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TASMANIA - EL 5/61

HAREFIELD INTERIM GEOLOGICAL REPORT

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**The Shell Company of Australia Limited
Coal Division**

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HAREFIELD INTERIM GEOLOGICAL REPORT

Ian Wolliff

CEPR 4/82

February, 1982.

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SUMMARY

The Harefield steaming coal deposit is located 2km south west of St. Marys in north east Tasmania. The deposit may be readily extracted by conventional open pit methods. The thin nature of the seams may preclude them from underground mining considerations.

There are four recognised seams, named in descending order, the DD, D2, D3 and D4. The first three seams have a combined thickness of 3 to 5m, located within a vertical stratigraphic section of 14 to 20m. The D4 seam is about 1m thick and located approximately 8m below the D3 seam, but is not readily correlatable or persistent. The area is divided into three main sections by north south normal faults, which have downthrown western blocks of 20 to 60m. The central area is further divided on the basis of drill hole spacing for reserve calculation purposes. The coal seams regional dip is to the south, though within the Eastern Central area the seams dip to the south east at 1 in 30. The coal type appears to be similar to that found at Mount Nicholas. Within the area of indicated reserves the coal quality ranges from 23.2% Raw Ash (88.5% yield at F 1.7 and 17.2% Ash) in the D3 seam to 28.7% Raw Ash (75.5% yield at F1.7 and 23.8% Ash) in the DD seam.

Reserves of insitu coal are calculated from an assumed RD, over the average seam thickness (within each given reserve area) and the area between the subcrop and the position of the DD seam's 10m highwall. The Indicated In Situ Reserves (Eastern Central area) for the three upper seams is approximately 5.8 million tonnes with an overburden/In Situ coal ratio of 5.2 m³/t. The Assumed In Situ reserve for the remainder of the area is approximately 5.7 million tonnes with overburden ratios varying from 5.3 to 6.3. A further brief examination of the Indicated In Situ reserves indicates that washed product of 3.75 million tonnes might be attainable if all of the Indicated Reserve is of mineable quality.

The initial assessment of the overburden material is that the fresh rock will be marginally rippable and facilitate conventional mining techniques. The coal seams are generally wet and the water level is at the base of the soil profile (3m).

The 1981 exploration programme has outlined the character of the Harefield coal deposit which is sufficiently encouraging to warrant further development of the area.

1. INTRODUCTION

1.1 Scope

This report presents a basic qualitative and quantitative description of the coal seams occurring in the Harefield deposit in north east Tasmania. The data is derived from an exploration programme which has progressed to a stage whereby reserves can be assessed as Indicated and Assumed status.

Local topography, climate and infrastructure are briefly described as these subjects have been covered to a large extent in the Mount Nicholas deposit reports.

The account of coal quality is brief as the degree of sampling from the deposit is, as yet, insufficient to define coal quality trends accurately.

1.2 Location, Access and Infrastructure

The Harefield deposit is located at the head of the Esk Valley in north eastern Tasmania. It lies on the south side of the valley, at an elevation of slightly less than 300m above sea level.

St. Marys (population 700), the nearest town, is some 2km to the north east of the deposit, and contains a hospital, schools, shops and other community facilities. The deposit is accessible from the Esk Highway at St. Marys by a partially sealed road. There is a general system of farm tracks throughout the area which are suitable for dry weather traffic only.

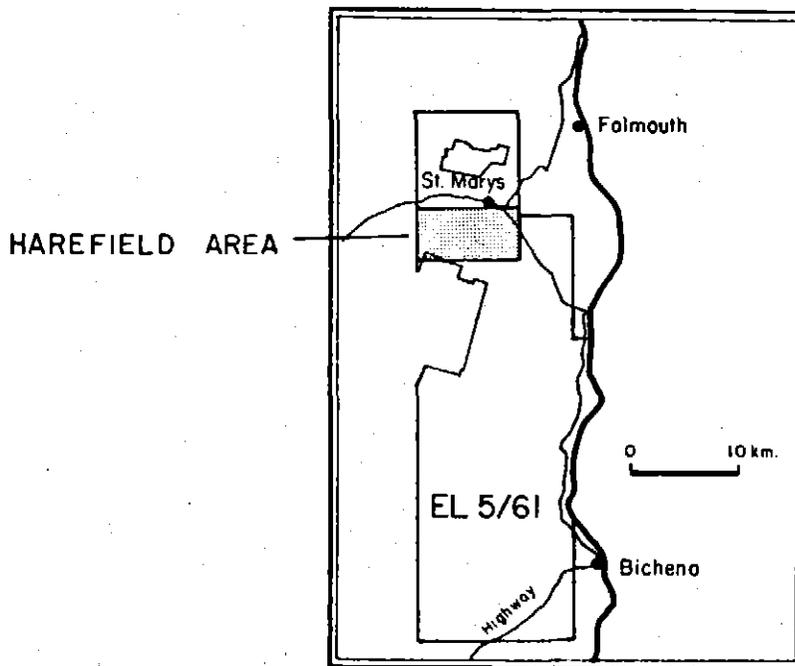
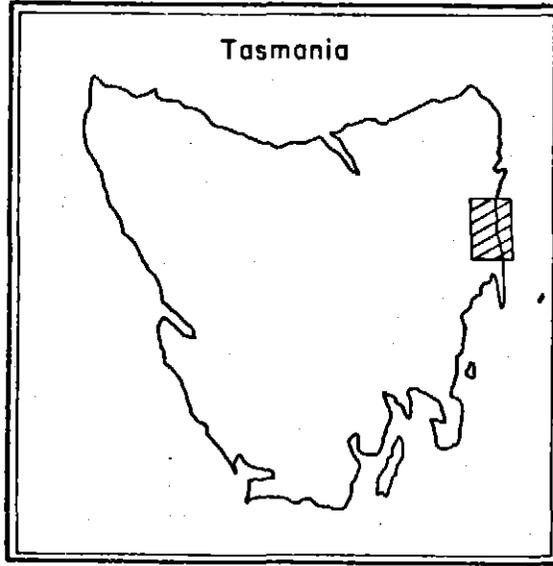
The rail head at St. Marys is linked with Hobart (170km) and Bell Bay (140km).

1.3 Topography and Climate

The topography of the deposit is that of a slightly undulating to flat plain that rises abruptly to the south to the Fingal Tier and drops slightly to the north to form a series of marshes in the winter. The deposit lies in an east west orientation between these extremes of topography.

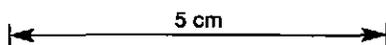
The area is crossed by several non-perennial creeks and drains that feed the Break O'Day River some 1 to 2 km to the north.

The climate of the area can be classified as cool, temperate, marine, with a rainfall varying from 1038mm (100 rain days) at St. Marys to 1278mm (138 rain days) at Gray, 6km southeast of St. Marys. Rainfall is greatest in the months May to September though heavy rain can occur at any time of the year when moist onshore winds prevail.



Location Map

TASMANIA - GRAY EL 5/61
HAREFIELD AREA



Author : Coal Division

Date : February 1982

Report No: CEPR 4/82

Drawing No: 2493

Fig. 1

Flooding of the Break O'Day Plain and the Fingal Valley to the west may occur several times a year, and occasionally disrupts road and rail transport. Fogs extending to west of Fingal are common during autumn and winter, and occasionally do not dissipate until early afternoon.

Mean maximum daily temperature varies between 21°C in mid-summer to 9°C in mid-winter. Minimum temperatures of less than -5°C are frequent in winter.

1.4 Mining and Land Tenure

The Harefield deposit is located within the northern end of Exploration Licence (EL) 5/61 (Gray) which was granted to Industrial and Mining Investigations Proprietary Limited (IMI) on the 23rd February, 1961. The Shell Company of Australia Limited (Shell) has since acquired a 60% interest in the EL.

All of the land under which coal occurs at Harefield is private property, (see Enclosure 1). A list of regional land owners is contained in Enclosure 2. The land is used primarily for stock grazing with some winter and summer stock feed crops being grown. The freehold title to the land has an improved value of approximately \$250 to \$300 per hectare. Coal rights over the land are presently being researched. Some of the property boundaries across the coal areas are defined in part by creeks. Immediately east and south east of the deposit lies a sealed road and a number of dwellings.

The region has a long history of coal mining, as outlined in CEPR11/81, although there has been no previous mining within the Harefield area, nor in any part of the valley floor farm areas.

1.5 History of Exploration

The historic stratigraphic (1890) drill holes "Harefield" and "Killymoon" are located on the Break O'Day plain within the EL. The Harefield drill hole recorded several thin seams at shallow depth while the Killymoon drill hole was located below the general coal bearing sequences (Hills 1922). Coal seams have been mined from outcrop on the adjacent Nicholas Range and Fingal Tier areas. The regional drilling conducted by Shell in 1980 indicated that some coal seams may persist under the south side of the Break O'Day Plain.

At the conclusion of the 1981 Mount Nicholas drill programme two exploratory holes (GY47 and GY48) were located in the forestry area of the south side of the Break O'Day plain to test the indications of possible open cut coal shown by the interpreted regional structure. The results of these holes encouraged a follow up exploration programme of mapping, open and cored holes in the latter half of 1981 (see Table 1).

The appropriate permits were obtained from the Department of Mines and notices of intention were circulated to the respective landholders. A Bank Guarantee of \$15,000 was arranged in compliance with Section 70(2) of the Mining Act 1929 as a performance deposit covering our obligations.

