



**Narrabri Coal Pty Ltd**

ABN: 76 107 813 963

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**Narrabri Coal Project**

**Geological Assessment**

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Prepared by:  
**Belford Dome Resource Assessment**

March, 2007

**Specialist Consultant Studies Compendium**  
**Volume 2, Part 10**

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## Narrabri Coal Project

# Geological Assessment

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## **EXECUTIVE SUMMARY**

Exploration Licence (EL) 6243 is located in the northern part of the Gunnedah Basin, approximately 30km southeast of Narrabri.

A drilling program consisting of more than 100 partly cored and open holes has been conducted since the exploration licence was granted in May 2004. The drill holes have been geophysically logged by Groundsearch Australia and coal seam samples have been analysed for standard coal quality parameters by CCI Laboratories.

The exploration has identified a coal resource of approximately 400 million tonnes in the Hoskissons Coal Member of the Black Jack Group in the northern part of EL 6243. The coal resource is cut off approximately 150m below the surface by a low angle unconformity with the overlying Digby Formation.

The identified potential working section of the seam consists of the lower section of the seam up to a maximum thickness of 4.2m. The (approximately) 200 million tonnes of coal identified in this working section contains a low ash, medium volatile thermal coal resource.

A range of geotechnical studies have been undertaken on the drill core, and drilling results that have assisted Narrabri Coal Pty Ltd to design the proposed underground mining within the northern part of EL 6243. These studies have included the following.

- The stratigraphic and coal seam data has been modelled on Vulcan software by JB Mining Services.
- The interpretation of the regional geology has included a detailed aeromagnetic survey and a structural risk interpretation by SRK Consultants.
- Geotechnical data from the rocks overlying the coal seam have been tested by Australia Soil Laboratories.
- Stress direction tests have been conducted on selected drillholes by SIGRA.
- Comprehensive studies of the coal seam gas content have been conducted by Earth Data Geological Consultants.
- Eight piezometers have been installed within EL 6243 and a groundwater model has been developed by GHD Pty. Ltd.

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## 1. INTRODUCTION

Exploration Licence (EL) 6243 was granted to Narrabri Coal Pty Ltd on the 21<sup>st</sup> May 2004 for a period of five years. The area granted was part of Authorisation 216, held by the former NSW Department of Mineral Resources.

## 2. LOCATION

EL6243 is located approximately 30km southeast of the town of Narrabri and is situated mainly on farm land west of the Kamilaroi Highway between the villages of Turrawan and Baan Baa (**Figure 1**). The western part of EL 6243 is located within the Pilliga East and Jacks Creek State Forests. EL 6243 has an area of 113.4 km<sup>2</sup> and is approximately 7km x 16.2 km (**Figure 2**).

It is situated mainly on undulating farmland with Pilliga East and Jacks Creek State Forests in the western part of the EL.

