PROPOSED PITS 1, 2, 3, 4, 5 & 6

ex-QUINSAM 78 (6)A (SEC 3)

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BOOK I

GEOLOGY OF PROPOSED PITS 1, 2 & 3 SOUTH

S. Gardner
R. Ronaghan
J. Nyberg

September 1978

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GEOLOGY OF PITS 1, 2 and 3

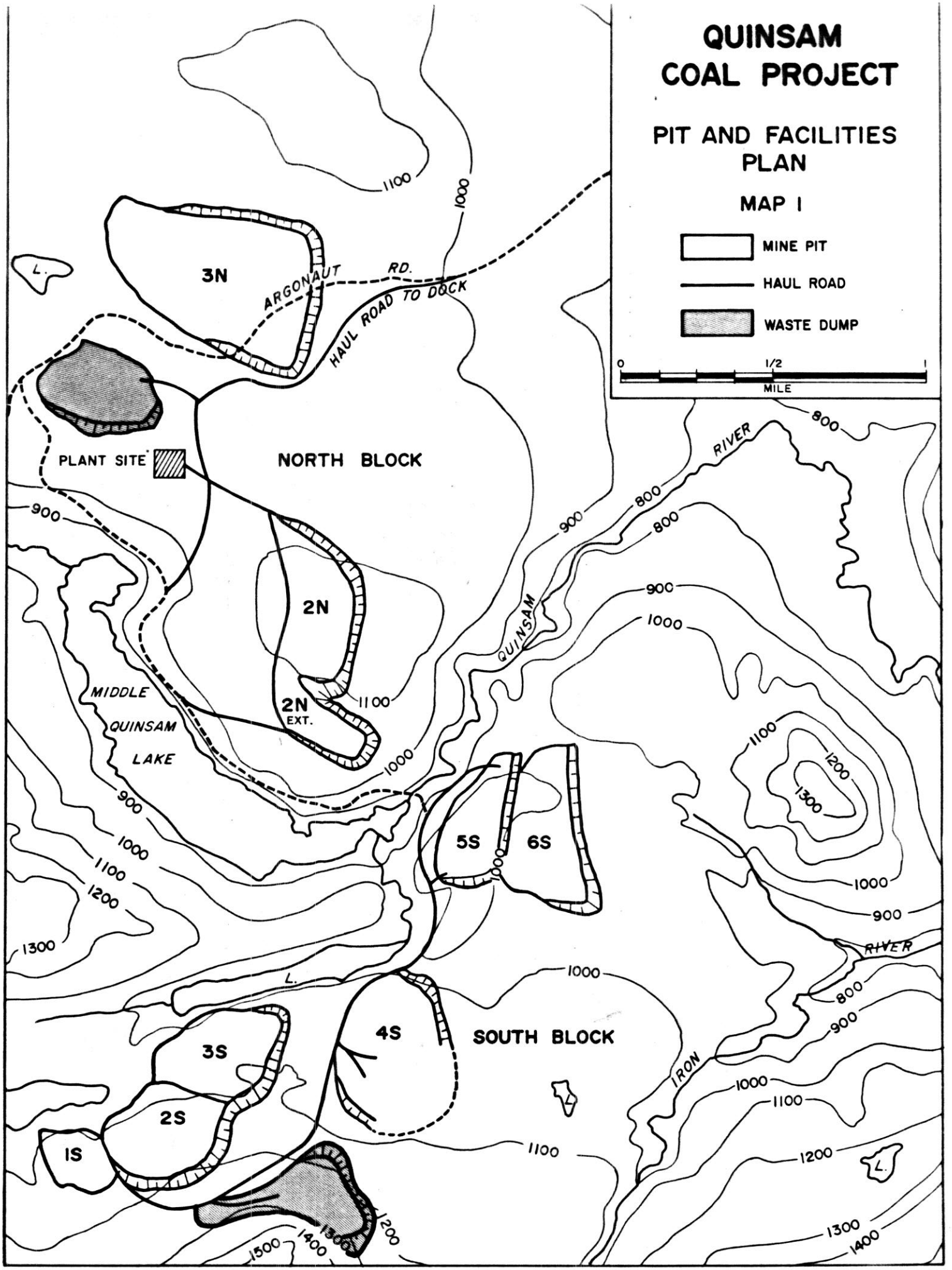
INTRODUCTION

Area Worked

The area encompassing Pits 1, 2 and 3 is located to the south west of Pit 4 in the vicinity of Long Lake (Map 1). It is separated from Pit 4 by a large basement high feature that is approximately 1000 feet wide. The proposed mining area is approximately 4000 ft. long by 1200 ft. wide, or 110 acres.

Pit 1, which is the maximum southwestern limit of the coal measures, contains the No. 1 seam. Pits 2 and 3 contain both the No. 1 and No. 2 seams.

Pit 1 is separated from Pit 2 by a secondary fault that has displacements of 10 to 20 feet. Pit 2 is separated from Pit 3 by a fault zone made up of at least 2 faults, each with displacements of 10 to 25 feet.


QUINSAM
COAL PROJECT
PIT AND FACILITIES
PLAN
MAP I
MINE PIT
HAUL ROAD
WASTE DUMP
0
1/2
1
MILE
3N
ARGONAUT RD.
HAUL ROAD TO DOCK
L.
PLANT SITE
NORTH BLOCK
2N
2N EXT.
MIDDLE QUINSAM LAKE
QUINSAM RIVER
5S
6S
4S
SOUTH BLOCK
3S
2S
1S
IRON
1100
1000
900
800
1200
1300
1400
1500

Summary & Conclusions

Technical investigations in the areas of proposed pits 1, 2 and 3 have reasonably determined the mineable limits of coal reserves. Coal quality information from this drill program is not yet available from the Lexco Lab and will be supplied in a later report.

Two seams are deemed as mineable in this area, the No. 1 seam and the No. 2 seam. Bulk samples of these seams were taken in 1977 and analysed by Cyclone Engineering Sales Ltd. Results are as follows:

	R.M. %	ASH %	V.M.%	F.C. %	SULPHUR %	BTU/lb.
No. 1 Seam (Pit 1)	3.07	16.54	34.37	46.02	1.14	11,500
No. 2 Seam (Pit 2)	3.09	12.38	34.88	49.65	2.41	12,200

Reserves for Pits 1, 2, and 3 are calculated to total 3,231,200 tons at an average combined ratio of 5.71 c.y. of overburden per ton of coal.

Topography and Drainage

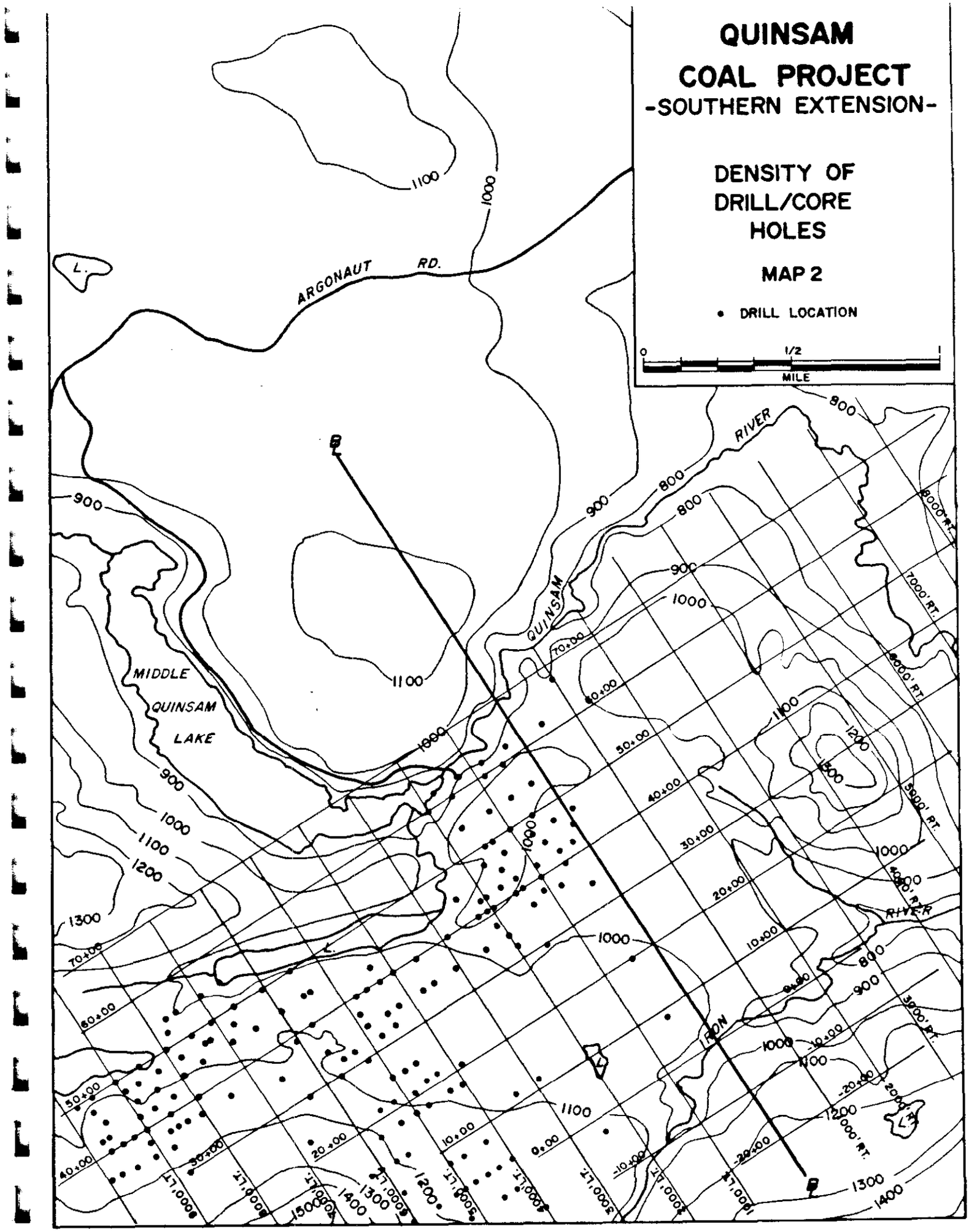
The area is well drained and relatively high (average elevation is 1150 ft. a.s.l. over the mineable area). Intermittent drainages occur into the two small lakes, which in turn flow into Middle Quinsam Lake. A high bounding ridge to the southeast effectively cuts off sedimentary deposition.

Technical Investigations

Drilling and coring operations in the Pit 1, 2 and 3 area were undertaken during the month of July. Two ten day work periods were required to complete the evaluation.

Lexco Testing Ltd. Rigs 06 and 07 completed the work; support equipment and services included a D-6 Caterpillar, a contract line-cutting crew, a geophysical logging unit owned by Lexco Testing Ltd. and two staff geologists.

Because a reasonable amount of drilling and coring was conducted in this area during 1977 (see Progress Report of Coal Exploration on the Quinsam Property, Vancouver Island), only a limited number of drillholes and coreholes were required to complete structural interpretations in the area (Map 2).


QUINSAM
COAL PROJECT
-SOUTHERN EXTENSION-
DENSITY OF
DRILL/CORE
HOLES
MAP 2
• DRILL LOCATION
0
1/2
1
MILE
ARGONAUT RD.
MIDDLE
QUINSAM
LAKE
QUINSAM
RIVER
IRON
RIVER
8000' RT.
7000' RT.
6000' RT.
5000' RT.
4000' RT.
3000' RT.
2000' RT.
1000' RT.
70+00
60+00
50+00
40+00
30+00
20+00
10+00
0+00
-10+00
-20+00
L.
B
B'

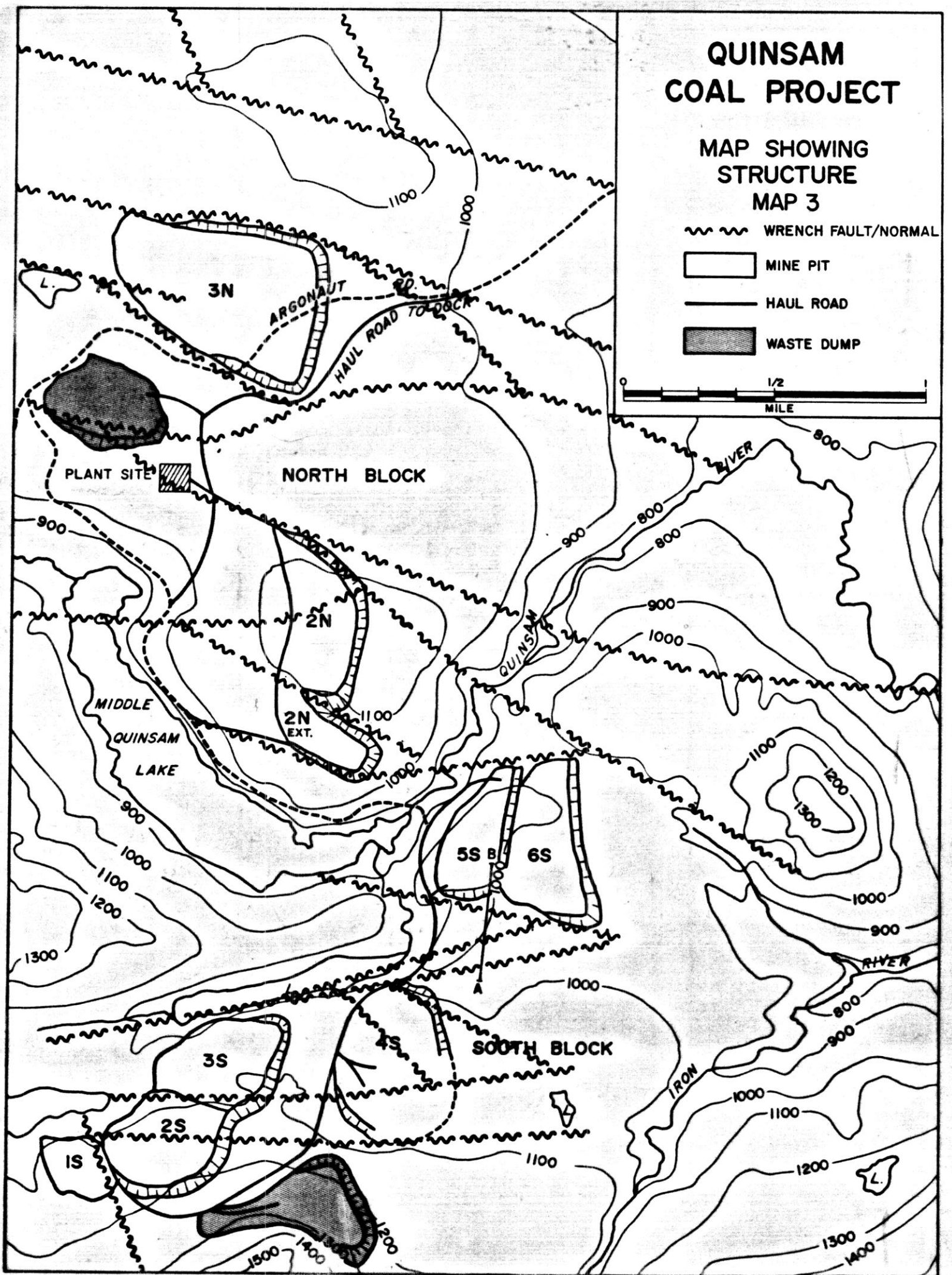
SURFICIAL GEOLOGY

Glacial overburden thicknesses over the majority of the mining area in Pits 1, 2 and 3 average between 5 and 10 feet. There are two main areas of glacial deposition, in the region of the small lake to the west of the pits and in the area between the high bounding ridge on the south and the mining area. In these two areas the subcrop edges of the No. 1 seam are actually the result of deep glacial erosion and subsequent deposition. In the area at the north-eastern end of the lake, till thicknesses reach 50 to 60 feet. This is also the case at the south end of the pits.

Glacio-fluvial action in these areas of deep till has resulted in sand layers and fine gravelly layers throughout the till section, especially at the south end of the pits, where the total till section consists of medium to coarse sand and gravel.

THE GROUNDWATER REGIME

Although the deep glacial overburden sections are sandy, they contain minimal amounts of groundwater. Most of the groundwater is found in the sedimentary sections, and it appears to be related to joints and fracture zones, as is the case over the majority of the mining area. It does not, however, appear in such quantities as was found in the Pits 4, 5 and 6 areas. No flowing holes were encountered in the Pits 1, 2 and 3 area, although some of the holes produced as much as 10 i.g.p.m.


QUINSAM
COAL PROJECT
MAP SHOWING
STRUCTURE
MAP 3
WRENCH FAULT/NORMAL
MINE PIT
HAUL ROAD
WASTE DUMP
0
1/2
1
MILE
3N
ARGONAUT RD.
HAUL ROAD TO COAL
PLANT SITE
NORTH BLOCK
2N
2N EXT.
MIDDLE QUINSAM LAKE
QUINSAM RIVER
5S
6S
4S
SOUTH BLOCK
3S
2S
1S
IRON RIVER
L.
1100
1000
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1200
1300
1400
1500

STRUCTURAL GEOLOGY

The main structural features of the area of Pits 1, 2 and 3 south are the basement high that detaches this area from Pits 4, 5 and 6, and the large fault zone that extends through the small lake to the southwest of Long Lake. This fault zone essentially parallels the Long Lake fault zone. Displacements, however, are not as large and the sediments do not appear to be as disturbed. Vertical throws in the area of the fault zone range from 10 to 25 feet. In the middle of the zone, dips range from 7 degrees to 2 degrees, as the sediments steepen, then flatten down dip. This could be due to minor rolls within the sheared zone, or additional secondary breaks. In the Pit 3 area on the north side of the fault zone, dips average 3.5 degrees on the south-west side of the pit, and flatten out even more on the down-dip side. Behind the 200 foot highwall limit, the dip actually reverses as the sediments lap on to the basement high that separates Pits 3 and 4.

Pits 1 and 2 are separated by a minor secondary fault with displacements of 10 to 20 feet. Pit 1 is the downthrown side - it has dips of about 6 degrees. Pit 2 is the hanging wall side with dips of about 7 degrees (Map 3).

COAL GEOLOGY AND STRATIGRAPHY

Throughout the area of Pits 1 and 2, the normal lower sequence is found. Pit 1, which is the maximum south-western limit of the coal measures, contains a No. 1 seam that averages 12 feet thick, including a 1 to 4 foot coal zone at the base that is somewhat higher in ash than the main part of the seam. The No. 1 rider is either directly incorporated into the seam or missing. In Pit 1, the No. 1 seam occurs from its subcrop and outcrop limits to a maximum depth of 50 to 60 feet below ground surface. The No. 2 seam is not present in this area, due to erosion or non-deposition.

Over the area of Pit 2, both the No. 1 and No. 2 seams are found. The No. 2 seam occurs at an average of 60 feet above the top of the No. 1 seam. It averages 4 feet thick, and is capped by an upper cycle massive arkosic sandstone.