HAREFIELD TASMANIA. EL 5/61

STATISTICAL SEAM SUMMARY

SEAM	NUMBER OF COMPLETE DRILL INTERSECTIONS	AVERAGE COAL THICKNESS (m)	STANDARD DEVIATION (m)	MINIMUM THICKNESS (m)	MAXIMUM THICKNESS (m)
DD	17	1.55	0.45	0.55	2.25
D2	12	0.73	0.37	0.30	1.40
D3	21	1.11	0.52	0.20	2.01
D4	10	0.94	0.25	0.49	1.26

WEATHERING PROFILE SUMMARY

	NUMBER OF DRILL INTERSECTIONS	AVERAGE DEPTH (m)	STANDARD DEVIATION (m)	MINIMUM DEPTH (m)	MAXIMUM DEPTH (m)
SOIL	54	3.16	2.36	0.1	10.0
BASE OF WEATHERING	54	6.39	3.11	2.3	16.0

DRILLING STATISTICS FOR 1981 PROGRAMME

Total Number of Holes	54
Total Open Hole meterage	1330
Total Cored meterage	168
Total Metres Drilled	1498

Number of samples sent for coal analysis	19
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Open hole drilling was conducted over a one kilometre grid, with some infilling of both core and open holes. Hole depth varied from 12 to 50m. Most of the holes were petrophysically logged by SIE Australia Pty. Ltd. or BPB Instruments (Australia) Pty. Ltd., though some holes collapsed before logging. The drill holes and selected topographic features were surveyed by Peacock Darcey & Anderson Pty. Ltd. to an accuracy of 0.1m. Drill hole infilling was conducted at the end of the programme. Coal samples were analysed at Australian Coal Industry Research Laboratories Ltd. (ACIRL), while the geotechnical samples have been waxed for long term storage in Melbourne. The core has been photographed and is stored in north east Tasmania. Cuttings were not retained.

2. GENERAL GEOLOGY

2.1 Regional Setting

The Harefield coal deposit lies within the Permo-Triassic Tasmania Basin which extends over most of the eastern half of Tasmania. Unconformably underlying the basin is a basement of Siluro-Devonian sediments and Upper Devonian granite. Intruded into the basin, but now effectively overlying it, are dolerite sills emplaced during the Jurassic concurrent with an episode of major tensional faulting. Surficial deposits of alluvium, dolerite scree have accumulated during recent phases of topographic evolution (Spry & Banks 1962).

2.2 Harefield Geology

2.2.1 General

The Harefield deposit, as defined, extends from the foot of the Fingal Tier northwards to outcrop. The coal seams are located in the lower section of the Triassic coal measures, and may be correlated to the Mount Nicholas Lower Seams and to the Dalmayne D Seam. Some Permian outcrops have been recorded in the north west of the area, and several creek exposures of coal measures occur throughout the area. Soil with a dolerite scree component blankets the area to an average depth of 3m. In the Harefield historic drill hole, the Triassic coal measure sediments extend for 85m below the surface, indicating that the only developed coal seam sequence is that outlined by the present exploration programme.

2.2.2 Stratigraphy and Coal Measure Sedimentation

The Parmeener Super Group has been divided into a Lower marine group (formerly designated Permian) and an Upper group of essentially non-marine sediments. The Triassic coal measures make up the top portion of this Upper group.

Four seams, each with thicknesses extending into the 1 to 2m range, have been designated in descending order DD, D2, D3 and D4. (see Figure 2).

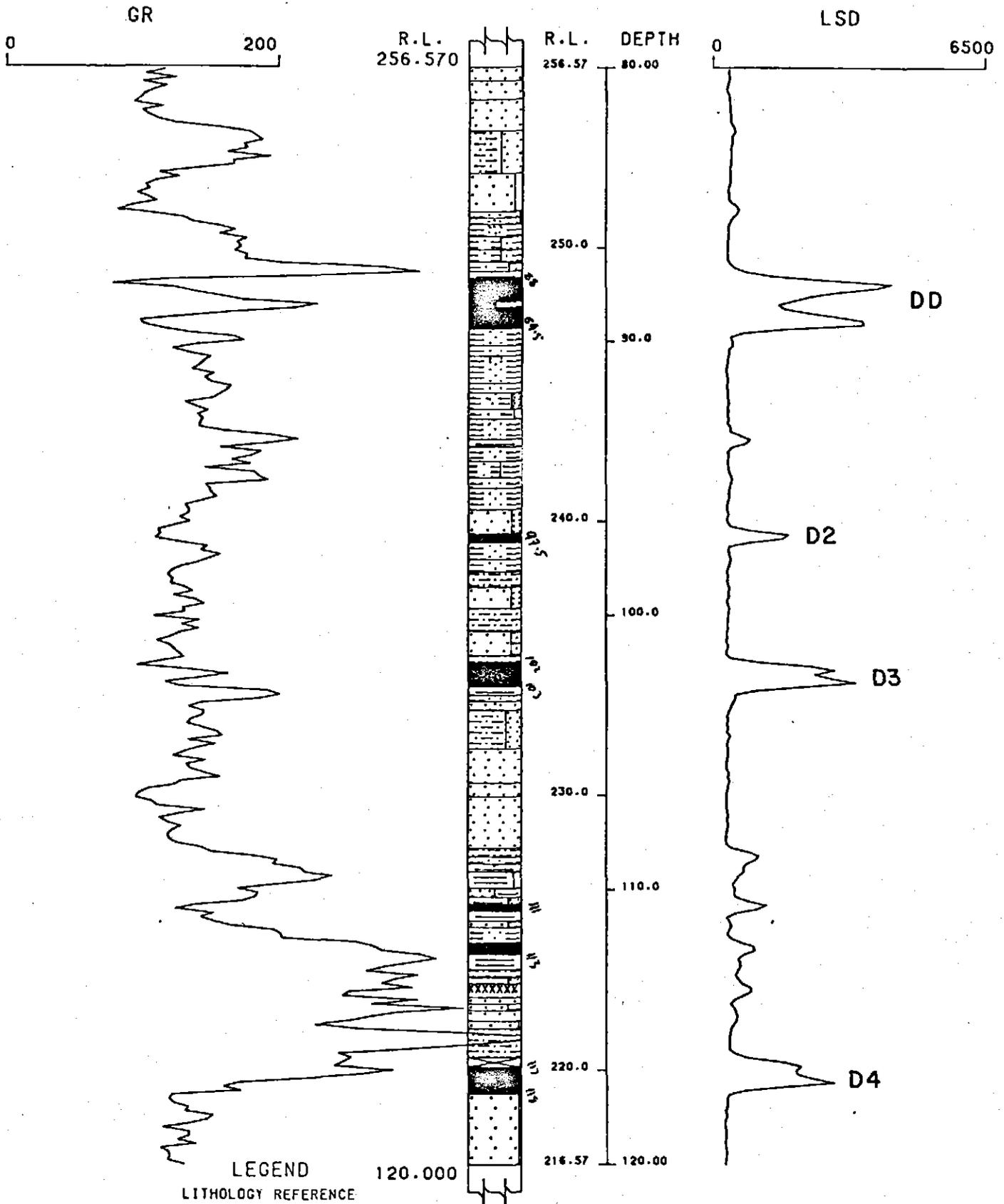
The coal measure sequence appears to be consistent with that found at Mount Nicholas which is of an upper fluvial flood plain regime (CEPR 11/81). The coal seams appear to be prone to splitting and rapid lateral quality variation. Seam washouts have been inferred in several drill holes (see borehole seam summary tables - Appendix 1).

2.2.3 Coal Measure Structure

The coal seams at Harefield dip to the south and south east within a graben bounded by north south trending faults on the western and eastern flanks of the deposit. The subcrop limits the northern extent of the deposit. To the south the seams dip beneath the Fingal Tier bounding the open cut potential of the deposit in that direction. The overall dip magnitude is 30m/km with a general consistency between all seams. Folding about a NNW to SSE axis, about the centre of the area, has produced a south east dip on the central eastern portion of the deposit, (though later work may result in this being reinterpreted as a tilt block).

Two major north-south trending faults have been inferred at the east and west limits of the deposit. The eastern fault is part of the Cornwall Fault and brings the western downthrown Triassic coal measures into contact with the Permian sediments. The western fault is part of the Mitchell Fault which is interpreted from regional geological maps and the extrapolation of the recorded structures of Mount Nicholas. Two smaller north south trending normal faults are implied through structural correlations and are each dipping to the west, such that their western sides are downthrown by 20m to 60m. The small western fault may be related to the Mount Nicholas eastern graben fault.

An east west striking normal fault has been interpreted from the coal seam correlation and structure (see Enclosure 3). This fault has a downthrow of 10m to the north.



STRATIGRAPHIC SECTION

DATE: 02 / 12 / 82
SPOOLED: 09:58

FILE: SPLO001
STARTED: 09:58

Author: Coal Division	Date: February 1982	Fig. 2
Report No. CEPR 4782	D. N. 2406	

2.2.4 Igneous Intrusions

The intrusive rocks at Harefield are dolerites which conform to the general character of Tasmanian mid-Jurassic dolerites. Two dolerite dykes have been located at Harefield. Regional trends suggest they may have north south lineation. The northern dyke was intersected from the surface in GY70. The southern dyke was intersected in the lower part of the coal sequence of GY48 and consisted of several close spaced steeply dipping dykes. The outcrop trace of these dykes has not been mapped.

Immediately to the south of the Harefield area, on the Fingal Tier, is an extensive dolerite sill and plug system.

2.2.5 Surficial Cover

Surficial cover at Harefield generally consists of brown to black clay rich soil with dolerite boulders scattered through it. In general these boulders are slightly weathered, 0.1 to 0.3m in diameter, and are exposed at the surface. Dolerite cobbles and boulders were intersected in 29 drill holes and contributed to an average of 50% of the soil profile content within these holes (with a standard deviation of 27%).

Adjacent to some of the creeks in the south of the deposit, there are some concentrations of dolerite boulders with very little soil component.

The water level is generally at the base of the soil profile, except in the west of the area, and where the topography rises dramatically to the south, where the water table is up to 65.7m below the surface.

2.2.6 Interburden Sediments

The interburden sediments are composed of a variety of rock types consisting mainly of lithic sandstone, siltstone, mudstone and carbonaceous mudstone. The sediments are essentially similar to those of Mount Nicholas however the Harefield sediments are subject to more vertical variation and there is an overall greater siltstone content.

