded directly into unit trains.

E. Service Facilities

Ample service facilities will be provided at the mine site to handle all equipment repairs, but extensive use will be made of equipment dealer service facilities in Prince George and Dawson Creek for repairs that can be accommodated off the minesite.

Sewer and water service will be necessary at the minesite and will be constructed to meet applicable provincial regulations.

Communications will be provided by radio-telephone in a linkage with B.C. Tel's provincial telephone system.

The adjacent Grizzly Valley Airstrip will allow for air service to either Prince George or Grande Prairie where commercial connections are available. An air ambulance will also be arranged in the case of emergencies arising at the minesite, whilst a nursing station at the minesite will provide basic first aid.

24 TYPE W SCRUBBER
TRAMP IRON MAGNET
SLOPE BELT
ONE(1) 6x16 SD SCALPING SCREEN
1018-5 BIRMINGHAM BREAKER
5000 TON STORAGE SILO
FOUR(4) 7x16 D.D. RAW COAL SCREENS
TWO (2) 6x16 S.D. PRE-WET SCREENS
12'-0 PRIMARY HEAVY MEDIA VESSEL
TWO(2) 5x16 D.D. CLEAN COAL D/R SCREENS
CLEAN COAL CRUSHER
ONE(1) VC-48 CLEAN COAL CENTRIFUGE
8'-0 SECONDARY HEAVY MEDIA VESSEL
ONE(1) 4x16 S.D. MIDDS SCREEN
MIDDS CRUSHER
ONE(1) 4x16 REFUSE D&R SCREEN
250 TON REFUSE BIN
PRIMARY HEAVY MEDIA SUMP
SECONDARY HEAVY MEDIA SUMP
RAW COAL SUMP
ONE(1) 4-WAY DISTRIBUTOR
FOUR(4) 6'0 W DESLIME SIEVE BEND
FOUR(4) 6x16 L.H.S.D. DESLIME SCREENS
THREE(3) 3 CELL BANKS FROTH CELLS
TWO(2) 10'-6ϕ 13 DISC CLEAN COAL FILTERS
SPRAY BOOSTER
120'-0 STATIC THICKENER
FRESH H2O
O-FLO TANK
ONE (1) 10'-6 x 6 DISC REFUSE FILTER
FOUR(4) 20" ϕ CLASSIFYING CYCLONES
THICKENER MAGNETITE DIVERTER
M T O HEAD TANK
TWO(2) 30"x 60" DOUBLE DRUM MAGNETIC SEPARATORS
53'-0 MAG THICKENER
MAGNETIC SEPARATOR TAILINGS SUMP
FOUR(4) 24"ϕ HEAVY MEDIA CYCLONES
ONE(1) 5'-0 W 80°+40° REFUSE SIEVE BEND
FOUR(4) 6-0 x 40°+40° CLEAN COAL SIEVE BENDS
FOUR(4) 6x16 H.S.D. CLEAN COAL SCREENS
ONE(1) 6x16 LH SD REFUSE SCREEN
THREE (3) VC-48 CLEAN COAL CENTRIFUGES
ONE (1) 80"x 72" PRIMARY MAGETIC SEPARATOR
DILUTE MEDIA SUMP
HEAVY MEDIA CYCLONE SUMP
TO REFUSE SCREEN
CLEAN UP SUMP
10'x 16' THERMAL DRYER
LOAD-OUT BELT CONVEYOR
3000 TON CLEAN COAL SILO
AUTOMATIC SAMPLING SYSTEM
CLEAN COAL LOAD-OUT
COMPANY LOAD-OUT FACILITIES
STORAGE PILE

LEGEND

1. RAW COAL
2. CLEAN COAL
3. REFUSE
4. SLURRY & WATER LINES

PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT

TENTATIVE
PREPARATION PLANT
FLOW DIAGRAM

Date DECEMBER/77
Revised
Author A.G.S.
Drafted R.P.B.

FIGURE 6.

