PANORAMA COAL PROJECT

GEOLOGICAL REPORT

1980

GULF CANADA RESOURCES INC.

COAL DIVISION

GR. Panorama 80(1A

GULF CANADA RESOURCES INC.

PANORAMA COAL PROJECT GEOLOGICAL REPORT

1980

COAL LICENCE NUMBERS 5484 TO 5520 INCLUSIVE

CASSIAR LAND DISTRICT

NTS MAP NO. 104 A

LATITUDES BETWEEN 56° 44' AND 56° 53' N

LONGITUDES BETWEEN 128° 24' AND 128° 39' W

GULF CANADA RESOURCES INC.

- and -

J. MATTHEW DUFORD
CONSULTING GEOLOGIST

DECEMBER, 1980

PANORAMA PROJECT

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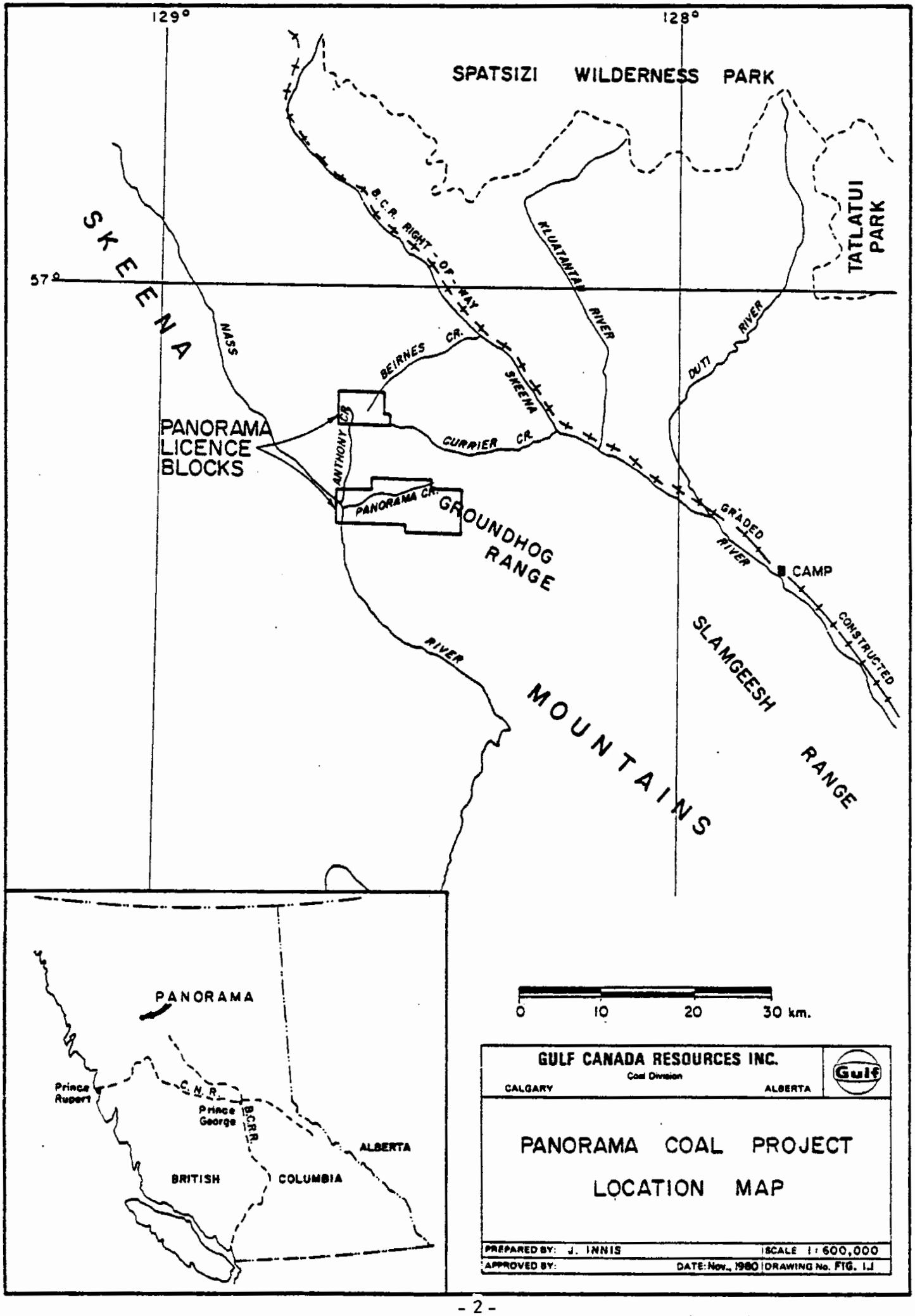
" " : GR-Panorama 80(3)A

" " : GR Panorama 80(4)A

PANORAMA COAL PROJECT

1.0 SUMMARY


129°
128°
57°
SPATSIZI WILDERNESS PARK
TATLATUI PARK
SKEENA
NASS
B.C.R. RIGHT-OF-WAY
KLUATANTAN RIVER
DUTI RIVER
BEIRNES CR.
SKEENA
PANORAMA LICENCE BLOCKS
ANTHONY CR.
CURRIER CR.
PANORAMA CR.
GROUNDHOG RANGE
GRADED
RIVER
CAMP
CONSTRUCTED
SLAMGEESH RANGE
MOUNTAINS
RIVER
PANORAMA
Prince Rupert
C.N.R.
Prince George
B.C.R.R.
ALBERTA
BRITISH
COLUMBIA
0
10
20
30 km.
GULF CANADA RESOURCES INC.
Coal Division
CALGARY
ALBERTA
Gulf
PANORAMA COAL PROJECT
LOCATION MAP
PREPARED BY: J. INNIS
SCALE 1:600,000
APPROVED BY:
DATE: Nov., 1980
DRAWING No. FIG. 1.1

LOCATION

THE PANORAMA COAL LICENCES ARE LOCATED IN NORTHWESTERN BRITISH COLUMBIA APPROXIMATELY 234 AIR KILOMETRES NORTH OF SMITHERS, BRITISH COLUMBIA. THE LICENCE BLOCKS LIE WITHIN THE GROUNDHOG RANGE BETWEEN THE SKEENA AND NASS RIVERS.

ACCESS

THE CLEARED RIGHT-OF-WAY FOR THE ABANDONED PRINCE GEORGE - DEASE LAKE BRITISH COLUMBIA RAILWAY LINE PASSES WITHIN 15 KILOMETRES OF THE NORTHERN LICENCE BLOCK. THE SEA PORT OF STEWART IS ONLY 129 KILOMETRES TO THE SOUTHWEST, BUT NO ACCESS IN THIS DIRECTION PRESENTLY EXISTS.

LICENCES

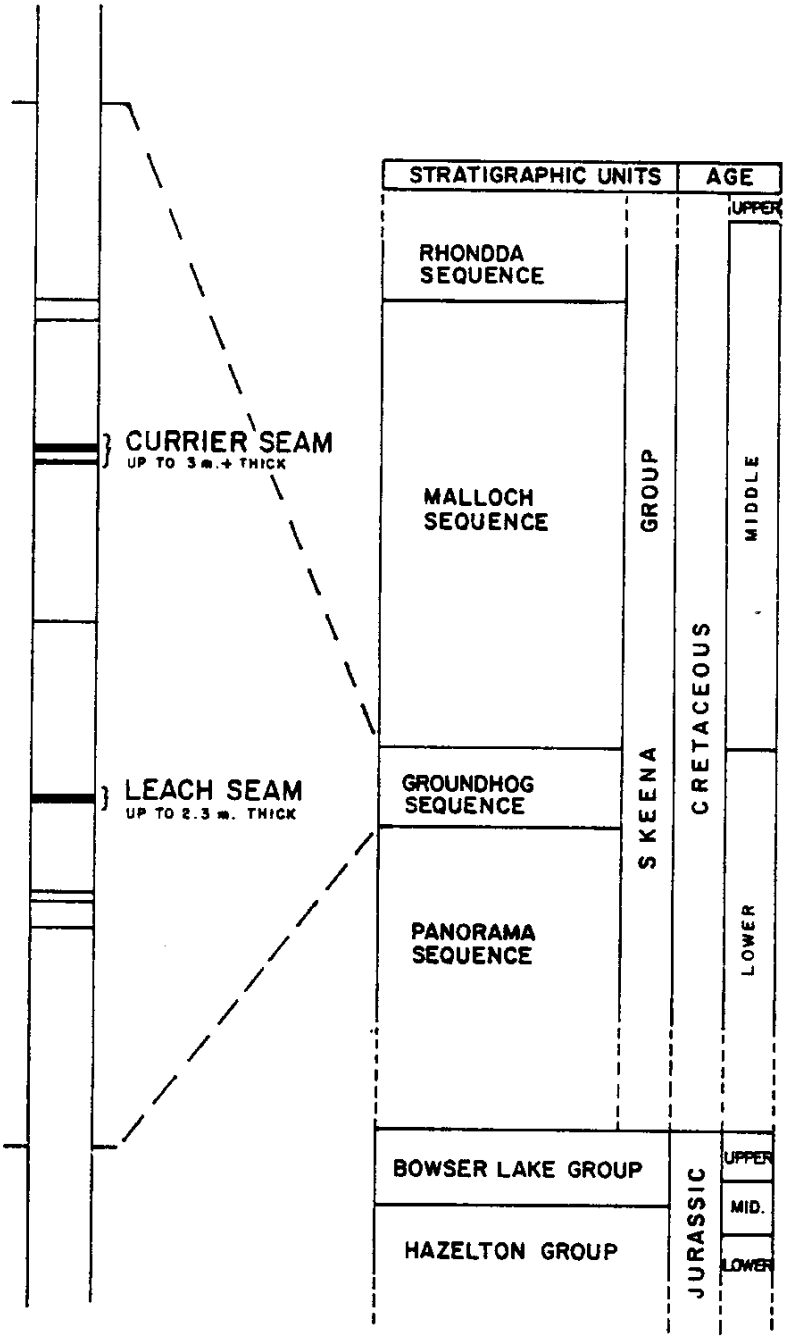
THE PROPERTY HELD IS DIVIDED INTO TWO LICENCE BLOCKS. THE NORTHERN BLOCK OF 8 LICENCES IS 2 121 HECTARES IN AREA. THE SOUTHERN BLOCK OF 29 LICENCES COMPRISES 8 236 HECTARES.

OWNERSHIP

GULF CANADA RESOURCES INC. HOLDS 100% INTEREST IN THE PANORAMA LICENCES WHICH WERE ACQUIRED ON NOVEMBER 5, 1980.

EXPLORATION

TO DATE, INVESTIGATION OF THE PANORAMA LICENCE AREA HAS INCLUDED HELICOPTER-SUPPORTED GEOLOGICAL MAPPING OF THE ENTIRE AREA ON A 1:10 000 SCALE, HAND TRENCHING OF ALL SEAMS DISCOVERED IN EXCESS OF 0.5 METRES IN THICKNESS, AND ANALYSIS OF SAMPLES FROM THE TRENCHES.

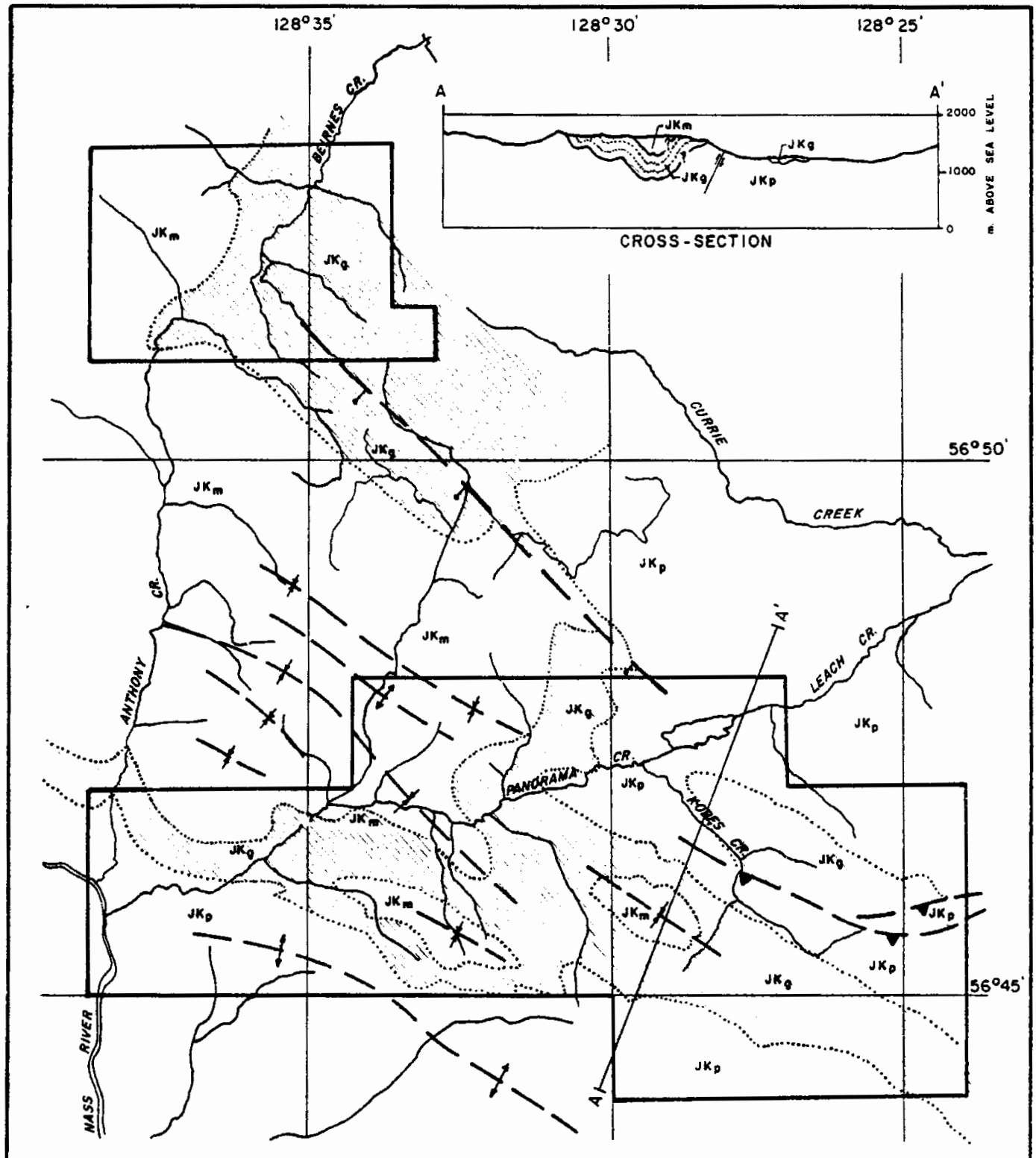


NOTE: SUB-CRETACEOUS UNITS ARE NOT DRAWN TO SCALE.

GULF CANADA RESOURCES INC. Coal Division	
CALGARY ALBERTA	Gulf
PANORAMA COAL PROJECT	
SCHEMATIC STRATIGRAPHIC COLUMN SHOWING LOCATION OF COAL ZONES	
PREPARED BY: J. INNIS	SCALE N.T.S.
APPROVED BY: DATE: NOV. 1980	DRAWING No. FIG. 1.2

GEOLOGY

THE PANORAMA LICENCE AREA IS UNDERLAIN BY LOWER TO MIDDLE CRETACEOUS SEDIMENTARY ROCKS OF THE SKEENA GROUP. THE SKEENA GROUP WAS FIELD SUBDIVIDED INTO FOUR UNITS WHICH WERE NAMED THE PANORAMA, GROUNDHOG, MALLOCH, AND RHONDDA SEQUENCES. THE MAJOR COAL DEVELOPMENT LIES WITHIN THE GROUNDHOG SEQUENCE, WHICH CONTAINS A TOTAL OF 8 SEAMS IN EXCESS OF 0.5 METRES IN THICKNESS. ONE OF THESE EXCEEDS 1 METRE IN THICKNESS AND TWO OTHERS EXCEED 2 METRES IN THICKNESS WITH A MAXIMUM THICKNESS OF 3 METRES. DIFFICULTY HAS BEEN EXPERIENCED IN TRACING THE COAL SEAMS FOR ANY DISTANCE. INTENSE DEFORMATION HAS RESULTED IN COMPLEX FOLDING AND SOME RELATED FAULTING.



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Coal Division
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Gulf

PANORAMA COAL PROJECT

GEOLOGY MAP

PREPARED BY: J. INNIS	SCALE 1: 100,000
APPROVED BY:	DATE: Nov, 1980 DRAWING No. FIG. 1.3

RESOURCE POTENTIAL

THE RESOURCE POTENTIAL IN THE PANORAMA LICENCE AREA IS LOCATED WITHIN THE GROUNDHOG SEQUENCE. THIS SEQUENCE OUTCROPS OVER MOST OF THE LICENCE BLOCKS. TWO MAIN COAL SEAMS WERE DELINEATED WITH AN AGGREGATE THICKNESS OF 4 METRES. THE TOTAL RESOURCE POTENTIAL OF THESE SEAMS IS 322.5 MILLION TONNES.

SIX OTHER SEAMS, ALL GREATER THAN 0.5 METRES IN THICKNESS, WERE NOT FOUND TO BE SUFFICIENTLY CONTINUOUS TO JUSTIFY THEIR INCLUSION IN A PRELIMINARY RESOURCE POTENTIAL CALCULATION.

TABLE 1.1

AVERAGE PANORAMA COAL QUALITY

RAW HEAD ANALYSIS

ASH	22.58%
RESIDUAL MOISTURE	6.17%
VOLATILE MATTER	14.10%
VOLATILE MATTER (DMMF)	17.70%
FIXED CARBON	55.88%
BTU/LB	9 369
SULPHUR	0.47%
S.G.	1.63
H.G.I.	102

SIMULATED PRODUCT ANALYSIS

YIELD	82.46%
ASH	14.00%
RESIDUAL MOISTURE	4.48%
VOLATILE MATTER	15.90%
VOLATILE MATTER (DMMF)	18.15%
FIXED CARBON	65.62%
BTU/LB	10 871
SULPHUR	0.56%
S.G.	1.57
H.G.I.	109

COAL QUALITY

THE COAL IN THE PANORAMA AREA RANGES FROM LOW VOLATILE BITUMINOUS TO SEMI-ANTHRACITE. THE ADJACENT TABLES PROVIDE THE RESULTS OF ANALYSIS ON AN AIR-DRIED BASIS OF A RAW COAL AND A SIMULATED PRODUCT COAL CUT AT 1.8 SPECIFIC GRAVITY. THE FIGURES ARE AN AVERAGE OF VALUES FOR BOTH SEAMS, WEIGHTED BY THE THICKNESS OF THE SEAMS.

2.0 INTRODUCTION

2.1 Objectives

The objectives of the 1980 Panorama exploration program were:

a) to subdivide the sedimentary package into mappable units,

b) to determine the structural style of the area covered by the licences,

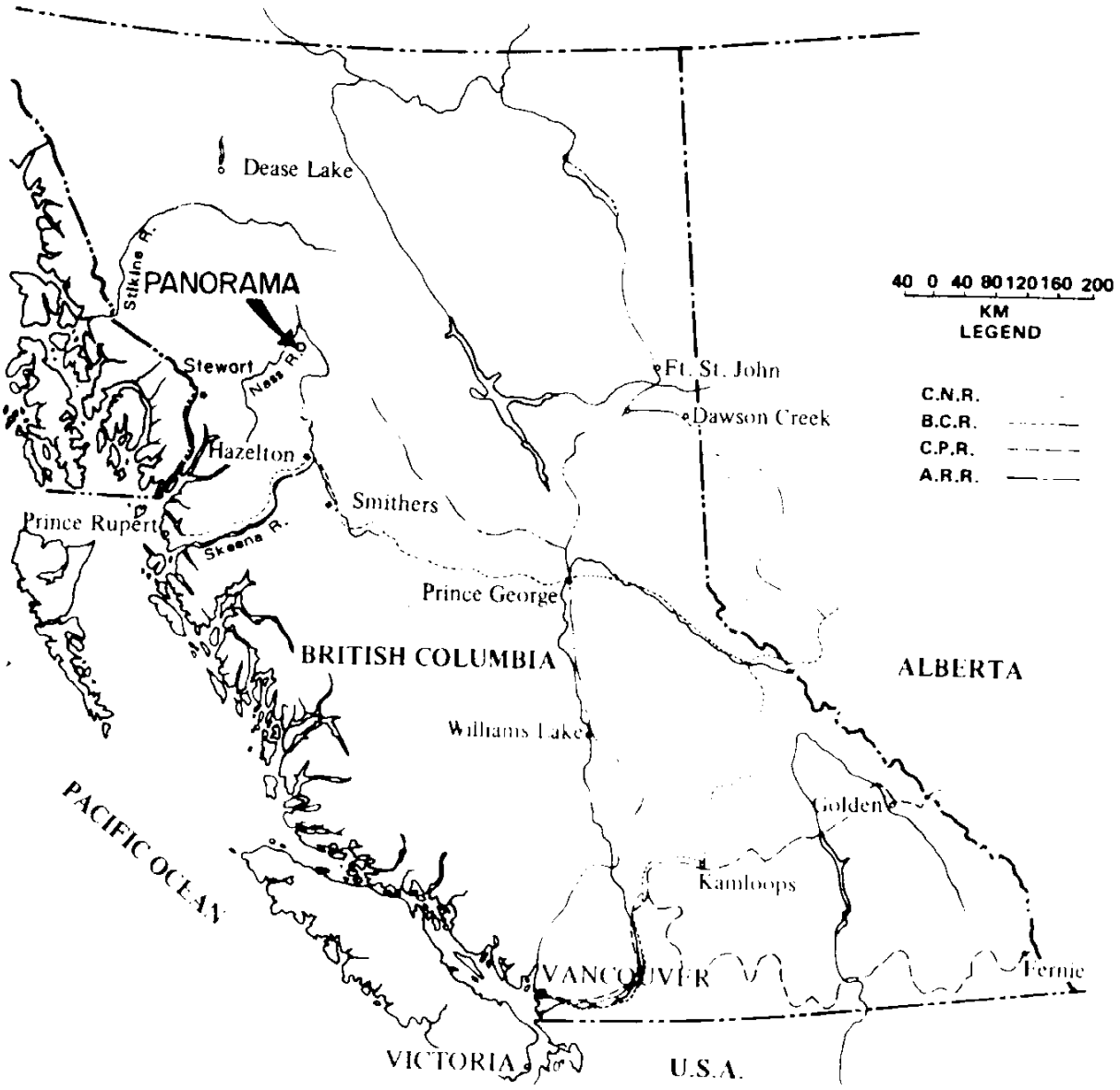
c) to locate and expose by trenching all coal seams greater than 1 metre in thickness,

d) to sample all significant coal seams for coal quality analyses and,

e) to delineate areas of potential surface mineable coal for future drilling.

2.2 Location

The Panorama coal licences are located between the Nass and Skeena Rivers of northwestern British Columbia, within the area of the Skeena Mountains (Figure 2.1). The area between 56^{o} 44' and 56^{o} 53' north latitude and 128^{o} 24' and 128^{o} 39' west longitude includes all of the Panorama licences. The two blocks which contain the Panorama coal licences are situated with centres about 12 kilometres apart and comprise a total of 10 357 hectares (25 592 acres).

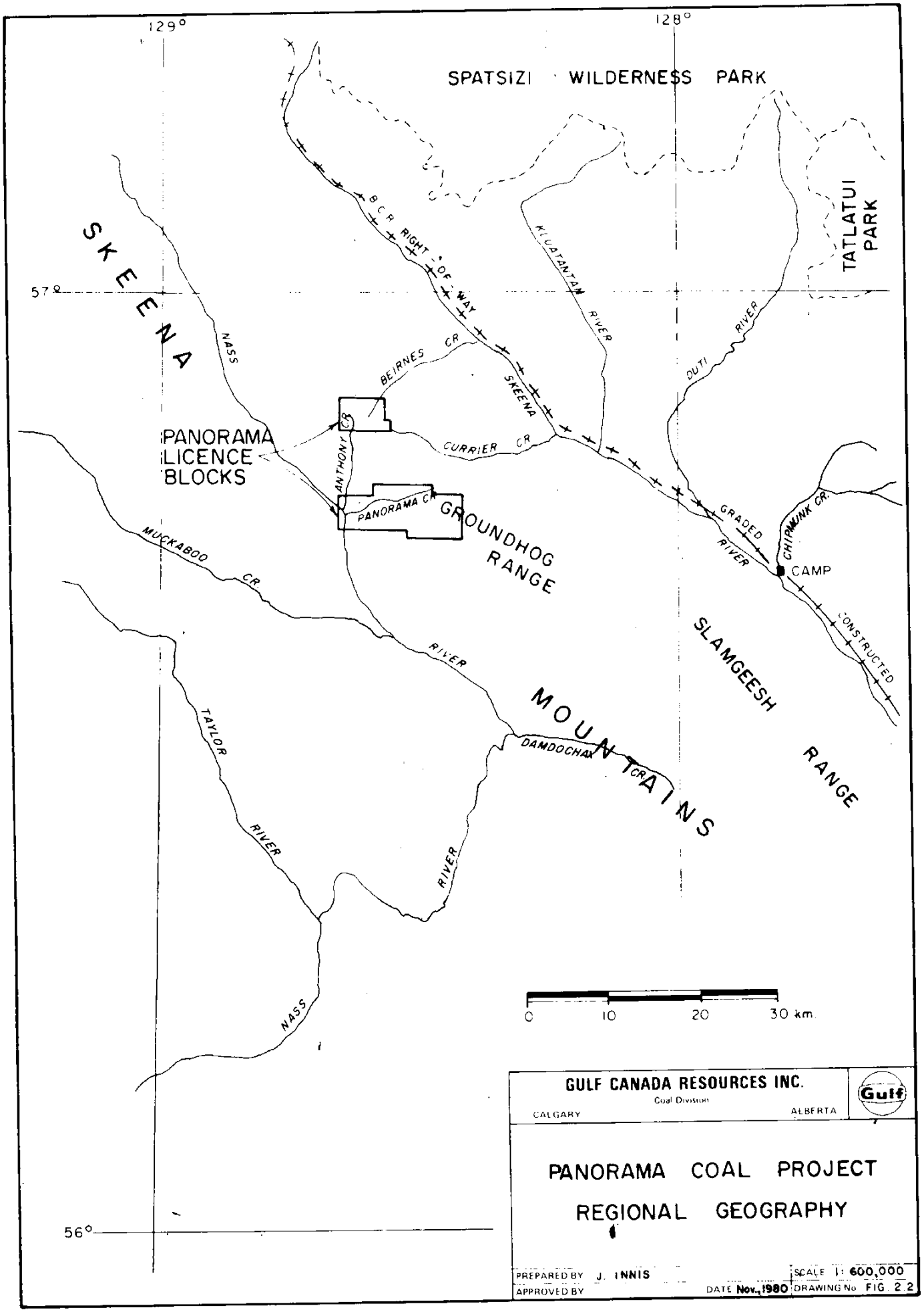


GULF CANADA RESOURCES INC.
CALGARY ALBERTA

LOCATION MAP

PANORAMA COAL PROJECT

PREPARED BY J. INNIS
APPROVED BY
SCALE
DATE NOV., 1980 DRAWING No. FIG. 2.1


129°
128°
SPATSIZI WILDERNESS PARK
TATLATUI PARK
SKEENA
57°
NASS
B.C.R. RIGHT-OF-WAY
KLUATANTAN RIVER
DUTI RIVER
BEIRNES CR.
SKEENA
ANTHONY CR.
CURRIER CR.
PANORAMA LICENCE BLOCKS
PANORAMA CR.
GROUNDHOG RANGE
GRADED
CHIPMUNK CR.
CAMP
MUCKABOO CR.
RIVER
CONSTRUCTED
SLAMGEESH RANGE
MOUNTAINS
TAYLOR
DAMDOCHAX
RIVER
RIVER
NASS
56°
0
10
20
30 km.
GULF CANADA RESOURCES INC.
Coal Division
CALGARY
ALBERTA
Gulf
PANORAMA COAL PROJECT
REGIONAL GEOGRAPHY
PREPARED BY J. INNIS
APPROVED BY
SCALE 1: 600,000
DATE Nov., 1980
DRAWING No FIG 2.2

2.3 Coal Licences

Thirty-five whole licences and 2 partial licences are contained wthin the two Panorama coal licence blocks. Numbers 5503 to 5510 inclusive lie within the northern block. Numbers 5484 to 5502 and 5511 to 5520 inclusive are contained by the larger southern block. These are illustrated in Figure 2.3 and listed in Appendix I.

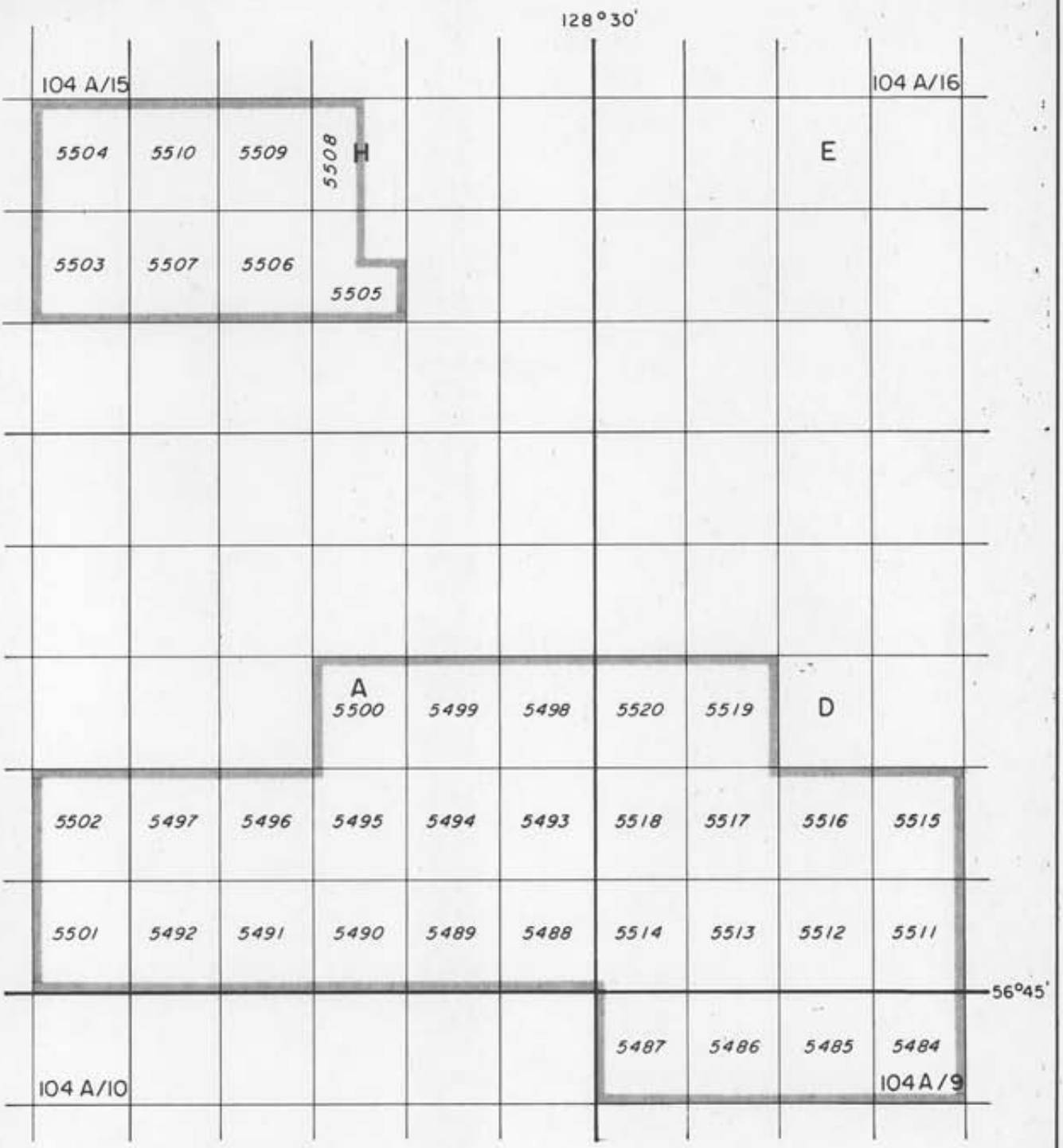
2.4 Ownership

The Panorama coal licences are wholly owned by Gulf Canada Resources Inc.

2.5 Access

At present, there is no road access to the area of the Panorama coal licences. The cleared right-of-way for the abandoned British Columbia Railway line between Prince George and Dease Lake lies within 15 kilometres of the northeast cornerd of the northern Panorama licence block (Figure 2.2). Present railhead is 39 kilometres southeast of the southern licence block.

The coal licences are 129 air kilometres east of Stewart, B.C. (population 1 357), 249 kilometres northeast of Terrace (population 9 991), and 234 kilometres north of Smithers (population 3 864).



GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA COAL PROJECT
COAL LICENCE MAP

PREPARED BY: J. INNIS		SCALE 1: 100,000
APPROVED BY:	DATE: Nov., 1980	DRAWING No. FIG. 2.3

2.6 Biophysical Environment

The Panorama licences are located within the Skeena Mountains' physiographic region (Figure 2.2). Topography reflects the underlying structure somewhat, but is strongly influenced by the regional drainage pattern. The height of land in the middle of the property forms a drainage divide. Anthony Creek from the northern licence block and Panorama Creek from the southern licence block, flow east into the Nass River. Beirnes Creek in the north and Currier Creek in the south flow northeast into the Skeena River. The Nass and Skeena Rivers approximately parallel each other, flowing south and then west to the Pacific.

Elevations range from less than 700 metres at the Nass River in the southwest corner of the property, to over 2 000 metres on Cushing Ridge to the east (Appendix V).

Many who have worked in the Panorama area have remarked on the abundance of precipitation that characterizes local weather patterns. Approximately half the yearly precipitation falls as snow. Most summers are reported as "exceptionally wet" (Buckham and Latour, 1950), with frequent days of precipitation. Daily temperatures range between 0^{o} C and 23^{o} C during the summer months.

The most abundant trees are alpine, fir, white and black

spruce, lodgepole pine, aspen, balsam poplar and white birch. The timber line is approximately 1 350 metres above sea level with timber quite dense below 1 100 metres.

Game appeared plentiful with frequent sightings of moose, caribou, mountain goat and black bear. Grizzly bears were also observed on rare occasions. Grouse and ptarmigan are abundant as are Canada geese in the late summer. Steelhead and rainbow trout, cohoe salmon and dolly varden are reported in the upper Skeena and Kluatantan rivers (Tompson, 1977).

3.0 EXPLORATION

3.1 Introduction

The Panorama coal licences were applied for in June, 1979 on the basis of a mapped distribution of coal-bearing strata reported by Black (1968).

The 1980 Panorama coal exploration program immediately preceeded the Sustut coal exploration program (see Sustut Coal Project, Geological Report, 1980). For logistical reasons, exploration operations for the Panorama licences to the north and the Sustut licences to the south were based at one camp.

3.2 Cartography

Government maps are available for the Panorama area on both the 1:50 000 and 1:250 000 scale. For the purpose of detailed mapping, this coverage was augmented by maps on a 1:10 000 scale with 10-metre contour intervals prepared from existing aerial photography by Hardy and Associates (1978) Ltd. (Appendix VIII). These 1:10 000 maps are limited to the immediate area of the two licence blocks and the land directly between them.

3.3 Field Camp

Field camp operations began July 17, 1980 at a site adjacent to the Chipmunk airstrip along the Skeena River. All

initial supplies and equipment were flown from Smithers, British Columbia as were weekly supplies. The camp consisted of 3, 16 x 14 foot common tents and 6 smaller personnel tents. Power for the lights and freezer was supplied by a 3.5 KW diesel generator. Camp operations ceased on September 8, 1980 at which time the majority of the camp equipment was stored at Smithers Transport in Smithers.

3.4 Geologic Mapping

The Panorama coal project utilized 3 crews, each consisting of a geologist and a geological assistant. The crews were air-supported by a Hughes 500 C helicopter. Outcrops were plotted on 1:10 000 scale map cards or 1:10 000 scale orthophotos which became available later in the program. Altimeters were used to provide elevation control. Aerial photographs were used in conjunction with the topographic maps to verify locations and outcrop patterns. All geological information was transferred from the map cards, orthophotos and field notes to 1:10 000 scale dylar maps in the field office. The results of the geological mapping program are summarized at a scale of 1:50 000 at the end of the text (Appendix V). The same maps and cross-sections are provided at 1:10 000 scale in Appendix IX. A map outlining each of the traverse locations is presented in Appendix VI.