Some rock strength characteristics of the nearby Mount Nicholas sediments are included in Table 2 for considerations of the rippability of these rocks. The laboratory seismic values indicate that the fresh sediments appear to be marginally rippable for a D9L to D10 class of machine. It is anticipated that in ground seismic values would be slower due to discontinuities (joints etc.), which may improve the indicated rippability of the sediments. Several geotechnical samples have been taken from Harefield for future testing.

SUMMARY OF SONIC VELOCITIES AND ASSOCIATED ROCK STRENGTH TEST VALUES
FOR TASMANIAN COAL MEASURES

TABLE 2

SHELL GRAY SAMPLES	34T03	36 T 15	36 T 19	36 T 20	41 T 01	41 T 03
Rock Type	Mudstone	Sandstone	Sandstone	Mudstone	Mudstone	Fine Sandstone
Degree of Weathering	Fresh	Fresh	Fresh	Fresh	Fresh	Fresh
Density (kg/cubic metre)	2448	2385	2474	2380	2415	2415
P-Wave Velocity (m/sec)	2338	2988	2710	2560	3175	3409
S-Wave Velocity (m/sec)	918	1652	1464	1586	1435	2224
Dynamic E (GPa)	5.84	16.7	13.6	14.3	13.9	26.7
Dynamic Poisson's Ratio	0.41	0.28	0.30	0.19	0.36	0.13
Static mid-third E (GPa)	1.68	2.13	2.79		3.65	8.95
Static mid-third V	0.42	0.34	0.35		0.34	0.31
Dynamic E/Static E	3.48	7.84	4.87		3.8	3.0
Brazilian Tensile Strength (MPa)	2.60	1.32	3.16			
Unconfined Compressive Strength (MPa)	20.5	15.6	17.3		27.3	41.7
Inferred ϕ	58°				45°	36°

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3. COAL DISTRIBUTION

3.1 General

Coal distribution information is based on the results of 54 drill holes, petrophysical logging (where available), outcrop mapping and accurate topographic surveying of drillhole collars and selected outcrops. Drillholes are spaced on a 1km grid, though this spacing has been reduced in some areas for greater geological control.

Tentative correlations have been made using the macrolithology of the coal seams and adjacent sediments, petrophysical log character and spatial distributions. The correlations are tabulated on the borehole seam summary table and displayed in the north south and east west cross sections. Enclosure 5 and 6.

3.2 Thickness and Extent

The average and range of each coal seams thickness is presented in Table 1. The available data suggests that each seam has no well defined regional trend. However, within the central eastern indicated reserve area (see Section 5) the DD seam thins down dip from the subcrop, the D2 and D3 seams thicken down dip from their subcrop.

The stratigraphic relationship of the coal seams relative to one another are shown in Figure 2.

3.3 Macrolithology and Micropetrology

The macrolithology of each seam varies laterally to some extent, though generally the DD seam contains a distinguishing tonstein marker horizon, the D2 contains a prominent mudstone band and the D3 seam is generally clean. The D4 seam nomenclature has been allocated to the well developed section of coal within a sequence of carbonaceous rich sediments below the D3 seam. Initial correlation between drillholes suggests that this seam may not be continuous, and thus it has been excluded from the reserve estimations. The coal seams generally have a short transitional roof and base.

No micropetrological studies have been conducted on coal samples from Harefield, though these seams are expected to be similar to the Mount Nicholas lower seam in having characteristically low percentage of reactives (Vitrinite and Exinite) and correspondingly high inerts (Inertinite).

3.4 Workable Section

The DD seam contains a prominent tonstein band near the centre of the coal seam. The seam ply samples were split at a point about 100mm above this band where the visual nature of the coal changed from an apparently clean top half to a dirty lower half. The washed coal analyses do not confirm this observation.

The D2 seam is generally thin though the prominent mudstone parting in the centre of the seam is sufficiently distinct that it may be possible to selectively mine each half of the coal seam.

The D3 seam has generally a dirtier top portion, as confirmed by the analysis of GY78, though it is likely that the entire seam may be mineable.

The D4 seam is generally a visually clean seam where it is well developed, though initial correlations suggest that it is highly susceptible to rapid lateral changes of quality, to carbonaceous mudstone, and possibly prone to splitting.

3.5 Washouts

Washouts are interpreted in a number of drill intersections, (see borehole seam summary) and in particular appear to have removed much of the D2 seam from the central western area and adjacent western area. Lost coal due to washouts has not been taken into account in the interpreted reserves of this report as the extent of the washouts are unknown.

4. BASIC COAL QUALITY

All analyses presented in this report were determined on whole samples of N.Q. wireline triple tube core (nominal 45.1mm diameter) with a recovery of greater than 95%. After detailed logging in the field, the seams were often separated into ply samples, the number and thickness of ply samples being governed by the apparent variation in the particular seam.

All samples were crushed to -25mm for float sink testing at R.D.'s 1.60, 1.70 and 1.80. The mass yields, ash contents and R.D.'s were determined. An outline of the results are presented on the Coal Seam Analysis Summary, Table 3. Quality trends are outlined in terms of potential mining directions.

After completion of the float/sink test of the DD seam in GY47, a composite sample was reconstituted using the 1.70 cumulative float fractions (yield 60.5%) for detailed utilisation testing. The results are presented on Table 4.

4.1 DD Seam

The Eastern Central area contains four analysed coal intersections, three of which (GY82, 84 and 86) are beyond the proposed reserve area (see Section 5) while the fourth intersection (GY90) lower ply is incomplete due to core loss. The raw ash appears to increase down dip from the subcrop, from 28.7% to 51.7% for the upper ply. The washed coal (F 1.7) yield decreases down dip from the subcrop (75.5 to 23.4%) while the ash increases to the south from 23.8 to 33.6%.

The Eastern area contains one intersection (GY47) which is beyond the proposed reserve area. The raw ash is 38% with a washed coal (F 1.7) yield of 60.5% with a 22% ash. There are no evident trends.

4.2 D2 Seam

The Eastern Central area contains three analysed coal intersections, two of which (GY90 and 102) are within the proposed reserve area while GY84 is taken from an extremely thin (0.05m) seam section. Within the proposed reserve area the raw ash is uniformly high (36%). The washed coal (F 1.7) yield increases down dip from the subcrop (63.6 to 86.5%) while the ash decreases to the south from 29.3 to 23.0%.

The Western area contains one analysed intersection, GY80, which is within the proposed reserve area. The raw ash is 47.8% with a washed coal (F 1.7) yield of 17.2% with a 30.2% ash.

COAL SEAM ANALYSIS SUMMARY

TABLE 3

HAREFIELD EL5/61

SEAM	AREA	SAMPLE NO.	BASE DEPTH m	THICKNESS m	RAW COAL		WASHED COAL (F1.7)	
					R.D.	ASH %	MASS %	ASH %
DD	Eastern	47A02	87.98	0.28	1.69	40.7	44.1	22.5
		47A03	89.22	1.24	1.64	38.4	59.3	22.6
		47A04	89.57	0.35	1.49	27.1	81.3	17.7
	Eastern Central	82A01	21.59	1.14	1.75	45.3	42.2	31.1
		82A02	22.32	0.73	1.69	46.6	48.9	23.5
		84A01	19.36	0.84	1.67	42.1	44.5	27.5
		84A02	20.03	0.67	1.92	61.9	11.1	33.8
		86A01	18.40	0.99	1.85	51.7	23.4	33.6
		86A02	19.22	0.82	1.79	48.6	45.5	32.5
		90A01	8.60	0.44	1.54	28.7	75.5	23.8
		90A02*	8.67	0.07	1.67 1.89	36.8 60.0	63.6 12.1	23.0 34.6
		D2	Eastern Central	84A03	24.30	0.05	1.47	24.1
90A03	15.91			0.69	1.67	36.8	63.6	23.0
102A1	12.96			0.44	1.64	36.1	75.2	29.3
Western	80A01		12.60	0.71	1.79	47.8	17.2	30.2
D3	Eastern		47A05	102.66	0.85	1.6	31.1	75.7
	Eastern Central	90A04	24.01	0.93	1.47	23.2	88.5	17.2
		102A2	22.33	0.55	1.72	42.1	57.6	26.3
	Western	78A01	9.67	0.59	1.64	34.1	64.1	25.0
		78A02	10.13	0.47	2.04	59.0	29.7	20.1
		80A04	19.35	1.00	1.43	23.3	88.4	17.1
	D4	Eastern	47A07	117.22	1.12	1.82	43.9	36.8
99A01			17.86	0.84	1.72	42.3	57.5	30.3
100A1			7.49	1.26	1.72	45.2	58.5	30.3
Eastern Central		102A3	26.35	0.49	1.85	52.3	3.1	39.1
		OTHER	Western	78A03	13.12	0.34	1.41	18.2
80A02	13.35		0.39	1.85	53.0	5.3	40.1	
80A03	14.55		0.27	1.49	24.7	92.9	22.1	

* Core loss in lower half of seam reduced sample selection.

Note 1. 47A01 & 47A06 have been excluded from this table as they are from transitional contacts that have been excluded from seam nomenclature.

2. The drill hole number is represented by the digits preceding the letter A within the sample number.

DD SEAM DETAILED ANALYSES

47A20 - A composite of the cumulative RD 1.70 floats of 47A02, 47A03, 47A04 combined in the raw coal mass ratio of 47:207:49.
(Calculated yield of 60.5% over a seam thickness of 1.87m.)