Through the fault zone and into the southwestern part of Pit 3, the seam characteristics remain the same. On the downdip side of Pit 3, however, the seams begin to pinch closer together and the No. 1 seam begins to thin out as proximity to the basement high affects deposition. A gentle synclinal effect is generated as the characteristic north-west dipping sediments flatten out, then rise to the north-west (reversing the dip) as the sediments lap on to the high. Section 45+00 illustrates this very well (See figure 1). It should be noted that in Hole QU-77-8, which is located near the crest of the high, the No. 1 and No. 2 seams have merged to form one seam.

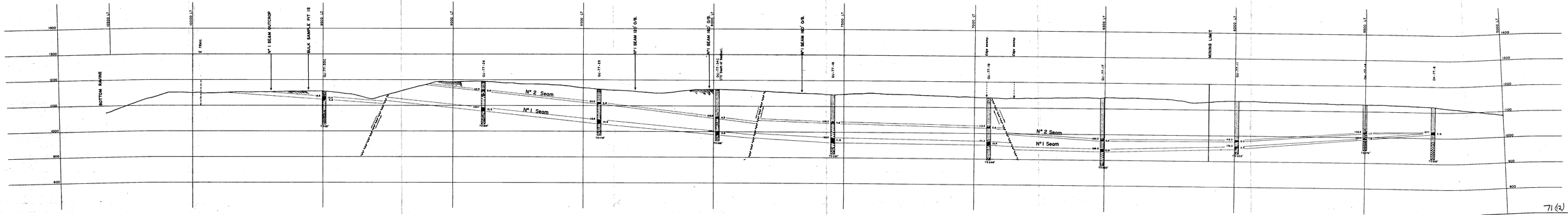
CALCULATION OF RESERVES

Reserves have been calculated with the use of a planimeter, and are categorized into the three standard overburden groups. A standard cut-off of 20:1 overburden to coal ratio has been applied. A density factor of 1.2 ton/cu.yd. of coal is employed.

TABLE I

QUINSAM PIT 4 GEOLOGICAL RESERVES

OVERBURDEN LIMITS	AREA ($x10^6$ sq.ft.)	AVE. COAL THICKNESS (ft.)	COAL TONNAGE ($x10^6$)	OVERBURDEN VOLUME ($x10^6$ cu.yd.)	RATIO
0 - 120					
main seam	4.89	6.4	1.244	10.86	7.4
lower seam	2.43	2.0	0.223		
120 - 160					
main seam	1.06	7.3	0.332	5.73	13.98
lower seam	0.89	2.0	0.078		
160 - 200					
main seam	1.13	7.9	0.361	7.56	16.26
lower seam	1.05	2.1	0.104		
TOTAL	7.08		2.342	24.15	10.31



REPORT: "GEOLOGY OF ROSES N°5 TO ROSES SOUTH"
BY: I. SAPONIS
R. RONAGHAN
J. WEBER
DATE: Saskatoon Sept. 11, 1978.
DRAWN BY: K. VAUCHER

LUSCAR LTD.
QUINSAM
LINE NO. 45+00
Fig. #

SCALE: HORIZONTAL 1"=100' VERTICAL 1"=100'
0 100 1000 miles

71 (12) (N-2)

This major basement high has formed another sub-basin, comparable to the sub-basin that was formed in the Pit 4 area. Pits 1, 2 and 3 all fall within this new sub-basin. While the basement high has in fact created a barrier in continuity of the mining sequence, it has caused higher than normal plant accumulations in the Pit 1, 2 and 3 area, resulting in abnormally thick coal intersections. Hole QU-77-28 (Line 51+95, 7441 ft. left), for instance, intersected almost 18 feet of coal through the No. 1 seam.

CALCULATION OF RESERVES

A conversion factor of 1.2 tons/cu.yd. of coal is employed for reserve calculations in Pits 1, 2 and 3. Reserves are calculated with the aid of a planimeter and are categorized into the three standard overburden groups; 0-120 feet, 120-160 feet and 160-200 feet. In areas where raw coal thickness is decreasing due to depositional or other factors, as in the southern part of Pit 2 and the northeastern part of Pit 3, a standard cut-off of 20:1 combined overburden to coal ratio is used. The following table lists volumes of coal and overburden as calculated for each category in each pit.

TABLE 1

QUINSAM PITS 1, 2 & 3 GEOLOGICAL RESERVES

OVERBURDEN LIMITS	COAL THICKNESS (ft)	COAL TONNAGE ($K10^6$)	OVERBURDEN VOLUME ($C.Y.x10^6$)	RATIO
PIT 1				
No. 1 Seam				
0-120	12.83	.369905	1.441707	3.90
PIT 2 & 3				
No. 1 Seam				
0-120	12.83	1.203806	4.691844	3.90
120-160	12.68	.599031	5.512132	9.20
160-200	10.84	.492171	6.811167	13.67
	Sub Total -	2.295008	17.015143	
No. 2 Seam				
0-120	3.53	.227814		7.41
120-160	3.10	.146420		
160-200	4.23	.192055		
	Sub Total -	2.861297	17.015143	5.94
TOTAL.....		3.231202	18.45685	5.71

Coal Quality

Quality analyses are not yet completed for the core samples from the drill program. A separate report dealing with quality from Pits 1, 2, 3, 4, 5, and 6 will follow.

Bulk samples from Pits 1 and 2, taken in 1977 indicate the quality of the No. 1 and No. seams to be as follows:

	R.M.%	ASH %	V.M.%	F.C.%	SULPHUR %	BTU/lb.
No. 1 Seam (Pit 1)	3.07	16.54	34.37	46.02	1.14	11,500
No. 2 Seam (Pit 2)	3.09	12.38	34.88	49.65	2.41	12,200

Further information is available in Cyclone Engineering Sales Ltd. Report No. R1-78-04.

BOOK II

GEOLOGY OF PROPOSED PITS 4, 5 & 6 SOUTH

S. Gardner
R. Ronaghan
J. Nyberg

September 1978

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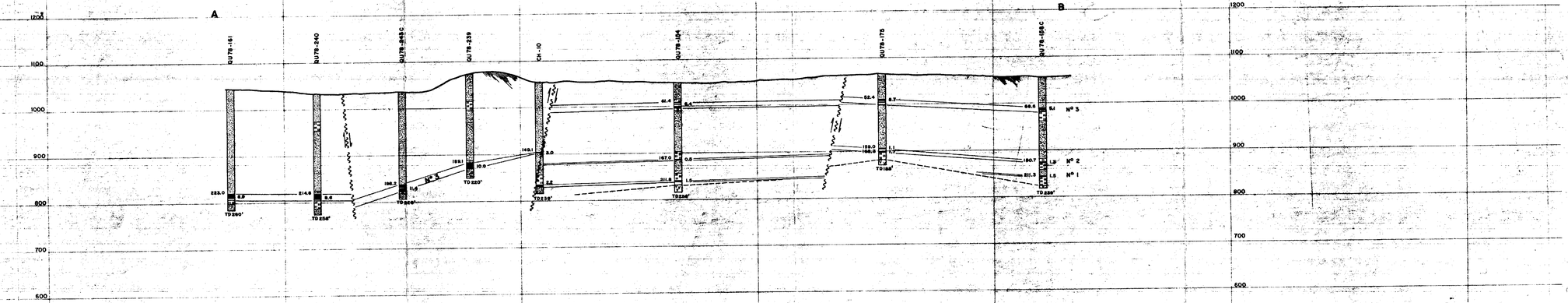

71(12) M2

REPORT: "GEOLOGY OF PROPOSED PITS 4,5 & 6 SOUTH"
BY: S. GARDNER
R. MONAGHAN
J. NYBERG

DATE: September 11, 1978.
DRAWN BY R. VALENCIA

LUSCAR LTD.

QUINSAM

LINE NO. TRAVERSE SECTION A-B

Fig #1

SCALE
HORIZONTAL 1"=100'
VERTICAL 1"=100'

0 100 200 miles

LIST OF MAPS, FIGURES & TABLES

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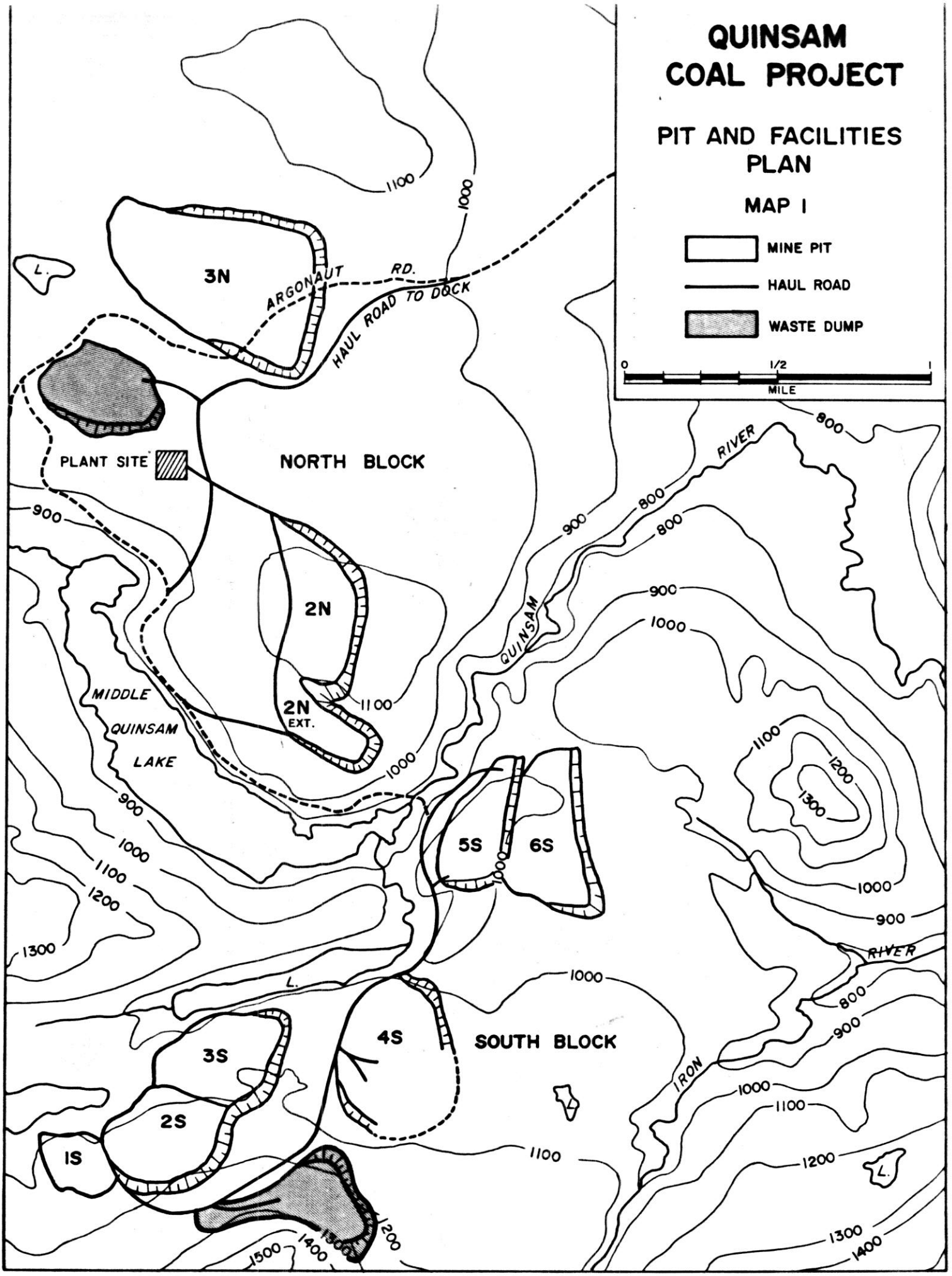
INTRODUCTION

Area Worked

The area designated as proposed Pits 4, 5 and 6 South is located south of the Quinsam River where it drains out of Middle Quinsam Lake (see Map 1). This area is subdivided topographically and geologically by the major fault zone that runs parallel to Long Lake, called the Long Lake fault zone. Pits 5 and 6 on the north side of the fault zone form a continuous block, while Pit 4 which is on the south side of the fault zone must be treated separately.

Pits 5 and 6 fall between Line 37+50 and Line 65+00, from the baseline to 2000 feet left. This constitutes an area of approximately 180 acres. Because the No. 1, No. 2 and No. 3 seams all occur in this area, the pits have a common depositional boundary. Pit 5 encompasses the strippable limits of the No. 1 seam from its subcrop edge to the 200 foot depth. Pit 6 is designed for the removal of the No. 3 seam which occurs some one hundred and ninety feet above the No. 1 seam: thus the subcrop edge of the No. 3 seam sometimes overlaps the downdip mineable limit of the No. 1 seam forming a common boundary between the pits.

Pit 4 is located approximately 3000 feet farther to the south and west of Pits 5 and 6, across the linear topographic low that marks the Long Lake fault zone. The proposed pit area runs southeast from Line 40+00 and drilling is still continuing in Pit 4, to delineate a southern boundary for the No. 3 seam mineable limits.


QUINSAM
COAL PROJECT
PIT AND FACILITIES
PLAN
MAP I
MINE PIT
HAUL ROAD
WASTE DUMP
0
1/2
1
MILE
3N
ARGONAUT RD.
HAUL ROAD TO DOCK
L.
PLANT SITE
NORTH BLOCK
2N
2N EXT.
MIDDLE QUINSAM LAKE
QUINSAM RIVER
5S
6S
4S
SOUTH BLOCK
3S
2S
1S
IRON RIVER
1100
1000
900
800
1200
1300
1400
1500

Summary & Conclusions

Technical investigations in the proposed Pits 5 and 6 areas have been completed outlining the mineable reserves. Drilling in the region of Pit 4 indicates a southern extension of mineable reserves and exploration is continuing in this direction to determine the limits.

Pit 5, designed to mine the No. 1 seam and the No. 1 seam rider, has in place reserves of 518,800 tons at an average ratio of 13.67:1. Quality information from this drill program is not completed, however previous analytical data indicates the following average values for the No. 1 seam.

R.M.%	ASH %	V.M.%	F.C.%	SULFUR %	FSI	BTU/lb.
2.90	17.56	34.81	44.76	1.45	2	11,475

In Pit 6 the No. 3 seam in place reserves are 1,142,600 tons at an average ratio of 13.30:1. Past quality information shows the No. 3 seam quality to be:

R.M.%	ASH %	V.M.%	F.C.%	SULFUR %	FSI	BTU/lb.
2.14	20.70	36.08	41.06	3.36	2	11,078

Topography and Drainage

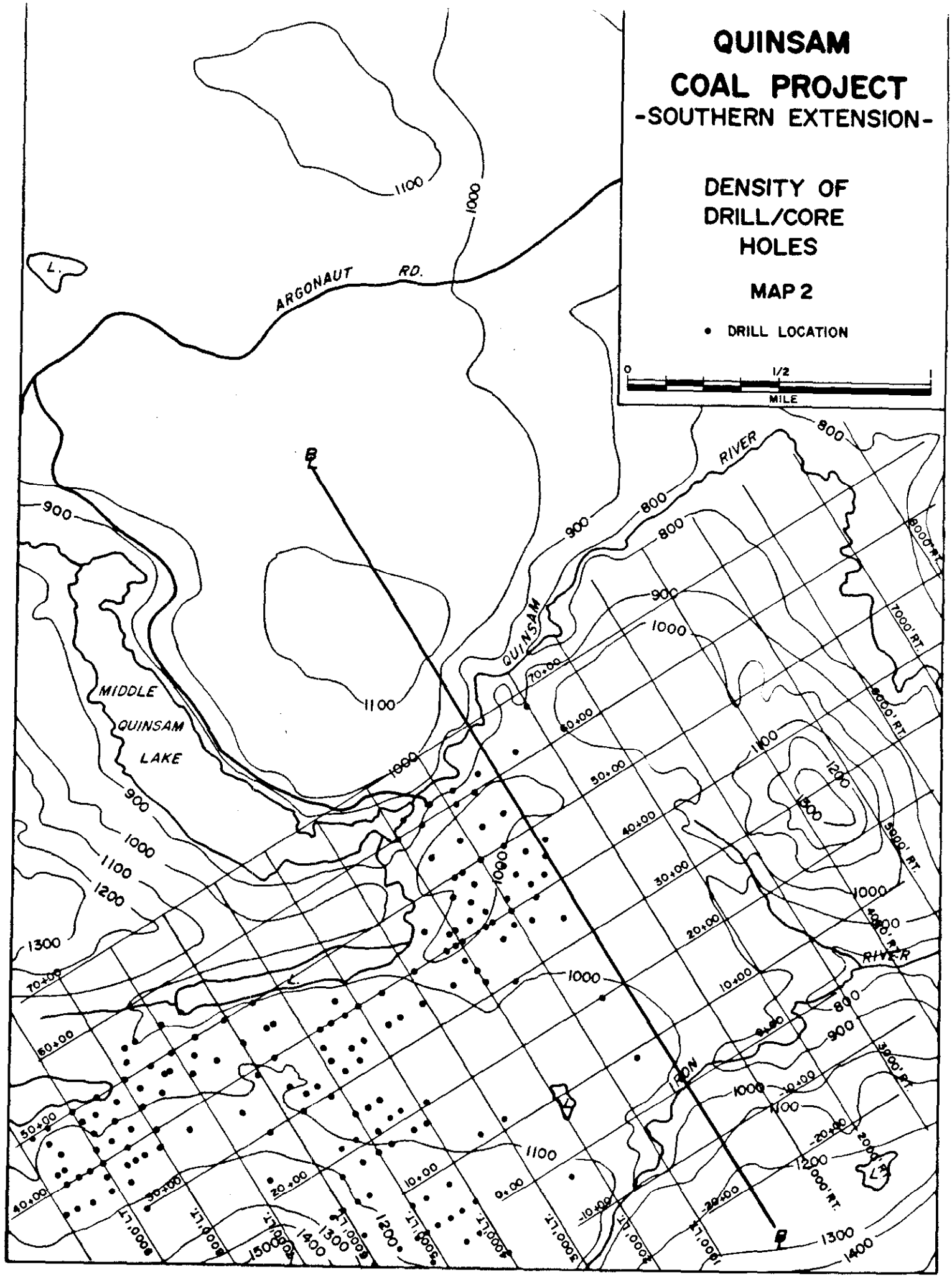
Two tertiary drainages occur in the area in the form of intermittent creeks that both run into Long Lake, which is joined to Middle Quinsam Lake by a small secondary drainage. One is through the linear depression called the Long Lake fault zone which separates Pits 5 and 6 from Pit 4. The other is on the downdip side of Pit 4 in a swampy area that has been dammed up by beavers. Drainage over the proposed mining areas is rapid due to the dip slope nature of the topography and the height of the mining areas relative to the surrounding terrain.

Topographically the area of proposed Pits 5 and 6 can be compared to the Pit 2 North area, its counterpart on the northwest bank of the Quinsam River: a high, relatively flat-topped hill overlooking the lake, with a gentle but persistent slope to the northeast. The southwestern edge of the mining area marks the erosional edge of the sediments which invariably forms scarp-like steeply dipping sides.