3.5 Trenching

A hand-trenching program was undertaken during the latter portion of the field mapping. A two-man crew worked under the direction of geologists responsible for mapping particular areas. The objective of trenching was to prove the thickness of coal seams where it was deemed possible to expose the coal section with hand-shovel trenches, and to collect coal samples for quality analyses. Due to the fact that overburden tends to mask the true extent of a seam, all coal exposures greater than 0.5 metres were trenched to avoid missing more extensive seams.

The trenches were approximately 0.7 metres wide and cut to a depth of 1 metre. A total of 42 trenches were dug and logged on the Panorama coal licences. Several others were dug, but the actual coal thickness did not warrant logging and sampling.

All coal seams greater than 0.5 metres were sampled for coal quality analyses. In each trench, the channel sample was approximately 0.1 m x 0.1 m x the length of the coal seam. The trench logs illustrating the sampled sections are presented in Appendix III at the end of the text, while the trench location map may be found in Appendix VII. Trench locations are also plotted on the geology maps.

3.6 Reclamation

The area of environmental disturbance associated with the 1980 Panorama coal exploration program was minimal since all transportation was via helicopter or fixed-wing aircraft. Only minor disturbances were associated with the camp and with trenching. Several hand trenches were left open for later viewing, while the remaining trenches were filled in. The camp utilized a pre-existing clearing, cleared by construction activities of the British Columbia Railway. The camp site was left in its original condition.

3.7 Project Management & Contractors

The 1980 coal exploration program was managed by B.P. Flynn (Project Supervisor) of Gulf Canada Resources Inc. Field operations was supervised by J.M. Duford, Consulting Geologist. The geological report was prepared by J.M. Duford and J.W. Innis of Gulf Canada Resources Inc.

The following additional professional and technical personnel contributed to the Sustut coal projects:

G. Johnson	Senior Geological Assistant
R. Brezovski	Geological Assistant
E. Legresley	Geological Assistant
D. Spencer	Geological Assistant
J. Currie	Helicopter Pilot

The following also contributed to the project:

B. Warren	Cook
M. Hatch	Cook
P. Russell	Trencher

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

Smithers Air Service	Smithers, B.C.	(604) 847-9666
Norcrown Air Ltd.	Kelowna, B.C.	(604) 765-1437
Quasar Helicopters Ltd.	Richmond, B.C.	(604) 270-9696
Smithers Hardware Ltd.	Smithers, B.C.	(604) 847-4277
Super Valu Stores	Smithers, B.C.	(604) 847-9737
Canadian Propane Gas & Oil Ltd.	Smithers, B.C.	(604) 847-9928
MR Rentals	Smithers, B.C.	(604) 847-3897
J & D Rewind	Smithers, B.C.	(604) 847-3894
C J L Enterprises	Smithers, B.C.	(604) 847-3612
Cyclone Engineering Sales Ltd.	Edmonton, Alta.	(403) 436-1385
Hardy & Associates Ltd.	Calgary, Alta.	(403) 272-8761

4.0 GEOLOGY

4.1 Introduction

The coal development which was the object of investigation of the Panorama coal exploration program is part of a Jurassic - Cretaceous depositional sequence in one of several successor basins in the Intermontane Belt of northwestern British Columbia (Eisbacher, 1974(a)).

Volcanism dominated prior to the establishment of the successor basins, producing the Takla and Hazelton groups. Through the Upper Jurassic to Tertiary times, the marine strand line retreated to the southwest, coinciding with the deposition of the predominantly marine Bowser Lake Group, the marginally marine Skeena Group, and finally, the mostly continental Sustut Group (Figure 4.1).

The licence area is underlain solely by strata from the Skeena Group. These were deposited in an alluvial fan and coal swamp setting (Eisbacher, 1974(a)) prograding over the older Bowser Lake marine deltaic complex. The resulting facies is typically laterally discontinuous, but with significant local coal deposits.

Tectonism has complicated the geology to a major extent. Generally the structure is characterized by large, open folds and widely-spaced faults. Synclines are usually broader

STRATIGRAPHY
TABLE OF FORMATIONS

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

FIG. 4.1

than intervening anticlines. However, deformation on a smaller scale is often quite intense with tight isoclinal folds and extensive minor faulting.

Structural complexity appears to increase from north to south. Perhaps associated with this increase is a change in regional strike from northern to southern licence blocks. The regional strike describes an arc, changing from southeast-northwest in the northern block to almost east-west south of Panorama Creek.

The geology is illustrated on the 1:50 000 scale map and cross-sections in Appendix V and is reproduced on 1:10 000 scale maps and cross-sections in Appendix IX. The reconnaissance nature of the mapping limited the detail with which local areas of extreme structural complexity could be described. To provide a rough indication of the trend of this smaller-scale deformation, zones of "intense deformation" or "limited geologic control" are labelled on the cross-sections.

4.2 Stratigraphy

A stratigraphy for the area of the Groundhog coalfield has been slow in developing due to the lithological similarity between sequences of different ages coupled with a complex structural style. The sedimentological regime varied little through the Jurassic and Cretaceous, and produced a sequence with a considerable recessive component. The combination of a

relatively homogeneous sequence, locally severe tectonic disturbance and sometimes poor exposure, has hampered efforts to construct a definitive geological model for the area.

Difficulty has been almost universally encountered in identifying a sequence in more than one locality because of the lack of distinctive horizons or recognizable lateral continuity. Most reporting has, therefore, been restricted to facies modelling of the entire sedimentary package into units which are not necessarily mappable, or comparisons of previously constructed stratigraphies.

4.2.1 Previous Work

The most valuable background material used in coming to an understanding of the stratigraphy in the Panorama area was found in a Geological Survey of Canada report by G.S. Malloch (1912); and in two industry reports: one by J.M. Black (1968) and one by W.D. Tompson, D.M. Jenkins, and M.W. Roper (1970). These reports all discuss the sedimentary package in the Panorama area differently and three separate stratigraphies emerge. This section presents each stratigraphic subdivision, concentrating on the strata correlative with the Skeena Group.

4.2.1.1 G.S. Malloch

Malloch conducted a regional program of investigation, ranging a considerable distance to the south of the Panorama licence area. His Hazelton Group does not outcrop in the licence area. All Panorama area strata are included in the Skeena Series.

4.2.1.2 J.M. Black

Black (1968) discussed a "Lower Conglomerate", "Lower Shale", "Upper Shale", and "Upper Conglomerate" sequence of an age range corresponding to that of the Skeena Group. These were also based on observations over a large area.

The Lower Conglomerate is composed of thick sandstone and conglomerate units with interbedded thinner sandstones, silstones, and shales. The thicker sandstones are sometimes found to be quite dirty. The sequence, as a whole, fines and becomes more thinly-bedded upward with minor coal at the top and a gradational boundary with the overlying Lower Shales.

The Lower Shales unit comprises interbedded shale, sandstone, and coal units. The sandstones here are also quite dirty and, like those

in the Lower Conglomerate, are non-marine. A few sandstones of marine character contain abundant bivalve shells. Black's (1968) mapped distribution of the coal-bearing Lower Shales was one of the main criteria applied in determining the number and location of licences for the Panorama coal project.

A gradational boundary separates the Lower Shales from the Upper Shales. The Upper Shales unit contains predominantly sandstone, siltstone, and shale beds, but lacks the coal of the Lower Shales. Also present are thin beds of limy material and horizons containing excellently preserved plant fossils.

The Upper Conglomerate is made up of conglomerate beds 15 to 60 metres thick, interbedded with sandstone and shale. Some of the latter is carbonaceous, but no coal seams are reported.

Fossil evidence is interpreted to indicate an age of Upper Jurassic for the Lower Conglomerate, Lower Shales, and most of the Upper Shales. The uppermost Upper Shales and the Upper Conglomerate are, therefore, Lower Cretaceous in age.

4.2.1.3 Tompson, Jenkins, and Roper

The comparable stratigraphy of Tompson et al (1970) consists of several "lithosomes" named on the basis of the location of the described sections. The McEvoy Ridge lithosome is dominated by silty claystone with a relatively minor proportion of immature sandstone and very minor conglomerate. The sequence is evenly bedded with little cross-bedding and lateral and vertical gradational boundaries between lithologies. The sandstone beds usually have sharp bases and are friable to a degree that varies with the maturity of the sandstone.

The Coal-Bearing lithosome comprises coal, siltstone and silty claystone with about 15 to 20 percent carbonaceous material, and very minor cross-bedded, medium-grained sandstone. A recessive weathering habit largely obscures the bedding character, but float is a characteristic brown-orange streaked with black.

Tompson et al's Lonesome Mountain lithosome comprises sandstone, conglomerate and claystone with contained coal. Fine-grained

metres in thickness. Burrows and marine molluscan fossils are found in some sandstones.

The Devil's Claw Conglomerate lithosome is described by Tompson et al (1970) as being a time stratigraphic equivalent of the Lonesome Mountain lithosome, lacking the extent of claystone and coal development of the Lonesome Mountain lithosome, and characterized by a much greater proportion of thick (60 metres) pebbly sandstones and conglomerates. Thick claystone units do occur between the conglomerates and are carbonaceous, but the zones are not significantly coaly or continuous.

4.2.1.4 Correlation

The mapping undertaken as part of Gulf's Panorama coal exploration project involved detailed comparisons of previously prepared geological maps, and close attention to the apparent distribution of stratigraphic units on the ground. It became apparent that there was considerable discrepancy between the sedimentological divisions constructed by Black (1968) and by Tompson (1970). As the geology was interpreted during the Panorama project, the

intended stratigraphic sequence of Black's and Tompson's units, as gleaned from their written reports, does not always seem to correspond with the sequence implied by the mapped distribution of their units (see Figure 4.2). The interpretation developed during the Panorama project required, for the purpose of clarifying stratigraphic relationships of the observed lithologic sequences, that a modified stratigraphy be established using elements from each of Malloch's, Black's and Tompson's schemes.

4.2.2 Proposed Stratigraphy

The rocks of the Skeena Group were divided into four "sequences", which were field named (from oldest to youngest) as follows: The "Panorama Sequence" is found in type exposures on Panorama Mountain. The "Groundhog Sequence" which includes the coal-bearing strata, was named after the Groundhog Coalfield. The "Malloch Sequence" including the shales above the coal-bearing Groundhog sequence, is named after G.S. Malloch of the Geological Survey of Canada, who did much important pioneering work in the area in the field seasons of 1911 and 1912. The

COMPARED STRATIGRAPHIES

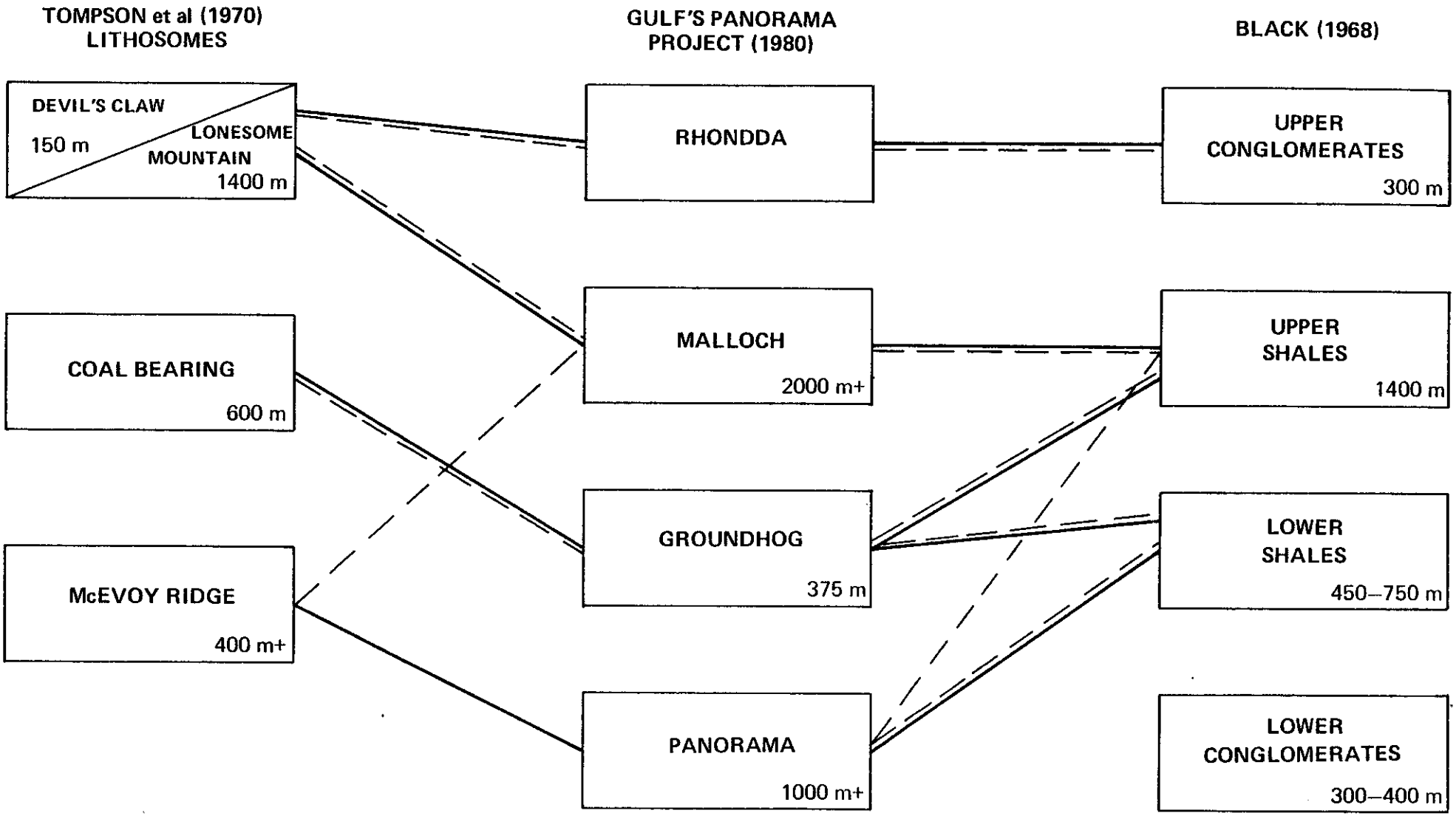


FIG. 4.2

"Rhondda Sequence" which does not outcrop within the licence block, but is the highest part of the succession represented in the area, is named after Lord Rhondda who had key financial influence in the earliest development of the Groundhog Coalfield in 1913 (Tompson, 1977).

The correlation of these sequences with the units of Black and Tompson is indicated in Figure 4.2.

4.2.2.1 Panorama Sequence

Stratigraphically, the lowest sequence encountered in the licence area, termed the Panorama Sequence, consists of predominantly fine-grained, medium to thick bedded, grey sandstone gradationally associated with subordinate interbeds of quite recessive and sometimes brittle claystone to siltstone. There is very little concentrated development of carbonaceous material in the fine-grained sediments. The sandstones grade locally up to a medium-grain size; exhibit cross-bedding and some ripples with a minor inclusion of siltstone clasts which locally define lamination. Plant fossils (sometimes quite carbonaceous) are abundant in

some horizons. The content of bivalve and cephalopod fossils and the greenish to maroon weathering of a few sandstones are strongly suggestive of marine dominance during at least part of the depositional history of the Panorama sequence. One particular bed, noted in several localities, is quite densely packed with oyster-like bivalve fossils. The base of the Panorama sequence was not found within the map area, but it is likely in excess of 1 000 metres thick.

4.2.2.2 Groundhog Sequence

The transition into the Groundhog sequence from the Panorama is very gradual. As sandstones give way to a greater proportion of siltstone and claystone, the remaining sands are thinner yet coarser (up to medium-grained), and the intervening finer zones begin to contain increasing quantities of carbonaceous material. The base of the Groundhog sequence is placed near the top of the thick sandstones just beneath the first appreciable (over 0.3 metres) coal seam. Sandstones at the base of the Groundhog continue to be planar cross-bedded with ripple mark, containing rip-up clasts of siltstone and plant

fossils, and in addition, may be slightly micaceous in the rare medium-grained beds. With the advent of coal, however, the lithology rapidly changes to alternating claystone and silstone with minor thin fine-grained sandstones. Fossilized plant fragments appear in all lithologies throughout the Groundhog sequence, and a few sandstone beds contain abundant bivalve fossils, (though not of the oyster-type seen in the Panorama sequence). Burrows are apparent mostly in the lower, thicker sandstones. At the top of the Groundhog sequence, thick, resistant, medium-grained sandstones interrupt the sequence of finer-grained lithologies. A thin but well-developed granule to pebble conglomerate marks the top of the Groundhog.

A fairly regular cycle of lithologies is seen to be established in the Groundhog. There is a gradational oscillation from siltstone or fine-grained sandstone through claystone and carbonaceous claystone to coal. The oscillation has an average period of about 20 metres through the middle portion of the Groundhog. The coal is generally thin in seams less than 0.5 metres,

though more than one seam may be present in each carbonaceous interval, and two seams extend to over 2 metres in thickness.

The carbonaceous sediment is grey when fresh, but a pervasive though relatively small iron content produces an orangey weathering colour, which, interspersed with black carbonaceous or coaly bloom, gives the area of the Groundhog sequence exposure a very characteristic appearance. Though quite recessive, the Groundhog can usually be distinguished from the other recessive sequences with which it is associated.

Both top and bottom of the Groundhog sequence was established in the mapped area and a thickness of about 375 metres projected from a composite section (Appendix II).

4.2.2.3 Coal Development

As a result of the trenching program, a total of 8 seams in excess of 0.5 metres, with an aggregate thickness of 10.5 metres are interpreted to occur within the Groundhog sequence on the property.

Of the eight seams, three seams occurring in the middle and upper portion of the sequence are in excess of 1 metre. The thinnest of the three seams was not found to be reliably traceable between exposures of the Groundhog sequence. The other two, however, could be located with sufficient consistency that they were extrapolated across all portions of the licence area underlain by the Groundhog sequence. They comprise the coal resource in the Panorama area.

The upper of the two, called the Currier seam, ranges in thickness from 1.12 to 3.20 metres, averaging 2.10 metres, and occurs approximately 120 to 130 metres from the top of the Groundhog sequence. The lower seam, call the Leach seam, ranges in thickness from 0.75 to 2.55 metres, averaging 1.97 metres, and is developed approximately 240 to 260 metres from the top of the Groundhog sequence.

The "average thickness" of the Currier seam is calculated from all trenched coal exposures occurring within the 120 to 130 metres range from the top of the Groundhog sequence.

The "average thickness" value for the Leach seam is similarly calculated using all

trenched coal thicknesses in the strata interval between 240 and 260 metres from the top of the Groundhog sequence.

These seam thicknesses are applied universally to both the northern and southern Panorama licence blocks.

As a result of the intense deformation and the lack of exposure, great difficulty was experienced in tracing the thinner seams over any distance. Trenches suggest that the seams are thicker in the southern block than in the northern block; however, the apparent thickness difference is probably due to the relatively poor exposures available in the north, and the consequent lack of trenches.

4.2.2.4 Malloch Sequence

The Malloch sequence is also very recessively weathering, but lacks the orange-brown and black colouration of the Groundhog. The transition between the two is gradational, and the Malloch, like the Groundhog, is composed of interbedded sandstones, siltstones, and claystones with the finer-grained lithologies dominating. The Malloch, however, weathers a drab brown rather

than orange. The conglomerate marking the lower boundary of the Malloch is succeeded by several other quite thickly bedded, coarse sands and granular to pebbly conglomerates in the lower third of the Malloch sequence as observed on the property. These cliff-forming units are very resistant and often exhibit marked cross-bedding, which is particularly clear when defined by pebble bands in the coarse, sandy intervals.

More typically, the Malloch sequence comprises interbedded sandstone units: a) grey, fine, medium-grained, medium to thickly bedded, distinctly cross-bedded, 5 to 10 metres thick, and b) claystone/siltstone intervals, very recessive with gradational boundaries, some horizons contain excellent plant fossils, averaging 20 to 25 metres thick. Many of the plant fossils in the claystone and siltstone are carbonaceous and rare accumulations of unfossiliferous carbonaceous to coaly material do occur, but in quite thick zones and impure development. Thin, discontinuous marl bands also make a minor contribution to the Malloch sequence.

The top of the Malloch sequence does not occur within the map area so a local thickness

Figure 4.3 Panorama Licence Area Looking Northwest

(Northern Licence Block is in the Background)

Figure 4.4 Panorama Licence Area Looking Southeast

cannot be provided. A minimum of 2 000 metres may be expected.

4.2.2.5 Rhondda Sequence

The very thick and prominent conglomerates topping the just described sedimentary succession, mentioned by both Black (1968) and Tompson (1970), do not occur within the Panorama licence area. The contact between these conglomerates, here included in a sequence named the Rhondda, and the Malloch sequence, can be found just to the northeast of the licence area on Devil's Claw Mountain. It is surprising that such a prominently weathering and resistant sequence as the Rhondda does not have a more extensive distribution. However, the factors controlling its erosion or non-deposition in the licence area are not known.

4.3 Structure

The structure of the Panorama licence blocks is dominated by several broad, open synclines with steep southwestern limbs, and tighter anticlines. Both large-scale normal faults and thrust faults have been mapped. Imprinted on

the larger structures are numerous, very tight isoclinal folds and associated minor faults.

Structures in the northern licences are generally broader than those in the southern licences, where deformation is more intense. The regional strike forms an arc trending from approximately 135^{o} in the north to 110^{o} in the south. Deformation is thought to have occurred during uplift of the Coast Crystalline Belt in Late Cretaceous and Early Teritary time (Eisbacher, 1974(b)).

4.3.1 Structural Style

Structural style includes box folds in addition to the broad folds previously mentioned. The box folds are frequently broken by minor thrust displacements at the box corners. The major folds trend to the northwest, plunging approximately 15^{o} with occasional local, rapid changes. Very intense folding is evident on a slightly smaller scale. Pairs of isoclinal folds (recumbent in places) are common in Panorama South (the southern licence block). These extremely tight folds become disharmonic with depth. Associated with the intense deformation is extensive quartz veining in fracture fills. These fracture fillings are found in all lithologies including the coal.

The competency of the rock type may be partially controlling the folding in the area south of Panorama Creek. The competence of thick conglomerates in the north prevents the tight-folding style that dominates in the southern area where conglomerates are lacking.

4.3.2 Panorama South

The major structures in Panorama South consist of a large anticline in the western portion and two broad synforms on either side of Kobes Creek. Two thrust faults which combine southwest of Cushing Ridge separate the two areas of Groundhog expsoure.

The major anticline exposes Panorama sequence sediments at its core and plunges consistently to the northwest towards the junction of Panorama Creek and the Nass River. In places, this major fold assumes a box-like configuration with minor faults in the core. The two synforms consist mainly of the Groundhog sequence and are themselves extensively folded and faulted. Within the synforms are the most deformed areas of the licence blocks. Dip direction changes rapidy, but remains fairly steep; individual beds and seams are

difficult to trace laterally despite reasonably good exposure. The westernmost of the synforms is bordered by Grizzly Ridge, while the easternmost includes Cushing Ridge.

Separating the synforms is a thrust fault which dies out in an anticline at Marmot Creek. Further to the southeast, this fault splits into two thrusts. Displacement along these faults ranges from 300 to 500 metres.

In addition to the thrust faults and faults associated with folding, numerous normal faults are observed. On Cushing Ridge, normal faults are observed every 50 to 100 metres with approximately 5 to 10 metres of displacement. Folding is not associated with these small faults, however, the number of quartz-fracture fillings is quite high.

4.3.3 Panorama North

Deformation in the northern licence block does not appear to be as intense as that in the south. Despite limited outcrop, dips are seen to follow consistent trends except for occasional

radical variances. Major structures in the licence block consist of numerous, relatively shallow folds and a normal fault.

The shallow folds are continuous over most of the mapped area in the Malloch Sequence, and generally plunge to the northwest with only minor, local changes. One of these folds, an anticline, exposes the Groundhog sequence in its core just south of the northern licence area. The normal fault is between the two licence blocks, and is defined by a linear northwest-southeast valley trend.

4.3.4 Regional Structure

Outside the licence area, the general structure style can be observed at Devil's Claw Mountain.

The mountain itself is in the centre of a broad syncline plunging northwest. The fold can be traced past Mount Beirnes to Mount Gunanoot, 40 kilometres away. The plunge changes to the southeast near Otsi Creek. This fold has a very steep southwestern limb which is overturned to the east near Currier Creek where the beds are dipping 70° to the southwest (Appendix V). The linear

nature of Currier Creek suggests a fault trace which may be associated with the overturn. The trend can be followed along strike over 15 kilometres southeast of the Currier Creek headwaters. The fault associated with this trend uplifts the Panorama sequence.

Folding appears to be more complex to the southwest of the broad extensive syncline.

5.0 RESOURCE POTENTIAL

The figure for resource potential, calculated below, is only intended as a rough guide to the possible magnitude of the coal resource in the Panorama area that may be proved out by a program of further exploration. The current understanding of the structure of the area is insufficient to provide a more meaningful figure.

The resource potential of the Panorama licences is confined to the Groundhog Sequence. Although a total of 8 seams in excess of 0.5 metres, with an aggregate thickness of 10.5 metres, occur within the sequence, lack of interpretable lateral continuity of the six thinner seams has precluded them from any resource calculation at this time.

The resource calculation for the property involves only the Currier and Leach seams, averaging 2.10 and 1.97 metres in thickness respectively.

The figures calculated from the parameters listed in Table 5.1 are shown in millions of tonnes. A value is presented for each seam in every cross-section. The resource potential is divided between the two licence blocks as follows:

Panorama North	Currier Seam	45.3 tonnes
	Leach Seam	59.5 tonnes
Panorama South	Currier Seam	93 tonnes
	Leach Seam	124.7 tonnes
	Total	322.5 tonnes

TABLE 5.1

TENTATIVE TRENCH CORRELATION*

CURRIER SEAM		LEACH SEAM	
Trench	Coal/Coal + Rock	Trench	Coal/Coal + Rock
PS-TR-80-01	1.22/1.98	PN-TR-80-04	0.92/1.42
PS-TR-80-24	1.12/1.12	+PS-TR-80-02	2.00/2.55
PS-TR-80-25	1.05/1.16	+PS-TR-80-07	1.35/1.57
PS-TR-80-27	1.18/1.27	PS-TR-80-13	1.22/1.91
		+PS-TR-80-14	1.34/1.52
PS-TR-80-28	0.68/1.19	PS-TR-80-15	1.19/1.60
+PS-TR-80-37	3.20/3.80	PS-TR-80-15	0.87/0.87
		+PS-TR-80-22	2.08/2.34
		PS-TR-80-32	0.55/0.75
		PS-TR-80-33	0.66/0.94
		PS-TR-80-34	0.71/0.99
		PS-TR-80-36	1.05/1.23
Average Coal + Rock Thickness	2.104		1.97

Total Aggregate Average Coal + Rock Thickness = 4.07

* Correlation Based on Stratigraphic Position Only

+ Complete Washability Done

TABLE 5.2

PANORAMA RESOURCE POTENTIAL DATA

Cross Section	Coal Seam	Seam Thickness (m)	Seam Length (m)	Seam Width (m)	Boundary Effect	Specific Gravity	In Place Raw Coal (million tonnes)
P 2000	Currier	2.104	230	3000	0.70	1.66	1.7
P 2000	Leach	1.97	980	3000	1.0	1.61	9.3
P 4000	Currier	2.104	1090	2000	1.0	1.66	7.6
P 4000	Leach	1.97	3420	2000	1.0	1.61	21.7
P 6000	Currier	2.104	2020	2000	1.0	1.66	14.1
P 6000	Leach	1.97	2310	2000	1.0	1.61	14.7
P 8000	Currier	2.104	1080	1500	1.0	1.66	5.7
P 8000	Leach	1.97	3300	1500	1.0	1.61	15.7
P 9100	Currier	2.104	4470	1150	1.0	1.66	18.0
P 9100	Leach	1.97	5610	1150	1.0	1.61	20.5
P 10000	Currier	2.104	4400	1650	1.0	1.66	25.3
P 10000	Leach	1.97	5870	1650	1.0	1.61	30.7
P 12000	Currier	2.104	2950	2000	1.0	1.66	20.6
P 12000	Leach	1.97	1750	2000	1.0	1.66	11.1
P 14000	Currier	2.104	0	2000	1.0	1.66	0
P 14000	Leach	1.97	165	2000	1.0	1.61	1.0
P 16000	Currier	2.104	970	2000	1.1	1.66	7.5
P 16000	Leach	1.97	970	2000	0.95	1.61	5.8
P 18000	Currier	2.104	2120	2000	1.0	1.66	14.8
P 18000	Leach	1.97	3640	2000	1.0	1.61	23.1
P 20000	Currier	2.104	3140	3000	0.7	1.66	23.0
P 20000	Leach	1.97	3220	3000	1.0	1.61	30.6
					TOTAL		322.5

5.1 Resource Calculation Procedure and Parameters

The preceeding resource figures were calculated using the generalized cross-sections (AppendixIX). Seam thickness, length, width, and specific gravity constitute the basic data for the calculation (Table 5.1).

The seam length is that length measured from the cross-section, between the topographic surface and a vertical depth of 600 metres. The seam width is the distance the coal seam extends between the geologic cross-sections, called the strike length influence. This figure was usually 2 000 metres except for the first and last cross-sections where it was greater to account for the distance to the property boundary.

In conjunction with the section influence is a boundary effect at licence boundaries and faults. This effect generally decreases the section influence.

The specific gravity of raw coal was based on the average raw coal values for the two zones. The specific gravity for the Leach seam was 1.61 while the specific gravity for the Currier seam was 1.66.

The Panorama resource was calculated using the following formula:

In Place Raw Coal = Seam Length x Seam Thickness x Seam Width x Boundary Effect x Specific Gravity

6.0 COAL QUALITY

6.1 Procedures

During the 1980 field program, coal samples were collected from 42 trenches in the Panorama area. At the end of the program, the samples were sent to the laboratory for analyses as per the flow diagram presented in Figure 6.1.

After the 1.5 float/sink tests, the results were reviewed. On the basis of (a) the coal quality indicated by the preliminary analysis, (b) the thickness of the coal seams from which the samples were taken, and (c) the geographic locations of the trenches; five samples were selected for further analysis. A range of coal quality was apparent from the preliminary analysis, so samples were chosen to represent this range. Only seams thicker than 1.5 metres were considered and the specific trenches were chosen such that a good areal coverage of the southern Panorama licence block was attained. Four of the five selected samples are from the Leach seam, while 01369 is from the Currier seam on Grizzly Ridge. Sample 01312 was found in Cushing Creek, samples 01354 was on Grizzly Ridge, sample 01367 was on the ridge immediately south of Panorama Creek and southwest of Ptarmigan Ridge, and sample 01375 was on Ptarmigan Ridge itself.

Trenching in Panorama North failed to uncover seams over 1.5 metres in thickness.

PANORAMA – SUSTUT TRENCH SAMPLE
FLOW SHEET

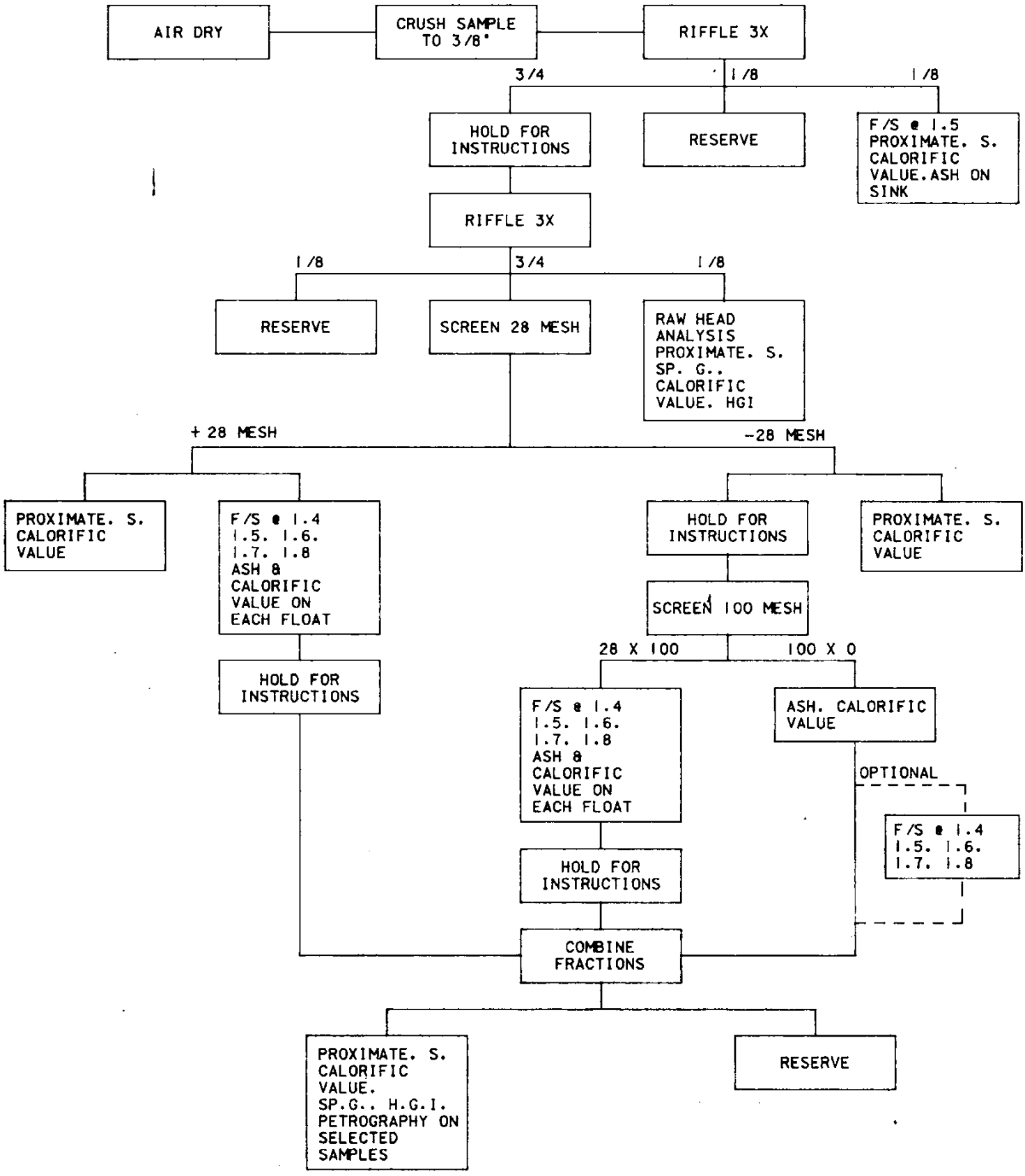


FIG. 6.1

Washability results for the five selected samples (Appendix IV) were reviewed and cut points selected for a simulated clean coal product. The washability results indicated that a reasonable clean coal product with good BTU values could be obtained by cleaning the two coarse fractions at 1.8 specific gravity, and then combining all of the minus 100 mesh material. At 1.8 specific gravity, the amount of near-gravity material is substantially less than at the lower densities, therefore providing a better separation.

6.2 Results

Coal in the Panorama licence area ranges from semi-anthracite to low volatile bituminous (Table 6.1). Sample 01375 from the Leach seam may possibly represent a medium volatile bituminous coal, but the high moisture content (15.73%) makes classification difficult. Because all of the samples are from shallow trenches, they are most likely oxidized.

The range of BTU values (Table 6.2) is somewhat lower than the 12,000 to 14,000 level usually encountered in Groundhog coals. Moisture values are relatively high suggesting that oxidation of the samples may have significantly reduced BTU values for the samples taken.

All values in the report are on an air-dried basis unless otherwise noted.

Raw coal analyses (Appendix IV) are relatively

TABLE 6.1

AVERAGE PANORAMA COAL QUALITY[1]

RAW HEAD ANALYSIS

Ash	22.58%
Residual Moisture	6.17%
Volatile Matter	14.10%
Volitile Matter (DMMF)	17.70%
Fixed Carbon	55.88%
BTU/LB	9 369
Sulphur	0.47%
S.G.	1.63
H.G.I.	102

SIMULATED PRODUCT ANALYSIS

(Cut at 1.8 S.G.)

Yield	82.46%
Ash	14.00%
Residual Moisture	4.48%
Volatile Matter	15.90%
Volatile Matter (DMMF)	18.15%
Fixed Carbon	65.62%
BTU/LB	10 871
Sulphur	0.56%
S.G.	1.57
H.G.I.	109

[1] Weighted Average for both Currier and Leach Seams.

