FISHER CREEK PROJECT

1979

FISHER CREEK PROJECT 1979

Geological Report

Reconnaissance Investigation - August 26 - 28, 1979

Licence Nos. 4750 and 4751

93-0-9-F ~~-43,~~ 44, 53, 54
93-0-9-F - 63, 64, 73, 74

Latitude 55° 38' Longitude 122° 17'

Owner/Operator - Gulf Canada Resources Inc.

Brian P. Flynn
March, 1980

PREFACE

This report presents the findings of a limited reconnaissance investigation of the Fisher Creek licences in north-eastern British Columbia.

STATEMENT OF QUALIFICATIONS

I, Brian Patrick Flynn, obtained my Bachelor of Science Degree (Geology) at the University of Natal, South Africa, in 1971. I worked one year in base metal exploration in South Africa and since 1976 have been involved in the mapping and exploration of coal measures in northeastern British Columbia; first with the British Columbia Ministry of Mines and Petroleum Resources (1976 - 1977), and since 1978 with Gulf Canada Resources Inc. (formerly Gulf Oil Canada Limited).

The reconnaissance investigation of the Fisher Creek licences, both in the field and off the property was conducted under my supervision.

Brian P. Flynn

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ENCLOSED DRAWINGS

APPENDICES IN TEXT

Appendix I	Schedule of Coal Licences; Current & Under Application
Appendix II	Seam Details
Appendix III	Coal Quality Data Refer to Confidential Coal Analysis File.
Appendix IV	Abbreviations

1 SUMMARY

The Fisher Creek licences lie within the Foothills belt of northeastern British Columbia, approximately 43 km west of Chetwynd. The licences were explored at a reconnaissance level, comprising geological mapping and coal seam trenching during the last week of August, 1979. The property is underlain by folded and faulted strata of the coal-bearing Lower Cretaceous Gething Formation of the Bullhead Group. A number of coal exposures exist on the property, three of which were trenched; however at present both the lack of stratigraphic control and the structural complexity does not allow their stratigraphic position within the Gething Formation to be determined. Coal seams vary from a few centimetres to a measured thickness of 1.96 metres. Coal quality tests indicate the coal to be of medium volatile bituminous rank; however, because of the oxidized nature of the trench samples, no information is available on the swelling characteristics of the coal. Average proximate analysis, B.T.U., and sulphur values on the raw coal, on an air-dried basis, were calculated for the three seams analyzed and are as follows:

Moisture	5.5
Ash	15.7
Volatile Matter	23.9
Volatile Matter (dmmf)	29.04
Fixed Carbon	54.8
Sulphur	0.73

Upon completion of the program, a further 28 licences were applied for, covering both the Gething and Brenot Formations (Hughes 1967). (Fig. 2 and Appendix I.)

2 RECOMMENDATIONS

The thick tree cover and poor outcrop would necessitate detailed geological mapping, followed by diamond drilling of the licences before any meaningful evaluation of the geological and economic potential of the area could be made. Together with the licences now under application, Gulf will hold an area sufficiently large enough to warrant a full exploratory mapping and drilling program and it is recommended that such a program be implemented during 1980.

3 INTRODUCTION

3.1 Licences and Location

The Fisher Creek property comprises two contiguous licences situated on the north side of Pine River, 43 kilometres west of Chetwynd, northeastern British Columbia (Fig. 1).

3.2 Property Ownership

Gulf Canada Resources Inc. applied for and received two licences, numbered 4750 and 4751, (Fig. 2) on April 23, 1979, in which Gulf Canada Resources Inc. has 100% ownership. The reconnaissance investigation was undertaken entirely by Gulf Canada Resources Inc. personnel.

3.3 Access and Infrastructure

Access to the extreme south is gained by the John Hart Highway which crosses the extreme southeast corner of the licences. Although a power transmission line support road suitable for travel by four-wheel drive vehicles provides access to the south central portion, the remainder of the property is accessible by foot only.

The property is well situated with respect to both rail and townsite facilities as B.C.R. track runs just south of the licences in the Pine River Valley and the town of Chetwynd lies 43 km to the east along the John Hart Highway.

