PR- SUKUNKA 77(1)

GEOLOGICAL INVESTIGATION OF THE UNDERGROUND WORKINGS: SUKUNKA COLLIERY

PREPARED FOR: B P EXPLORATION CANADA LIMITED

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DECEMBER 1977

REPORT NO. 3/1

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1. SUMMARY

An investigation of the mine workings at Sukunka has been carried out complementing and expanding upon previous geological studies of the area. The aim is to relate the geological conditions to the results of the present mining as an aid to future mine development.

The observations and conclusions drawn are tabulated as follows:

1. THE SKEETER SEAM - MINE NO. 1

   a) The upper and lower coal splits show little change in thickness from the portal to the face while the rock band gradually increases in thickness.

   b) The roof and floor strata are very hard and uniform, and the roof should provide an excellent medium for bolt anchorage.

   c) The internal characteristics of the coal are extremely regular, suggesting that only gradual changes due to sedimentary processes should be experienced.

   d) Roof falls occur at the unsupported lip of thrust faults and extend to a coal parting in the roof usually located 0.20 metres to 0.25 metres above the seam.

   e) Stone rolls in the floor are produced by folding on a small scale and are not abrupt. The stone rolls often precede roof thrusts and their presence may be a useful guide to roof support problems to follow.

   f) The coal of the pillars is generally hard, even in tectonically disturbed zones, except for a zone of sheared coal near the floor.

   g) All coal-rock contacts are sharp, and the floor surface appears to be even.

2. THE CHAMBERLAIN SEAM - MINE NO. 1

   a) The seam roof is a thin-bedded laminite which has deteriorated, probably due to successive freezing and thawing of moisture in the roof.

   b) The floor is a hard carbonaceous sandstone with an uneven surface.

   c) Stone rolls are abrupt and show no particular trend. Hence they are believed to be sedimentary in origin.

   d) The principal coal horizon shows a steady increase in thickness from the portal to the face, while the layer of bone coal and sheared rock does not appear to increase in thickness.

e) The Zone "A" roof and floor structures can be projected to the main zone of tectonic disturbance in the Skeeter seam, hence the zones "B" and "C" structures should also be projected to the Skeeter seam in plan to indicate expected zones of disturbance in advance of mining.

THE CHAMBERLAIN SEAM - "WINDOW MINE" AREA

a) The roof of the seam is laminite, and shows scaling similar to that in Mine No. 1. This is probably produced in the same manner.

b) The seam consists of two layers: an upper high specific gravity 'bone' coal layer and a principal coal section. Both units show no marked change in thickness within the workings.

c) The floor is very hard carbonaceous sandstone, although a thin band of claystone above the sandstone has been reported in some sections.

d) The coal is very hard except for a sheared layer near the floor.

e) No roof structures can be seen underground, but the presence of sigmoidal laminite roof structures can be seen at the surface.

f) No tectonic structures are present in the floor, but a small group of sedimentary stone rolls was mapped. The floor surface is notably irregular.

g) The "Window Mine" area appears to provide the best geological setting for mining when comparing the three areas studied. However, it is impossible to determine the level of stability of the roof, seam, and floor strata when mining is undertaken beneath average depths of cover. The intersection of small scale roof and floor tectonic structures, such as were encountered at Mine No. 1, should be anticipated. It is reasonable to expect that similar mining conditions would prevail under these circumstances.

2. INTRODUCTION

At the request of B P Canada Limited, a study of the underground workings of the Sukunka coal mine was carried out. The following report includes the results of that study and an interpretation of the effect of the various geological features upon mining conditions.

An investigation of the main Chamberlain seam workings had been carried out in 1973 by Clifford McElroy and Associates for Coalition Mining Limited, and the results of that study were made available as Report No. 1/4/24 in January of 1976. That report concerned only the mine workings developed to September of 1973.

The current investigation is intended to complement Report No. 1/4/24 by providing similar data for the Skeeter seam and the additional Chamberlain seam workings at Mine No. 1 and for the Chamberlain seam working at Chamberlain Creek. In addition, the following report and accompanying plans are intended to establish a system for reporting underground geological data as mining proceeds on the Sukunka - Bullmoose property.

While the previous study was especially concerned with aspects of the detailed structural geology, the current investigation is concerned not only with structural geology but also with stratigraphy and the prediction of various aspects of the geology in advance of mining.

The following geological features have been investigated in the present study:

a) Seam stratigraphy, to determine the continuity of coal and rock banding, as well as roof and floor lithological variations.

b) Roof falls and their relationship to both structural and stratigraphic features.

c) Contact relationships between coal and non-coal materials.

d) The dimensions and orientation of stone rolls and their relationship to stratigraphy and structure.

e) The orientation and intensity of faults, joints, and other tectonic structures.

f) Roof and rib stability, especially where tectonic structures are present or where roof falls have occurred.

3. THE SKEETER SEAM - MINE NO. 1

The following discussion includes a description of the roof, seam and floor strata of the Skeeter seam observed underground at Mine No. 1. These observations are compared with the geological logs of adjacent drill holes. A description of structural features such as stone rolls, thrust faults, slip planes and cleats is also given. The effect of these structures on mining and on variations of seam unit thicknesses is also described.

3.1 SKEETER SEAM ROOF STRATA

A detailed investigation of the roof strata of the Skeeter seam was made at each intersection and at selected locations along the roadways and cross-cuts.

The roof of the seam is composed of a well-lithified, slightly silty carbonaceous and fossiliferous mudstone. No variation to this lithology was found throughout the mine workings. Minor local variations in the roof strata caused by an increase or reduction in the abundance of plant debris were observed. The bedding of roof strata appears to be poorly developed when compared with the Chamberlain seam roof.

The immediate seam roof described above is usually 0.20 metres to 0.25 metres thick and is overlain by a thin coal band or parting. The silty carbonaceous mudstone lithology persists above the coal parting.

The contacts of the coal parting with the mudstone above and below always showed tectonic "polishing" with slickensides and listric surfaces being well developed at each point of observation. This feature will be further discussed later in this report in conjunction with a description of Skeeter seam roof falls.

The sequence described above was compared with the detailed logs of drill core from holes within or immediately adjacent to the mine workings. The core descriptions tend to suggest that the roof lithologies have considerable variation, perhaps due to facies changes between

holes. It would appear that this is not the case, however, and the recorded differences probably reflect the logging styles of different geologists. The roof strata underground can readily be seen to be very consistent.

3.2 SKEETER SEAM STRATA

The Skeeter seam consists of two coal splits separated by a rock band located approximately two thirds of the distance from the roof to the floor. Section No. A4 on the following page is included as a typical seam section.

The internal lithologies of each split and the rock band are remarkably consistent throughout the mine workings.

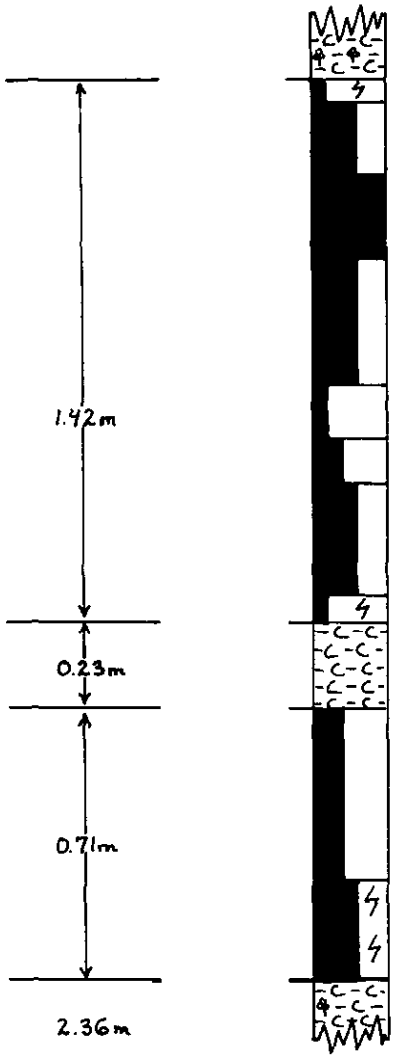
The upper coal parting is characterised by a zone of bright coal bands near the top and by a very persistent and easily identifiable bed of dull hard coal towards the base. The contacts of the coal with the roof and the rock band are sharp with no gradation to mudstone. Thin bands of hard dull coal are usually located at the contacts, although these bands were often found to be intensely sheared by tectonic movement at the coal-rock interfaces.

Map No. 1 is an isopach map showing the variation in thickness of the upper coal split. Although the split is thickened within the main zone of tectonic disturbance crossing the mine workings, only a small increase in thickness from the portal to the face is apparent. The average upper split thickness is 1.45 metres at the portal and 1.60 metres at the face.

The rock band is composed of a hard, very poorly bedded carbonaceous mudstone and is found to be continuous throughout the mine workings. Map No. 2 is an isopach map showing the thickness variation of the rock band. The map shows that there is an increase in thickness at the face to 0.30 metres, especially towards the western side of the mine workings.

One of the miners at the site commented that the lack of weakness planes such as bedding had made cutting and removal of the band difficult during mining.

MINE NO.1 – SKEETER SEAM – Section A4



CARBONACEOUS MUDSTONE - slightly silty, abundant plant fossils.

COAL – dull, sheared.

– dull & bright.

– bright.

– dull & bright.

– dull.

– dull banded.

– dull & bright.

– dull, sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

– dull & bright, sheared.

CARBONACEOUS MUDSTONE – small plant fragments.

SCALE 1:20

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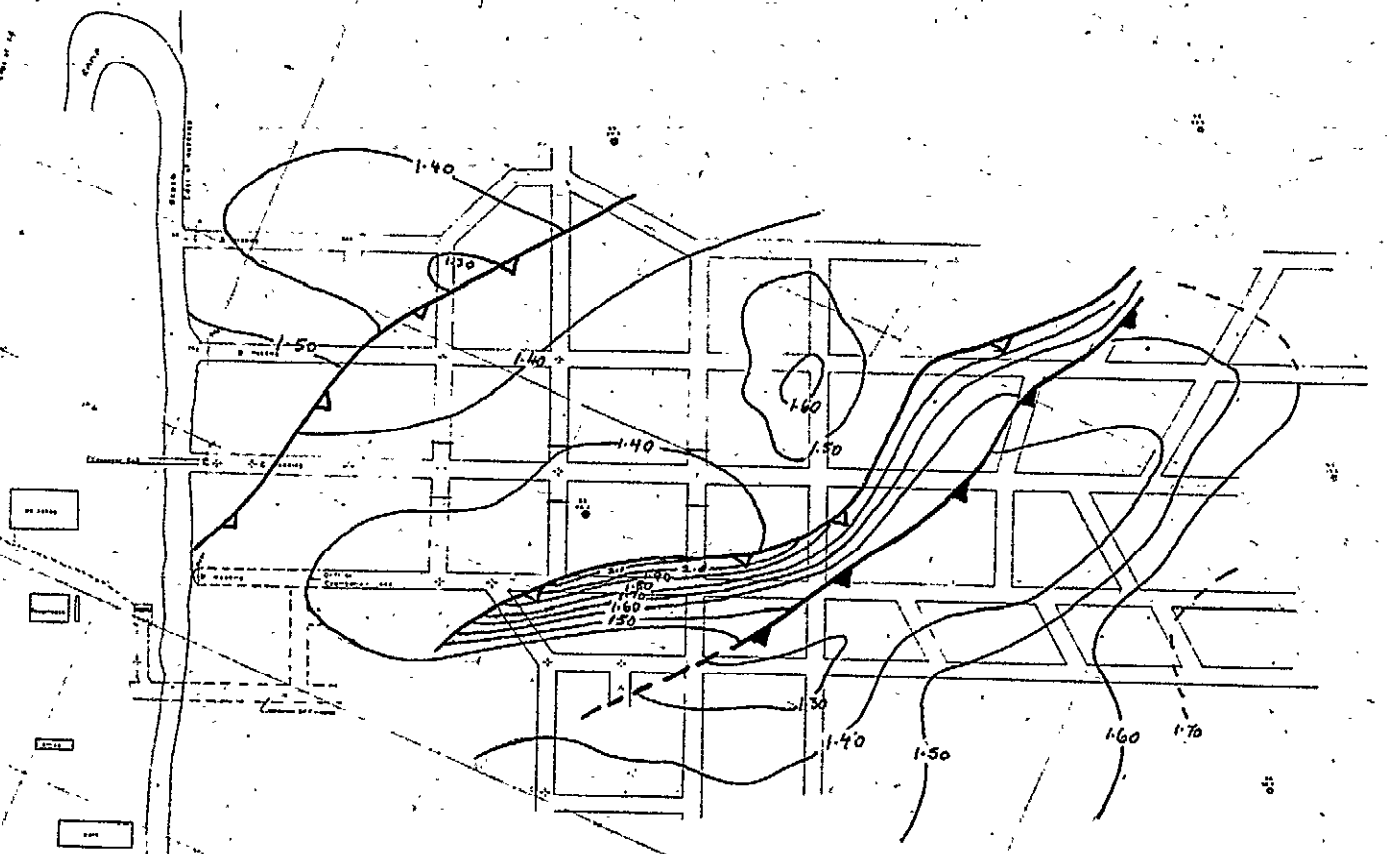
MINE NO.1 - SKEETER SEAM - UPPER SPLIT ISOPACH MAP



Geology compiled by
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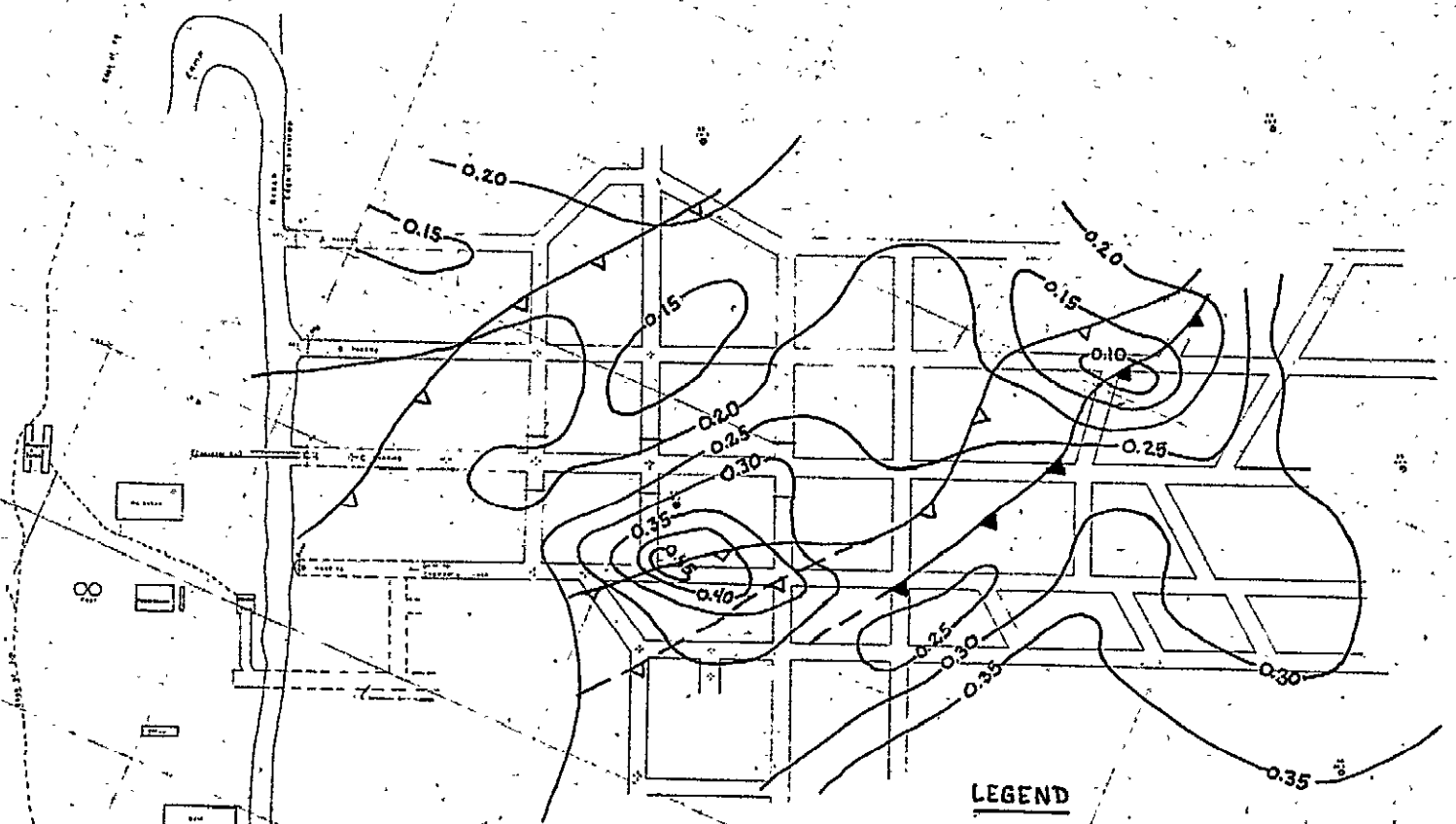
Map No 1
MINE PLAN SKEETER SEAM
1: 2500

MINE NO.1 – SKEETER SEAM – ROCK BAND ISOPACH MAP



LEGEND

THRUST FAULT – roof

THRUST FAULT – floor

Contour Interval = 0.05 m

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Map No. 2

MINE PLAN SKEETER SEAM

1:2500

The lower coal split is characterized by dull banded coal in the top half becoming dull and bright banded coal in the lower half. The lower dull and bright coal is usually intensely sheared and soft. the pattern described above is found in all seam sections measured throughout the mine workings. The contacts between the rock band the seam floor are sharp with no gradation to mudstone. Map No. 3 is an isopach map of the lower split and, like the upper split, shows that there is little normal variation of split thickness from the portal to the face except for a tectonically disturbed zone where a system of thrust faults trends across the mine workings.

Map No. 4 shows the locations where Skeeter seam section measurements were taken, and Appendix "A" includes seam graphic sections prepared from measurements.

3.3 SKEETER SEAM FLOOR STRATA

The Skeeter seam floor consists of a hard fossiliferous carbonaceous mudstone. This lithology appears to be persistent throughout the mine workings without variation.

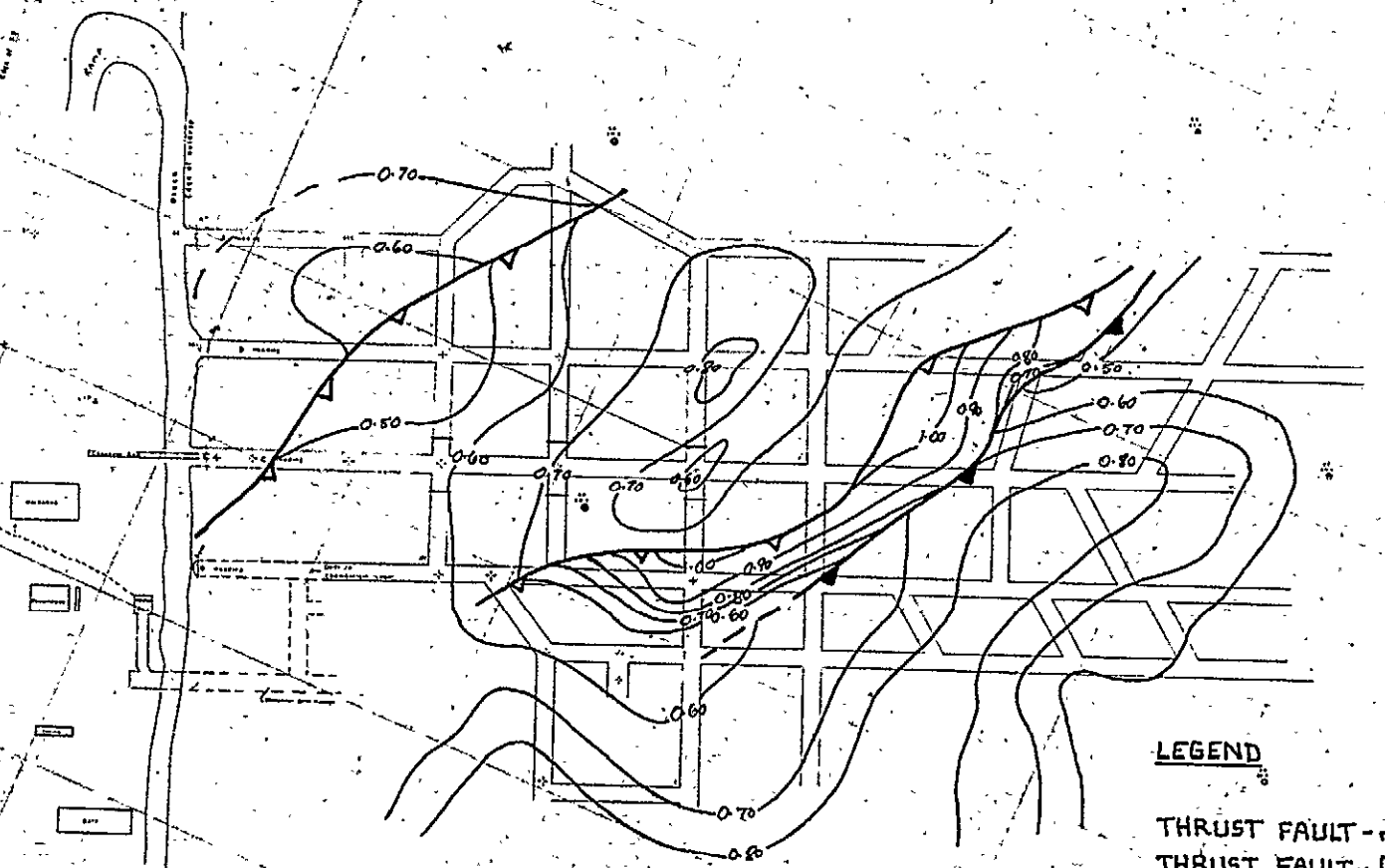
The floor surface, although not completely planar, appears to be regular, and free of sedimentary irregularities such as abrupt pot holes and rises which are characteristic of the Chamberlain seam floor. Several "stone rolls" were observed and these will be discussed in a separate section of this report.

3.4 THRUST FAULTS AND SLIP PLANES

Small scale thrust faulting is frequently observed in the Skeeter seam roof and occasionally in the seam floor. Most of the roof thrusts are small scale slip planes involving no displacement of the coal seam.

With very minor exceptions, all the thrust fault structures trend in a north west - south east direction diagonally across the mine workings and the fault planes dip towards the south west. Figure No. 1 shows the trend of the principal roof and floor thrust faults and slip planes, and Map No. 5 shows all the structures in detail.