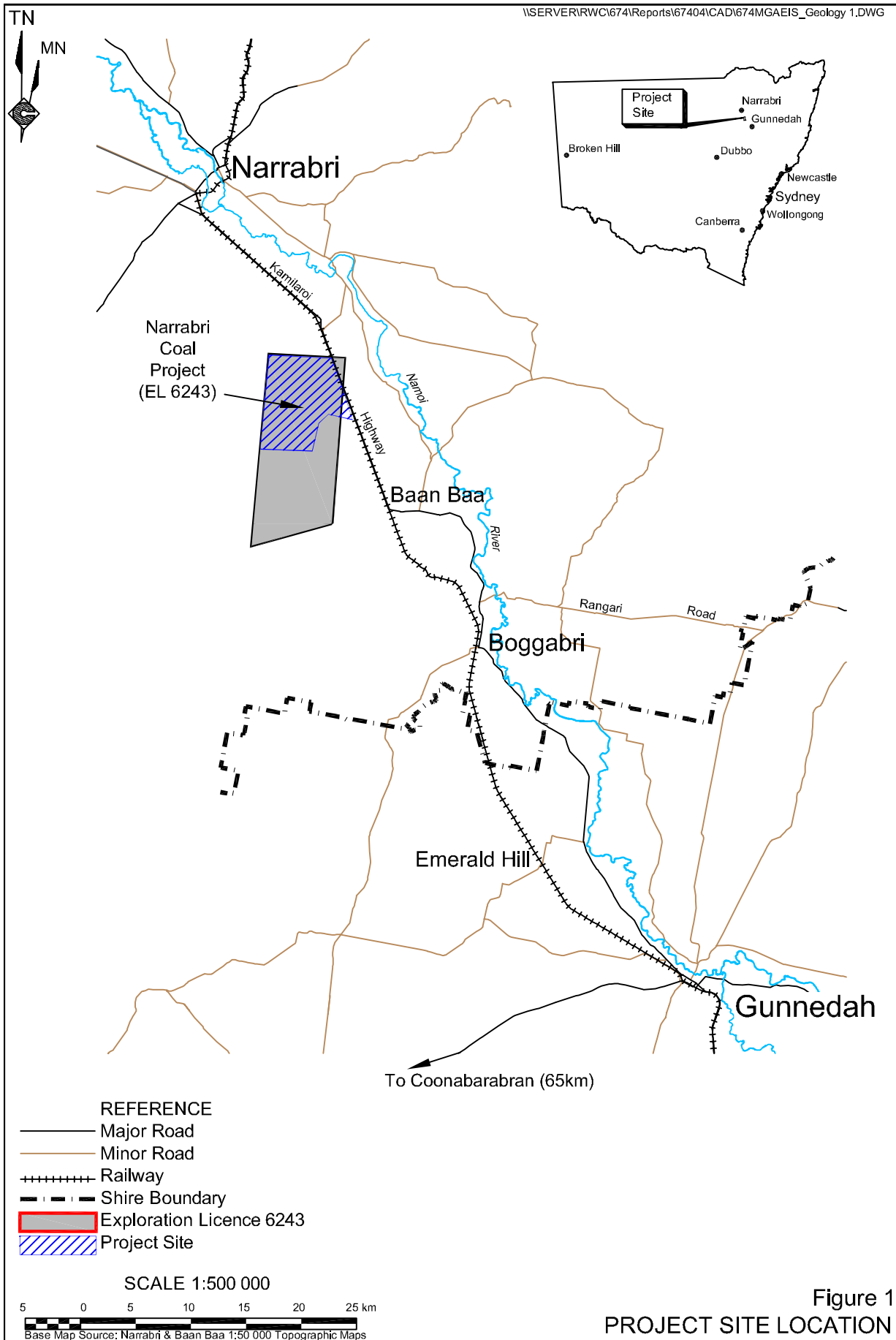
The topography within EL 6243 comprises low to undulating hills rising gradually to forested country in the west. The elevation of the area ranges from about 250m AHD in the east to approximately 350m AHD on the western boundary, over a distance of 7 km. It is traversed by east to northeast draining ephemeral creeks. The eastern part of EL 6243 is mainly cleared farmland with cattle, sheep and some cropping.

## 3. REGIONAL GEOLOGY

EL 6243 is located in the northern part of the Gunnedah Basin in the Mullalley Sub-basin to the west of the Boggabri Ridge. The Boggabri Ridge is a north-south trending anticlinal ridge of Early Permian volcanic rocks which forms the basement of the Permo-Triassic Gunnedah Basin. It divides the basin into two parts, the eastern, Maules Creek, and a western, Mullalley, Sub-basins (**Figure 3**).

The Mullalley Sub-basin contains Permian and Triassic sedimentary and volcanic rocks. The rocks strike approximately north-south and dip to the west at an angle of less than 10 degrees. In the area of the EL, adjacent to the Boggabri Ridge, there is a local angular unconformity between the Late Permian Black Jack Group and the overlying Triassic Digby Formation (**Figure 4**).

The western part of the EL is unconformably overlain by Jurassic sedimentary and volcanic rocks along the eastern margin of the Oxley Sub-basin, a part of the Great Artesian Basin.



Note: A colour version of this figure is included on the CD for the Narrabri Coal Project





## 4. LOCAL GEOLOGY

### 4.1 Introduction

The outcropping rocks in EL 6243 consist of medium to coarse grained sandstone of the Jurassic Pilliga Sandstone, fine grained silty sandstone and siltstone of the Jurassic Purlawaugh Formation, basalt flows and sills of the Jurassic to Triassic Garrawilla Volcanics and fine grained sandstone and siltstone of the Triassic Deriah and Napperby Formations. The Triassic Digby Formation and the coal-bearing Black Jack Group rocks do not outcrop in the EL. To the east of the EL, the Boggabri Volcanics have been uplifted and faulted along a north-south trending anticlinal structure, the Boggabri Ridge. The proximity of the EL to the Boggabri Ridge is a major control on the outcrop and structure of the local geology.