The area of Pit 4, at an average 1150 feet a.s.l., is generally 100 feet higher in elevation than the Pit 5 and 6 area. While the topography falls off to the northeast, it is much more irregular and broken then the Pit 5 and 6 area indicating a greater number of minor fault features and geologic disturbance of the upper cycle sandstones.

Technical Investigations

Drilling and coring operations in the Pits 4, 5 and 6 areas were undertaken during the months of July and August. Drilling in Pit 4 is continuing into September. The work was interrupted by a ten day shutdown period arising from the extreme fire hazard.


QUINSAM
COAL PROJECT
-SOUTHERN EXTENSION-
DENSITY OF
DRILL/CORE
HOLES
MAP 2
• DRILL LOCATION
0
1/2
MILE
ARGONAUT RD.
L.
MIDDLE
QUINSAM
LAKE
QUINSAM RIVER
LYON
B
B'
1100
1000
900
800
1200
1300
1400
70+00
60+00
50+00
40+00
30+00
20+00
10+00
0+00
-10+00
-20+00
8000' RT.
7000' RT.
6000' RT.
5000' RT.
4000' RT.
3000' RT.
2000' RT.
1000' RT.
L.T.

Three 10 day work periods were required to complete the evaluation. Lexco Testing Ltd. Rigs 06 and 07 completed the majority of the work, with some support from a contract rig equipped with a casing hammer. Support equipment and services included a D-6 caterpillar, a contract line cutting crew, a geophysical logging unit owned by Lexco Testing Ltd., and two staff geologists.

In the interests of scheduling, a drillhole plan on a 500 foot line spacing with holes spaced 500 feet apart, was initiated. Due to complexities in structure in the southern portion of Pits 5 and 6 and in all of Pit 4, hole centers were closed to a 250 foot spacing. (Map 2)

Drillholes in the vicinity of Pits 5 and 6 numbered 38 holes, for a total drilled footage of 7385 feet. Coreholes numbered 7 holes, for a cored footage of 382 feet and a drilled footage of 1299 feet.

Drillholes in the vicinity of Pit 4 numbered 26 holes for a total drilled footage of 4773 feet. Coreholes numbered 2 for a cored footage of 43 feet and a drilled footage of 156

Field costs in the Pits 5 and 6 area approximated $ 65,904.00

Field costs in the Pit 4 area approximated $ 36,143.00.

SURFICIAL GEOLOGY

Average glacial overburden thickness over all of these proposed pit areas is minimal - between 5 and 10 feet. This is due to the resistant nature of the sandstones and the higher elevations of the mining areas relative to the surrounding landscape: glacial scour is the rule on the highs, while glacial deposition is most common in the low areas. Significant thicknesses of glacial till are present in the Long Lake fault zone. In this lineal depression glacial deposition has resulted in till accumulating to thicknesses in excess of 40 feet. On the lower, downdip side of Pit 6, till has reached 70 feet in thickness in some locations, but the average is 30 feet. Local accumulations in the gullies and swamps in the area of Pit 4 vary between ten and thirty feet, but these are few.

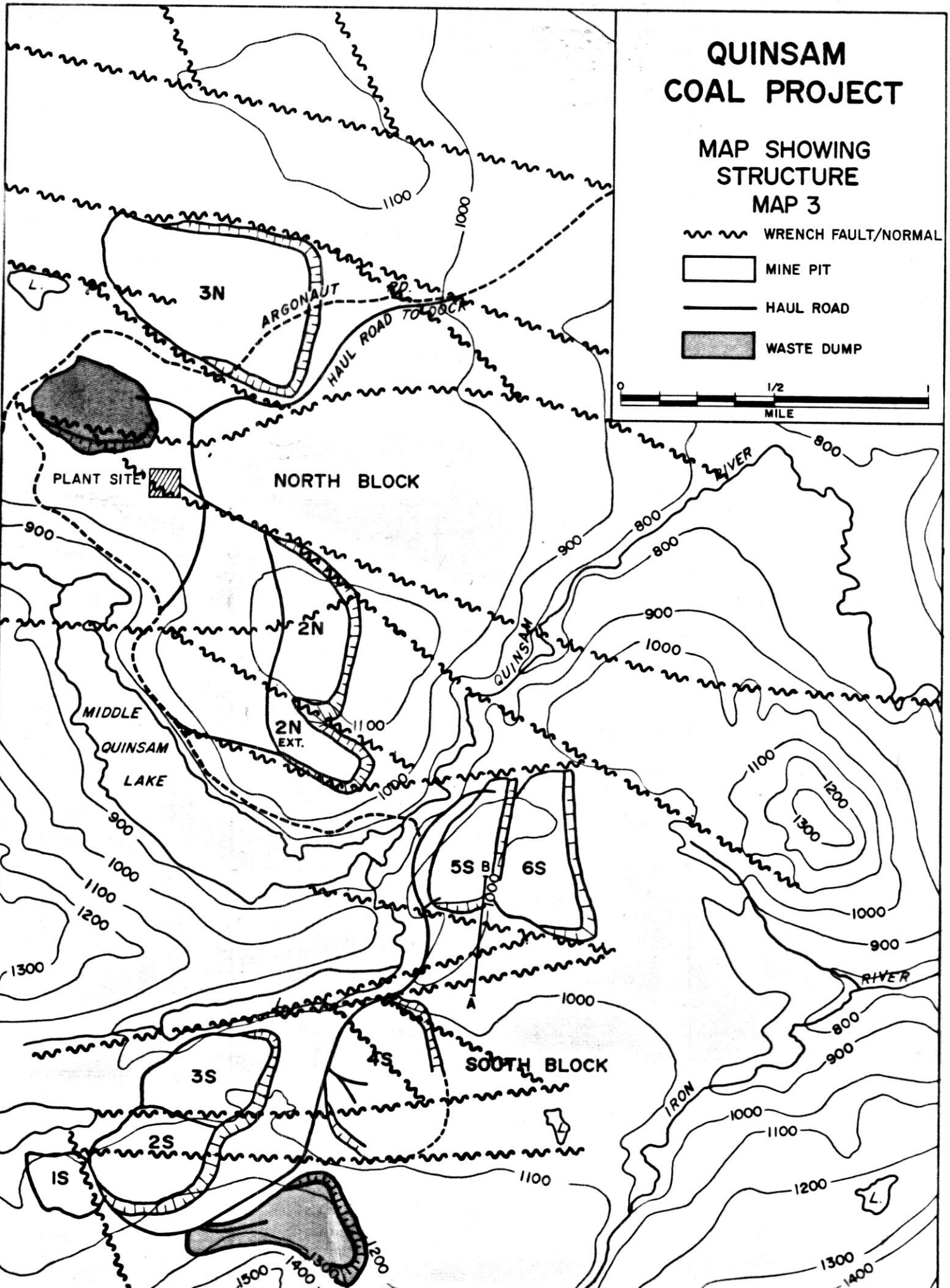
Because of the proximity of the proposed pits to the granitic uplift to the south of Middle Quinsam Lake, large granite boulders in the till are common. Some of these boulders are as much as seven or eight feet in diameter, though the average is one to three feet.

As is the case in the mining areas north of the Quinsam River, the glacial till takes on a very mucky, soupy texture when exposed to rainfall.

THE GROUNDWATER REGIME

South of the Quinsam River groundwater is present in large quantities as opposed to the limited volumes found in the areas to the north. The majority of the holes encountered groundwater between one hundred and two hundred feet over the mining areas. Compressor tests resulted in most of the holes producing volumes in the 5 to 15 i.g.p.m. range. This groundwater occurrence is almost certainly a function of secondary porosity i.e. joint planes and fault zones.

Hole QU-78-156 (Line 40+00 2200 ft. left) located in the depression of the Long Lake fault zone encountered a fractured zone at 155 feet that flowed to surface at a rate of 5 i.g.p.m. until the hole was plugged. Groundwater problems can be expected when highwalls exceed about 100 feet.


QUINSAM
COAL PROJECT
MAP SHOWING
STRUCTURE
MAP 3
WRENCH FAULT/NORMAL
MINE PIT
HAUL ROAD
WASTE DUMP
0
1/2
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MILE
3N
ARGONAUT RD.
HAUL ROAD TO COAL
PLANT SITE
NORTH BLOCK
2N
2N EXT.
MIDDLE QUINSAM LAKE
QUINSAM RIVER
5S
B
6S
A
3S
4S
SOUTH BLOCK
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1S
IRON
L.
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1400
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STRUCTURAL GEOLOGY

When viewed on a large scale, overall structural trends in the Pit 4, 5 and 6 areas are evident. The major structural feature is the Long Lake fault zone. This fault zone is the largest fault feature on the entire property, composed of a series of parallel faults rather than one large fracture, approximately 400 to 500 feet wide, trending 60° NE. The zone runs directly along the southern flank of a large basement high that is directly connected to the granitic wedge on the south side of Middle Quinsam Lake. To the north of the fault zone, on the uplifted side, the sediments are striking 100° East of North with an average dip of 7 degrees. Across the fault zone to the south, the sediments are badly broken into small wedge shaped structural blocks, with dips ranging from 5 to 15 degrees. In the middle of the disturbed zone, small counter rotated blocks strike 45 degrees E of N and steeply dip at approximately 19 degrees. (Map 3)

A traverse down the creek from Long Lake to Middle Quinsam Lake revealed basal conglomerate in direct contact with the granites and a halo of metamorphosed sediment near the contact indicating some type of volcanic activity resulting in uplift throughout and later than the sedimentary deposition.

Transverse section A-B illustrates the structure across the Long Lake fault zone (Figure 1).

PC

LEXCO TESTING LTD.

GAMMA DENSITY - RESISTANCE

700 ROYAL TRUST TOWER, EDMONTON CENTRE, EDMONTON, ALBERTA

HOLE QU-18-14

LOCATION 1205' FSL SEC. TP RGE. W

AREA Quesnel

PROVINCE B.C.

SURVEYED DATA

ELEV. 1116

LOG 5th Feb 14

DATE OF JOB: June 13, 1978

DEPTH - LOGGER 3451

DEPTH - DRILLER 3451

CASING TYPE

CASING DRILLED @ 3451

RUN NO. 3

WITNESSED BY: H. MACNEIL, J. BOWMAN

BIT: SIZE 6" FROM Surf TO 3451

CASING: SIZE 5" FROM Surf TO 3451

TUBING: SIZE 2" FROM Surf TO 3451

TOOL SIZE: DIAMETER 3 5/8" WEIGHT 300 LBS

TOOL MODEL NO.: DIAMETER 3 1/8" WEIGHT 300 LBS

SPACING: SOURCE TO DETECTOR 10'

SOURCE MODEL: 300 GA/RA

DETECTOR MODEL NO.: DENSITY 3 1/8" CALIPER 3 1/8"

EQUIPMENT USED

TRUCK NO.

LOCATION

ENGINEER

WITNESS

GAMMA RAY CALIBRATOR: PRIMARY SEC. 0 TO 100 API UNITS

GAMMA RAY SCINTILLOMETER: SEC. 0 TO 200 API UNITS

RESISTIVITY: FOCUSED 16" NORMAL

DENSITY: 16" NORMAL

SPONTANEOUS POTENTIAL: MV

CALIPER: 1" TO 10"

GAMMA RAY API UNITS 0 TO 5

DEPTH

OHMS 60 TO 0 RESISTANCE

DENSITY

Gamma Ray

Resistance

Density

FLUID LEVEL

146

0

25

gray 55

50

75

100

125

137.2

150

175

187.2

200

225

250

275

300

325

DB-335

Resistance (ohms)

0 100

Density C.P.S.

1000 0

Gamma Ray C.P.S.

0 0

COAL GEOLOGY AND STRATIGRAPHY

The stratigraphy of the northern one-half of the Pits 5 and 6 area is relatively conformable. The No. 3 seam averages 8 feet of raw coal in four distinct bands over a 16 foot section. Approximately 50 feet below the No. 3 seam, the No. 2 seam occurs, averaging 1 foot in thickness - it is therefore considered as unmineable. The No. 1 seam occurs approximately 130 feet below the No. 2 seam, with an average thickness of 6.5 feet of raw coal. The familiar No. 1 rider which in this area averages 1.5 feet, occurs one to two feet above the top of the No. 1 seam. The accompanying E-log of Hole QU-78-146 (Line 55+00 to 695' Lt) illustrates a typical section through the coal measures.

The major basement high located south of Line 47+00 and the accompanying Long Lake fault zone on its south flank has affected the total coal sequence through the south half of Pits 5 and 6, and in particular the lower cycle which contains the No. 1 seam. The sedimentary sequence is thinning in the direction of the high. The No. 1 and No. 2 seams are pinching together due to the natural wedging of the lower cycle as it approaches the high. The upper cycle retains its average thickness but the No. 3 seam shales out directly over the crest of the feature. While no coal exists in the lower cycle directly adjacent to the high, the No. 1 and No. 2 zones are still recognizable as carbonaceous zones. In order to explain this, it must be assumed that a pre-existing paleotopographic high may have undergone localized uplifting at some period between No. 2 seam and No. 3 seam deposition. The most logical time period would be early in the upper cycle when a major event caused the radical change from a basaltic siltstone to a granitic medium grain sandstone deposition.

Faulting may have occurred at any time during either cycle. Later movements may even occur on weakened pre-existing fault planes.

South of the basement high in the region of the fault zone there is a marked change in the character of the No. 3 seam. Figure 2 illustrates this change. It would seem that the basement high acted as a semi-confining barrier during deposition of the No. 3 sequence, trapping a large amount of vegetation in a deeper 'sub-basin'. This phenomenon appears in the southern part of Pit 4 also.

Across the basement high in the trough of the Long Lake fault zone, a unique combination of the No. 1 and No. 2 seams is found. It consists of three major bands of coal between one and three and one half feet thick, and two smaller bands less than one foot thick, over a total section of 16 feet (see Hole QU-78-241, Line 42+06, 2438 ft. left). The total raw coal thickness of the three major bands is 5.8 feet. This seam was present in Hole QU-77-5 (1977 drilling) and was tentatively classed as a No. 2 zone. This unique merging of the No. 1 and No. 2 seams is only found between the major basement high located on the south half of Pits 5 and 6, and the other major basement high located between Pits 3 and 4, which will be discussed in the report on Pits 1, 2 and 3. The reason for this is obscure but it would appear that this elevated portion of the lower cycle basin was not accumulating plant matter at the same rate and consistency as the areas on either side of it. The situation was reversed however, at the time of No. 3 seam deposition, when a much cleaner, more consistent No. 3 seam was generated between the two highs.

E-log Cross Section Showing
Change in #3 Seam

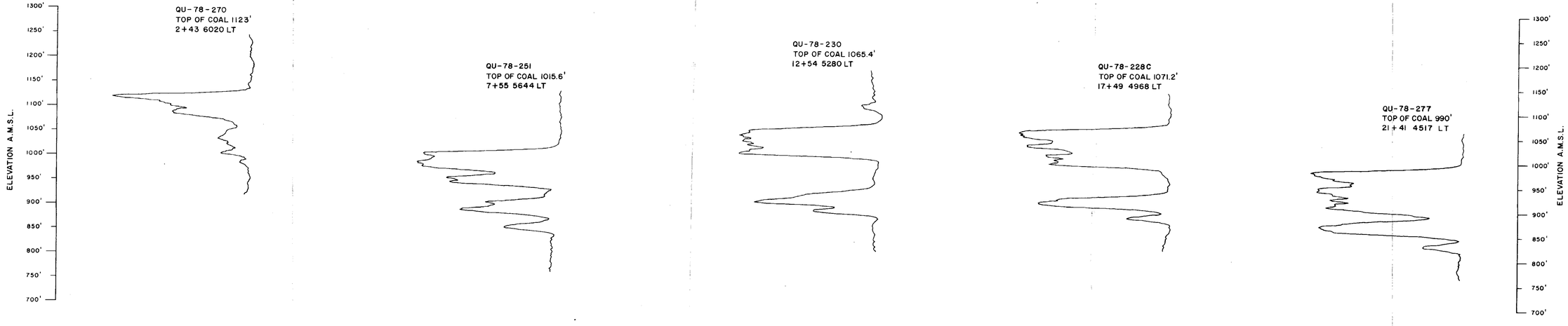

FIG. 2

VERT. & HORIZ. 0 50 100 150 200 FEET

DRAWN: K.G.L.
REPORT: SUPPLEMENT TO GEOLOGY OF PROPOSED PITS 4, 5 & 6 SOUTH.
BY: S. GARDNER
J. NYBERG
R. RONAGHAN

71 (12)
M3

In Pit 4, which abuts the second major basement high that may also have been active between No. 2 and No. 3 seam deposition, the same remarkable change in the character of the No. 3 seam occurs. In the northwestern part of the pit (the area directly adjacent to the high that occurs south of Long Lake), the seam is badly split apart with sandstone interfingerings. In the lower reaches of the sub-basin, which is toward the southeastern part of Pit 4, the seam is characterized by an eight foot zone of coal, then a one to two foot parting, followed by a two to three foot lower portion (see Hole QU-78-219, Line 17+50, 4250 feet left, in the Appendix). The seam is uniform and consistent southeast from Line 20+00, and further drilling will establish the extent of this addition to Pit 4 reserves.

CALCULATIONS OF RESERVES

A conversion factor of 1.2 tons/cu. yd. of coal is employed for reserve calculations in Pits 4, 5 and 6 south. Reserves are calculated with the aid of a planimeter and are categorized into the three standard overburden groups: 0-120 feet overburden, 120-160 feet overburden, and 160-200 feet overburden. In areas where raw coal thickness is decreasing downdip due to depositional or other factors, such as the northern part of Pit 6, a standard cut-off of a 20 to 1 combined overburden to coal ratio is employed. The following table lists volumes of coal and overburden as calculated for each category, in each pit.

TABLE I

QUINSAM PIT 5 & 6 GEOLOGICAL RESERVES

OVERBURDEN LIMITS	COAL THICKNESS (Ft.)	COAL TONNAGE (x 10^6)	OVERBURDEN VOLUME (C.Y.x10^6)	RATIO
No. 3 Seam				
0-120	7.30	.777778	5.3118	6.83
120-160	7.80	.244280	3.6575	14.97
160-200	8.30	.120510	2.1801	18.09
Sub-Total		1.142568	11.1494	13.30
No. 1 Seam				
0-120	7.73	.1967	1.273	6.47
120-160	7.73	.1524	2.303	15.11
160-200	7.73	.1697	3.296	19.42
Sub-Total		.5188	6.872	13.67
TOTAL		1.6614	18.0214	10.85

COAL QUALITY

As is the case in the previous mining areas north of the Quinsam River, the number of core samples from each pit dictates a considerable lag time for quality analysis and reporting from the Lexco lab.

Core quality information from 1976 and 1977 work is available over the Pits 4, 5 and 6 area. The No. 3 seam bulk sample was extracted in the Pit 4 area (see Cyclone Engineering Sales Ltd. Report No. R1-78-04). The No. 1 seam adit was driven in the Pit 5 area during the preliminary work in 1975.

For the new area at the south end of Pit 4, the only quality information to date is some preliminary sulphur values from Hole QU-78-228(c) (Line 17+49, 4968' Lt.). The following Figure (Fig.3) illustrates the range in sulphur values between the upper main zone and the lower rider.

for Fig 3, REFER TO BOOK III.