SAMPLE DETAILS			47A20		
ULTIMATE ANALYSIS					
D.A.F.	Basis				
Carbon	%	81.5	ASH ANALYSIS		
Hydrogen	%	4.40	Silicon as SiO ₂	%	64.9
Nitrogen	%	1.45	Aluminium as Al ₂ O ₃	%	27.3
Sulphur	%	0.41	Iron as Fe ₂ O ₃	%	2.44
Oxygen	%	12.24	Calcium as CaO	%	0.46
-----			Magnesium as MgO	%	0.35
Carbonates (CO ₂)	%	0.42	Titanium as TiO ₂	%	1.48
			Sodium as Na ₂ O	%	0.17
			Potassium as K ₂ O	%	0.28
			Phosphorus as P ₂ O ₅	%	0.03
			Manganese as Mn ₃ O ₄	%	0.21
			Sulphur as SO ₃	%	0.56
			ASH FUSION PROPERTIES		
			Deformation	°C	1490
			Spherical	°C	> 1600
			Hemisphere	°C	> 1600
			Flow	°C	> 1600
PROXIMATE ANALYSIS					
A.R. Basis					
Moisture	%	5.5			
Ash	%	21.9			
Volatile Matter	%	22.0			
Fixed Carbon	%	50.6			

Sulphur	%	0.30			
Chlorine	%	0.08			
Phosphorus	%				
Specific Energy MJ/kg		23.730			

Hardgrove Grindability
Index 55

4.3 D3 Seam

The Eastern Central area contains two analysed coal intersections (GY90 and 102) which are within the proposed reserve area. The raw ash decreases to the south from 42.1 to 23.2%. The washed coal (F 1.7) yield increases to the south from 57.6 to 88.5% while the ash decreases to the south from 26.3 to 17.2%. These trends are highly tentative as they are based on only two analyses.

The Eastern area contains one analysed intersection, GY47, which is beyond the proposed reserve area. The raw ash is 31.1% with a washed coal (F 1.7) yield of 75.7% and ash of 21.2%. There are no evident trends.

The Western area contains two analysed coal intersections (GY78 and 80) which are within the proposed reserve area. The raw ash decreases to the south from 34.1 to 23.3%. The washed coal (F 1.7) yield increases to the south from 64.1 to 88.4% while the ash decreases to the south from 17.1 to 25.0%. These trends are highly tentative as they are based on only two analyses.

4.4 D4 Seam

The Eastern Central area contains one analysed coal intersection, BY102, which is within the proposed reserve area. The raw ash is 52.3% with a washed coal (F 1.7) yield of 3.1% and ash of 39.1%.

The Eastern area contains three analysed coal intersections, GY47, 99 and 100 of which the latter two are within the proposed reserve area. The raw ash is uniformly high (42.3 - 45.2%). The washed coal (F 1.7) yield decreases downdip from 58.5 to 36.8%, similarly the ash decreases from 30.3 to 25.0%.

4.5 Other Seams

In the Western area three thin (0.27 to 0.39m) uncorrelated seams were analysed from two drill holes, GY78 and 80. Two of the analyses had a low raw ash (18.2 and 24.7%) with a suitable washed coal (F 1.7) yield of 90.4 and 92.9% with ash values of 14.6 and 22.1%.

4.6 Trend Summary

Within the Eastern Central area the DD degrades in quality downdip (SE) and to the south, while the D2 and D3 seams improve in quality downdip and to the south. There are no evident trends for the D4 seam.

Within the Eastern area there are no evident quality trends in the DD, D2 and D3 seams, though the quality of the D4 seam improves downdip to the south.

Within the Western Central area there are no analyses to indicate quality trends.

Within the Western area there are no analyses to indicate quality trends for the DD seam and no evident trends for the D2 seam (one analysis). The D3 seam improves in quality to the south. There are no analyses to indicate the quality of the D4 seam though some other thin seams exhibit good quality but lack correlation and trends.

5. COAL RESERVES

All coal reserves quoted are from sound, though sparse geological data which has been manipulated in the simplest possible form to calculate in-situ reserves. Due to the lack of confident correlation of the D4 seam, and the other seams, they have been excluded from coal reserve considerations.

A detailed structure map of each seam was constructed and subcrops plotted. A proposed 10m highwall on the upper most coal seam (DD) was adopted as the downdip limit and the area of each seam enclosed thereby calculated. Lost coal due to washouts have not been taken into account due to the present lack of relevant geological control.

The average seam thickness and an assumed R.D. of 1.50 was applied to the respective seam area to produce an estimate of in-situ reserves.

The Harefield area was subdivided into an Eastern, Central and Western area along the north south fault boundaries. The Central area was further divided into a Eastern Central and Western Central area on the basis of the spatial density of drill hole intersections; the Eastern Central area being assessed as Indicated Reserves, with the remainder of the Harefield area being assessed as Assumed Reserves. See Table 5.

Assuming that all the potential reserves are mined within the proposed area, then the total assumed washed product is calculated to be 3,750,000 tonne (see Table 5). This quantity of reserves is highly tentative and may have a 50% order of accuracy, depending on quality and mining scenarios.

Eastern Central Block

819023

SEAM	AREA (ha)	ASSUMED WORKABLE THICKNESS (m)	ASSUMED RD	INSITU RESERVES THOUSAND TONNES	OVERBURDEN RATIO CUBIC METRES ³ / TONNE INSITU
DD	65.3	0.5	1.5	500	
D2	184.1	0.7	1.5	1900	
D3	224.9	1.0	1.5	3400	
TOTAL	224.9			5800	5.2

ASSUMED RESERVES (AS 2519)

Eastern Block

SEAM	AREA (ha)	ASSUMED WORKABLE THICKNESS (m)	ASSUMED RD	INSITU RESERVES THOUSAND TONNES	OVERBURDEN RATIO CUBIC METRES ³ / TONNE INSITU
DD	3.6	1.9	1.5	100	
D2	18.6	0.3	1.5	80	
D3	34.7	0.9	1.5	470	
TOTAL	34.7			650	6.3

Western Central Block

SEAM	AREA (ha)	ASSUMED WORKABLE THICKNESS (m)	ASSUMED RD	INSITU RESERVES THOUSAND TONNES	OVERBURDEN RATIO CUBIC METRES ³ / TONNE INSITU
DD	12.9	1.5	1.5	290	
D2	38.7	0.3	1.5	170	
D3	57.3	1.2	1.5	1030	
TOTAL	57.3			1490	5.3

Western Block

SEAM	AREA (ha)	ASSUMED WORKABLE THICKNESS (m)	ASSUMED RD	INSITU RESERVES THOUSAND TONNES	OVERBURDEN RATIO CUBIC METRES ³ / TONNE INSITU
DD	45.4	0.8	1.5	540	
D2	95.8	0.5	1.5	720	
D3	154.9	1.0	1.5	2320	
TOTAL				3580	5.5

6. CONCLUSION

The exploration programme has outlined the Harefield steaming coal deposit. A significant area of indicated reserves have a favourable character and warrant further development to bring them up to measured status. Furthermore a large area of assumed reserves has a potential, through further exploration, to contribute to an improved reserve status. The reserves are readily accessible through open pit development. Conventional ripping equipment may be suitable for overburden removal. Further testing of the sediment's strength character, soil character and ground water profile will contribute to a more comprehensive mining scenario. The present information indicates that it may be possible to initiate mining a raw product from the D3 seam, closely followed by a washed product from the D2 and DD seams.

APPENDIX 1

BOREHOLE SEAM SUMMARY

HAREFIELD, TASMANIA

BOREHOLE SEAM SUMMARY

EL 5/61.

HOLE NO.	GY47	GY48	GY49	GY50	GY51	GY52	GY53
R.L. m	336.57	340.71	262.13	268.90	255.95	252.0	249.86
SOIL DEPTH m	0	3.80	4.50	6.0	6.0	3.0	3.0
% DOLERITE	0	80	0	50	75	50	60
B.W. DEPTH m	2.00	11.14	4.50	6.0	6.0	3.0	3.0
REST WATER DEPTH m	65.7		2.10	0.0	1.6	2.8	2.0
DD SEAM							
DEPTH m	87.43	117.68		26.50	7.34		
R.L. BASE m	247.00	220.19		241.40	246.97		
THICKNESS m	2.14	2.84		1.00	1.64		
	10m	9m		5m			
D2 SEAM							
DEPTH m	97.01	126.30		31.00		12.64	
R.L. BASE m	239.22	213.65		235.90		238.60	
THICKNESS m	0.34	0.76		2.00		0.76	
	4m	9m					
D3 SEAM							
DEPTH m	101.81	135.19		45.70		21.64	6.72
R.L. BASE m	233.91	204.76		222.20		228.48	242.36
THICKNESS m	0.85	0.76		1.00		1.88	0.78
	15m	12m					
D4 SEAM							
DEPTH m	116.10	147.00	6.40				11.23
R.L. BASE m	219.35	192.71	254.58				238.13
THICKNESS m	1.12	1.00	1.15				0.50
OTHER COAL							
DEPTH m				16.70			
R.L. BASE m				249.40			
THICKNESS m				2.80*			
TOTAL DEPTH m	124.50		57.0	48.0	19.0	33.0	27.0

* Denotes Split Seam
GY50 seam has 1.80m of coal.

HAREFIELD, TASMANIA

BOREHOLE SEAM SUMMARY

EL 5/61.

HOLE NO.	GY54	GY55	GY56	GY57	GY58	GY59	GY60
R.L. m	249.06	263.91	277.05	246.55	270.75	252.0	262.91
SOIL DEPTH m	0.35	2.10	3.10	2.80	2.90	2.20	5.00
% DOLERITE	0	0	40	0	0	100	0
B.W. DEPTH m	6.0	3.0	5.0	2.80	9.25	6.00	8.00
REST WATER DEPTH m	2.0	1.0	5.5	1.0	5.0	3.0	3.4
DD SEAM							
DEPTH m		2.10	30.80				
R.L. BASE m		259.56	244.75				
THICKNESS m		2.25	1.50				
D2 SEAM							
DEPTH m			35.00		5.8		
R.L. BASE m			241.05		264.45		
THICKNESS m		w	1.00		0.5		
D3 SEAM							
DEPTH m		21.83	42.80		9.25		
R.L. BASE m		241.21	233.05		260.40		
THICKNESS m		0.87	1.20		1.10		
D4 SEAM							
DEPTH m		42.5 E	55.00				
R.L. BASE m		220.4	221.05				
THICKNESS m		1.0 E	1.00				
OTHER COAL							
DEPTH m		22.80					22.20
R.L. BASE m		226.66					240.31
THICKNESS m		0.40					0.40
TOTAL DEPTH m	37.0	42.0	60.0	30.0	31.0	24.0	30.0

E - Estimated
w - Washout

HAREFIELD, TASMANIA

BOREHOLE SEAM SUMMARY

EL 5/61.