MINE NO. 1 – SKEETER SEAM – LOWER SPLIT – ISOPACH MAP



LEGEND

THRUST FAULT - roof

THRUST FAULT - floor

Contour Interval = 0.10 m

Geology compiled by
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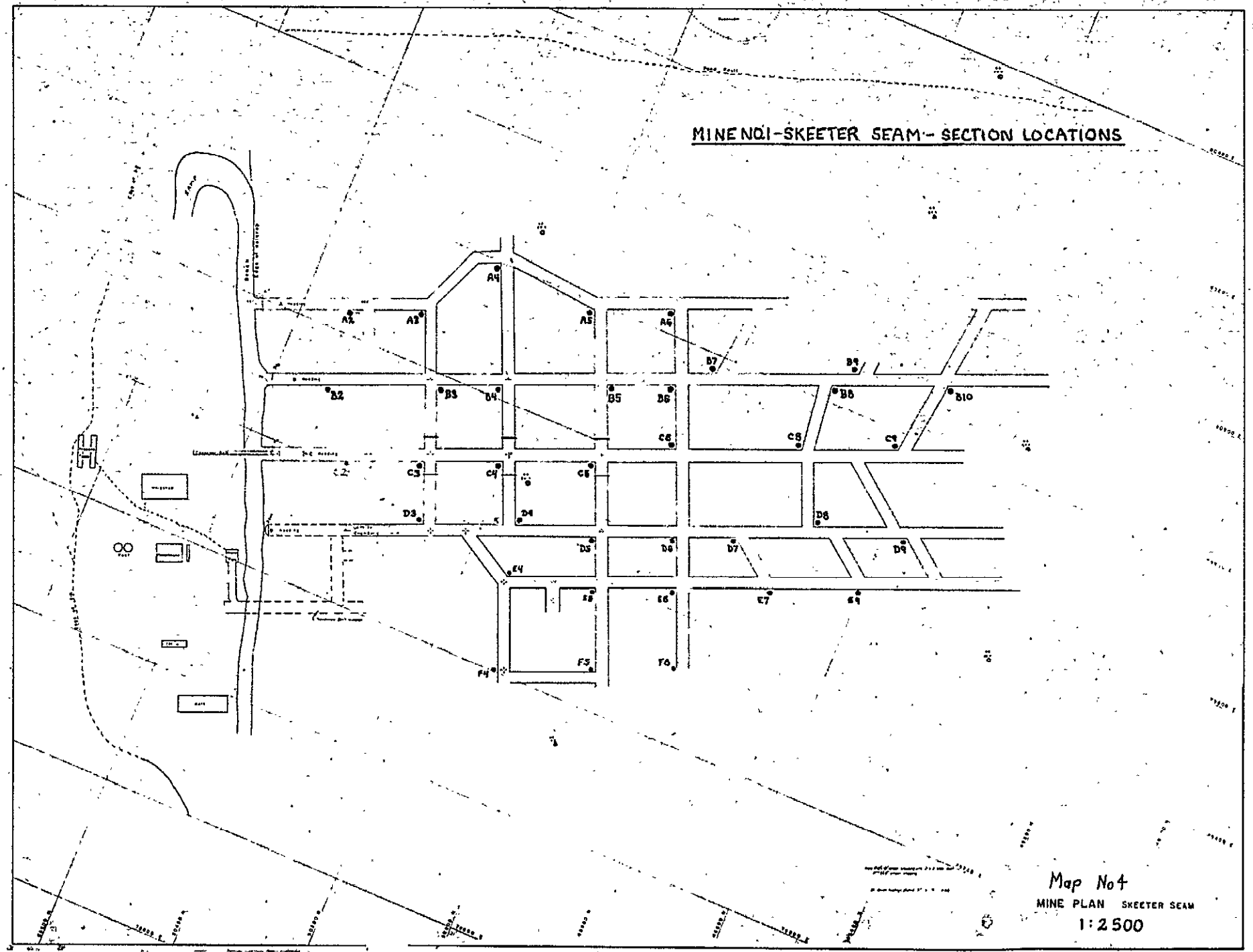
Map No 3

MINE PLAN SKEETER SEAM
1:2500

MINE NO1-SKEETER SEAM- SECTION LOCATIONS

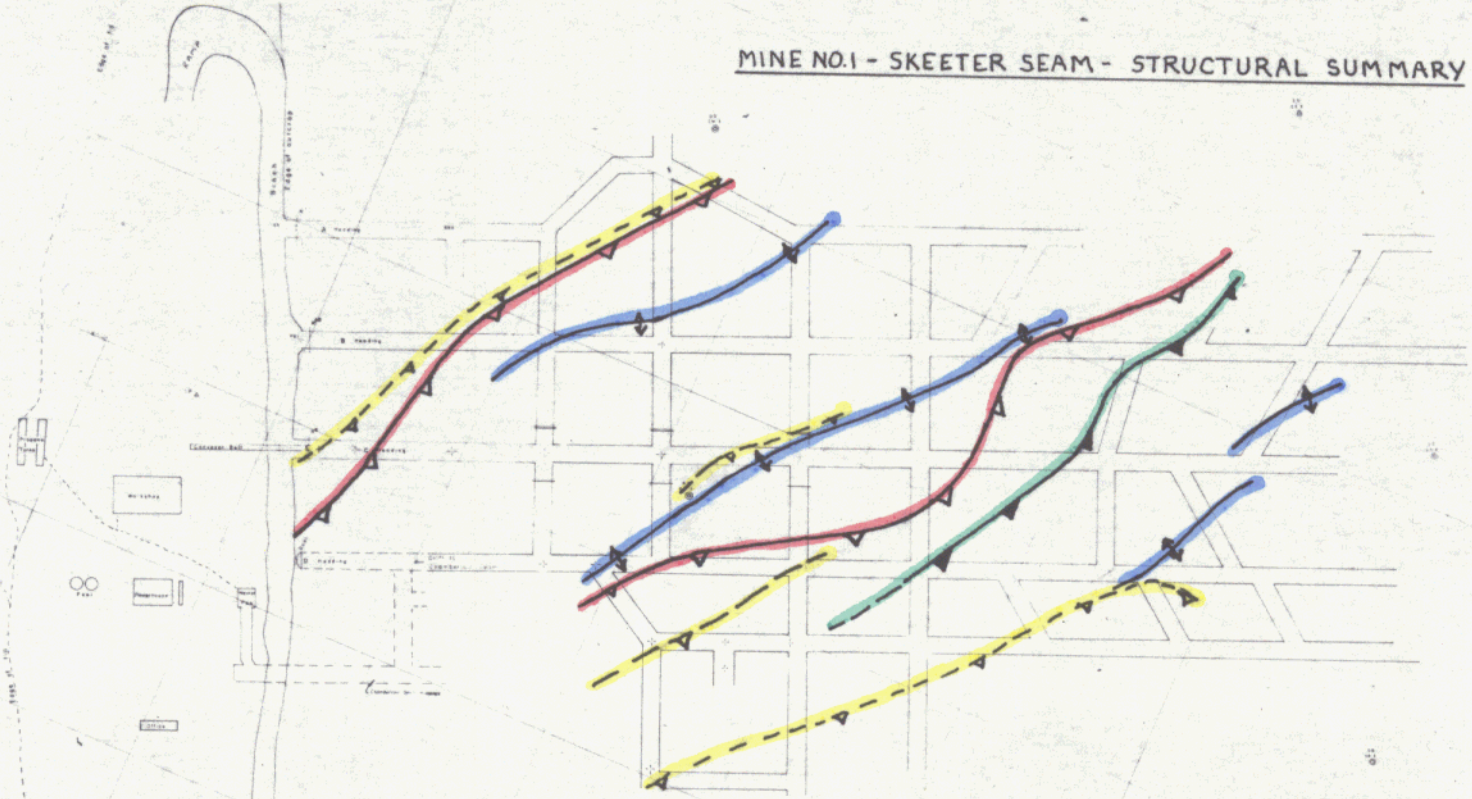


Map No 4

MINE PLAN SKEETER SEAM

1:2500

MINE NO.1 - SKEETER SEAM - STRUCTURAL SUMMARY



LEGEND

THRUST FAULT - roof

THRUST FAULT - floor

STONE ROLL

SLIP PLANE - no seam dislocation

Figure No. 1

Geology compiled by
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MINE PLAN SKEETER SEAM
1:2500

The McElroy report No. 1/4/24 documented a bedding plane fault located at the top of the Chamberlain seam in Mine No. 1. A similar structure sppears to be present at the top of the Skeeter seam in Mine No. 1 and most of the thrust faults located in the Skeeter seam roof have developed from this fault in a "ski jump" fashion. Consequently no displacement of the coal is observed. Only two thrust faults in the roof and one in the floor displace the coal, and in some instances it can be observed that these structures have developed in a similar manner to the "ski jump" style of structure. It therefore appears that the nature of thrust faulting is related to the degree of deformation. Figure No. 2 illustrates such a mechanism with increasing intensity of deformation. This mechanism suggests that small scale slip structures will be the most common thrust fault related structures encountered underground, displacement of the seam roof the next most common, and failure of the roof and floor being the least common situation. Roof and floor thrust faulting apparently required the greatest amount of deformation and the least conservation of energy.

The floor thrust and its roof thrust, which is located immediately to the north, are clearly the same thrust fault. Projection of the "Zone A" structures of the Chamberlain seam shows that this is also the same structure.

The roof thrust displacing only the Skeeter seam roof, located closer to the portal, is therefore intermediate in the degree of deformation between the numerous "ski jump" slip planes and the "Zone A" and related structures.

3.5 STONE ROLLS

Rolls have been recorded at several locations in the Skeeter seam workings. These structures are small scale folds produced by tectonic stresses and are not sedimentary in origin.

The rolls are broad and regular and follow the trend of the roof structures. They are distinctly different from stone rolls of the Chamberlain seam floor which are abrupt, often asymetrical, discontinuous

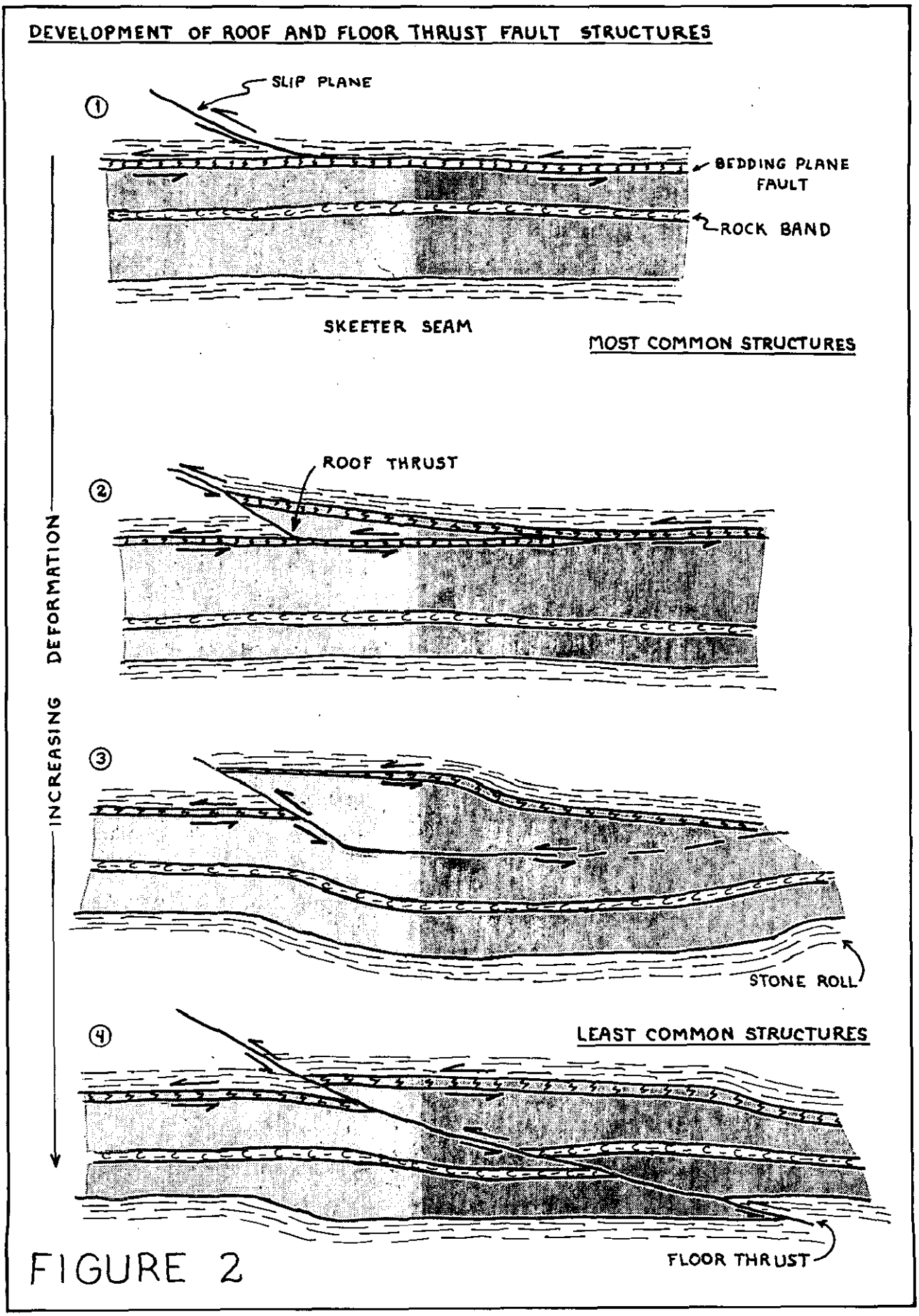

DEVELOPMENT OF ROOF AND FLOOR THRUST FAULT STRUCTURES
SLIP PLANE
①
BEDDING PLANE FAULT
ROCK BAND
SKEETER SEAM
MOST COMMON STRUCTURES
ROOF THRUST
②
INCREASING DEFORMATION
③
STONE ROLL
④
LEAST COMMON STRUCTURES
FLOOR THRUST

FIGURE 2

and trend in a random manner with respect to the tectonic structures.

The rolls in the Skeeter seam floor usually have an amplitude (γ) of 0.25 metres to 0.5 metres and a half wave length ($\frac{1}{2}\lambda$) of five metres to fifteen metres.

During mining and mapping of the subsequent worked area it was observed that the rolls often occurred immediately below or preceeding the "lip" of a thrust fault displacing the seam at the roof or floor. Hence the presence of stone rolls can be a useful indicator of roof support difficulties to follow.

The relationship between the Skeeter seam floor rolls and the thrust faults is shown diagramatically on Figure No. 3 of the following page and in detail for each roadway section on Map No. 6.

3.6 ROOF FALLS

At several locations roof falls have occurred in the Skeeter seam workings. In all cases the falls have been small, especially when compared with the extensive areas of fallen roof in the Chamberlain seam workings of Mine No. 1.

All Skeeter seam roof falls occur at the unsupported lip of a slip plane or roof thrust and terminate upwards at the slickensided coal parting located 0.20 metres to 0.25 metres above the immediate seam roof. In most cases the roof was "caught" within 3 metres of the slip plane joining the polished coal parting. Instances where roof material to the coal parting continued to fall are found near the portal. This may reflect weakening of the strata in this area due to weathering effects.

It is observed that a high frequency of roof falls occur at roadway and cross-cut intersections. It would appear that this is not related to mining practice but to the unusually high frequency of slip planes and roof thrusts being intersected at these junctions. The spacing between slip planes may be statistically similar to the diagonal width of the pillars; the evidence underground would suggest that this is the case. Hence, with the thrust fault structures trending at approxi-

RELATIONSHIP BETWEEN ROOF THRUSTS AND STONE ROLLS - SKEETER SEAM

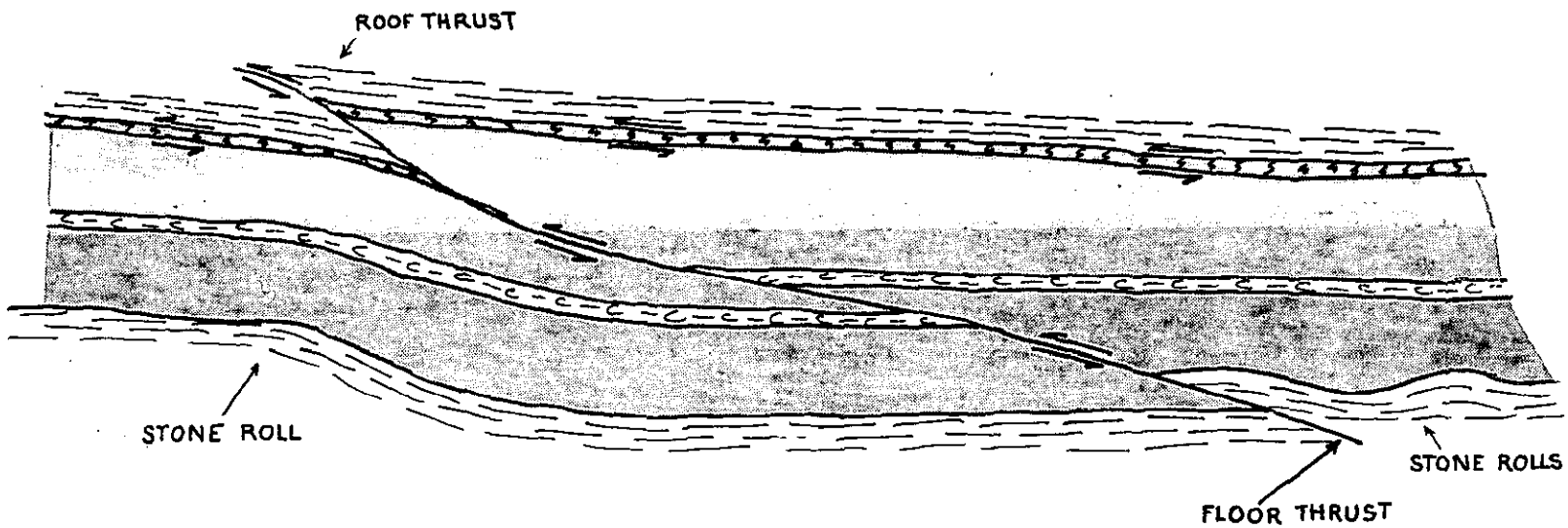


FIGURE 3

mately 45° to the heading directions, it is possible, with extreme bad luck, to encounter a thrust plane at each intersection.

The roof strata above the coal parting are extremely competent with only a weakly developed bedding. Hence it provides an excellent medium for bolt anchorage. One of the miners at the site commented that the roof material was so hard that bolting was achieved using stopers after unsuccessful attempts were made to drill the roof using the bolting unit on the site.

The areas of high roof located within the main zone of tectonic disturbance are free of roof falls. The height was simply achieved by cutting the coal to the natural seam roof.

3.7 RIB JOINTS AND PILLAR CONDITION

Map No. 5 shows an area selected for the measurement of intra seam joints. Seventy-five failure planes were randomly selected, measured and plotted as poles on the stereogram included in Appendix "B".

Both shear joints and coal cleats were anticipated to appear on the sterographic plot. No attempt is made here to analyse the results of this single plot since a thorough study involving measurements from numerous areas would be the only way to achieve any conclusive results. However, it can be observed that the plot is very similar to a plot of rib joints measured in the Chamberlain seam of Mine No. 1.

It is believed that the great scatter of results compared with results from the Chamberlain seam of the "Window Mine" area reflects the increased tectonic deformation at Mine No. 1. The principal coal failure plane, a near vertical cleat, has a bearing of 135°.

The coal of the rib was hard at all points of investigation including the mine areas showing the most intense tectonic deformation. The only significant portion of "soft" coal was consistently located within the sheared layer near the floor of the seam.

4. THE CHAMBERLAIN SEAM - MINE NO. 1

A detailed description of the Chamberlain seam in Mine No. 1 was presented in the McElroy Report No. 1/4/24. In this report, comments will be confined to the studied mine workings which were constructed subsequent to the presentation of Report 1/4/24. Some of the comments made in the earlier report will be repeated to allow comparison between the Chamberlain seam and Skeeter seam workings of Mine No. 1.

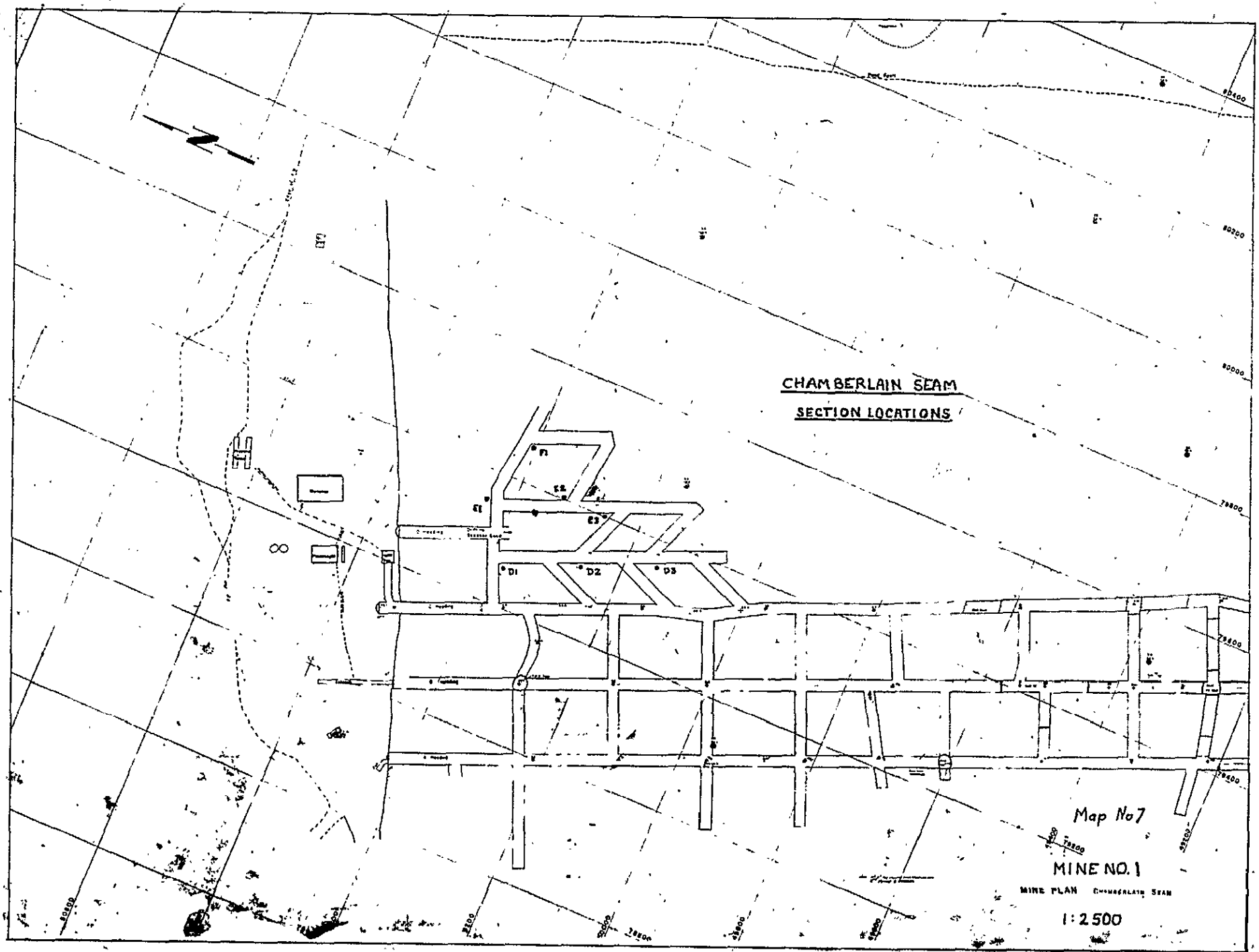
4.1 CHAMBERLAIN SEAM ROOF STRATA

The Chamberlain seam roof consists of a well-bedded sequence of thin graded beds within the first two metres of seam roof. Each unit is composed of siltstone at the base grading to claystone at the top and has a thickness or less than one centimetre. Hence the Chamberlain seam roof has been described as a laminite. The strata above the laminite consists of a hard massive siltstone.

The Chamberlain seam roof usually contains stratigraphically controlled continuous zones of tectonically disturbed strata with a characteristic internal configuration. These structures have been referred to as sigmoidal laminite zones. The presence of these zones when combined with thrust faults in the roof usually resulted in large roof falls of laminite roof to the base of the overlying siltstone.

Map No. 7 shows the location of seam sections measured in the Chamberlain seam workings of Mine No. 1. The graphic sections prepared from these measurements are included within Appendix "A". In the more recent workings of the Chamberlain seam, laminite was again the only immediate seam roof lithology observed.