The rocks strike north-south and dip gently to the west. Minor variations to the north-south strike may be the result of variable thickness and compaction of the sedimentary units being draped over the faulted and uneven surface on the underlying Boggabri Volcanics.

### 4.2 Stratigraphy

The Pilliga Sandstone outcrops along the western margin of the EL. It is up to 60 m thick, (DME Narrabri DDH-30), and consists of medium bedded, cross bedded, well sorted fine to coarse grained quartz sandstone.

The Purlawaugh Formation is up to 140 m thick and outcrops over the western half of the EL. It consists of thinly bedded, generally fine grained, silty lithic sandstone, siltstone and minor claystone. Thin stony coal seams are present in the lower part of the unit.

The Garrawilla Volcanics unconformably overlie the Triassic Napperby Formation or the Deriah Formation where it is present. The volcanics consist mainly of alkali basalt flows with very minor intervening mudstone and clastic rocks. The Garrawilla Volcanics are up to 40m thick

The Deriah Formation is sporadically developed within EL6243. It consists mainly of fine to medium grained lithic sandstone rich in volcanic fragments. Intersections up to 15 m thick are present in the northern part of the EL area.

The Napperby Formation is up to 140 m thick. It consists of a coarsening-up sequence of siltstone, sandstone siltstone laminate, and fine to medium grained quartz-lithic sandstone.

An intrusive Basalt Sill is present in the lower part of the Napperby Formation in EL6243. It varies in thickness from 0 to 30 m but is typically 15 to 20 m thick. It occurs approximately 30 to 35 m above the base of the Napperby Formation. It is dark green alkali basalt and is almost certainly related to the Garrawilla Volcanics. The basalt typically has strongly developed sub-vertical fractures infilled with secondary chlorite and zeolite minerals. The fractures do not continue into the enclosing rocks and may be related to cooling shrinkage.

The Digby Formation is divided into two units, the lower Digby Conglomerate and the overlying Ulinda Sandstone. The Ulinda Sandstone is either not present in the EL area or the boundary between these units is not clear with interbedded conglomerate and sandstone common in the top of the conglomerate. Consequently, the whole unit is referred to as the Digby Conglomerate in this area.

The Digby Conglomerate unconformably overlies the Black Jack Group. The unit consists mainly of thickly bedded, polymictic, lithic, pebble conglomerate with clasts of volcanic, meta-sediment and jasper in a lithic rich matrix. Minor finely to medium bedded, lithic sandstone beds are present towards the top of the unit. The Digby Formation is typically 15 to 20 m thick in the EL area. The boundary with the underlying Black Jack Group is an angular unconformity. In the east of the EL, it cuts the Hoskissons Coal at a depth of approximately 160 m. In the west, over a distance of approximately 5 km, there is up to 20 m of Black Jack Group developed above the Hoskissons Coal Seam.

The Black Jack Group consists of lithic sandstone, siltstone, claystone and coal with minor tuff. It is up to 70 m thick in the western part of the EL area but is less than 40 m thick in the east due to the low angle unconformity with the overlying Digby Formation. The Hoskissons Coal and the Melvilles seam are present in the EL area. Thickness and quality characteristics are such that only the Hoskissons Coal is currently considered to contain coal resources with mining potential.

The Watermark Formation and the Porcupine Formation are marine rocks that consist mainly of silty sandstone and siltstone. They are up to 200 m thick in total. These rocks have only been penetrated in the EL area by DM Turrawan DDH-1, the initial scout drillhole in the area.

The Maules Creek Coal Measures contain the Maules Creek Formation and the Leard Formation. They consist of lithic sandstone, siltstone, minor coal and pelletaloidal claystone. They unconformably overlie the Boggabri Volcanics.

The Boggabri Volcanics consist of dacitic to rhyolitic basalt and pyroclastic rocks. A weathered topographic surface developed on the Boggabri Volcanics prior to the deposition of the overlying Maules Creek Coal Measures.