SUPPLEMENT TO

GEOLOGY OF PROPOSED PITS

4, 5 & 6 SOUTH

S. Gardner
J. Nyberg
R. Ronaghan

October, 1978

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LIST OF MAPS, FIGURES & TABLES

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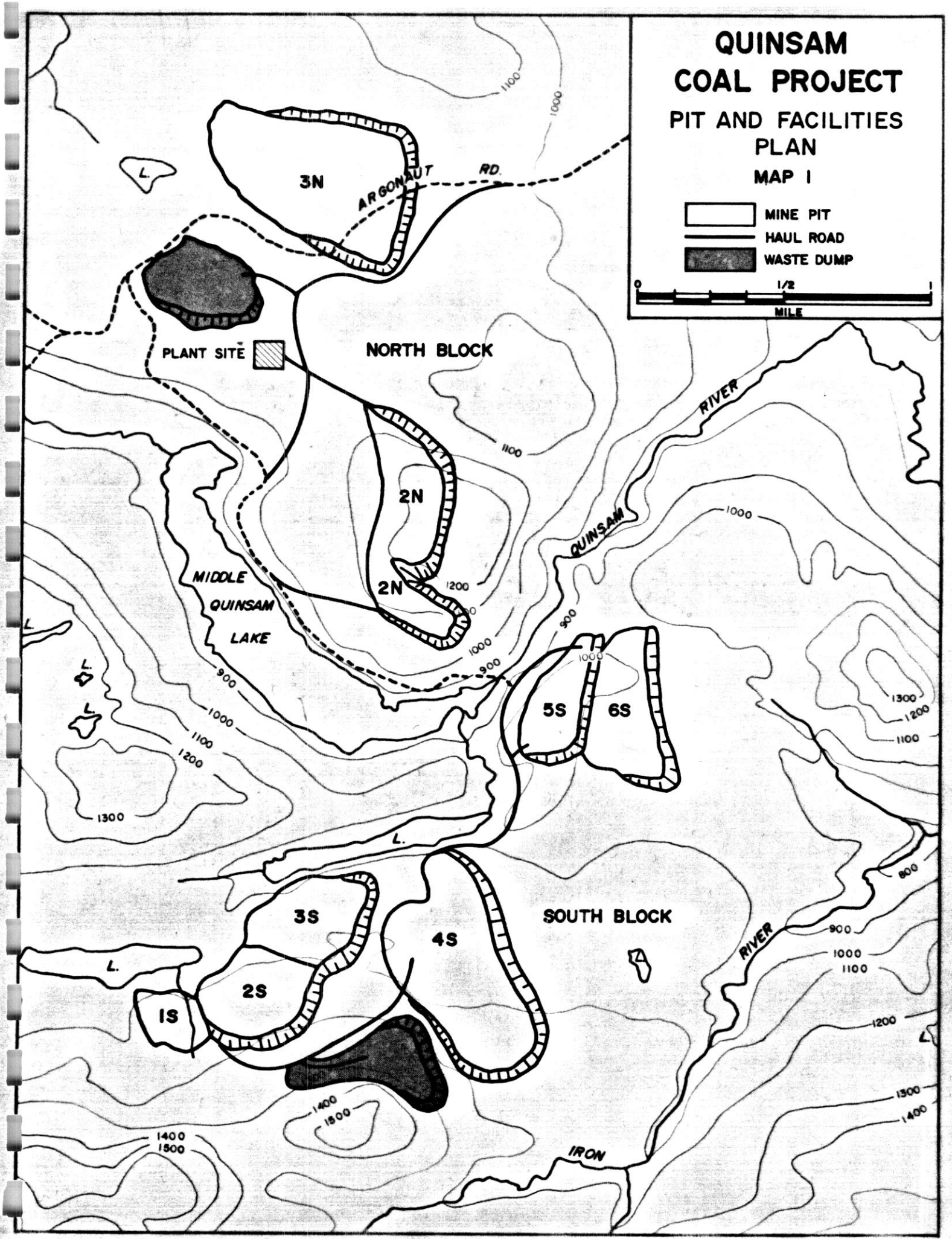
INTRODUCTION

The preliminary exploration of the proposed Pit 4 area has been discussed in "Geology of Proposed Pits 4, 5, and 6 South". Further drilling in the area has outlined an area of mineable reserves lying between lines 45 + 00 and - 2 + 50, from 3000 feet to 6000 feet left of the baseline. A strip of reserve area between lines 45 + 00 and 40 + 00 connects Pit 4 to Pits 5 and 6.

Only the No. 3 seam occurs at mineable depths within this area. Based on present corehole information, the seam has been divided into a high sulphur bottom band, averaging 2.0 feet, and a lower sulphur main seam averaging 7.0 feet.


QUINSAM
COAL PROJECT
PIT AND FACILITIES
PLAN
MAP I
MINE PIT
HAUL ROAD
WASTE DUMP
0
1/2
1
MILE
3N
ARGONAUT
RD.
PLANT SITE
NORTH BLOCK
2N
2N
MIDDLE
QUINSAM
LAKE
QUINSAM
RIVER
5S
6S
3S
4S
2S
1S
SOUTH BLOCK
RIVER
IRON
L.
1100
1000
1200
900
1300
1400
1500
800

SUMMARY AND CONCLUSIONS

Exploration in the proposed Pit 4 area has outlined the No. 3 seam mineable reserves of 2,342,000 tons, at an average stripping ratio of 10.3:1.

Quality information from this drill program is not available to date. The No. 3 seam bulk sample from the northern part of Pit 4, taken in 1977, indicates the following quality:

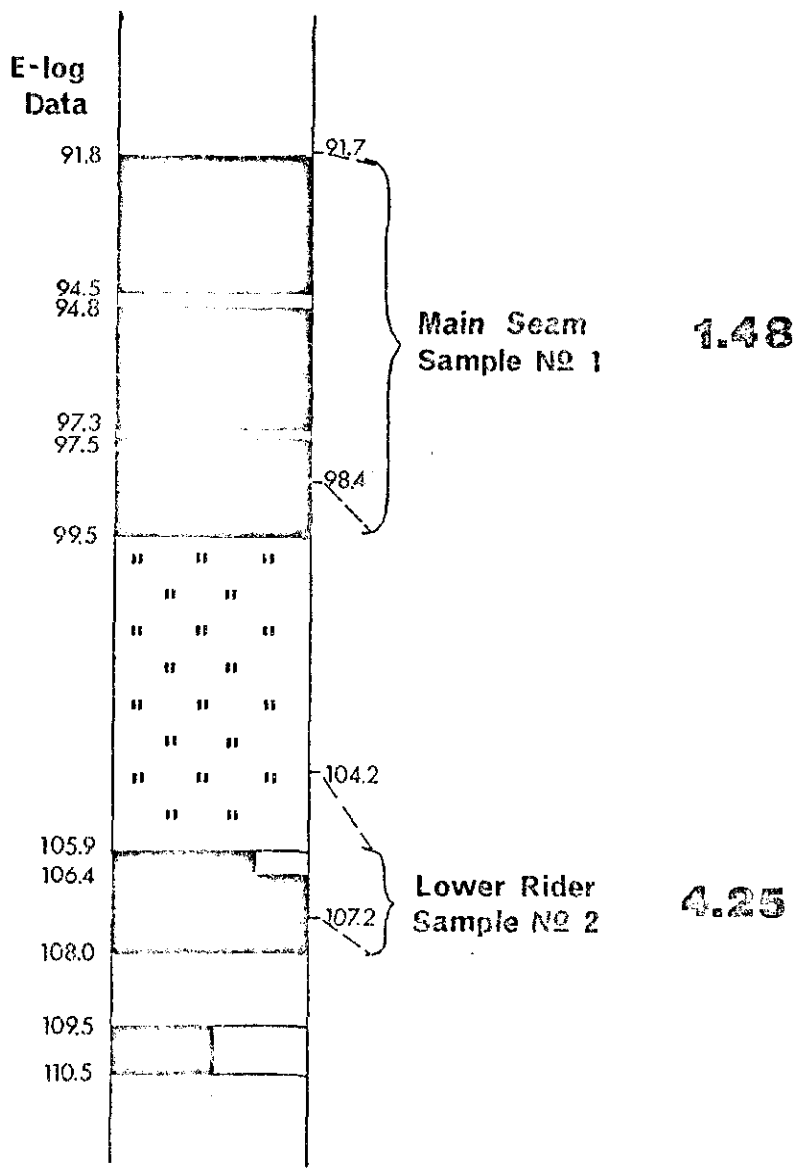
R.M.%	ASH %	V.M.%	F.C.%	SULFUR %	BTU/LB
2.86	25.93	30.18	41.03	1.84	10,090

Corehole Qu-78-228C has been analyzed for sulphur content and shows a higher concentration in the lower part of the seam (Fig. 1). Based on this information, reserves have been calculated separately for the main seam and lower seam.

Figure 1

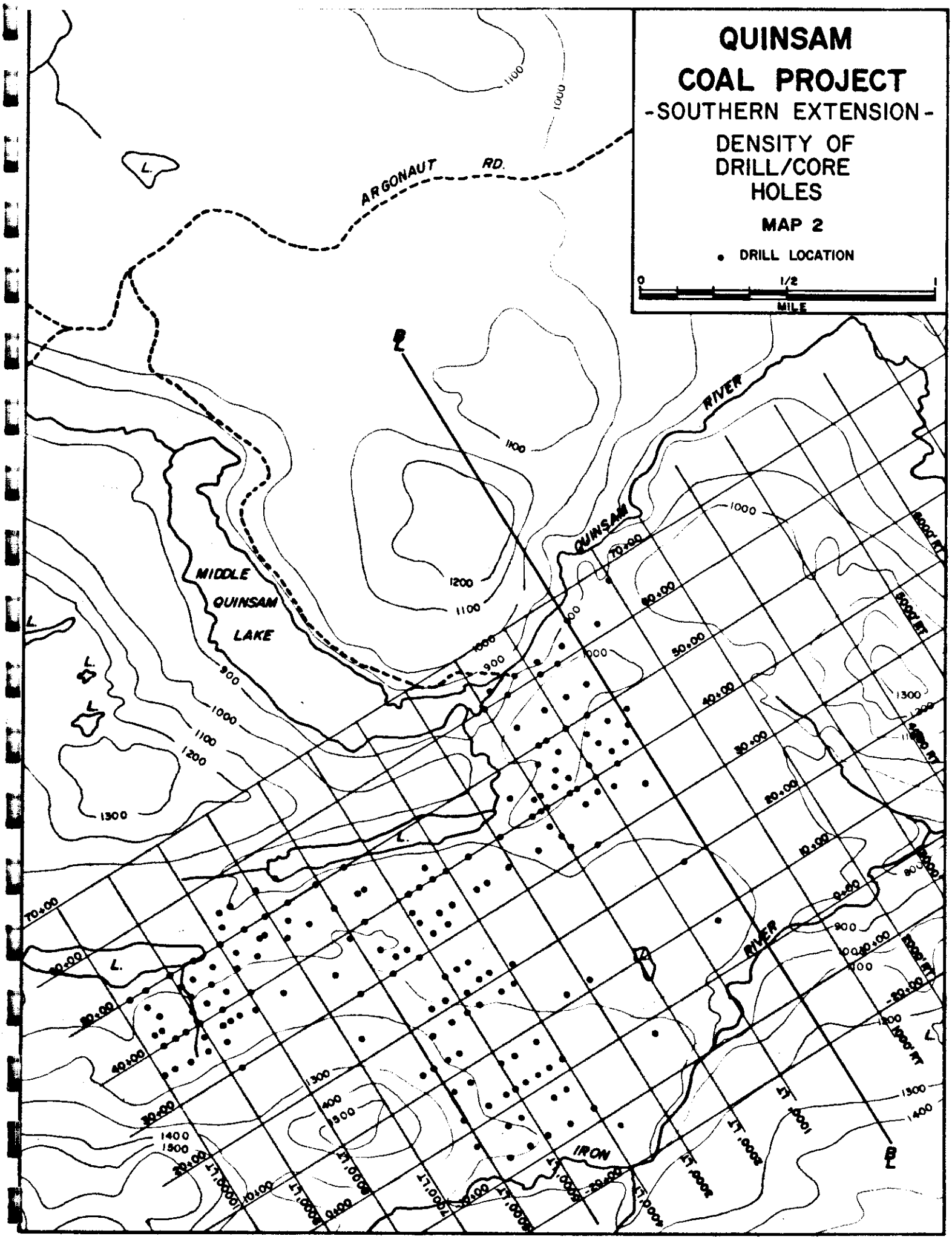
Sulfur Values: Nº 3 Seam

QU-78-228c



TECHNICAL INVESTIGATIONS

In the previous drilling, 26 drillholes and 2 coreholes were completed in the proposed Pit 4 area. In the following 2 shifts, an additional 32 drillholes and 4 coreholes were completed, providing the necessary data to determine the structure and outline the mineable reserve area.


QUINSAM
COAL PROJECT
-SOUTHERN EXTENSION-
DENSITY OF
DRILL/CORE
HOLES
MAP 2
• DRILL LOCATION
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1/2
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MILE
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MIDDLE
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LAKE
QUINSAM
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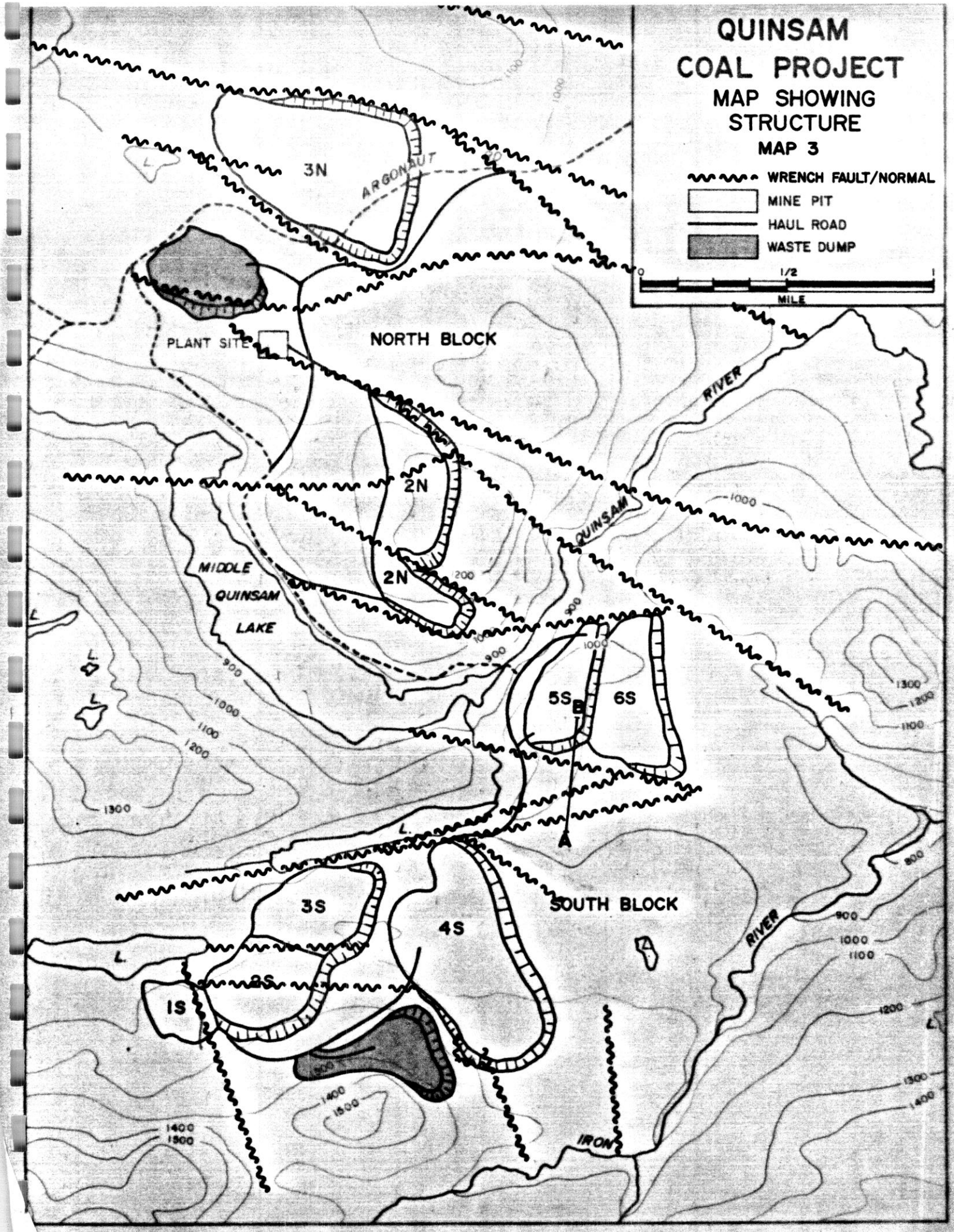
999000' FT.
999500' FT.
1000000' FT.

STRUCTURAL GEOLOGY

Pit 4 lies south of the Long Lake fault zone, and is bounded to the south by a granitic intrusive. Adjacent to the intrusive, there is a series of hinge faults, with displacements ranging from 1 foot to more than 100 feet (See Map 3).

The sediments lie unconformably on basalt basement, which has been upthrust by the intrusive. A local basement high, at about 5500 feet left, line 21 + 50, has brought about a doming of the sediments. The general strike in this area is northwest to southeast. The average dip is 10° to the northeast, ranging from 3° to 20°.


QUINSAM
COAL PROJECT
MAP SHOWING
STRUCTURE
MAP 3
WRENCH FAULT/NORMAL
MINE PIT
HAUL ROAD
WASTE DUMP
0
1/2
1
MILE
3N
ARGONAUT
PLANT SITE
NORTH BLOCK
RIVER
2N
2N
QUINSAM
MIDDLE
QUINSAM
LAKE
5S
6S
A
B
SOUTH BLOCK
3S
4S
2S
1S
RIVER
IRON

COAL GEOLOGY

The No. 3 seam is found at mineable depths in the proposed Pit 4 area. The No. 2 seam occurs about 150 feet beneath the No. 3 seam, and the No. 1 seam about 100 feet beneath the No. 3 seam.

In the eastern half of the proposed Pit 4 area the No. 3 seam averages 9.0 feet in thickness, and as followed from north to south, it tends to split into a 7.0 foot upper zone and a 2.0 foot lower zone. In the western part of the explored area, the No. 3 seam is split into several bands with sandstone interfingerings. As the No. 3 seam approaches the high, it thins considerably, to as low as 1 foot in thickness, abutting the intrusive.