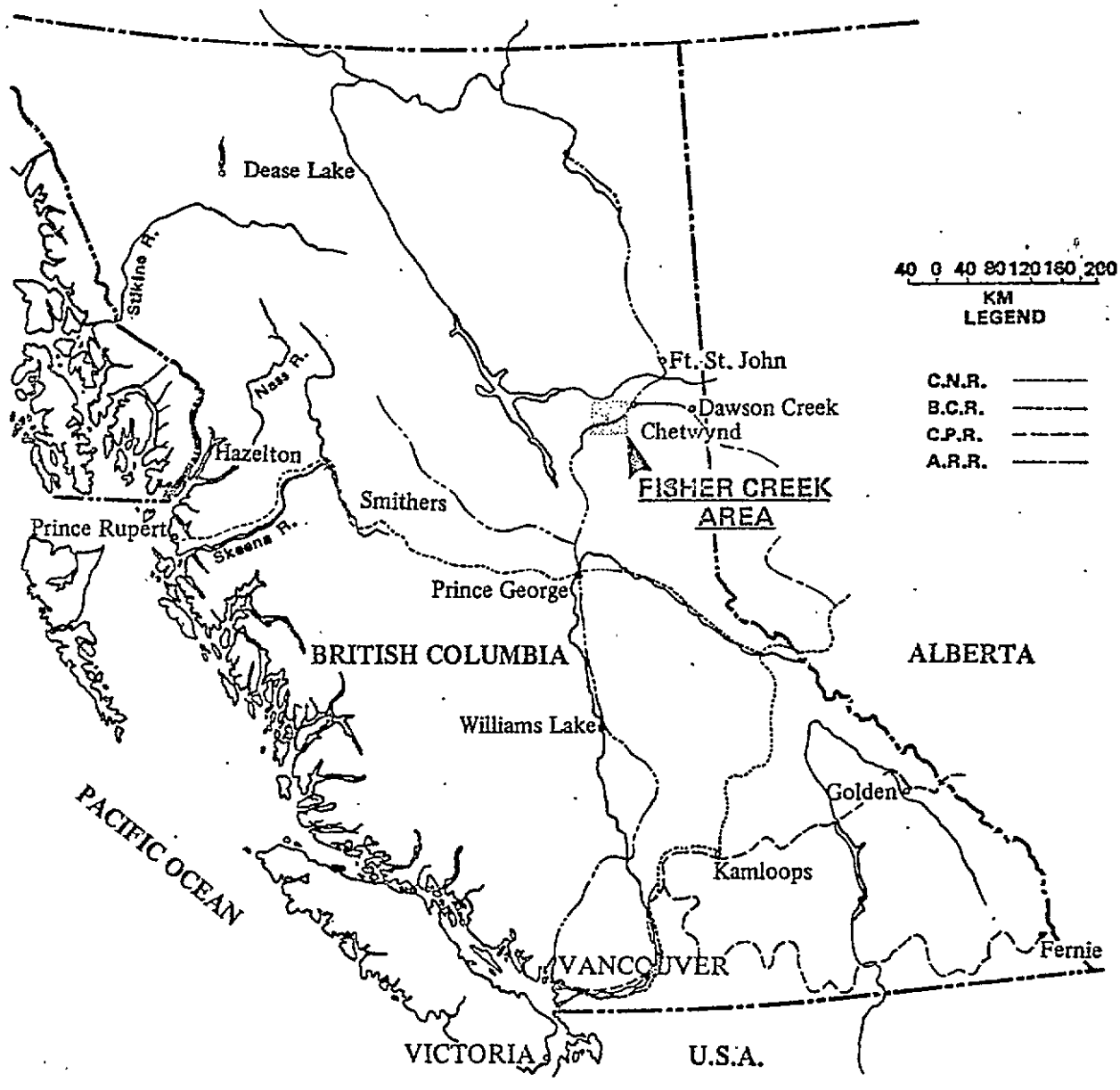
FIGURE 1

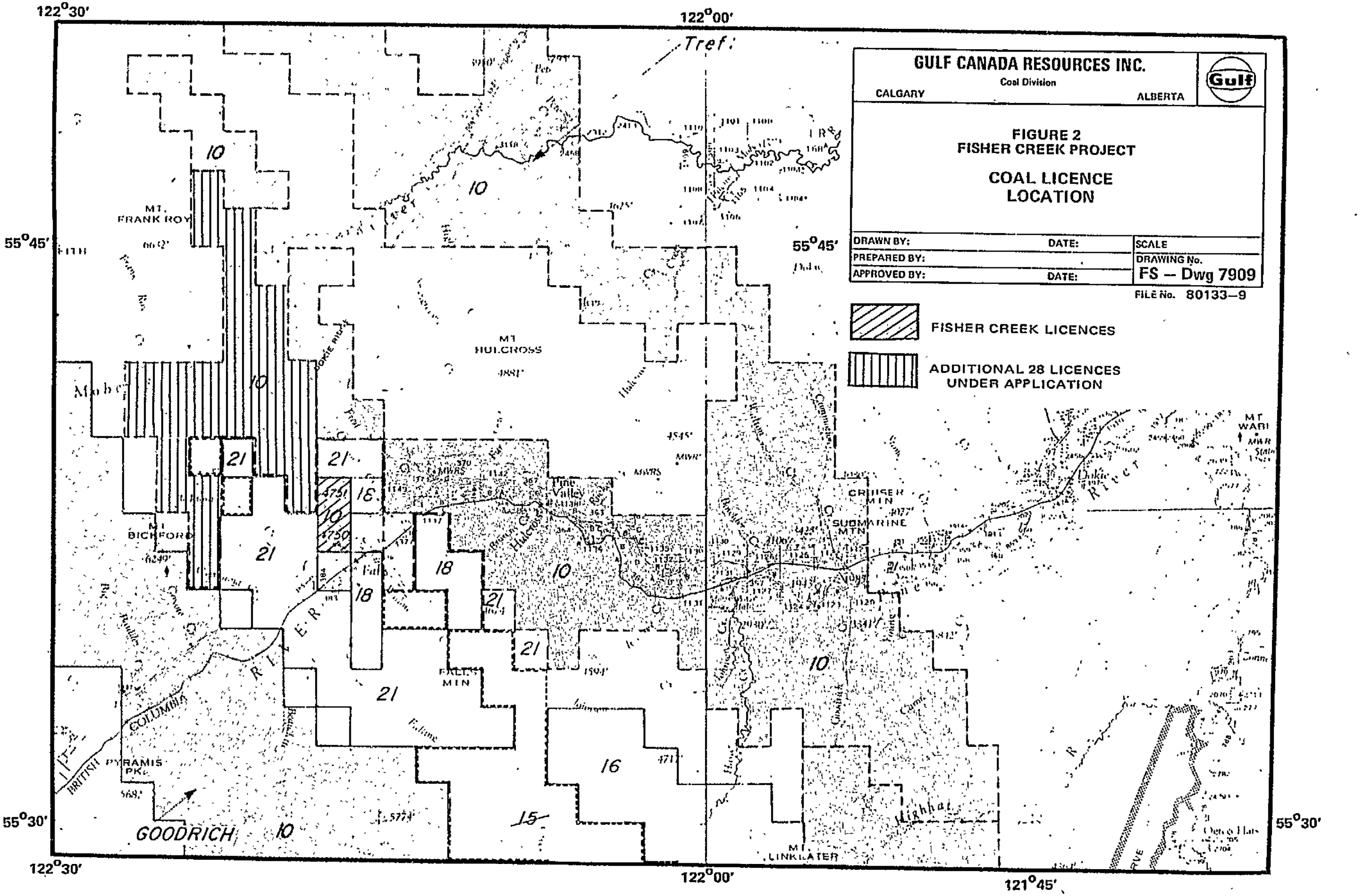
BRITISH COLUMBIA

FISHER CREEK AREA

LOCATION MAP

FILE NO. 79452–2




GULF CANADA RESOURCES INC.
Coal Division
CALGARY
ALBERTA
Gulf
FIGURE 2
FISHER CREEK PROJECT
COAL LICENCE
LOCATION
DRAWN BY:
DATE:
SCALE
PREPARED BY:
DRAWING No.
APPROVED BY:
DATE:
FS – Dwg 7909
FILE No. 80133-9
FISHER CREEK LICENCES
ADDITIONAL 28 LICENCES
UNDER APPLICATION
122°30'
122°00'
121°45'
55°45'
55°30'
Tref.
MT. FRANK ROY
MT. HULCROSS
MT. BICKFORD
CRUISER MTN
SUBMARINE MTN
FALLS MTN
MT. WARI
MT. LINKLATER
PYRAMIS PK.
GOODRICH
BRITISH COLUMBIA
RIVER
10
21
18
16
15

3.4 Physiography

The licences lie along the eastern edge of the Rocky Mountain Foothills Belt with elevations varying from 640 metres in the Pine River Valley in the south to 1 280 metres in the north. The entire property, with the exception of man-made right-of-ways, is heavily treed with coniferous forests and stands of deciduous trees. Undergrowth is a mixture of alder, aspen and other secondary growth. Narod Creek cuts across the property in an easterly direction before swinging southeast and joining the Pine River.

3.5 Logistics

Operations were based in the town of Chetwynd where all necessary facilities to support the program were available. Personnel were housed in the Pine Cone Motel, and a Hughes 500 C helicopter was used during mapping which took place during the last week in August, 1979.

Contributors to the success of the program were as follows:

Lift Air International - Calgary, Alberta

3.6 Geological Techniques

The program lasted three days from August 26 to August 28 involving two, two-man parties and comprised reconnaissance mapping at a scale of 1:25 000, and hand

4 GEOLOGY

4.1 Stratigraphy

4.1.1 General Stratigraphy

The most recent and widely accepted subdivision of the sedimentary section within the Peace River Coalfield is that of Stott (1968), illustrated in Table I. However, the mapping and subsequent subdivision and nomenclature of the Lower Cretaceous by J.E. Hughes (1967), within a limited area along the Pine River Valley, is of interest with respect to the mapping of the licences. Table II illustrates Hughes' subdivision while Table III is a comparison of Hughes' and Stott's work.

As a result of the field mapping, it is felt that although the Brenot, and in particular the Dresser Formations of Hughes' cannot be extended throughout the coalfield, the lithologic parameters defining these formations is a key to the geological mapping and formation recognition within the area covered by the licences.

Coal seams of economic significance occur within the Gething Formation over the northern portion of the coalfield and in the Gates Member of the Commotion Formation over the southern half. The property is underlain by the Gething Formation.

TABLE I

TABLE OF FORMATIONS AFTER STOTT 1968

FILE NO. 80133—10

(thickness in feet)

	Group	Formation	Member	Description
Upper Cretaceous		Wapiti (0-1,500)		Conglomerate; fine- to coarse-grained sandstone; carbonaceous shale and coal.
	Smoky Group (1,250-3,900)	Pusiwaskau (375-1,200)	Nomad (0-159)	Rusty weathering rubbly shales, greenish grey shales and fine-grained, thin-bedded sandstones.
			Chungo (12-194)	Fine-grained, thick-bedded, brown weathering sandstones and dark grey siltstone.
			Hanson (115-176)	Dark grey, rusty weathering, blocky to rubbly shales.
			Thistle (100-600)	Dark grey to black, calcareous, platy to fissile shales.
			Dowling (50-200?)	Dark grey, rubbly to platy shales, weathering rust.
		Bad Heart (0-85)		Fine-grained, thick- to thin-bedded sandstone, weathering brown. In some regions, includes brackish and non-marine carbonaceous, greyish and greenish shales.
		Muskiki (115-381)		Dark grey, rubbly to platy shales, weathering rust and having banded appearance.
		Cardium (15?-225)	Baytree (0-37)	Massive to thick-bedded conglomerate of chert and quartzite pebbles in coarse-grained sandstone matrix.
			Moosehound (0-143)	Greyish green to brown, carbonaceous, rubbly shales; fine- to coarse-grained carbonaceous sandstones; thin coal beds, minor conglomerate.
			Ram (40-84)	Fine-grained, thick-bedded sandstone, weathering rusty brown.
		Kaskapau (850-2,800)	Opabin (175-325)	Dark grey, rusty weathering, blocky to rubbly shales.
			Haven (100-620)	Dark grey to black, rubbly to platy shales, weathering rust, with yellow efflorescence and fetid odour.
			Vimy (250-800)	Dark grey to black, calcareous, platy to fissile shales. Includes much fine-grained, thick- to thin-bedded sandstone in northwestern part of region.
			Sunkay (100-1,000)	Dark grey, rubbly to platy shales, weathering rust; sandstone, fine-grained, thick- to thin-bedded and siltstone, argillaceous; sideritic concretions.
		Dunvegan (350-1,200)		Fine- to coarse-grained sandstone; conglomerate; carbonaceous shale and coal.
Lower Cretaceous	Fort St. John (2,000-5,000)	Cruiser Fm.[1] (350-800)		Dark grey marine shale with sideritic concretions; some sandstone
		Goodrich Fm.[1] (50-1,350)		Fine-grained, crossbedded sandstone; shale and mudstone.
		Hasler Fm.[1] (500?-1,500)		Silty, dark grey marine shale with sideritic concretions; siltstone in lower part.
		Commotion (1,080-1,600)	Boulder Creek Member (240-560)	Fine-grained, well sorted sandstone; massive conglomerate; non-marine sandstone and mudstone.
			Hulcross Member (0-450)	Dark grey marine shale with sideritic concretions.
			Gates Member[2] (220-900)	Fine-grained, marine and non-marine sandstones; conglomerate; coal; shale and mudstone
		Moosebar (100-1,000)		Dark grey marine shale with sideritic concretions; glauconitic sandstone and pebbles at base.
	Bullhead (300-2,500)	Gething (75-1,800)		Fine- to coarse-grained, brown, calcareous, carbonaceous sandstone; coal, carbonaceous shale, and conglomerate
		Cadomin (45-700)		Massive conglomerate containing chert and quartzite pebbles
	Regional erosional unconformity; bevels rock of successively older age northward and eastward			
	Minnes (0-6,500)	Unnamed (0-1,100?)		Sandstone, fine-grained and silty shale; carbonaceous in part
		Monach (0-1,000)		Sandstone, fine-grained, argillaceous; massive, fine- to coarse-grained quartzose sandstone.
		Beattie Peaks (0-1,300)		Interbedded fine-grained sandstone and silty shales.
		Monteith (0-2,000)		Sandstone, fine grained; white, quartzose fine- to coarse-grained sandstone
Jurassic		Fernie (0-1,900)		Calcareous and phosphatic shales; rusty weathering shales; glauconitic siltstone; sideritic shales, thinly interbedded sandstone, shale, and siltstone.