### 4.3 Structure

EL 6243 is located on the eastern side of the Mullaley Sub-basin adjacent to the north-south trending Boggabri Ridge. The Boggabri Ridge is a faulted anticlinal fold involving the basal Boggabri Volcanics. The major structural elements of the geology of the EL area are strongly influenced by the proximity to the Boggabri Ridge. The rocks overlying the Boggabri Ridge strike north-south and dip gently to the west. Aeromagnetic data show a strong northwest structural trend with several northwest trending fault blocks in the basement. The overlying sedimentary units are draped over this fault topography but are not apparently faulted at the level of the coal measures. The current exploration drilling has not identified any faults that cut the coal measures. A detailed interpretation of the structure is available in the Structural Risk Interpretation report for EL 6243 prepared by SRK Consulting in November 2005 (SRK, 2005).

\\SERVER1\RWC\674\Reports\67404\CAD\674MGAEIS\_Geology 4 & 5.DWG

**Figure 4**  
**GEOLOGY OF EL6243**

**Figure 5**  
**EAST-WEST CROSS**  
**SECTION THROUGH EL6243**

## 4.4 Coal Resources

The coal resources are contained in the Hoskissons Coal and the Melvilles Coal seam within the Late Permian Black Jack Formation. Coal seams within the Early Permian Maules Creek Formation are not developed in the EL area.

The Hoskissons Coal is up to 10 m thick and occurs at depths ranging from approximately 160m in the east to approximately 350m in the western side of the EL. In the area of the EL, the lower part of the Hoskissons Coal contains low ash coal suitable for thermal applications. The upper part of the Hoskissons Coal contains high ash stony coal and tuffaceous claystone bands. The lower part of the seam has potential for recovery by underground mining methods.

Two splits of the Melvilles Coal Seam occur at depths approximately 50 m below the Hoskissons Coal. The thickness and poor quality of the Melvilles Coal Seam exclude them from any current mining potential.

## 5. PREVIOUS EXPLORATION

The coal resource potential in Authorisation 216 was identified by previous regional and targeted exploration drilling by the former Department of Mineral Resources.

DM Turrawan DDH-1 was drilled in 1982 and contained a 6.50 m intersection of high quality coal in the Hoskissons Coal at a depth of approximately 167 m.

The DME Narrabri DDH series of exploration drilling in 1985-86 consisted of 42 drillholes at 4 km spacing. The program targeted the subcrop of the Hoskissons Coal along the eastern margin of the Mullalley Sub-basin between Boggabri and Narrabri. Ten of the DME Narrabri drillholes are within EL 6243.

The EL contains 11 previous drillholes (**Table 1** and **Figure 6**).

**Table 1 Previous Drilling EL6243**

<b>DRILLHOLE</b>	<b>EAST-ISG</b>	<b>NORTH-ISG</b>	<b>DEPTH m.</b>
DM Turrawan DDH-1	384529.0	1621727.0	463.0
DME NRI-DDH-11	383104.0	1613696.0	220.5
DME NRI-DDH-12	382656.9	1617669.7	232.5
DME NRI-DDH-13	382323.0	1621890.0	273.5
DME NRI-DDH-14	382019.0	1625681.0	283.0
DME NRI-DDH-24	386555.0	1617894.0	52.9
DME NRI-DDH-25	385741.0	1621484.0	130.2
DME NRI-DDH-26	386226.0	1625512.0	142.4
DME NRI-DDH-29	380361.0	1616786.0	345.0
DME NRI-DDH-30	380148.0	1625548.0	343.9
DME NRI-DDH-39	381300.0	1611522.0	313.9
		<b>Total</b>	<b>2,800.8</b>



## 6. CURRENT EXPLORATION

### 6.1 Exploration Drilling

#### 6.1.1 Introduction

Exploration drilling on EL6243 has been designed to identify a coal resource in the Hoskissons Coal. Drilling activities have been carried out by JD Operations Group and Nitro Drilling Services. The drillholes were geophysically logged by Groundsearch Australia Pty Ltd and the coal samples analysed by CCI Hunter Valley Laboratories. Drillhole locations were surveyed by Stewart Surveys, Gunnedah.

#### 6.1.2 Exploration Status

At the end of March 2007, approximately 120 drillholes totalling approximately 4,000m of drilling have been completed. The drilling has included cored, partly cored and open hole drilling. The locations of the drillholes are listed in **Table 2** and shown on **Figure 7**. Drilling, geological and access difficulties have meant that relevant coal data have been recovered from approximately 90 of the drillholes. The current drilling is concentrated in the northern part of the EL, in the area identified by mining studies as the proposed mining area for the Narrabri Coal Project – Stages 1 and 2.