HOLE NO.	GY61	GY62	GY63	GY64	GY65	GY66	GY67R
R.L. m	262.67	277.24	260.89	284.11	299.52	295.42	267.73
SOIL DEPTH m	2.00	6.00	2.00	4.00	2.00	0.50	9.00
% DOLERITE	0	40	30	70	0	0	40
B.W. DEPTH m	5.00	6.00	10.00	7.00	4.00	3.00	11.50
REST WATER DEPTH m	4.8	DRY	1.7	1.6	14.5	9.6	2.1
DD SEAM DEPTH m				16.00	20.75	40.75	
R.L. BASE m				266.11	276.97	254.12	
THICKNESS m				2.00	1.80*	0.55	
D2 SEAM DEPTH m	5.00						
R.L. BASE m	257.17						
THICKNESS m	0.50			w	w		
D3 SEAM DEPTH m	10.65			29.00	37.30		
R.L. BASE m	251.67			253.11	261.02		
THICKNESS m	0.35	w		2.00	1.20		
D4 SEAM DEPTH m		22.00					
R.L. BASE m		254.24					
THICKNESS m		1.00					
OTHER COAL DEPTH m							16.30
R.L. BASE m							251.13
THICKNESS m							0.30
TOTAL DEPTH m	30.0	37.0	20.00	48.00	42.00	49.00	24.00

* Split Seam

GY65 DD seam has 1.55m of coal.

HAREFIELD, TASMANIA

819030

BOREHOLE SEAM SUMMARY

EL 5/61.

HOLE NO.	GY68	GY69	GY70	GY71	GY72	GY73	GY74
R.L. m	258.45	303.60	265.63	257.76	252.84	278.86	302.47
SOIL DEPTH m	1.50	1.00	0.10	8.00	4.00	4.50	1.20
% DOLERITE	0	0	100	50	50	60	10
B.W. DEPTH m	4.20	6.00	15.00	10.90	10.30	10.65	8.00
REST WATER DEPTH m	2.0	4.1	12.5	DRY	2.8	4.0	1.6
DD SEAM							
DEPTH m						9.30	15.0
R.L. BASE m						268.21	
THICKNESS m						1.35	?
D2 SEAM							
DEPTH m	5.60					15.8	
R.L. BASE m	252.55					261.56	
THICKNESS m	0.30					1.50*	
D3 SEAM							
DEPTH m	7.69						
R.L. BASE m	249.58						
THICKNESS m	1.18*						
D4 SEAM							
DEPTH m							
R.L. BASE m							
THICKNESS m							
OTHER COAL							
DEPTH m		3.50					
R.L. BASE m		298.60					
THICKNESS m		1.50					
TOTAL DEPTH m	42.00	42.00	19.00	18.00	25.00	18.0	16.0

* Denotes Split Seam

GY68 D3 seam has 0.98m coal

GY73 D2 seam has 1.35m coal.

HAREFIELD, TASMANIA

BOREHOLE SEAM SUMMARY

EL 5/61.

HOLE NO.	GY75	GY76	GY77	GY78	GY79	GY80	GY81
R.L. m	274.40	271.95	268.79	259.65	260.95	269.94	256.76
SOIL DEPTH m	8.00	4.30	10.00	3.75	0.10	4.50	0.30
% DOLERITE	100	40	100	0	0	0	0
B.W. DEPTH m	13.00	11.00	16.00	5.58	2.30	4.50	4.00
REST WATER DEPTH m	DRY	33.3	DRY	2.2	DRY	4.3	11.0
DD SEAM							
DEPTH m						4.50	
R.L. BASE m						264.64	
THICKNESS m						0.80	
D2 SEAM							
DEPTH m						11.89	
R.L. BASE m						257.34	
THICKNESS m						0.71	
D3 SEAM							
DEPTH m				9.08	0.10	18.35	
R.L. BASE m				249.52	259.95	250.59	
THICKNESS m				1.05*	+0.90	1.00	
D4 SEAM							
DEPTH m							
R.L. BASE m							
THICKNESS m							
OTHER COAL							
DEPTH m				12.78			
R.L. BASE m				246.53			
THICKNESS m				0.34			
TOTAL DEPTH m	30.00	36.00	19.00	14.30	20.0	21.29	18.00

* Denotes Split Seam

GY78 DD seam has 0.85m of coal.

HAREFIELD, TASMANIA

BOREHOLE SEAM SUMMARY

EL 5/61.

HOLE NO.	GY82	GY83	GY84	GY85	GY86	GY87	GY88
R.L. m	261.47	264.92	270.29	273.31	275.09	272.33	272.50
SOIL DEPTH m	2.00	0.10	2.00	0.80	2.00	2.00	2.90
% DOLERITE	30	0	40	0	0	50	40
B.W. DEPTH m	4.00	7.60	5.00	7.80	5.30	6.80	6.00
REST WATER DEPTH m	2.1	5.0	1.2	6.2	4.7	2.7	4.0
DD SEAM							
DEPTH m	20.45		18.52	5.50	17.36	3.20	27.20
R.L. BASE m	239.15		250.26	265.51	255.87	268.73	244.3
THICKNESS m	1.87		1.51	2.30*	1.86	+0.40	
D2 SEAM							
DEPTH m			24.25	12.30			
R.L. BASE m			246.04	258.71			
THICKNESS m			0.05	2.30P		w	
D3 SEAM							
DEPTH m		6.90		18.40		21.10	
R.L. BASE m		257.22		253.61		250.13	
THICKNESS m		0.80		1.30		1.10	
D4 SEAM							
DEPTH m							
R.L. BASE m							
THICKNESS m							
OTHER COAL							
DEPTH m							
R.L. BASE m							
THICKNESS m							
TOTAL DEPTH m	24.45	18.00	25.26	30.00	22.40	30.00	27.17

* Denotes Split Seam
 GY85 DD seam has 1.70m coal.

P denotes very poor quality

E denotes correlation depth/estimated depth.

HAREFIELD, TASMANIA

BOREHOLE SEAM SUMMARY

EL 5/61.

HOLE NO.	GY89	GY90	GY91	GY92	GY93	GY94	GY95
R.L. m	262.48	267.86	270.35	261.05	254.04	291.16	287.73
SOIL DEPTH m	2.10	3.00	3.50	1.00	0.80	3.80	1.00
% DOLERITE	0	40	0	0	0	0	0
B.W. DEPTH m	4.00	5.50	7.10	3.50	3.00	4.10	4.20
REST WATER DEPTH m	0.5	3.4	0.0	0.5	DRY	DRY	DRY
DD SEAM DEPTH m		8.16					
R.L. BASE m		258.00					
THICKNESS m		1.70					
D2 SEAM DEPTH m		15.22	7.00				
R.L. BASE m		251.78	261.95				
THICKNESS m		0.86*	1.40				
D3 SEAM DEPTH m		23.08	15.80				
R.L. BASE m		243.81	253.55				
THICKNESS m		0.97	1.00				
D4 SEAM DEPTH m	4.70						
R.L. BASE m	256.98						
THICKNESS m	0.90						
OTHER COAL DEPTH m							
R.L. BASE m							
THICKNESS m							
TOTAL DEPTH m	12.00	30.37	24.00	12.00	12.00	24.00	30.00