During an inspection of the Chamberlain seam workings it was observed that a large amount of the seam roof had failed and scaled off as bedding plane slabs or flakes. The same phenomenon was observed during the earliest workings of the Chamberlain seam at Mine No. 1 prior to the installation of heating equipment. At that time the rapid rate of deterioration of the seam roof caused considerable concern.


CHAMBERLAIN SEAM
SECTION LOCATIONS
C1
C2
C3
D1
D2
D3
Map No 7
MINE NO. 1
MINE PLAN CHAMBERLAIN SEAM
1:2500

Subsequent to the installation of heating equipment it was found that roof deterioration was greatly retarded. It was concluded that the freezing of moisture in the roof was forcing the beds to separate and fail in a manner similar to frost heaving. In the new workings of Mine No. 1 flooding of the mine followed by removal of the mine water and freezing probably has resulted in the extreme amount of immediate seam roof deterioration.

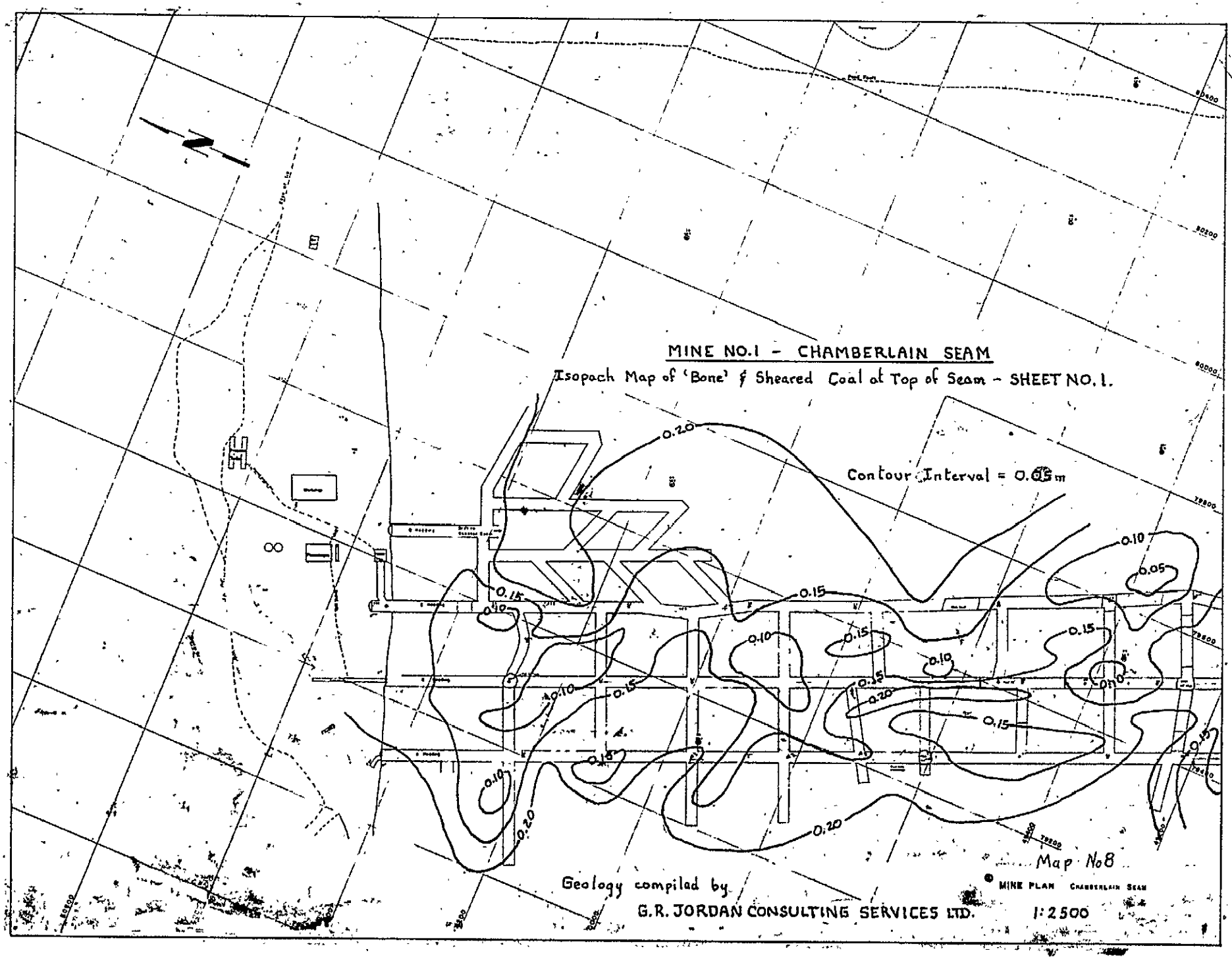
4.2 CHAMBERLAIN SEAM STRATA

Section No. E1 is included on the following page as a typical seam section for the Mine No. 1 area. The seam consists of two principal beds: an upper bed of high specific gravity low swelling boney coal underlain by the principal coal section. The bone coal layer is usually partially or wholly sheared by bedding plane faulting at the seam and roof contact. An isopach map of the bone coal layer, including the sheared portion, has been prepared from new and existing data for the mine workings. The isopach map is included here as Map No. 8 and it shows that there is no sigificant change of the unit thickness throughout the mined area.

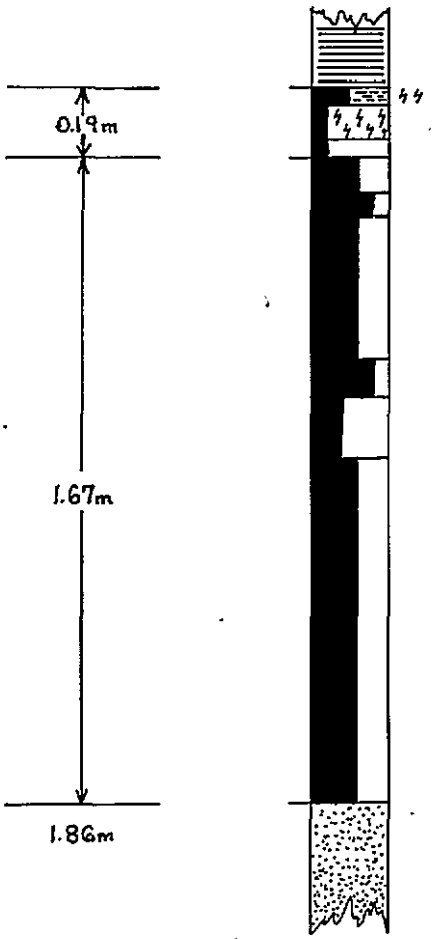
The principal coal horizon is a fairly uniform section of dull and bright coal with a few consistent units displaying a moderate increase or reduction of the percentage of bright bands. Map No. 9 is an isopach map of the principal coal section which shows that there is a significant increase in thickness for the coal section from the portal to the southern working face. The average thickness is 1.60 metres at the portal and 1.85 metres at the face.

4.3 CHAMBERLAIN SEAM FLOOR STRATA AND STONE ROLLS

The Chamberlain seam floor in Mine No. 1 consists of a very hard carbonaceous sandstone. The surface is irregular having potholes, etc. often 0.3 metres across and projecting 0.1 metres above or below the normal surface. The irregularities are often circular or oval shaped in plan.


MINE NO.1 - CHAMBERLAIN SEAM
Isopach Map of 'Bone' & Sheared Coal at Top of Seam - SHEET NO. 1.
Contour Interval = 0.05m
0.20
0.15
0.10
0.05
Map No 8
Geology compiled by
G.R. JORDAN CONSULTING SERVICES LTD.
1:2500
MINE PLAN CHAMBERLAIN SEAM

MINE NO.1 – CHAMBERLAIN SEAM – Section E1



LAMANITE.

COAL & CLAYSTONE – sheared.
COAL – bonsy, sheared.
– bonsy.
– dull & bright.
– bright banded.

– dull & bright.

– bright banded.

– dull banded.

– dull & bright.

CARBONACEOUS SANDSTONE.

SCALE 1:20

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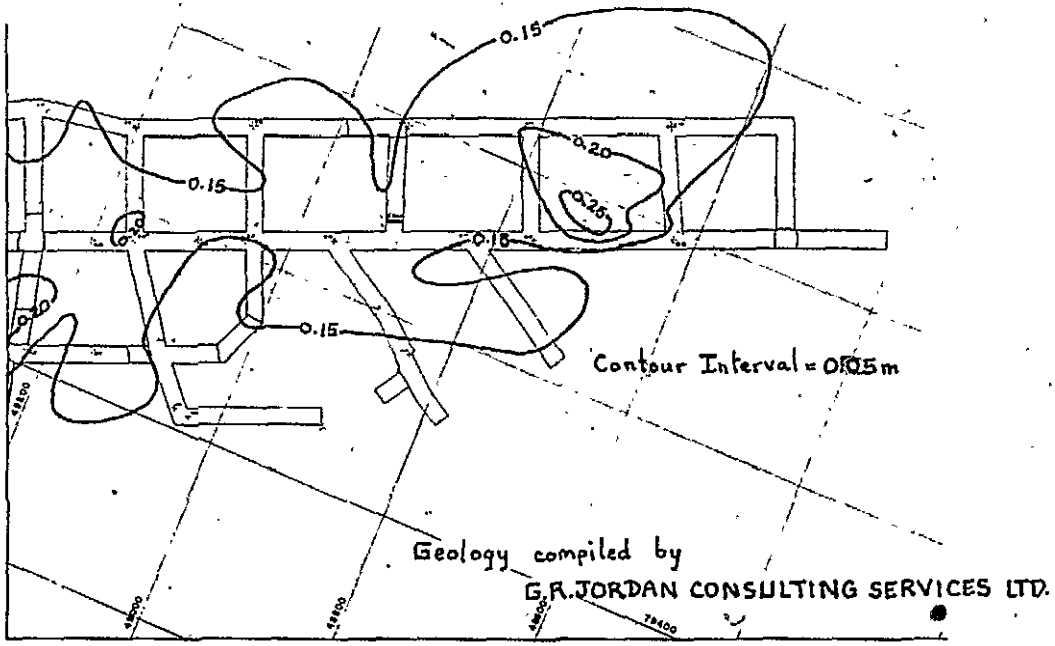
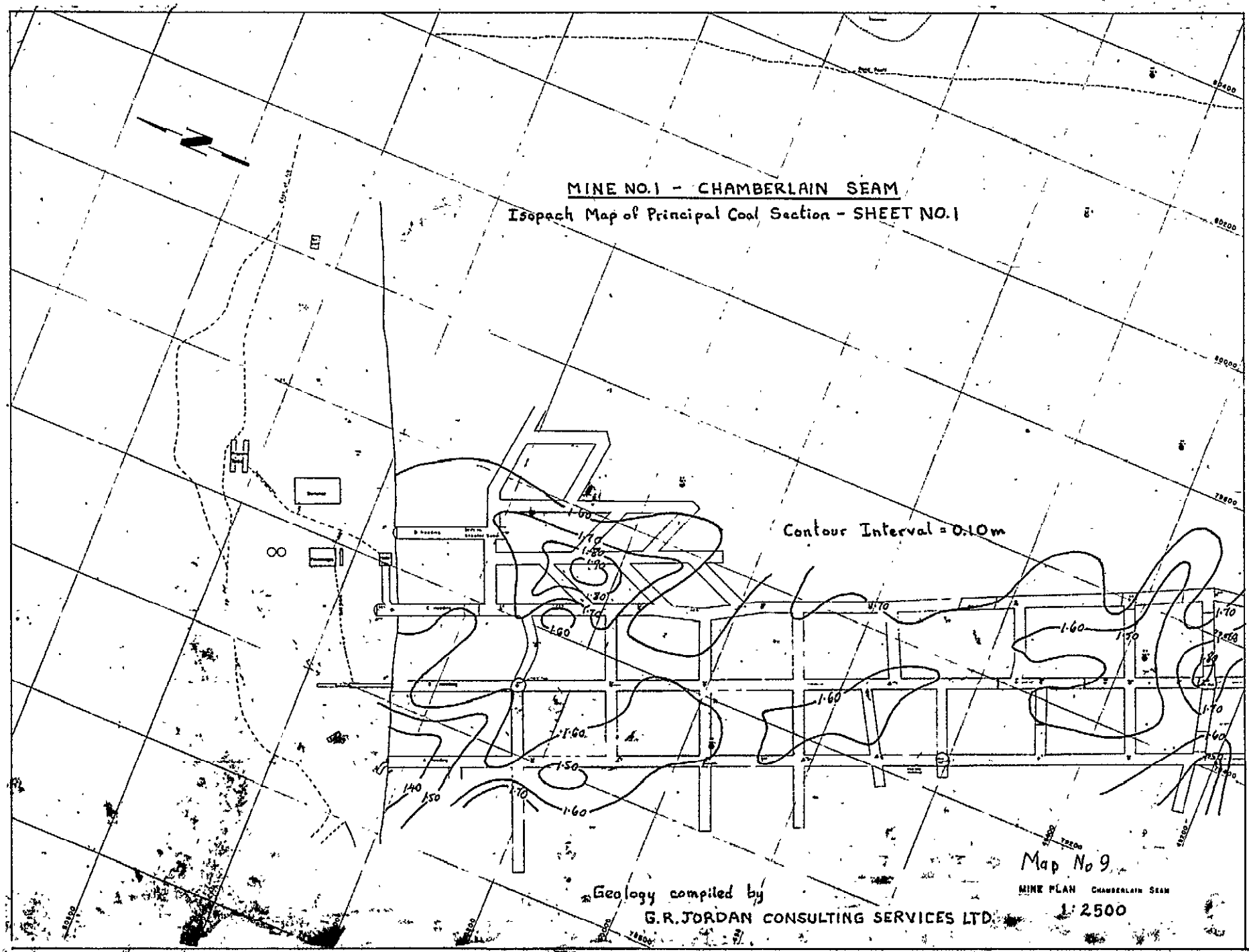
MINE NO. 1 - CHAMBERLAIN SEAM

Isopach Map of 'Bone' & Sheared Coal at Top of Seam - SHEET NO. 2.



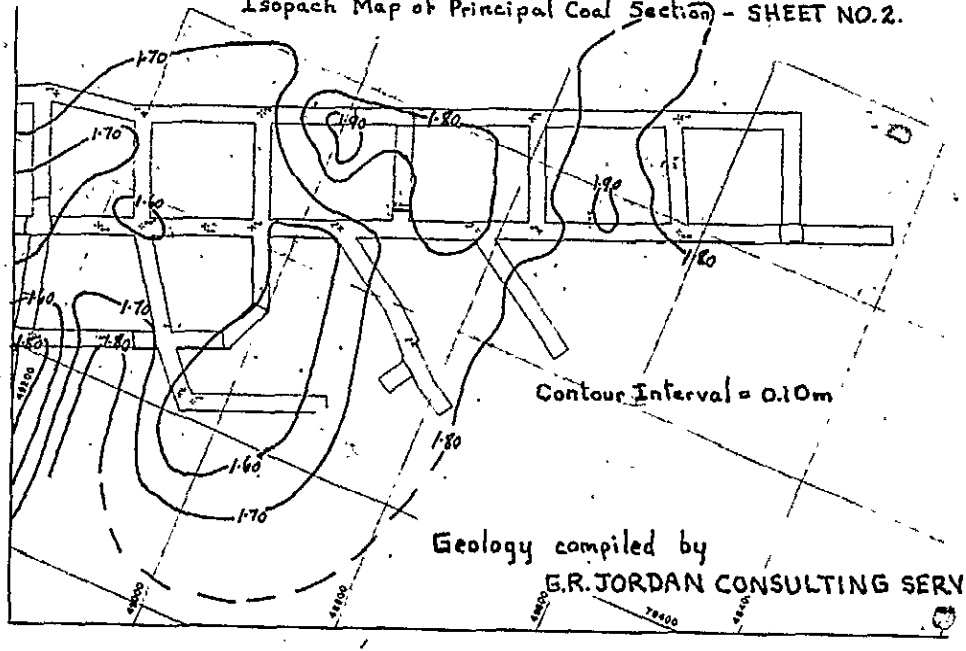
MINE PLAN - CHAMBERLAIN SEAM.

SCALE - 1:2500 Map No 8


MINE NO.1 - CHAMBERLAIN SEAM
Isopach Map of Principal Coal Section - SHEET NO.1
Contour Interval = 0.10m
Map No 9
Geology compiled by
G.R.JORDAN CONSULTING SERVICES LTD.
MINE PLAN CHAMBERLAIN SEAM
1:2500

MINE NO.1 - CHAMBERLAIN SEAM

Isopach Map of Principal Coal Section - SHEET NO.2.



MINE PLAN - CHAMBERLAIN SEAM.

SCALE - 1:2500 Map No.9

Stone rolls are occasionally found in the Chamberlain seam floor of Mine No. 1. At these structures the change in floor elevation is usually abrupt; the floor may rise 0.2 metres to 0.3 metres over a horizontal distance of 1 to 2 metres.

5. THE CHAMBERLAIN - "WINDOW MINE" AREA

Although the workings of the "Window Mine" area are not extensive at this time, an investigation was carried out. Documentation of geological data in this area has been made to provide a comparison with the Mine No. 1 area. The "Window Mine" area is located in the central western portion of the Sukunka block along the seam outcrop at Chamberlain Creek, some 3.5 kilometres distant from Mine No. 1.

5.1 CHAMBERLAIN SEAM ROOF STRATA

The Chamberlain seam roof in the "Window Mine" area is composed of the same lithology as was found in the Mine No. 1 area. A thin-bedded laminite forms the immediate roof, and drill cores show that this unit extends upwards for two to three metres. Scaling of the roof strata is particularly apparent in this area and it is believed that the same process has taken place here as is thought to have caused roof deterioration at Mine No. 1, i.e. successive freezing and thawing of moisture in the roof initiates a process of frost heaving causing separation of the strata along bedding.

The installation of heating equipment in this area would probably cause an increase in this process for a short period of time before stability is achieved.

The roof strata at the "Window Mine" area contain sigmoidal laminite structures similar to those encountered at Mine No. 1. The presence of these structures has had no apparent adverse effect on roof stability at this time. Severe roof support difficulties at Mine No. 1 were encountered only where the sigmoidal laminite zones and roof thrust structures were present at the same location. Hence it should be anticipated that small scale roof thrusts in the "Window Mine" area may cause similar roof support problems.

Patterns of roof joints can be readily observed in the "Window Mine" area. Time limitations have not allowed a detailed investigation of these structures to be made. However, the principal joint directions are shown on Map No. 8 at several locations within the mine workings.

5.2 CHAMBERLAIN SEAM STRATA

Measured sections of the Chamberlain seam were made at the locations shown on Map No. 10. The results of these sections are presented in graphic form within Appendix "A". Map No. 14 shows sections of the seam along each of the roadways and Section No. 28 is included on the following page as a typical Chamberlain seam section for this area.

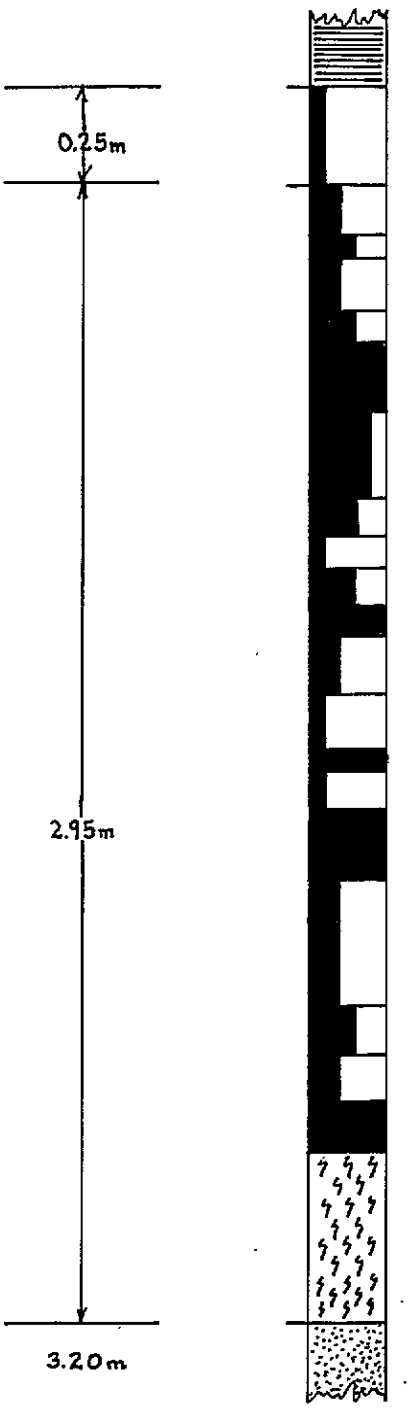
The seam contains two distinct units: an upper bed of dull, high specific gravity bone coal and a lower principal coal unit. The bone coal layer is continuous throughout the mine workings and has a sharp contact with the overlying laminite roof. Map No. 11 is an isopach map of the bone coal unit which shows that there is no particular change in thickness throughout the mine workings.

Unlike the Mine No. 1 area, there is no bedding plane fault and associated shear zone at the contact between the bone coal and laminite roof.

The principal coal horizon consists of generally dull and bright banded coal with some consistent beds having either a reduction or an increase in the percentage of bright bands. The base of the seam is usually sheared and in places appears to contain some sheared claystone material. Map No. 12 is an isopach map of the principal coal horizon and it shows that the seam thickness is uniform throughout the mine workings.

An area shown on Map No. 13 was selected for the measurement of rib joints. Seventy-five measurements were made in this area and the results, plotted as poles, are shown on the stereogram included in Appendix "B". The stereogram shows that there are two principal joint directions of near vertical structures. These structures are cleats, with the principal orientation being 020°.

CHAMBERLAIN SEAM - WINDOW MINE - Station 28



LAMANITE.

COAL - boney.

- dull banded.
- dull & bright.
- dull banded.
- dull & bright.
- bright.

- bright banded.
- dull & bright.
- dull.
- dull & bright.
- bright.
- dull banded.

- dull.
- bright.
- dull.
- bright

- dull banded.

- dull & bright.

- dull banded.

- sheared.

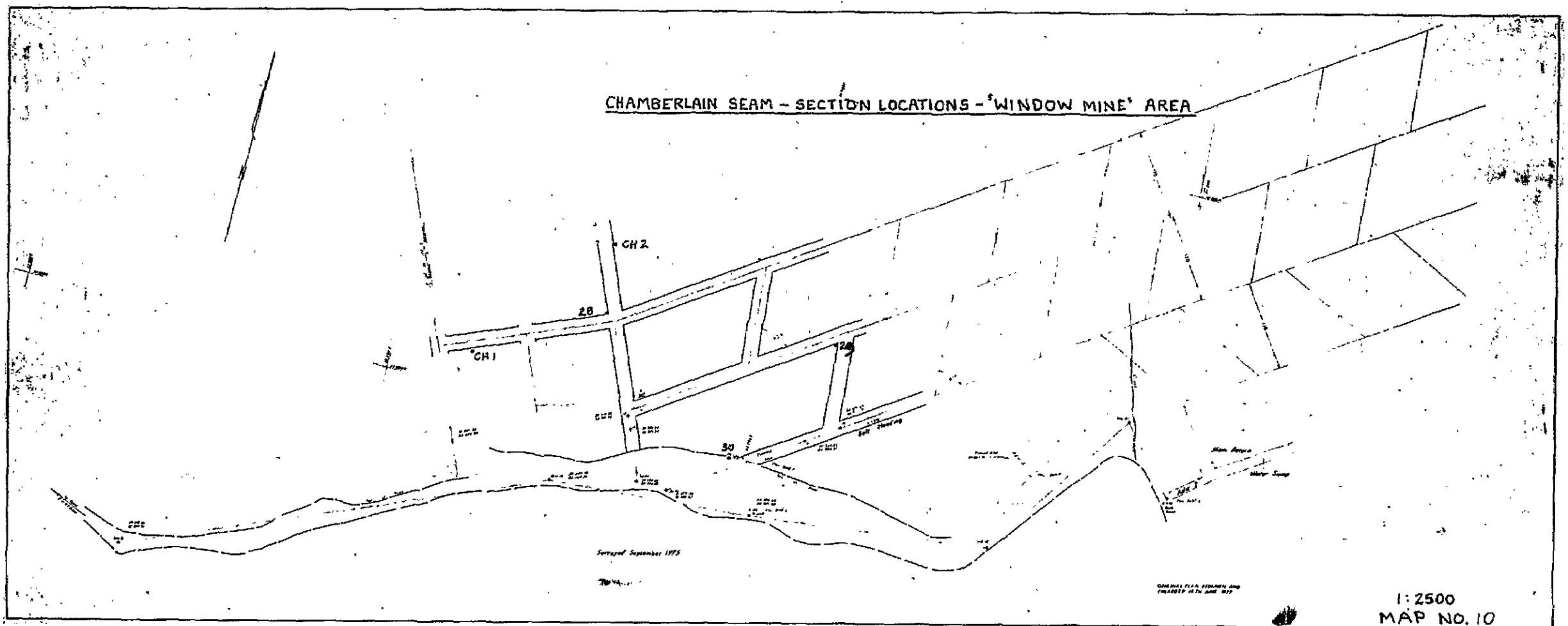
CARBONACEOUS SANDSTONE.