E-log Cross Section Showing
Change in # 3 Seam

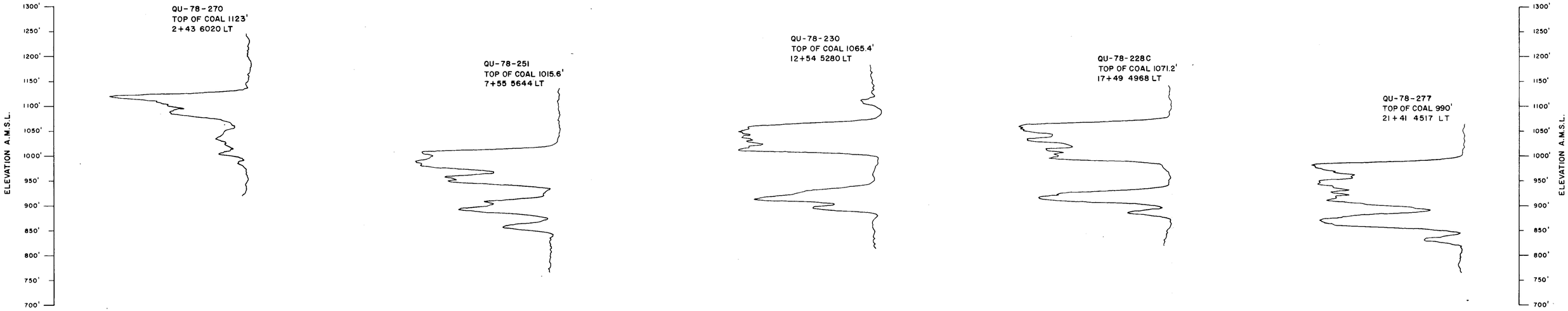
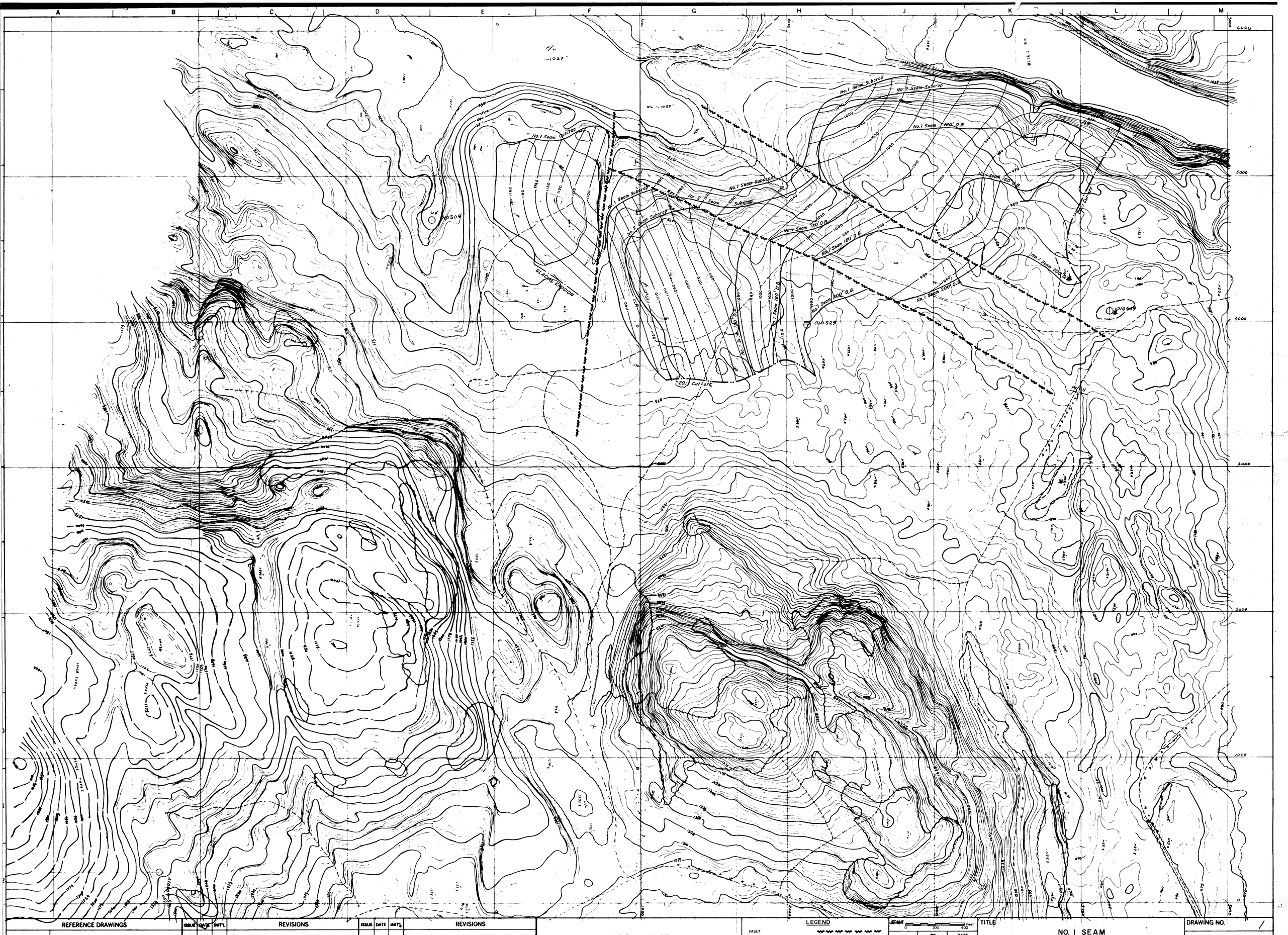


FIG. 2

VERT & HORIZ 0 50 100 150 200 FEET

DRAWN: K.G.L.
REPORT: SUPPLEMENT TO GEOLOGY OF PROPOSED PITS 4,5 & 6 SOUTH.
BY: S. GARDNER
J. NYBERG
R. RONAGHAN

71 (12)
(M4)



REFERENCE DRAWINGS	ISSUE	DATE	INIT'L

REVISIONS	ISSUE	DATE	INIT'L

REVISIONS	ISSUE	DATE	INIT'L

LUSCAR LTD.

QUINSAM PROJECT

LEGEND

FAULT

OVERBURDEN LIMITS

20:1 COMBINED RATIO

ELEVATION OF TOP OF NO. 1 SEAM — 1000 —

SCALE 0 200 400 Feet

	BY	DATE
DRAWN	K.G.L.	11/10/78
CHECKED		
APPROVED		
1st ISSUED		

TITLE

NO. 1 SEAM
STRUCTURE CONTOUR
PITS 1,2 & 3

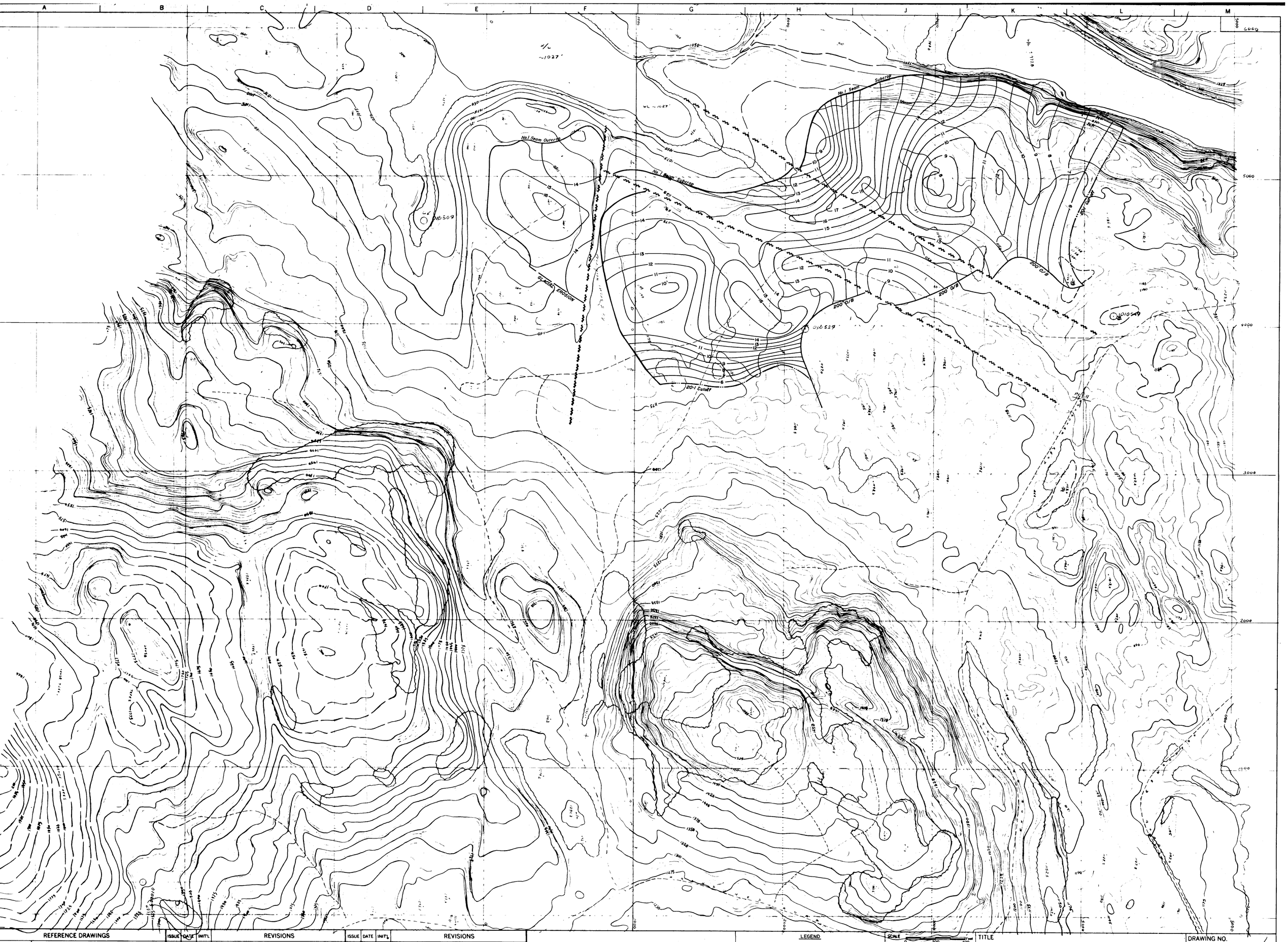
71
VMS

CK Quinsam 71(6)A (Sec. 3).

DRAWING NO. 1

QS.G. 204 GF. 13

ISSUE



REFERENCE DRAWINGS	ISSUE	DATE	INIT'L	REVISIONS	ISSUE	DATE	INIT'L	REVISIONS

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QUINSAM PROPERTY

LEGEND

- FAULT
- 10 — SEAM THICKNESS (feet)
- 200 FT. O.B. LIMIT
- NO.1 SEAM OUTCROP
- 20:1 CUT-OFF

SCALE 0 200 400 feet

	BY	DATE
DRAWN	S.J.N.	20/09/78
CHECKED		
APPROVED		
1st ISSUED		

TITLE

NO. 1 SEAM ISOPACH

PITS 1,2 & 3

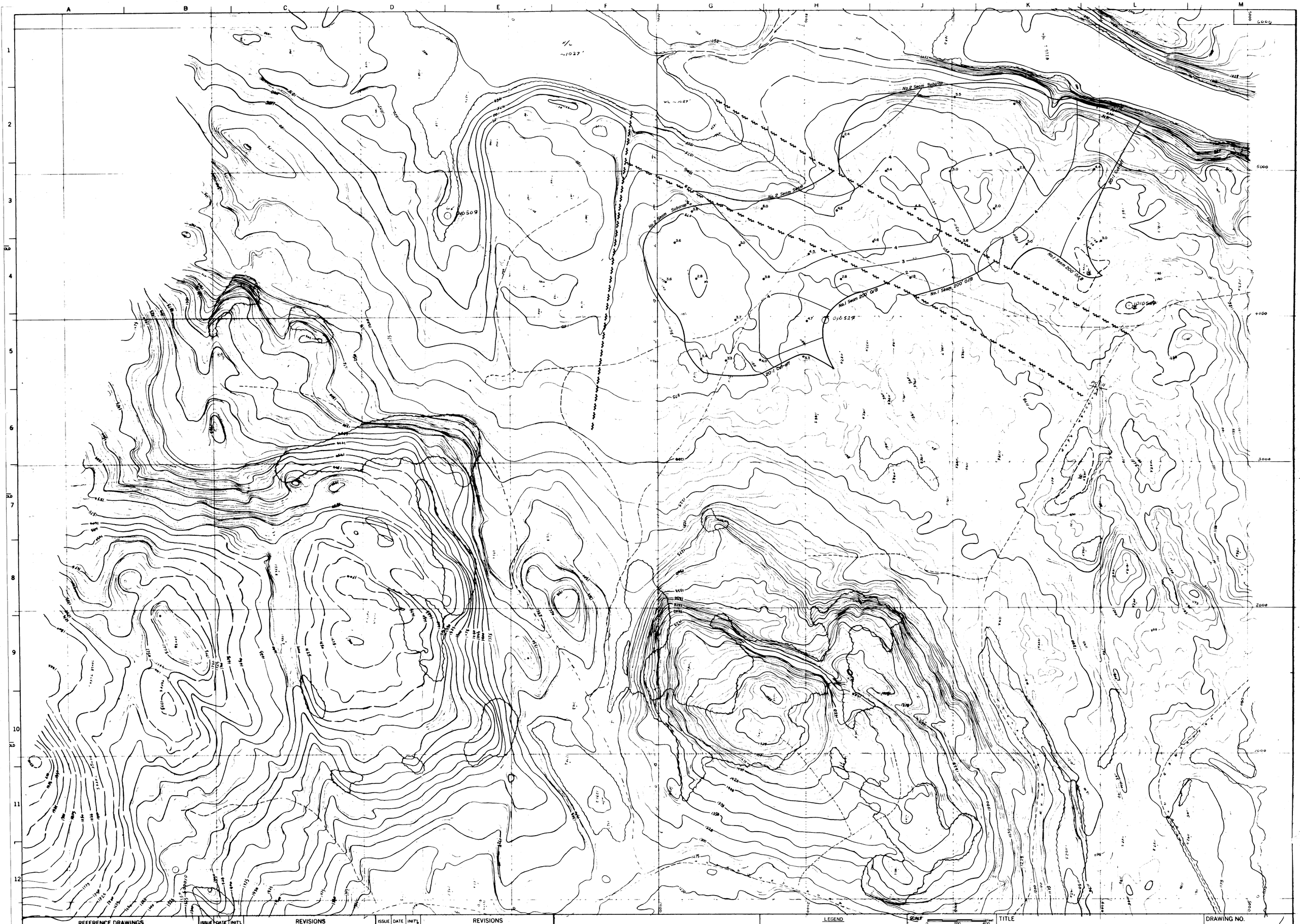
Ex Quinsam 78(6)A (Sec. 3

71 M6

DRAWING NO. 1

QS. G. 206 GF. 13

ISSUE



REFERENCE DRAWINGS	ISSUE	DATE	INIT'L	REVISIONS	ISSUE	DATE	INIT'L	REVISIONS

LUSCAR LTD.

QUINSAM PROJECT

LEGEND

FAULT

3 SEAM THICKNESS (feet)

MINING LIMITS

SCALE 0 200 400 feet

	BY	DATE
DRAWN	S.J.N.	20/09/78
CHECKED		
APPROVED		
1st ISSUED		

TITLE

NO. 2 SEAM ISOPACH

PITS 1, 2 & 3

71

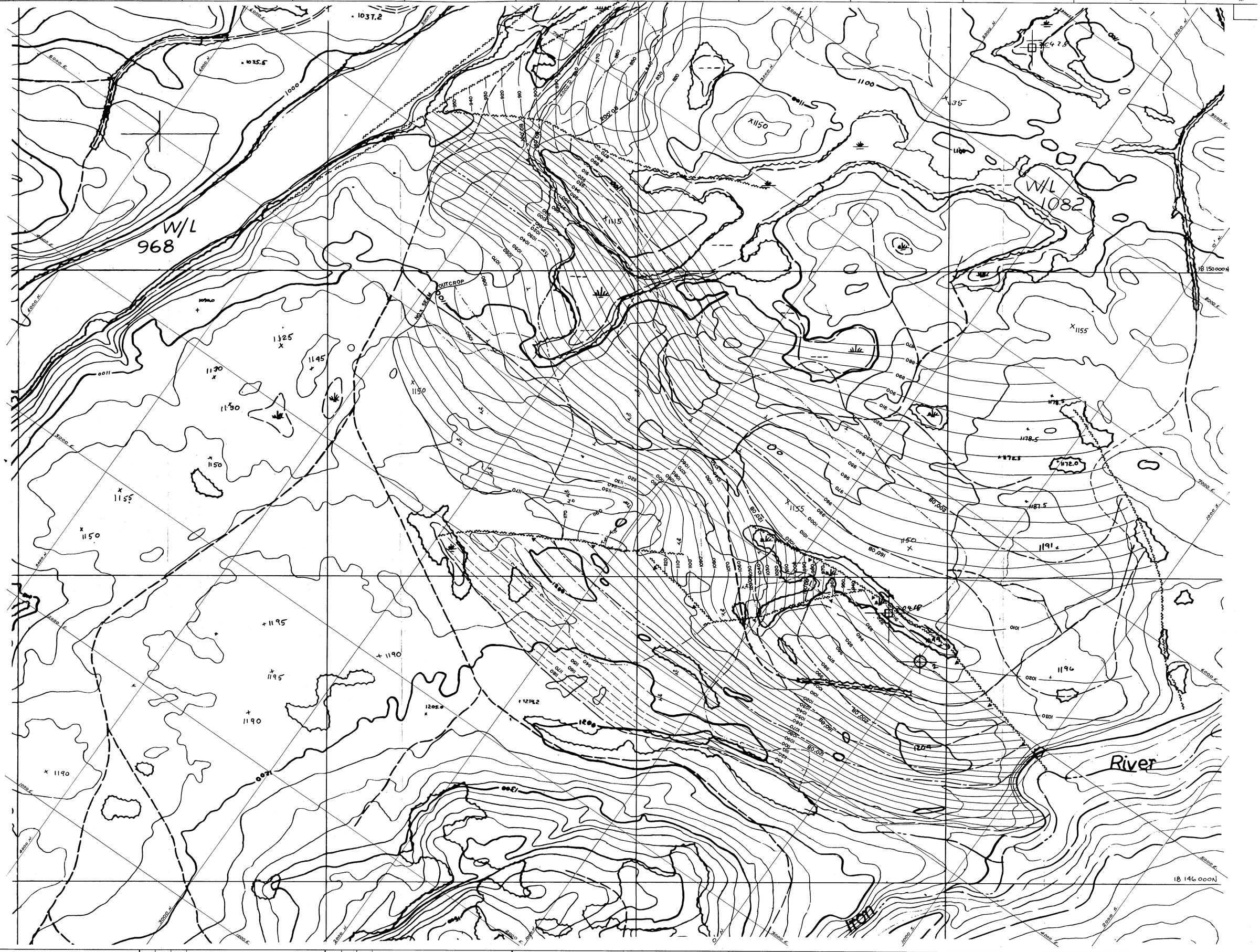
(M 7)

Ex- Quinsam 78 (6) A (SEAM)

DRAWING NO. 1

QS. G. 205 GF. 13

ISSUE



REFERENCE DRAWINGS	ISSUE	DATE	INIT'L	REVISIONS	ISSUE	DATE	INIT'L	REVISIONS

LUSCAR LTD.