* Denotes Split Seam

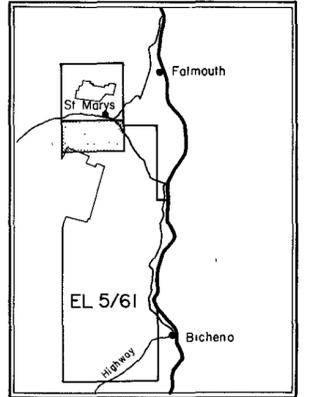
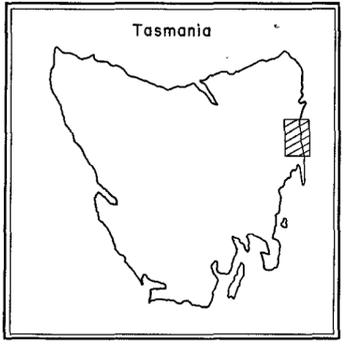
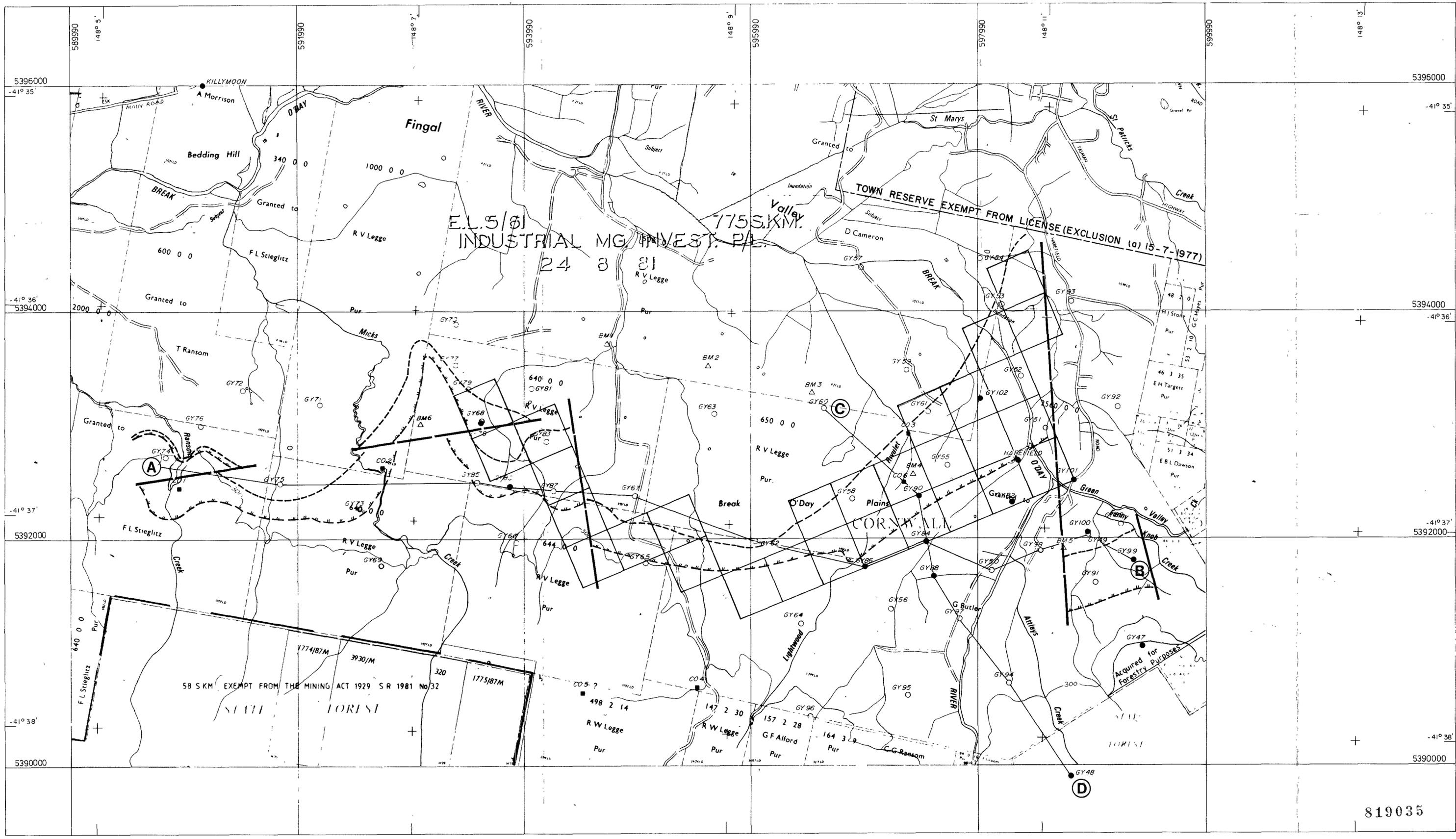
GY90 D2 seam has 0.70m coal.

HAREFIELD, TASMANIA

BOREHOLE SEAM SUMMARY

EL 5/61.

HOLE NO.	GY96	GY97	GY98	GY99	GY100	GY101	GY102
R.L. m	299.90	277.89	266.09	266.54	262.01	259.44	254.15
SOIL DEPTH m	8.50	3.00	4.00	2.30	0.81	4.00	3.50
% DOLERITE	50	80	30	5	0	20	10
B.W. DEPTH m	9.50	5.00	5.50	6.00	3.99	5.00	6.00
REST WATER DEPTH m	DRY	0.6	1.6	-	0.6	1.9	-
DD SEAM							
DEPTH m			39.33				
R.L. BASE m			225.83				
THICKNESS m			1.38				
D2 SEAM							
DEPTH m							12.52
R.L. BASE m							241.19
THICKNESS m							0.44
D3 SEAM							
DEPTH m				7.01			21.78
R.L. BASE m				257.52			231.82
THICKNESS m				2.01			0.55
D4 SEAM							
DEPTH m				17.02	6.23		25.86
R.L. BASE m				248.68	254.52		227.80
THICKNESS m				0.84	1.26		0.49
OTHER COAL							
DEPTH m							
R.L. BASE m							
THICKNESS m							
TOTAL DEPTH m	30.00	42.00	42.00	18.63	8.49	15.65	30.00



LEGEND

- GY56 Open hole
- GY88 Cored hole
- CO1 Coal outcrop
- △ BM1 Bench mark
- Subcrop D3 seam
- 10m Highwall for DD seam
- Fault trace
- Ⓐ Ⓑ Cross section location (see Enclosures 5 & 6)

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TASMANIA - GRAY EL 5/61
HAREFIELD

BOREHOLE LOCATIONS

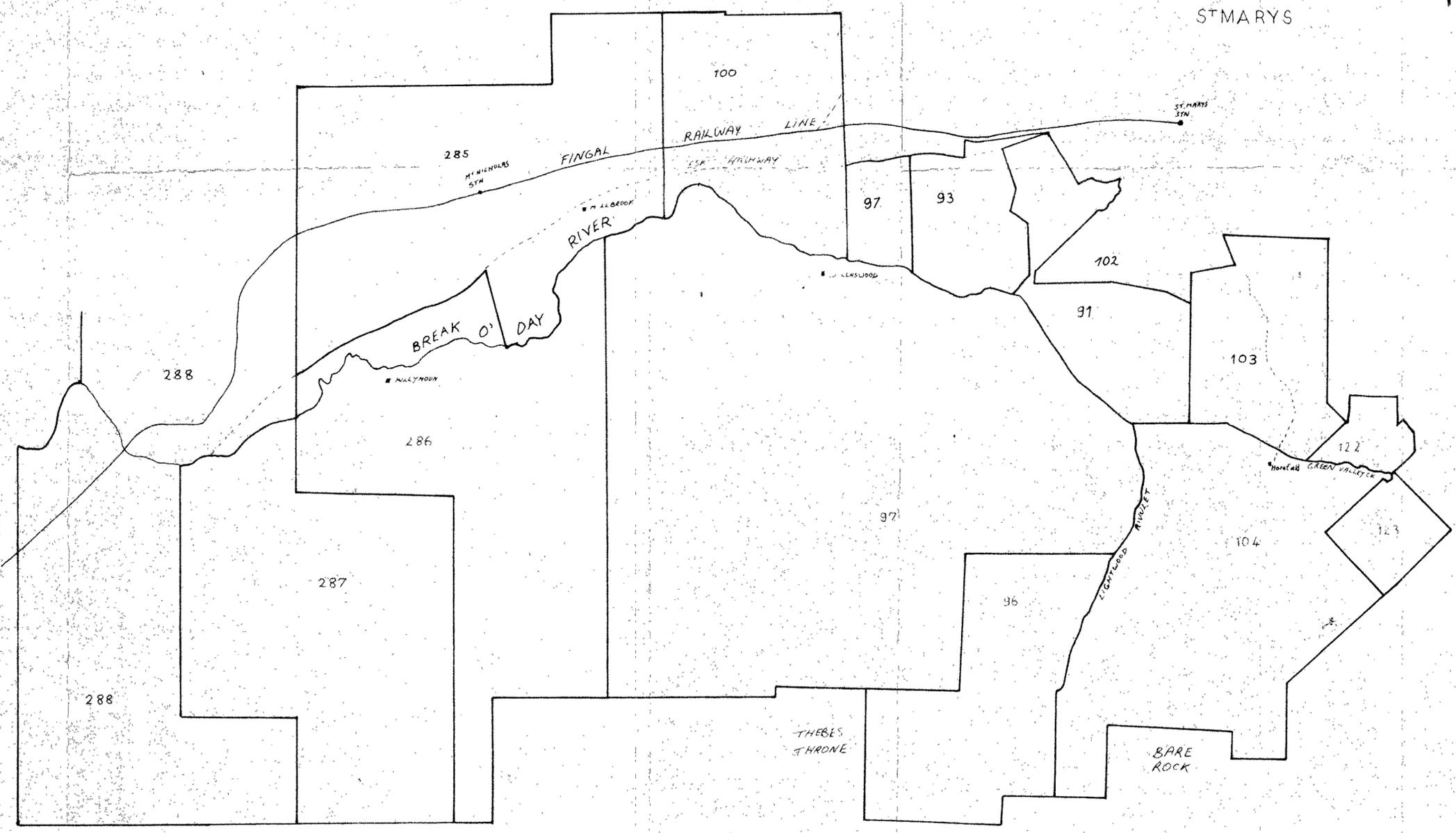
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Report No CEPR 4/82	Drawing No 2491	

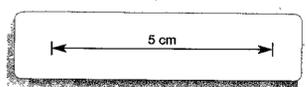
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CORNWALL

ST. MARYS



- 91 YOUNG, D.L.L. & V. "Londavra"
- 93 DAVERN, P.J. ST. MARYS
- 96 LEGGE, R.W. Estate c/- Cullenswood Pty Ltd.
- 97 CULLENSWOOD PTY LTD c/- A.W. Legge "Cullenswood"
- 100 NAPIER, J.R. & M.H. AND WATERHOUSE, J.H. c/- "MILLBROOK"
- 102 NAPIER, G.H. Estate c/- "MILLBROOK"
- 103 LOANE, C.D. & S.M. "Brooklyn"
- 104 G.H. NAPIER AND SON c/- "MILLBROOK"
- 122 DAKIN, I.J. "Rosegarland"
- 123 LOANE, C.D. & S.M. "Brooklyn"
- 285 NAPIER, J.R. & M.H. AND WATERHOUSE, J.H. c/- "MILLBROOK"
- 286 KILLYMOON PTY. LTD. P.O. BOX 82 ST. MARYS
- 287 KODRINGA PTY. LTD. 54 Cameron St. Launceston
- 288 BRODRIBB, KA. & SON "FRODSLEY"