Table 6.2

PANORAMA CLEAN COAL ANALYSES[1]

SEAM SAMPLE NUMBER TRENCH NUMBER	Leach 01312 PS-TR-80-14	Leach 01354 PS-TR-80-22	Leach 01367 PS-TR-80-02	Leach 01375 PS-TR-80-07	Leach Seam Average 2	Currier 01369 PS-TR-80-37
Yield	94.47%	87.40%	76.44%	87.63%	84.21%	77.10%
Ash	12.68%	8.74%	15.69%	10.58%	13.51%	17.44%
Residual Moisture	4.25%	4.95%	2.90%	8.87%	4.94%	3.59%
Volatile Matter	14.55%	18.37%	10.60%	24.76%	17.44%	15.10%
Volatile Matter (dmmf)	16.35%	20.50%	11.22%	29.91%	20.15%	17.47%
Fixed Carbon	68.52%	67.94%	70.81%	55.79%	64.11%	63.87%
BTU/LB	11 313	11 436	11 959	8 713	10 555	10 573
Sulphur	0.38%	0.41%	1.02%	0.30%	0.43%	0.52%
Specific Gravity	1.53	1.51	1.56	1.64	1.57	1.59
H.G.I.	62	130	167	104	92	81

1 Values on an air-dried basis except where indicated
2 Average weighted by thickness of seams sampled

consistent except for sample 01375 (taken from the Leach seam where trenched on Ptarmigan Ridge). This sample is unique in its high moisture content and relatively high volatile content, while the BTU/LB value is substantially lower than all the other samples.

This coal is the most dense of the five (it did not have any 1.5 float), yet its head ash is lower than the average of 20.5%.

Sulphur values are reasonably low, averaging less than 0.45% with most values considerably less. The Hardgrove grindability index values have a wide range from 68 to 137.

Generally, the coal in the Panorama area is quite dense, averaging 1.63 g/cc raw and 1.57 g/cc cleaned at 1.8 S.G. The high density is apparent when comparing the clean coal yields (Table 6.2) with the 1.5 float yields (Appendix IV).

The clean coal results of sample 01375 (Table 6.2) are also considerably different from the other four samples. Volatiles remain high, as does residual moisture, while the BTU/LB values remain relatively low. This sample has a substantial effect on the weighted average values of Table 6.1.

Clean coal sulphur values all increased from the raw coal analysis, however this increase was minimal in all but sample 01367 (also from the Leach seam). Apparently some of the sulphur was found as organic sulphur in the coal rather than the rock partings, particularly in sample 01367.

A comparison between the Panorama results and those of Tompson et al (1977) indicates that the Panorama area contains coal with substantially higher volatiles than the seams in the Skeena River Valley. Volatiles in Tompsons' report (1977) range from 4 to 13% with most samples in the lower half of the range, while the Panorama samples range from 6 to 23% with most samples in the middle of the range.

The average BTU value reported by Tompson (1977) is 13 366, considerably higher than found in Panorama.

Other quality variables are consistent between the two areas. Since the coal in both areas occupies the same stratigraphic position, the apparently lower rank of the Panorama coal may be attributed to the difference in elevation or perhaps to different sampling procedures.

Further controlled sampling and analysis, perhaps including petrography, will help resolve the questions concerning Panorama coal rank.

7.0 RECOMMENDATIONS

The following recommendations are presented regarding the Panorama coal licences:

a) Additional trenching is required to trace the surface extent of the most economic seams. Additional trenching would be essential for seam correlation.

b) Additional mapping in greater detail is required to further define the stratigraphy and perhaps some marker horizons. Greater control on the stratigraphy would assist the structural interpretation.

d) Preliminary drilling is suggested for future exploration work.

Drilling would:

1) Provide unweathered samples and hence more accurate washability data.

2) Contribute to the stratigraphy and correlation by refining the stratigraphic column.

3) Provide more accurate unit and coal zone thickness.

4) Contribute to the structural knowledge of the area.

5) Help prove any potential mining situations.

e) Recommended drill sites (Figure 7.1) are as follows:

Location A

This is the one area on the property which appears to be relatively undisturbed and, therefore, the best location to obtain a complete section of the Groundhog sequence.

Location B

At the present time, Cushing Ridge appears to have one of the most favourable mining situations (cross-section 1000) where a number of tight folds, probably faulted, occur within a topographic high. It is also one of the more structurally complex areas.

Location C

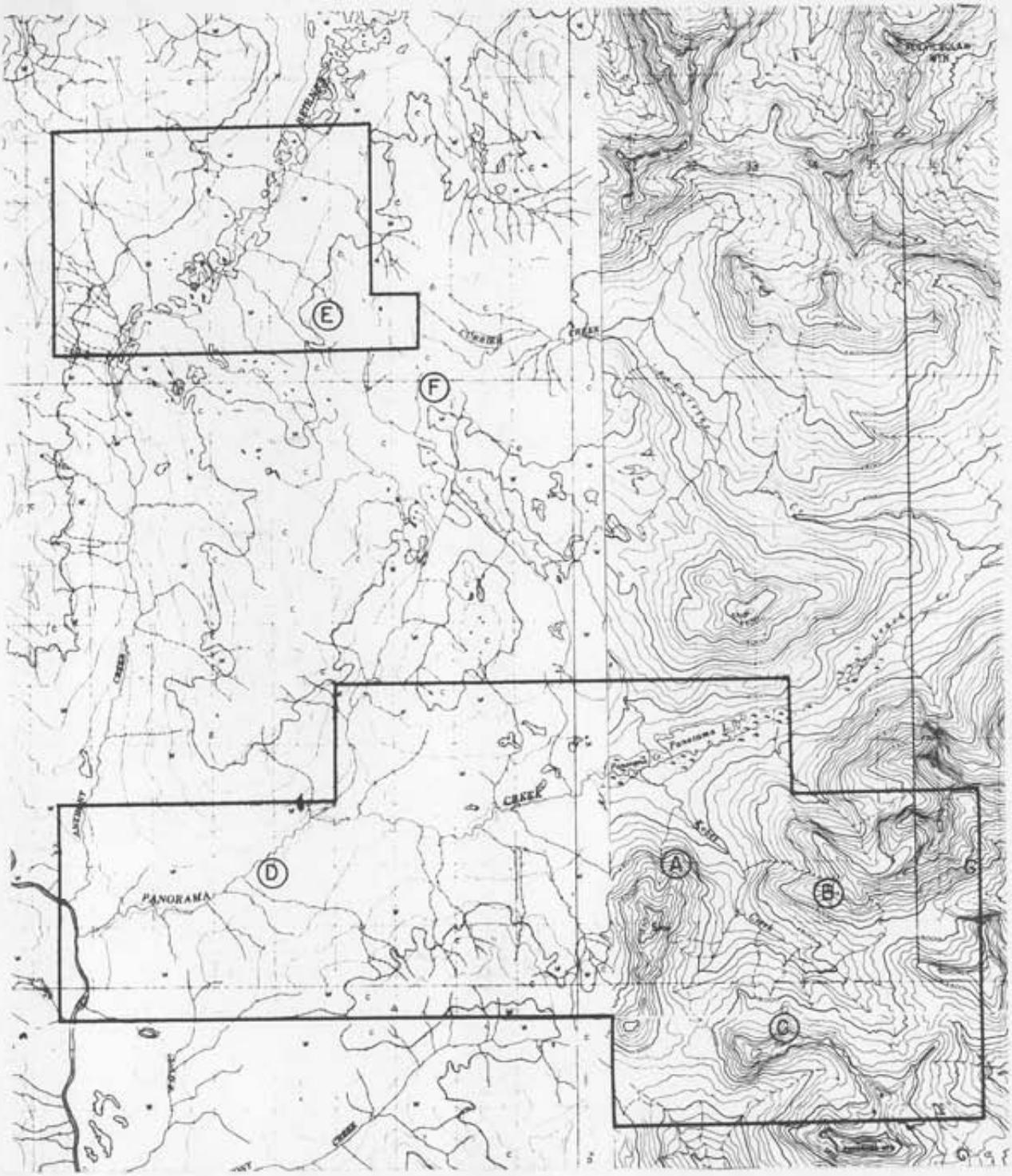
The seams on Grizzly Ridge are the thickest found to date on the licence block. Also, the area is highly deformed which could concentrate and structurally thicken these seams.

Location D

Good coal exposures are present in Panorama Creek and the seams appear to be close to the surface as well.

Location E

In the northern licence block, exposure is severely limited. Drilling in this location would allow utilization of existing exposure for control and contribute to a stratigraphy for the



GULF CANADA RESOURCES INC. Coal Division	Gulf
CALGARY ALBERTA	
PANORAMA COAL PROJECT	
RECOMMENDED DRILLING SITES	
PREPARED BY: J. INNIS	SCALE 1:100,000
APPROVED BY: DATE: DEC. 1980	DRAWING No. FIG. 7.1

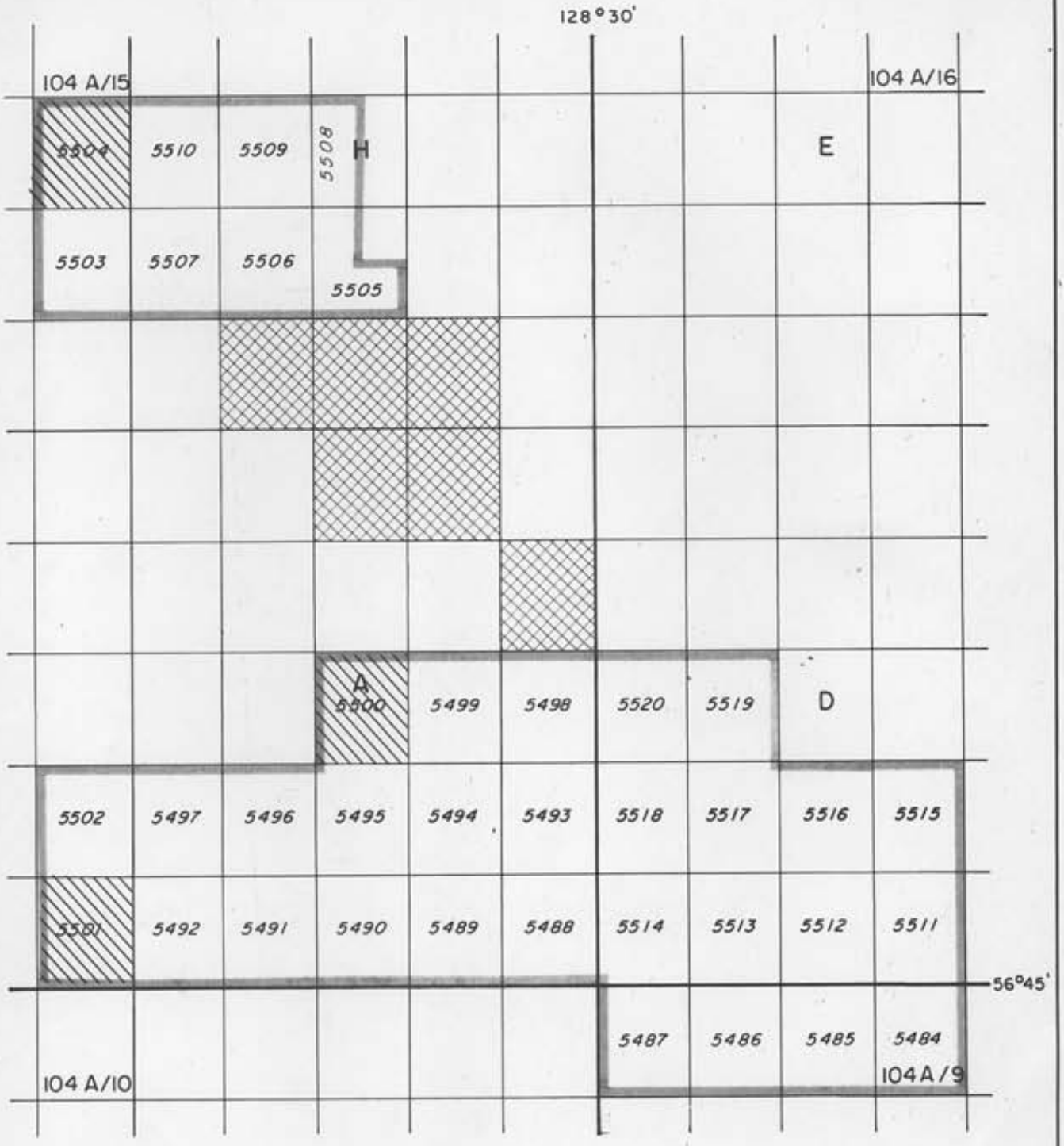
northern licences. The coal seams are interpreted to be relatively close to the surface.

Location F

This location is off the present licence boundary, but is along the same trend as Location E. Due to the almost total lack of exposure here, drilling is required to prove the continuation of the Groundhog sequence.

f) The geological mapping undertaken during the 1980 Panorama project has provided reasonable control of the stratigraphy and structure of the coal-bearing Groundhog sequence. On the basis of this mapping, there appears to be no outcrop of the Groundhog sequence within licences 5500, 5501, and 5504. These licences could, therefore, be surrendered if desired.

g) If it is desirable to control the ground where the Groundhog sequence outcrops, the acquisition of six additional licences is recommended (Figure 7.2). The licences extend southeast from the southeast corner of the northern licence block. Interpretation of the 1980 results suggest the Groundhog sequence may outcrop as a shallow anticline along this trend. This interpretation is supported by coal exposed (PN-TR-80-04) along this very recessive trend. The acquisition will allow Gulf Canada Resources Inc. to control most, if not all, of the major coal-bearing units in the immediate area.



5472 LICENCES FOR ACQUISITION

5470 LICENCES TO BE SURRENDERED

5468 LICENCE NUMBER

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA COAL PROJECT
LICENCE REVISIONS

PREPARED BY	J. INNIS	SCALE 1: 100,000
APPROVED BY	DATE Nov., 1980	DRAWING No. FIG. 7.2

8.0 SELECTED BIBLIOGRAPHY

BLACK, J.M., 1968, Groundhog Coal Survey, Report Written for Dillingham Corporation on Ground Held By Coastal Cool Co. Ltd.

BUCKHAM, A.F. and LATOUR, B.A., 1950, The Groundhog Coal Field, British Columbia, Geological Survey of Canada, Bulletin 16, 81 pg.

EISBACHER, G.H., 1974(a), Deltaic Sedimentation in the Northeastern Bowser Basin, British Columbia, Geological Survey of Canada, Paper 73-33, 13 pg.

_____, 1974(b), Evolution of Successor Basins in the Canadian Cordillera of British Columbia; in Society of Economic Paleantologists & Mineralogists, Special Volume No. 19, pg. 274 - 291.

_____, 1976, Successor Basins of the Western Cordillera, Geological Survey of Canada, Paper 76-1, Pt. A, pg. 113 - 116.

MALLOCH, G.S., 1912, The Groundhog Coalfield, British Columbia, Geological Survey of Canada, Summary Report.

RICHARDS, T.A. and GILCHRIST, R.D., 1979, Groundhog Coal Area, British Columbia, Geological Survey of Canada, Paper 79-1, Part B, pg. 411 - 414.

TOMPSON, W.D., JENKINS, D.M., and ROPER, M.W., 1970, Exploration of the Groundhog Coalfield, Upper Skeena River Area, British Columbia, Report to Joint Venture: National Coal Corporation Ltd., Placer Development Ltd., Quintana Minerals Corporation.

_____, 1977, Geology of the Groundhog Coalfield, Upper Skeena River Area, British Columbia, for: B.C. Hydro and Power Authority.

APPENDIX I

LEGAL DESCRIPTION OF LICENCES

PANORAMA COAL PROJECT LICENCES 1980

Licence No.	Date Issued	Hectares	Land Description		
			Series	Block	Units
5484	November 5/79	284	104-A-9	L	83, 84, 93, 94
5485	"	"	"	"	85, 86, 95, 96
5486	"	"	"	"	87, 88, 97, 98
5487	"	"	"	"	89, 90, 99, 100
5488	"	"	104-A-15	A	1, 2, 11, 12
5489	"	"	"	"	3, 4, 13, 14
5490	"	"	"	"	5, 6, 15, 16
5491	"	"	"	"	7, 8, 17, 18
5492	"	"	"	"	9, 10, 19, 20
5493	"	"	"	"	21, 22, 31, 32
5494	"	"	"	"	23, 24, 33, 34
5495	"	"	"	"	25, 26, 35, 36
5496	"	"	"	"	27, 28, 37, 38
5497	"	"	"	"	29, 30, 39, 40
5498	"	"	"	"	41, 42, 51, 52
5499	"	"	"	"	43, 44, 53, 54
5500	"	"	"	"	45, 46, 55, 56
5501	"	"	104-A-15	B	1, 2, 11, 12
5502	"	"	"	"	21, 22, 31, 32
5511	"	"	104-A-16	D	3, 4, 13, 14
5512	"	"	"	"	5, 6, 15, 16
5513	"	"	"	"	7, 8, 17, 18
5514	"	"	"	"	9, 10, 19, 20
5515	"	"	"	"	23, 24, 33, 34
5516	"	"	"	"	25, 26, 35, 36
5517	"	"	"	"	27, 28, 37, 38
5518	"	"	"	"	29, 30, 39, 40
5519	"	"	"	"	47, 48, 57, 58
5520	"	"	"	"	49, 50, 59, 60
5503	"	"	104-A-15	G	21, 22, 31, 32
5504	"	283	"	"	41, 42, 51, 52
5505	"	245	104-A-15	H	25, 26, 35, 36 PTN
5506	"	284	"	"	27, 28, 37, 38
5507	"	284	"	"	29, 30, 39, 40
5508	"	175	"	"	45, 46, 55, 56 PTN
5509	"	283	"	"	47, 48, 57, 58
5510	"	283	"	"	49, 50, 59, 60
TOTAL		10,357	Final Application		
		31,180	Initial Application		

JI/cbb
80-12-16

GR - Panorama 80(2)A

"Panorama Coal Project Geological Report, 1980"
Gulf Canada Resources Inc.

Maps, Cross Sections

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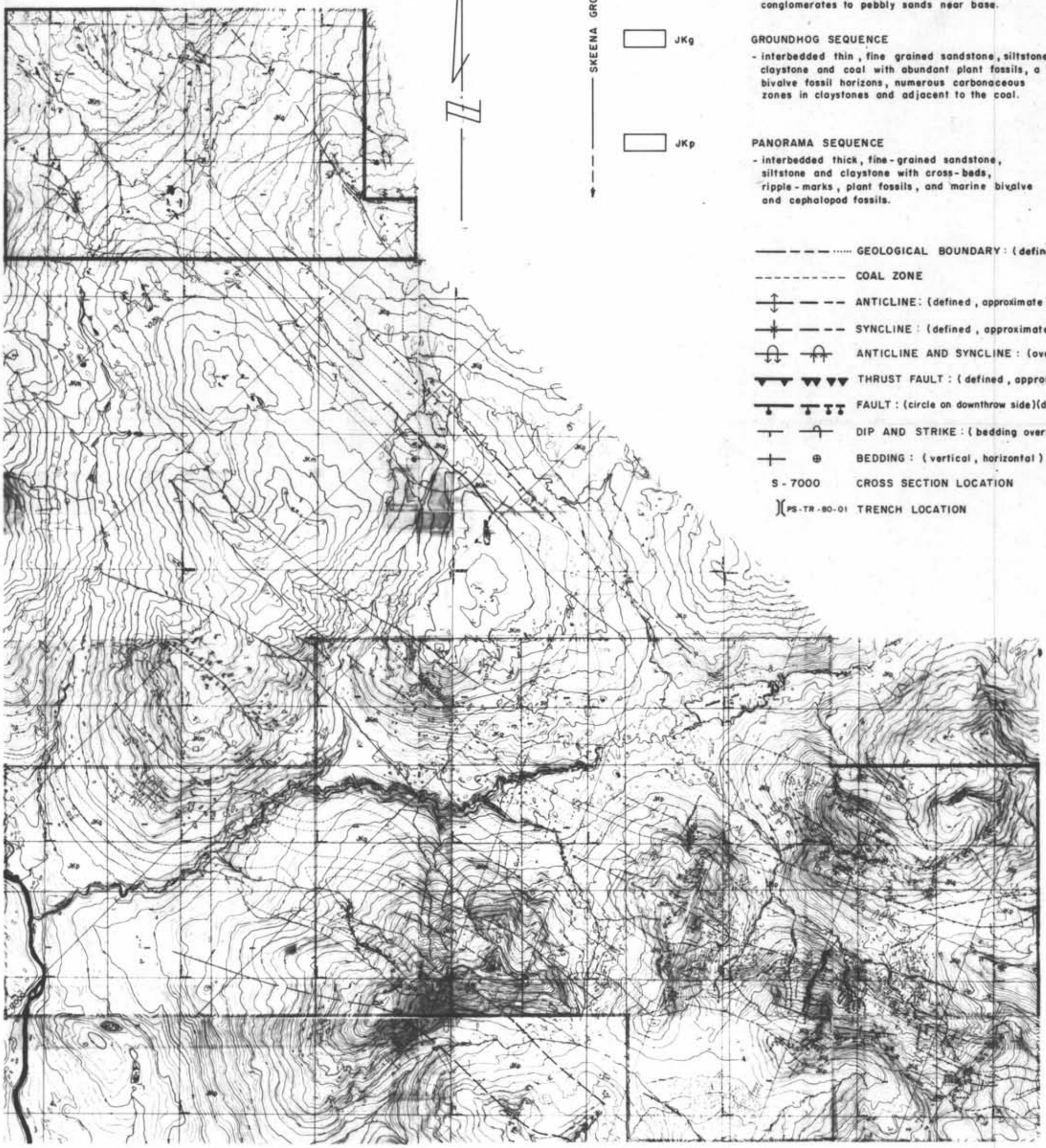
APPENDIX II

GROUNDHOG SEQUENCE SCHEMATIC SECTION



SKEENA GROUP

JKm — MALLOCH SEQUENCE
- interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

JKg — GROUNDHOG SEQUENCE
- interbedded thin, fine grained sandstone, siltstone, claystone and coal with abundant plant fossils, a few bivalve fossil horizons, numerous carbonaceous zones in claystones and adjacent to the coal.

JKp — PANORAMA SEQUENCE
- interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.

——— — — — ····· GEOLOGICAL BOUNDARY : (defined, approximate, inferred)

---------- COAL ZONE

ANTICLINE : (defined, approximate)

SYNCLINE : (defined, approximate)

ANTICLINE AND SYNCLINE : (overturned)

THRUST FAULT : (defined, approximate, inferred)

FAULT : (circle on downthrow side)(defined, approximate, inferred)

DIP AND STRIKE : (bedding overturned)

BEDDING : (vertical, horizontal)

S-7000 CROSS SECTION LOCATION

PS-TR-80-01 TRENCH LOCATION

GR-Panorama 80(2)A

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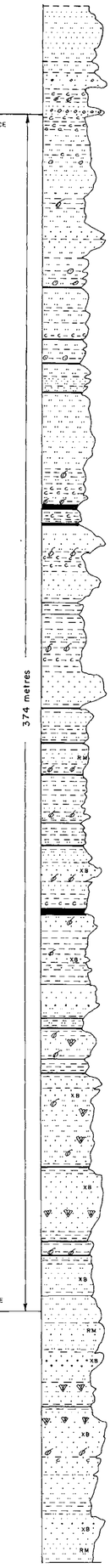
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GEOLOGY MAP

PREPARED BY: J. M. DUFORD		SCALE 1:50,000
APPROVED BY:	DATE: DEC. '80	DRAWING No.



SANDSTONE – FINE GRAINED, WITH OCCASIONAL SILTSTONE INTERBEDS, GREY, THICK BEDDED, SOME RIP UP CLASTS.

SILTSTONE – OCCASIONAL CLAYSTONE INTERBEDS. BROWN TO ORANGE BROWN.

SANDSTONE – MEDIUM GRAIN, OCCASIONAL PEBBLE BANDS

CLAYSTONE – CARBONACEOUS IN PLACES. POORLY EXPOSED.

CONGLOMERATE – MEDIUM GRAINED SANDSTONE MATRIX

SILTSTONE – WITH INTERBEDDED CLAYSTONE, CARBONACEOUS IN PLACES. DARK GREY TO BLACK. OCCASIONAL ORANGE WEATHERING.

SILTSTONE – SOME FINE GRAINED SANDSTONE, DARK BROWN TO GREY, THIN BEDDED.

SILTSTONE – MEDIUM GRAINED SANDSTONE IN CENTRE OF SECTION, CLAYSTONE INTERBEDS THROUGHOUT. DARK GREY TO BROWN, WEATHERS ORANGE. IN PLACES, SANDSTONE IN CENTRE HAS SALT AND PEPPER APPEARANCE WITH CLAYSTONE CLASTS. POORLY EXPOSED NEAR TOP.

SILTSTONE – FREQUENT CLAYSTONE INTERBEDS, CARBONACEOUS, OCCASIONAL FINE GRAINED SANDSTONE INTERBEDS. GREY TO BROWN, THIN BEDDED. UP TO 4 COAL SEAMS, 2 OF WHICH ARE APPROXIMATELY 1 m.

SILTSTONE – OCCASIONAL FINE GRAINED SANDSTONE INTERBEDS. GREY BROWN, LAMINATED TO THIN BEDDED. POORLY EXPOSED.

CLAYSTONE – CARBONACEOUS, OCCASIONAL SILTSTONE INTERBEDS. DARK BROWN TO BLACK, THIN BEDDED, RECESSIVE, COAL SEAM UP TO 2.0 m. MINOR SEAM PRESENT AS WELL.

SANDSTONE – MEDIUM GRAINED, SOME FINE GRAINED. CLAYSTONE IN MID SECTION, CARBONACEOUS. BROWN–GREY, THIN BEDDED. RECESSIVE IN MID SECTION.

CLAYSTONE – OCCASIONAL SILTSTONE INTERBEDS. CARBONACEOUS OR SILTY IN PLACES, BROWN–GREY OR ORANGE. MINOR COAL UP TO 0.5 m. RECESSIVE.

SANDSTONE – MEDIUM GRAINED, BROWN–GREY, THICK BEDDED. SOME CLAYSTONE CLASTS, RESISTANT.

CLAYSTONE – FINE GRAINED SANDSTONE AND SILTSTONE INTERBEDS, THIN BEDDED, BROWN, ORANGE TO GREY. THIN COAL SEAMS AVG .85 m.

CLAYSTONE – SILTSTONE AND FINE GRAINED SANDSTONE INTERBEDS, CROSS LAMINATED, GREY TO ORANGE BROWN. RECESSIVE. POORLY EXPOSED.

CLAYSTONE – SILTSTONE AND FINE GRAINED SANDSTONE INTERBEDS, GREY TO BROWN, THIN BEDDED, RECESSIVE. POORLY EXPOSED. MINOR COAL <0.3 m.

CLAYSTONE – SILSTONE INTERBEDS, MINOR COAL SEAMS UP TO 0.5 m. POORLY EXPOSED.

SANDSTONE – MAINLY FINE GRAINED WITH OCCASIONAL SILTSTONE AND CLAYSTONE INTERBEDS. LIGHT BROWN TO GREY, THIN TO MEDIUM BEDDED. RECESSIVE.

CLAYSTONE – SILTY IN PLACES. COAL UP TO 2.3 m. CLAYSTONE IS BROWN TO RUSTY BROWN. VERY RECESSIVE.

CLAYSTONE – FREQUENT INTERBEDS OF MEDIUM GRAINED SANDSTONE WITH SILTSTONE LAMINATIONS NEAR TOP, BROWN TO RUST BROWN, THIN TO MEDIUM BEDDED. VERY RECESSIVE AND POORLY EXPOSED.

CLAYSTONE – OCCASIONAL LIGHT BROWN SILTSTONE INTERBEDS AND MEDIUM GRAINED ORANGE–BUFF SANDSTONE NEAR CENTRE, THIN BEDDED. 3 COAL SEAMS RANGING IN THICKNESS FROM .1 – .8 m.

SANDSTONE – MEDIUM GRAINED CLAYSTONE LAMINATIONS, THICK BEDDED, SOME CROSS BEDDING. BROWN TO GREY.

SILTSTONE – WITH INTERBEDDED FINE GRAINED SANDSTONE, CLAYSTONE AND THIN COAL AT BASE. CLAYSTONE CAN BE CARBONACEOUS TO DARK GREY. BROWN TO ORANGE BROWN. SANDSTONE CONTAINS LENTICULAR SILTSTONE, THIN BEDDED, MODERATELY RECESSIVE.

SANDSTONE – MEDIUM GRAINED WITH THIN INTERBEDS OF SILTSTONE AND VERY FINE GRAINED SANDSTONE. BROWN TO ORANGE BROWN, MEDIUM TO THICK BEDDED NEAR TOP, THIN BEDDED NEAR BASE. SILTSTONE BANDS ARE LENTICULAR.

CLAYSTONE – SILTY IN PLACES, OCCASIONAL THIN SANDSTONE INTERBEDS. DARK BROWN. UP TO 2 THIN (.3 m) COAL SEAMS. RECESSIVE.

SILTSTONE – OCCASIONAL SANDSTONE AND CLAYSTONE INTERBEDS. SANDY AT TOP. CARBONACEOUS WITH COALY WISPS AND A THIN COAL SEAM (.4 m), DARK GREY TO BROWN AND RUST. GENERALLY THIN BEDDED AND FLAGGY.

SANDSTONE – FINE GRAINED WITH THIN UNITS OF MEDIUM AND COARSE GRAINED. SILTSTONE AND CLAYSTONE INTERBEDS. GREY BROWN, THIN TO THICKLY BEDDED RESISTANT. RIPPLE MARKS COMMON, OCCASIONAL CROSS BEDDING.

SANDSTONE – MEDIUM AND FINE GRAINED WITH CLAYSTONE INTERBEDS AND VERY THIN COAL SEAMS (AVERAGE .1 m). GENERALLY THIN BEDS, OCCASIONAL PELECYPOD BEDS. RECESSIVE.

SANDSTONE – MEDIUM GRAINED, COARSENING TOWARDS TOP. GREY BROWN TO ORANGE. MEDIUM BEDDED. THINNER BEDS AT TOP, CROSS BEDS NEAR BASE, RESISTANT.

SANDSTONE – MAINLY MEDIUM GRAINED WITH OCCASIONAL SILTY CLAYSTONE BEDS. GREY TO BROWN. MEDIUM TO THICKLY BEDDED WITH SOME THIN BEDDED UNITS, MODERATELY RESISTANT.

CLAYSTONE – SILTY IN PLACES, DARK GREY–BROWN. THIN BEDDED. RECESSIVE.

SANDSTONE – SILTY AT BASE, MEDIUM GRAINED, COARSE GRAINED AT TOP, GREY TO BROWN. MEDIUM TO THICK BEDDED, THIN BEDDED AT BASE. SILTSTONE RIP–UP CLASTS.

KEY

- CONGLOMERATE
- SANDSTONE – COARSE GRAINED
- SANDSTONE – MEDIUM GRAINED
- SANDSTONE – FINE GRAINED
- SILTSTONE
- SILTY CLAYSTONE
- CLAYSTONE
- CARBONACEOUS CLAYSTONE
- COAL
- PLANT FOSSILS
- SHELL FOSSILS
- CONCRETIONS
- RM – RIPPLE MARKS
- XB – CROSS BEDDING

0 50 m.