QUINSAM PROJECT

LEGEND

- FAULT
- OVERBURDEN LIMITS
- 20:1 CUT-OFF
- ELEVATION OF TOP OF NO. 3 SEAM — 1000
- MINING LIMIT LOWER SEAM

SCALE 1" = 200'
0 200 400

	BY	DATE
DRAWN	T.C.	NOV. 16/78.
CHECKED		
APPROVED		
1st ISSUED		

TITLE

NO. 3 SEAM
STRUCTURE CONTOUR
PIT 4

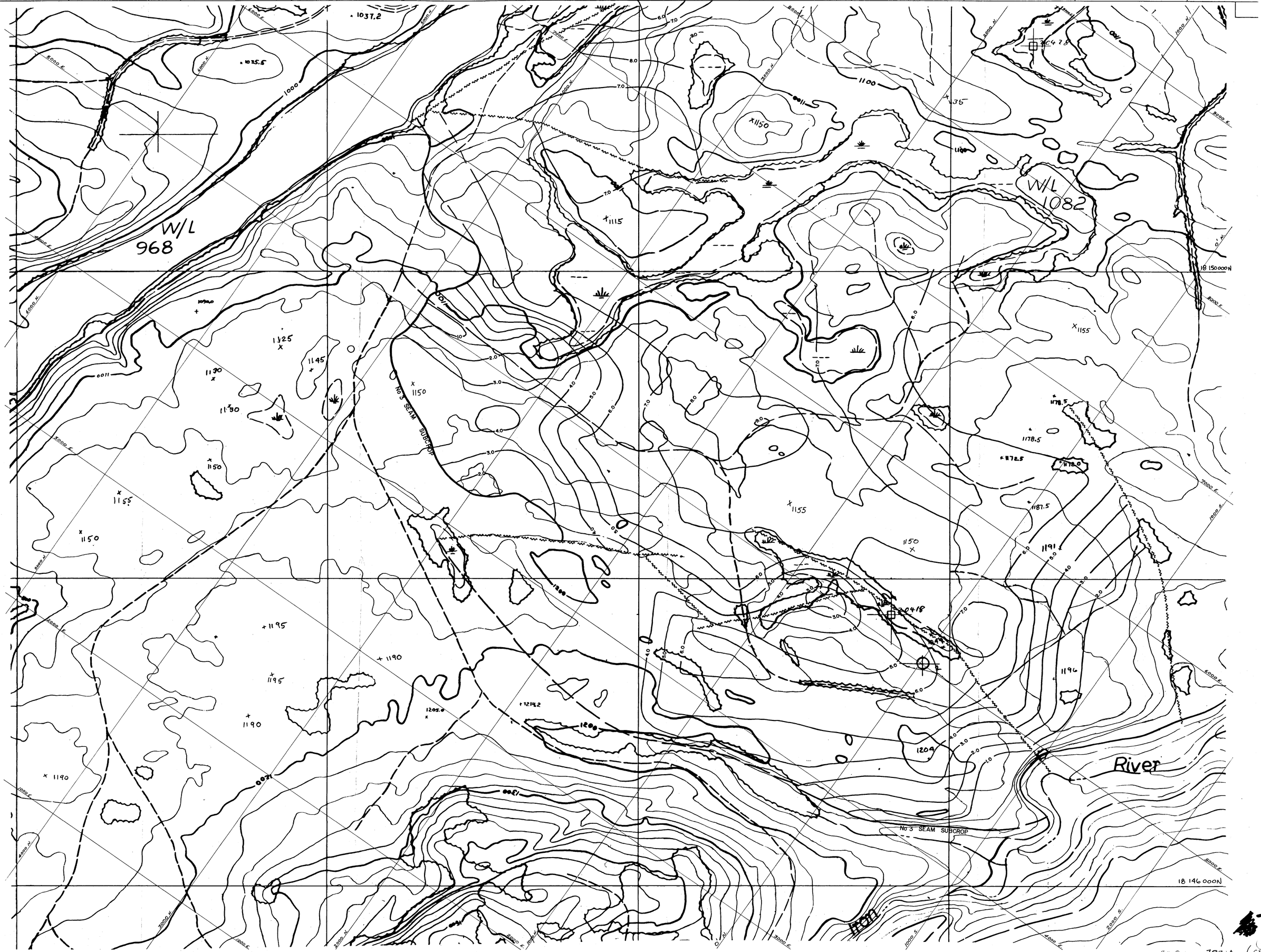
71 (M8)

ex-Quinsam 78 (8)A (Sht. 3)

DRAWING NO

QS.G.208
GF. 13

ISSUE



REFERENCE DRAWINGS	ISSUE	DATE	INIT'L	REVISIONS	ISSUE	DATE	INIT'L	REVISIONS

LUSCAR LTD.

QUINSAM PROJECT

LEGEND

SEAM THICKNESS(FT) ——70——

OUTCROP/SUBCROP ——————

SCALE 1"=200' (0 200 400)

	BY	DATE
DRAWN	T.C.	17/11/78.
CHECKED		
APPROVED		
1st ISSUED		

TITLE

NO. 3 SEAM
STRUCTURE CONTOUR
PIT 4

DRAWING NO.

QS. G. 209
GF. 13

ISSUE

C.R. Quinsam - 78-(29)-A (Copy)

W/L 968

W/L 1082

1037.2

1035.5

1000

1100

1150

1135

1115

1155

1125

1145

1130

1180

1150

1155

1150

1195

1190

1195

1190

1190

1214.2

1205.8

1200

1209

1178.5

1172.5

1172.0

1187.5

1191

1196

2.0

3.0

0011

0021

0031

N03 SEAM SUBCROP

No.3 SEAM SUBCROP

River

18 150 000N

18 146 000N

REFERENCE DRAWINGS	ISSUE	DATE	INIT'L	REVISIONS	ISSUE	DATE	INIT'L	REVISIONS

LUSCAR LTD.

QUINSAM PROJECT

LEGEND

SEAM THICKNESS LIMITS

SCALE 1"=200' (0 200 400)	BY	DATE
DRAWN	T.C.	17/11/78.
CHECKED		
APPROVED		
1st ISSUED		

TITLE

NO. 3 SEAM ISOPACH
LOWER SEAM
STRUCTURE CONTOUR
PIT 4

71
M10

Cx QUINSAM 78(6)A. (SEC. 3)

DRAWING NO.
QS. G. 207
GF. 13

ISSUE

GEOLOGY OF THE COAL RESERVE

IN THE AREA OF

PIT 3 NORTH

ex- QUINSAM 78 (4) (SEC. 2) A

Submitted by:

R. Ronaghan

S. Gardner

June, 1978

TABLE OF CONTENTS

LIST OF DIAGRAMS AND TABLES

LIST OF APPENDICES

INTRODUCTION

This report is a summary of the drilling and coring program undertaken in the proposed Pit 3 North area which lies between line 132 + 50N and 185 + 00N. It has a total area of 220.46 acres. Within this area a recoverable coal reserve in the order of 5.079 million tons was outlined.

Pit 3 is situated on a high, relatively flat promontory or plateau, bounded by low swampy lands on all sides. The height of land is near the center of the proposed pit, line 162 + 50 - 300 RT, at 1100' above sea level. (see diagram 1 and 2)

Much of the area drains to the south east and then into the Quinsam River. The remaining drainage is into the Quinsam Lake drainage pattern then into the Quinsam River.

Diagram 1

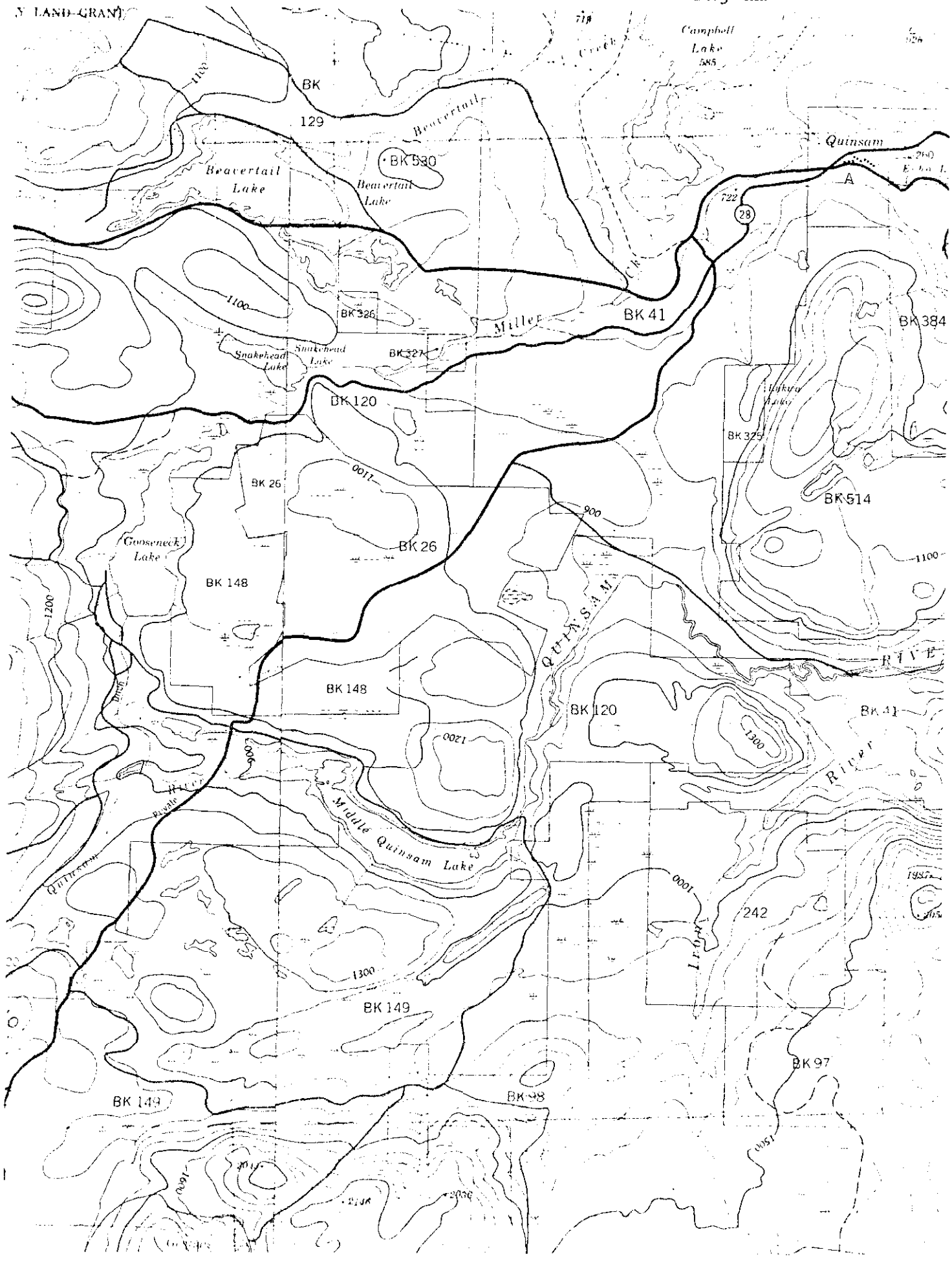
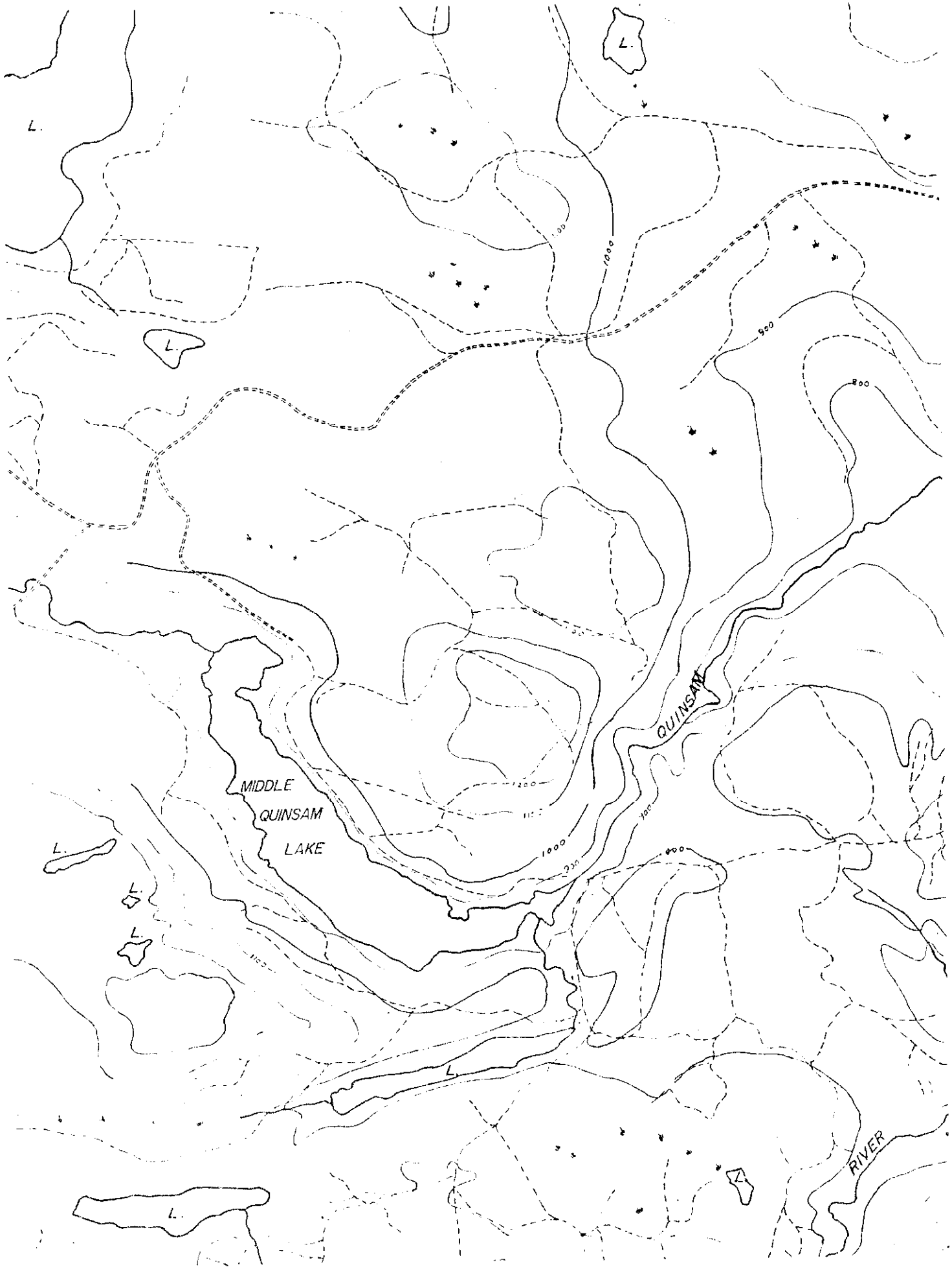

BK 129
Beavertail Lake
BK 530
Beavertail Lake
Campbell Lake
585
Quinsam
A
28
BK 41
BK 326
Miller
BK 384
Snakehead Lake
Snakehead Lake
BK 327
BK 120
BK 325
Lakeview Lake
BK 26
BK 514
Gooseneck Lake
BK 26
BK 148
BK 148
QUINSAM
RIVER
BK 120
BK 41
Middle Quinsam Lake
River
242
BK 149
BK 97
BK 149
BK 98
1100
1200
1000
900
1300
1500
1600

Diagram 2



TECHNICAL INVESTIGATIONS

Drilling and coring operations commenced in the proposed Pit 3 North area in mid April and was completed in mid June, at an approximate field cost of $149,000.00.

TABLE NO. I

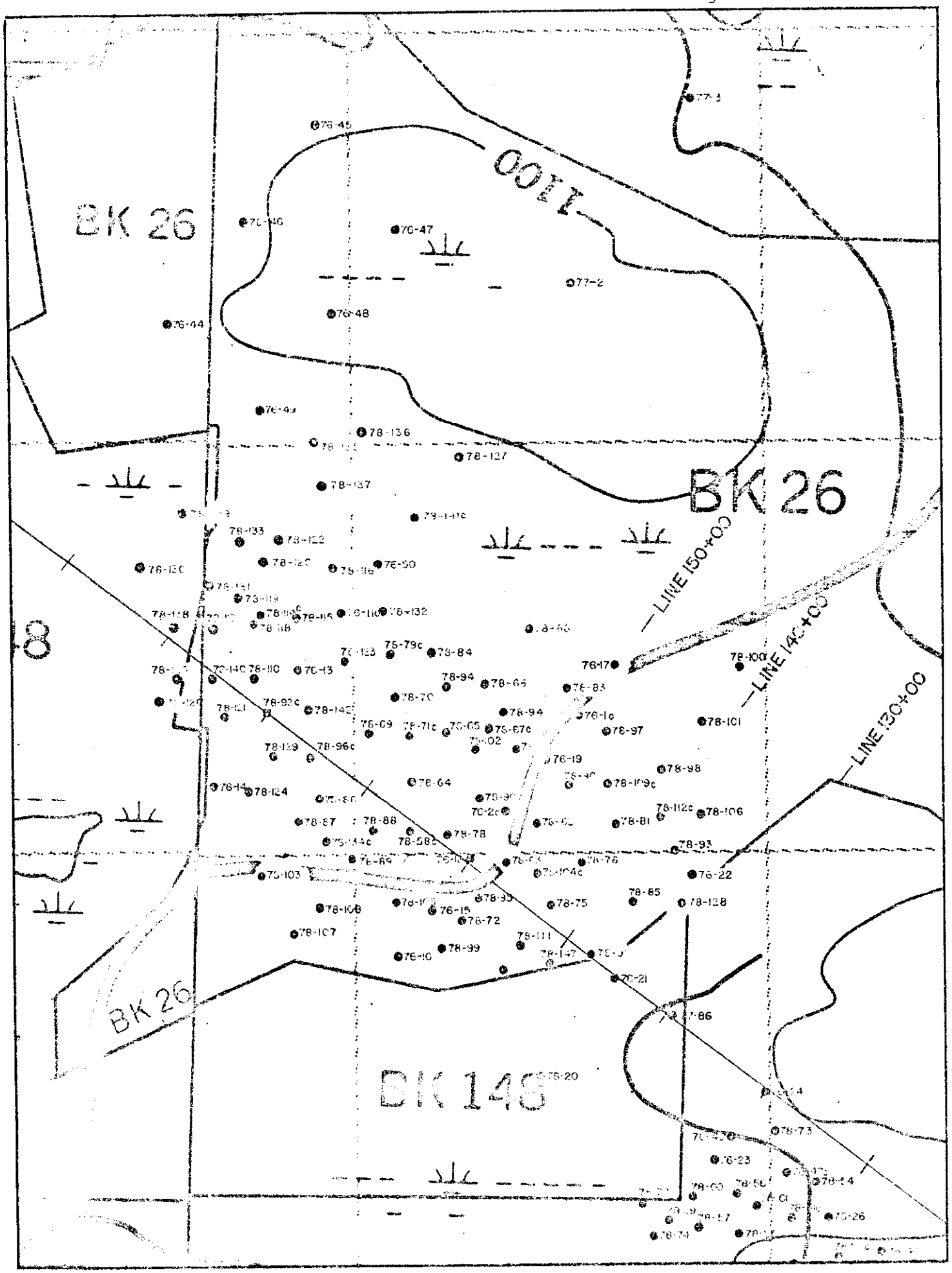
FOOTAGE BREAKDOWN

RIG NO	FOOTAGE DRILLER	FOOTAGE CORED
06	1732	919
07	9502	
02	3533	

Rigs 07 and 02 were used mainly for drilling although rig 02 set casing for rig 06 in a few cases. Rig 06 performed all coring by a wireline coring system with all cores logged and sampled at Camp 8. These samples were then shipped to Lexco Lab in Edmonton for analysis.