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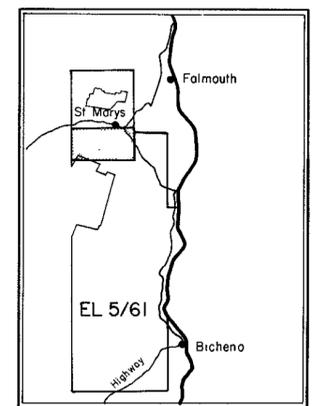
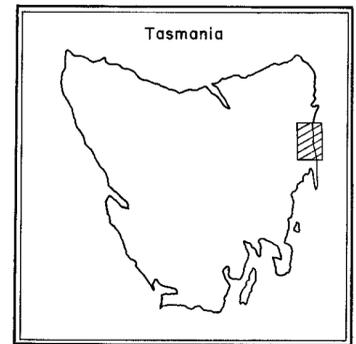
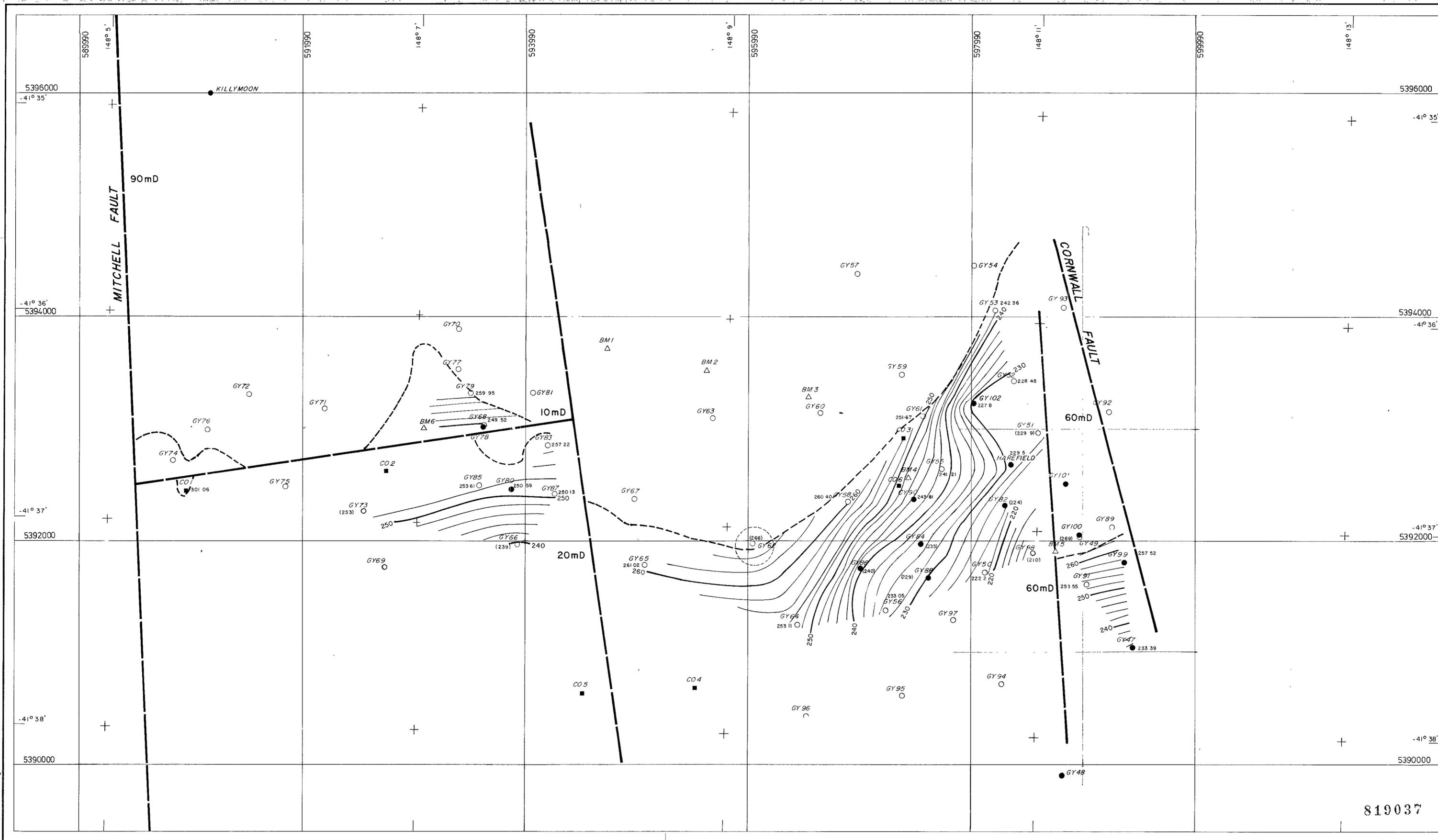
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THE SHELL COMPANY OF AUSTRALIA LTD.
 TASMANIA - GRAY · EL 5/61
 HAREFIELD

LAND OWNERSHIP (As at Oct 81)
 Compiled from Tasmania Lands Department Records
 Scale 1 : 1000

Author	Coal Division/PS	Date	February 1982
Report No	CEPR 4/82	Drawing No	2495

Encl 2



LEGEND

- GY56 Open hole
- GY88 Cored hole
- CO1 Coal outcrop
- △ BM1 Bench mark
- - - Subcrop D3 seam
- · - · - Washout
- Fault
- 257.52 Base of seam R.L.
- (210) Interpreted base of seam R.L.
- 20mD Fault displacements (Down)

0 250 500 1000 1500 2000 metres

SCALE 1 20 000

5 cm

82-1712. Org.

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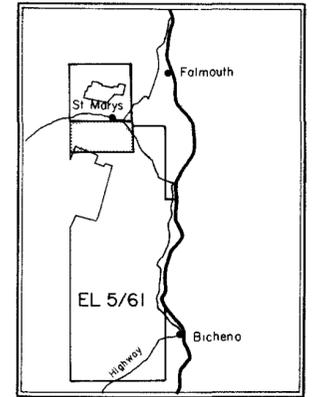
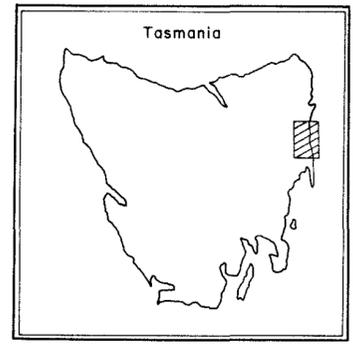
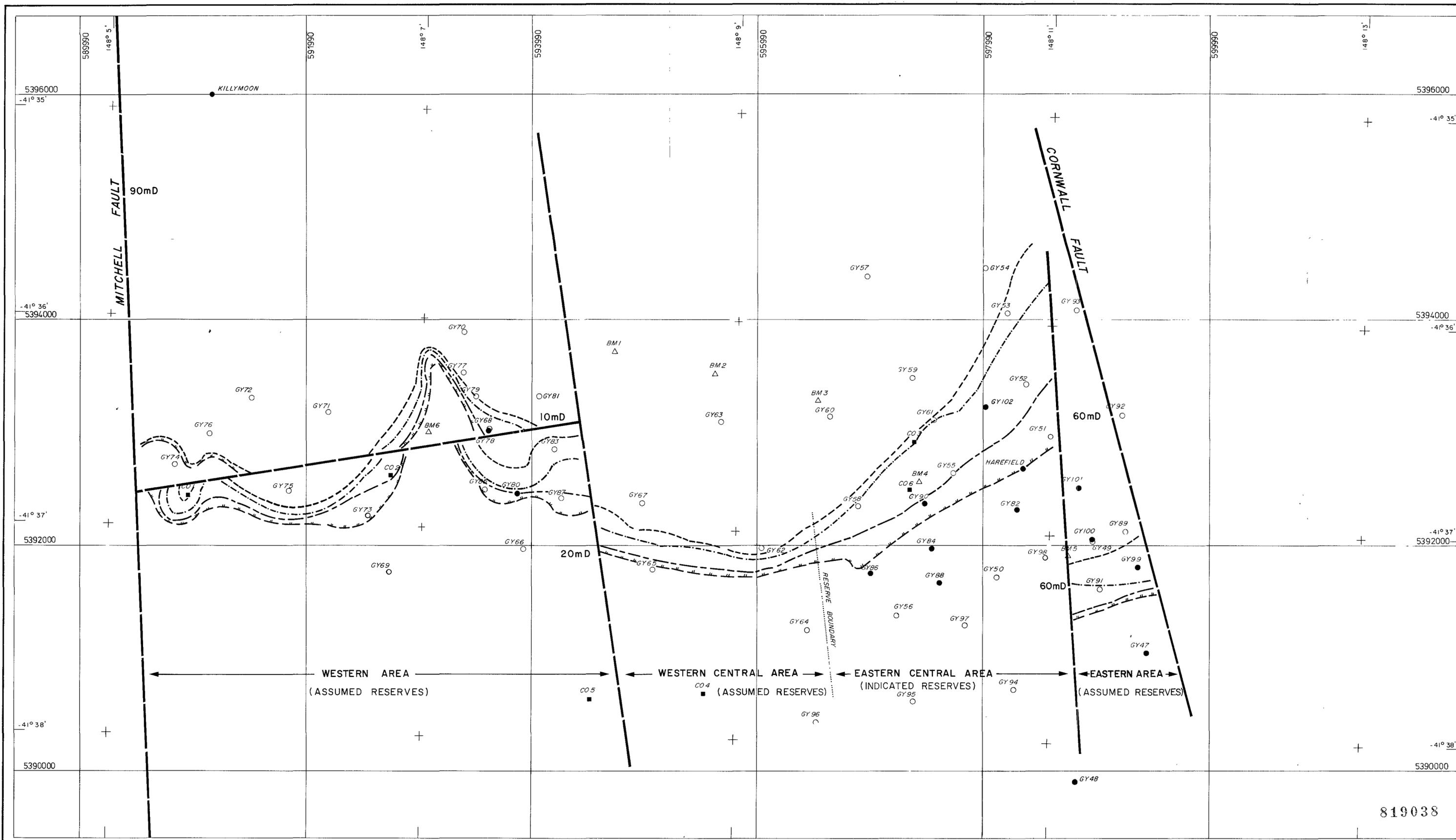
TASMANIA — GRAY EL 5/61
HAREFIELD