GR Panorama 80(2)A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

GENERALIZED STRATIGRAPHIC SECTION OF THE GROUNDHOG SEQUENCE

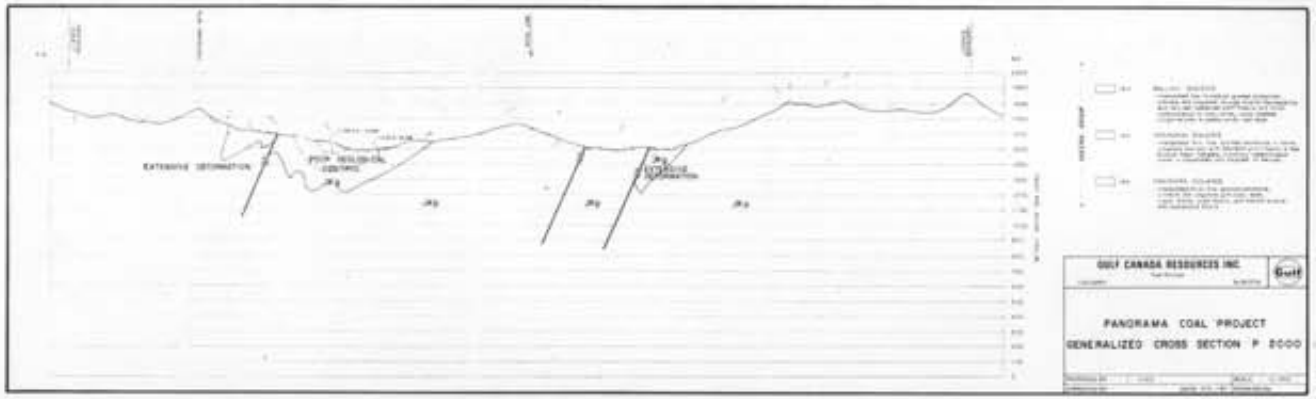
112

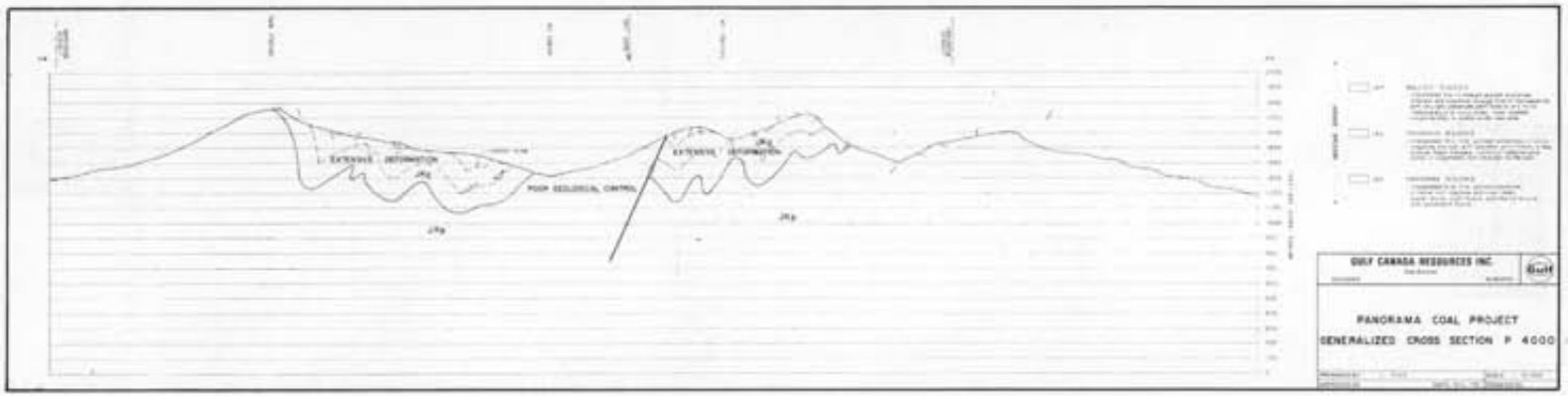
PANORAMA COAL PROJECT

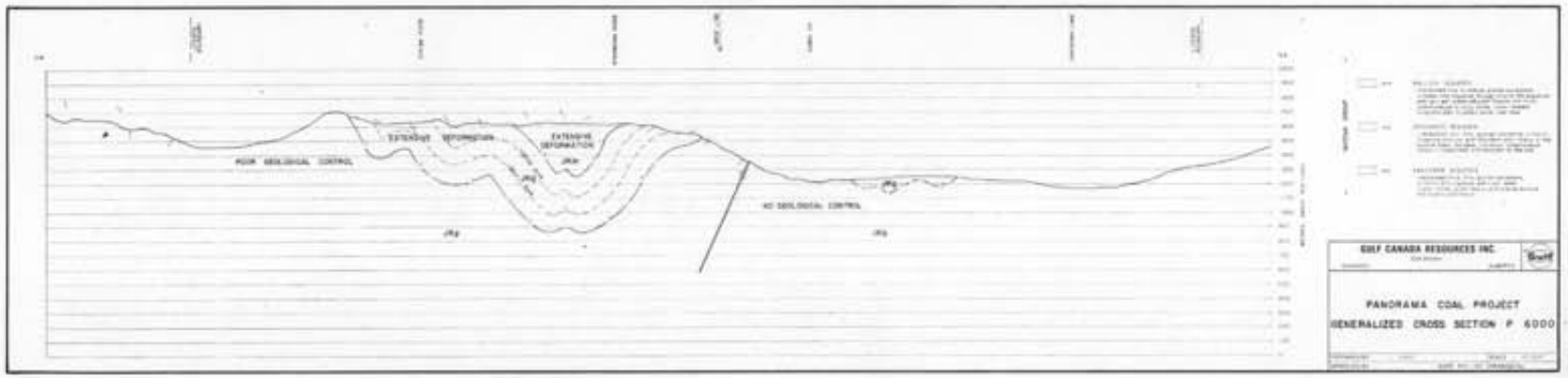
PREPARED BY: J.M. DUFORD	SCALE
APPROVED BY: DATE: SEPT. 1980	DRAWING No. PN–80–001

APPENDIX V

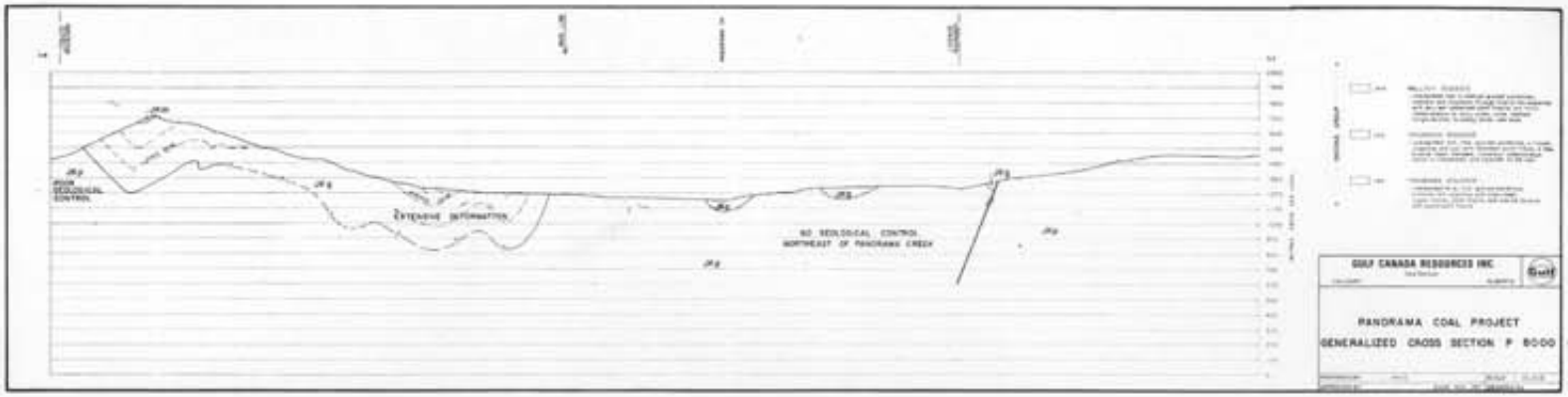
GEOLOGY MAPS AND CROSS-SECTIONS (1:50 000)

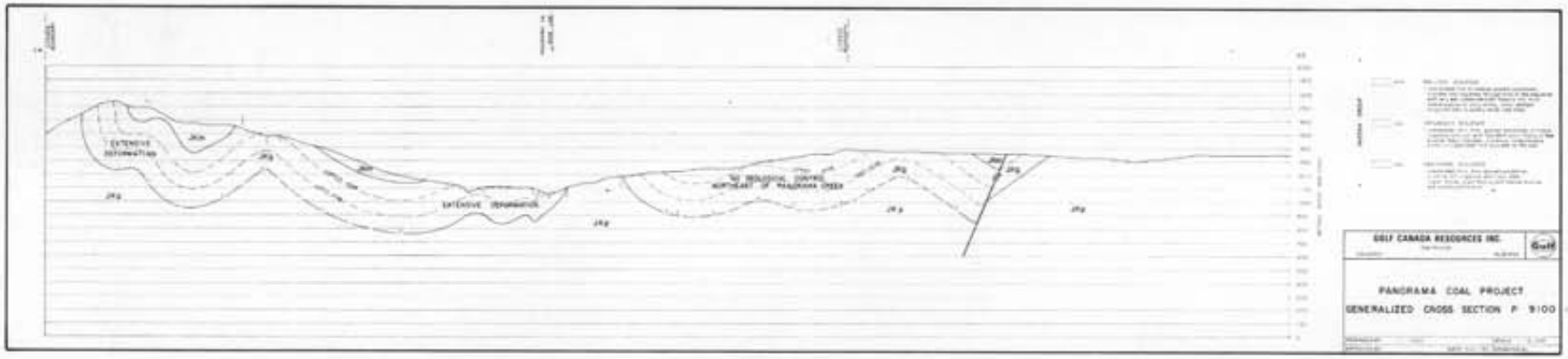


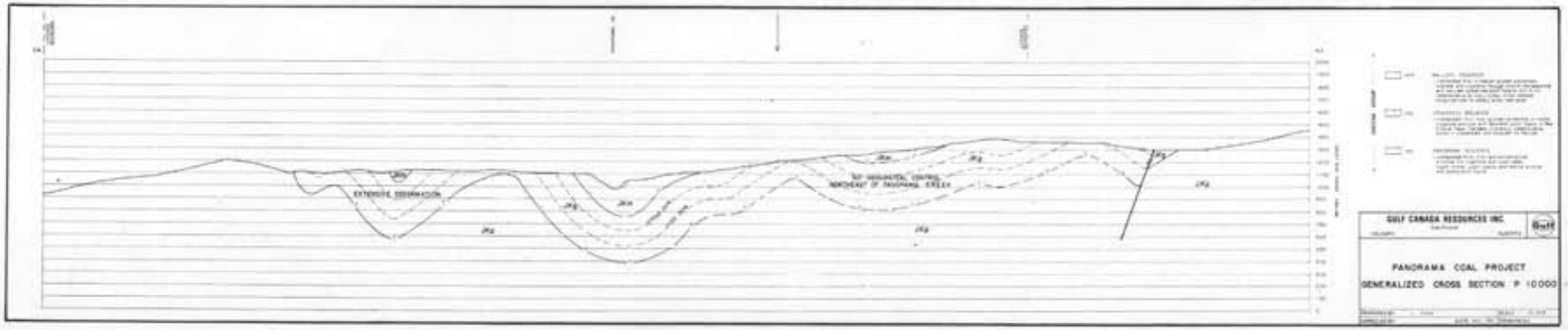




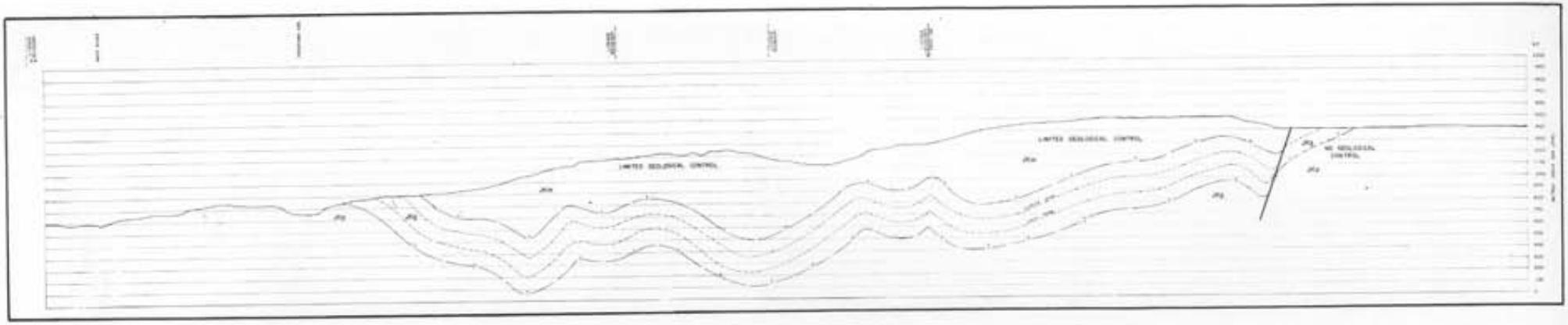
GR-Panorama 80(2)A

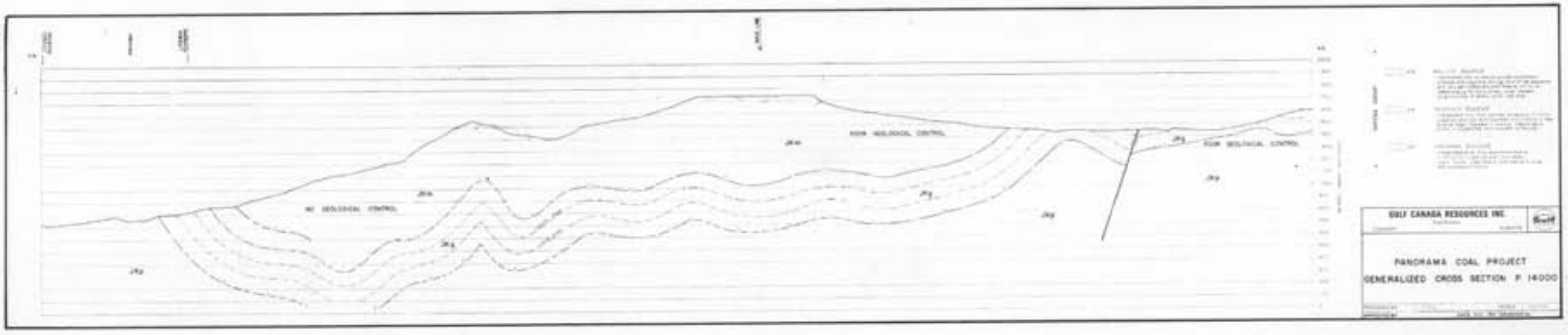




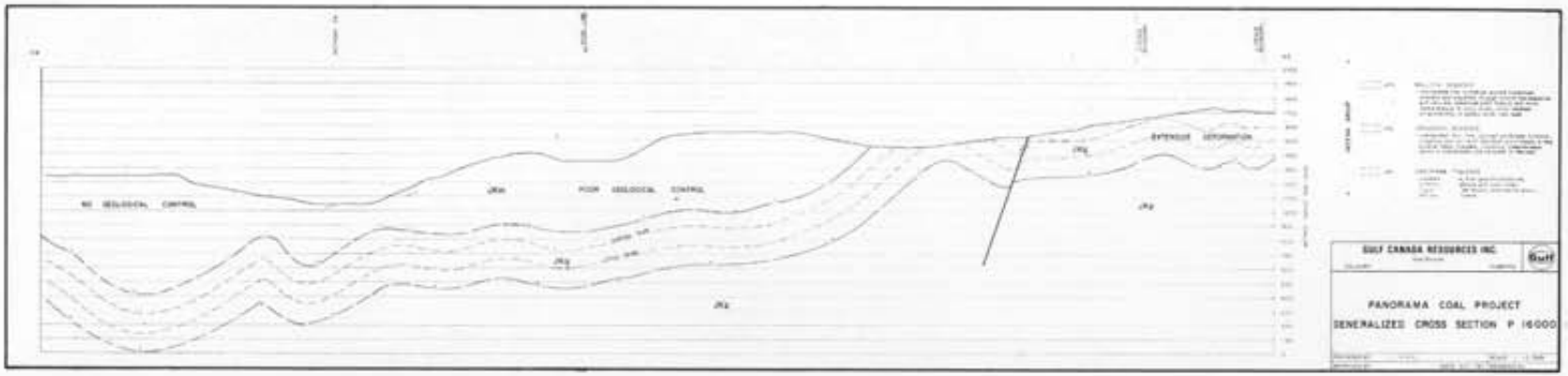


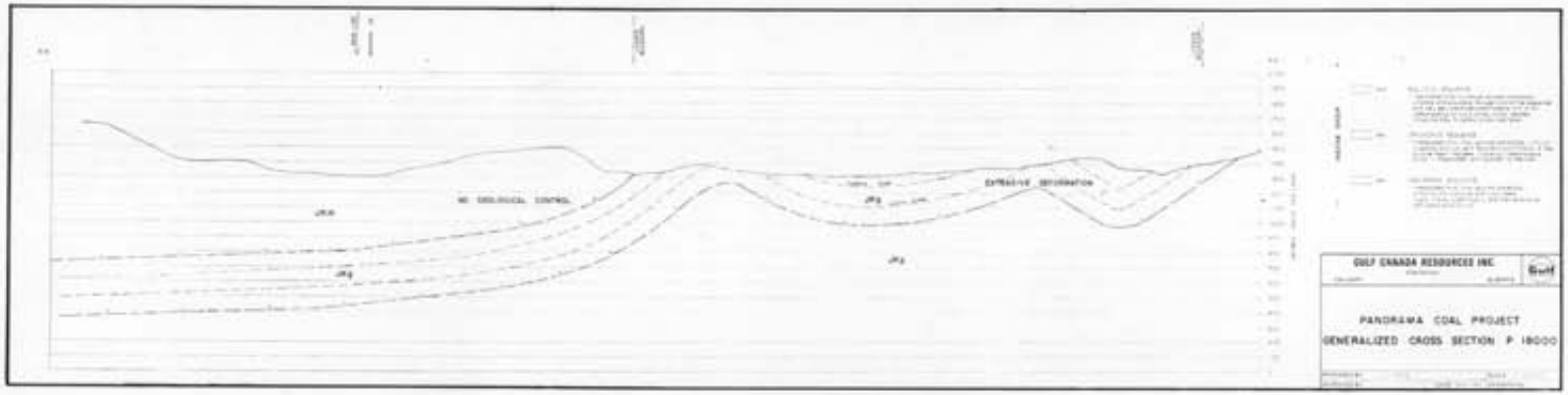
GR-Panorama P0010.

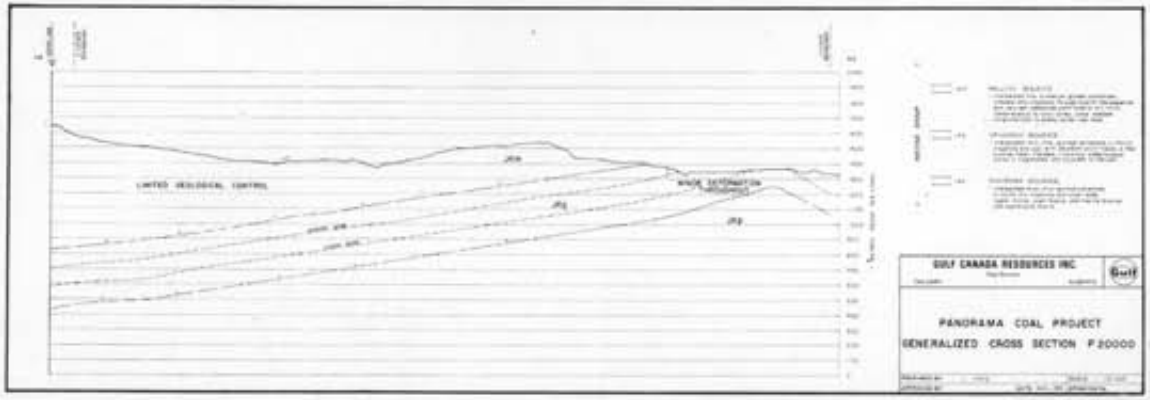




GR. Panorama 80(21A





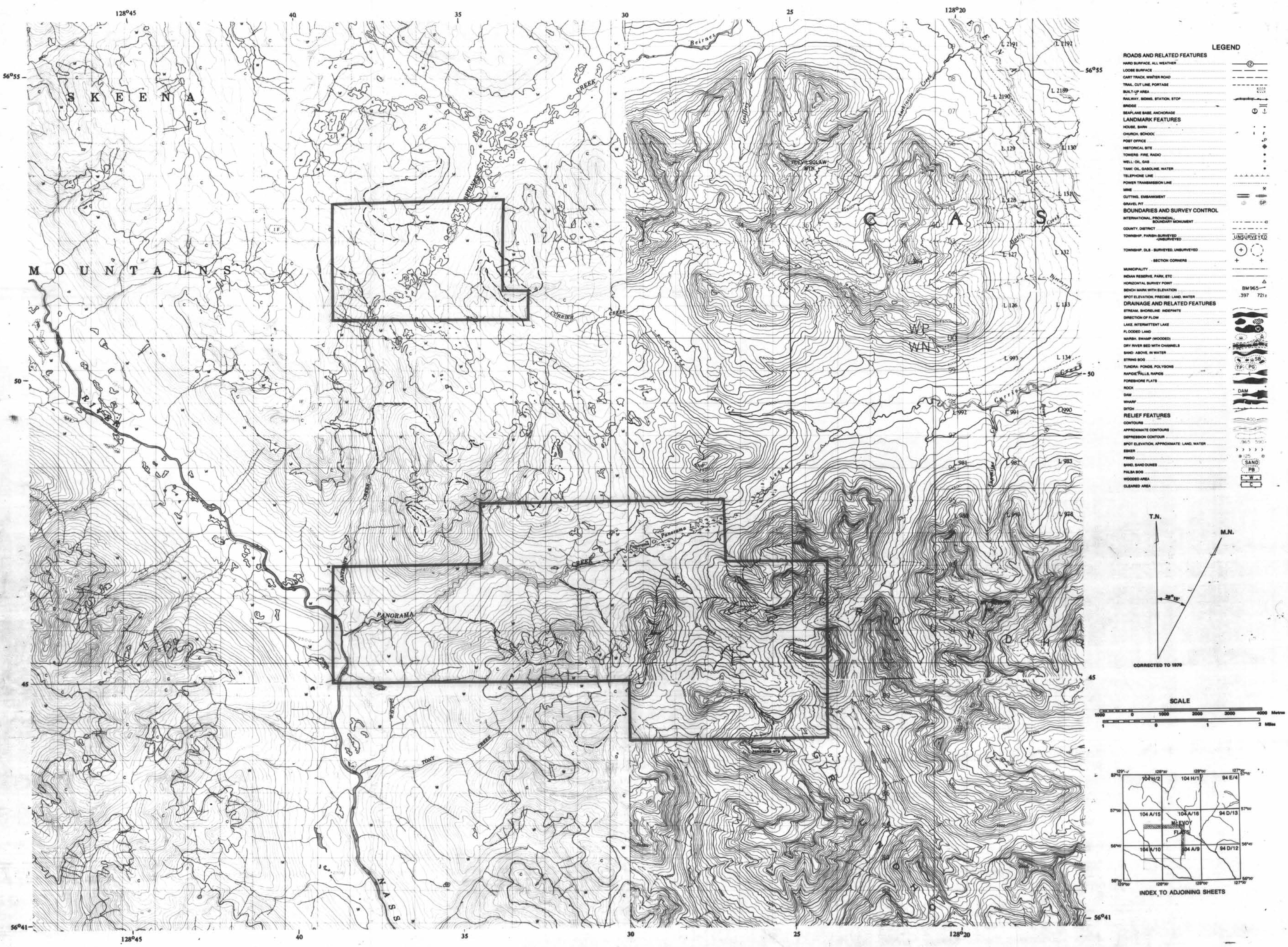


GR-Panorama 80(2)A

APPENDIX VI

TRAVERSE LOCATION MAP

GR Panorama 80(2)A



Published 1950.

Compiled by the Topographical Survey in 1949 from photographs taken in 1948 by the Royal Canadian Air Force.

Converted from 1:63,360 to 1:50,000 without revision, by the Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa, in 1971.

Copies may be obtained from the Map Distribution Office, Department of Energy, Mines and Resources, Ottawa.

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA CREEK AREA
TRAVERSE LOCATION MAP

DRAWN BY:	DATE:	SCALE 1:50,000
PREPARED BY: J. INNIS		DRAWING No.
APPROVED BY:	DATE:	Pn-80-048

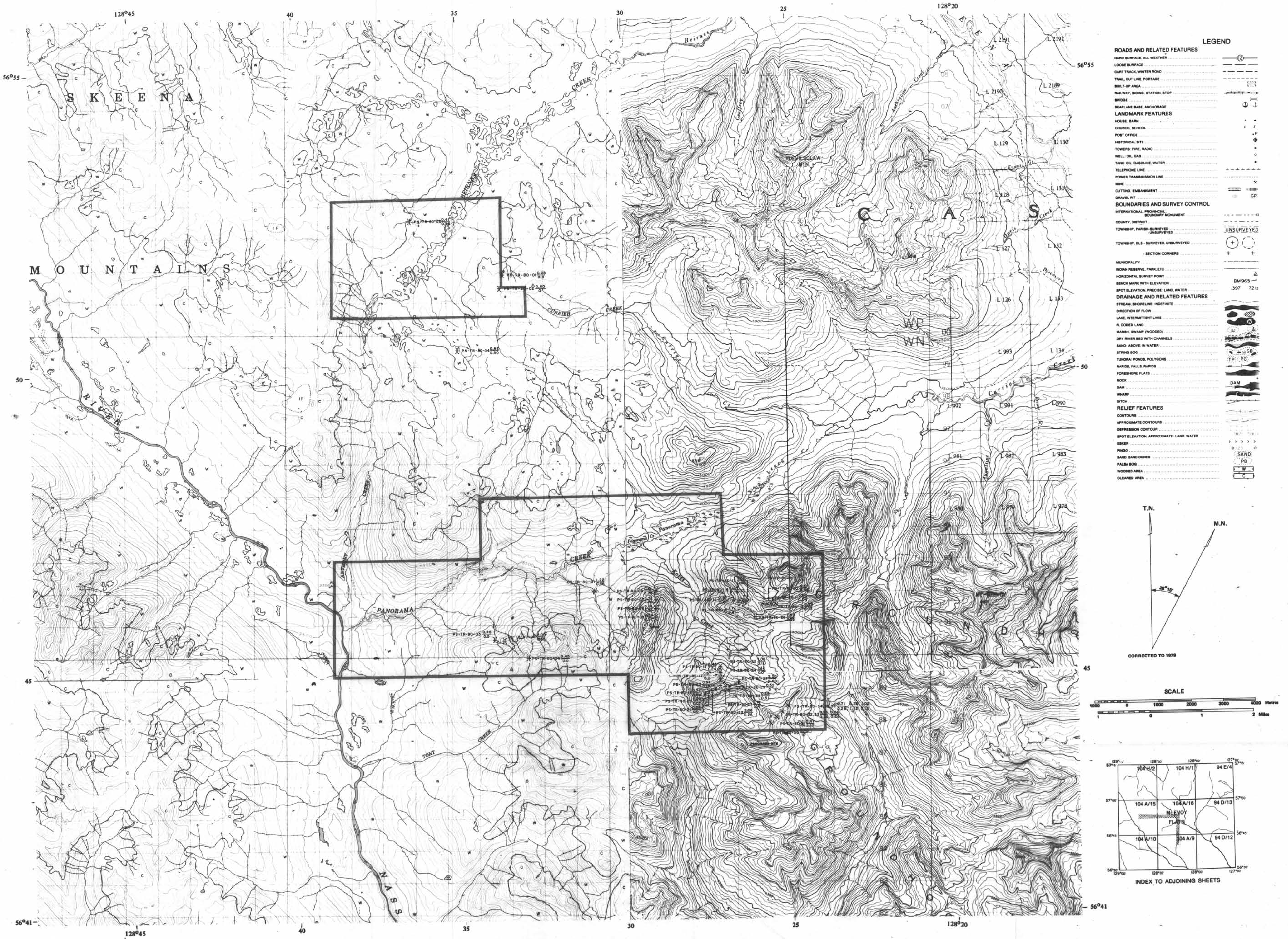
FILE No.

112

GR-Panorama 80(3)A

APPENDIX VII

TRENCH LOCATION MAP



Published 1950.
Compiled by the Topographical Survey in 1949 from photographs taken in 1948 by the Royal Canadian Air Force.

Converted from 1:63,360 to 1:50,000 without revision, by the Surveys and Mapping Branch, Department of Energy, Mines and Resources, Ottawa, in 1971.

Copies may be obtained from the Map Distribution Office, Department of Energy, Mines and Resources, Ottawa.

GULF CANADA RESOURCES INC.
Coal Division
CALGARY **ALBERTA**

PANORAMA CREEK AREA
TRENCH LOCATIONS

DRAWN BY:	DATE:	SCALE 1 : 50,000
PREPARED BY: J. INNIS		DRAWING No. Pn-80-049
APPROVED BY:	DATE:	

FILE No.

112

GR-Panorama 80(3)A

APPENDIX VIII

BASE MAP PREPARATION PROCEDURE

HARDY ASSOCIATES (1978) LTD.

CONSULTING ENGINEERING & PROFESSIONAL SERVICES

File No.

December 21, 1979

CALGARY OFFICE (MAIN)
219 - 18th STREET S.E.
CALGARY, ALBERTA
T2E 6J5
TELEPHONE: (403) 272-8761
TELEX NO.: 03-826717

Gulf Resources Canada Inc.
401 Ninth Avenue S.W.
Calgary, Alberta
T2P 3C5

Attention: Mr. Brian Flynn

Dear Sir:

Re: Reconnaissance Type Photogrammetric Mapping of the Sustut and Panorama Project Areas

In reference to our meeting in your office with yourself and Mr. G.D. Childs, we are pleased to submit the following proposal to satisfy your photogrammetric mapping requirements on the above two project areas.

To obtain the 1:10 000 approximate scale reconnaissance type photogrammetric mapping with a 10 metre form line interval, we propose the following procedures:

1) We will obtain from the Federal Government photography and diapositives covering the Sustut Project at the approximate scale of 1:72 000; and we will obtain from the British Columbia Government the set of contact prints and diapositives for the Panorama Project at the approximate scale of 1:63 000.

2) For control in the above mapping, we shall utilize existing data, i.e. Government monuments and locations providing they are photo identifiable, and survey control from existing NTS maps.

3) Prior to mapping, we will carry out aerial triangulation and numerical adjustment for both project areas.

4) Mapping will be carried out on our first and second order stereo plotter instruments and we will submit to you, as an end product, pencil manuscripts showing the approximate position of UTM grids and all necessary details as specified for this type of reconnaissance mapping by the CAAS.

Production of this type of reconnaissance mapping is very economical and may be accomplished within a short period of time. However, the mapping will only be as accurate as existing data and their photo identifiability. In other words, the relative elevation between form lines will be good but absolute elevation differences for the whole property, plus the scale, will not be exact or as reliable as if special survey had been carried out for the project. The map, therefore, is only a reconnaissance type map which can only be used as a tool during the field geology, but cannot be used for detailed evaluation or engineering feasibility studies, etc.

The entire Sustut area will be mapped photogrammetrically, as aforementioned, and the maps will be produced on irregular sheet sizes on reproducible cronoflex sheets. However, the Panorama area which is outlined and marked number 10 on the 1:250 000 map sheets will be mapped photogrammetrically and the area between the two blocks will be mapped by enlarging the existing 1:50 000 map sheets to the 1:10 000 scale and hand interpolate 50 metre form lines and trace all other details. For both areas, the extent of the maps and mapping area is shown on the Appendix maps.

We estimate that producing both maps could take as long as 3 1/2 to 4 months of which 2 months would be spent obtaining necessary data, material, and carrying out aerial triangulation and numerical adjustments. It is our understanding that no photo reproduction, enlargements or reductions will be carried out by our organization, but that

this will be taken care of by your company in accordance with our specifications.

It is also our understanding that you may require ortho photos for both the above properties. For the ortho photos, we suggest we utilize the diapositives produced by us and controlled for the mapping. The ortho photos should be produced at the approximate scale of 1:20 000 (end product would not be good at the 1:10 000 approximate scale because of the 7 X enlargement) on the individual model basis. All photo reproduction in connection with the ortho photos should be carried out by your organization. To relate the ortho photos to the line map, we suggest the following procedures:

1) Obtain the original ortho photo negatives and Gulf will enlarge them to 1:20 000.

2) Reduce manuscripts of the line map to 1:20 000 (some of the lines such as intermediate contours may not reproduce very well because the original is only pencil).

3) By fitting ortho photo negatives by their control points on the line map, the grids should be transferred onto the negatives.

4) From the above negatives, screen cronoflex positives on photographic paper prints should be produced as an end product.

5) If you should require a composite and ortho photos to be made from the line map, we strongly recommend that the line map should be redrafted for better reproduction purposes prior to the production of the composite map.

We also discussed the possibility of transferring the geological interpretation onto the line map using a photogrammetric method. It is quite possible and we suggest, some test models should

be done as soon as the field work is completed. We feel that photo geological interpretation could be extended during the plotting phase of the above, if needed, on the geological overlay.

FEE SCHEDULE:

1. To provide aerial triangulation and numerical adjustment to cover both project areas and to produce the above reconnaissance photogrammetric mapping at the approximate scale of 1:10 000 with 10 metre form line intervals as shown on the appendix maps:

   OUR ESTIMATED FEE: $26,000.

   The above fee will include the manual interpretation of the enlarged 1:50 000 map to cover the area between two blocks No. 10 on the Panorama Project, the end product on manuscripts on the reproducible cronoflex sheets as discussed in the attached proposal.

2. To provide ortho photo negatives from existing photograph at the same scale as the photography, our fee will be $120 per model, (please note that all photo reproductions will be done by Gulf Canada Resources Inc.

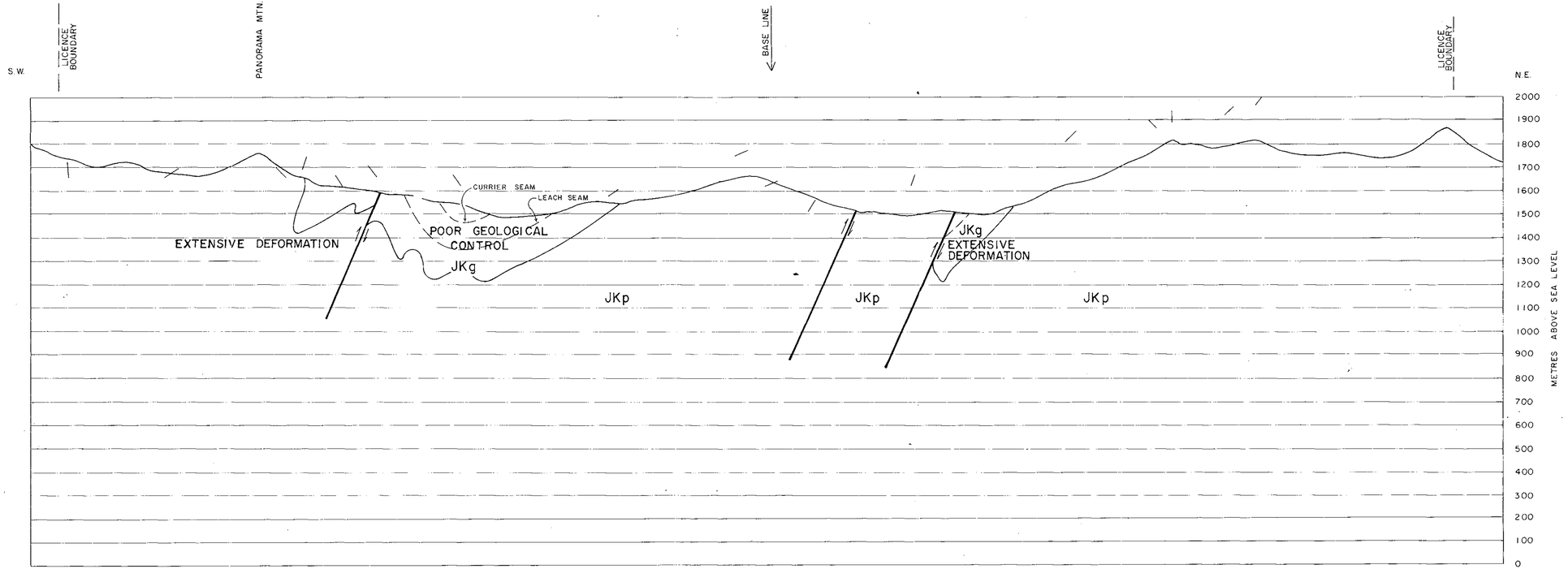
We thank you for the opportunity of submitting the above proposal and cost estimate. We look forward to hearing from you in the near future.

Yours truly,

HARDY ASSOCIATES (1978) LTD.

J. Kende, C.C.
Director, Mapping Section

JK:bc



SKEENA GROUP

JKm — MALLOCH SEQUENCE
- interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

JKg — GROUNDHOG SEQUENCE
- interbedded thin, fine-grained sandstone, siltstone, claystone and coal with abundant plant fossils, a few bivalve fossil horizons, numerous carbonaceous zones in claystones and adjacent to the coal.

JKp — PANORAMA SEQUENCE
- interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.

112

(7B - Panorama 80(2)A

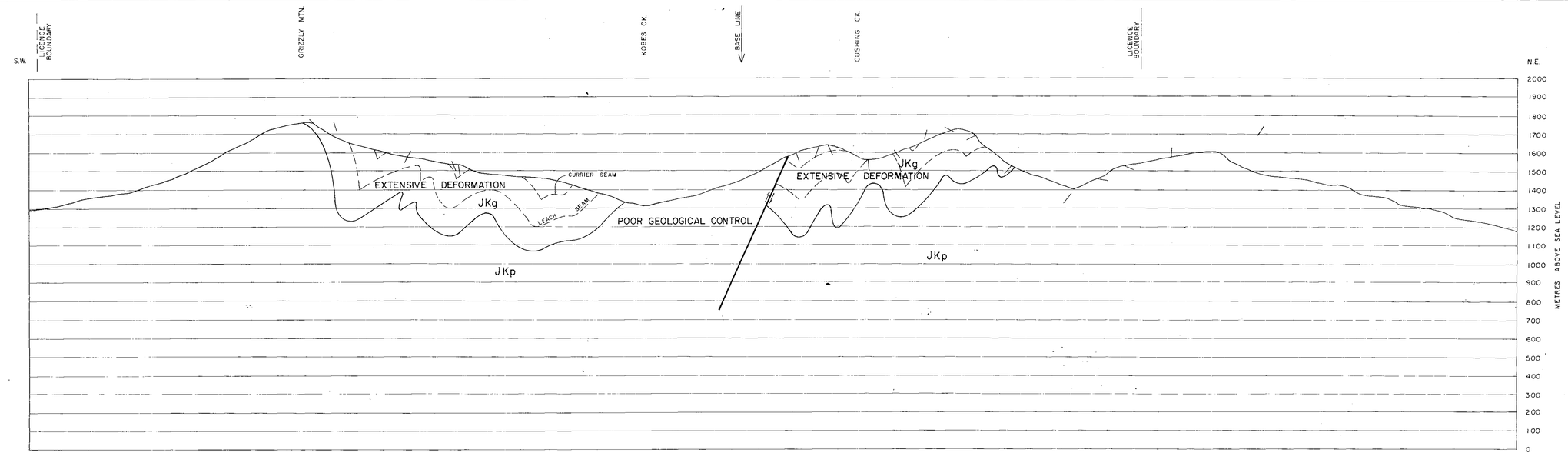
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA COAL PROJECT

GENERALIZED CROSS SECTION P 2000

PREPARED BY: J. INNIS		SCALE 1:10,000
APPROVED BY:	DATE: NOV., '80	DRAWING No.



SKEENA GROUP

JKm — MALLOCH SEQUENCE
- interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

JKg — GROUNDHOG SEQUENCE
- interbedded thin, fine-grained sandstone, siltstone, claystone and coal with abundant plant fossils, a few bivalve fossil horizons, numerous carbonaceous zones in claystones and adjacent to the coal.

JKp — PANORAMA SEQUENCE
- interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.

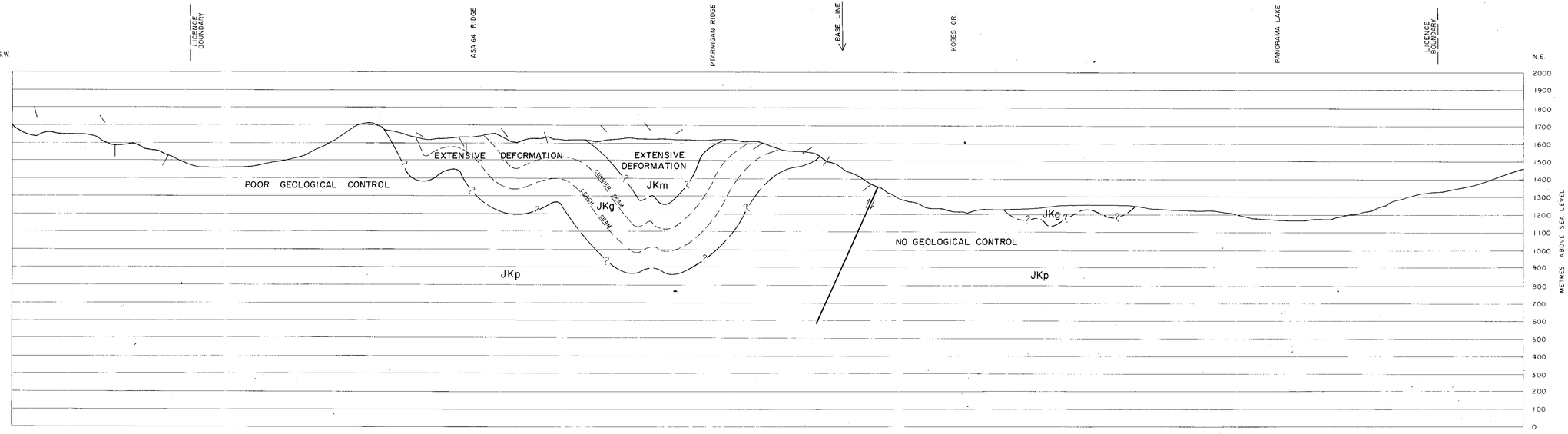
112 GR-Panorama 80(3)A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA COAL PROJECT
GENERALIZED CROSS SECTION P 4000

PREPARED BY: J. INNIS	SCALE 1:10,000
APPROVED BY: DATE: NOV./80	DRAWING No.