[1] The Hasler, Goodrich, and Cruiser Formations are recognized in the Foothills.

[2] Equivalent shales in the Plains are included in the Shaftesbury Formation.

Gates sandstones in Peace River Region are considered as a formation; farther south, they are included in Gates Member of Commotion Formation.

TABLE II

TABLE OF FORMATIONS AFTER HUGHES 1967

FILE NO. 80133–11

Age	Group	Stratigraphic Units: Thickness (in Feet): Lithology		
QUATERNARY	Recent	Alluvium.		
	Pleistocene	Lacustrine clays, silts, sands. Fluvioglacial sands and gravels. Glacial till.		
CRETACEOUS	Fort St. John Group	Dunvegan Formation (*+1,194*). Sandstones, shales, and siltstones; minor conglomerate; few thin coals; largely non-marine.		
		Cruiser Formation (450 to 850). Shales and mudstones; minor thin sandstones; marine.		
		Goodrich Formation (500 to 1,225). Sandstones; minor conglomerate; some shales; marine.		* Shales with sandstones (*760*). Shales; four arenaceous members.
		Hasler Formation (*785* to 1,100). Shales with minor thin siltstones and sandstones; marine.		
		Commotion Formation (*1,417* to 1,425). Marine sandstones, conglomerates, and shales; some non-marine beds; thin coal measures at top in outcrops.		
		Moosebar Formation (*1,083* to 1,400). Mudstones and shales; minor sandstones; marine.		
	Crassier Group	Crassier Group Undivided (+2,500). Coal measures, and coal measures with much sandstone; few conglomerates.	Gething Formation (*513* to 1,800). Coal measures.	
			Dresser Formation (*670* to 1,200). Coal measures with thick sandstones, grits; some conglomerates.	
			Brenot Formation (*305* to 750). Coal measures with thin coals and thin or barren cyclothems.	
				* Chetwynd Beds (*245*). Sandstones, quartzites, shales; thin coal measures.
	Beaudette Group	Beaudette Group. Undivided (3,150). Mostly sandstones; minor quartzites; minor shales; marine.	Monach Formation (—300 to 400). Sandstones with or without quartzites in upper part; marine.	* Beaudette Group. Undivided (*688*). Sandstones, quartzites, siltstones, shales.
			Beattie Peaks Formation (650 to 950). Shales, siltstones, sandstones; marine.	
			Monteith Formation (+1,500.) Sandstones: quartzites in upper third; minor shales; marine.	
JURASSIC	Fernie Group	Transition Beds (75 to ? 150). Shales, siltstones, sandstones; marine.		
		Middle Shales (*313* to 600). Mostly dark-grey and black shales; marine.		
		Nordegg Beds (50 to *97*). Limestones; followed by thin shales, siltstones, and sandstones; chert; marine.		
TRIASSIC	Schooler Creek Group	Pardonet Formation (? *nil* to 700). Argillaceous, silty limestones; aphanitic limestones; shell beds of *Halobia* and *Monotis;* marine.		
		Grey Beds, Division (ii)	Baldonnel Formation (550). Limestones, with shelly fragmental and arenaceous limestones; marine.	* Baldonnel Formation (*425*). Dolomites; arenaceous dolomites; shales, siltstones, chert.
		Grey Beds, Division (i)	Charlie Lake Formation (475). Limestones, dolomites, siltstones, sandstones, quartzites, anhydrites; marine.	* Charlie Lake Formation (*+163*). Dolomites; arenaceous dolomites; anhydrites; siltstones.
			Halfway Formation (400). Dolomitic and calcareous siltstones and sandstones grading to arenaceous dolomites; marine.	* Not drilled.

* Stratigraphic units and lithology belonging to subsurface section in east part of the map-area (drilled in Sun et al Chetwynd 14–20).

Italic figures denote thickness for stratigraphic units in subsurface, in east part of the map-area (drilled in Sun et al Chetwynd 14–20).

TABLE III

COMPARISON OF STRATIGRAPHIC SUBDIVISIONS BY HUGHES & STOTT

FILE NO. 80133–12

	HUGHES 1967		STOTT 1962 and 1967		
AGE	GROUP	FORMATION	GROUP	FORMATION	MEMBER
CRETACEOUS		DUNVEGAN		DUNVEGAN	
	FORT ST. JOHN	CRUISER	FORT ST. JOHN	CRUISER	
		GOODRICH		GOODRICH	
		HASLER		HASLER	
		COMMOTION		COMMOTION	BOULDER CREEK
					HULCROSS
					GATES
		MOOSE BAR		MOOSE BAR	
	CRASSIER	GETHING	BULL HEAD	GETHING	
		DRESSER		CADOMIN	
		BRENOT	MINNES	UNNAMED	
	BEAUDETTE	MONACH		MONACH	
		BEATTIE PEAKS		BEATTIE PEAKS	
		MONTEITH		MONTEITH	
JURASSIC	FERNIE	TRANSITION BEDS		FERNIE	
		MIDDLE SHALES			
		NORDEGG BEDS			

4.1.2 Detailed Stratigraphy

The licences are predominantly underlain by the Gething Formation. The Cadomin Formation has been inferred along the extreme northeast border of the property Stott (1975); however, typical Cadomin strata were not recognized during mapping. Thus the area covered by the licences is underlain predominantly by Gething sediments.

The Gething Formation comprises interbedded sandstone, siltstone, claystone, carbonaceous claystone and coal sequences. The sandstones vary from fine to coarse-grained and occur in beds up to 7 metres thick, but averaging 2 to 4 metres in thickness. The sandstones are interbedded with siltstone, claystone and coal sequences varying from 2 to 40 metres in thickness and averaging 4 to 8 metres.

4.2 Coal Seams

Coal seams vary from a few centimetres to a measured maximum thickness of 1.96 metres, but are generally in the 0.5 to 1 metre range. Between 1946 and 1957, a diamond drilling program mounted by the Coal Division of the Department of Lands and Forests intersected a number of seams both west and east of the licences (McKechnie 1955). To the east in the Noman Creek (Cleveland Creek) area; two seams of significance, 198 metres and 167 metres below the Gething-Moosebar

contact, were intersected. The lower seam varied from 0.6 to 6.7 metres in thickness and the upper seam 0.3 to 3 metres. No information is available on individual seam or interseam thicknesses. No logs are available for these holes.

Although the maximum seam thickness measured during mapping operations was 1.96 metres, thicker seams could be present on the property because only a small percentage of the area is not covered by forest. A 30-metre section of Gething exposed in a road cut just outside the southwest boundary of the licences is estimated to contain an aggregate thickness of 4 metres of coal in 3 seams, all in excess of one metre. Maximum seam thickness is 1.5 metres.