SCALE 1:20

After A. NEWSON.

Prepared by
G.R. JORDAN CONSULTING SERVICES

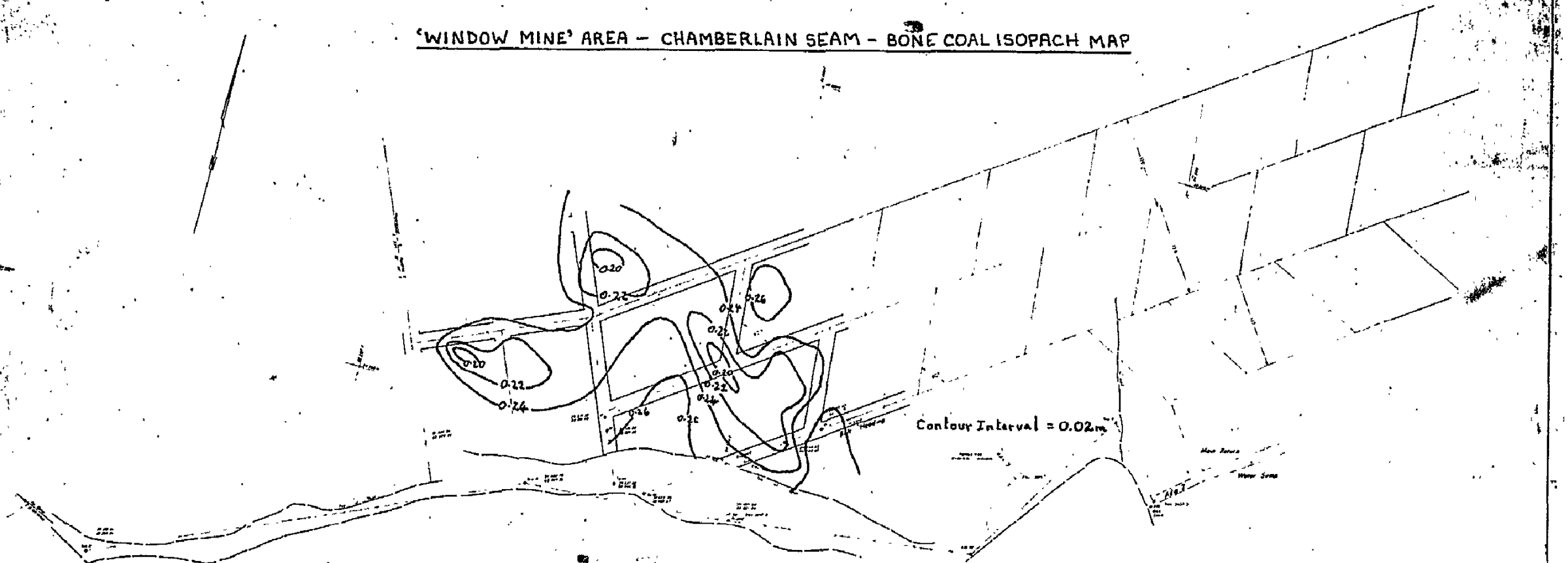
CHAMBERLAIN SEAM – SECTION LOCATIONS – 'WINDOW MINE' AREA



1:2500

MAP NO. 10

'WINDOW MINE' AREA – CHAMBERLAIN SEAM – BONE COAL ISOPACH MAP

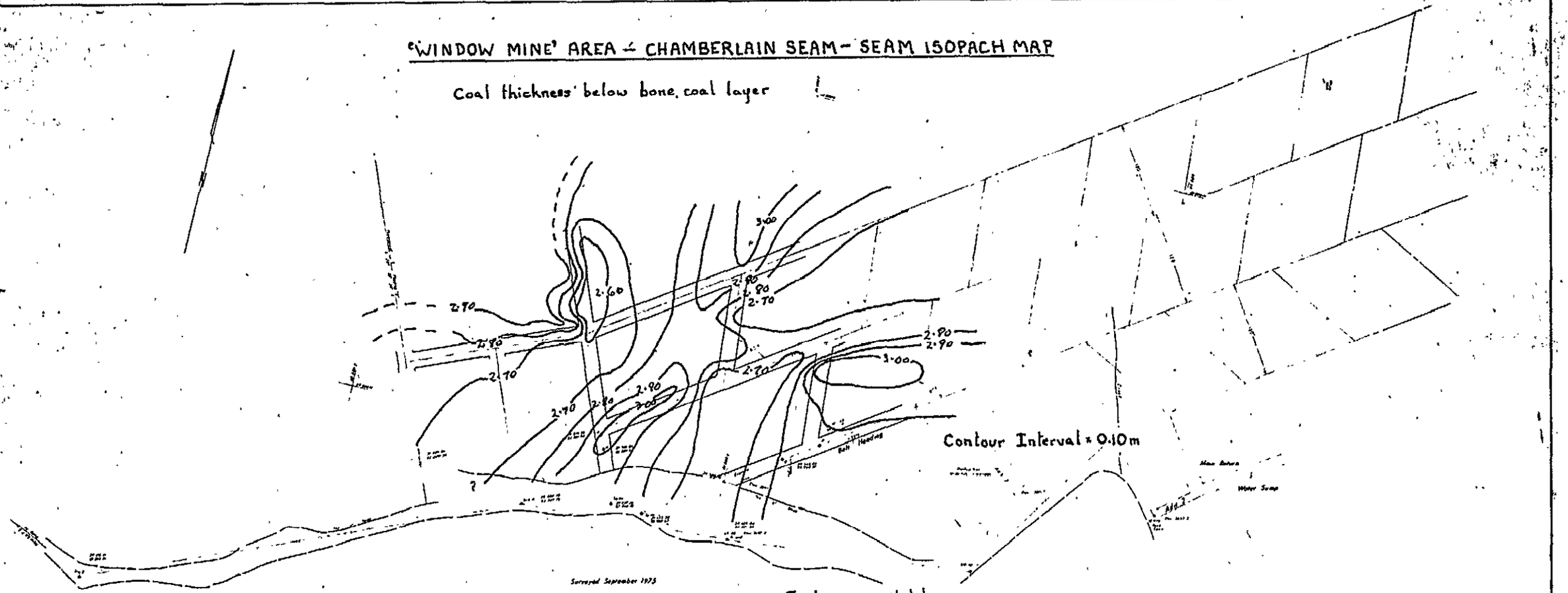


Geology compiled by
G.R.JORDAN CONSULTING SERVICES LTD.

1:2500
MAP No. 11

'WINDOW MINE' AREA – CHAMBERLAIN SEAM – SEAM ISOPACH MAP

Coal thickness below bone coal layer



Contour Interval = 0.10m

Geology compiled by
G.R. JORDAN CONSULTING SERVICES LTD.

1:2 500
MAP NO. 12

5.3 CHAMBERLAIN SEAM FLOOR STRATA

The floor of the Chamberlain seam consists of a very hard carbonaceous sandstone in most instances. A. Newson has recorded the presence of a thin layer of carbonaceous mudstone in some places between the sandstone floor and the coal section.

The surface of the floor is uneven, containing small, irregularly shaped depressions or rises.

5.4 STONE ROLLS, TECTONIC STRUCTURES, AND MINING CONDITIONS

Map No. 13 is a plan showing structures present in the "Window Mine" area. No roof structures of a tectonic or sedimentary nature are observed underground. The sigmoidal laminite of the roof can be observed in surface outcrop near the mine portal.

No floor structures of a tectonic nature are observed but some sedimentary stone rolls are shown within one of the headings. The stone rolls do not appear to be continuous across the workings.

The stone rolls are abrupt and asymmetrical and usually have a half wave length of approximately seven metres and an amplitude of 0.25 metres.

The coal of the pillars is very hard except for the layer of sheared coal near the floor. The stereogram of the rib joints shows only a few concentrations and these are well defined as opposed to those found at Mine No. 1. This suggests that the coal of the "Window Mine" area has experienced much reduced tectonic deformation.

The present workings in the "Window Mine" area indicate that mining problems related to geological conditions are greatly reduced when compared with both the Skeeter seam and Chamberlain seam workings at Mine No. 1. However, the workings do not as yet represent typical conditions for the area since the mine does not extend beneath an average cover thickness for the Sukunka area. The stability of the roof, pillars, and floor under normal cover intervals cannot be assessed. In addition, it must be anticipated that zones or small scale roof and floor structures will be intersected which it is expected will produce mining conditions similar to those encountered previously.

6. RECOMMENDATIONS AND CONCLUSIONS

It can be shown that the Zone "A" structures of the Chamberlain seam in Mine No. 1 are the same structures as those encountered at the main zone of faulting in the overlying Skeeter seam. The Zone "B" and Zone "C" structures may similarly persist to the Skeeter seam level and these could be predicted before mining by projection to the Skeeter mine plans.

Similarly, the isopach maps of various coal or rock units could be extended using drill hole data to give general seam unit trends. It is not possible, however, to predict tectonically thickened zones, similar to the one present in the Skeeter seam workings.

At the present time, the Chamberlain seam workings of the "Window Mine" area appear to provide the best geological conditions for mining. However, the stability of the various strata under greater depths of cover cannot be determined and problems related to the intersection of small scale tectonic structures should be expected.

APPENDIX A

SKEETER & CHAMBERLAIN SEAM SECTIONS

M1SEC

WMSEC

SYMBOLS USED ON COAL SECTION DRAWINGS :

COAL – bright.

COAL – bright banded.

COAL – dull & bright.

COAL – dull banded.

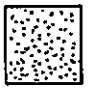
COAL – dull.

COAL – sheared.

COAL & CLAYSTONE – sheared.

LAMANITE.

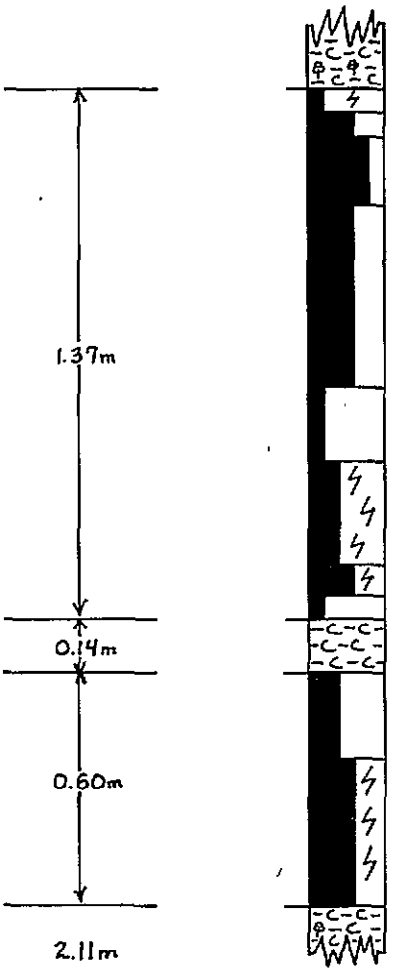
CARBONACEOUS MUDSTONE – with plant fossils, slightly silty at base.



CARBONACEOUS SANDSTONE.

G.R. JORDAN CONSULTING SERVICES

MINE NO.1 – SKEETER SEAM – Section A2



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

COAL – dull, sheared.
– dull & bright.
– bright banded.
– dull & bright.
– dull.
– dull banded, sheared.
– dull & bright, sheared.
– dull.

CARBONACEOUS MUDSTONE.

COAL – dull banded.
– dull & bright, sheared.

CARBONACEOUS MUDSTONE – minor plants.

SCALE 1:20

Prepared by
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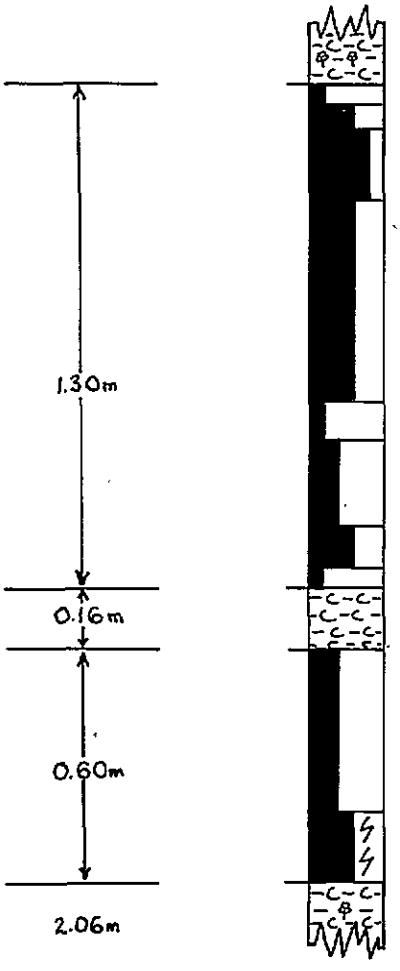
MINE NO.1 – SKEETER SEAM – Section A3



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

COAL – dull.
– dull & bright.
– bright banded.
– dull & bright.
– dull.
– dull banded.
– dull & bright.
– dull.

CARBONACEOUS MUDSTONE.

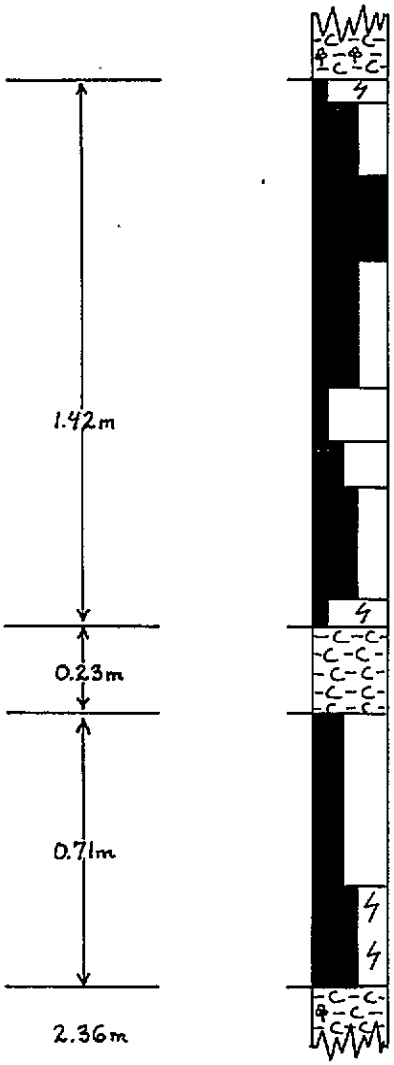
COAL – dull banded.
– dull & bright, sheared.

CARBONACEOUS MUDSTONE – minor plant fossils.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES

MINE NO.1 – SKEETER SEAM – Section A4



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

COAL – dull, sheared.

– dull & bright.

– bright.

– dull & bright.

– dull.

– dull banded.

– dull & bright.

– dull, sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

– dull & bright, sheared.

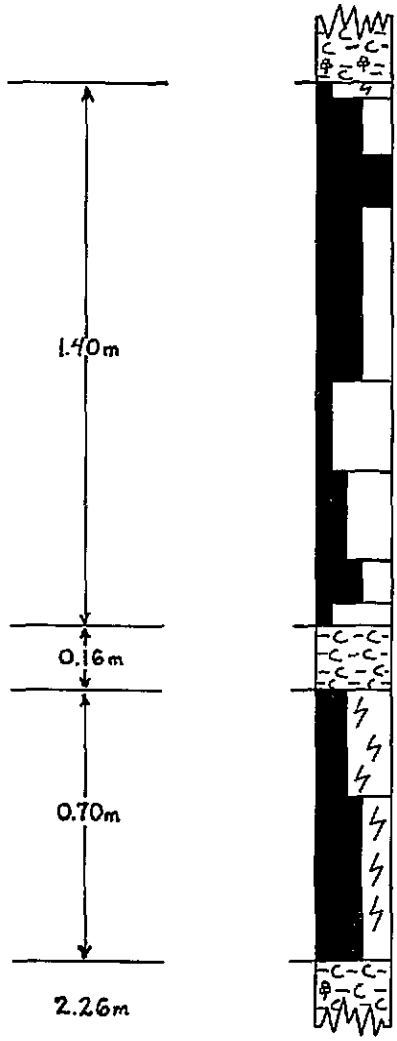
CARBONACEOUS MUDSTONE – small plant fragments.

SCALE 1:20

Prepared by

G.R.JORDAN CONSULTING SERVICES LTD

MINE NO.1 – SKEETER SEAM – Section A5



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

COAL – dull, sheared.

– dull & bright

– bright.

– dull & bright.

– dull.

– dull banded.

CARBONACEOUS MUDSTONE.

COAL – dull banded, sheared.

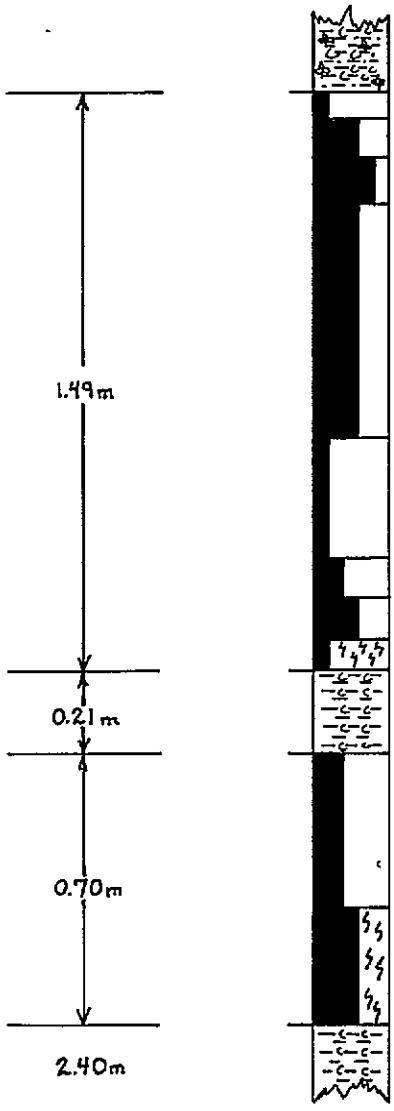
– dull & bright, sheared.

CARBONACEOUS MUDSTONE – small fossil fragments.

SCALE 1:20

G.R.JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - SKEETER SEAM - Section A6



CARBONACEOUS MUDSTONE - slightly silty, abundant plant fossils

COAL - dull, movement plane at top.
- dull & bright.
- bright banded.
- dull & bright.
- dull.
- dull banded.
- dull & bright.
- dull, sheared.

CARBONACEOUS MUDSTONE.

COAL - dull banded.
- dull & bright, sheared.

CARBONACEOUS MUDSTONE - minor plants.

SCALE 1:20

Prepared by
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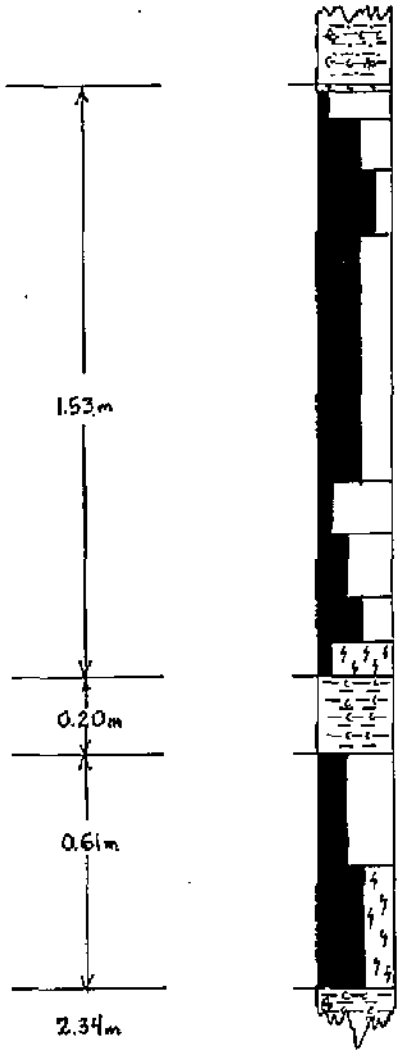
MINE NO.1 – SKEETER SEAM – Section B2



CARBONACEOUS MUDSTONE – slightly silty, with coaly inclusions, abundant plant fossils.

COAL – sheared
– dull.
– dull & bright.
– bright banded.
– dull & bright.
– dull.
– dull banded.
– dull & bright.
– dull, sheared.

CARBONACEOUS MUDSTONE.

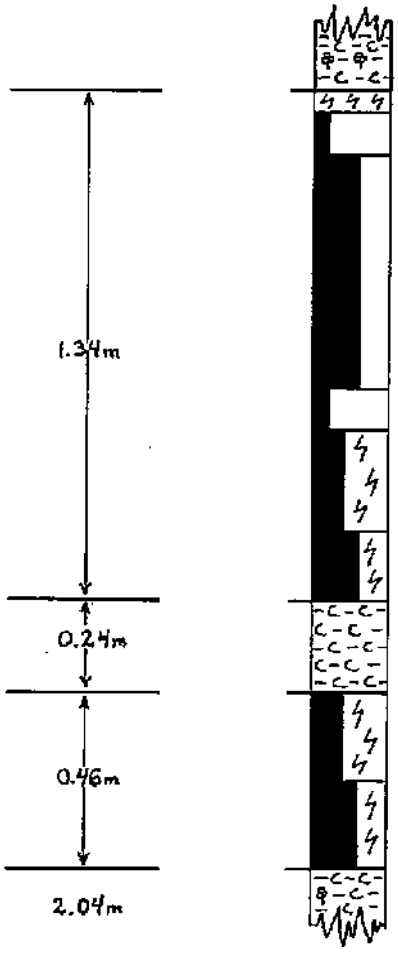
COAL – dull banded.
– dull & bright, sheared.

CARBONACEOUS MUDSTONE – minor plant fossils.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES

MINE NO.1 – SKEETER SEAM – Section B3



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

COAL – sheared.

– dull.

– dull & bright.

– dull.

– dull banded, sheared.

– dull & bright.

CARBONACEOUS MUDSTONE.

COAL – dull banded, sheared.