**D3 SEAM STRUCTURE CONTOUR
(BASE OF SEAM)**

Scale 1 20 000

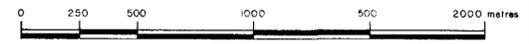
Author Coal Division	Date February 1982	Encl. 3
Report No CEPR 4/82	Drawing No 2492	

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LEGEND

- GY56 Open hole
- GY88 Cored hole
- CO1 Coal outcrop
- △ BM1 Bench mark
- - - Subcrop D3 seam
- - - Subcrop D2 seam
- - - Subcrop DD seam
- - - 10m highwall for DD seam
- Fault
- 20mD Fault Displacement (Down)



SCALE 1: 20 000



82-1712 ORGL

THE SHELL COMPANY OF AUSTRALIA LTD.
 TASMANIA - GRAY EL 5/61
 HAREFIELD
BASIS OF RESERVES ESTIMATION
 Scale 1: 20 000
 Author: Coal Division Date: February 1982
 Report No: CEPR 4/82 Drawing No: 2494 Encl 4

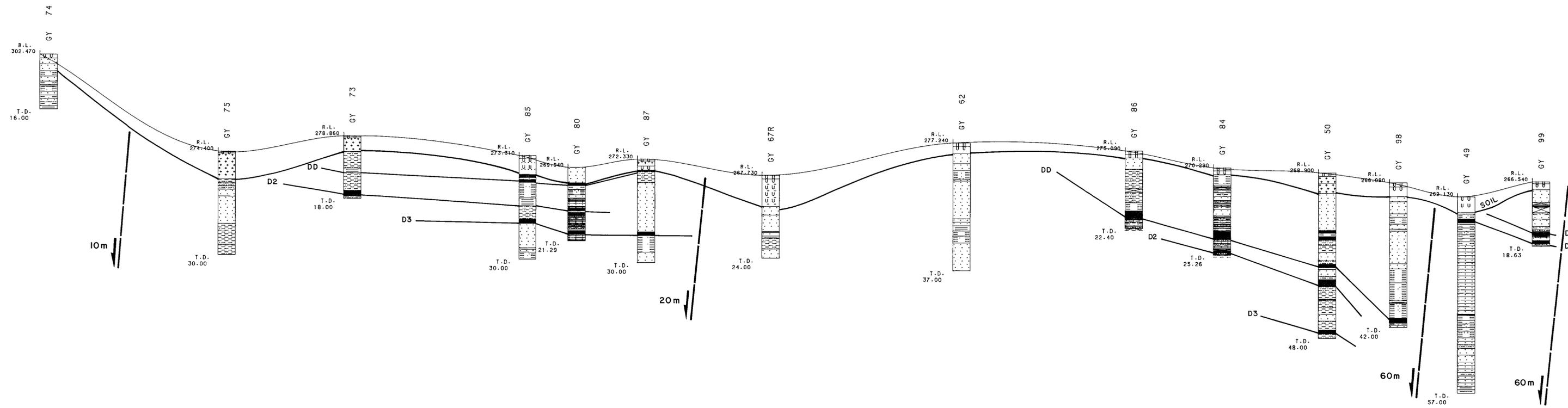
819038

WEST

EAST

A

B



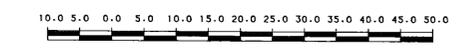
LEGEND
LITHOLOGY REFERENCE

- | | | | |
|--|-----------------------|--|---------------------|
| | SOIL | | CLAY |
| | DOLERITE SCREE | | COAL |
| | SANDSTONE | | SILT |
| | MUDSTONE | | CLAYSTONE |
| | CARBONACEOUS MUDSTONE | | TONSTEIN |
| | SILTSTONE | | NOT CORED/CORE LOSS |
| | | | COAL STONY |

HORIZONTAL SCALE
1:10000



VERTICAL SCALE
1:500



810039

DATE 2/12/82 FILE SPL0004
SPOOLED 12 56 STARTED 13 14

82-1712. ORG.

THE SHELL COMPANY OF AUSTRALIA LTD.
COAL DIVISION
HAREFIELD

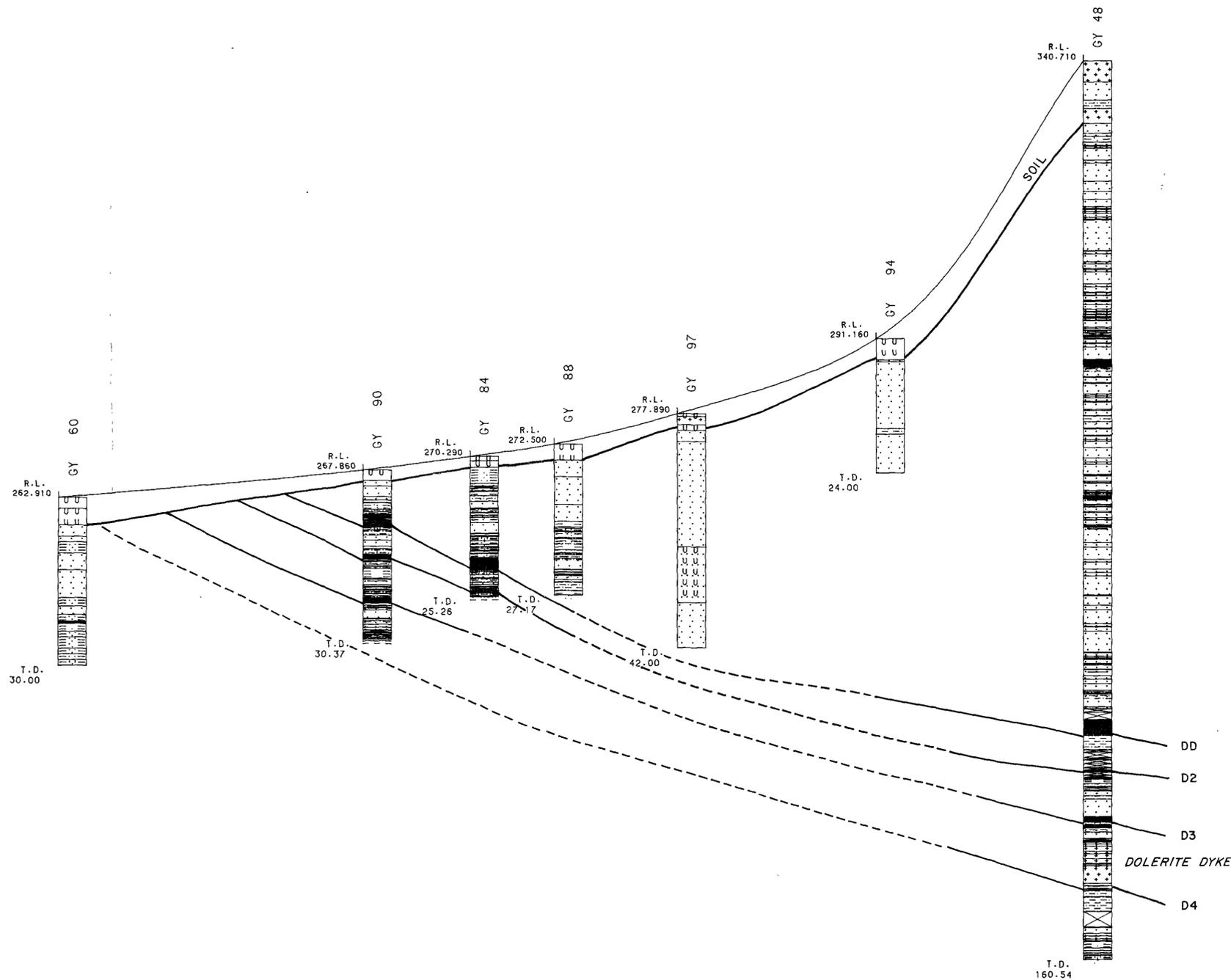
**WEST - EAST CROSS SECTION
(FOR LOCATION SEE ENCL.1)**

AUTHOR: Coal Division	DATE: February 1982
REPORT NO: CEPR 4/82	DRAWING NO: 2497

Encl. 5

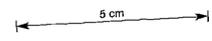
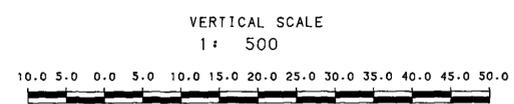
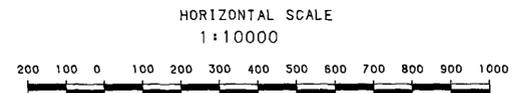
NORTH
C

SOUTH
D



LEGEND
LITHOLOGY REFERENCE

- | | | | |
|--|----------------|--|-----------------------|
| | SOIL | | TONSTEIN |
| | DOLERITE SCREE | | NOT CORED/CORE LOSS |
| | SANDSTONE | | CARBONACEOUS MUDSTONE |
| | MUDSTONE | | CLAYSTONE |
| | COAL | | LIMESTONE |
| | SILTSTONE | | SILT |
| | | | CLAY |



819040

82-1712. ORGL.

THE SHELL COMPANY OF AUSTRALIA LTD.
COAL DIVISION
HAREFIELD

**NORTH - SOUTH CROSS SECTION
(FOR LOCATION SEE ENCL. 1)**

AUTHOR: Coal Division	DATE: February 1982	Encl. 6
REPORT NO: CEPR 4/82	DRAWING NO: 2498	

DATE 02/11/82 FILE SPOO14
SPOOLED 16 10 STARTED 16 31