SKEENA GROUP

JKm — MALLOCH SEQUENCE
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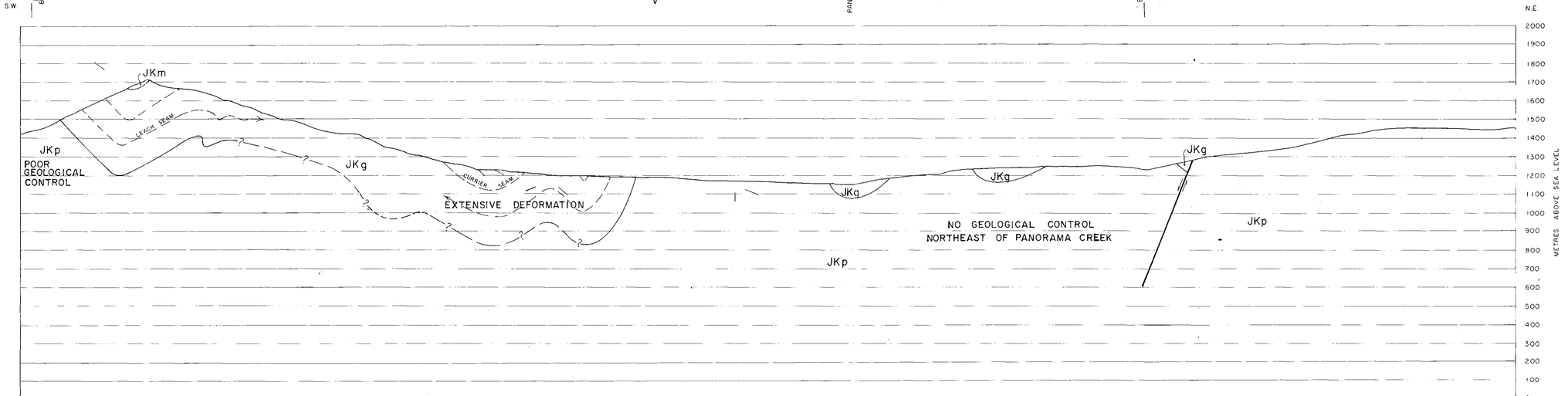
112 GR. Panorama 80/219

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

GENERALIZED CROSS SECTION P 6000

PREPARED BY: J. INNIS	SCALE 1" = 10,000
APPROVED BY:	DATE: NOV, /80 DRAWING No.



SKEENA GROUP

JKm — MALLOCH SEQUENCE
- interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

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- interbedded thin, fine-grained sandstone, siltstone, claystone and coal with abundant plant fossils, a few bivalve fossil horizons, numerous carbonaceous zones in claystones and adjacent to the coal.

JKp — PANORAMA SEQUENCE
- interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.

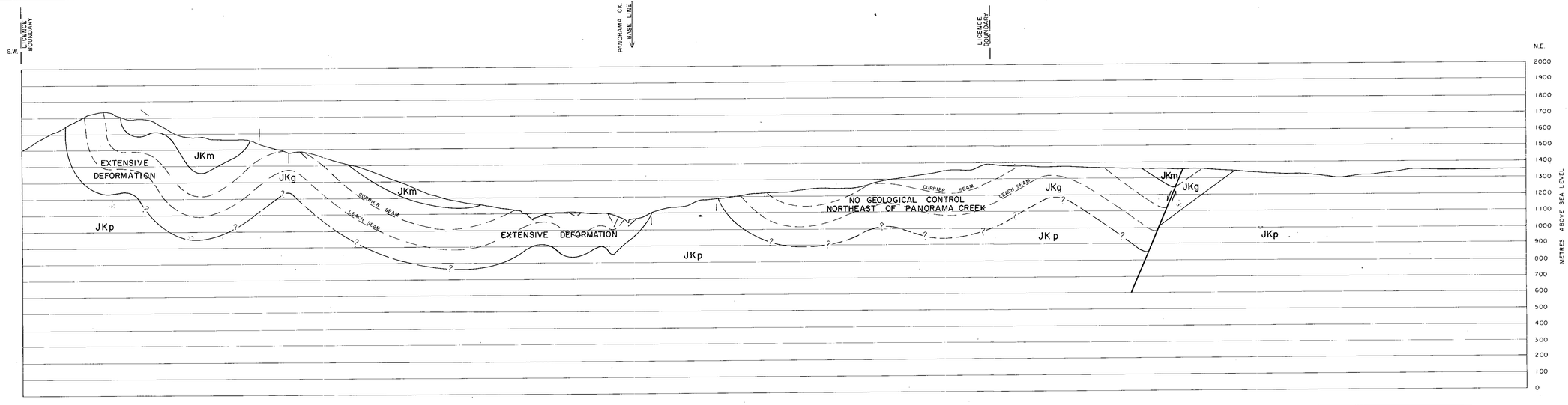
112 GR Panorama Bo(a)A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

GENERALIZED CROSS SECTION P 8000

PREPARED BY: J. INNIS		SCALE 1" = 10,000
APPROVED BY:	DATE: NOV, /80	DRAWING No.



SKEENA GROUP

JKm — MALLOCH SEQUENCE
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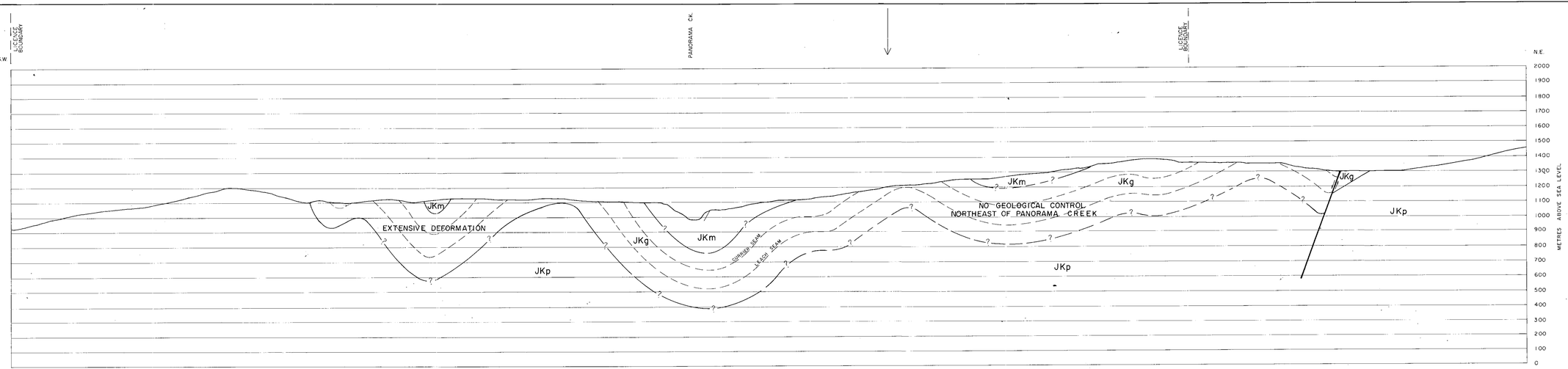
112 GR-Panorama RD(3)A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GENERALIZED CROSS SECTION P 9100

PREPARED BY: J. INNIS	SCALE 1:10,000
APPROVED BY:	DATE: NOV./80 DRAWING No.



SKEENA GROUP

JKm — MALLOCH SEQUENCE
- interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

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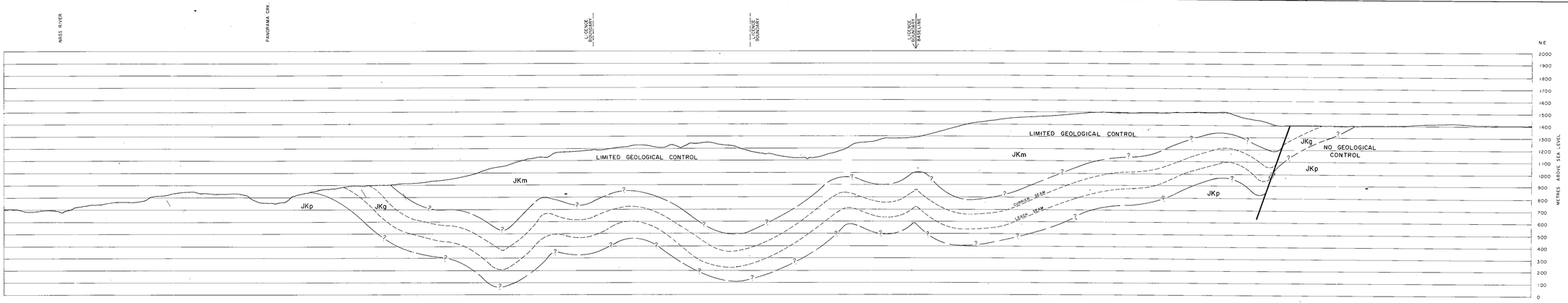
112 GR. Panorama RD(3)A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

GENERALIZED CROSS SECTION P 10000

PREPARED BY: J. INNIS	SCALE 1" = 10,000
APPROVED BY:	DATE: NOV./80 DRAWING No.



SKEENA GROUP

JKm — MALLOCH SEQUENCE
- interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

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JKp — PANORAMA SEQUENCE
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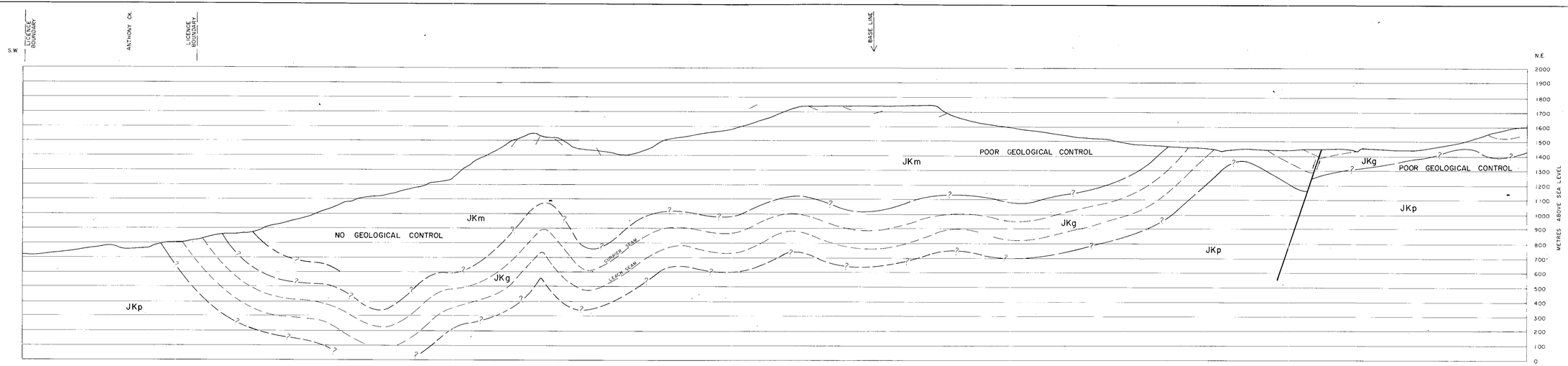
112 G.R. Panorama 80(3)10

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

GENERALIZED CROSS SECTION P 12000

PREPARED BY: J. INNIS	SCALE 1 : 10,000
APPROVED BY:	DATE: NOV./80 DRAWING No.



SKEENA GROUP

JKm — MALLOCH SEQUENCE
- interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

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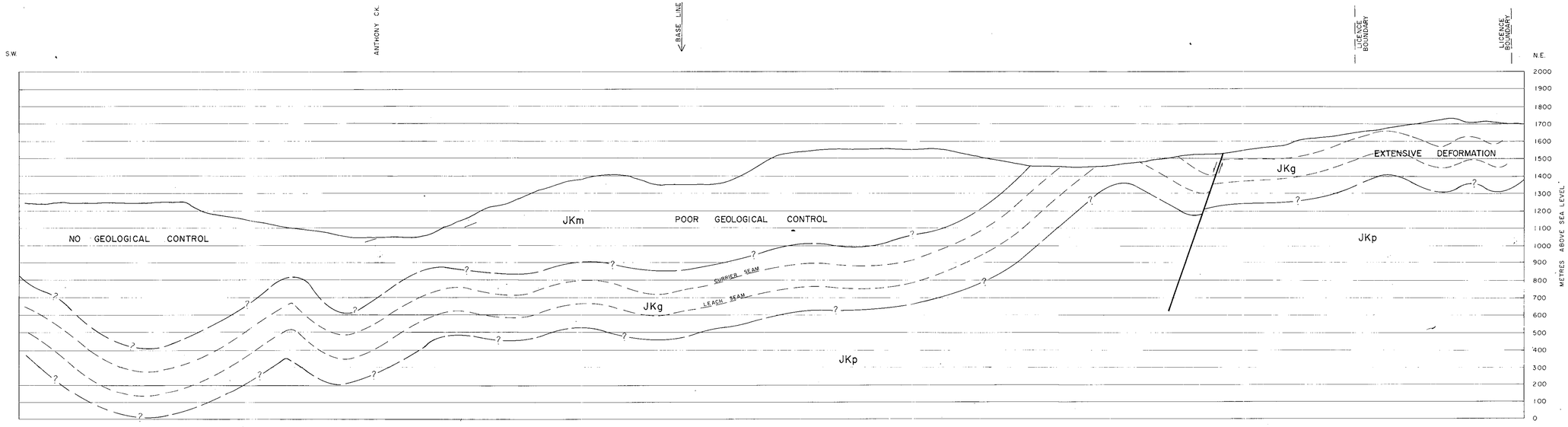
JKp — PANORAMA SEQUENCE
- interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.

112 GP-Panorama Project

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GENERALIZED CROSS SECTION P 14000

PREPARED BY: J. INNIS	SCALE 1:10,000
APPROVED BY: DATE: NOV./80	DRAWING No.



SKEENA GROUP

JKm — MALLOCH SEQUENCE
- interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

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- interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.

112

GR. Panorama 80(3)A

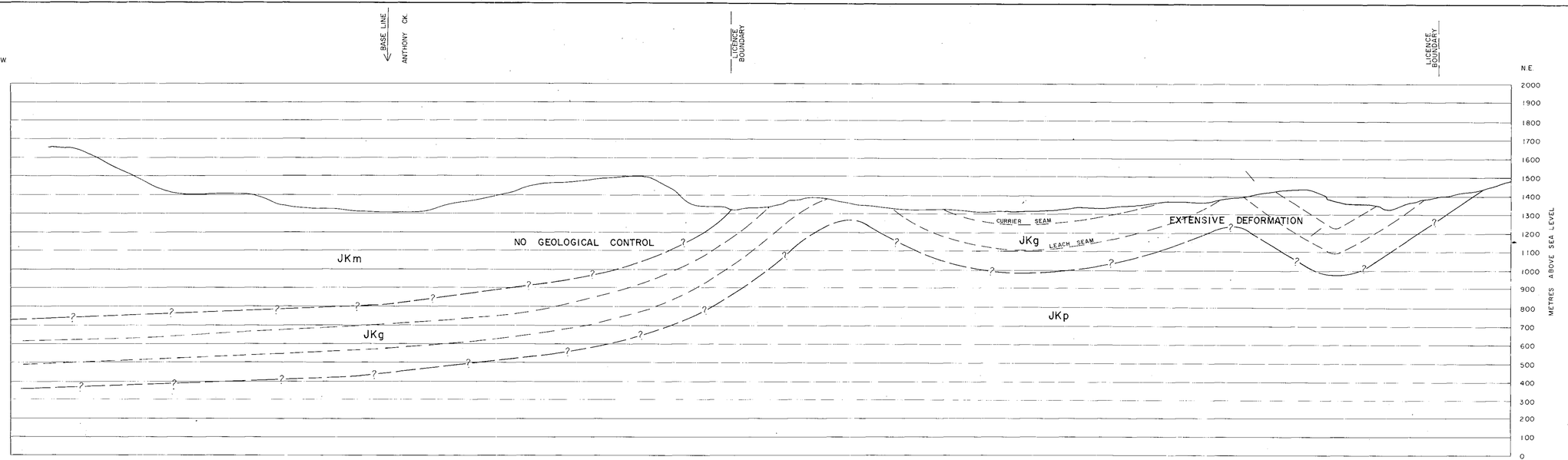
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA COAL PROJECT

GENERALIZED CROSS SECTION P 16000

PREPARED BY: J. INNIS		SCALE 1:10,000
APPROVED BY:	DATE: NOV./80	DRAWING No.



SKEENA GROUP

JKm — MALLOCH SEQUENCE
- interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

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JKp — PANORAMA SEQUENCE
- interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.

112

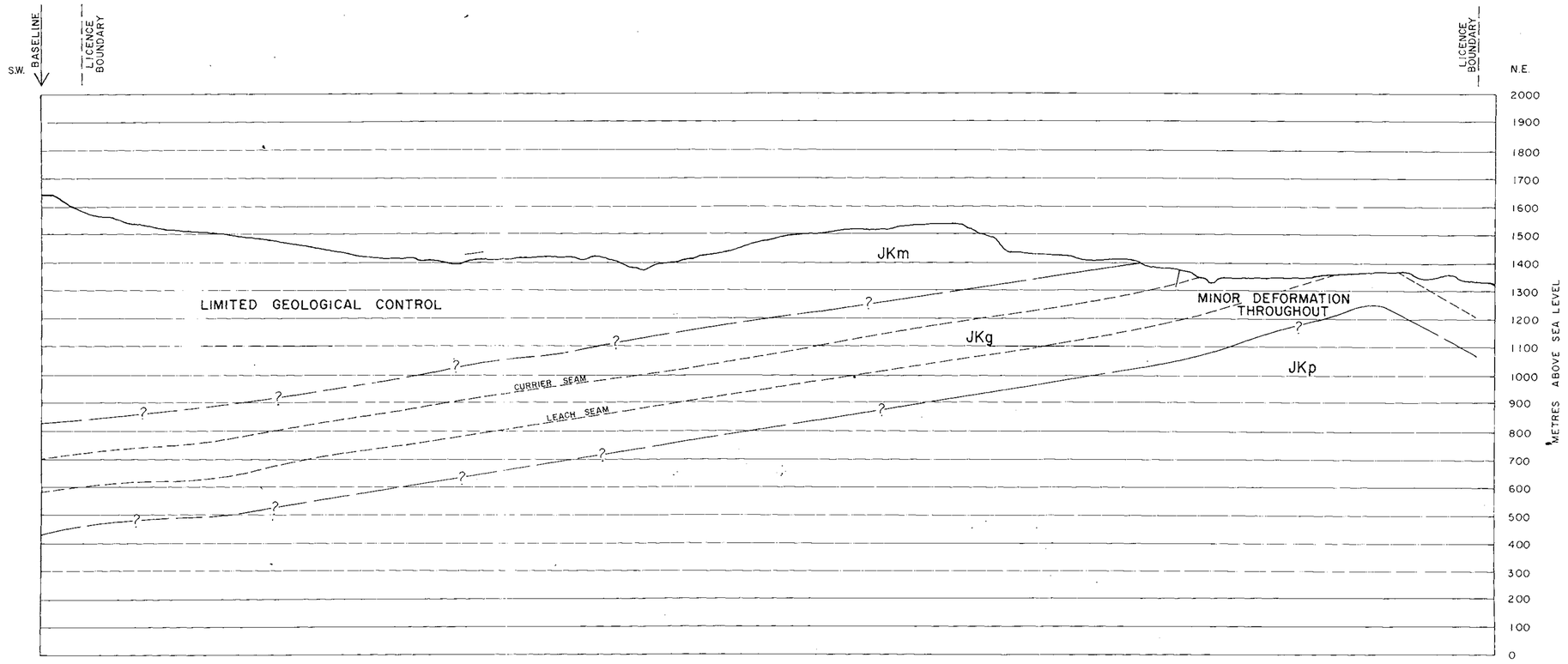
Cal-Panorama 80(3)A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA COAL PROJECT
GENERALIZED CROSS SECTION P 18000

PREPARED BY: J. INNIS	SCALE 1:10,000
APPROVED BY:	DATE: NOV./80 DRAWING No.



SKEENA GROUP

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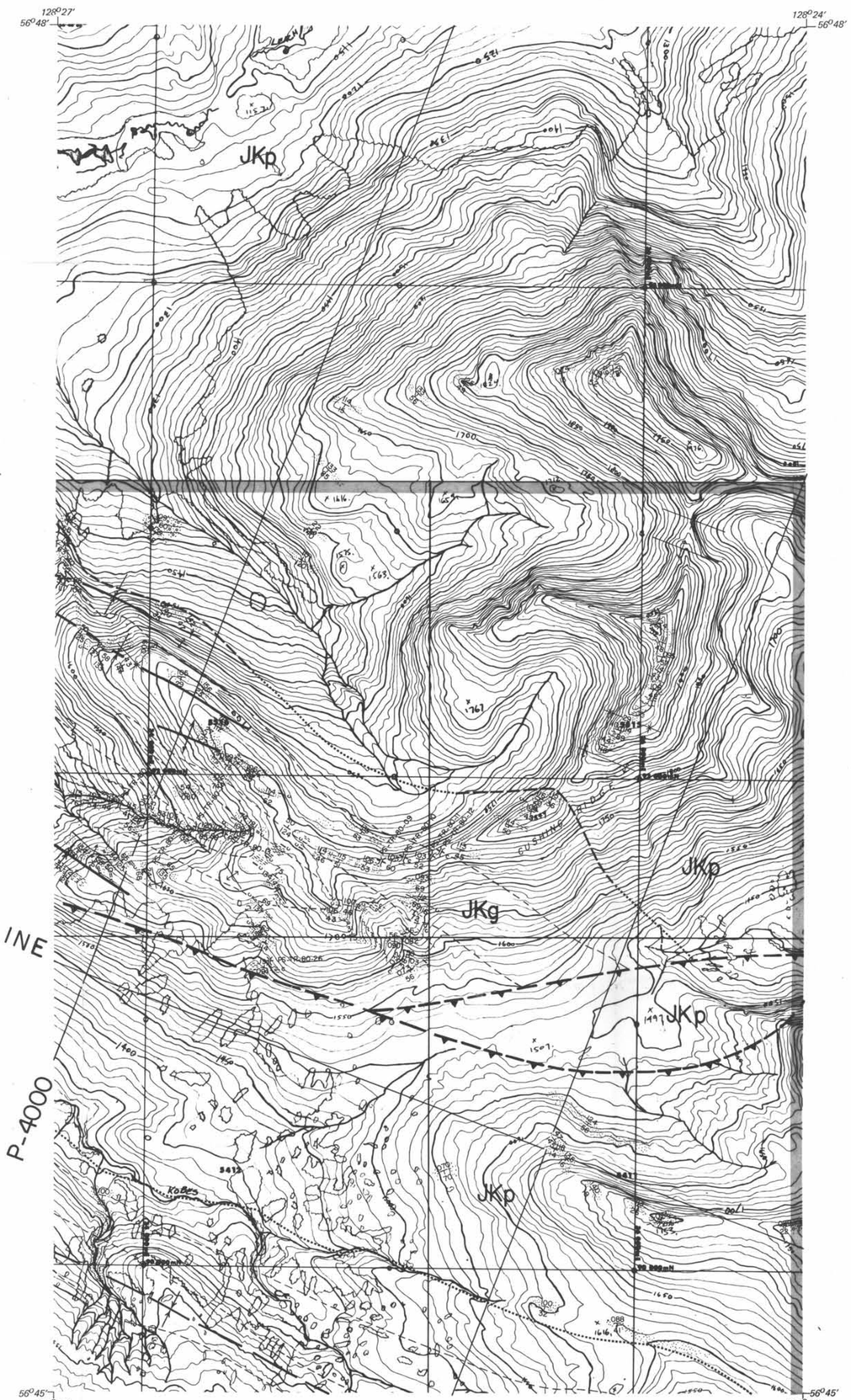
112 GR-Panorama 80(a)A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GENERALIZED CROSS SECTION P 20000

PREPARED BY: J. INNIS		SCALE 1:10,000
APPROVED BY:	DATE: NOV., 80	DRAWING No.



GEOLOGICAL BOUNDARY: (defined, approximate, inferred)

COAL ZONE

ANTICLINE: (defined, approximate)

SYNCLINE: (defined, approximate)

ANTICLINE AND SYNCLINE: (overturned)

THRUST FAULT: (defined, approximate, inferred)

FAULT: (circle on downthrow side) (defined, approximate, inferred)

DIP AND STRIKE: (bedding overturned)

BEDDING: (vertical, horizontal)

P-7000 CROSS SECTION LOCATION

PS-TR-80-02 TRENCH LOCATION

FAULT: (movement undefined)

LEGEND

RIVER
STREAM
LAKE
SAND
TREE LINE
FORM LINES
DEPRESSION FORM LINE
SPOT HEIGHT × 1012
MAIN ROAD
SECONDARY ROAD
TRACK
TRAIL
CUT LINE
RAILROAD
BUILDING
COAL LICENCE 5857

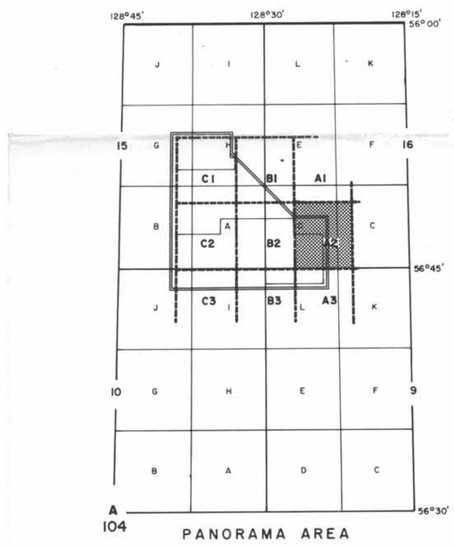
FORM LINE INTERVAL 10 METRES

SURVEY NOTE
SURVEY CONTROL TAKEN FROM EXISTING PHOTO IDENTIFIABLE GOVERNMENT SURVEY MONUMENTS AND N.T.S. MAPS. MAPPING IS BASED ON UNIVERSAL TRANSVERSE MERCATOR GRID AND GEODETIC DATUM.

SCALE 1:10,000

0 1/8 1/4 1/2 3/4 MILE

0 100 200 400 600 800 1000 METERS



PANORAMA AREA

INDEX MAP

112 GR Panorama 80(2)A

PANORAMA MAP
GEOLOGIC LEGEND

SKEENA GROUP

JKm — MALLOCH SEQUENCE
— interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

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CONGLOMERATE
SANDSTONE
SILTSTONE
CLAYSTONE
CARBONACEOUS CLAYSTONE
COAL
SILTY CLAYSTONE
FOSSILS

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GEOLOGY

MAP A-2

PREPARED BY: J. M. DUFORD	SCALE 1:10,000
APPROVED BY: DATE: DEC. 1980	DRAWING No. Pn. 80-061

GEOLOGICAL BOUNDARY: (defined, approximate, inferred)

COAL ZONE

ANTICLINE: (defined, approximate)

SYNCLINE: (defined, approximate)

ANTICLINE AND SYNCLINE: (overturned)

THRUST FAULT: (defined, approximate, inferred)

FAULT: (circle on downthrow side) (defined, approximate, inferred)

DIP AND STRIKE: (bedding overturned)

BEDDING: (vertical, horizontal)

P-7000 CROSS SECTION LOCATION

PS-TR-80-02 TRENCH LOCATION

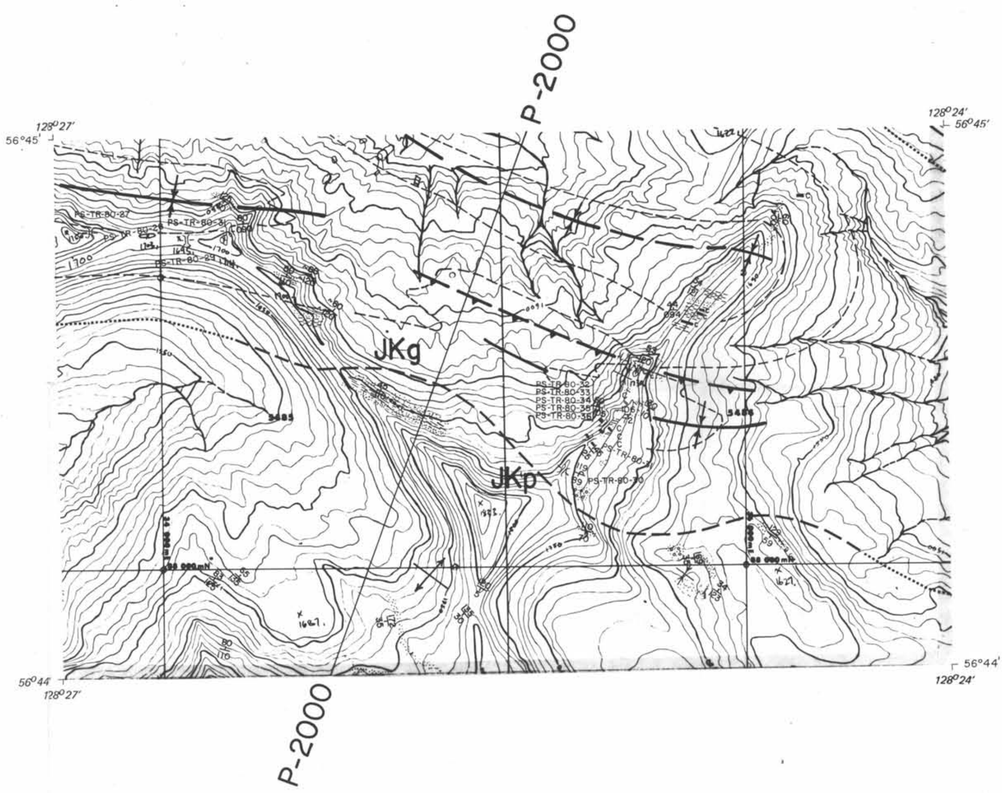
FAULT: (movement undefined)

LEGEND

RIVER
STREAM
LAKE
SAND
TREE LINE
FORM LINES 1000 1050
DEPRESSION FORM LINE
SPOT HEIGHT × 1012
MAIN ROAD
SECONDARY ROAD
TRACK
TRAIL
CUT LINE
RAILROAD
BUILDING
COAL LICENCE 5857

FORM LINE INTERVAL 10 METRES

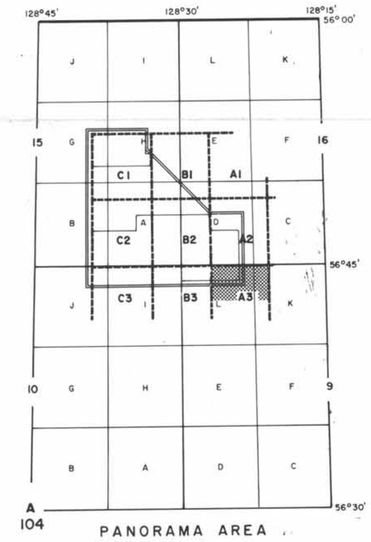
SURVEY NOTE
SURVEY CONTROL TAKEN FROM EXISTING PHOTO IDENTIFIABLE GOVERNMENT SURVEY MONUMENTS AND N.T.S. MAPS. MAPPING IS BASED ON UNIVERSAL TRANSVERSE MERCATOR GRID AND GEODETIC DATUM.



SCALE : 1:10,000

0 1/8 1/4 1/2 3/4 MILE

0 100 200 400 600 800 1000 METERS



PANORAMA AREA

INDEX MAP

112 GR Panorama '80(3)A

PANORAMA MAP
GEOLOGIC LEGEND

SKEENA GROUP

JKm — MALLOCH SEQUENCE
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CONGLOMERATE
SANDSTONE
SILTSTONE
CLAYSTONE
CARBONACEOUS CLAYSTONE
COAL
SILTY CLAYSTONE
FOSSILS

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GEOLOGY
MAP A-3

PREPARED BY: J.M. DUFORD	SCALE 1:10,000
APPROVED BY:	DATE: DEC. 1980 — DRAWING No. Pn. 80-062

GEOLOGICAL BOUNDARY: (defined, approximate, inferred)

COAL ZONE

ANTICLINE: (defined, approximate)

SYNCLINE: (defined, approximate)

ANTICLINE AND SYNCLINE: (overturned)

THRUST FAULT: (defined, approximate, inferred)

FAULT: (circle on downthrow side) (defined, approximate, inferred)

DIP AND STRIKE: (bedding overturned)

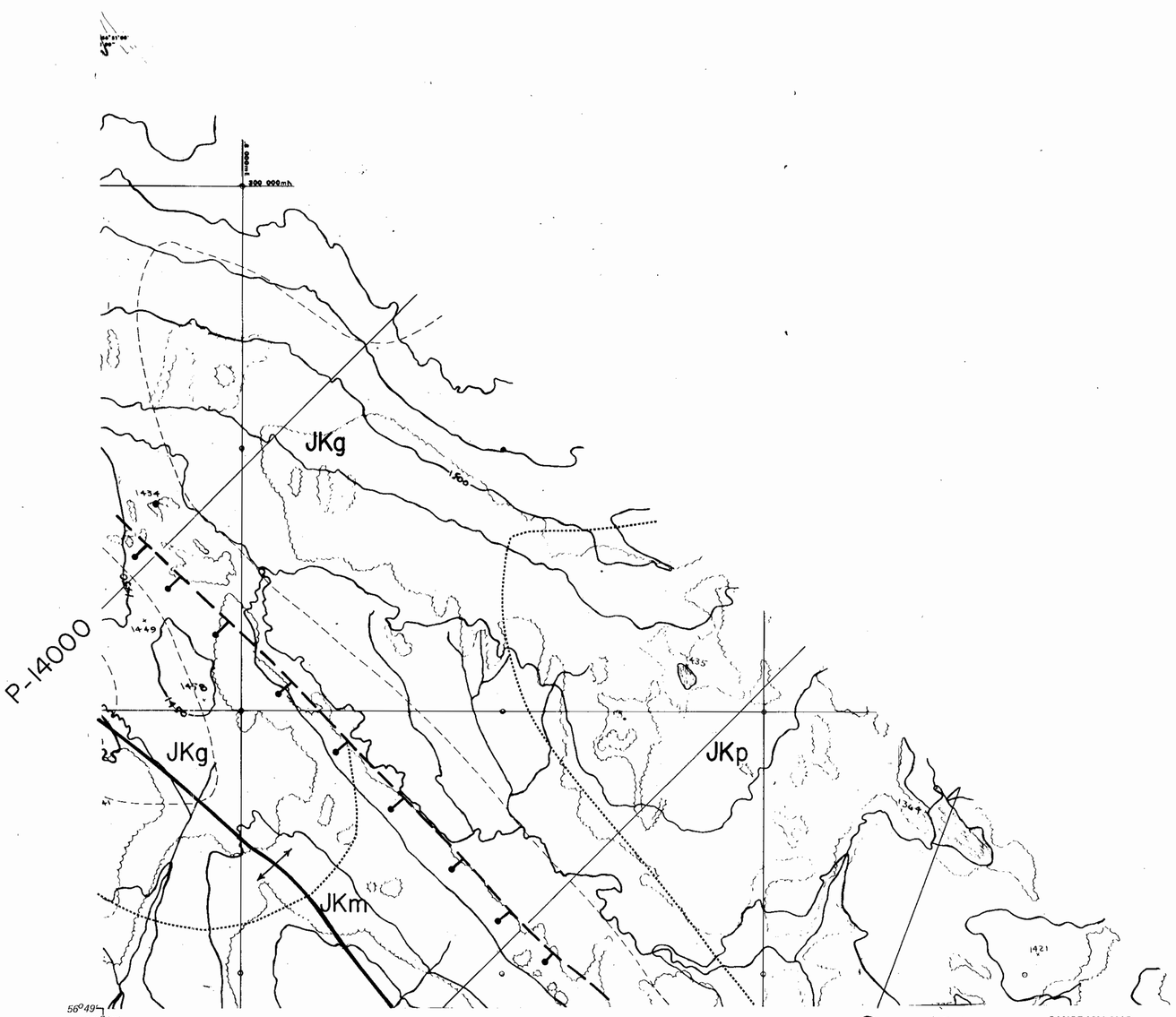
BEDDING: (vertical, horizontal)

P-7000 CROSS SECTION LOCATION

PS-TR-80-02 TRENCH LOCATION

FAULT: (movement undefined)

128°33'
56°51'30"



56°49'
128°33'

56°49'
128°28'30"

LEGEND

RIVER
STREAM
LAKE
SAND
TREE LINE
FORM LINES 1000 1050
DEPRESSION FORM LINE
SPOT HEIGHT × 1012
MAIN ROAD
SECONDARY ROAD
TRACK
TRAIL
CUT LINE
RAILROAD
BUILDING
COAL LICENCE 5857

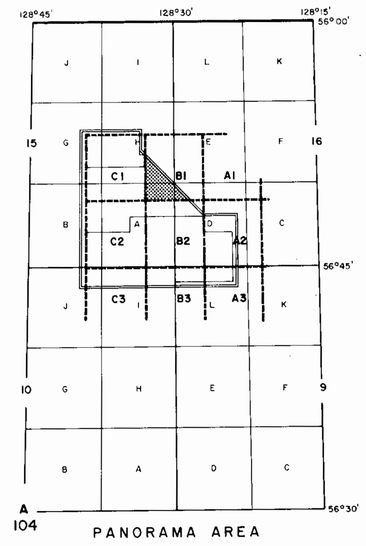
FORM LINE INTERVAL 10 METRES

SURVEY NOTE
SURVEY CONTROL TAKEN FROM EXISTING PHOTO IDENTIFIABLE GOVERNMENT SURVEY MONUMENTS AND N.T.S. MAPS. MAPPING IS BASED ON UNIVERSAL TRANSVERSE MERCATOR GRID AND GEODETIC DATUM.