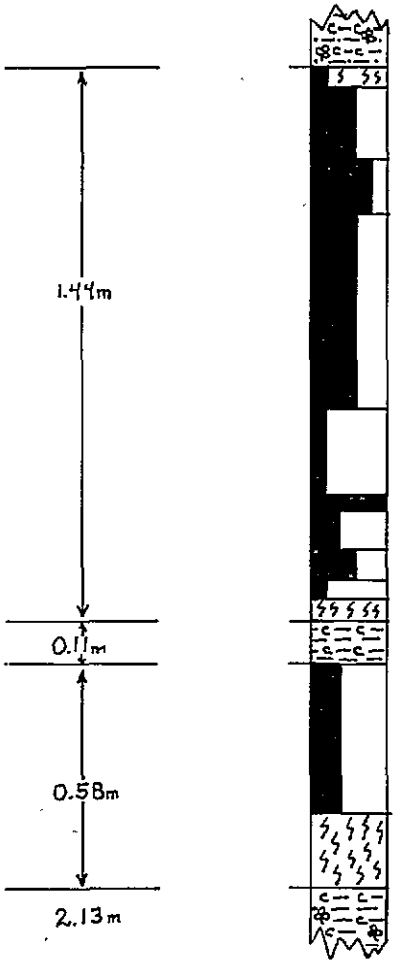
– dull & bright, sheared.

CARBONACEOUS MUDSTONE – small plant fossils.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES

MINE NO.1 – SKEETER SEAM – Section B4



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fragments.

COAL – dull, lightly sheared.

– dull & bright.

– bright banded.

– dull & bright.

– dull.

– bright.
– dull banded.
– dull & bright.
– dull.
– sheared.

CARBONACEOUS MUDSTONE – sheared at base.

COAL – dull banded.

– sheared.

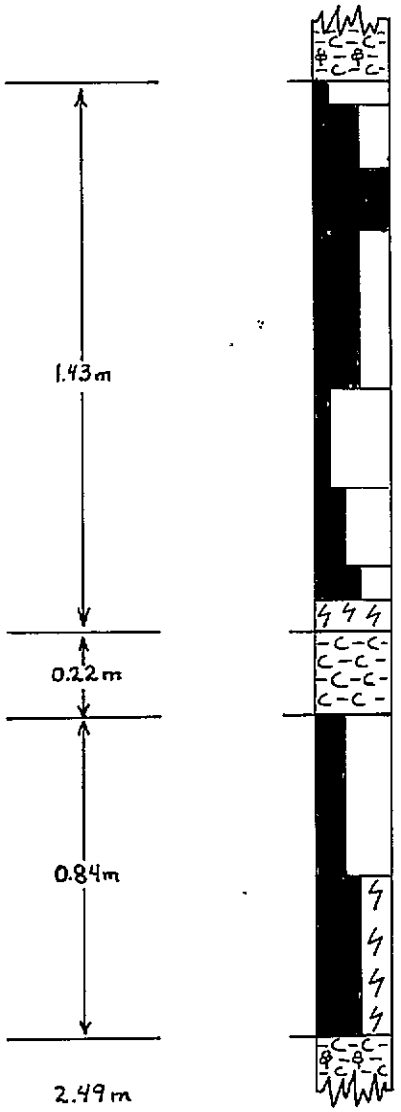
CARBONACEOUS MUDSTONE – plant fossils, coal inclusions.

SCALE 1:20

Prepared by

G.R.JORDAN CONSULTING SERVICES LTD.

MINE NO.1 – SKEETER SEAM – Section B5



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

COAL – dull.

– dull & bright.

– bright.

– dull & bright

– dull.

– dull banded.

– dull & bright.

– sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

– dull & bright, sheared.

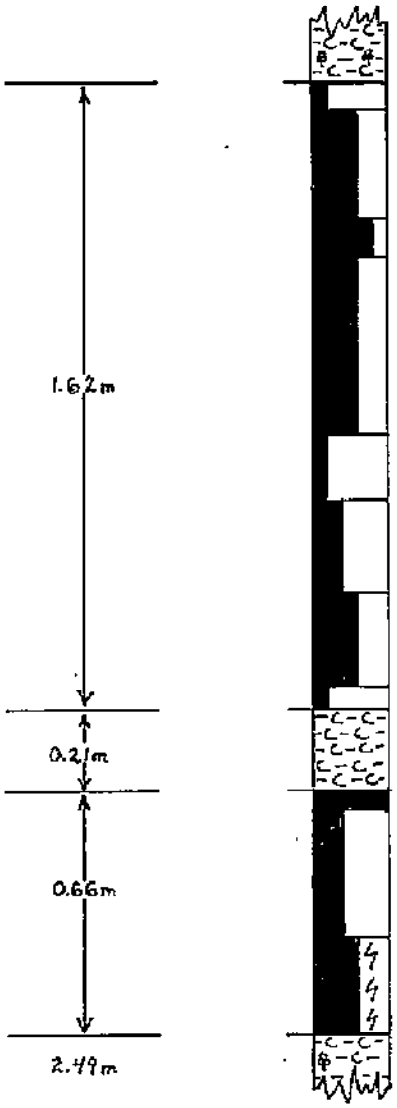
CARBONACEOUS MUDSTONE – numerous small plant fragments

SCALE 1:20

Prepared by

G.R. JORDAN CONSULTING SERVICES LTD.

MINE NO.1 – SKEETER SEAM – Section BG



CARBONACEOUS MUDSTONE – slightly silty, plant fossils.

COAL – dull, shear plane at top.

– dull & bright.

– bright banded.

– dull & bright.

– dull.

– dull banded.

– dull & bright.

– dull.

CARBONACEOS MUDSTONE.

COAL – bright.

– dull banded

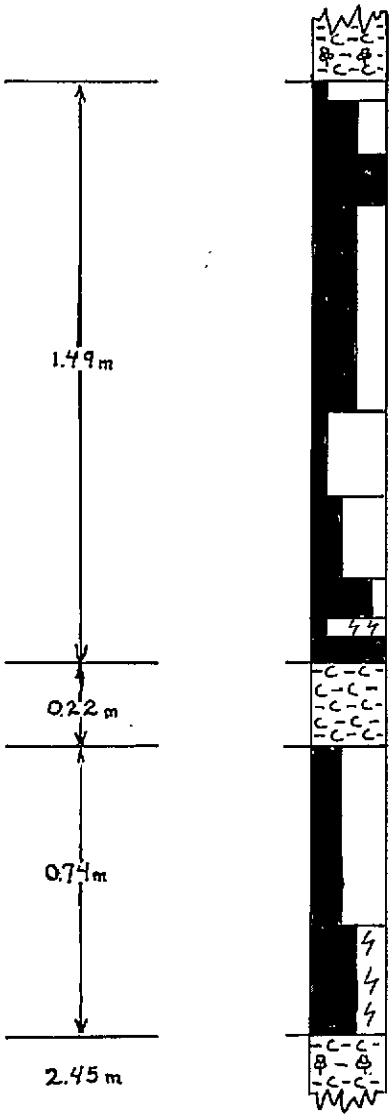
– dull & bright; sheared.

CARBONACEOUS MUDSTONE – minor plant fossils.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - SKEETER SEAM - Section B7



CARBONACEOUS MUDSTONE - slightly silty, abundant plant fossils.

COAL - dull, shear plane at top.
- dull & bright.
- bright.
- dull & bright.
- dull.
- dull banded.
- bright banded.
- dull, sheared.
- bright.

CARBONACEOUS MUDSTONE.

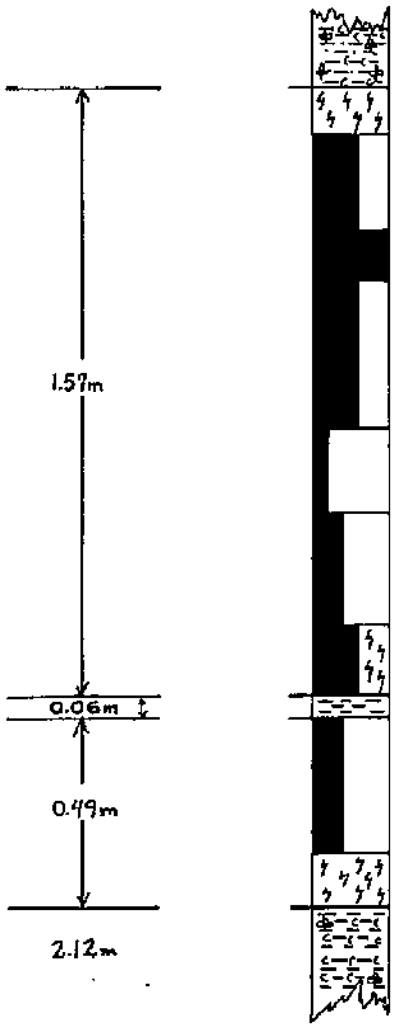
COAL - dull banded.
- dull & bright, sheared.

CARBONACEOUS MUDSTONE - small plant fragments.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - SKEETER SEAM - Section BB



CARBONACEOUS MUDSTONE - slightly silty, abundant plant fossils.

COAL - sheared.

- dull & bright.

- bright.

- dull & bright.

- dull

- dull banded.

- dull & bright, sheared.

CARBONACEOUS MUDSTONE.

COAL - dull banded.

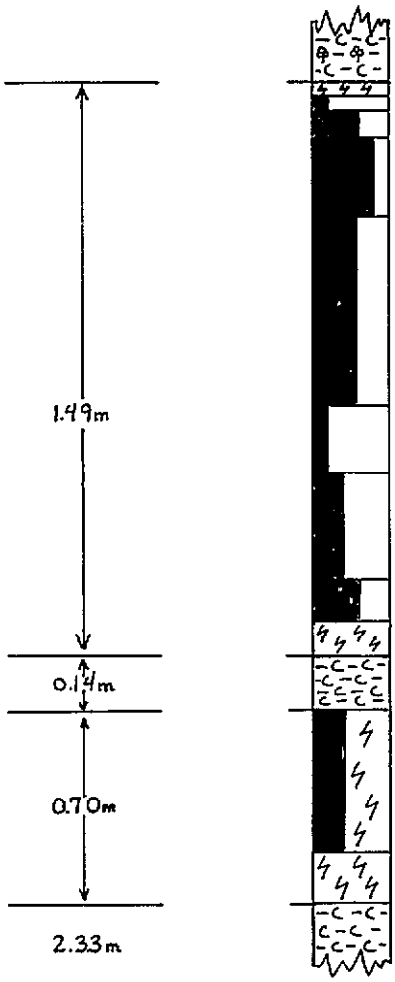
- sheared.

CARBONACEOUS MUDSTONE - minor plant fossils.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES LTD.

MINE NO.1 – SKEETER SEAM – Section B9



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils, coaly inclusions.

COAL – sheared.
– dull.
– dull & bright.
– bright banded.
– dull & bright.
– dull.
– dull banded.
– dull & bright.
– sheared.

CARBONACEOUS MUDSTONE – heavily sheared, lystric surfaces, faulted.

COAL – dull banded, sheared.
– sheared.

CARBONACEOUS MUDSTONE

SCALE 1:20

Prepared by
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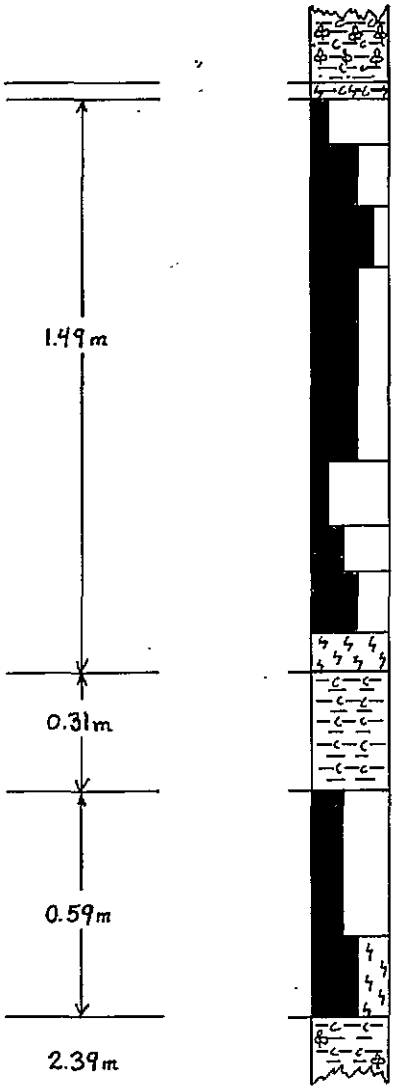
MINE NO. 1 - SKEETER SEAM - Section B10



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

CARBONACEOUS MUDSTONE – as above, sheared.

COAL – dull.

– dull & bright.

– bright banded.

– dull & bright.

– dull.

– dull banded.

– dull & bright.

– sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

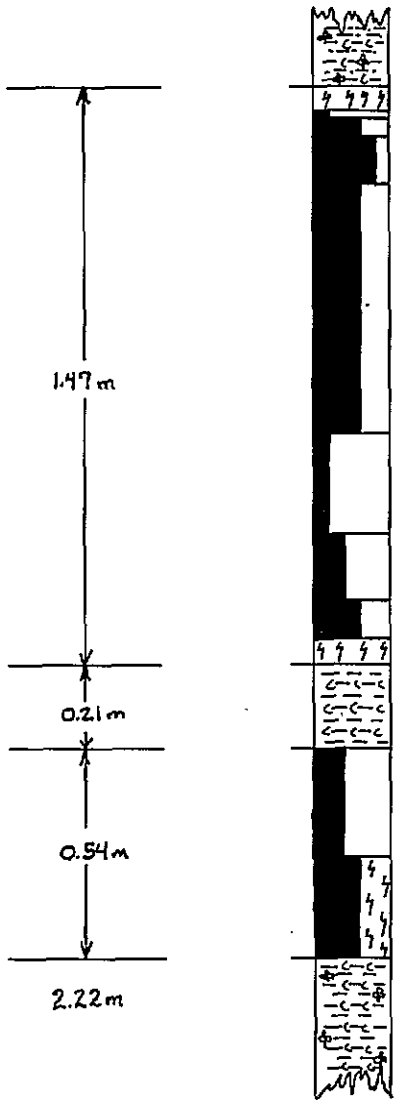
– dull & bright, sheared.

CARBONACEOUS MUDSTONE – minor plant fossils.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTIN SERVICES

MINE NO.1 - SKEETER SEAM - Section C2



CARBONACEOUS MUDSTONE - slightly silty, abundant plant fossils.

COAL - sheared
- dull
- dull & bright.
- bright banded.

- dull & bright.

- dull.

- dull banded.

- dull & bright.

- sheared.

CARBONACEOUS MUDSTONE.

COAL - dull banded.

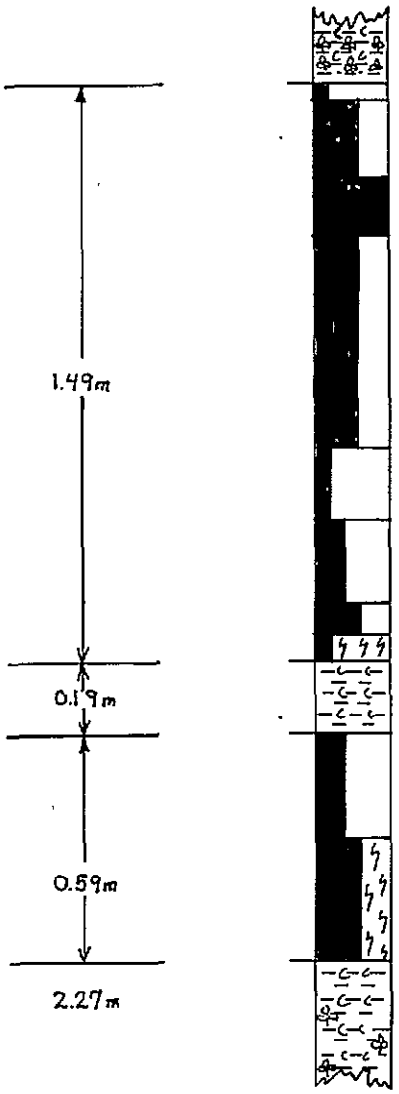
- dull & bright, sheared.

CARBONACEOUS MUDSTONE - minor plants.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES

MINE NO.1 – SKEETER SEAM – Section C3



CARBONACEOUS MUDSTONE – slightly silty, highly fossiliferous.

COAL – dull.

– dull & bright.

– bright.

– dull & bright.

– dull.

– dull banded.

– dull & bright.

– dull, sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

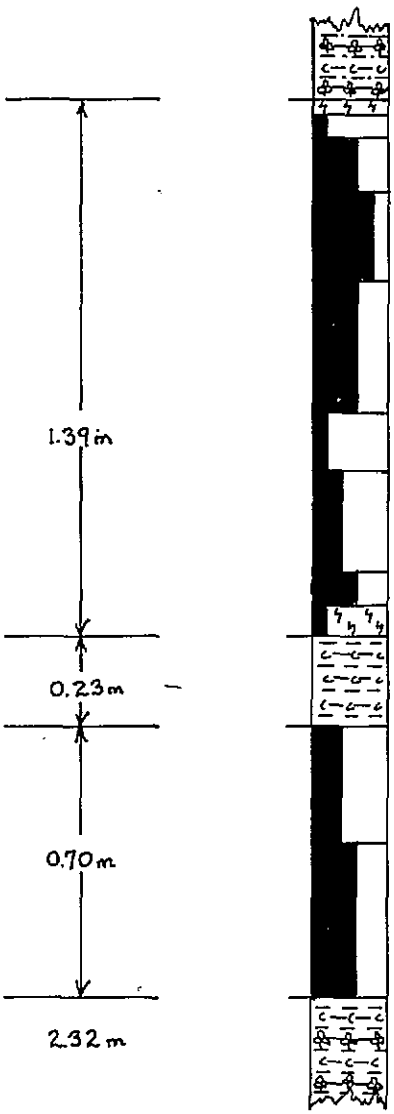
– dull & bright, sheared.

CARBONACEOUS MUDSTONE – minor plant fossils.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES LTD.

MINE NO.1 – SKEETER SEAM – Section C4



CARBONACEOUS MUDSTONE – slightly silty, with abundant coaly plant remains.

COAL – sheared.
– dull.
– dull & bright.

– bright banded.

– dull & bright.

– dull.

– dull banded.

– dull & bright.
– dull, sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

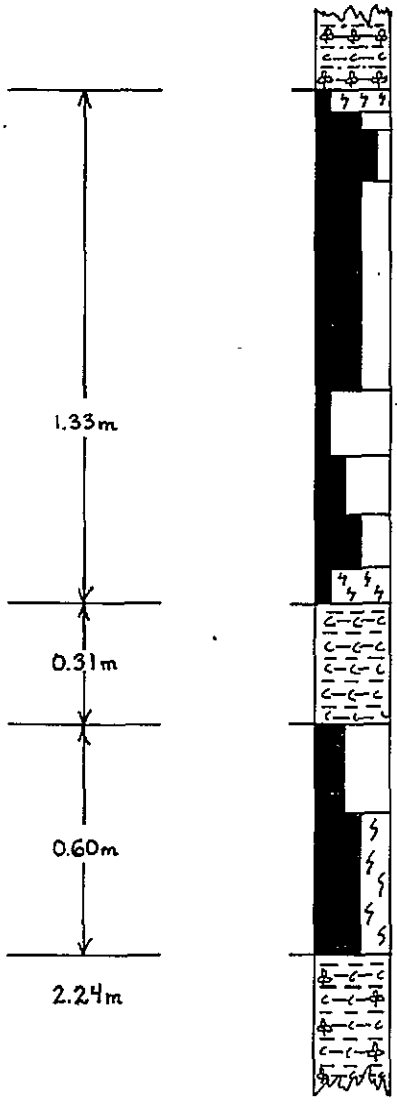
– dull & bright.

CARBONACEOUS MUDSTONE – abundant plant fragments

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - SKEETER SEAM - Section C5



CARBONACEOUS MUDSTONE - slightly silty, abundant plant fossils.

COAL — dull, sheared.
— dull & bright.
— bright banded.

— dull & bright.

— dull.

— dull banded.
— dull & bright.
— dull, sheared.

CARBONACEOUS MUDSTONE.

COAL — dull banded.

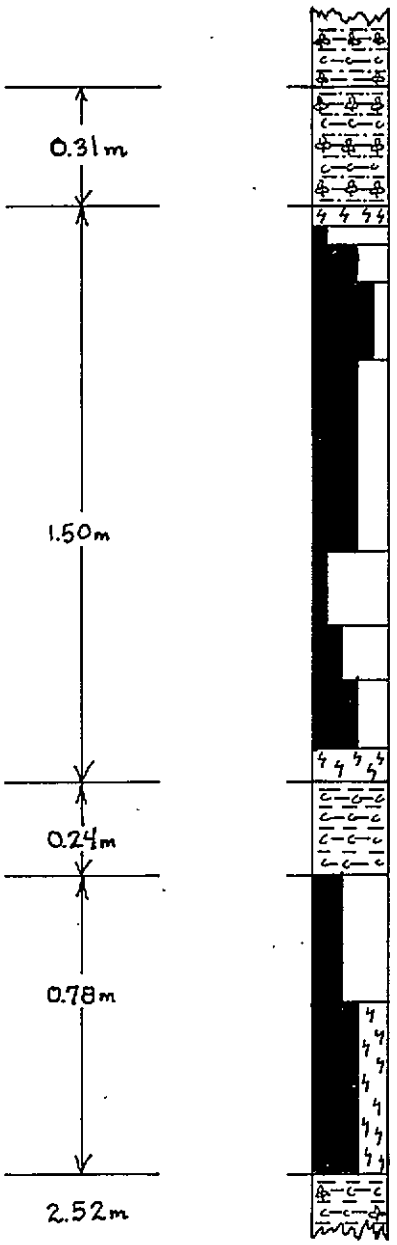
— dull & bright, sheared.

CARBONACEOUS MUDSTONE - minor plant fossils.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES

MINE NO.1 – SKEETER SEAM – Section C6



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

– as above, with bright coal bands

COAL – sheared.
– dull.
– dull & bright.
– bright banded.

– dull & bright.

– dull.

– dull banded.

– dull & bright.
– sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

– dull & bright, sheared.

CARBONACEOUS MUDSTONE – minor plant fossils.

SCALE 1:20

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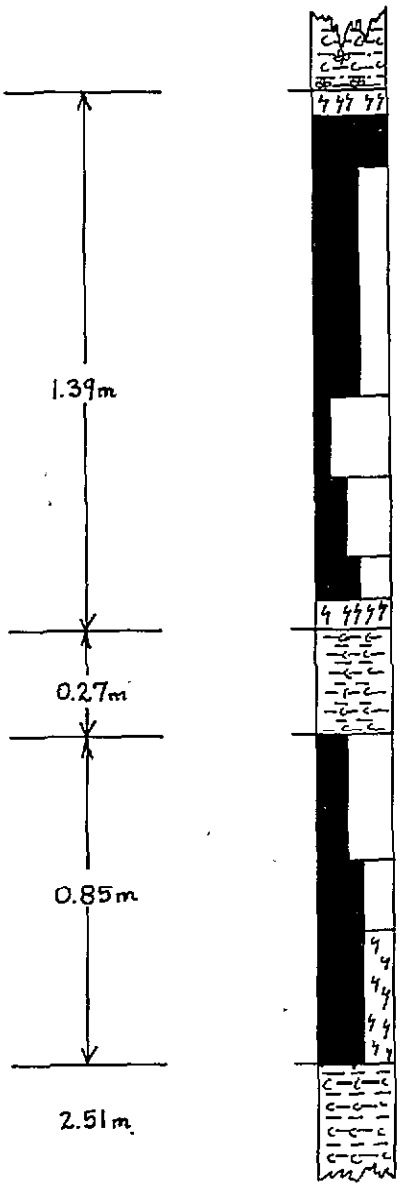
MINE NO.1 - SKEETER SEAM - Section C8



CARBONACEOUS MUDSTONE - slightly silty, fossil fragments.