On the licences, 3 seams exposed in road cuts along the power line support road, were hand-trenched and sampled. See drawing FS -Dwg 7903. Thicknesses from east to west are 1.35, 1.96 and 0.83 metres. Strip logs of the seams are included in Appendix I. All 3 trenches were back-filled upon completion of logging activities.

Insufficient data, resulting from poor and discontinuous exposures, structural complexities and the reconnaissance nature of the program, hampered attempts to determine the stratigraphic position of the seams within the Gething Formation and all that presently can be said is that the seams occur in the Lower Gething Formation. It is felt that a more

TABLE IV

Coal Seam Trench Data

Trench Number	Licence Number	Thickness in Metres		
		Rock	Coal	Total
Fs Tr. 7901	4750	0.00	1.35	1.35
Fs Tr. 7902	4750	0.07	1.89	1.96
Fs Tr. 7903	4750	0.00	0.83	0.83

certain stratigraphic determination could be obtained by more detailed mapping over a wider area.

Table IV summarizes the coal seams trenched during the program.

4.3 Structure

4.3.1 General Structure

The licences lie within the northwesterly trending Foothills Structural Belt which can be subdivided into two parts (Hughes 1967).

a) An Inner Foothills belt of "strongly folded, faulted and disturbed rocks of Triassic, Jurassic and Cretaceous ages", and

b) An Outer Foothills Belt of "discontinuous folds and faults in which Cretaceous rocks form the main exposures".

The property lies along the eastern edge of the Inner Foothills Belt.

4.3.2 Detailed Structure

The area under licence is structurally controlled by the Pine River anticlinorium which comprises two main en echelon elements; the Fisher Creek anticline, north and east and the Willow Creek anticline, south and east of the licences.

The Fisher Creek and Willow Creek anticlines are well developed northwest and southeast of the licences respectively, but cease to remain distinct entities in the Pine River Valley where they dissolve into a number of lesser folds cut by minor high angle reverse faults. The licences cover this complexly folded area. Difficulty was experienced in tracing fold axes over any distance both in the field and on aerial photography, and strikes measured from a number of outcrops are erratic and not in accordance with the general northwest - southeast structural trend.

5 COAL QUALITY

Three coal seams exposed along the power line support road were hand trenched and the samples were sent to Warnock Hersey Professional Services Ltd. for proximate analysis and sulphur determinations. Sample sink-float analyses at 1.5 specific gravity were also done on each sample. A flow diagram of sample procedures is shown in Figure 2.

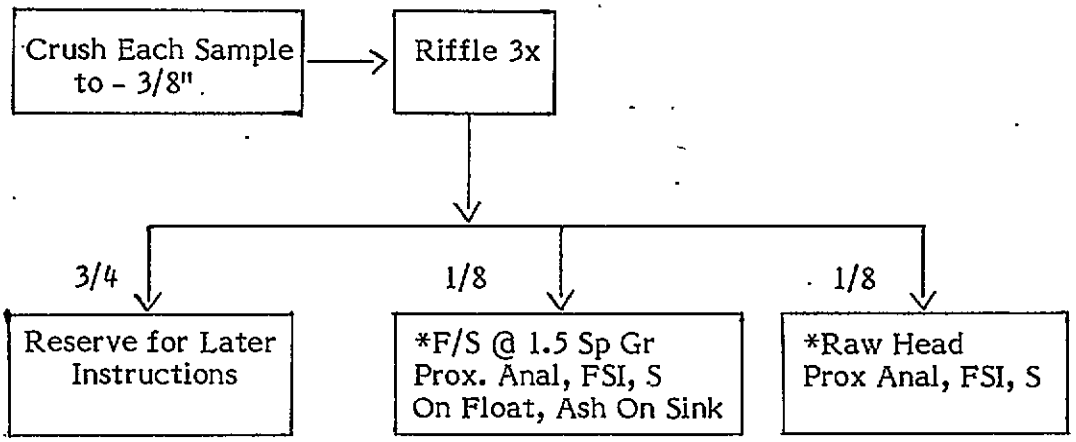
Test results indicate that the coal is of medium volatile bituminous rank, but as the samples were taken from oxidized coal within less than 1 metre from the surface, little can be said on the coking potential of the coal.

Coal tested as a result of the diamond drilling program of the Coal Division, Department of Lands and Forests (McKechnie 1955) in the Noman Creek (Cleveland Creek) area to the west of the licences, is somewhat ambiguous with respect to coking properties as they do not indicate whether the coal is non-coking or whether the samples were not tested for that property. Tests conducted on coal samples obtained during the same program in the Willow Creek area, south-east of Pine River and on the same structural trend as the licences, indicate that the coals are coking.

Table V summarizes the results of proximate analysis and sulphur determinations, on an air-dried basis, on the 3 trench samples.

FIGURE 2

Trench Sample - Coal Analysis Flow Diagram



On an "as received" and dry basis only.

TABLE V

Summary of Coal Analyses (adb)

Trench No.	Sample No.	Seam Thickness			Moisture	Ash	Volatile Matter		Fixed Carbon	Sulphur
		Rock	Coal	Total						
Fs Tr. 7901	F 6	0	1.35	1.35	8.3	11.3	24.3	29.23*	56.1	0.68
Fs Tr. 7902	F 7-2	0.07	1.89	1.96	5.5	24.7	21.8	28.97*	48.0	0.73
Fs Tr. 7903	F 8-2	0	0.83	0.83	2.8	11.2	25.7	28.92*	60.3	0.78

* dmmf basis

6 RECLAMATION

Disturbance to the area was minimal and involved the excavation of 3 hand trenches along the side of the power transmission line support road. All 3 trenches were backfilled upon completion of logging activities, and as they were excavated directly into coal seams exposed in road cuts, no reseeding was necessary.

A total disturbance of 2.3 square metres resulted from the hand trenching.

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APPENDIX I

Coal Licence Schedule Issued

and Under Application

FISHER CREEK COAL LICENCES 1979

Licence No.	Date Issued	Hectares	Land Description		
			Map Series	Block	Units
Issued					
4750	April 23/79	293	93-0-9	F	43, 44, 53, 54
4751	April 23/79	293	93-0-9	F	63, 64, 73, 74
		586			
Under Application					
		293	93-0-9	E	21, 22, 31, 32
		293	93-0-9	E	41, 42, 51, 52
		293	93-0-9	E	61, 62, 71, 72
		293	93-0-9	E	63, 64, 73, 74
		293	93-0-9	E	83, 84, 93, 94
		293	93-0-9	F	65, 66, 75, 76
		292	93-0-9	F	85, 86, 95, 96
		292	93-0-9	F	87, 88, 97, 98
		292	93-0-9	K	5, 6, 15, 16
		292	93-0-9	K	7, 8, 17, 18
		292	93-0-9	K	9, 10, 19, 20
		292	93-0-9	K	25, 26, 35, 36
		292	93-0-9	K	27, 28, 37, 38
		292	93-0-9	K	29, 30, 39, 40
		292	93-0-9	K	47, 48, 57, 58
		292	93-0-9	K	49, 50, 59, 60
		292	93-0-9	K	67, 69, 77, 79
		292	93-0-9	K	69, 70, 79, 80
		292	93-0-9	K	89, 90, 99, 100
		292	93-0-9	L	1, 2, 11, 12
		292	93-0-9	L	3, 4, 13, 14
		292	93-0-9	L	5, 6, 15, 16
		292	93-0-9	L	21, 22, 31, 32
		292	93-0-9	L	23, 24, 33, 34
		292	93-0-9	L	25, 26, 35, 36
		292	93-0-16	C	9, 10, 19, 20
		292	93-0-16	D	1, 2, 11, 12
		292	93-0-16	D	21, 22, 31, 32
		8182 hectares			

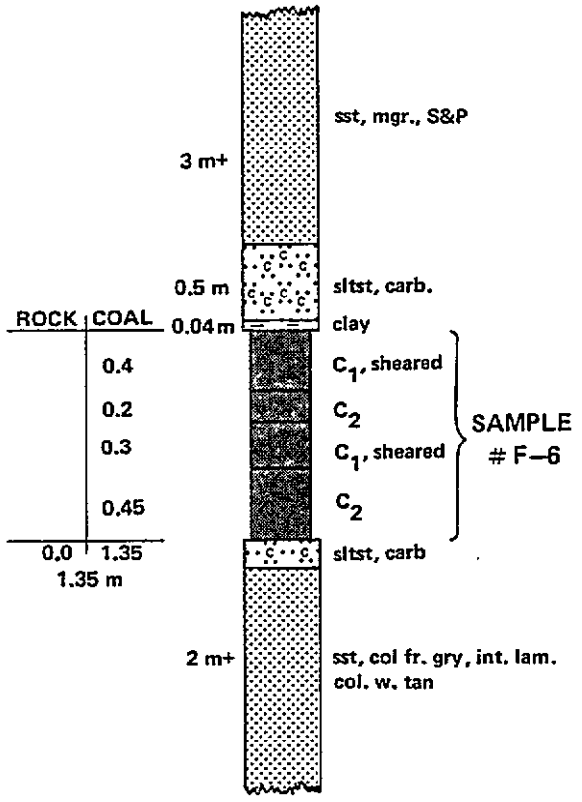
APPENDIX II

Seam Details

F-79 Tr 01

PINE VALLEY (Fisher Ck.)