SCALE : 1:10,000

0 1/8 1/4 1/2 3/4 MILE

0 100 200 400 600 800 1000 METERS



PANORAMA AREA

INDEX MAP

112

GP Panorama 80(21)

PANORAMA MAP
GEOLOGIC LEGEND

SKEENA GROUP

JKm — MALLOCH SEQUENCE
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CONGLOMERATE
SANDSTONE
SILTSTONE
CLAYSTONE
CARBONACEOUS CLAYSTONE
COAL
SILTY CLAYSTONE
FOSSILS

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GEOLOGY
MAP B-I

PREPARED BY: J.M. DUFORD	SCALE 1:10,000
APPROVED BY: DATE: DEC. 1980	DRAWING No. Pn. 80-063

128°33'
56°49'

128°27'
58°49'

JKm

JKp

JKg

BASELINE

P-10000

P-9100

P-8000

P-6000

P-4000

PANORAMA LAKE

BUSHING PASS

56°45'
128°33'

56°45'
128°27'

GEOLOGICAL BOUNDARY: (defined, approximate, inferred)

COAL ZONE

ANTICLINE: (defined, approximate)

SYNCLINE: (defined, approximate)

ANTICLINE AND SYNCLINE: (overturned)

THRUST FAULT: (defined, approximate, inferred)

FAULT: (circle on downthrow side) (defined, approximate, inferred)

DIP AND STRIKE: (bedding overturned)

BEDDING: (vertical, horizontal)

P-7000 CROSS SECTION LOCATION

PS-TR-80-02 TRENCH LOCATION

FAULT: (movement undefined)

LEGEND

RIVER
STREAM
LAKE
SAND
TREE LINE
FORM LINES 100' 50'
DEPRESSION FORM LINE
SPOT HEIGHT × 1012
MAIN ROAD
SECONDARY ROAD
TRACK
TRAIL
CUT LINE
RAILROAD
BUILDING
COAL LICENCE 5857

FORM LINE INTERVAL 10 METRES

SURVEY NOTE
SURVEY CONTROL TAKEN FROM EXISTING PHOTO IDENTIFIABLE GOVERNMENT SURVEY MONUMENTS AND N.T.S. MAPS. MAPPING IS BASED ON UNIVERSAL TRANSVERSE MERCATOR GRID AND GEODETIC DATUM.

SCALE : 1:10,000

0 1/8 1/4 1/2 3/4 MILE

0 100 200 400 600 800 1000 METERS

128°45' 128°30' 128°15' 56°00'

15 16 10 9 A 104

56°45' 56°30'

PANORAMA AREA

INDEX MAP

112

G.R. Panorama B0(3)A

PANORAMA MAP
GEOLOGIC LEGEND

SKEENA GROUP

JKm MALLOCH SEQUENCE
— interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

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— interbedded thin, fine-grained sandstone, siltstone, claystone and coal with abundant plant fossils, a few bivalve fossil horizons, numerous carbonaceous zones in claystones and adjacent to the coal.

JKp PANORAMA SEQUENCE
— interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.

CONGLOMERATE
SANDSTONE
SILTSTONE
CLAYSTONE
CARBONACEOUS CLAYSTONE
COAL
SILTY CLAYSTONE
FOSSILS

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GEOLOGY

MAP B-2

PREPARED BY: J.M. DUFORD	SCALE 1:10,000
APPROVED BY:	DATE: DEC. 1980 — DRAWING No. Pn. 80-064

GEOLOGICAL BOUNDARY: (defined, approximate, inferred)

COAL ZONE

ANTICLINE: (defined, approximate)

SYNCLINE: (defined, approximate)

ANTICLINE AND SYNCLINE: (overturned)

THRUST FAULT: (defined, approximate, inferred)

FAULT: (circle on downthrow side) (defined, approximate, inferred)

DIP AND STRIKE: (bedding overturned)

BEDDING: (vertical, horizontal)

P-7000 CROSS SECTION LOCATION

PS-TR-80-02 TRENCH LOCATION

FAULT: (movement undefined)

LEGEND

RIVER
STREAM
LAKE
SAND
TREE LINE
FORM LINES 1000 1050
DEPRESSION FORM LINE
SPOT HEIGHT × 1012
MAIN ROAD
SECONDARY ROAD
TRACK
TRAIL
CUT LINE
RAILROAD
BUILDING
COAL LICENCE 5857

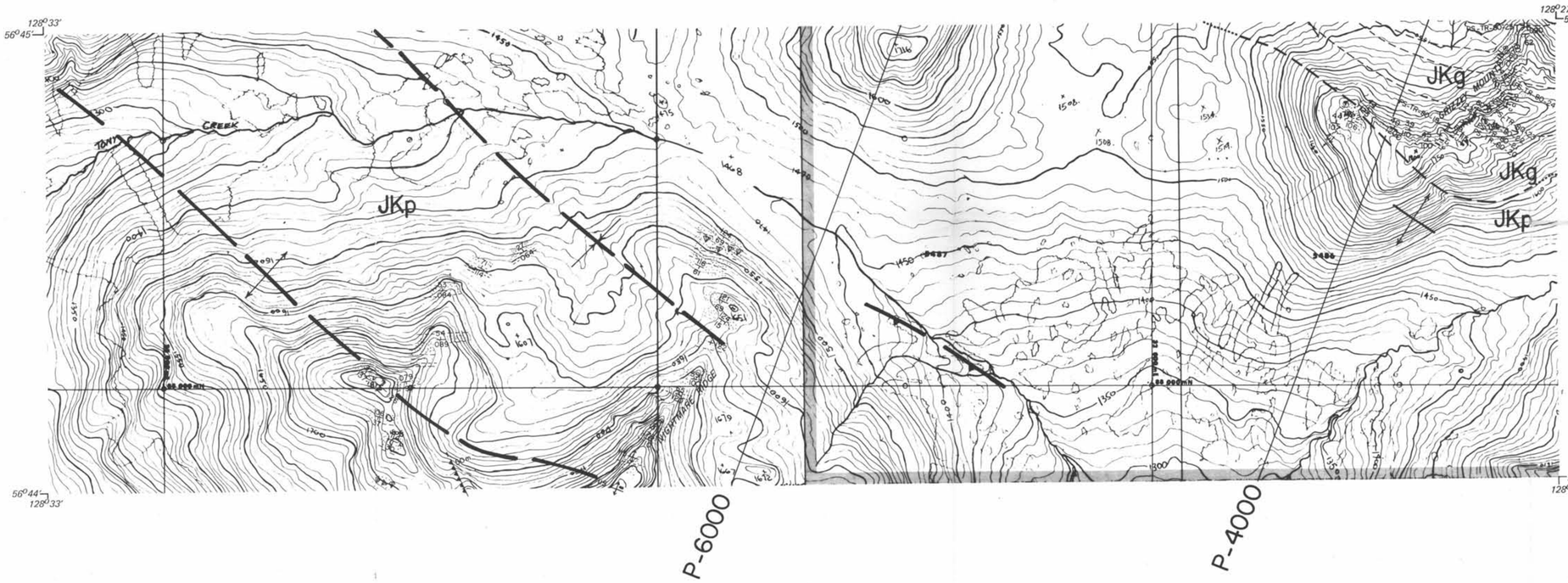
FORM LINE INTERVAL 10 METRES

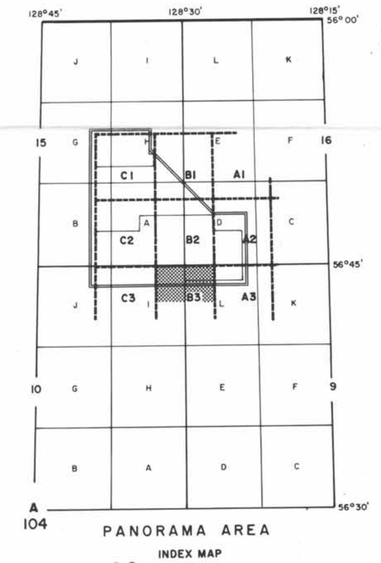
SURVEY NOTE
SURVEY CONTROL TAKEN FROM EXISTING PHOTO IDENTIFIABLE GOVERNMENT SURVEY MONUMENTS AND N.T.S. MAPS. MAPPING IS BASED ON UNIVERSAL TRANSVERSE MERCATOR GRID AND GEODETIC DATUM.

SCALE : 1:10,000

0 1/8 1/4 1/2 3/4 MILE

0 100 200 400 600 800 1000 METERS





PANORAMA AREA

INDEX MAP

112

PANORAMA MAP
GEOLOGIC LEGEND

SKEENA GROUP

JKm — MALLOCH SEQUENCE
— interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

JKg — GROUNDHOG SEQUENCE
— interbedded thin, fine-grained sandstone, siltstone, claystone and coal with abundant plant fossils, a few bivalve fossil horizons, numerous carbonaceous zones in claystones and adjacent to the coal.

JKp — PANORAMA SEQUENCE
— interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.

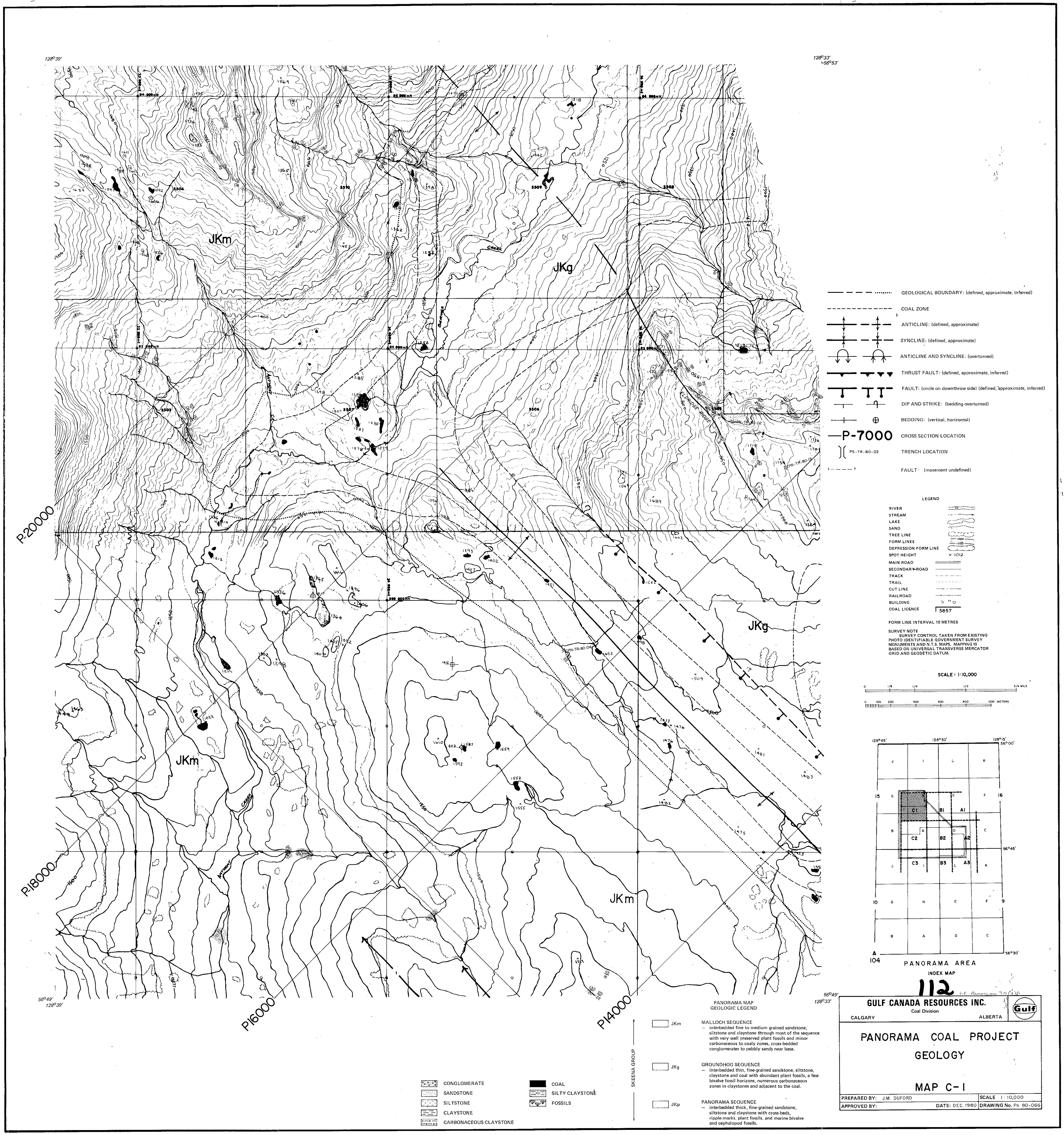
CONGLOMERATE
SANDSTONE
SILTSTONE
CLAYSTONE
CARBONACEOUS CLAYSTONE
COAL
SILTY CLAYSTONE
FOSSILS

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GEOLOGY

MAP B-3

PREPARED BY: J.M. DUFORD	SCALE 1:10,000
APPROVED BY:	DATE: DEC., 1980 DRAWING No. Pn. 80-065


128°39'
128°33'
56°53'
JKm
JKg
JKg
JKm
JKm
P-20000
P-18000
P16000
P14000
GEOLOGICAL BOUNDARY: (defined, approximate, inferred)
COAL ZONE
ANTICLINE: (defined, approximate)
SYNCLINE: (defined, approximate)
ANTICLINE AND SYNCLINE: (overturned)
THRUST FAULT: (defined, approximate, inferred)
FAULT: (circle on downthrow side) (defined, approximate, inferred)
DIP AND STRIKE: (bedding overturned)
BEDDING: (vertical, horizontal)
P-7000
CROSS SECTION LOCATION
PS-TR-80-02
TRENCH LOCATION
FAULT: (movement undefined)
LEGEND
RIVER
STREAM
LAKE
SAND
TREE LINE
FORM LINES
DEPRESSION FORM LINE
SPOT HEIGHT
× 1012
MAIN ROAD
SECONDARY ROAD
TRACK
TRAIL
CUT LINE
RAILROAD
BUILDING
COAL LICENCE
5857
FORM LINE INTERVAL 10 METRES
SURVEY NOTE
SURVEY CONTROL TAKEN FROM EXISTING PHOTO IDENTIFIABLE GOVERNMENT SURVEY MONUMENTS AND N.T.S. MAPS. MAPPING IS BASED ON UNIVERSAL TRANSVERSE MERCATOR GRID AND GEODETIC DATUM.
SCALE 1:10,000
128°45'
128°30'
128°15'
56°00'
56°45'
56°30'
A
104
PANORAMA AREA
INDEX MAP
112
56°49'
128°39'
56°49'
128°33'
PANORAMA MAP
GEOLOGIC LEGEND
SKEENA GROUP
JKm
MALLOCH SEQUENCE
– interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.
JKg
GROUNDHOG SEQUENCE
– interbedded thin, fine-grained sandstone, siltstone, claystone and coal with abundant plant fossils, a few bivalve fossil horizons, numerous carbonaceous zones in claystones and adjacent to the coal.
JKp
PANORAMA SEQUENCE
– interbedded thick, fine-grained sandstone, siltstone and claystone with cross-beds, ripple-marks, plant fossils, and marine bivalve and cephalopod fossils.
CONGLOMERATE
SANDSTONE
SILTSTONE
CLAYSTONE
CARBONACEOUS CLAYSTONE
COAL
SILTY CLAYSTONE
FOSSILS
GULF CANADA RESOURCES INC.
Coal Division
CALGARY
ALBERTA
Gulf
PANORAMA COAL PROJECT
GEOLOGY
MAP C-1
PREPARED BY: J.M. DUFORD
SCALE 1:10,000
APPROVED BY:
DATE: DEC. 1980
DRAWING No. Pn. 80-066

BASELINE

P-16000

P-14000

P-12000

P-10000

128°39' 56°49'

128°33' 56°49'

56°45' 128°39'

56°45' 128°33'

JKm

JKg

JKp

RIVER

GEOLOGICAL BOUNDARY: (defined, approximate, inferred)

COAL ZONE

ANTICLINE: (defined, approximate)

SYNCLINE: (defined, approximate)

ANTICLINE AND SYNCLINE: (overturned)

THRUST FAULT: (defined, approximate, inferred)

FAULT: (circle on downthrow side) (defined, approximate, inferred)

DIP AND STRIKE: (bedding overturned)

BEDDING: (vertical, horizontal)

P-7000 CROSS SECTION LOCATION

PS-TR-80-02 TRENCH LOCATION

FAULT: (movement undefined)

LEGEND

RIVER
STREAM
LAKE
SAND
TREE LINE
FORM LINES
DEPRESSION FORM LINE
SPOT HEIGHT × 1012
MAIN ROAD
SECONDARY ROAD
TRACK
TRAIL
CUT LINE
RAILROAD
BUILDING
COAL LICENCE 5857

FORM LINE INTERVAL 10 METRES

SURVEY NOTE
SURVEY CONTROL TAKEN FROM EXISTING PHOTO IDENTIFIABLE GOVERNMENT SURVEY MONUMENTS AND N.T.S. MAPS. MAPPING IS BASED ON UNIVERSAL TRANSVERSE MERCATOR GRID AND GEODETIC DATUM.

SCALE : 1:10,000

0 1/8 1/4 1/2 3/4 MILE

0 100 200 400 600 800 1000 METERS

128°45' 128°30' 128°15' 56°00'

15 16 56°45' 10 9 56°30'

A1 B1 C1 A2 B2 C2 A3 B3 C3 D

A 104

PANORAMA AREA

INDEX MAP

112 GR. Panorama 80(3)A

PANORAMA MAP
GEOLOGIC LEGEND

SKEENA GROUP

JKm — MALLOCH SEQUENCE
— interbedded fine to medium grained sandstone, siltstone and claystone through most of the sequence with very well preserved plant fossils and minor carbonaceous to coaly zones, cross-bedded conglomerates to pebbly sands near base.

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CONGLOMERATE
SANDSTONE
SILTSTONE
CLAYSTONE
CARBONACEOUS CLAYSTONE
COAL
SILTY CLAYSTONE
FOSSILS

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GEOLOGY
MAP C-2

PREPARED BY: J.M. DUFORD	SCALE 1:10,000
APPROVED BY:	DATE: DEC. 1980 DRAWING No. Pn. 80-067

GEOLOGICAL BOUNDARY: (defined, approximate, inferred)

COAL ZONE

ANTICLINE: (defined, approximate)

SYNCLINE: (defined, approximate)

ANTICLINE AND SYNCLINE: (overturned)

THRUST FAULT: (defined, approximate, inferred)

FAULT: (circle on downthrow side) (defined, approximate, inferred)

DIP AND STRIKE: (bedding overturned)

BEDDING: (vertical, horizontal)

P-7000 CROSS SECTION LOCATION

PS-TR-80-02 TRENCH LOCATION

FAULT: (movement undefined)

LEGEND

RIVER
STREAM
LAKE
SAND
TREE LINE
FORM LINES 1000 1050
DEPRESSION FORM LINE
SPOT HEIGHT × 1012
MAIN ROAD
SECONDARY ROAD
TRACK
TRAIL
CUT LINE
RAILROAD
BUILDING
COAL LICENCE 5857

FORM LINE INTERVAL 10 METRES

SURVEY NOTE
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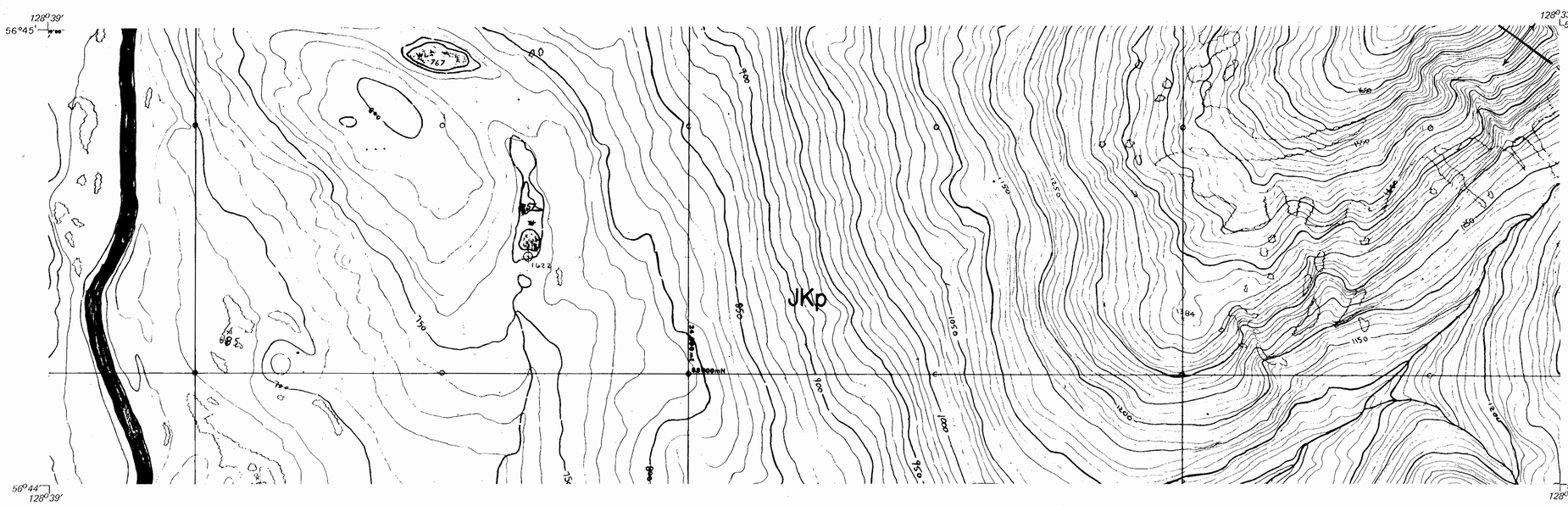
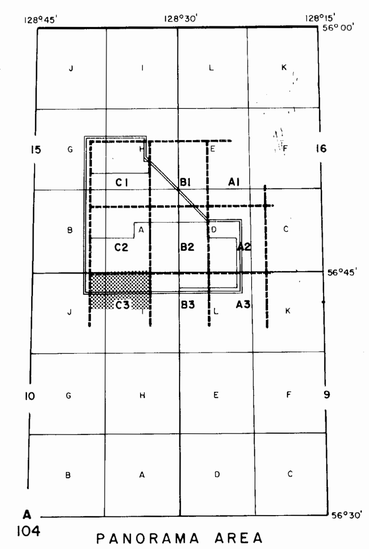


SCALE : 1:10,000

0 1/8 1/4 1/2 3/4 MILE

0 100 200 400 600 800 1000 METERS



PANORAMA AREA

INDEX MAP

112 GR - Panorama 80(3)9

CONGLOMERATE
SANDSTONE
SILTSTONE
CLAYSTONE
CARBONACEOUS CLAYSTONE
COAL
SILTY CLAYSTONE
FOSSILS

PANORAMA MAP
GEOLOGIC LEGEND

SKEENA GROUP

JKm — MALLOCH SEQUENCE
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GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT
GEOLOGY

MAP C-3

PREPARED BY: J.M. DUFORD	SCALE 1:10,000
APPROVED BY:	DATE: DEC. 1980 — DRAWING No. Pn. 80-068

GR- Panorama 80(3)A

"Panorama Coal Project Geological Report, 1980"

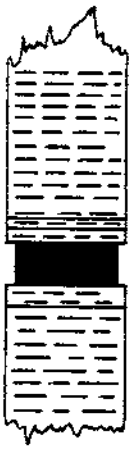
Gulf Canada Resources Inc.

TRENCH LITHOLOGIC LOGS

112

APPENDIX III

TRENCH LITHOLOGIC LOGS



	ROCK	COAL		
			1 m +	CLYST
			0.05 m	CLYST
			0.08 m	CLYST, COALY PTGS
		0.28		COAL, POWDERED, QUARTZ STRINGERS
TOTAL		0.28	0.18 m	CLYST
			0.70 m +	CLYST

ATTITUDE OF ROOF = 110/69° N.E.

ATTITUDE OF FLOOR = N/A not seen

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

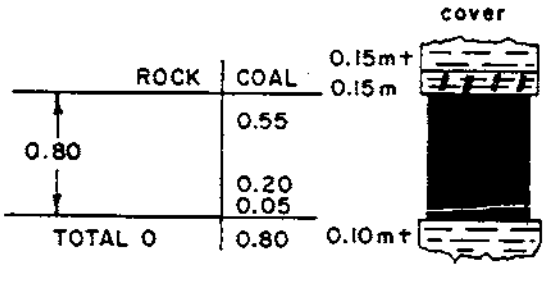
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PN – TR – 80 – 01

DRAWN BY: D.D. DATE 29-9-80 SCALE 1:50
PREPARED BY: J. INNIS DRAWING No.
APPROVED BY DATE



CLYST

CLYST, V. CARB.

COAL, CLAYSTONE LENSES, BRIGHT BANDS

COAL, FISSILE
COAL, BRITTLE
CLYST, COALY LENSES

ATTITUDE OF ROOF = 122/15° N.E.

ATTITUDE OF FLOOR = 120/37° N.E.

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

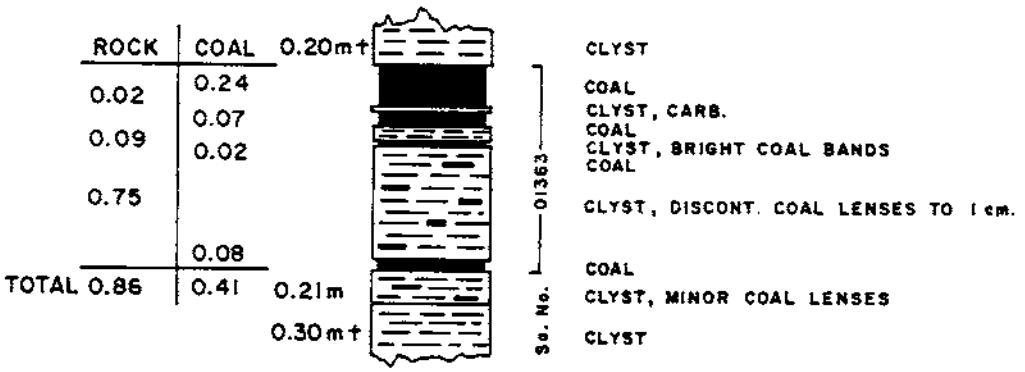
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PN–TR–80–02

DRAWN BY D.D.	DATE 29-9-80	SCALE 1:50	
PREPARED BY J. INNIS		DRAWING No	
APPROVED BY	DATE		



ATTITUDE OF ROOF = 130/15 S.W.

ATTITUDE OF FLOOR = N/A near water table

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

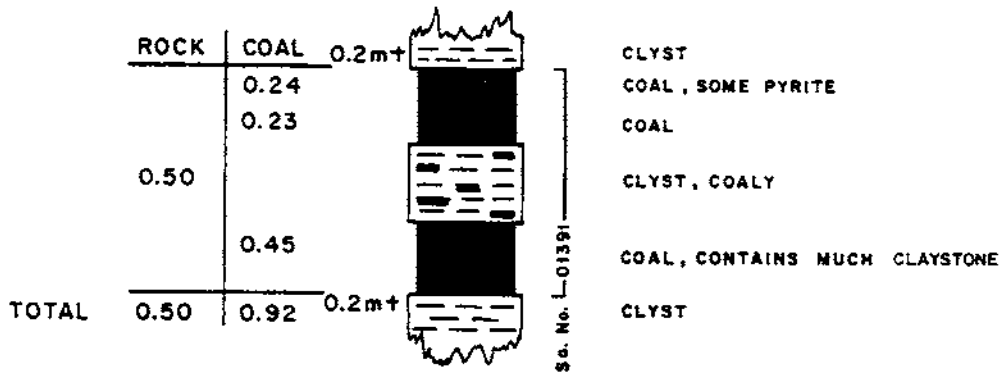
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PN–TR–80–03

DRAWN BY D. D. DATE 29-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE



ATTITUDE OF ROOF = N/A

ATTITUDE OF FLOOR = 135/22° S.W.

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

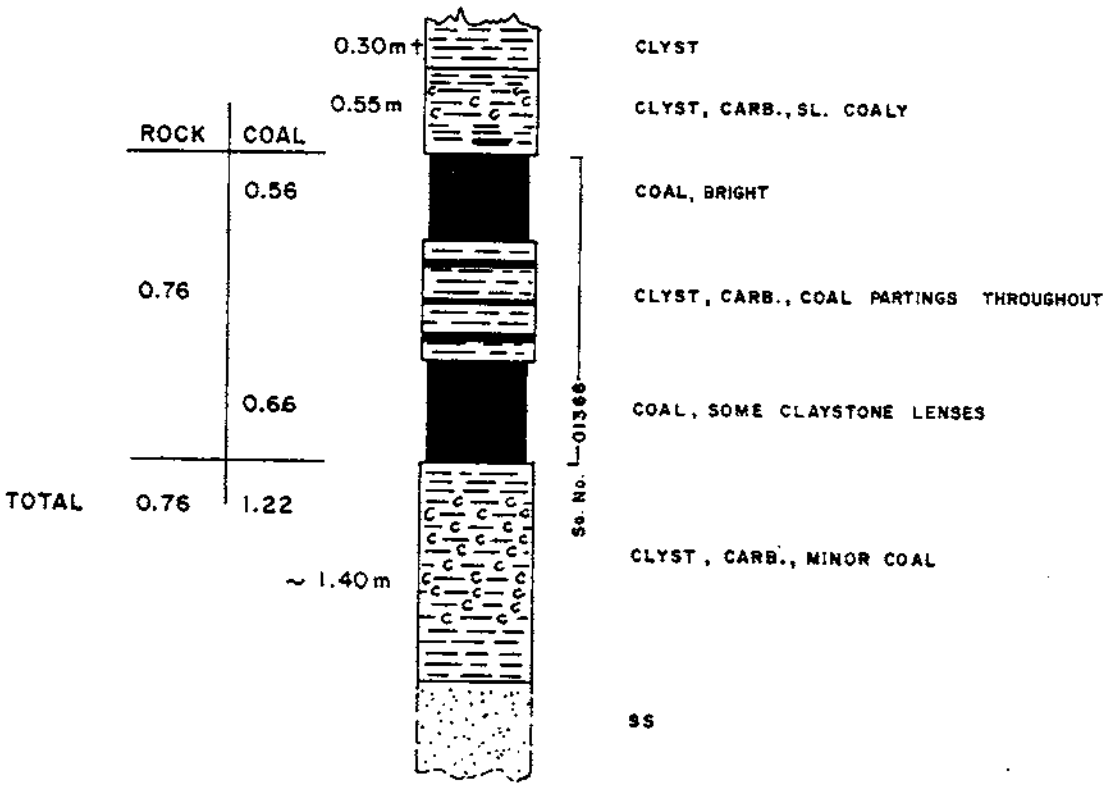
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PN - TR - 80 - 04

DRAWN BY D.D. DATE 29-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE



ATTITUDE OF ROOF = N/A v. weathered
ATTITUDE OF FLOOR = N/A underwater

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

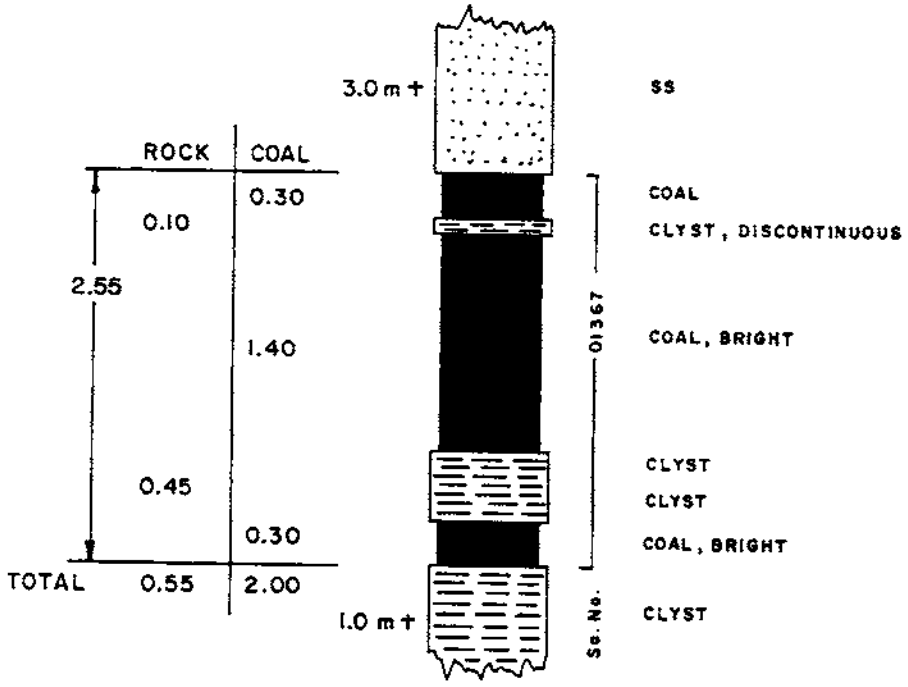
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–01

DRAWN BY: D.D. DATE: 29-9-80 SCALE: 1:50
PREPARED BY: J. INNIS DRAWING No:
APPROVED BY: DATE:



ATTITUDE OF ROOF = 090/59° N

ATTITUDE OF FLOOR = 100/55° N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–02

DRAWN BY D.D. DATE 30-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No
APPROVED BY DATE

	ROCK	COAL
		0.28
		0.20
TOTAL	0.00	0.48

CLYST

COAL

CLYST

ATTITUDE OF ROOF = 110/78°N

ATTITUDE OF FLOOR = 110/78°N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

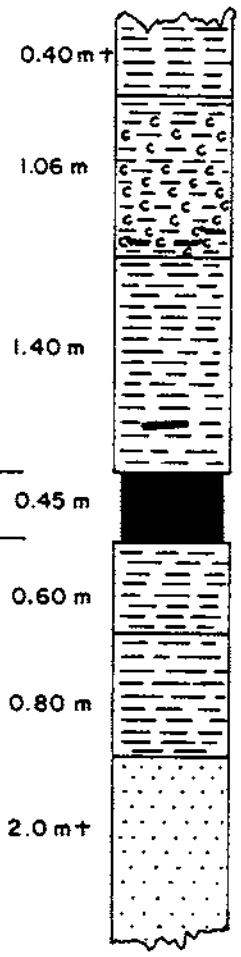
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–03

DRAWN BY D. D. DATE 30-9-80 SCALE 1 : 50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE



0.40 m+ CLYST

1.06 m CLYST, CARB., V. MINOR COAL STRINGERS

1.40 m CLYST, ONE COAL LENS

	ROCK	COAL	
	0	0.45	0.45 m COAL WITH CARBONACEOUS CLAYSTONE
TOTAL	0	0.45	

0.60 m CLYST, CARB.