COAL - sheared.

- bright.

- dull & bright.

- dull

- dull banded

- dull & bright.

- sheared.

CARBONACEOUS MUDSTONE.

COAL - dull banded.

- dull & bright.

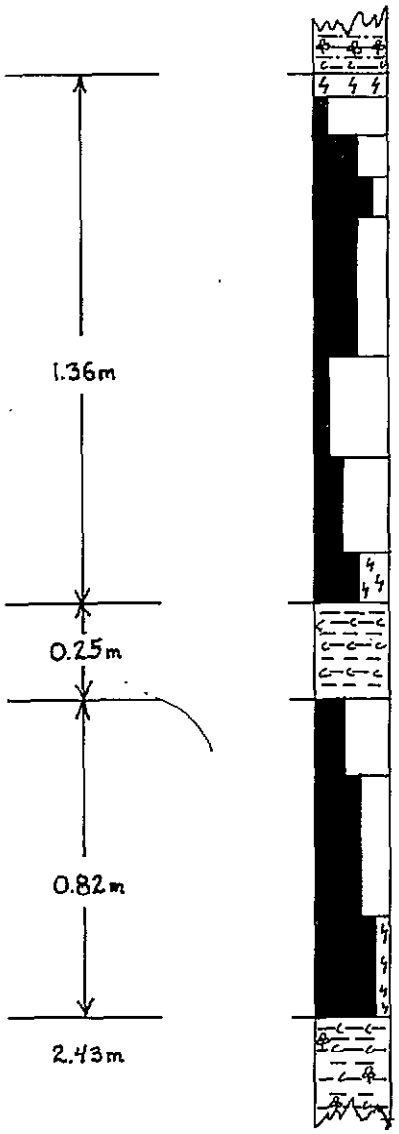
- dull & bright, sheared.

CARBONACEOUS MUDSTONE.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES

MINE NO.1 - SKEETER SEAM - Section C9



CARBONACEOUS MUDSTONE – slightly silty, with fossil fragments, and coal inclusions.

COAL – sheared.
– dull.
– dull & bright.
– bright banded.
– dull & bright.
– dull.
– dull banded.
– dull & bright, sheared.

CARBONACEOUS MUDSTONE – coaly inclusions at top.

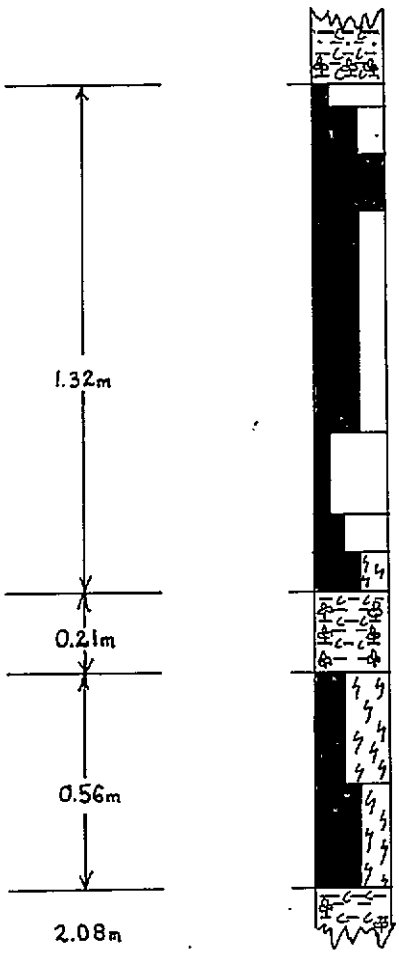
COAL – dull banded.
– dull & bright.
– bright banded, sheared.

CARBONACEOUS MUDSTONE - minor plants.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES

MINE NO 1 – SKEETER SEAM – Section D3



CARBONACEOUS MUDSTONE – slightly silty, plant fossils.

COAL – dull.

– dull & bright.

– bright.

– dull & bright.

– dull.

– dull banded.

– dull & bright, sheared.

CARBONACEOUS MUDSTONE – Fossiliferous.

COAL – dull banded, sheared.

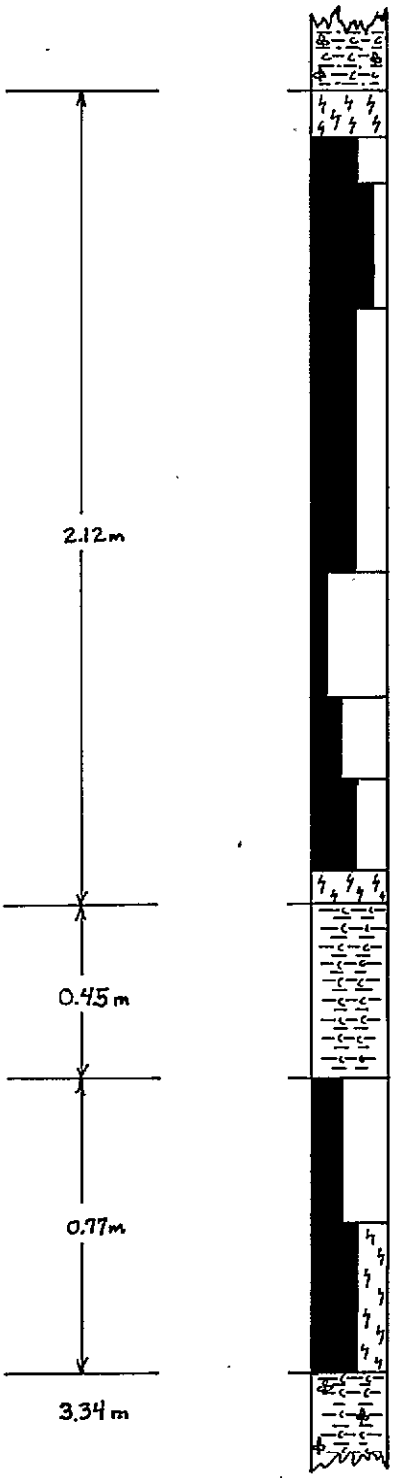
– dull & bright.

CARBONACEOUS MUDSTONE – minor plant fossils.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES

MINE NO.1 – SKEETER SEAM – Section D4



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

COAL – sheared.

– dull & bright.

– bright banded.

– dull & bright

– dull.

– dull banded.

– dull & bright.

– sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

– dull & bright, sheared.

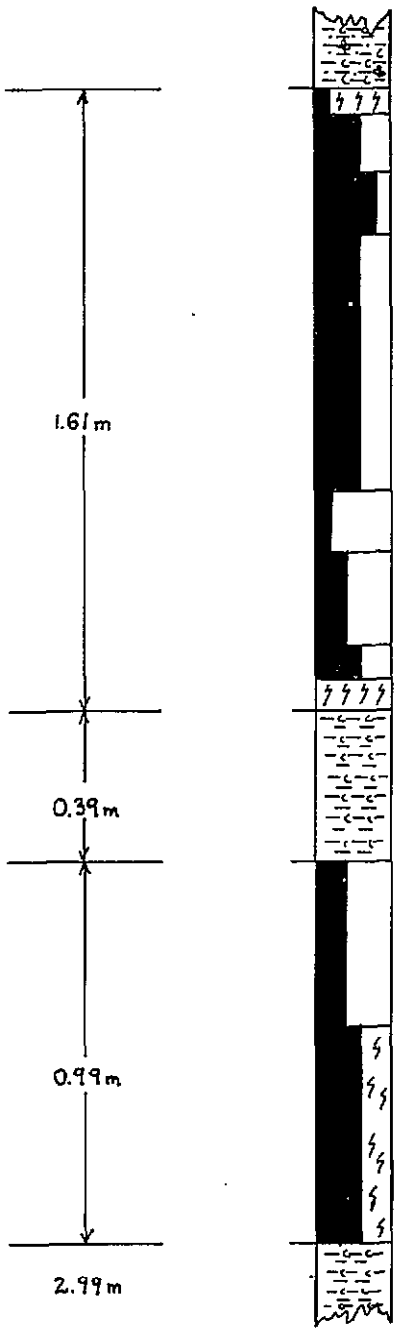
CARBONACEOUS MUDSTONE – minor plant fossils.

SCALE 1:20

Prepared by

G.R.JORDAN CONSULTING SERVICES

MINE NO.1 - SKEETER SEAM - Section D5



CARBONACEOUS MUDSTONE - slightly silty, plant fossils, coaly inclusions.

COAL – dull, sheared.

– dull & bright.

– bright banded.

– dull & bright.

– dull.

– dull banded.

– dull & bright.

– sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

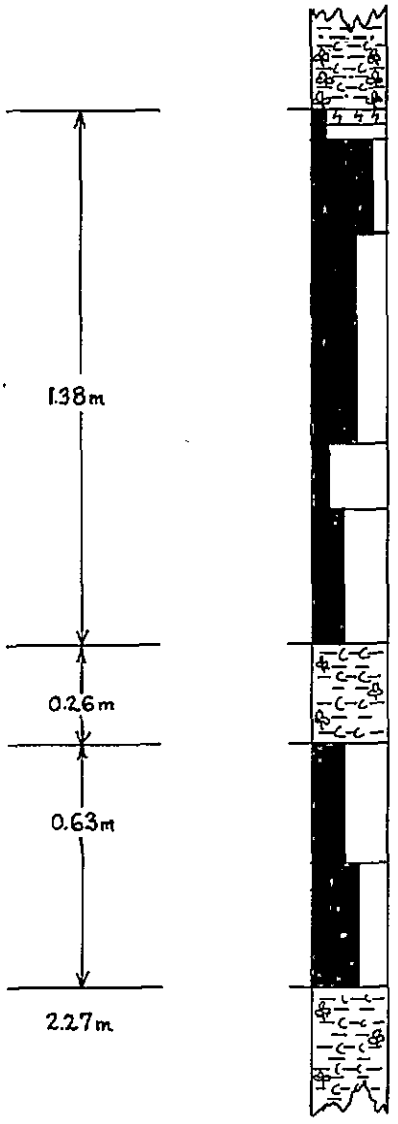
– dull & bright, sheared.

CARBONACEOUS MUDSTONE.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES

MINE NO.1 – SKEETER SEAM – Section D6



CARBONACEOUS MUDSTONE - slightly silty, abundant coalified plant remains.

COAL – dull, sheared.
– dull.
– bright banded.
– dull & bright.
– dull.
– dull banded.

CARBONACEOUS MUDSTONE – occasional coalified plant fossils and coal inclusions.

COAL – dull banded.
– dull & bright.

CARBONACEOUS MUDSTONE - occasional coaly plant fossils.

SCALE 1:20

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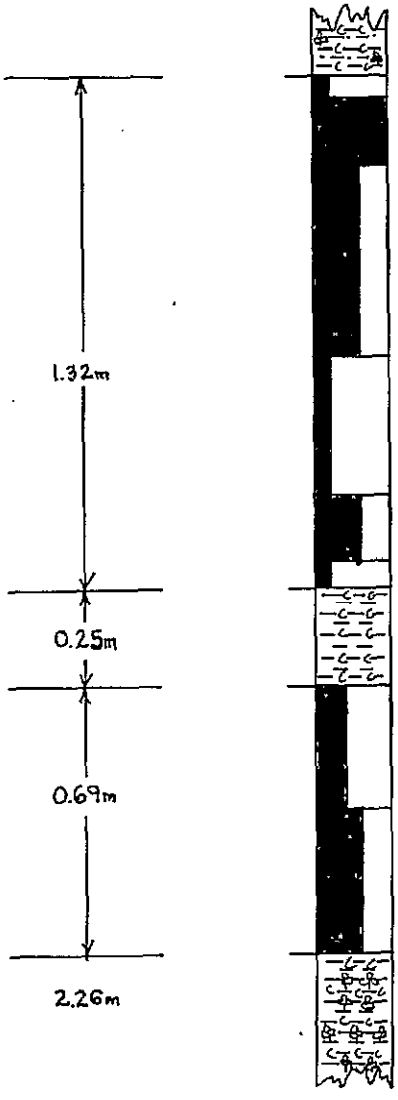
G.R.JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - SKEETER SEAM - Section D7



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

COAL – dull.

– bright.

– dull & bright.

– dull.

– dull & bright.

– dull.

CARBONACEOUS CLAYSTONE.

COAL – dull banded.

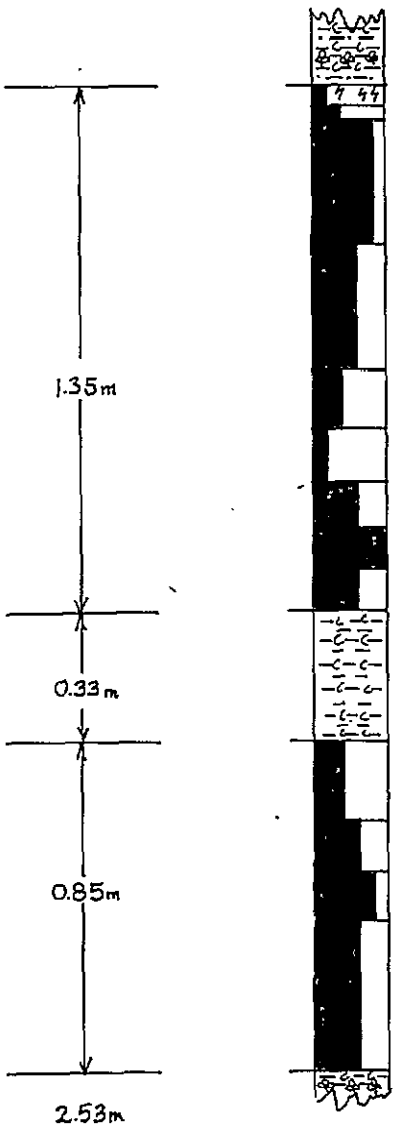
– dull & bright.

CARBONACEOUS MUDSTONE – plant fossils.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - SKEETER SEAM - Section D8



CARBONACEOUS MUDSTONE - slightly silty, coalified plant fossils.

COAL - dull, sheared.
- dull banded.
- bright banded.
- dull & bright.
- dull banded.
- dull.
- dull & bright.
- bright.
- dull & bright.

CARBONACEOUS MUDSTONE.

COAL - dull banded.
- dull & bright.
- bright banded.
- dull & bright.

CARBONACEOUS MUDSTONE - small coalified plant fragments.

SCALE 1:20

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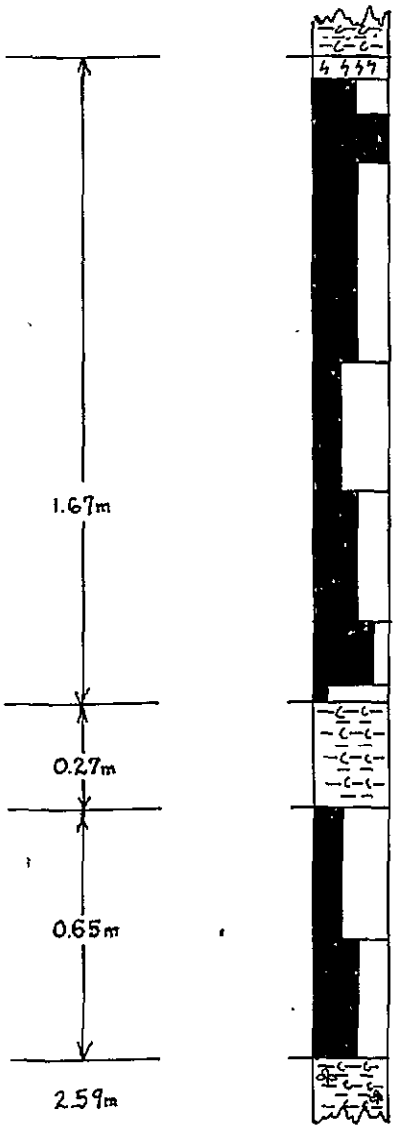
G.R.JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - SKEETER SEAM - Section D9



CARBONACEOUS MUDSTONE - slightly silty.
COAL - sheared.
- dull & bright.
- bright
- dull & bright.
- dull banded.
- dull & bright.
- bright banded.
- dull.
CARBONACEOUS MUDSTONE.
COAL - dull banded.
- dull & bright.
CARBONACEOUS MUDSTONE - fossiliferous.

SCALE 1:20

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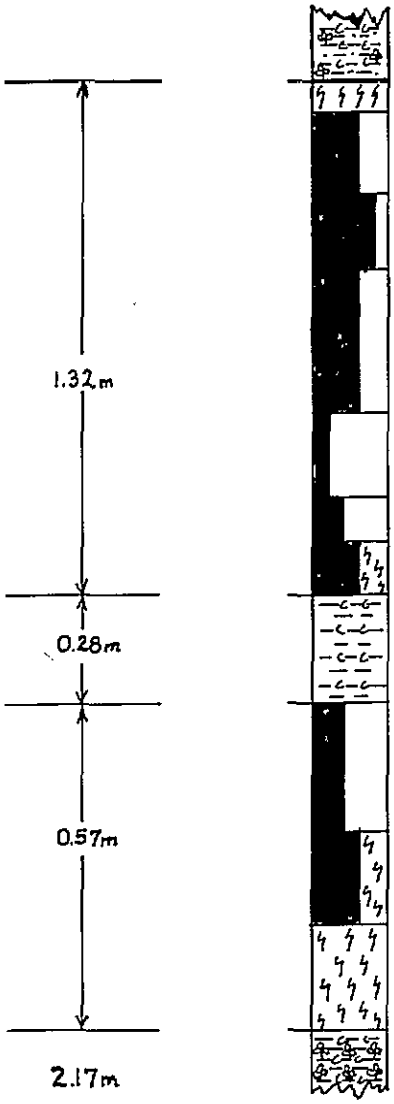
MINE NO.1 – SKEETER SEAM – Section E4



CARBONACEOUS MUDSTONE – slightly silty, abundant plant fossils.

COAL – sheared.

– dull & bright.

– bright banded.

– dull & bright.

– dull.

– dull banded.

– dull & bright, sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded

– dull & bright, sheared.

– sheared.

CARBONACEOUS MUDSTONE – very abundant plant fossils, lystric surfaces.

SCALE 1:20

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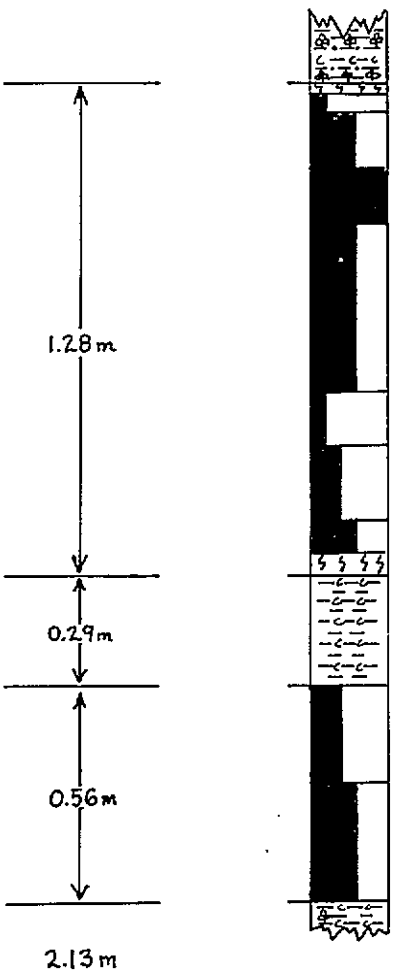
MINE NO.1 - SKEETER SEAM - Section E5



CARBONACEOUS MUDSTONE - slightly silty, very fossiliferous, numerous bright coal bands.

COAL - sheared.
- dull.
- dull & bright.
- bright.
- dull & bright.
- dull.
- dull banded.
- dull & bright.
- sheared.

CARBONACEOUS MUDSTONE.

COAL - dull banded.
- dull & bright

CARBONACEOUS MUDSTONE - minor plant fossils.

SCALE 1:20

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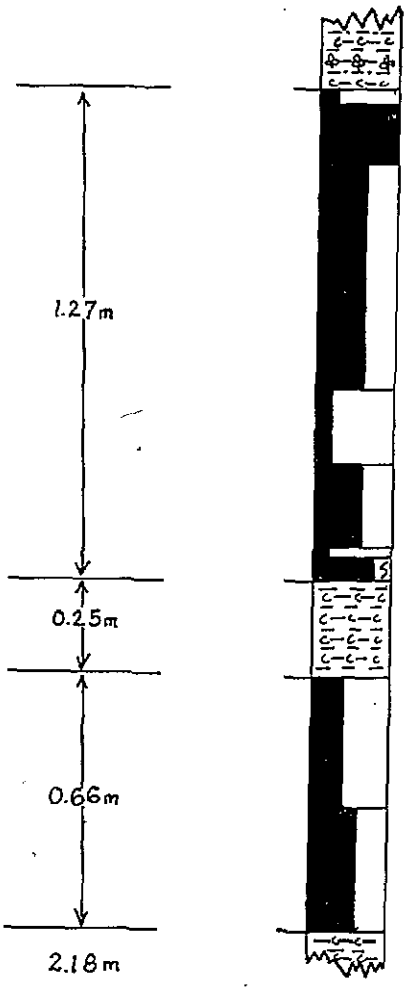
G.R. JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - SKEETER SEAM - Section EG



CARBONACEOUS MUDSTONE - slightly silty, abundant coaly plant fragments.

COAL – dull.
– bright.

– dull & bright.

– dull, pyrite on joints.

– dull & bright.

– dull.

– bright banded, sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

– dull & bright.

CARBONACEOUS MUDSTONE

SCALE 1:20

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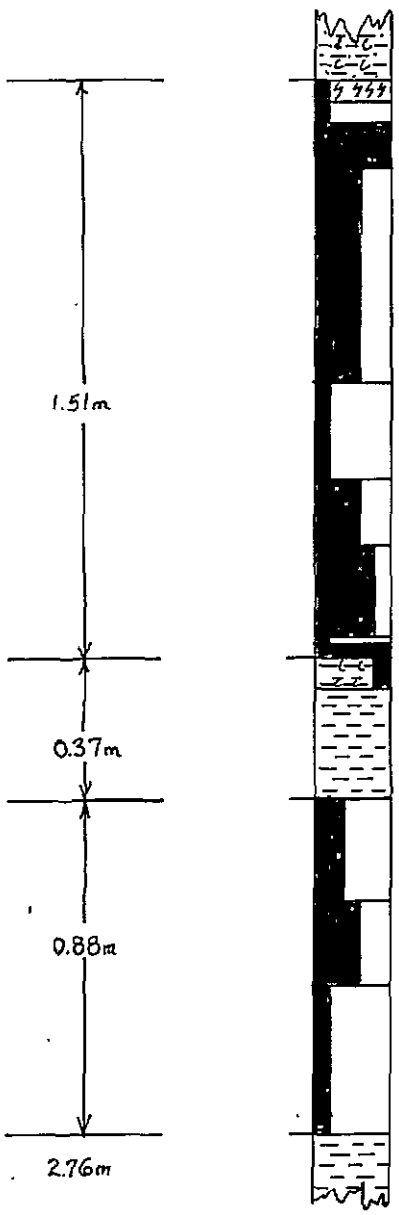
MINE NO. 1 – SKEETER SEAM – Section E7



CARBONACEOUS MUDSTONE – slightly silty.

COAL – dull, sheared.
– dull.
– bright.

– dull & bright.

– dull.

– dull & bright.

– bright banded-

– dull.
– bright.

CARBONACEOUS CLAYSTONE – numerous bright coal bands.

CARBONACEOUS CLAYSTONE.

COAL – dull banded.

– dull & bright.

– dull.

CARBONACEOUS MUDSTONE – plant fragments.