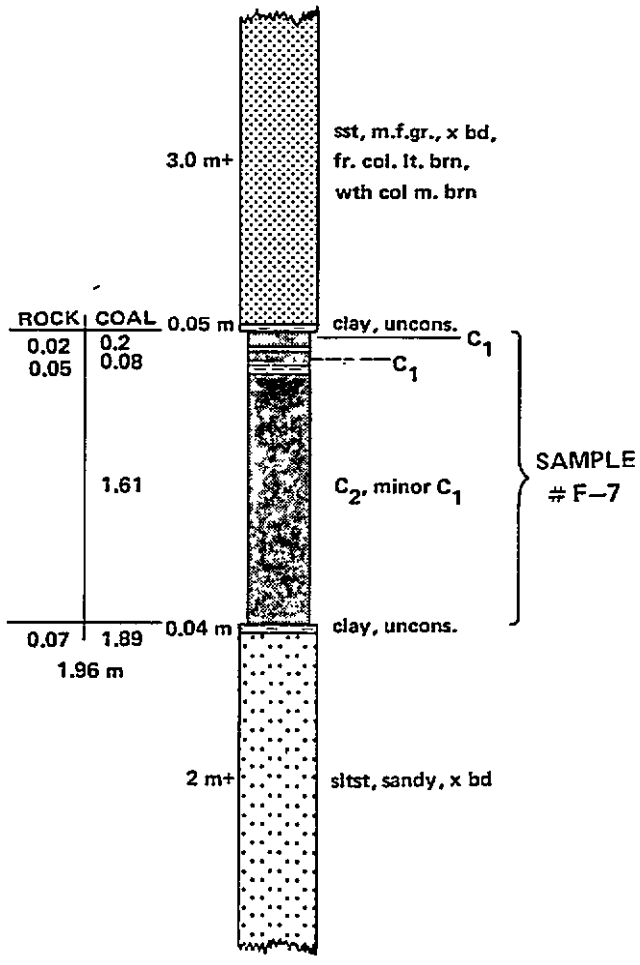
attitude of roof – 130°?/58°SW
attitude of floor – 138°/44° SW



F-79 Tr 02

PINE VALLEY (Fisher Ck.)

attitude of roof – 123°/60° NE
attitude of floor – 123°/59° NE



C_1 Coal predominantly Vitrain and Clarain mostly bright coals

C_2 Coal predominantly Durain and Fusain mostly dull coals

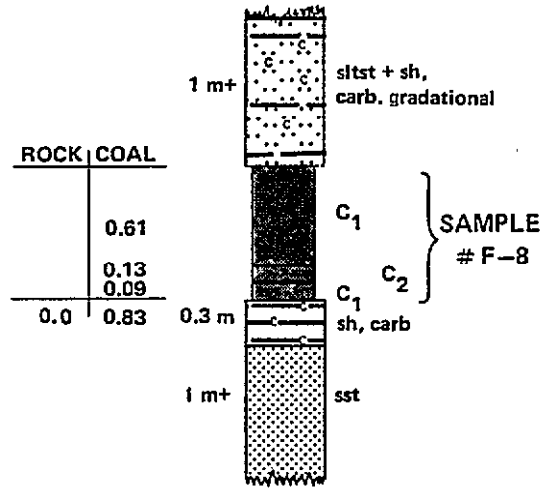
GULF CANADA RESOURCES INC. Coal Division		Gulf
CALGARY	ALBERTA	
FISHER CREEK PROJECT		
SEAM DETAILS		
DRAWN BY:	DATE:	SCALE 1 : 50
PREPARED BY: G.S.		DRAWING No. F.S. Dwg. 7905
APPROVED BY:	DATE:	

FILE No. 80133–7

F-79 Tr 03

PINE VALLEY (Fisher Ck.)

attitude of roof – 100°/30° SW
attitude of floor – 103°/29° SW



C_1 Coal predominantly Vitrain & Clarain mostly bright coals

C_2 Coal predominantly Durain & Fusain mostly dull coals

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

FISHER CREEK PROJECT
SEAM DETAILS

DRAWN BY:	DATE:	SCALE 1 : 50
PREPARED BY: G.S.		DRAWING No. F.S. Dwg. 7906
APPROVED BY:	DATE:	

FILE No. 80133–8

APPENDIX IV

Abbreviations

ABBREVIATIONS

FILE NO. 79266-2

Above	abv
Abundant	abnt
Amount	amt
Analysis	anal
Anthracite	anth
Approximate/ly	aprox
Argillaceous	arg
Arkose	ark
At	@
Bed	bd
Bedded	bdd
Bedding	bdg
Bedding plane	bd. pl.
Bentonite	bent
Between	betw
Bioturbated	bioturb
Bituminous	bit
Black	blk.
Blocky	blky
Blue	blu.
Boulder	bldr
Breccia	brec
Brown	brn
Buff	bf
Burrow	bur
Calcareous	calc
Calcite	calct
Cannel coal	can C
Carbonaceous	carb
Carbonaceous fragments	carb frag
Carbonaceous laminations	carb lam
Channel	chan
Chart	cht
Clarian	clar
Clayey	cly
Claystone	clyst
Clay-shale	cly-sh
Coal	C
Coaly	Cy
Coal bloom	C b
Coal seam	C sm
Coarse	c
Cobble	cbl
Colour	col
Concretions	conc
Conglomerate	cgl
Contact	ctc
Core	¢
Cross bed	x b
Cross bedded	x bd
Cross bedding	x bdg
Cross laminated	x lam
Dark	dk
Diameter	diam
Diamond Drill Hole	DDH
Disseminated	dism
Dolomite	dol
Durain	Dur
Fault	flt
Fine	f
Fissile	fis
Fixed Carbon	F.C.
Flaggy	flgy
Floor	flr
Fold	fld
Folding	fldg
Formation	Fm
Fossil	fos
Fracture	frac
Fractured	fracd
Friable	fri
Free Swelling Index	F.S.I.
Fusain	fus
Glauconite	glau
Grain/ed	gr
Granule	granl
Green	gn
Grey	gy
Group	Gr
Gradational	grad
Hard	hd
High Volatile Bituminous	hvb
Horizontal	hrtl
Indurated	ind
Interbed	intb
Interbedded	intbd
Interbeds	intbs
Interlaminated	intlam
Ironstone	Fe st
Iron staining	Fe stn