### 6.2 Specialist Exploration Studies and Activities

Comprehensive interpretations and analyses of geological factors other than coal analyses and geophysical logging have been carried out in conjunction with the exploration drilling or as ancillary studies to the exploration drilling in EL 6243. These studies are either appended to this report or are the subject of a separate specialist report.

The associated geological studies are as follows.

Geological Modelling. JB Mining Services developed a computer model of the Hoskissons Coal Seam and overlying strata on approximately 75 drillholes available at the end of September 2005. The plans and coal resource estimates from this model are included in this report.

JORC Compliant Resources Report. SRK Consultants are preparing an updated geological model incorporating the available drilling data at March 2006. This report will include a JORC compliant resource-reserve statement.

Geotechnical Analyses. Samples of overburden lithologies were submitted for geotechnical analysis of uniaxial and triaxial compressive strengths and for slake testing. The tests were carried out by Australian Soil Laboratories. The reports are reproduced in **Appendix 1** of this report. The results of point load testing in the field are contained in the drillhole reports. Geotechnical samples were taken from NC-069, 077, 078, 081, 092, 094 and 096. Point load testing data is available for NC-078, 081, 092 and 094.

**Table 2 Surveyed Drillhole Locations**

Page 1 of 2

DRILLHOLE	EASTING MGA	NORTHING MGA	ELEVATION (m AHD)	DRILLHOLE	EASTING MGA	NORTHING MGA	ELEVATION (m AHD) .
NC-001	775971.49	6620028.26	299.62	NC-051	775165.14	6621553.29	294.21
NC-002	775120.98	6620123.61	295.64	NC-052	775477.08	6622116.63	289.47
NC-003	776834.28	6619840.75	286.43	NC-053	776430.45	6622181.56	277.78
NC-004	775062.28	6621143.89	299.88	NC-054	775722.36	6618124.66	316.27
NC-005	775979.80	6621139.00	279.87	NC-055	775274.21	6618211.92	318.94
NC-006	774476.59	6620987.68	319.15	NC-056	774727.35	6618304.26	318.41
NC-007	776911.89	6622130.48	270.13	NC-057	776095.34	6623771.95	264.41
NC-008	776562.51	6621158.01	282.40	NC-058	775979.35	6623119.35	274.98
NC-009	775052.97	6622097.98	291.99	NC-059	775037.19	6623358.55	272.92
NC-010	776055.12	6622150.85	286.93	NC-060	775173.51	6623817.74	285.58
NC-011	774588.89	6622178.22	301.70	NC-061	776337.12	6618232.53	312.20
NC-012	776044.70	6619157.37	290.88	NC-062	775487.98	6618614.38	306.37
NC-013	776542.70	6619159.14	301.67	NC-063	775863.98	6618521.40	304.80
NC-014	775136.54	6619246.08	297.20	NC-064	776220.51	6618508.47	317.87
NC-015	774184.99	6618876.80	302.18	NC-065	775635.12	6619209.85	296.99
NC-016	774492.85	6618349.59	316.90	NC-066	775588.17	6619708.04	288.39
NC-017	774993.57	6618244.88	314.63	NC-067	776020.79	6619498.81	286.40
NC-018	775486.86	6618193.26	316.50	NC-068	775121.61	6619492.40	290.62
NC-019	776066.13	6618097.43	320.98	NC-069	775030.80	6619932.80	294.06
NC-020	774688.68	6617723.79	321.50	NC-070	775116.44	6620319.49	294.44
NC-021	774943.96	6617104.81	298.62	NC-071	775531.09	6620857.78	287.62
NC-022	776022.00	6617049.60	278.52	NC-072	775383.11	6620067.40	292.88
NC-023	776531.45	6617098.15	271.07	NC-073	776146.64	6619963.76	292.86
NC-024	774294.11	6616878.52	304.61	NC-074	775645.72	6621513.81	284.10
NC-025	774982.02	6616749.92	287.11	NC-075	776161.06	6621772.13	276.38
NC-026	775517.35	6616637.46	282.76	NC-076	775543.90	6621197.20	286.05
NC-027	776091.31	6616527.05	282.52	NC-077	775882.22	6622545.37	286.59
NC-028	775496.54	6617130.57	294.54	NC-078	774643.75	6621499.85	313.46
NC-029	775198.16	6618714.95	305.67	NC-079	776872.88	6621282.48	278.27
NC-030	774066.35	6616447.21	302.40	NC-080	776240.46	6621108.08	283.58
NC-031	774881.08	6616319.46	291.78	NC-081	775030.46	6614110.95	313.32
NC-032	775365.39	6616126.01	298.19	NC-082	774859.07	6613495.19	307.97
NC-033	776528.93	6618654.18	303.12	NC-083	775867.47	6613997.13	309.65
NC-034	776917.22	6619119.05	287.38	NC-084	775520.27	6613378.41	302.78
NC-035	774154.37	6615214.73	320.89	NC-085	776164.12	6621364.78	277.26
NC-036	775080.77	6619785.18	291.93	NC-086	774465.37	6614221.44	330.48
NC-037	775138.62	6620574.18	294.17	NC-087	774127.77	6613591.67	317.61
NC-038	775236.59	6616739.77	284.33	NC-088	773839.54	6614557.15	332.23
NC-039	775812.34	6616579.19	279.49	NC-089	772989.71	6615889.04	323.10
NC-040	776101.10	6616784.16	275.82	NC-090	773188.03	6616936.58	335.83
NC-041	775974.60	6617554.62	294.15	NC-091	774232.65	6616001.22	299.06