SCALE 1:20

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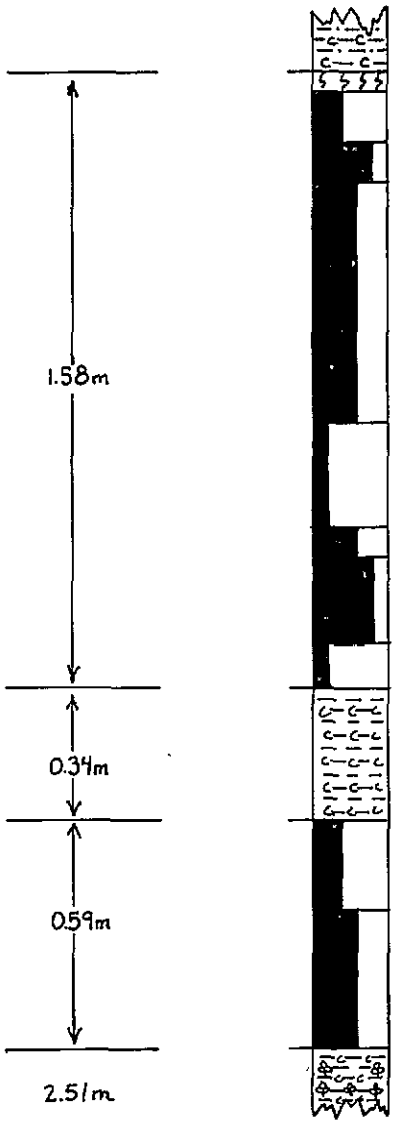
MINE NO.1 - SKEETER SEAM - SECTION E9



CARBONACEOUS MUDSTONE - slightly silty.

COAL – sheared.
– dull banded.
– bright banded.

– dull & bright.

– dull.

– dull & bright.

– bright banded.

– dull.

CARBONACEOUS CLAYSTONE.

COAL – dull banded.

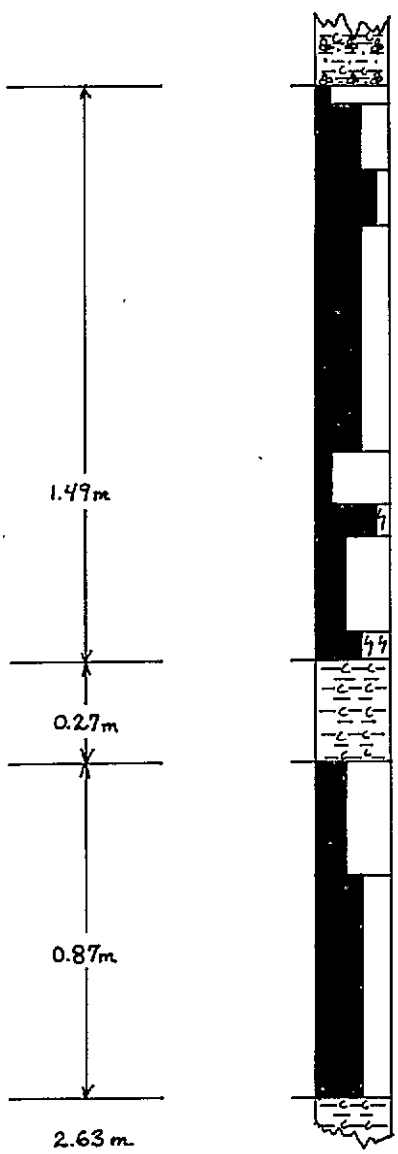
– dull & bright.

CARBONACEOUS MUDSTONE – fossiliferous.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - SKEETER SEAM - Section F4



CARBONACEOUS MUDSTONE - slightly silty, abundant plant fossils.

COAL - dull.

- dull & bright.

- bright banded.

- dull & bright.

- dull.

- bright banded, sheared.

- dull banded.

- bright banded, sheared.

CARBONACEOUS MUDSTONE.

COAL - dull banded.

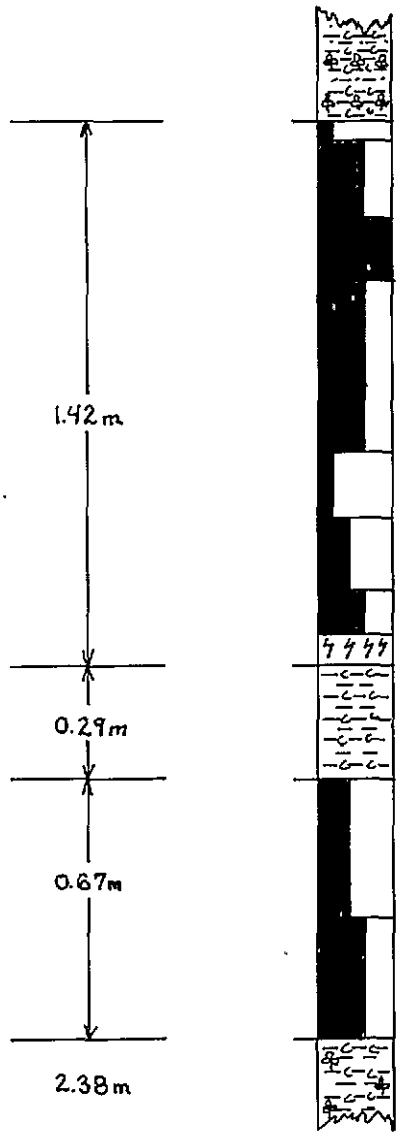
- dull & bright.

CARBONACEOUS MUDSTONE - minor plant fossils.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES LTD.

MINE NO.1 – SKEETER SEAM – SECTION F5



CARBONACEOUS MUDSTONE – slightly silty, very fossiliferous, numerous bright coal bands.

COAL – dull, shear plane at top.

– dull & bright.

– bright.

– dull & bright.

– dull.

– dull banded.

– dull & bright.

– sheared.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

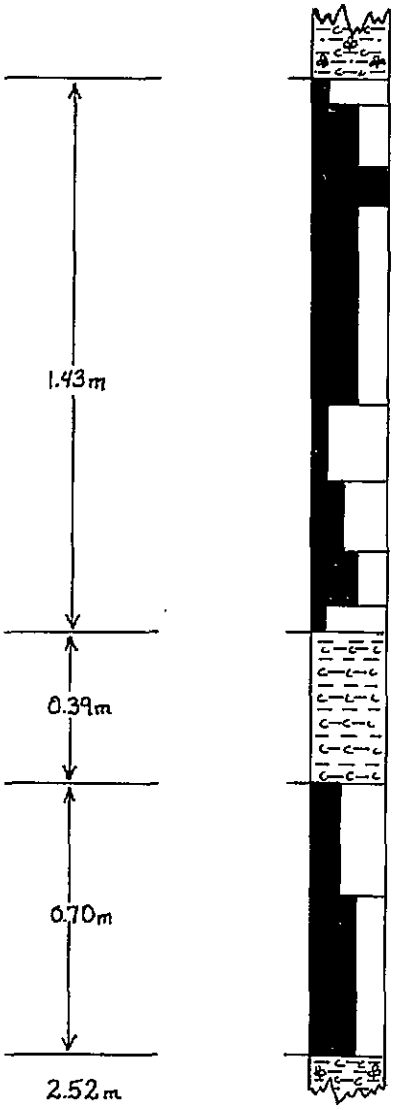
– dull & bright.

CARBONACEOUS MUDSTONE – minor plant fossils.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES

MINE NO.1 - SKEETER SEAM - Section F6



CARBONACEOUS MUDSTONE – slightly silty, with coalified plant fragments.

COAL – dull.

– dull & bright.

– bright.

– dull & bright.

– dull.

– dull banded.

– dull & bright.

– dull.

CARBONACEOUS MUDSTONE.

COAL – dull banded.

– dull & bright.

CARBONACEOUS MUDSTONE - occasional coalified plant remains.

SCALE 1:20

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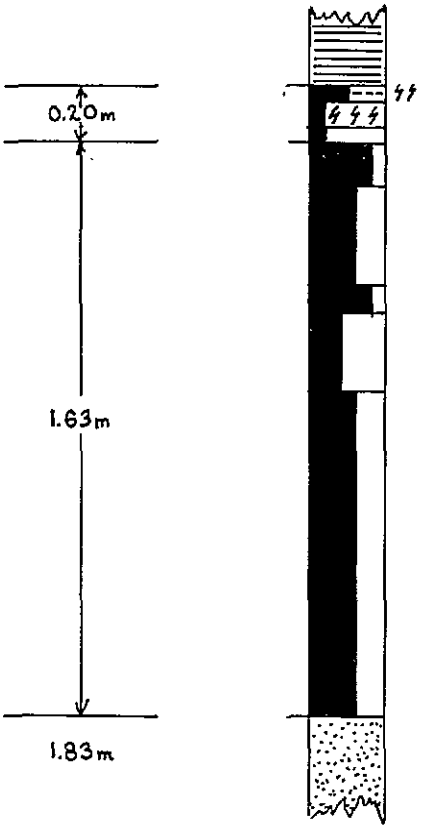
MINE NO.1 - CHAMBERLAIN SEAM - Section D1



LAMANITE.

COAL & CLAYSTONE - sheared.
COAL - boney, sheared.
- boney
- bright banded.
- dull & bright.
- bright banded.
- dull banded.
- dull & bright.

CARBONACEOUS SANDSTONE.

SCALE 1:20

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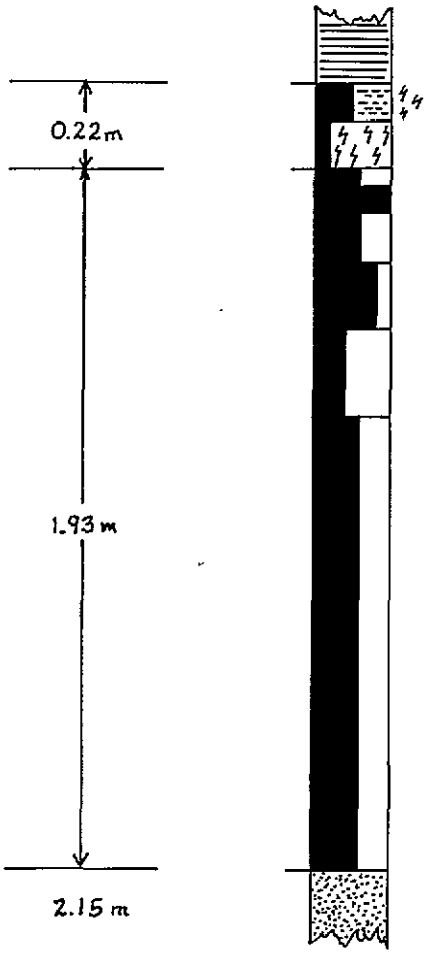
MINE NO.1 – CHAMBERLAIN SEAM – Section D2



LAMANITE.

COAL & CLAYSTONE – sheared.

COAL – bony, sheared.

– dull & bright.

– bright.

– dull & bright.

– bright banded.

– dull banded.

– dull & bright.

CARBONACEOUS SANDSTONE.

SCALE 1:20

Prepared by

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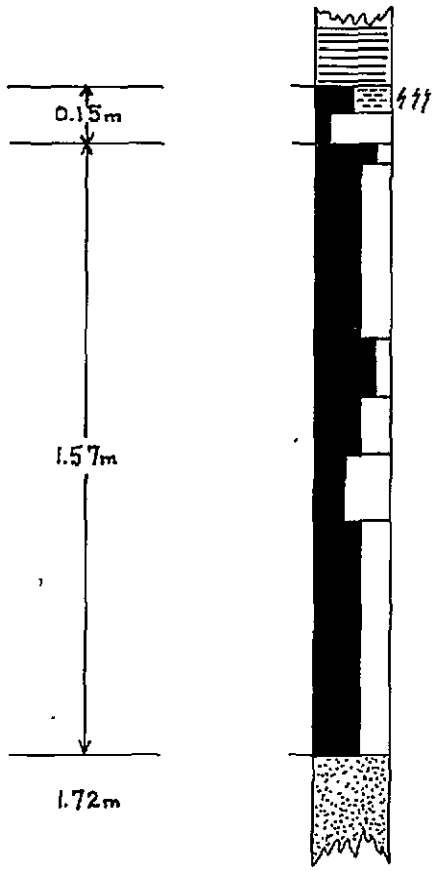
MINE NO.1 – CHAMBERLAIN SEAM – Section D3



LAMANITE.

COAL & CLAYSTONE – sheared.

COAL – boney.
– bright banded.

– dull & bright.

– bright banded.

– dull & bright.

– dull banded.

– dull & bright.

CARBONACEOUS SANDSTONE.

SCALE 1:20

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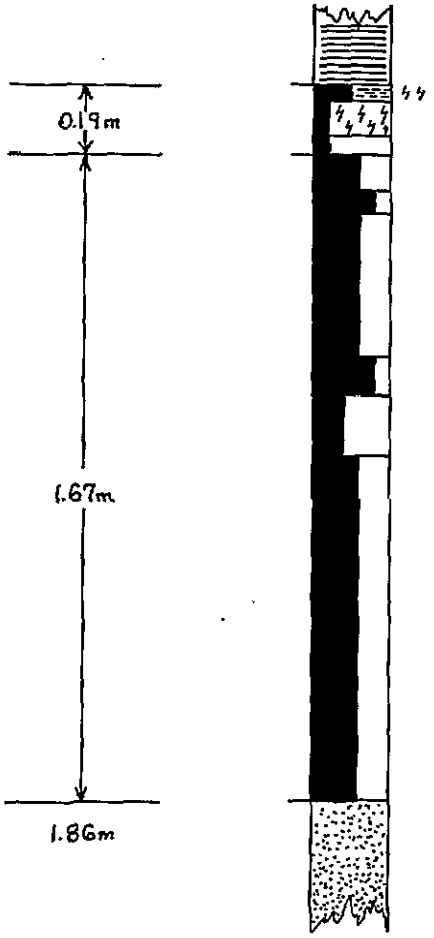
G.R.JORDAN CONSULTING SERVICES

MINE NO.1 – CHAMBERLAIN SEAM – Section E1



LAMANITE.

COAL & CLAYSTONE – sheared.
COAL – boney, sheared.
– boney.
– dull & bright.
– bright banded.

– dull & bright.

– bright banded.

– dull banded.

– dull & bright.

CARBONACEOUS SANDSTONE.

SCALE 1:20

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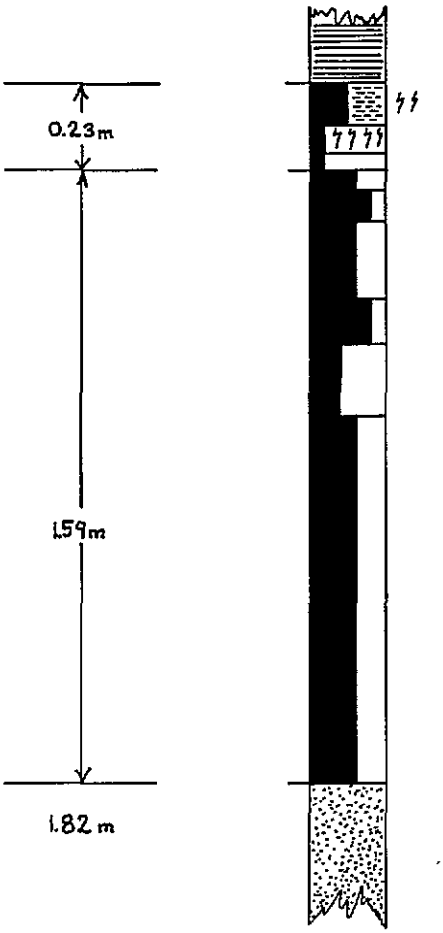
MINE NO.1 – CHAMBERLAIN SEAM – Section E2



LAMANITE.

COAL & CLAYSTONE – sheared.

COAL – boney, sheared.
– boney.
– dull & bright.
– bright banded.
– dull & bright.

– bright banded.

– dull banded.

– dull & bright.

CARBONACEOUS SANDSTONE.

SCALE 1:20

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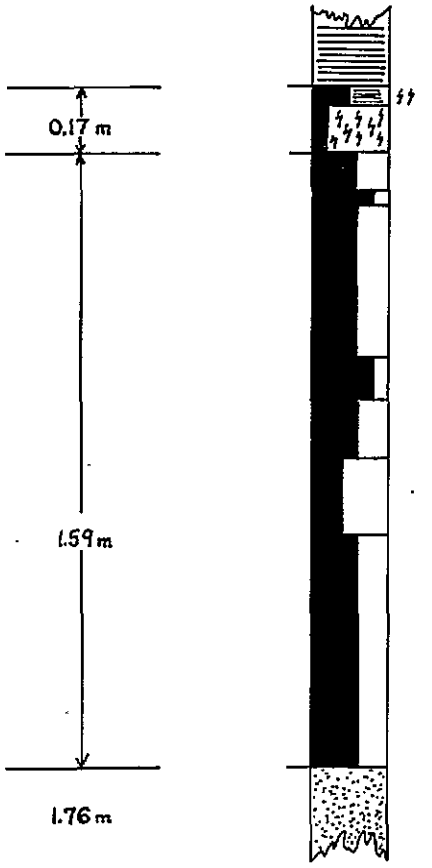
G.R.JORDAN CONSULTING SERVICES

MINE NO.1 - CHAMBERLAIN SEAM - Section E3



LAMANITE.

COAL & CLAYSTONE - sheared.

COAL - bony, sheared.
- dull & bright.
- bright banded.

- dull & bright.

- bright banded.

- dull & bright.

- dull banded.

- dull & bright.

CARBONACEOUS SANDSTONE.

SCALE 1:20

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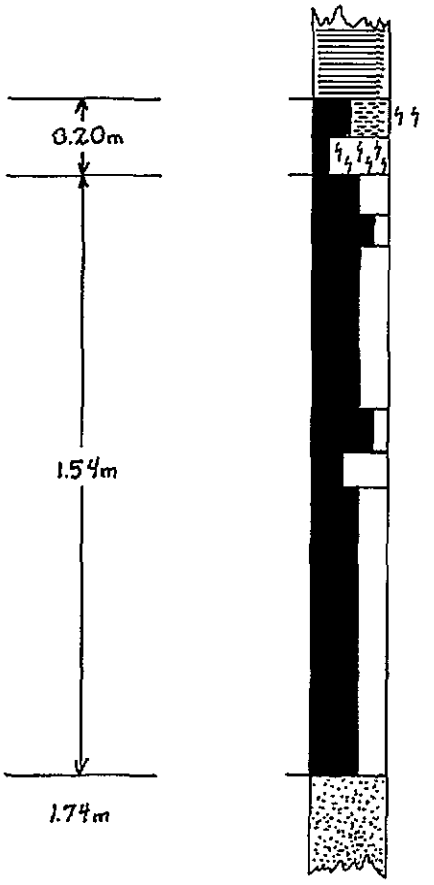
G.R.JORDAN CONSULTING SERVICES LTD.

MINE NO.1 - CHAMBERLAIN SEAM - Section F1



LAMANITE.

COAL & CLAYSTONE - sheared.

COAL - bony, sheared.

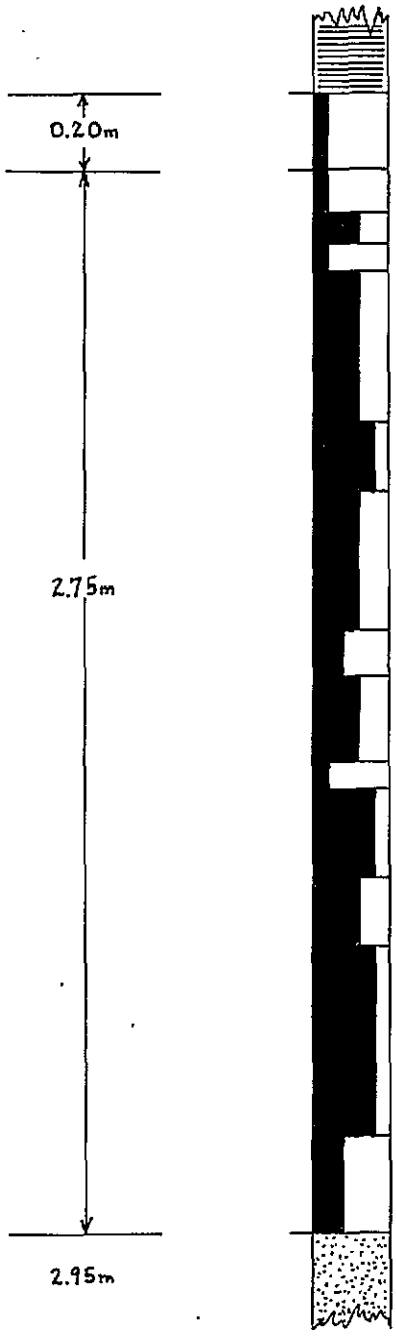
- dull & bright.
- bright banded.
- dull & bright
- bright banded.
- dull banded.
- dull & bright

CARBONACEOUS SANDSTONE.

SCALE 1:20

Prepared by
G.R.JORDAN CONSULTING SERVICES

'WINDOW MINE'- CHAMBERLAIN SEAM – Section CH1



LAMANITE.

COAL – boney.

– dull.
– dull & bright.
– dull.

– dull & bright.

– bright banded.

– dull & bright.

– dull banded.

– dull & bright.

– dull.

– bright banded.

– dull & bright.

– bright banded.

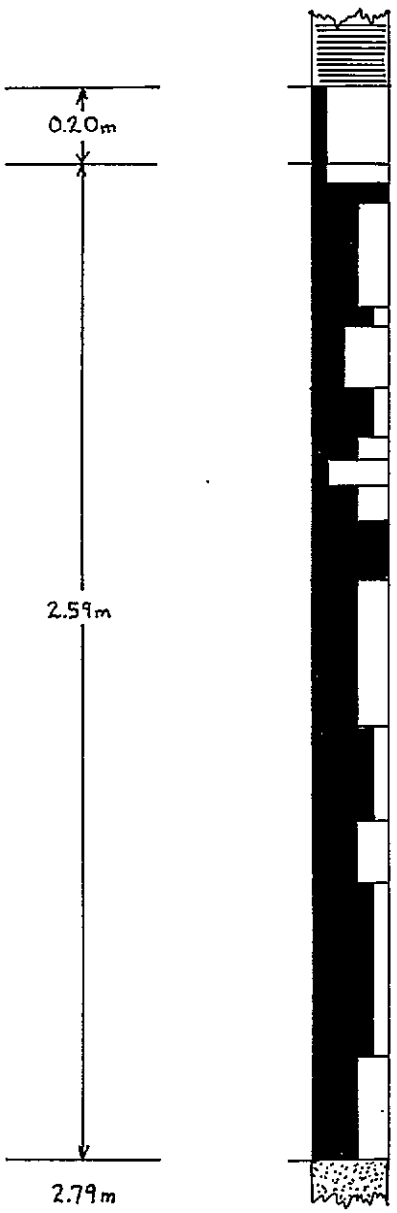
– dull banded.

CARBONACEOUS SANDSTONE.

SCALE 1:20

Prepared by
G.R. JORDAN CONSULTING SERVICES

'WINDOW MINE'– CHAMBERLAIN SEAM – Section CH2



LAMANITE.

COAL – boney.

– dull.
– bright.

– dull & bright.

– bright banded.

– dull banded.

– bright banded.
– dull & bright.
– dull.
– dull & bright.
– bright.

– dull & bright.

– bright banded.

– dull & bright.

– bright banded.

– dull & bright.

CARBONACEOUS SANDSTONE.