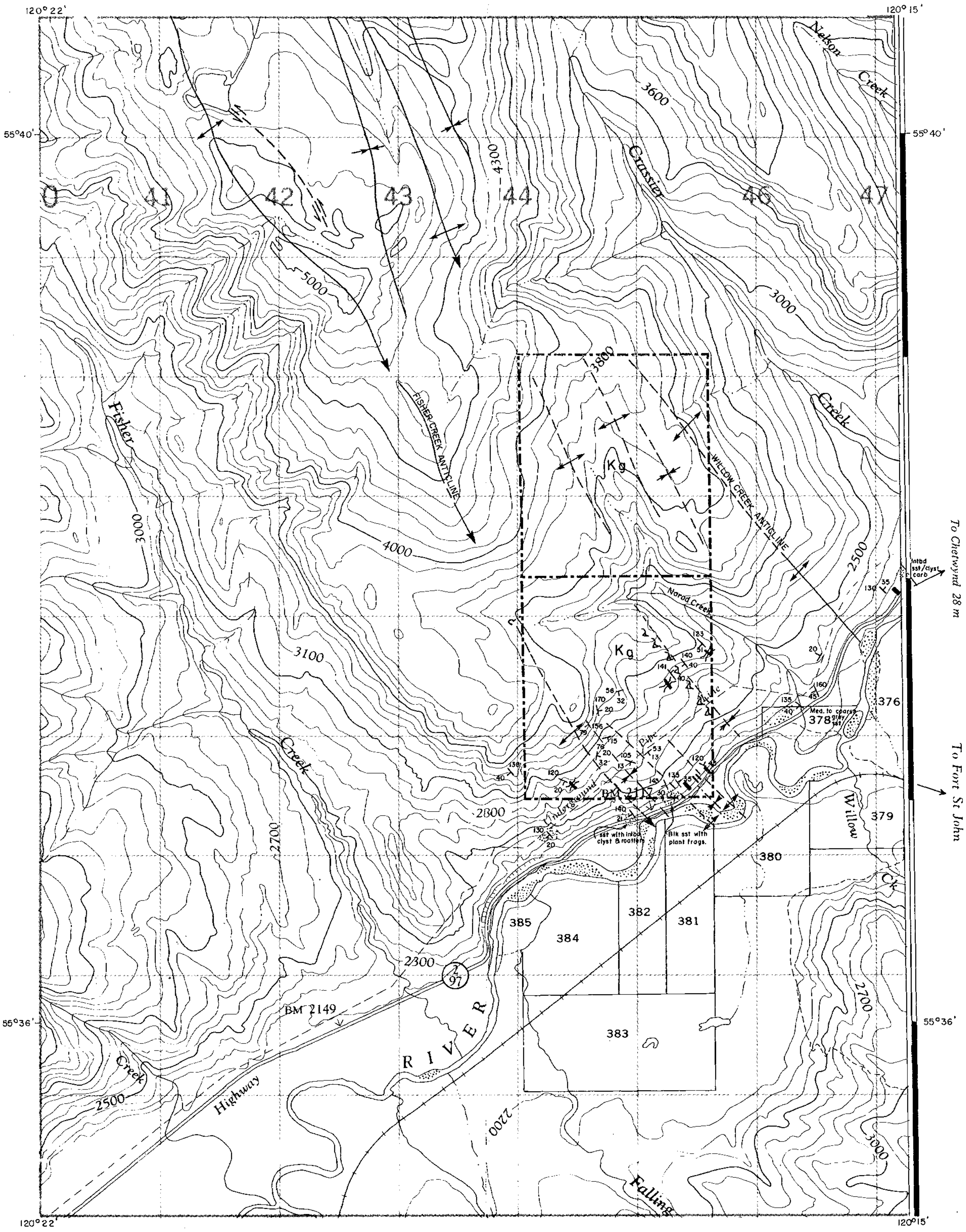
Joint	j
Kaolin	kao
Laminated	lam
Large	lge
Lens	ln
Lenses	lns
Light	lt
Lignite	lig
Limestone	ls
Limonite	lmn
Low Volatile Bituminous	l.v.b.
Lower	lwr
Maroon	mar
Massive	mas
Medium	m
Medium Volatile Bituminous	m.v.b.
Member	M
Miner	mnr
Mottled	mot
Mudstone	mudst
Mud-shale	mud-sh
No, none	n
Nodule	nod
Numerous	num
Occasional	occ
Oolite	ool
Orange	orng
Overburden	ovb
Oxidized	ox
Papery	pap
Parting	ptg
Pebble	pbl
Permiable	perm
Plant fossils	pl-fos
Plant Fragments	pl frag
Platy	plty
Poor	p
Porous	por
Predominantly	pred
Prominently	prom
Proximate Analysis	Prox Anal
Purple	purp
Pyrite	pyr
Quartz	qtz
Quartzitic	qtzc
Quartizite	qtzt
Recessive	rec
Resistant	rest
Ripple Marks	rip mk
Rootlet bed	rt b
Rotary Drill Hole	R.D.H.
Round	rd
Salt and Pepper	s&p
Sample	sa
Sandstone	ss
Sandy	ssy
Scattered	scat
Shale	sh
Shaly	shy
Shear	shr
Shear surface	shr surf
Sheared	shrd
Siliceous	sil
Siltstone	sltst
Silty	slty
Slabby	slby
Slickensided	sks
Small	sml
Soft	sft
Soft Sediment Deformation	S.S.D.
Stain	stn
Station	△
Stringers	strgs
Structure	struc
Sub-bituminous	sub-bit
Sugary	sug
Surface	surf
Texture	tex
Thick	thk
Thin	thn
Traverse	tra
Trench	tr.
Upper	up
Undisturbed	undist
Vertical	vrtl
Very	v
Vitrain	vit
Volatile Matter	V.M.
Wavy	wvy
Weak	wk
Weathered	wthrd
White	wh
Worm Burrow	wrm bur
Yellow	yel
Zone	zn

trenching of coal exposures for sampling purposes and thickness determinations. Because no large-scale base maps were available at the time, 1:50 000 topographical maps were enlarged to 1:25 000 for mapping purposes.

Dense tree cover restricted the greater portion of the mapping to the power line support road, gas pipeline right-of-way and along the John Hart Highway. The best exposures occur in road cuts along the John Hart Highway and power line support road, but outcrop over the remainder of the licences is sparse.

3.7 Personnel

B.P. Flynn	Party Leader
D. Smith	Geologist
G. Seve	Geologist
R. Rainbird	Assistant



SCALE

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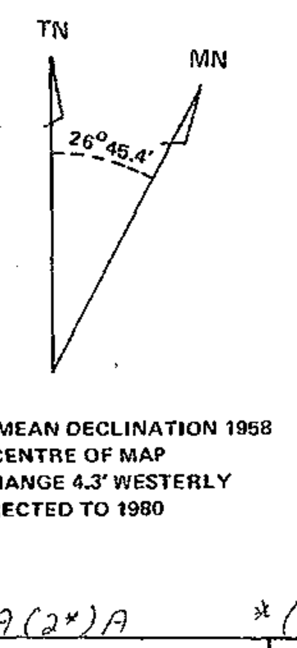
0 1000 2000 3000 METRES



APPROXIMATE MEAN DECLINATION 1958
FOR CENTRE OF MAP
ANNUAL CHANGE 4.3' WESTERLY
CORRECTED TO 1980

LITHOLOGICAL SYMBOLS

- ss.
- sltst
- clyy sltst
- slty clyst
- clyst
- cly-sh
- carb clyst
- cy clyst
- c