0.80 m CLYST

2.0 m+ SS

ATTITUDE OF ROOF = 110/44°S

ATTITUDE OF FLOOR = 110/44°S

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

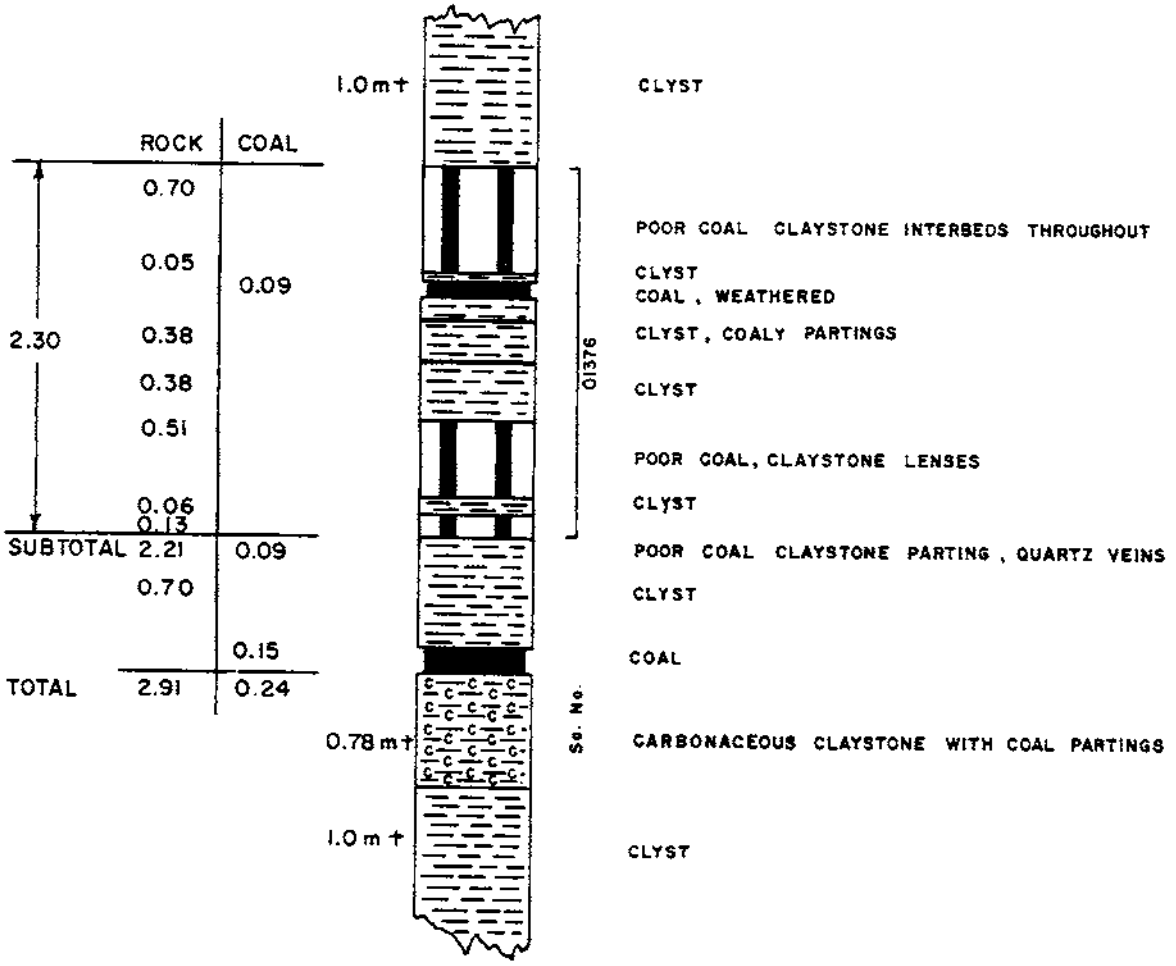
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–04

DRAWN BY D.D. DATE 30-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE



ATTITUDE OF ROOF = 105/51°S

ATTITUDE OF FLOOR = 090/49°S

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Coal Division
CALGARY ALBERTA

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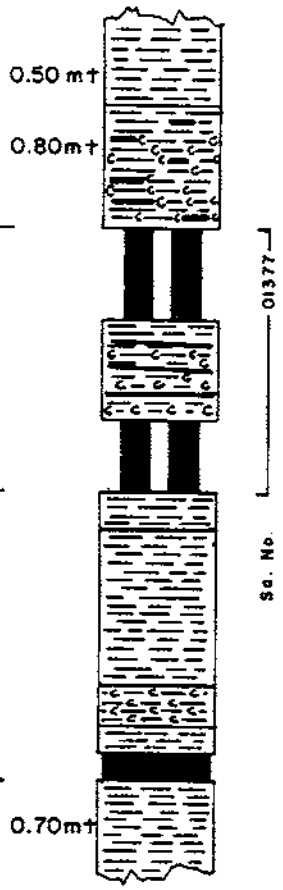
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–05

DRAWN BY D.D. DATE 30-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No
APPROVED BY DATE



	ROCK	COAL	
1.71	0.60		POOR COAL, QUARTZ VEINS
	0.63		CLYST, CARB., COAL PARTINGS
	0.48		POOR COAL QUARTZ VEINS
SUBTOTAL	1.71	0	CLYST, COALY AT BASE
	0.25		
	1.00		CLYST
	0.25		CLAYSTONE, CARBONACEOUS WITH QUARTZ VEINS
	0.18		CLYST
		0.18	COAL WITH CLAYSTONE INTERBEDS
TOTAL	3.39	0.18	

CLYST

CLYST, CARB., COAL LENSES

ATTITUDE OF ROOF = 120/41° S

ATTITUDE OF MIDDLE = 130/50° S

ATTITUDE OF FLOOR = 050/30° N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

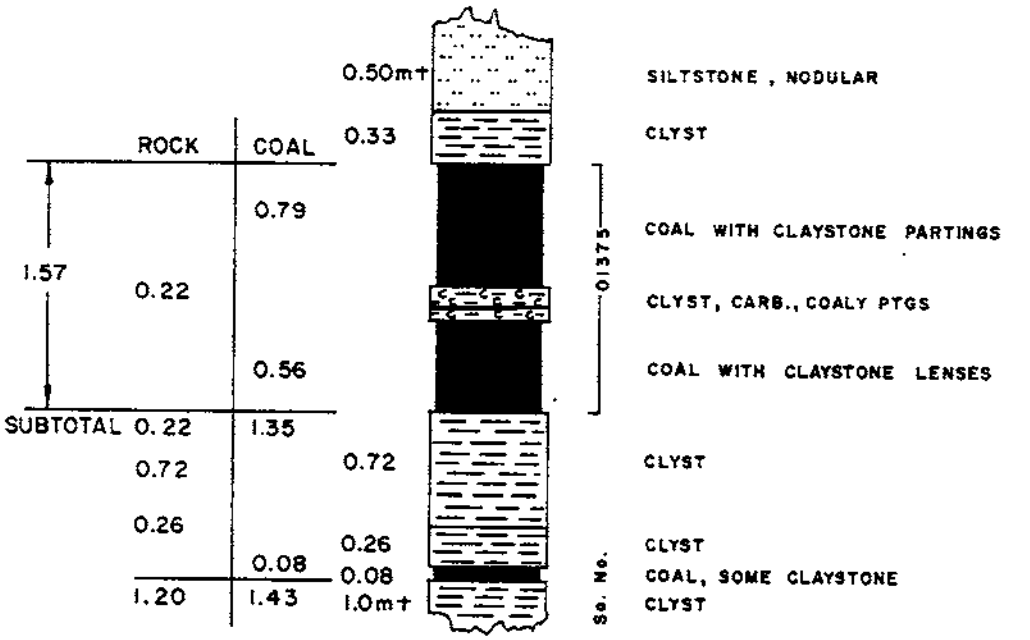
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–06

DRAWN BY D. D. DATE 30-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE



ATTITUDE OF ROOF = 70/21°S

ATTITUDE OF FLOOR = 60/23°S

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

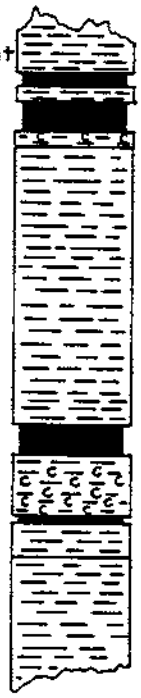
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–07

DRAWN BY D.D. DATE 30-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY: DATE

	ROCK	COAL	
			0.25m+
	0.10	0.08	
		0.19	
	0.09		
	1.80		
		0.20	
	0.39		
		0.04	
TOTAL	2.38	0.51	0.22 m
			1.0 m+



CLYST
COAL, QUARTZ VEINS
CLYST
COAL, RESIN BLEBS
CLYST, CARB.

CLYST

COAL

CLYST
COAL
CLYST

CLYST

ATTITUDE OF ROOF = 110/40°S

ATTITUDE OF FLOOR = 90/32°S

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

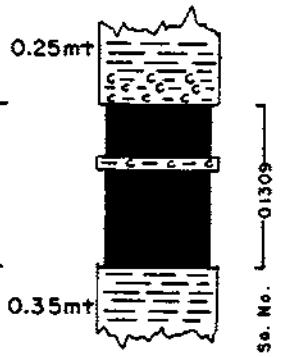
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–08

DRAWN BY D. D. DATE 30·9·80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE

	ROCK	COAL
		0.14
		0.18
		0.03
1.03	0.07	0.25
		0.09
		0.27
TOTAL	0.07	0.96



CLYST, CARB. AT BASE

COAL MINOR CLAYSTONE

CLYST, CARB. AT BASE, MINOR COAL

COAL NUMEROUS CLAYSTONE PARTINGS AND QUARTZ VEINS AT BASE

CLYST

ATTITUDE OF ROOF = 094/69°S

ATTITUDE OF FLOOR = 094/69°S

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

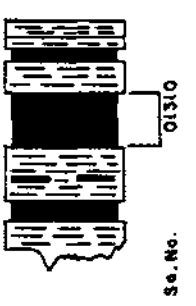
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–09

DRAWN BY D.D. DATE 30-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE

	ROCK	COAL		
		0.05	0.10m	CLYST
			0.08m	COAL, CLAYSTONE BANDS
	0.22			CLYST
		0.35		COAL, BRIGHT
	0.36			CLYST, COAL LENSES
		0.11		COAL, DULL WITH CLAYSTONE PARTINGS
TOTAL	0.58	0.51	0.10m+	CLYST



ATTITUDE OF ROOF = N/A

ATTITUDE OF FLOOR = 120/40°S

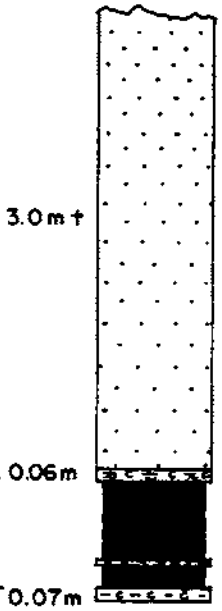
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-10

DRAWN BY	D. D.	DATE 30-9-80	SCALE 1:50
PREPARED BY	J. INNIS		DRAWING No.
APPROVED BY		DATE	



SS, mg.

CLYST, CARB., PLANT FOSSILS

COAL, SHEARED, HARD

CLYST, CARB., Fe STAIN
COAL
CLYST, CARB.

	ROCK	COAL
		0.51
0.72		
	0.04	0.17
TOTAL	0.04	0.68

ATTITUDE OF ROOF = 92/19°S

ATTITUDE OF FLOOR = N/A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

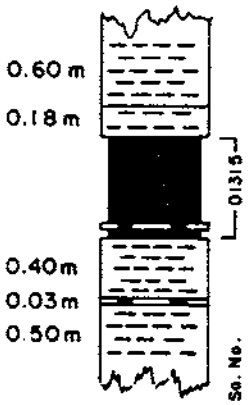
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–11

DRAWN BY: D.D.	DATE: 1-10-80	SCALE 1:50	
PREPARED BY: J. INNIS		DRAWING No.	
APPROVED BY	DATE:		

	ROCK	COAL
		0.55
0.62		
	0.03	0.04
TOTAL	0.03	0.59



CLAYSTONE, GREY
CLAYSTONE, YELLOW
COAL
CLAYSTONE
COAL
CLAYSTONE
POOR COAL
CLAYSTONE

ATTITUDE OF ROOF : N/A
ATTITUDE OF FLOOR : 120/51° S

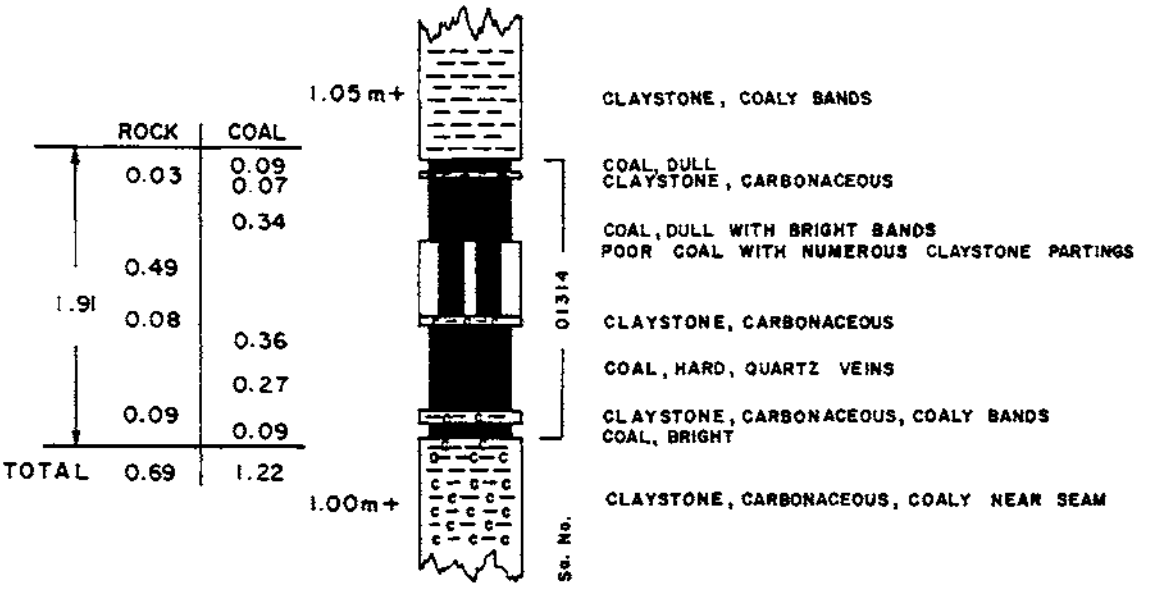
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

TRENCH LOG

PS--TR--80--12

DRAWN BY L. CHILD DATE 29-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE:



ATTITUDE OF ROOF : 104/vert.
ATTITUDE OF FLOOR : 106/70° S

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

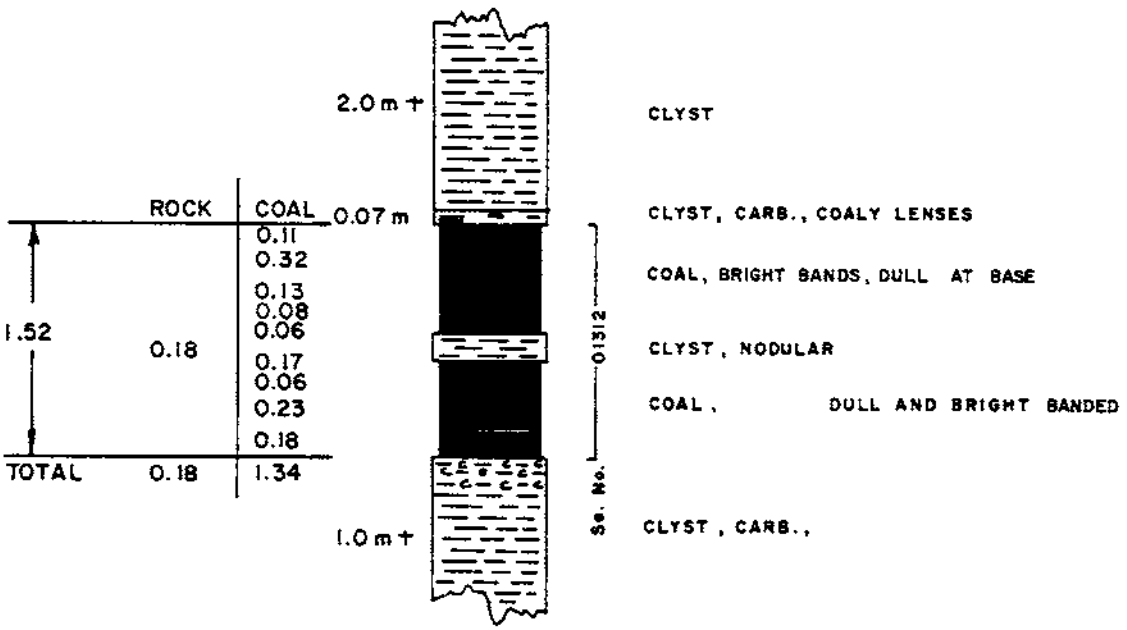
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-13

DRAWN BY	L. CHILD	DATE 29-9-80	SCALE 1:50
PREPARED BY:	J. INNIS		DRAWING No.
APPROVED BY		DATE:	



ATTITUDE OF ROOF = 132/74°S

ATTITUDE OF FLOOR = 111/76°S

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

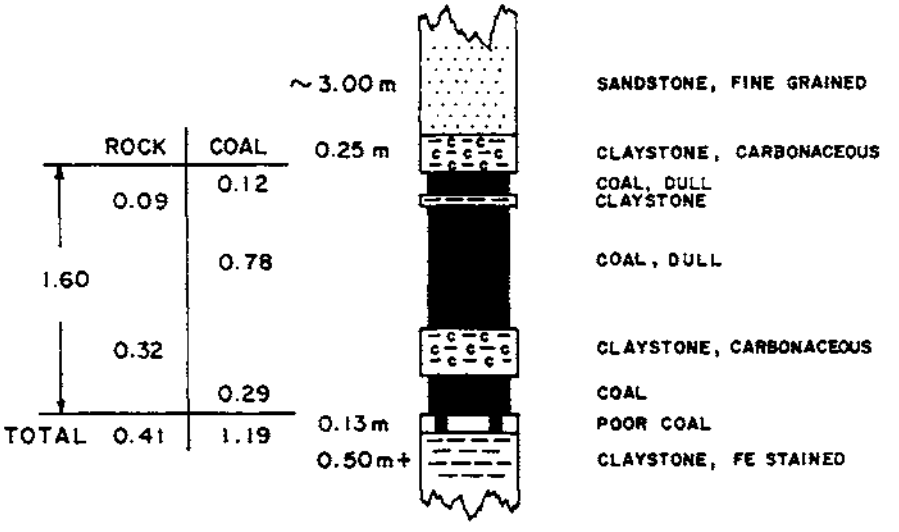
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-14

DRAWN BY D.D. DATE 1.10.80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE



ATTITUDE OF ROOF :
ATTITUDE OF FLOOR : N/A intensely folded area

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–15

DRAWN BY: L. CHILD	DATE: 29-9-80	SCALE: 1:50	
PREPARED BY: J. INNIS		DRAWING No	
APPROVED BY	DATE		

	ROCK	COAL
	0.87	0.87
TOTAL	0	0.87

CLAYSTONE

CLAYSTONE, CARBONACEOUS

COAL BRIGHT, PYRITE, QUARTZ VEINS

CLAYSTONE, CARBONACEOUS BANDS

ATTITUDE OF ROOF : 119/51°S

ATTITUDE OF FLOOR : N/A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

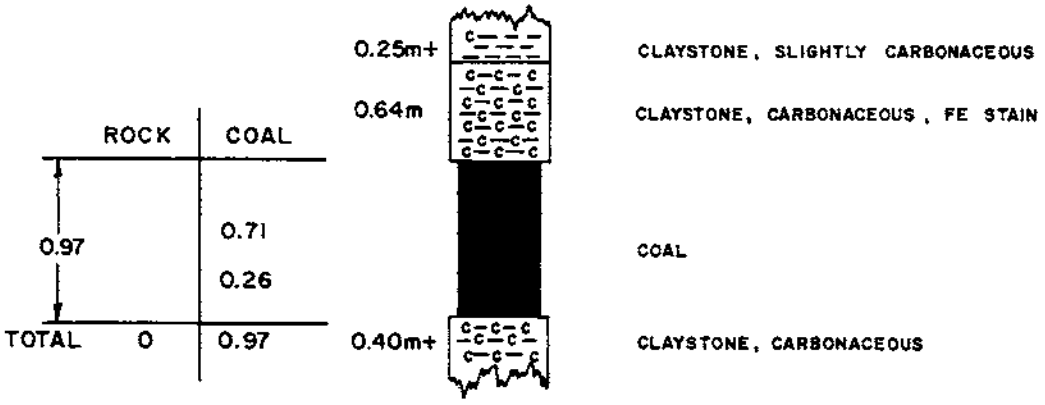
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-16

DRAWN BY	L. CHILD	DATE 29-9-80	SCALE 1:50
PREPARED BY	J. INNIS		DRAWING No
APPROVED BY		DATE	



ATTITUDE OF ROOF: 090/50°S

ATTITUDE OF FLOOR: BEDDING VERY DISTURBED

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

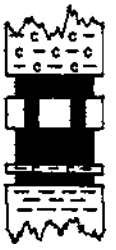
PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-17

DRAWN BY: L. CHILD	DATE: 29-9-80	SCALE 1:50
PREPARED BY: J. INNIS		DRAWING No.
APPROVED BY:	DATE:	

ROCK	COAL		
	0.13	0.30 m+	CLAYSTONE, CARBONACEOUS, COALY BANDS
0.19			COAL POOR COAL
	0.22		COAL, CLAYSTONE PARTINGS
0.05	0.07		CLAYSTONE, CARBONACEOUS COAL
TOTAL 0.24	0.42	0.50m+	CLAYSTONE



ATTITUDE OF ROOF : 081/56° N
ATTITUDE OF FLOOR : 097/55°N

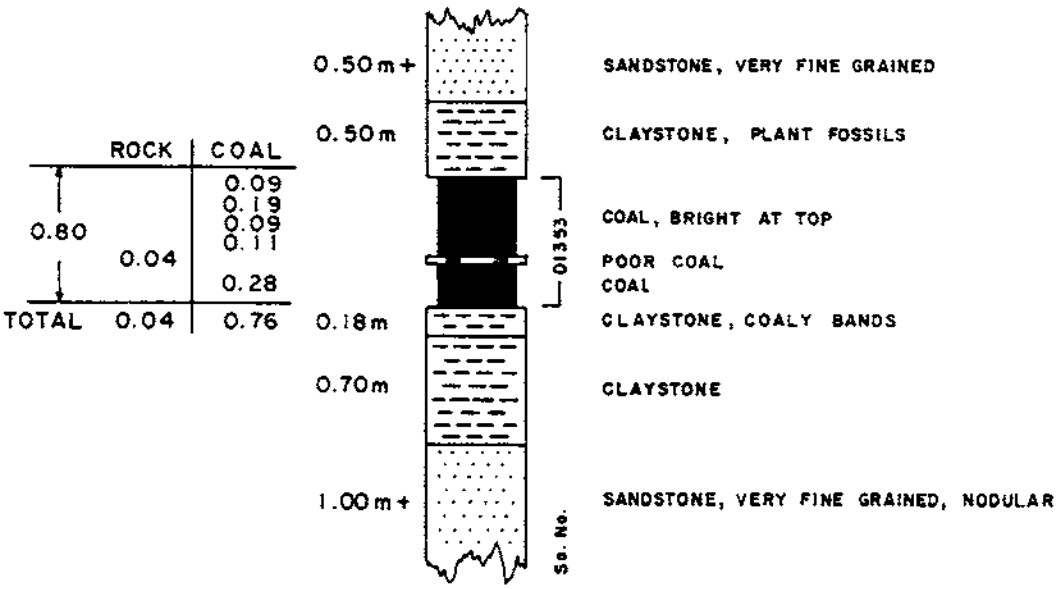
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–18

DRAWN BY L. CHILD DATE: 29-9-80 SCALE 1 : 50
PREPARED BY J. INNIS DRAWING No
APPROVED BY: DATE:



ATTITUDE OF ROOF : 142/87°N
ATTITUDE OF FLOOR : 133/61°N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

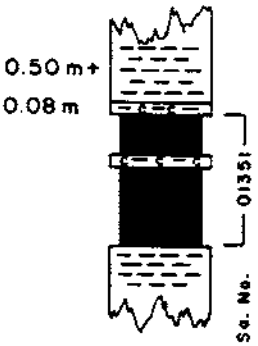
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–19

DRAWN BY: L. CHILD DATE 29·9·80 SCALE 1:50
PREPARED BY: J. INNIS DRAWING No.
APPROVED BY: DATE

	ROCK	COAL
		0.27
0.85	0.07	0.25
		0.26
TOTAL	0.07	0.78



CLAYSTONE
CLAYSTONE, CARBONACEOUS
COAL
CLAYSTONE, CARBONACEOUS
COAL
CLAYSTONE

ATTITUDE OF ROOF : ~ 106/41°S
ATTITUDE OF FLOOR : 113/86°N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

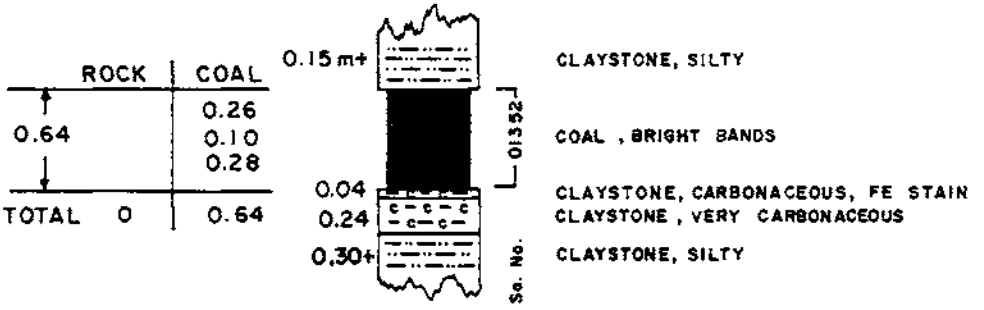
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–20

DRAWN BY: L. CHILD DATE: 29·9·80 SCALE 1:50
PREPARED BY: J. INNIS DRAWING No
APPROVED BY: DATE



ATTITUDE OF ROOF : 136/62° N
ATTITUDE OF FLOOR : 129/49° N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

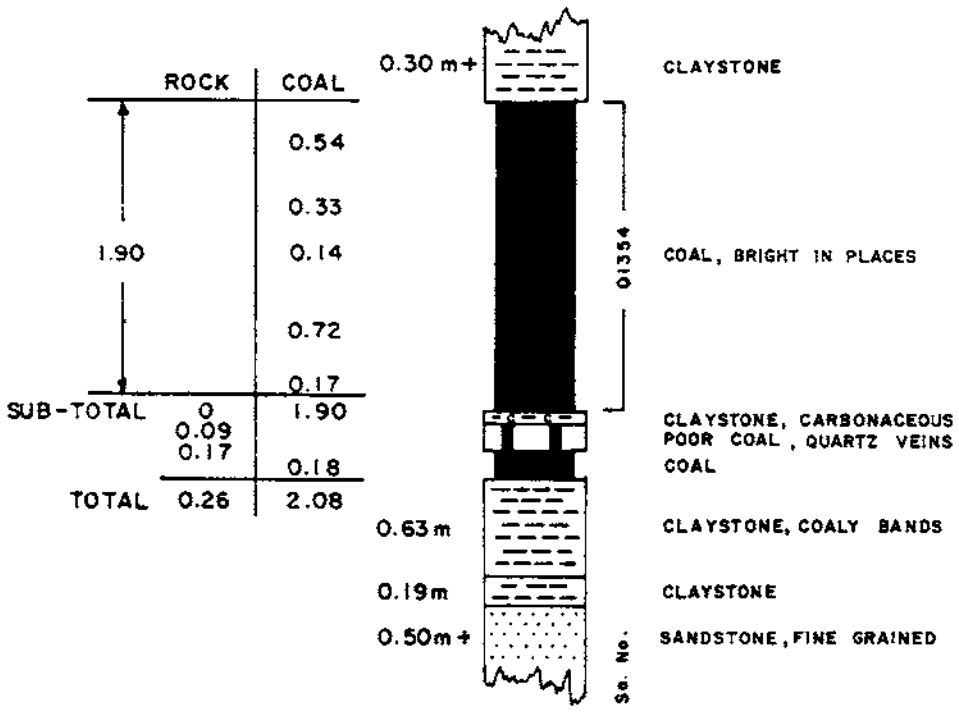
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–21

DRAWN BY	L. CHILD	DATE 29·9·80	SCALE 1:50
PREPARED BY	J. INNIS		DRAWING No.
APPROVED BY		DATE	



ATTITUDE OF ROOF : 113/70°N
ATTITUDE OF FLOOR : 134/66°N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–22

DRAWN BY. L. CHILD	DATE 29·9·80	SCALE 1 : 50	
PREPARED BY J. INNIS		DRAWING No.	
APPROVED BY	DATE		

	ROCK	COAL
		0.29
	0.18	
		0.28
TOTAL	0.18	0.57

CLAYSTONE

COAL WEATHERED

POOR COAL

COAL WEATHERED

CLAYSTONE

ATTITUDE OF ROOF : 121/77° N.
ATTITUDE OF FLOOR : INDISTINCT

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

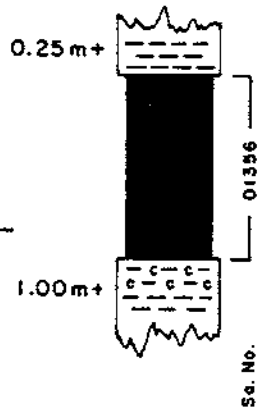
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–23

DRAWN BY	L. CHILD	DATE 29·9·80	SCALE 1 : 50
PREPARED BY	J. INNIS		DRAWING No.
APPROVED BY		DATE	

	ROCK	COAL
1.12		0.15
		0.15
		0.27
		0.12
		0.21
		0.22
TOTAL	0	1.12



ATTITUDE OF ROOF : 129 / 86° N
ATTITUDE OF FLOOR : 135 / vert.

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

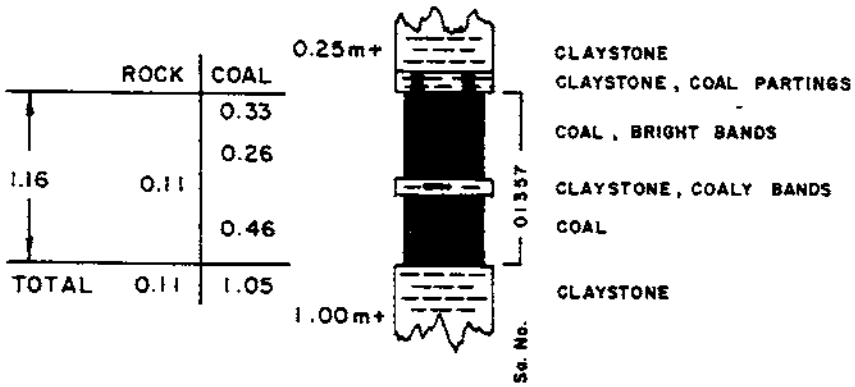
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–24

DRAWN BY: L. CHILD DATE: 29-9-80 SCALE: 1:50
PREPARED BY: J. INNIS DRAWING No.
APPROVED BY: DATE:



ATTITUDE OF ROOF : N/A
ATTITUDE OF FLOOR : 095/64°N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

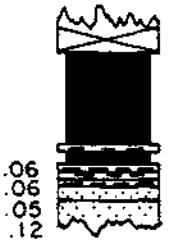
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–25

DRAWN BY L. CHILD DATE 29·9·80 SCALE 1 : 50
PREPARED BY J. INNIS DRAWING No
APPROVED BY DATE

	ROCK	COAL
		0.60
0.72		
	0.03	0.09
TOTAL	0.03	0.69



COVER

COAL, RESIN BLEBS, QUARTZ STRINGERS

CLAYSTONE
COAL
CLAYSTONE, CARBONACEOUS OR COALY

SANDSTONE

ATTITUDE OF ROOF : N/A (covered)
ATTITUDE OF FLOOR : 70/27°N (slumped)

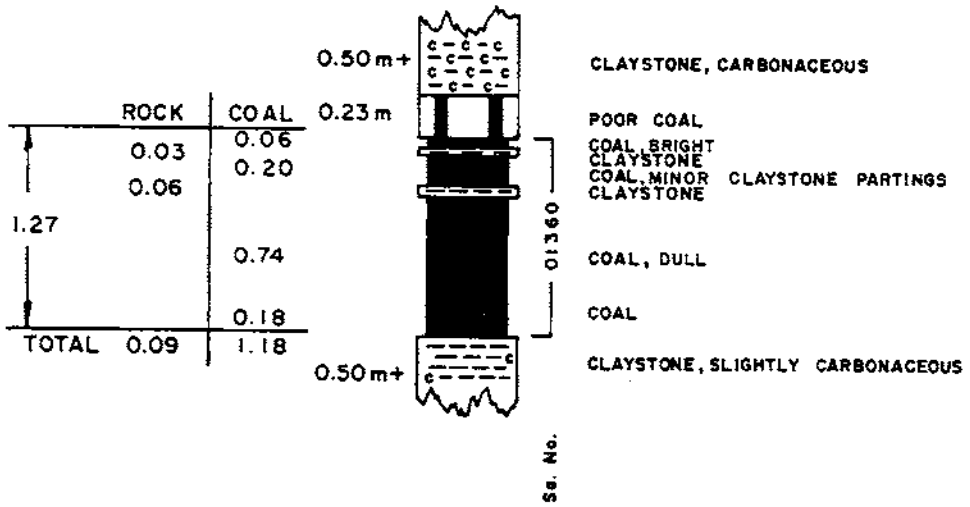
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-26

DRAWN BY: L. CHILD DATE 29-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No
APPROVED BY DATE



ATTITUDE OF ROOF : N/A
ATTITUDE OF FLOOR : N/A

intense folding

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

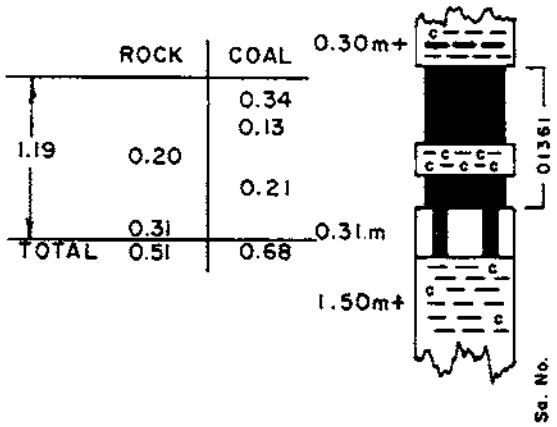
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–27

DRAWN BY: L. CHILD DATE 29-9-80 SCALE 1:50
PREPARED BY: J. INNIS DRAWING No.
APPROVED BY: DATE



ATTITUDE OF ROOF : 175/ 68°W
ATTITUDE OF FLOOR : 172/49°W

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

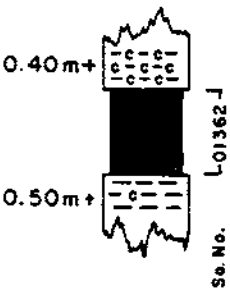
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–28

DRAWN BY: L. CHILD DATE 29-9-80 SCALE 1:50
PREPARED BY: J. INNIS DRAWING No
APPROVED BY: DATE:

	ROCK	COAL
		0.28
0.52		0.13
		0.11
TOTAL	0	0.52



CLAYSTONE, CARBONACEOUS NEAR BASE

COAL , SOME CLAYSTONE PARTINGS NEAR BASE

CLAYSTONE, SLIGHTLY CARBONACEOUS, FE STAIN

ATTITUDE OF ROOF : 114/57° N

ATTITUDE OF FLOOR : 132/61° N

GULF CANADA RESOURCES INC.