IV. Infrastructure

A. Townsite

The British Columbia Government has selected a townsite at Tumbler Ridge at the confluence of the Murray and Wolverine Rivers (see figure 7). This townsite was selected following studies by a sub-committee on North East Coal Development. Their selection criteria and initial planning are well documented in a report entitled "Preliminary Feasibility Report on Townsite/Community Development". At the time of the sub-committee's work, Denison (Quintette & Babcock), B.P. (Sukunka), and Teck Corp. (Bullmoose) were the only mining companies active in the area. The sub-committee states on page 5 of the report "Any future development of the Sukunka resources only would likely have to be serviced from Chetwynd. The proposed scale of development at Sukunka does not warrant the establishment of a new community. Thus a primary objective of the report investigation was to locate a site of sufficient size for community development purposes, with good access to proposed transportation corridors, to serve the needs of the Bullmoose - Wolverine - Babcock developments."

On page 8 of the report the sub-committee states that "An additional community(ies) will be required to serve the southern coal deposits of McIntyre (Monkman) North and South, Saxon (Denison) and Belcourt (Denison)". In view of the scale of development foreseen for the Monkman Coal Project, and the indefinite status of development at Saxon and Belcourt, it would be impractical to establish an isolated community to serve solely the Monkman property.

The adjacent Grizzly Valley Gas Field has considerable reserves of gas and a gas processing plant will be built shortly by Quasar Petroleum Ltd. The location of the gas processing plant has been finalized at Thunder Mountain, some 15 kilometres north of the proposed Duke Mountain open pit. This gas processing plant will probably supply the nucleus of a townsite for the Monkman Coal Project.

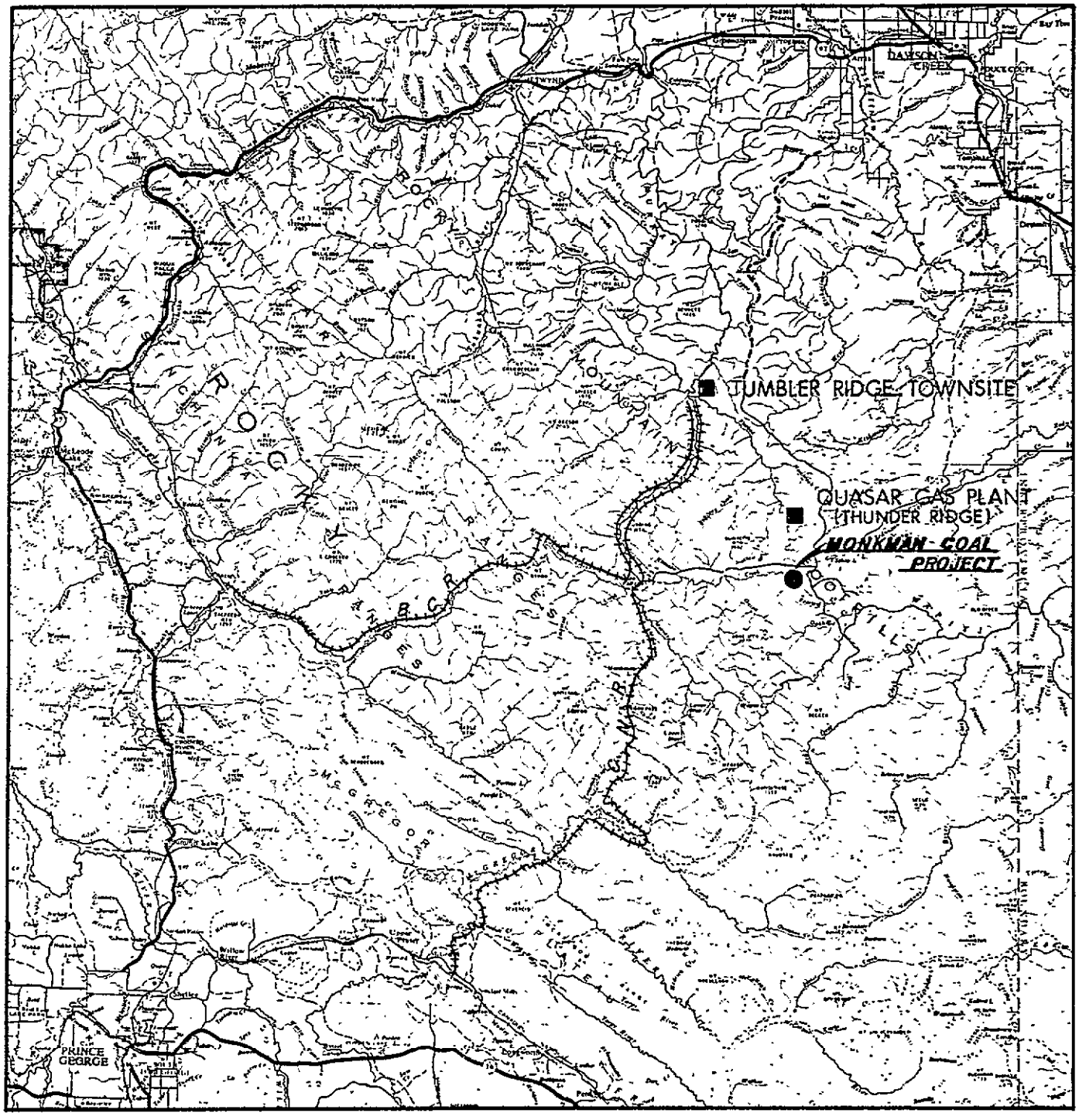
It has been assumed that the Monkman mine will produce 600,000 tonnes of clean coal per year initially. The estimated labour force will be 200 initially, if productivities of 15 tonnes per man shift are attained. The mathematics in the population projection by the coal subcommittee were adopted (see pages 19 - 29), and some 200 households will be required initially. Based on previous experience at Sparwood, the housing mix would be as follows:

Single detached	49.4%
Duplexes	17.6%
Apartments	14.8%
Mobile Homes	16.5%
Other	1.7%

Accordingly, the townsite at the gas plant will swell by some 500 people initially, and the final increase will approach 1600 people.

B. Railroad

The various alternate rail routes to serve the North East Coal Block are shown on figure 7. The favoured route follows the Hominka River and then the Wolverine River. This route from the B.C. Rail line



PACIFIC PETROLEUMS LTD.
MINING DEPARTMENT

MONKMAN COAL PROJECT	Date DECEMBER 1977
	Revised FEBRUARY 1978
REGIONAL MAP	Author A G S
SHOWING:-	Drafted R P B
ROAD ACCESS	Scale 1:1,200,000
TOWNSITE ALTERNATIVES	
RAILROAD ROUTE ALTERNATIVES	**FIGURE 7.**

at Anzac will permit shipment of coal to either Neptune Terminals on Burrard Inlet or Westshore Terminals at Roberts Bank on the Lower Mainland, or a new bulk terminal on Ridley Island at Prince Rupert. The various options are more fully described in relevant sections of "Preliminary Feasibility Report on Transport Development", by the Transport Sub-committee on Northeast Coal Development, December 1976.

It would appear that trucking of the coal to existing rail points, Chetwynd or Dawson Creek, would be prohibitively expensive in view of both the distance and the load restrictions that would be imposed. Accordingly, the construction of a branch line to service the North East Coal Block is a prerequisite for development of the Monkman Project.

C. Power

Presently, no power lines exist in the Monkman Project area and the closest transmission line passes through the Pine Pass, where the communities of Chetwynd and Dawson Creek are located. However, limited power will be available some 15 kilometres distant from the Monkman mine site at Quasar's gas plant. The power demand for an operation of this size would probably be some 15 Megawatts if no dragline were contemplated. Accordingly, either a 66 KV line or a 138 KV line would suffice. However, a large dragline would complicate matters, and then a 138 KV line would be essential to handle the cyclical power demand. For the purpose of this report, it can be assumed that the mine is exclusively a truck-shovel operation and that the wash plant is not equipped with any unique machinery that cannot accommodate minor power fluctuations associated with truck-shovel operations.

D. Roads

At the present time, fair-weather roads serve the immediate Monkman Project area; however, a new all-weather road is being pushed south from Feller Heights, south of Dawson Creek, to the vicinity of the Tumbler Ridge townsite. At the initiation of major work at the Quasar Gas Plant, this road will be extended to serve that project. Accordingly, some 15 kilometres of access road would be required from the Quasar Gas Plant. The cost of this road would probably be borne entirely by the operator of the Monkman Project.