LEGEND

ROADS
- HARD SURFACE, ALL WEATHER
- CART TRACK, TRAIL OR CUTLINE

RAILWAYS
- NORMAL GAUGE, SINGLE TRACK
- COAL LICENCE BOUNDARY
- TRENCH AND COAL SEAM
- COAL SEAM

GEOLOGICAL LEGEND

AGE	GROUP		
LOWER CRETACEOUS	FORT ST. JOHN		
	BULL-HEAD	Kg	GETHING FORMATION
	MINNES		
JURASSIC			

GEOLOGICAL SYMBOLS

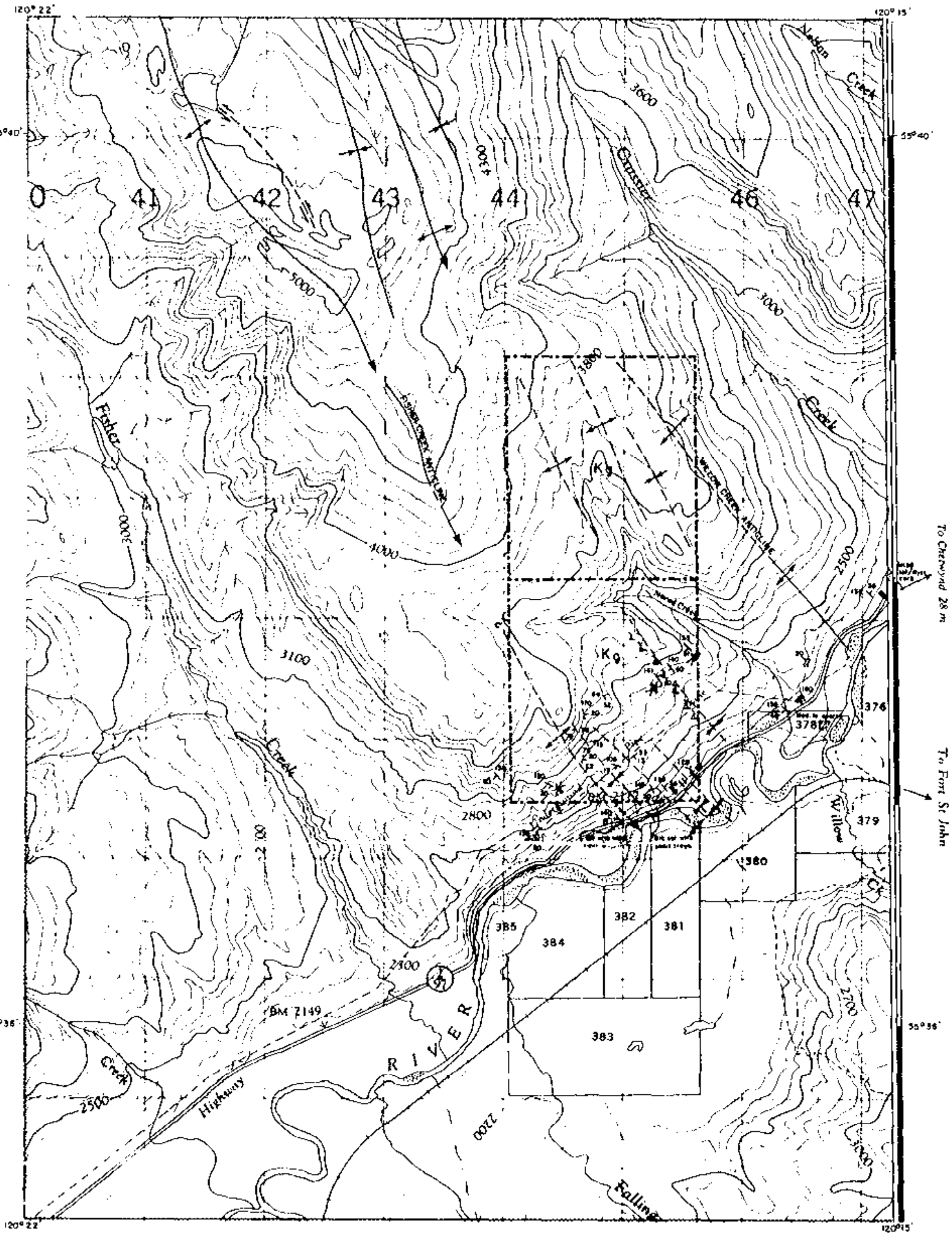
- 20 STRIKE AND DIP OF BEDS
- 30 APPROXIMATE STRIKE AND DIP
- THRUST FAULT INFERRED
- STRIKE SLIP FAULT SHOWING REL. DISP'NT
- ANTICLINE SHOWING TRACE OF AXIAL PLANE AND PLUNGE
- SYNCLINE " " " " " "
- APPROX. CREST OF ANTICLINE
- APPROX. TROUGH OF SYNCLINE

PR. FISHER CREEK 79(2*)A *(1)

GULF CANADA RESOURCES INC. Coal Division CALGARY ALBERTA	Gulf
FISHER CREEK PROJECT GEOLOGY	
DRAWN BY: DTW DATE: Jan. 16/80	SCALE 1: 25000
PREPARED BY: G.S.	DRAWING No. F.S.-DWG. 7903
APPROVED BY: DATE: Feb. 11/80	

FILE No. 80133-3

528



SCALE

0 ½ 1 2 MILES

0 1000 2000 3000 METRES

APPROXIMATE MEAN DECLINATION 1968
FOR CENTRE OF MAP
ANNUAL CHANGE 4.7' WESTERLY
CORRECTED TO 1980

LITHOLOGICAL SYMBOLS

LEGEND

ROADS
HARD SURFACE, ALL WEATHER
CART TRACK, TRAIL OR CUTLINE

RAILWAYS
NORMAL GAUGE SINGLE TRACK
COAL LICENCE BOUNDARY
TRENCH AND COAL SEAM
COAL SEAM

GEOLOGICAL LEGEND

AGE	GROUP	
LOWER CRETACEOUS	FORT ST. JOHN	
	BULL HEAD	Kg GETHING FORMATION
	MINNES	
JURASSIC		

GEOLOGICAL SYMBOLS

STRIKE AND DIP OF BEDS
APPROXIMATE STRIKE AND DIP
THRUST FAULT INFERRED
STRIKE SLIP FAULT SHOWING REL. DISP'NT
ANTICLINE SHOWING TRACE OF AXIAL PLANE AND PLUNGE
SYNCLINE
APPROX. CREST OF ANTICLINE
APPROX. TROUGH OF SYNCLINE

PC

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

FISHER CREEK PROJECT
GEOLOGY

DRAWN BY DTW
PREPARED BY G.S.
APPROVED BY
DATE Jan 16/80
DATE Feb. 11/80
SCALE 1: 50 000
DRAWING No. F.S.-DWG 7902
FILE No. 60135-3

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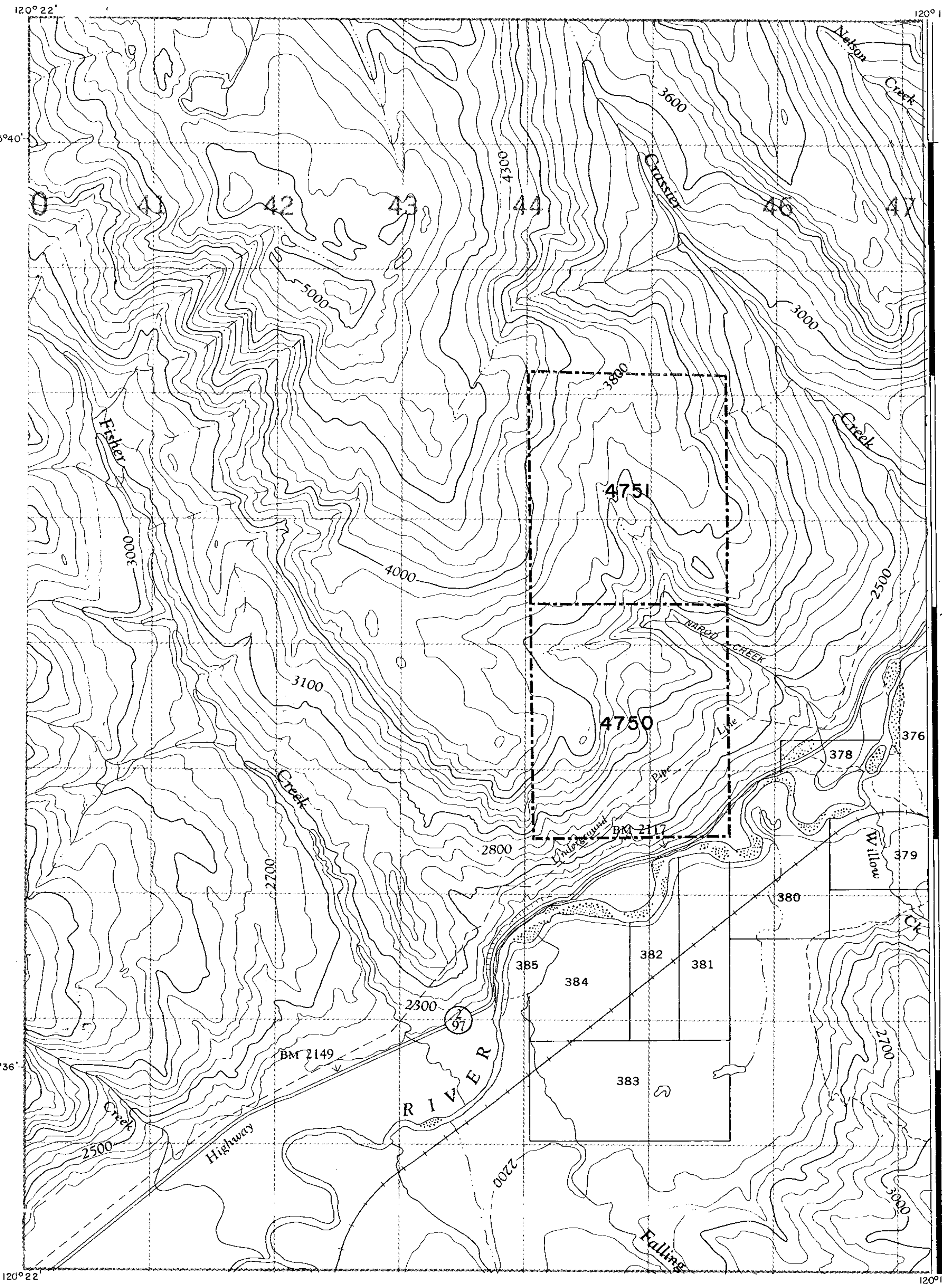
PR-FISHER CREEK
79 (2*) A
*(1)