Other equipment included a D-6 Caterpillar and a geophysical logging unit. The support staff included a two man survey crew, a contract line-cutting crew, a drill supervisor and two staff geologists.

Diagram 3


BK 26
BK 26
BK 26
BK 146
1100'
LINE 150+00
LINE 140+00
LINE 130+00
78-136
78-127
78-137
78-133
78-122
78-50
78-84
78-94
78-65
78-83
78-70
78-94
78-97
78-101
78-98
78-64
78-124
78-88
78-78
78-112c
78-106
78-81
78-93
78-22
78-85
78-128
78-75
78-108
78-72
78-107
78-99
78-73
78-23
78-54
78-26

COAL GEOLOGY

Over the proposed Pit 3 North area, recoverable coal is confined to the No. 2 and No. 1 seams. The No. 2 seam is present over all but the western edge of the pit (see diagram 6). Except for a small parting, the No. 2 seam is clean with an average thickness of 2.97. A bottom rider accompanies the No. 2 seam but the interburden between these seams varies between 4.5' to 44.5' with an average separation of 26.5'. The bottom rider is a clean seam with an average thickness of 1.3'.

The No. 1 seam in the proposed Pit 3 North area has an average thickness of 9.62' (see diagram 7), with two small partings. These partings vary in size from 0.2' to about 1.0' over all but the north eastern area. In the northern and north eastern area of the pit the No. 1 seam splits and becomes very dirty, shaling out on the basins edge.

The No. 1 seam is clean except for a bottom zone of inferior quality coal, being interbedded coal, bone and mudstone. The No. 1 seam in the Pit 3 area lacks the No. 1 rider seam. The seam is capped by a grey-green to brown, fairly massive silt stone, with minor bands of mudstone and coal near the coal contact.

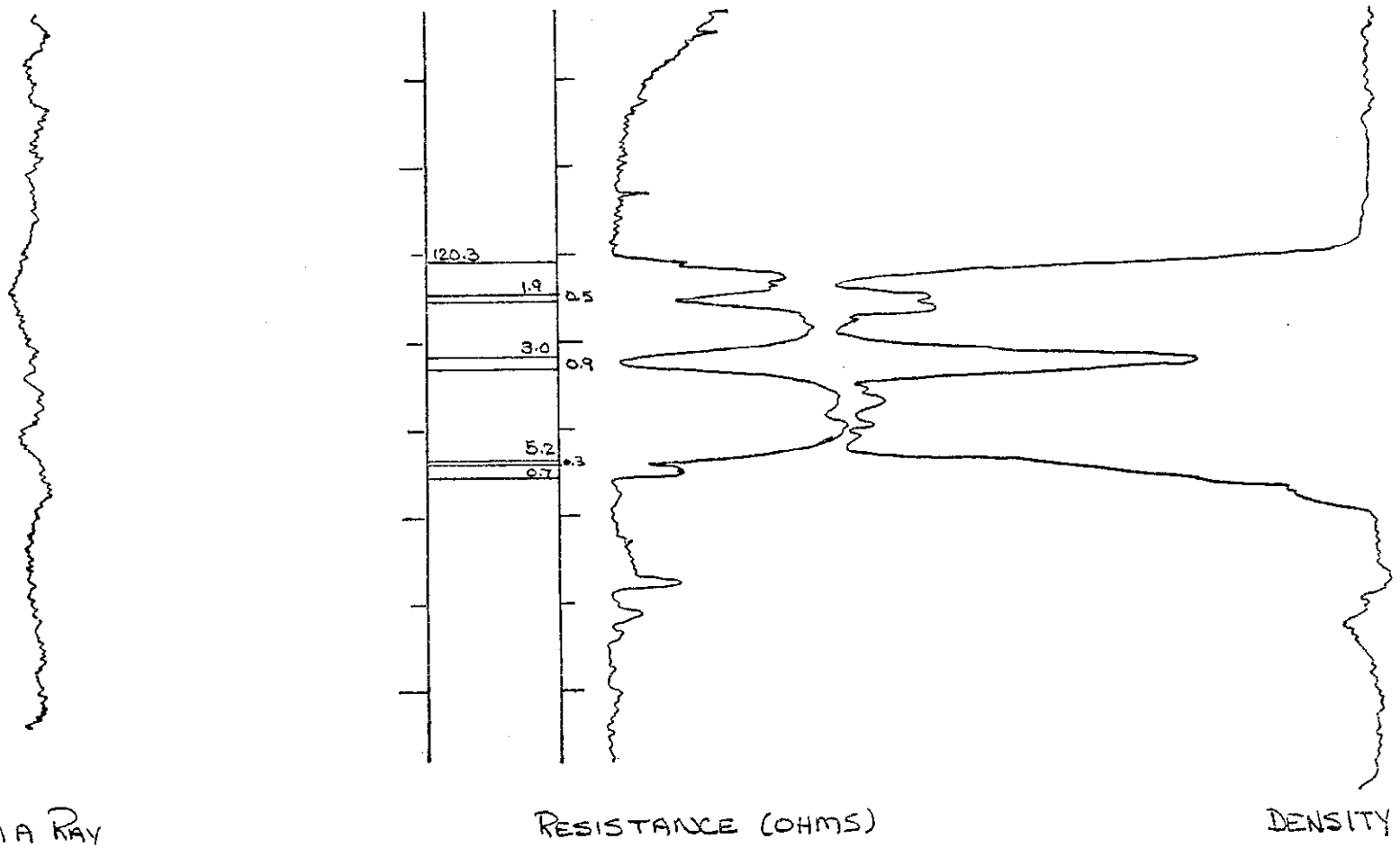
As stated in the Geology of the Coal Reserve in the area of Pit 2 North and Pit 2 Extension by S. Gardner, April 15, 1978, the seam is hard and massive except where the seam approaches a disturbed zone then the seam becomes lighter, softer and is easily broken.

QU-78-88

157+50 - 242 Lt

7.

Diagram 4



GAMMA RAY

RESISTANCE (OHMS)

DENSITY

SURFICIAL GEOLOGY

Glacial till over the Pit 3 North area consists mainly of boulder till with a sand or sandy-clay matrix. This light grey matrix oxidizes to a reddish brown color. Actual till cover over the pit area varies greatly with the least amount of cover over the central area of the pit (see diagram 8). This till thickens sharply to the south and west sides of the pit, dropping from 0' to 140' within 1000'. The till thickening in the south (line 135 + 00) represents an erosional channel that was filled with glacier retreat.

The same glacial action that disturbed the Pit 2 area on the west side also removed low ratio coal on the west side of Pit 3, although not disturbing the coal measures to the same extent. This glacial erosion on the subcrop edge has left the No. 1 seam subcropping at an average depth of 70'.

GEOLOGY

In the proposed Pit 3 North, the No. 2 and No. 1 seams occur within the Late Cretaceous Comox Formation. The sedimentary sequence consist of coarse conglomerate at the base above which lies a fine grained grey to brown siltstone interbedded with minor mudstone and coal seams. This is overlain by a medium grained thick bedded arkosic sandstone. The coarse conglomerate base lies with unconformity to the Triassic basement volcanics. In two locations in the proposed Pit 3 North area the No. 1 seam is thinned over highs in the basement rock (see diagram 7).

The No. 2 seam which normally has a seam thickness of 3.05' shales out completely to the northwestern side of the pit. The seam also thins on line 162 + 50 just right of the base line. To the north the stratigraphic separation between the No. 1 and No. 2 seam becomes less. Around line 195 + 00 the No. 1 seam shales out completely forming a carby zone just below the No. 2 seam. This is a sedimentary feature indicating the sedimentary basin is shallowing to the north and north east. As stated before, the No. 1 seam becomes badly split and very dirty in this area.

STRUCTURE

In the Pit 3 North vertical and horizontal stress has produced a series of high angle sub-parallel normal faults that originate in the basement. They trend in a north south direction and produce a series of up down blocks with an over all configuration of a syncline. (see diagram 5)

These faults were generated with the Cretaceous, uplift of the granitic batholith to the west.

Pit 3 North is split by two major north south trending faults with displacements of 10 to 50'. A series of minor faults accompanies these faults with displacements ranging from tenths of feet to ten feet. The syncline which plunges to the south is cut by a number of these faults striking sub-parallel to the axis. (see diagram 9)

The sandstone which is above the No. 2 seam exhibits very little fracturing or shearing, whereas softer less compotent siltstone and mudstone show varying amounts of stress. Coreholes near a disturbed zone showed numerous crushed and milled zones with abundent slickensides in siltstones and coal seams.

Sections A - A' B - B' showing synclinal in Pit 3 North area.

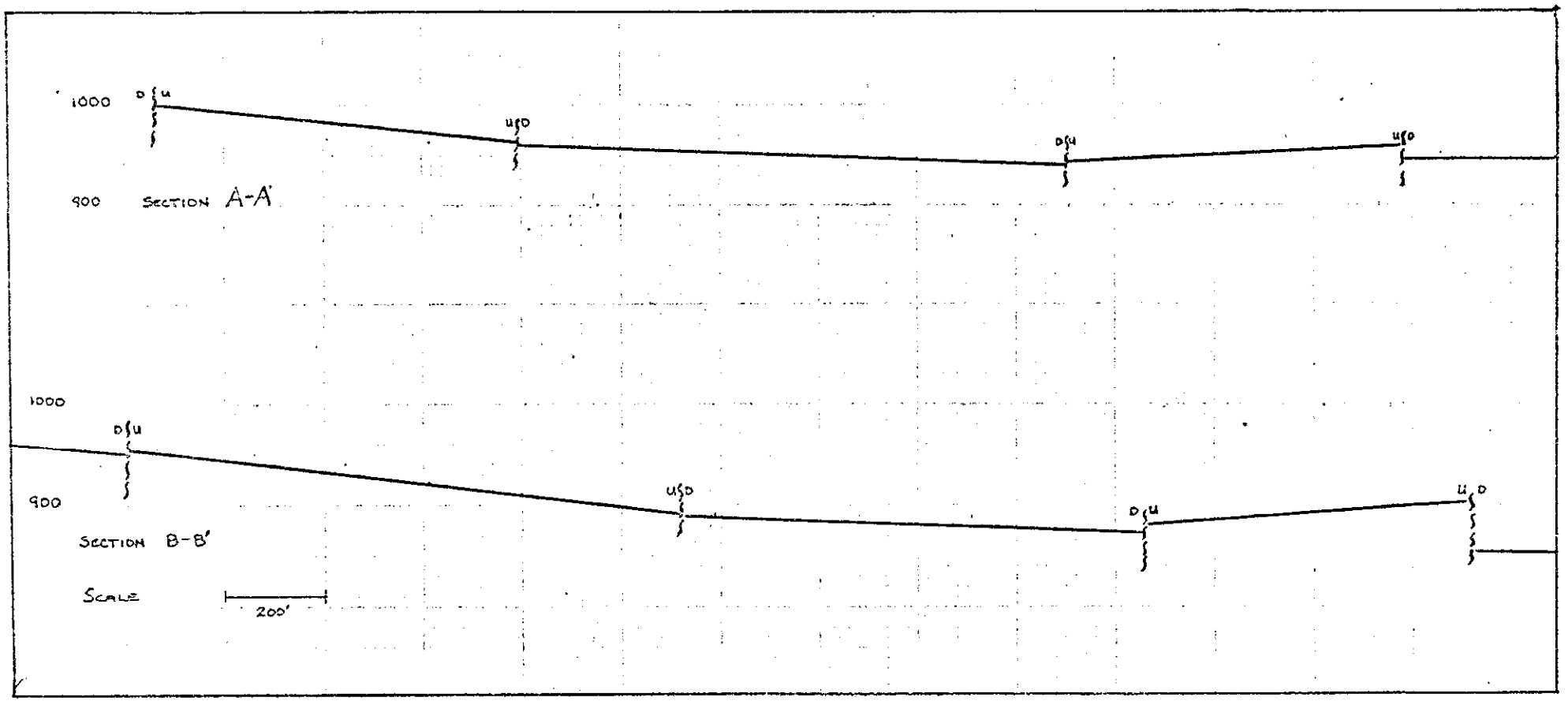
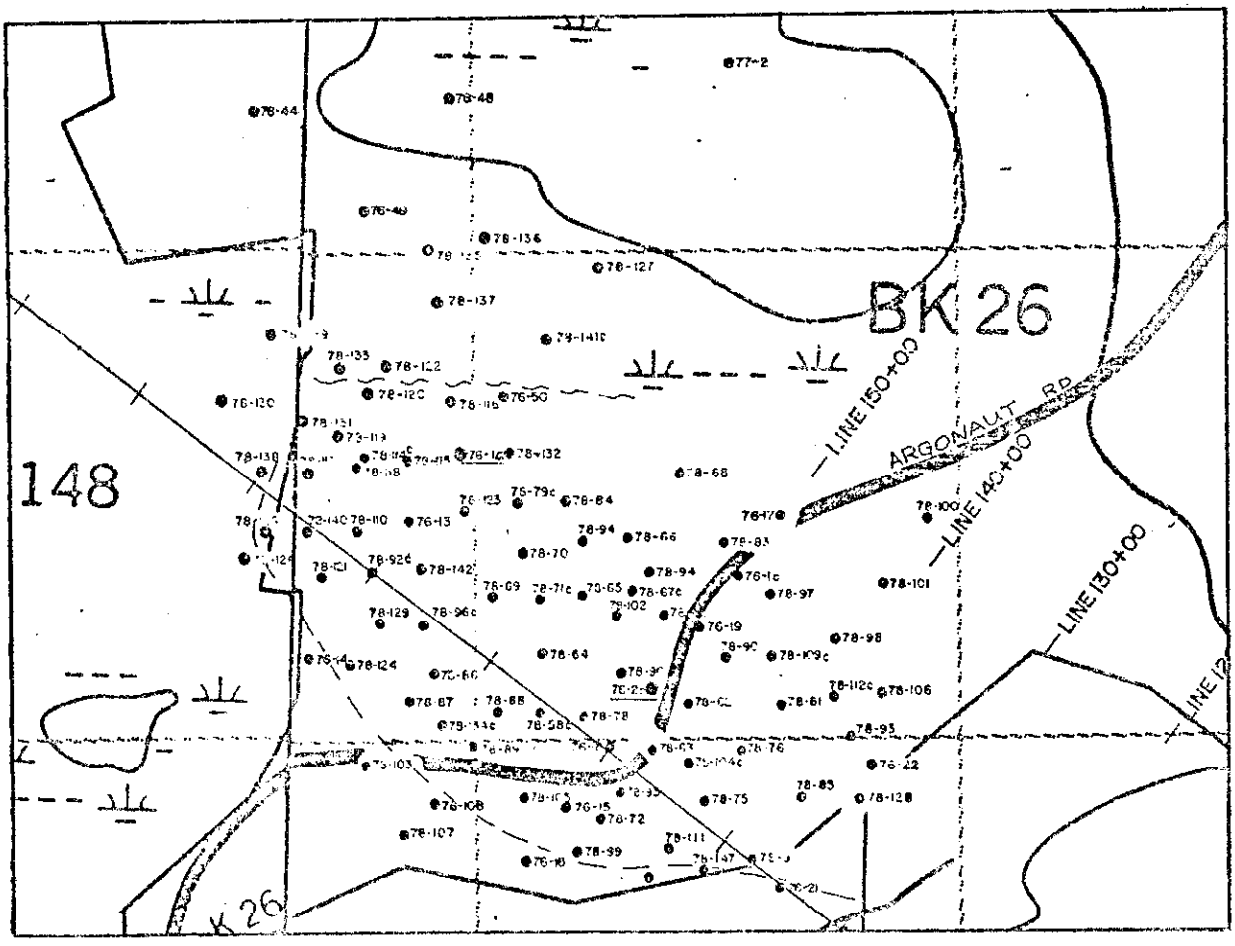


Diagram 5

COAL QUALITY

At the time of writing analytical results from the recent coring were not available. When analyses are complete, current results will be tabulated and examined in a Addendum to this report.

Existing quality data over the pit area is available from "Geology and Coal Reserves of the Quinsam Property, Vancouver Island, Phase I Report by R. Engler (1976)



RESERVES

The in place recoverable coal reserves were calculated within a 0 - 200' highwall using three categories:

1. 0 - 120' of overburden
2. 120 - 160' of overburden
3. 160 - 200' of overburden

Reserves were calculated by planimetering the areas of each of the three categories and converting this figure to square yards. This figure was then multiplied by the average raw coal thickness in the category to obtain a volume of coal. Coal volume was converted to a tonnage by using a coal density of 1.2 and overburden was estimated by multiplying surface area by mean overburden thickness.