Coal Division

CALGARY ALBERTA

Gulf

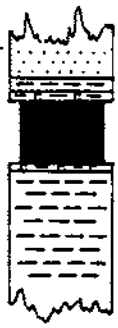
PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–29

DRAWN BY	L. CHILD	DATE 29-9-80	SCALE 1 : 50
PREPARED BY	J. INNIS		DRAWING No.
APPROVED BY		DATE	

	ROCK	COAL
		0.40
TOTAL	0	0.40



SANDSTONE , MG.
CLAYSTONE
CLAYSTONE , SLIGHTLY CARBONACEOUS
COAL
CLAYSTONE , CARBONACEOUS
CLAYSTONE, FE STAIN

ATTITUDE OF ROOF =110/23° S
ATTITUDE OF FLOOR =110/35° S

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

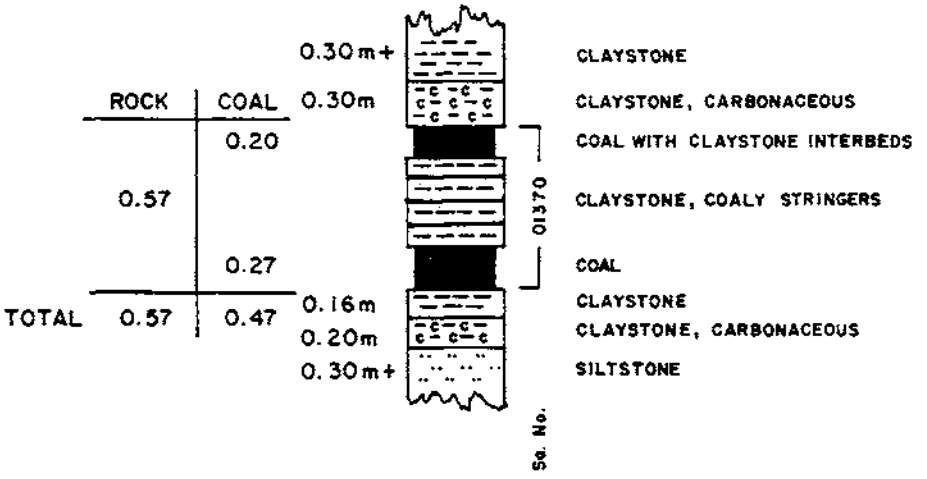
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–30

DRAWN BY L. CHILD DATE 29·9·80 SCALE 1 : 50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE



ATTITUDE OF ROOF : ~ 100 / 25° S
ATTITUDE OF FLOOR : ~ 112 / 35° S

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

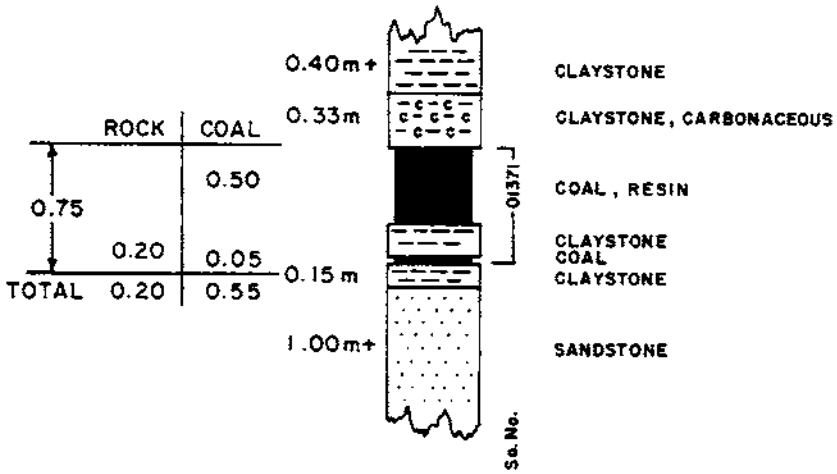
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-31

DRAWN BY L. CHILD DATE: 29-9-80 SCALE 1 : 50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE.



ATTITUDE OF ROOF : N/A
ATTITUDE OF FLOOR : 112/40°S

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

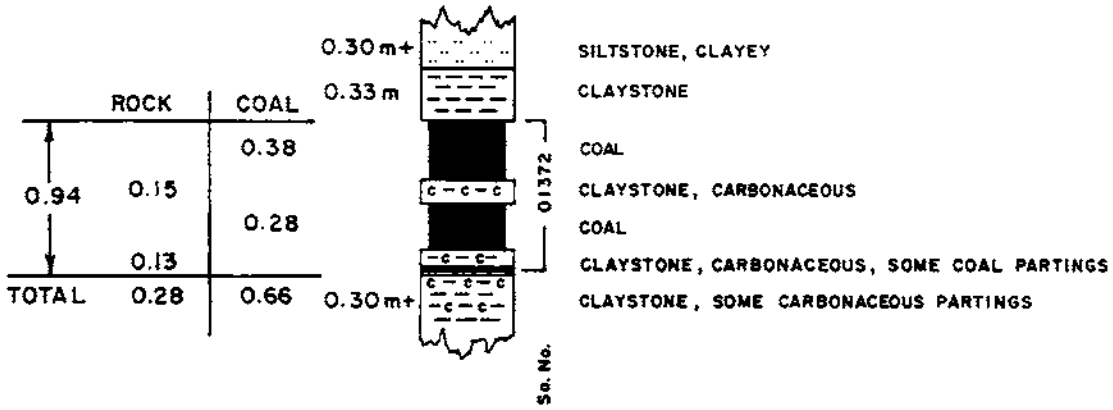
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-32

DRAWN BY L. CHILD DATE 29-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No.
APPROVED BY DATE



ATTITUDE OF ROOF : 115/~64°N

ATTITUDE OF FLOOR : 110/42°N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

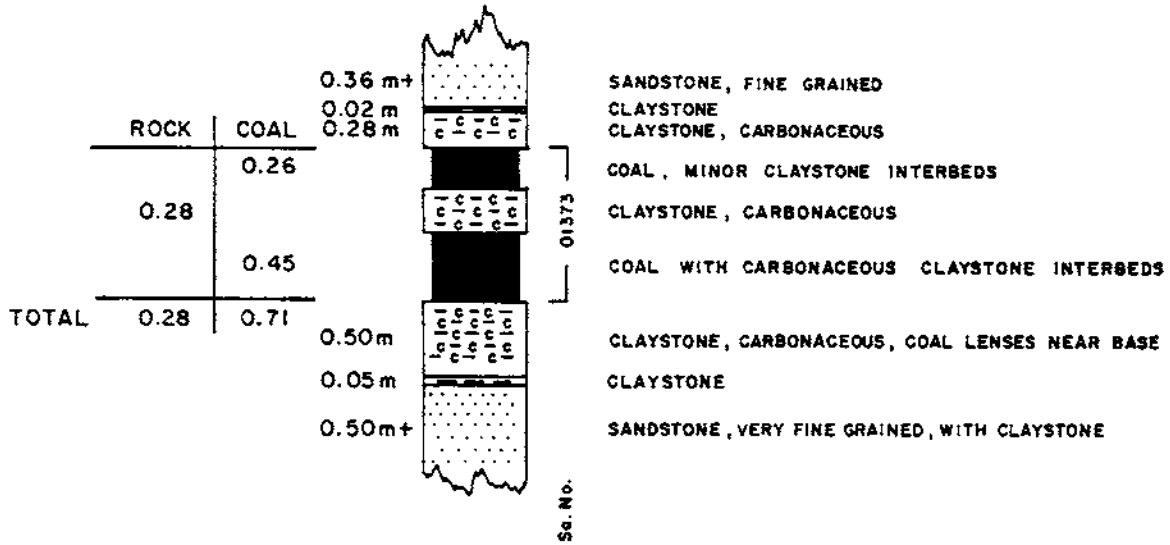
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–33

DRAWN BY: L. CHILD DATE 29·9·80 SCALE 1 : 50
PREPARED BY: J. INNIS DRAWING No.
APPROVED BY: DATE



ATTITUDE OF ROOF : 112/80°S
ATTITUDE OF FLOOR : 115/52°N

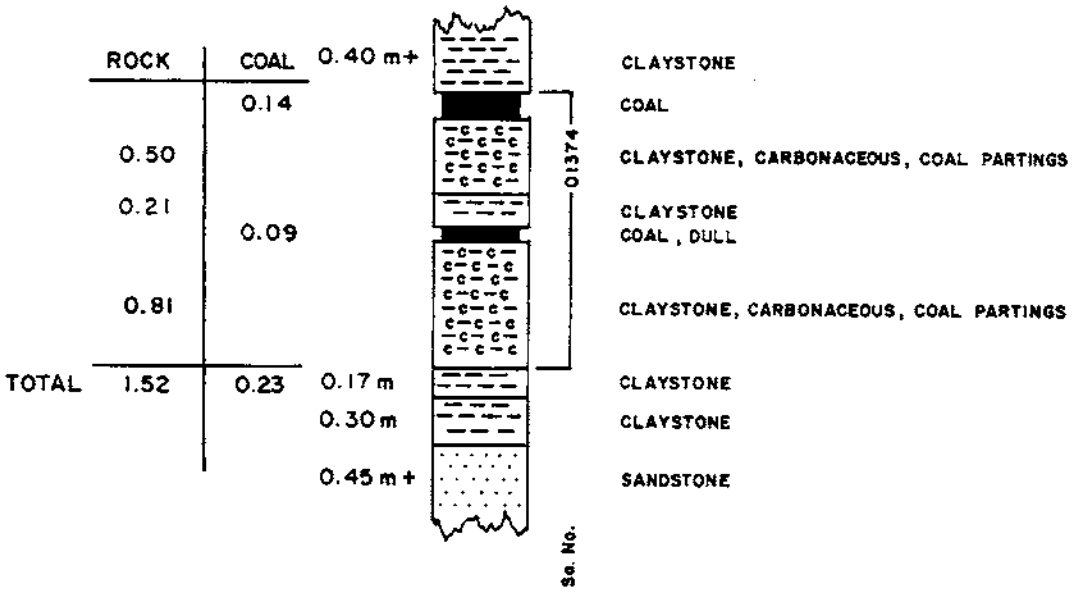
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-34

DRAWN BY L. CHILD DATE 29-9-80 SCALE 1:50
PREPARED BY J. INNIS DRAWING No
APPROVED BY DATE:



ATTITUDE OF ROOF : 113/80°S
ATTITUDE OF FLOOR : 114/88°S

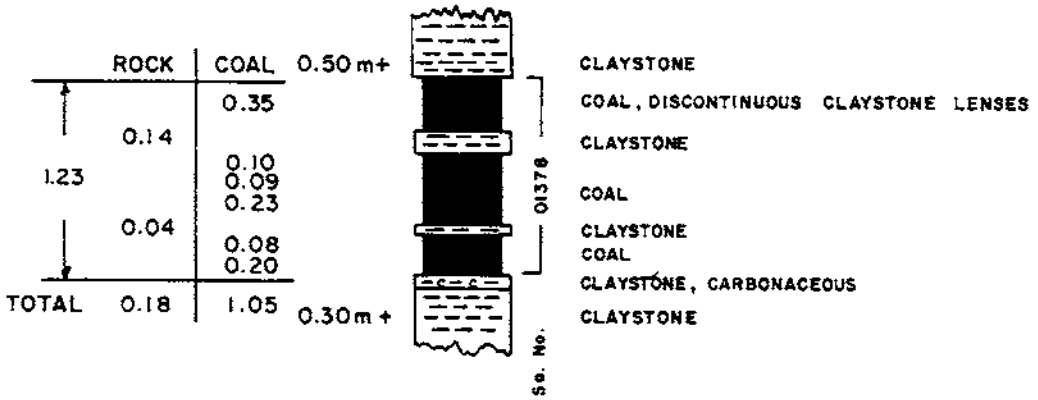
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–35

DRAWN BY: L. CHILD DATE 29-9-80 SCALE 1:50
PREPARED BY: J. INNIS DRAWING No.
APPROVED BY: DATE:



ATTITUDE OF ROOF : 110/86°S
ATTITUDE OF FLOOR : 118/34°N

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

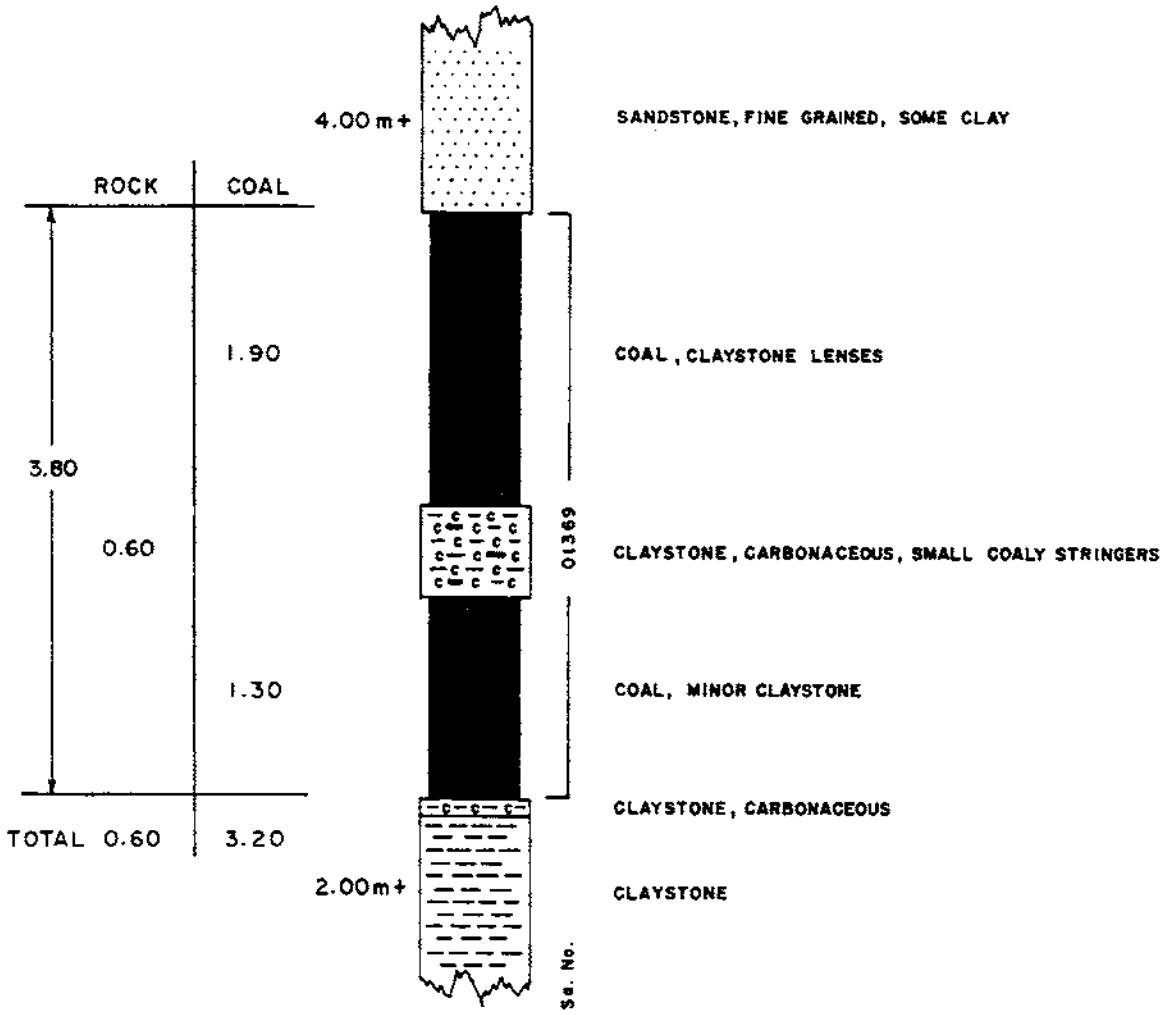
Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–36

DRAWN BY	L. CHILD	DATE 29-9-80	SCALE 1 : 50
PREPARED BY	J. INNIS		DRAWING No
APPROVED BY		DATE	



ATTITUDE OF ROOF : ~ 135/55°N
ATTITUDE OF FLOOR : 132/64°N

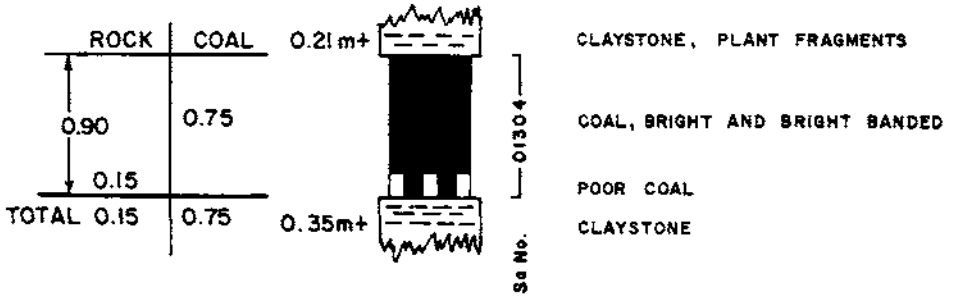
GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

PANORAMA COAL PROJECT

TRENCH LOG

PS–TR–80–37

DRAWN BY: L. CHILD DATE 29·9·80 SCALE 1:50
PREPARED BY: J. INNIS DRAWING No.
APPROVED BY: DATE



300 m

ATTITUDE OF ROOF: 121 / 56°S
ATTITUDE OF FLOOR: N/A

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

PANORAMA COAL PROJECT

TRENCH LOG

PS-TR-80-38

DRAWN BY: B.O.S.	DATE: 24-11-80	SCALE 1:50
PREPARED BY: J. INNIS		DRAWING No.
APPROVED BY:	DATE:	

GR-Panorama 80(4)A

"Panorama Coal Project Geological Report, 1980"
Gulf Canada Resources Inc.

COAL QUALITY

112

C.R. Panorama 80(4)A

OPEN FILE

APPENDIX IV

COAL QUALITY DATA

CONFIDENTIAL

CURRIER SEAM

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01369

TABLE 1. ANALYSIS OF HEAD SAMPLE

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	28.07	29.95
Moisture %	6.29	-
Volatile Matter %	12.64	13.49
Fixed Carbon %	53.00	56.56
CALORIFIC VALUE: (CAL./gm.)	4,870	5,196
(B.T.U./lb.)	8,765	9,353
SULPHUR %	0.42	0.45
SPECIFIC GRAVITY	1.66	1.70
HARDGROVE GRINDABILITY INDEX	86	

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 24

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01369

TABLE 2. SIZE CONSIST

Size	Wt. %
3/8" x 28 m.	71.51
28 m. x 100 m.	17.94
100 m. x 0	10.55
	100.00

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 24

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01369

TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3a. RAW SAMPLE ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	30.05	31.79
Moisture %	5.47	-
Volatile Matter %	12.62	13.35
Fixed Carbon %	51.86	54.86
CALORIFIC VALUE: (Cal./gm.)	4,751	5,026
(B.T.U./lb.)	8,552	9,047
SULPHUR %	0.41	0.43

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 24

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01369

TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3b. FLOAT-SINK ANALYSIS (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	-	-	-	-	-	-
1.40 - 1.50	7.54	5.21	13,300	7.54	5.21	13,300
1.50 - 1.60	40.37	15.50	11,362	47.91	13.88	11,667
1.60 - 1.70	15.45	23.52	9,422	63.36	16.23	11,120
1.70 - 1.80	8.51	32.15	7,911	71.87	18.12	10,740
+ 1.80	28.13	-	-	100.00	-	-

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 24

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01369

TABLE 4. ANALYSIS OF 28 MESH X 0 SIZE FRACTION

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	22.69	24.37
Moisture %	6.89	-
Volatile Matter %	14.16	15.21
Fixed Carbon %	56.26	60.42
CALORIFIC VALUE: (Cal./gm.)	5,230	5,617
(B.T.U./lb.)	9,414	10,111
SULPHUR %	0.42	0.45

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 24

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01369

TABLE 5. ANALYSIS OF 28 MESH X 100 MESH SIZE FRACTION (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	-	-	-	-	-	-
1.40 - 1.50	18.81	4.20	13,292	18.81	4.20	13,292
1.50 - 1.60	20.46	9.48	11,755	39.27	6.95	12,491
1.60 - 1.70	27.20	15.75	10,156	66.47	10.55	11,536
1.70 - 1.80	18.28	25.12	8,216	84.75	13.69	10,820
+ 1.80	15.25	-	-	100.00	-	-

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 24

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01369

TABLE 6. ANALYSIS OF 100 MESH X 0 SIZE FRACTION (a.d.b.)

ASH %		22.41
CALORIFIC VALUE:	(CAL./gm.)	5,129
	(B.T.U./lb.)	9,233

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 24

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01369

TABLE 7. SIMULATED PRODUCT

7a. CONTRIBUTION BY SIZE FRACTION

Size	Cut Point	Yield %	% of Raw	% of Product
3/8" x 28 m.	1.8	71.87	51.39	66.62
28 m. x 100 m.	1.8	84.75	15.20	19.71
100 m. x 0	-	100.00	10.55	13.67
Total	-	-	77.14	100.00

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 24

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01369

TABLE 7. SIMULATED PRODUCT

7b. ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	17.44	18.09
Moisture %	3.59	-
Volatile Matter %	15.10	15.66
Fixed Carbon %	63.87	66.25
CALORIFIC VALUE: (Cal./gm.)	5,874	6,093
(B.T.U./lb.)	10,573	10,967
SULPHUR %	0.52	0.54
SPECIFIC GRAVITY	1.59	1.61
HARDGROVE GRINDABILITY INDEX	81	

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 24

Date: Nov. 24/80

LEACH SEAM

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01312

TABLE 1. ANALYSIS OF HEAD SAMPLE

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	15.12	16.35
Moisture %	7.52	-
Volatile Matter %	13.54	14.64
Fixed Carbon %	63.82	69.01
CALORIFIC VALUE: (CAL./gm.)	5,953	6,437
(B.T.U./lb.)	10,716	11,587
SULPHUR %	0.36	0.39
SPECIFIC GRAVITY	1.55	1.59
HARDGROVE GRINDABILITY INDEX	66	

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 5

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01312

TABLE 2. SIZE CONSIST

Size	Wt. %
3/8" x 28 m.	72.89
28 m. x 100 m.	16.48
100 m. x 0	10.63
	100.00

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 5

Date: Nov.24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01312

TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3a. RAW SAMPLE ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	13.10	13.97
Moisture %	6.25	-
Volatile Matter %	12.17	12.98
Fixed Carbon %	68.48	73.05
CALORIFIC VALUE: (Cal./gm.)	6,270	6,688
(B.T.U./lb.)	11,286	12,038
SULPHUR %	0.36	0.38

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 5

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01312

TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3b. FLOAT-SINK ANALYSIS (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	-	-	-	-	-	-
1.40 - 1.50	34.50	4.35	13,780	34.50	4.35	13,780
1.50 - 1.60	39.10	10.78	12,118	73.60	7.77	12,897
1.60 - 1.70	11.67	20.08	9,178	85.27	9.45	12,388
1.70 - 1.80	9.53	29.58	7,041	94.80	11.47	11,851
+ 1.80	5.20	-	-	100.00	-	-

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 5

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01312

TABLE 4. ANALYSIS OF 28 MESH X 0 SIZE FRACTION

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	21.17	23.22
Moisture %	8.81	-
Volatile Matter %	16.78	18.40
Fixed Carbon %	53.24	58.38
CALORIFIC VALUE: (Cal./gm.)	5,001	5,484
(B.T.U./lb.)	9,002	9,872
SULPHUR %	0.34	0.37

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 5

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01312

TABLE 5. ANALYSIS OF 28 MESH X 100 MESH SIZE FRACTION (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	-	-	-	-	-	-
1.40 - 1.50	20.48	5.26	13,793	20.48	5.26	13,793
1.50 - 1.60	30.17	10.03	11,569	50.65	8.10	12,468
1.60 - 1.70	20.28	15.27	9,693	70.93	10.15	11,675
1.70 - 1.80	18.50	24.02	7,010	89.43	13.02	10,710
+ 1.80	10.57	-	-	100.00	-	-

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 5

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01312

TABLE 6. ANALYSIS OF 100 MESH X 0 SIZE FRACTION (a.d.b.)

ASH %		25.67
CALORIFIC VALUE:	(CAL./gm.)	4,443
	(B.T.U./lb.)	7,997

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 5

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01312

TABLE 7. SIMULATED PRODUCT

7a. CONTRIBUTION BY SIZE FRACTION

Size	Cut Point	Yield %	% of Raw	% of Product
3/8" x 28 m.	1.8	94.80	69.10	73.15
28 m. x 100 m.	1.8	89.43	14.74	15.60
100 m. x 0	-	100.00	10.63	11.25
Total	-	-	94.47	100.00

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 5

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01312

TABLE 7. SIMULATED PRODUCT

7b. ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	12.68	13.24
Moisture %	4.25	-
Volatile Matter %	14.55	15.20
Fixed Carbon %	68.52	71.56
CALORIFIC VALUE: (Cal./gm.)	6,285	6,564
(B.T.U./lb.)	11,313	11,815
SULPHUR %	0.38	0.40
SPECIFIC GRAVITY	1.53	1.55
HARDGROVE GRINDABILITY INDEX	62	

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 5

Date: Nov.24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01354

TABLE 1. ANALYSIS OF HEAD SAMPLE

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	13.71	14.87
Moisture %	7.81	-
Volatile Matter %	16.99	18.43
Fixed Carbon %	61.49	66.70
CALORIFIC VALUE: (CAL./gm.)	5,834	6,328
(B.T.U./lb.)	10,502	11,391
SULPHUR %	0.39	0.42
SPECIFIC GRAVITY	1.55	1.60
HARDGROVE GRINDABILITY INDEX	117	

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 12

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01354

TABLE 2. SIZE CONSIST

Size	Wt. %
3/8" x 28 m.	63.45
28 m. x 100 m.	23.55
100 m. x 0	13.00
	100.00

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 12

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01354

TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3a. RAW SAMPLE ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	14.84	16.13
Moisture %	7.99	-
Volatile Matter %	17.91	19.46
Fixed Carbon %	59.26	64.41
CALORIFIC VALUE: (Cal./gm.)	5,637	6,127
(B.T.U./lb.)	10,147	11,028
SULPHUR %	0.36	0.39

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 12

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01354

TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3b. FLOAT-SINK ANALYSIS (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	-	-	-	-	-	-
1.40 - 1.50	22.47	3.80	13,489	22.47	3.80	13,489
1.50 - 1.60	42.69	7.43	11,343	65.16	6.18	12,083
1.60 - 1.70	11.24	15.05	9,212	76.40	7.48	11,661
1.70 - 1.80	6.05	26.83	7,698	82.45	8.90	11,370
+ 1.80	17.55	-	-	100.00	-	-

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 12

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01354

TABLE 4. ANALYSIS OF 28 MESH X 0 SIZE FRACTION

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	8.72	9.44
Moisture %	7.64	-
Volatile Matter %	16.24	17.58
Fixed Carbon %	67.40	72.98
CALORIFIC VALUE: (Cal./gm.)	6,258	6,776
(B.T.U./lb.)	11,265	12,197
SULPHUR %	0.43	0.47

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 12

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01354

TABLE 5. ANALYSIS OF 28 MESH X 100 MESH SIZE FRACTION (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	-	-	-	-	-	-
1.40 - 1.50	53.54	3.32	13,337	53.54	3.32	13,337
1.50 - 1.60	25.39	6.84	11,039	78.93	4.45	12,598
1.60 - 1.70	12.23	11.97	9,600	91.16	5.46	12,196
1.70 - 1.80	2.64	25.11	7,895	93.80	6.01	12,075
+ 1.80	6.20	-	-	100.00	-	-

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 12

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01354

TABLE 6. ANALYSIS OF 100 MESH X 0 SIZE FRACTION (a.d.b.)

ASH %		8.94
CALORIFIC VALUE:	(CAL./gm.)	6,245
	(B.T.U./lb.)	11,241

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 12

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01354

TABLE 7. SIMULATED PRODUCT

7a. CONTRIBUTION BY SIZE FRACTION

Size	Cut Point	Yield %	% of Raw	% of Product
3/8" x 28 m.	1.8	82.45	52.31	59.85
28 m. x 100 m.	1.8	93.80	22.09	25.28
100 m. x 0	-	100.00	13.00	14.87
Total	-	-	87.40	100.00

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 12

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01354

TABLE 7. SIMULATED PRODUCT

7b. ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	8.74	9.20
Moisture %	4.95	-
Volatile Matter %	18.37	19.33
Fixed Carbon %	67.94	71.47
CALORIFIC VALUE: (Cal./gm.)	6,353	6,684
(B.T.U./lb.)	11,436	12,031
SULPHUR %	0.41	0.43
SPECIFIC GRAVITY	1.51	1.54
HARDGROVE GRINDABILITY INDEX	130	

CYCLONE ENGINEERING SALES LTD.

File: SI-316

Sample: 12

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01367

TABLE 1. ANALYSIS OF HEAD SAMPLE

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	29.22	30.35
Moisture %	3.72	-
Volatile Matter %	8.43	8.76
Fixed Carbon %	58.63	60.89
CALORIFIC VALUE: (CAL./gm.)	5,354	5,561
(B.T.U./lb.)	9,638	10,010
SULPHUR %	0.82	0.85
SPECIFIC GRAVITY	1.64	1.66
HARDGROVE GRINDABILITY INDEX	137	

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 22

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01367

TABLE 2. SIZE CONSIST

Size	Wt. %
3/8" x 28 m.	69.23
28 m. x 100 m.	16.14
100 m. x 0	14.63
	100.00

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 22

Date: Nov.24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01367

TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3a. RAW SAMPLE ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	32.06	32.99
Moisture %	2.82	-
Volatile Matter %	8.38	8.62
Fixed Carbon %	56.74	58.39
CALORIFIC VALUE: (Cal./gm.)	5,149	5,298
(B.T.U./lb.)	9,268	9,537
SULPHUR %	0.85	0.87

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 22

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01367

TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3b. FLOAT-SINK ANALYSIS (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	2.03	3.83	14,497	2.03	3.83	14,497
1.40 - 1.50	27.48	6.85	13,747	29.51	6.64	13,799
1.50 - 1.60	32.92	15.72	12,163	62.43	11.43	12,936
1.60 - 1.70	6.60	27.71	9,972	69.03	12.99	12,653
1.70 - 1.80	2.51	34.18	8,690	71.54	13.73	12,514
+ 1.80	28.46	-	-	100.00	-	-

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 22

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01367

TABLE 4. ANALYSIS OF 28 MESH X 0 SIZE FRACTION

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	25.65	26.40
Moisture %	2.85	-
Volatile Matter %	8.95	9.21
Fixed Carbon %	62.55	64.39
CALORIFIC VALUE: (Cal./gm.)	5,559	5,722
(B.T.U./lb.)	10,006	10,300
SULPHUR %	0.76	0.78

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 22

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01367

TABLE 5. ANALYSIS OF 28 MESH X 100 MESH SIZE FRACTION (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	4.33	3.33	14,640	4.33	3.33	14,640
1.40 - 1.50	36.94	6.86	13,612	41.27	6.49	13,720
1.50 - 1.60	22.40	14.18	11,873	63.67	9.20	13,070
1.60 - 1.70	8.63	23.87	10,374	72.30	10.95	12,748
1.70 - 1.80	3.79	32.10	8,988	76.09	12.00	12,561
+ 1.80	23.91	-	-	100.00	-	-

CYCLONE ENGINEERING SALES LTD.

File: S1-316

Sample: 22

Date: Nov. 24/80

GULF CANADA RESOURCES INC.

PROJECT: Panorama

SAMPLE: 01367

TABLE 6. ANALYSIS OF 100 MESH X 0 SIZE FRACTION (a.d.b.)

ASH %		23.20
CALORIFIC VALUE:	(CAL./gm.)	5,606
	(B.T.U./lb.)	10,091

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File: S1-316

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TABLE 7. SIMULATED PRODUCT

7a. CONTRIBUTION BY SIZE FRACTION

Size	Cut Point	Yield %	% of Raw	% of Product
3/8" x 28 m.	1.8	71.54	49.53	64.79
28 m. x 100 m.	1.8	76.09	12.28	16.07
100 m. x 0	-	100.00	14.63	19.14
Total	-	-	76.44	100.00

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PROJECT: Panorama

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TABLE 7. SIMULATED PRODUCT

7b. ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	15.69	16.16
Moisture %	2.90	-
Volatile Matter %	10.60	10.92
Fixed Carbon %	70.81	72.92
CALORIFIC VALUE: (Cal./gm.)	6,644	6,842
(B.T.U./lb.)	11,959	12,316
SULPHUR %	1.02	1.05
SPECIFIC GRAVITY	1.56	1.58
HARDGROVE GRINDABILITY INDEX	167	

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TABLE 1. ANALYSIS OF HEAD SAMPLE

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	16.48	19.56
Moisture %	15.73	-
Volatile Matter %	23.86	28.31
Fixed Carbon %	43.93	52.13
CALORIFIC VALUE: (CAL./gm.)	4,288	5,088
(B.T.U./lb.)	7,718	9,159
SULPHUR %	0.27	0.32
SPECIFIC GRAVITY	1.68	1.81
HARDGROVE GRINDABILITY INDEX	102	

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TABLE 2. SIZE CONSIST

Size	Wt. %
3/8" x 28 m.	64.88
28 m. x 100 m.	21.30
100 m. x 0	13.82
	100.00

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TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3a. RAW SAMPLE ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	17.48	20.35
Moisture %	14.11	-
Volatile Matter %	23.78	27.69
Fixed Carbon %	44.63	51.96
CALORIFIC VALUE: (Cal./gm.)	4,367	5,084
(B.T.U./lb.)	7,860	9,151
SULPHUR %	0.28	0.33

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TABLE 3. ANALYSIS OF 3/8" x 28 MESH SIZE FRACTION

3b. FLOAT-SINK ANALYSIS (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	-	-	-	-	-	-
1.40 - 1.50	-	-	-	-	-	-
1.50 - 1.60	71.74	8.02	9,371	71.74	8.02	9,371
1.60 - 1.70	5.02	16.41	7,594	76.76	8.57	9,255
1.70 - 1.80	7.62	22.37	7,015	84.38	9.82	9,053
+ 1.80	15.62	-	-	100.00	-	-

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TABLE 4. ANALYSIS OF 28 MESH X 0 SIZE FRACTION

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	15.39	18.40
Moisture %	16.35	-
Volatile Matter %	24.71	29.54
Fixed Carbon %	43.55	52.06
CALORIFIC VALUE: (Cal./gm.)	4,228	5,054
(B.T.U./lb.)	7,611	9,098
SULPHUR %	0.27	0.32

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TABLE 5. ANALYSIS OF 28 MESH X 100 MESH SIZE FRACTION (a.d.b.)

	FRACTIONAL			CUMULATIVE		
Sp. Gr.	Yield %	Ash %	BTU/lb.	Yield %	Ash %	BTU/lb.
- 1.40	-	-	-	-	-	-
1.40 - 1.50	-	-	-	-	-	-
1.50 - 1.60	67.48	8.18	8,463	67.48	8.18	8,463
1.60 - 1.70	6.12	11.84	8,295	73.60	8.48	8,449
1.70 - 1.80	15.88	18.70	6,991	89.48	10.30	8,190
+ 1.80	10.52	-	-	100.00	-	-

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TABLE 6. ANALYSIS OF 100 MESH X 0 SIZE FRACTION (a.d.b.)

ASH %		16.72
CALORIFIC VALUE:	(CAL./gm.)	4,079
	(B.T.U./lb.)	7,341

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TABLE 7. SIMULATED PRODUCT

7a. CONTRIBUTION BY SIZE FRACTION

Size	Cut Point	Yield %	% of Raw	% of Product
3/8" x 28 m.	1.8	84.38	54.75	62.48
28 m. x 100 m.	1.8	89.48	19.06	21.75
100 m. x 0	-	100.00	13.82	15.77
Total	-	-	87.63	100.00

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TABLE 7. SIMULATED PRODUCT

7b. ANALYSIS

	Air-Dry Basis	Dry Basis
PROXIMATE ANALYSIS:		
Ash %	10.58	11.61
Moisture %	8.87	-
Volatile Matter %	24.76	27.17
Fixed Carbon %	55.79	61.22
CALORIFIC VALUE: (Cal./gm.)	4,840	5,311
(B.T.U./lb.)	8,713	9,561
SULPHUR %	0.30	0.33
SPECIFIC GRAVITY	1.64	1.70
HARDGROVE GRINDABILITY INDEX	104	

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