SCALE

0 ½ 1 2 MILES

0 1000 2000 3000 METRES

LEGEND

ROADS

HARD SURFACE, ALL WEATHER

CART TRACK, TRAIL OR CUTLINE

RAILWAYS

NORMAL GAUGE, SINGLE TRACK

COAL LICENCE BOUNDARY

TN

MN

26°45.4'

APPROXIMATE MEAN DECLINATION 1958
FOR CENTRE OF MAP
ANNUAL CHANGE 4.3' WESTERLY
CORRECTED TO 1980

PR- FISHER CREEK 79 (2*) A *(1)

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

FISHER CREEK PROJECT
COAL LICENCE MAP

DRAWN BY: D.T.W	DATE:	SCALE 1:26000
PREPARED BY: G.S		DRAWING No.
APPROVED BY:	DATE: Mar 3/80	F.S.-DWG 7901

FILE No. 80133-1-4

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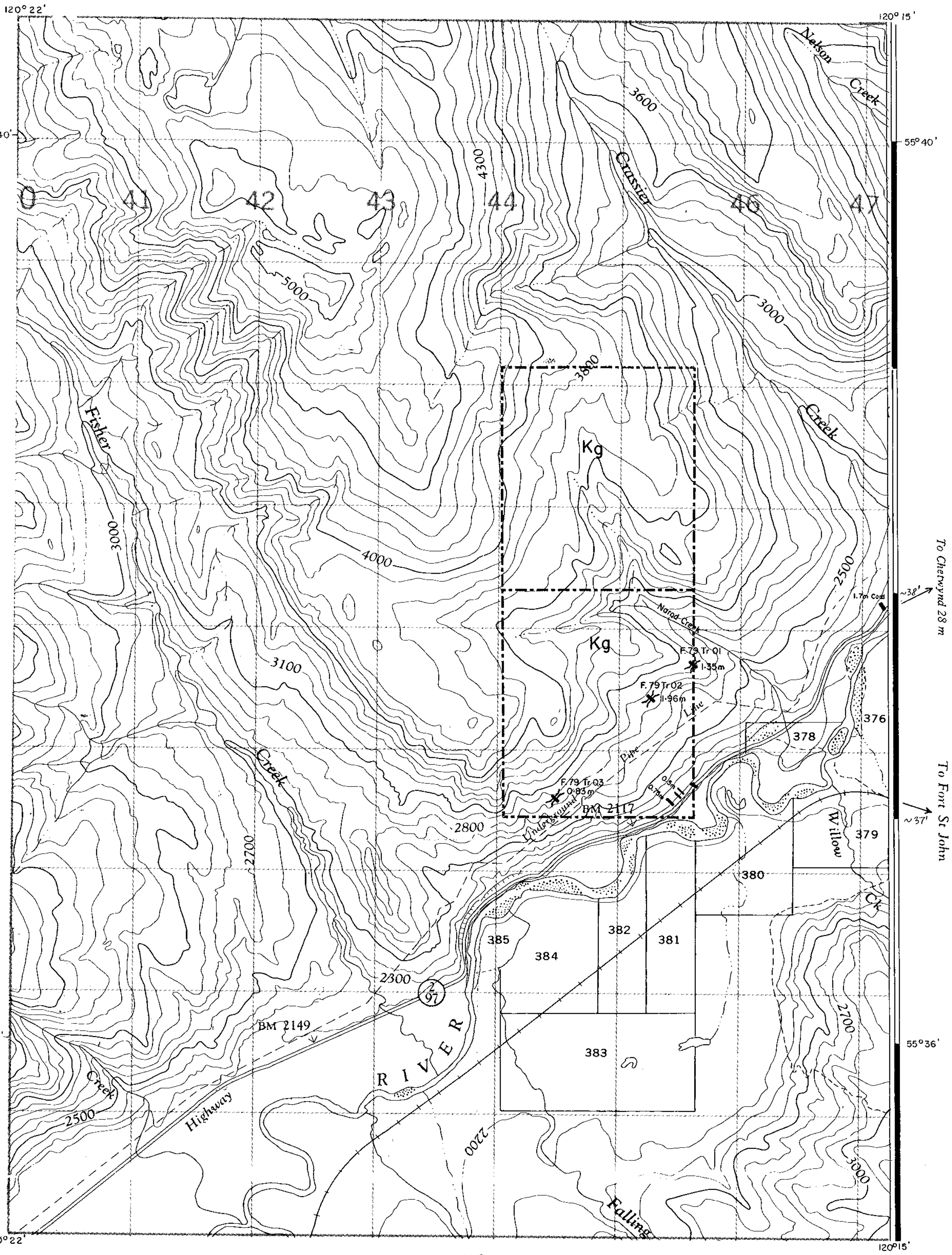

SCALE

0 ½ 1 2 MILES

0 1000 2000 3000 METRES

LEGEND

ROADS
- HARD SURFACE, ALL WEATHER
- CART TRACK, TRAIL OR CUTLINE

RAILWAYS
- NORMAL GAUGE, SINGLE TRACK
- COAL LICENCE BOUNDARY
- TRENCH AND COAL SEAM
- COAL SEAM

GEOLOGICAL LEGEND

AGE	GROUP		
LOWER CRETACEOUS	FORT ST. JOHN		
	BULLHEAD	Kg	GETHING FORMATION
	MINNES		
JURASSIC			

APPROXIMATE MEAN DECLINATION 1958
FOR CENTRE OF MAP
ANNUAL CHANGE 4.3' WESTERLY
CORRECTED TO 1980

PR-FISHER CREEK 79(2*)A *(1)

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

FISHER CREEK PROJECT
COAL OCCURENCES

DRAWN BY: O. T. W.	DATE: JAN. 16/80	SCALE 1: 25000
PREPARED BY: G.S.		DRAWING No.
APPROVED BY:	DATE: FEB. 11/80	F.S.-DWG 7904

FILE No. 80133-4

528

CONFIDENTIAL

APPENDIX III

Coal Quality Data

Warnock Hersey Professional Services Ltd.

CLIENT: GULF CANADA RESOURCES

SAMPLE I.D. FISHER CREEK F 6

LAB. NO.: 79 - 8142

	RAW COAL	1.50 FLOAT	1.50 SINK
AS ANALYZED BASIS			
MOIST. %	8.3	6.8	7,3
ASH %	11.3	7.5	12.3
VOLATILE MATTER %	24.3	26.8	
FIXED CARBON	56.1	58.9	
TOTAL	100.0	100.0	
SULPHUR %	0.68	0.66	
F.S.I.	0	0	
DRY BASIS			
ASH %	12.3	8.9	13.3
VOLATILE MATTER %	26.5	28.8	

SINK - FLOAT ANALYSIS

SINK	FLOAT	WEIGHT %
	1.50	8.5
1.50		91.5
TOTAL		100.0

Warnock Hersey Professional Services Ltd.

CLIENT: GULF CANADA RESOURCES

SAMPLE I.D. FISHER CREEK F 7 - 2

LAB. NO.: 79 - 8144

	RAW COAL	1.50 FLOAT	1.50 SINK
AS ANALYZED BASIS			
MOIST. %	5.5	3.2	8.1
ASH %	24.7	5.6	24.5
VOLATILE MATTER %	21.8	29.1	
FIXED CARBON	48.0	62.1	
TOTAL	100.0	100.0	
SULPHUR %	0.73	0.53	
F.S.I.	0	0	
DRY BASIS			
ASH %	26.2	5.7	26.7
VOLATILE MATTER %	23.0	30.0	

SINK - FLOAT ANALYSIS

SINK	FLOAT	WEIGHT %
	1.50	4.2
1.50		95.8
TOTAL		100.0

Warnock Hersey Professional Services Ltd.

CLIENT: GULF CANADA RESOURCES

SAMPLE I.D. FISHER CREEK F 8 - 2

LAB. NO.: 79 - 8146

	RAW COAL	1.50 FLOAT	1.50 SINK
AS ANALYZED BASIS			
MOIST. %	2.8	3.5	5.7
ASH %	11.2	5.2	17.1
VOLATILE MATTER %	25.7	24.5	
FIXED CARBON	60.3	66.8	
TOTAL	100.0	100.0	
SULPHUR %	0.78	0.64	
F.S.I.	0	0	
DRY BASIS			
ASH %	11.5	5.4	18.1
VOLATILE MATTER %	26.4	25.4	

SINK - FLOAT ANALYSIS

SINK	FLOAT	WEIGHT %
	1.50	47.8
1.50		52.2
TOTAL		100.0