TABLE NO. 2 OVERBURDEN THICKNESS

AREA	0-120'	120-160'	160-200'	TOTAL
1	726,866 ft^2	488,060 ft^2	1,613,731 ft^2	2,828,657 ft^2
	16.69 ac	11.20 ac	37.05 ac	64.94 ac
2	527,761 ft^2	658,806 ft^2	1,974,925 ft^2	3,161,492 ft^2
	12.12 ac	15.12 ac	45.34 ac	72.58 ac
3	500,299 ft^2	573,433 ft^2	903,284 ft^2	1,977,016 ft^2
	11.49 ac	13.16 ac	20.74 ac	45.39 ac
4	617,612 ft^2	675,224 ft^2	343,284 ft^2	1,636,120 ft^2
	14.18 ac	15.50 ac	7.88 ac	37.56 ac
TOTAL	2,372,538 ft^2	2,395,523 ft^2	4,835,224 ft^2	9,603,285 ft^2
	54.47 ac	54.99 ac	111.00 ac	220.46 ac

TABLE NO. 3

TABLE FOR IN PLACE RESERVES

	AVERAGE RAW COAL THICKNESS (FEET)		RESERVE AREA ($x10^6$ SQ.FT.)		RESERVE VOL. ($x10^6$ CU. YDS)		OVERBURDEN VOL. ($x10^6$ CU. YDS.)	RESERVE TONNAGE ($x10^6$ SHORT TONS)		COMBINED RATIO
RESERVE CATEGORY	NO. 2 SEAM	NO. 1 SEAM	NO. 2 SEAM	NO. 1 SEAM	NO. 2 SEAM	NO. 1 SEAM		NO. 2 SEAM	NO. 1 SEAM	
0 - 120	-	9.43	-	2.373	-	.828	8.349	-	.993	8.4:1
120 - 160	2.83	9.73	2.396	2.396	.251	.863	12.423	.301	1.035	9.3:1
160 - 200	3.1	9.7	4.835	4.835	.555	1.737	32.233	.666	2.084	11.7:1
TOTALS	2.97	9.62	7.231	9.604	.806	3.428	53.005	.967	4.112	10.4:1
								5.079		10.4:1

Pit 3 North 0 - 120 ft overburden limits

HOLE NO.	LINE	LOCATION	NO. 2 SEAM FT.	NO. 1 SEAM FT.
Qu 78-72	147 & 50	388 LT		11.3
Qu 78-99	147 & 50	678 L		11.6
Qu 78-15	150 & 00	480 LT	1.1	6.9
Qu 78-105	152 & 50	597 LT	0.9	10.8
Qu 78-102	155 & 00	766 RT		10.6
Qu 78-87	157 & 50	548 LT		9.8
Qu 78-88	157 & 50	242 LT	3.4	10.8
Qu 78-134C	160 & 00	536 LT		9.6
Qu 78-86	162 & 50	294 LT	2.4	10.3
Qu 78-87	162 & 50	548 LT		9.8
Qu 78-124	167 & 50	594 LT		9.5
Qu 78-121	172 & 50	229 LT		11.7
Qu 78-125	177 & 50	207 LT		12.6
Qu 78-117	177 & 50	254 LT		5.6
Qu 78-119	177 & 50	609 RT	1.0	1.7
Qu 78-120	177 & 50	930 RT		8.3
			1.76	9.43

Pit 3 North 120-160 ' overburden limits

HOLE NO.	LINE	LOCATION	NO. 2 SEAM FT.	NO. 1 SEAM FT.
Qu 78-91	137 & 50	12 RT	-	10.1
Qu 78-111	142 & 49	272 LT	-	10.9
Qu 78-95	147 & 50	170 LT	2.0	10.0
Qu 78-63	147 & 43	180 RT	3.4	11.3
Qu 78-78	152 & 52	28 RT	1.3	12.1
Qu 78-58C	154 & 99	43 LT	2.6	9.4
Qu 78-88	157 & 41	242 LT	3.4	10.8
Qu 78-96C	164 & 81	48 LT	2.3	10.5
Qu 78-129	167 & 40	252 LT	-	11.8
Qu 78-92C	169 & 89	7 RT	3.5	11.8
Qu 78-13	170 & 00	420 RT	3.0	10.4
Qu 78-11C	170 & 00	1001 RT	3.4	8.7
Qu 78-50	170 & 00	1488 RT	2.9	6.9
Qu 78-141C	169 & 95	1956 RT	2.7	6.9
Qu 78-110	172 & 38	154 RT	3.7	11.1
Qu 78-115	172 & 47	736 RT	3.3	9.6
Qu 78-116	172 & 53	1236 RT	3.0	7.9
Qu 78-114C	174 & 93	583 RT		8.3
			2.89	9.92

Pit 3 North 160 - 200 ft overburden limits

HOLE NO.	LINE	LOCATION	NO. 2 SEAM	NO. 1 SEAM
Qu 76-22	135 & 00	1006 RT	3.7	9.9
Qu 78-128	134 & 79	790 RT	3.6	9.8
Qu 78-85	137 & 72	548 RT	3.9	10.7
Qu 78-93	137 & 43	1076 RT	3.3	9.8
Qu 78-106	137 & 63	1436 RT	2.8	8.8
Qu 78-112C	140 & 20	1215 RT	2.8	10.3
Qu 78-75	142 & 64	116 RT	2.6	10.4
Qu 78-76	142 & 47	532 RT	1.1	11.1
Qu 78-81	142 & 57	975 RT	4.1	2.0
Qu 78-98	142 & 06	1538 RT	3.6	10.4
Qu 78-104C	145 & 02	283 RT	2.7	11.2
Qu 78-109C	144 & 93	1203 RT	3.4	10.9
Qu 78-62	147 & 57	598 RT	3.0	10.7
Qu 78-90	147 & 68	1000 RT	3.4	7.4
Qu 78-97	147 & 63	1512	2.9	9.3
Qu 76-2C	150 & 00	517 RT	3.0	11.7
Qu 76-19	150 & 00	1039 RT	3.4	7.2
Qu 76-1C	150 & 00	1500 RT	3.0	8.7
Qu 76-17	150 & 00	1966 RT	3.5	8.9
Qu 78-80	152 & 56	490 RT	3.3	11.0
Qu 78-82	152 & 66	989 RT	3.6	10.1
Qu 78-64	157 & 55	256 RT	3.8	9.8
Qu 78-65	157 & 47	724 RT	3.8	10.7
Qu 78-71C	159 & 76	511 RT	2.7	11.4
Qu 78-69	162 & 43	256 RT	0.5	10.6
Qu 78-70	162 & 53	711 RT	2.7	8.7
Qu 78-79C	165 & 04	980 RT	3.0	10.5
Qu 78-123	167 & 50	696 RT	3.4	11.5
Qu 78-132	167 & 50	1049	3.2	7.8
			3.10	9.70

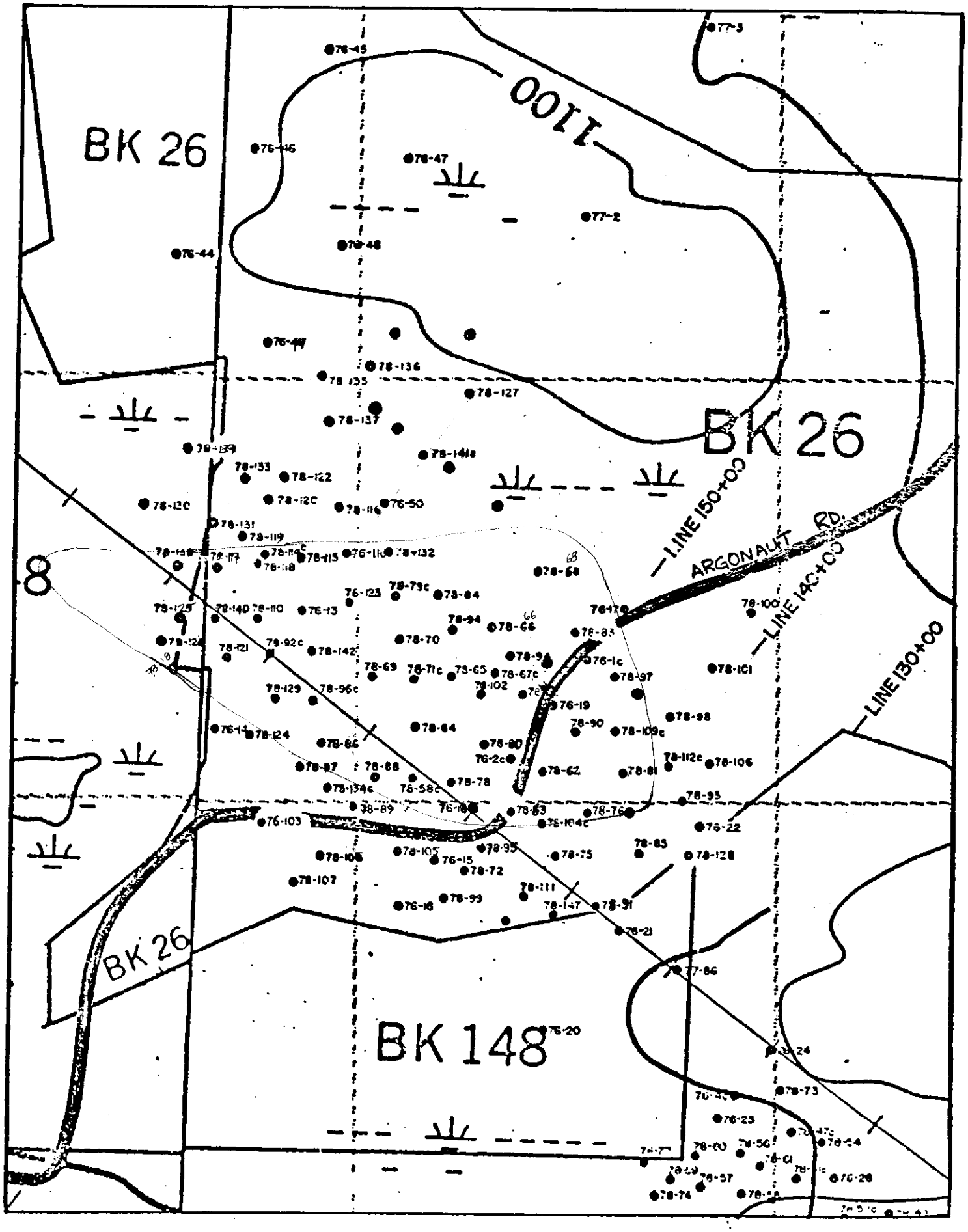
RECOMMENDATIONS

Drilling in the Pit 3 North area has brought about minor changes to the previous interpretation. These changes need more testing before a confident interpretation can be made (see Diagram 10)

On the northeast side of the pit, existing line (2000 RT base line) and road would give access to six drill hole locations. Some of these locations need cat work, so this work should be done before the Quinsam East block is started.

Three other holes in the main pit area would use existing line, and this work would be needed to check the existance of structural flat area. These holes would require approximately 2,300 feet of drilling which could be done in 5 shift days.

Diagram 10


BK 26
BK 26
BK 26
BK 148
1100
LINE 150+00
ARGONAUT RD.
LINE 140+00
LINE 130+00
8

REFERENCE DRAWINGS	ISSUE	DATE	INIT'L	REVISIONS	ISSUE	DATE	INIT'L	REVISIONS

SCALE 0 200 400 FEET

	BY	DATE
DRAWN	S.L.T. SOENEN	June 27/78
CHECKED		
APPROVED		
1st ISSUED		

TITLE

Seam I Thickness Isopach

71 (m1)

Cx Quinsam 78 (2) A (Sec. 2)

Diagram #7

DRAWING NO. 3

QS.G 121 GF 13

ISSUE

REFERENCE DRAWINGS

ISSUE	DATE	INITL	REVISIONS

ISSUE	DATE	INITL	REVISIONS

SCALE	1" = 200'	
	BY	DATE
DRAWN	S.L.T. SOENEN	June 26/78
CHECKED		
APPROVED		
1st ISSUED		

TITLE

Seam 2 Thickness Isopach

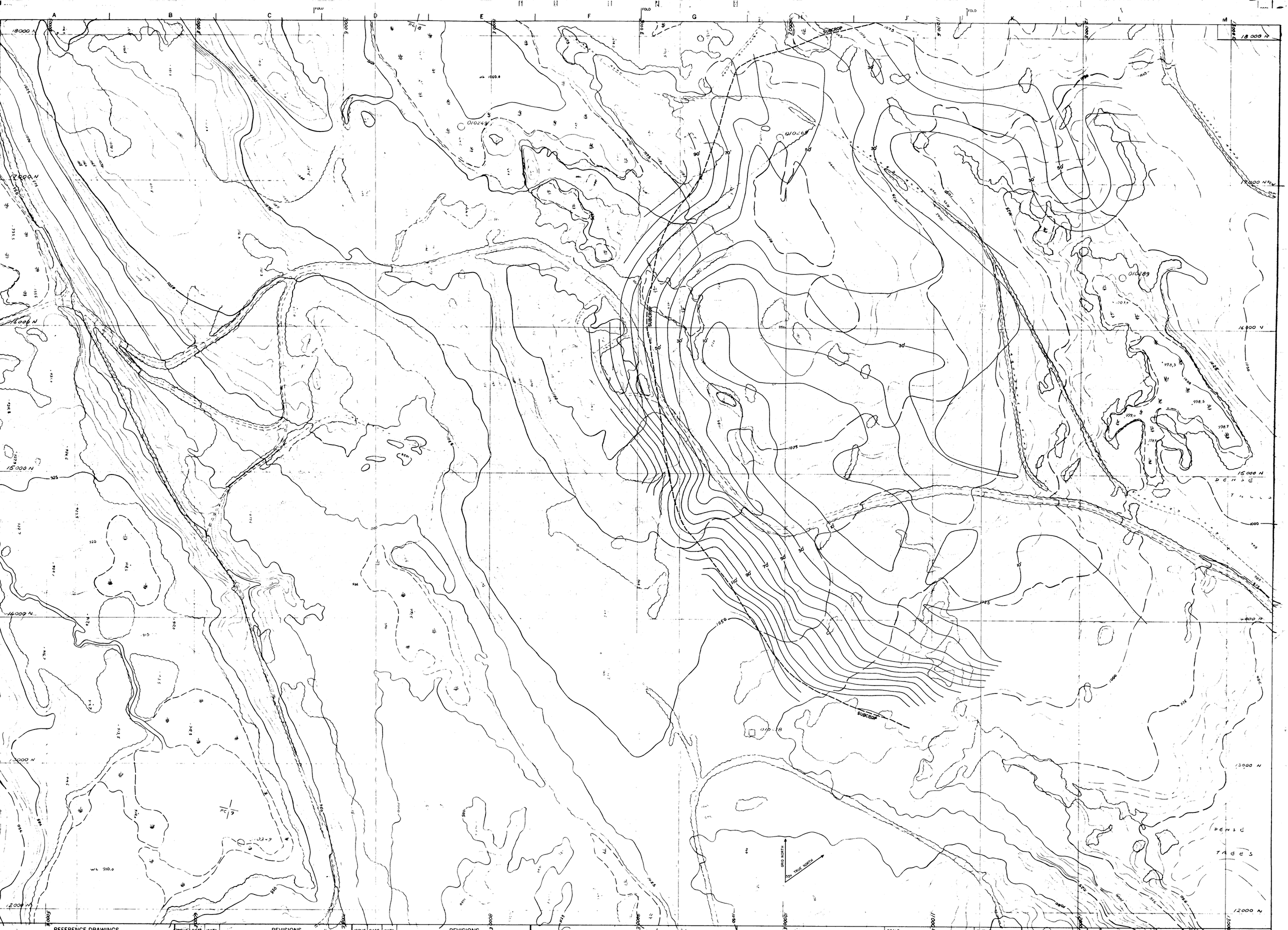
71 M2

Ck Gunsam 78(2)A (sec. 2)

DRAWING NO. 6.

45.G.006/GF.13

ISSUE



REFERENCE DRAWINGS	ISSUE	DATE	INIT'L	REVISIONS	ISSUE	DATE	INIT'L	REVISIONS

	BY	DATE
DRAWN	S.L.T. SOENEN	June 26/78
CHECKED		
APPROVED		
1st ISSUED		

SCALE 0 200 400 FEET

TITLE

Glacial Overburden Isopach

Ex- Guinsam 78 (2)A (Sec. 2).

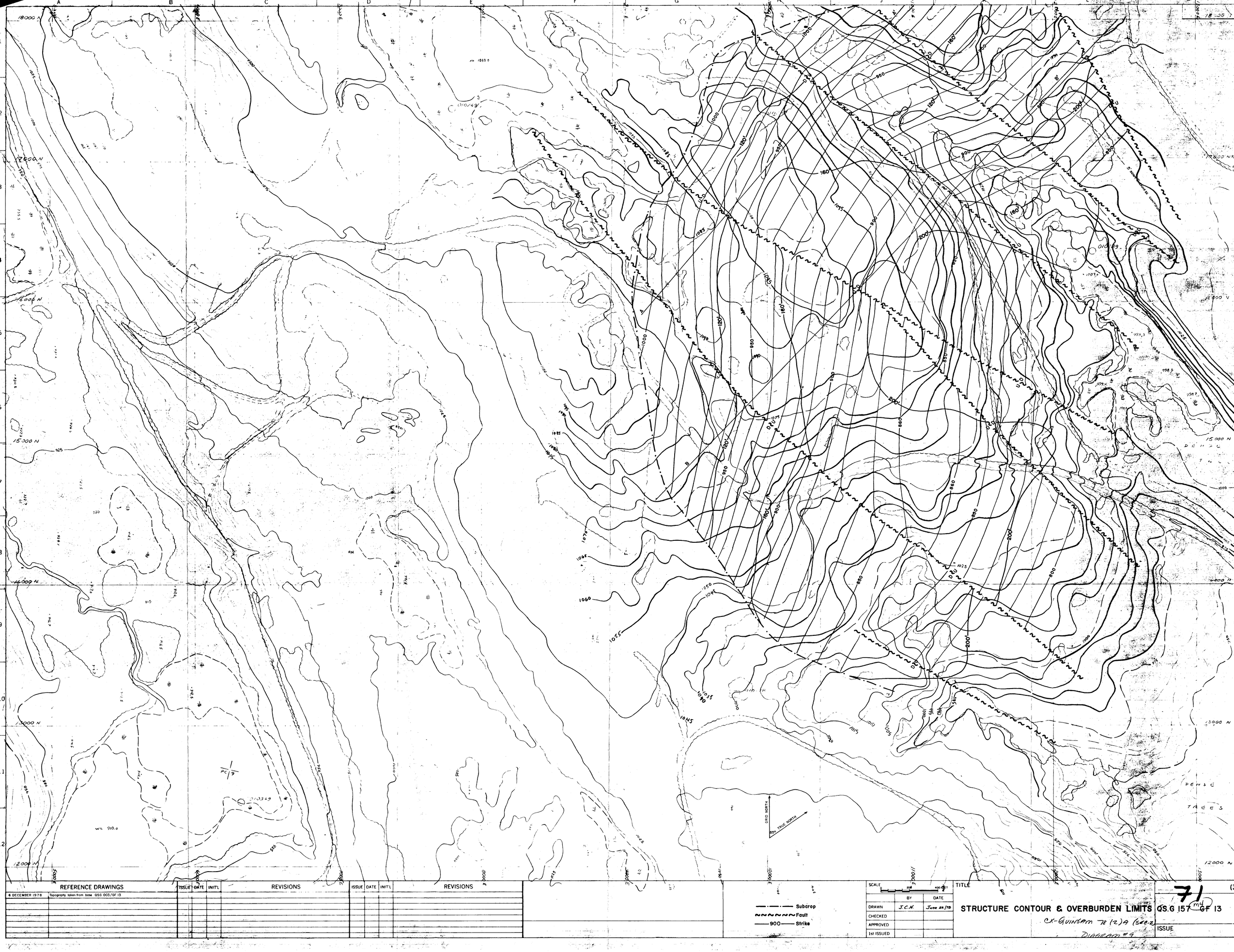
Diagram # 8

71 m3

DRAWING NO. ~3

QS.G 120 GF 13

ISSUE



REFERENCE DRAWINGS	ISSUE	DATE	INIT'L	REVISIONS	ISSUE	DATE	INIT'L	REVISIONS
6 DECEMBER 1978 Topography taken from base QSG 003/GF 13								

SCALE 0 200 400 FEET	BY	DATE
DRAWN	J.C.N.	June 28/78
CHECKED		
APPROVED		
1st ISSUED		

TITLE

STRUCTURE CONTOUR & OVERBURDEN LIMITS QS.G 157 GF 13

CX-GUINSAM 78 (12) A (Sec 2)

DIAGRAM #9

ISSUE

71