SCALE 1:20

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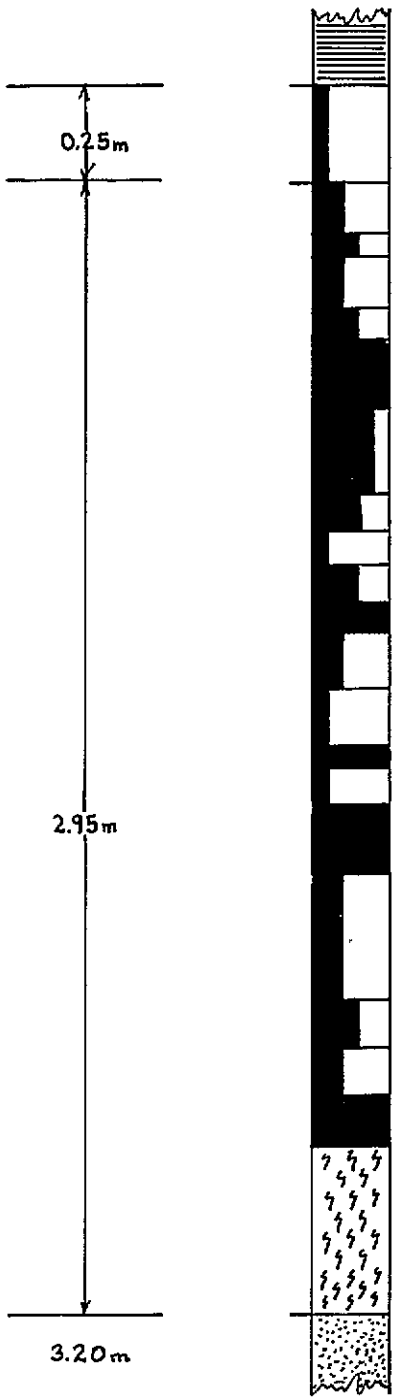
CHAMBERLAIN SEAM - WINDOW MINE - Station 28



LAMANITE.

COAL – boney.

– dull banded.
– dull & bright.
– dull banded.
– dull & bright.
– bright.

– bright banded.
– dull & bright.
– dull.
– dull & bright.
– bright.
– dull banded.

– dull.
– bright.
– dull.
– bright

– dull banded.

– dull & bright.

– dull banded.

– sheared.

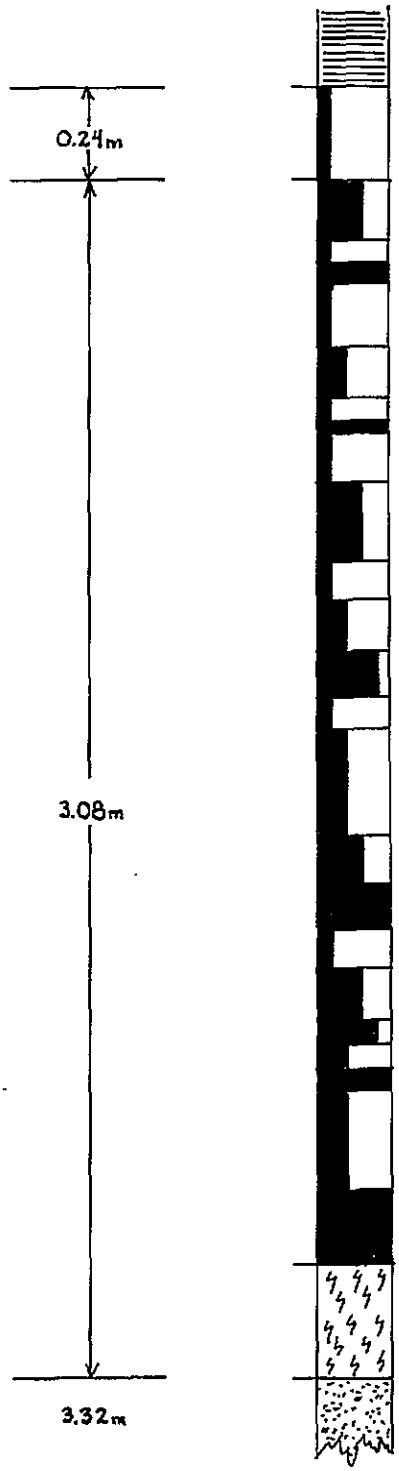
CARBONACEOUS SANDSTONE.

SCALE 1:20

After A. NEWSON.

Prepared by
G.R. JORDAN CONSULTING SERVICES

'WINDOW MINE' – CHAMBERLAIN SEAM – Station 29



LAMANITE.

COAL – boney.

– dull & bright.

– dull.
– bright.
– dull.

– dull banded.

– dull.
– bright.
– dull.

– dull & bright.

– dull.
– dull banded.

– bright banded.
– dull.

– dull banded.

– dull & bright.
– bright.
– dull.
– dull & bright.
– bright banded.
– dull banded.
– bright.

– dull banded.

– bright.

– sheared.

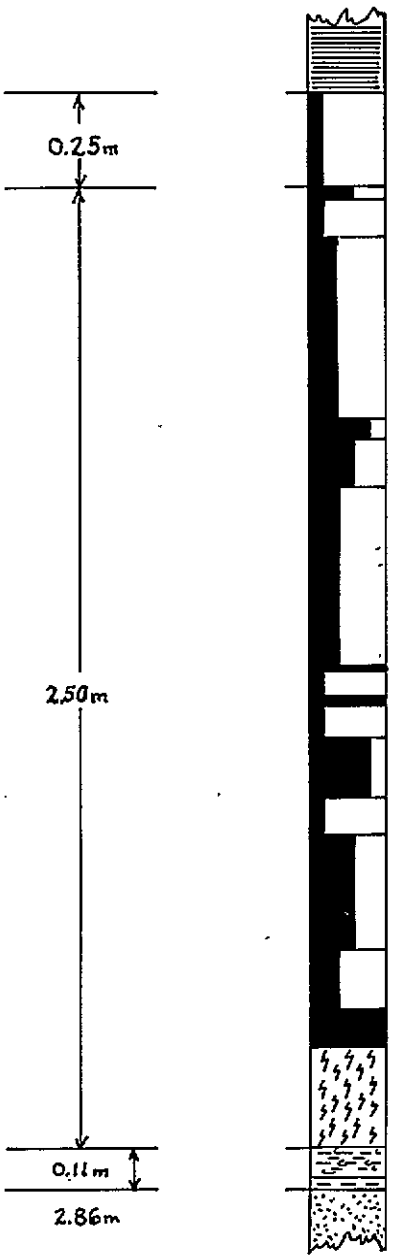
CARBONACEOUS SANDSTONE.

SCALE 1:20

After A. NEWSON.

Prepared by
G.R. JORDAN CONSULTING SERVICE

'WINDOW MINE' – CHAMBERLAIN SEAM – Station 30



LAMANITE.

COAL – boney.

– dull & bright.
– dull.

– dull banded.

– bright banded.
– dull & bright.

– dull banded.

– bright.
– dull.
– bright.
– dull.
– bright banded.
– dull.

– dull & bright.

– dull banded.
– bright.

– sheared.

CARBONACEOUS CLAYSTONE.
CLAYSTONE.

CARBONACEOUS SANDSTONE.

SCALE 1:20

After A. NEWSON.

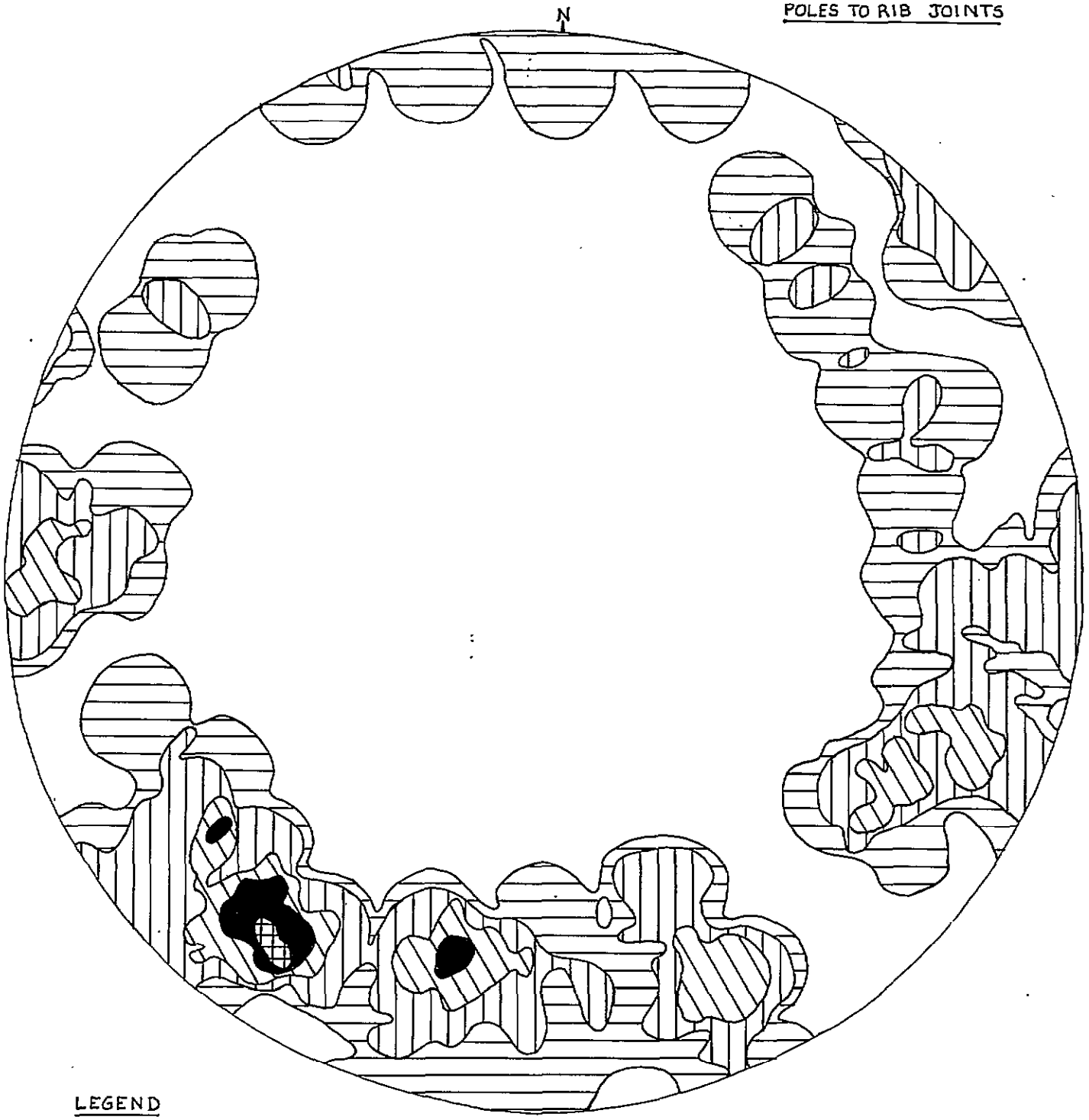
Prepared by
G.R. JORDAN CONSULTING SERVICES

APPENDIX B

STEREOGRAMS OF POLES TO RIB JOINTS

SKEETER SEAM – MINE NO.1 AREA

POLES TO RIB JOINTS



LEGEND

1 Percentile

2 Percentile

4 Percentile

6 Percentile

8 Percentile

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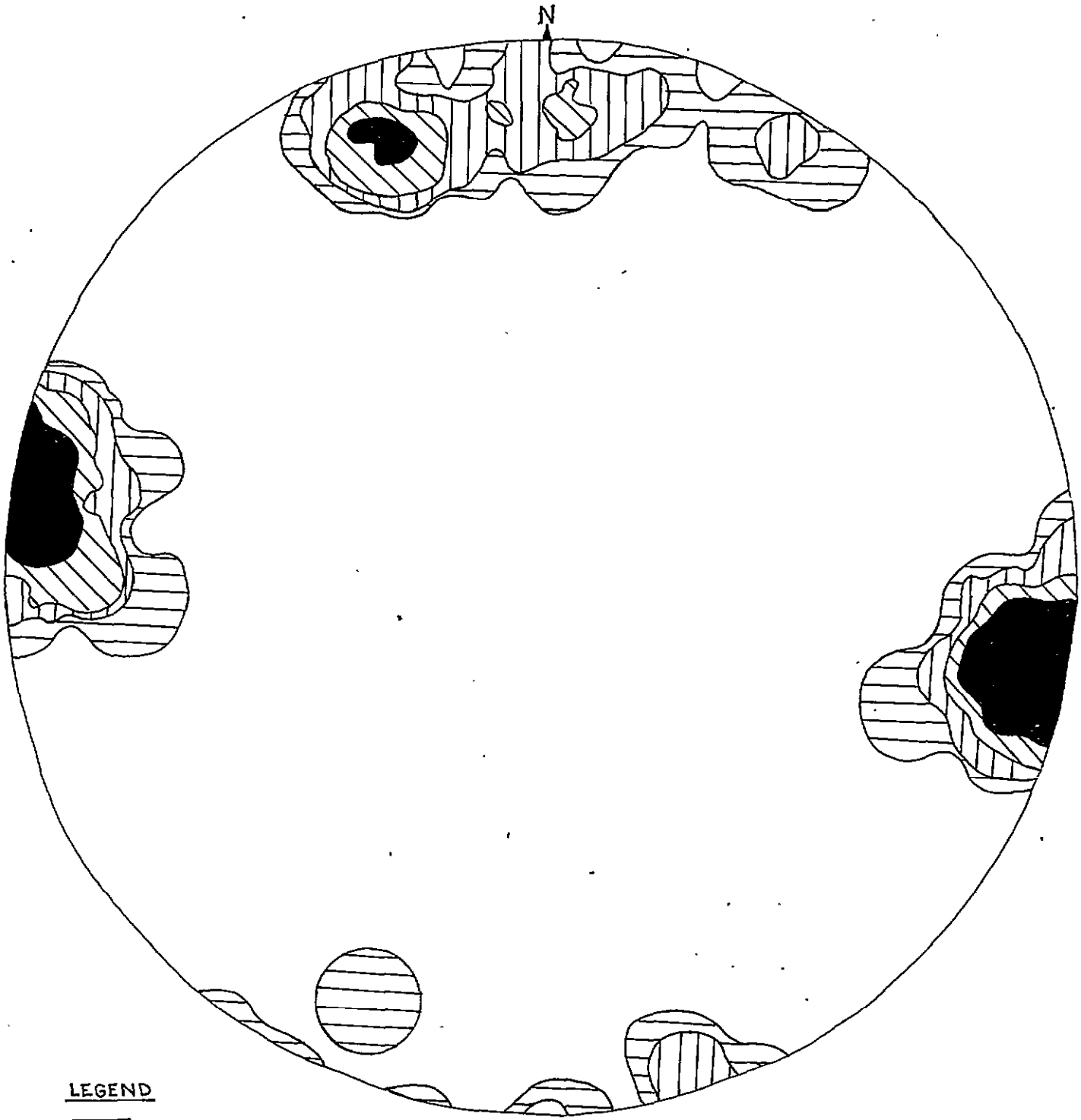
G.R. JORDAN CONSULTING SERVICES LTD.

CHAMBERLAIN SEAM – 'WINDOW MINE' AREA

POLES TO RIB JOINTS



LEGEND

1 Percentile

2 Percentile

4 Percentile

6 Percentile

8 Percentile

Prepared by

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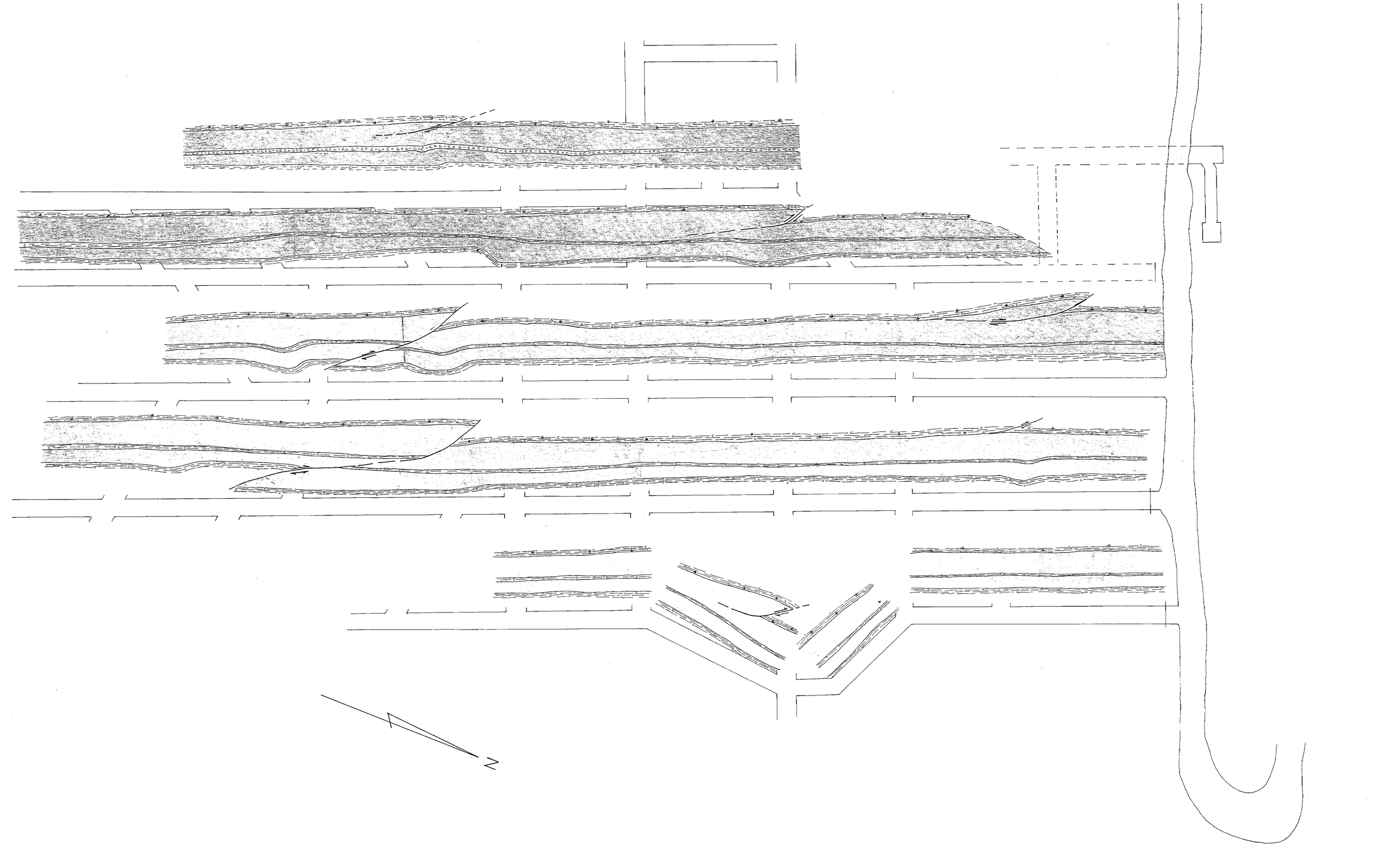

LEGEND

FOSSILIFEROUS CARBONACEOUS MUDSTONE - slightly silty.

COAL.

CARBONACEOUS MUDSTONE.

664

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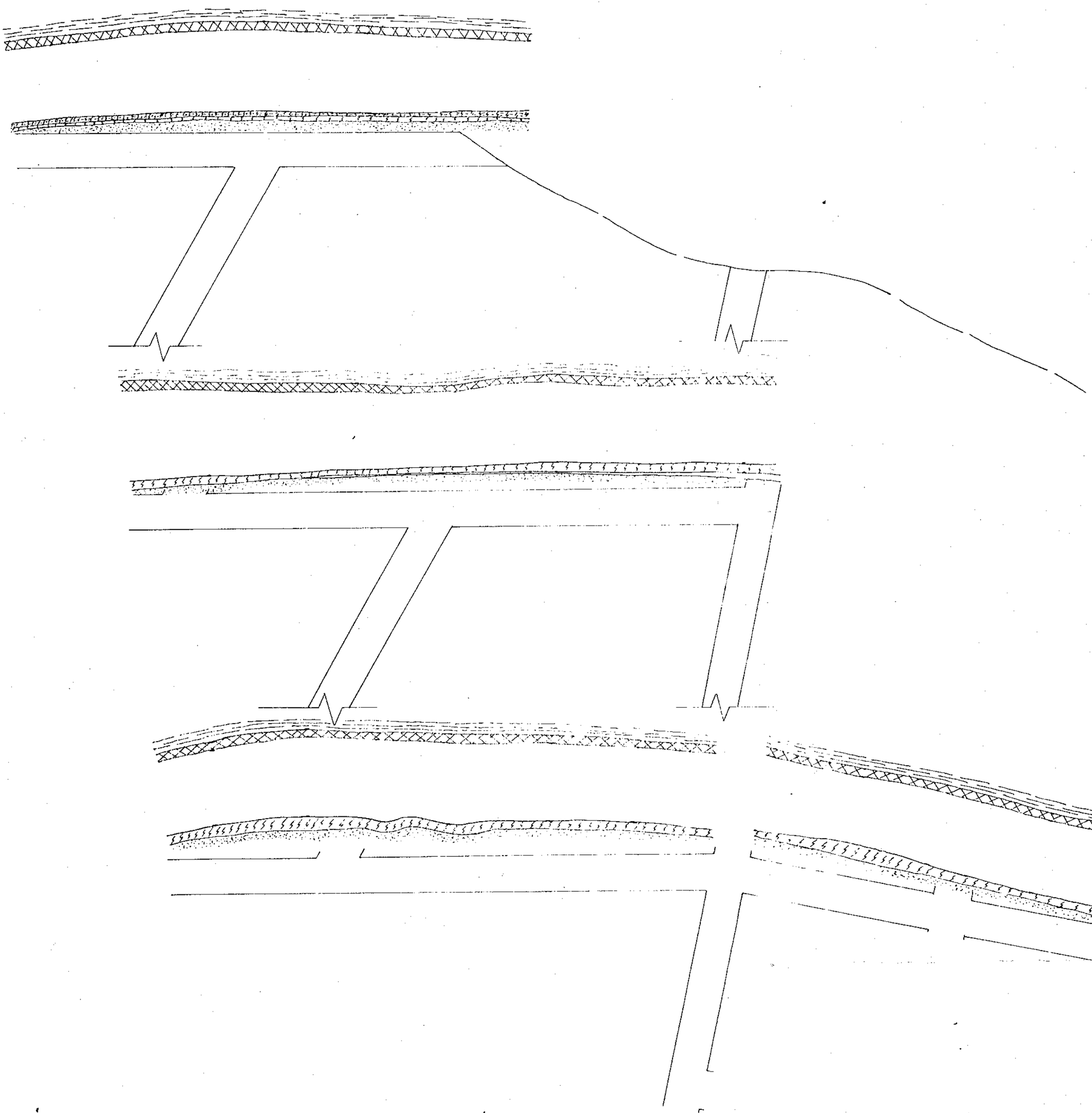
BP CANADA LIMITED

PR-SUKUNKA 77(2)B.

SKEETER SEAM - MINE NO. 1.
MINE-1 SEC
ROADWAY SECTIONS

MAP NO. 6.

HORIZONTAL SCALE 1:500 VERTICAL SCALE 1:100



LEGEND

- LAMANITE.
- COAL - boney.
- COAL.
- COAL - sheared.
- COAL AND/OR CLAYSTONE - sheared.
- CARBONACEOUS SANDSTONE.

664

Prepared by G.R. JORDAN CONSULTING SERVICES LTD. For

BP CANADA LIMITED

PR- SUKUNKA 77(2)B.

CHAMBERLAIN SEAM

'WINDOW MINE'

W-MINE SEC

ROADWAY SECTIONS

MAP NO. 14.

HORIZONTAL SCALE 1:500 VERTICAL SCALE 1:100