Table 2 (Cont'd) Surveyed Drillhole Locations

Page 2 of 2

DRILLHOLE	EASTING MGA	NORTHING MGA	ELEVATION (m AHD)	DRILLHOLE	EASTING MGA	NORTHING MGA	ELEVATION (m AHD) .
NC-042	775549.70	6617297.67	290.30	NC-092	775954.30	6620141.38	299.11
NC-043	775576.54	6617952.26	311.44	NC-093	773367.70	6617918.11	330.92
NC-044	775620.53	6617485.05	291.54	NC-094	776755.81	6620349.49	275.28
NC-045	775157.57	6617597.70	308.27	NC-095	776745.31	6620300.55	276.13
NC-046	775465.66	6620530.11	288.08	NC-096	776731.86	6620250.18	276.69
NC-047	775422.94	6620289.95	289.40	NC-097	776650.00	6620130.00	274.00
NC-048	776279.33	6619439.07	286.16	NC-098	776514.00	6619970.00	275.50
NC-049	776620.91	6620264.21	273.46	NC-099	776102.00	6620487.00	281.50
NC-050	776601.64	6620646.87	274.32	NC-100	775045.08	6622550.00	282.50

Gas Desorption. Gas desorption rates and volumes, and gas analysis testing of Hoskissons Coal Seam was undertaken by consultants, Earth Data. Gas testing has been carried out on 13 drillholes. Results are currently available for nine holes as reports by Earth Dataie. for drillholes NC-012, 017, 022, 025, 029, 051, 069, 077, 078, 087, 103, 104 and 105. Gas data and analysis has also been carried out on three drillholes associated with stress and permeability testing.

Spontaneous Combustion Assessment. Samples of Hoskissons Coal Seam from two drillholes were submitted for assessment of spontaneous combustion potential. The drillholes are NC-091 and 092. The report shows that the coal has medium to high potential for spontaneous combustion (Beamish, 2006)

Stress and Permeability Testing. Directional stress measurements and permeability testing by SIGRA has been carried out on all formations in three drillholes. The drillholes are NC-093, 097 and 100.

Aeromagnetic Survey. A detailed aeromagnetic survey of EL6243 was carried out in 2005 by SRK Consulting.

Structural Risk Interpretation. A structural risk interpretation of structural factors that may influence mining conditions expected in EL 6243 was carried out by SRK Consulting using geological and geophysical data available at December 2005. The interpretation is available as a report by SRK (2005).

Groundwater Studies. Water samples collected during drilling activities have been analysed for 11 drillholes, namely NC-004, 005, 008, 010, 022, 029, 037, 048, 059, 073 and 077. Water intersection formations, depths and estimated flows were recorded for another 11 drillholes but were not analysed. A groundwater model for EL 6243 is being developed by GHD Pty Ltd - Groundwater Consultants (GHD). The study by GHD included the insertion of eight piezometers at five sites across the EL.



## 6.3 Geological Model

### 6.3.1 Introduction

Drillhole data from EL 6243 were computer modelled on “Vulcan” software by JB Mining Services in November 2005. Isopachs, structure contours and quality parameters for the Hoskissons Coal were modelled. Coal resource estimates were generated from the model for the EL area and for the identified initial mining area polygon (see **Figure 7**).

Isopachs and structure contours were modelled for the overlying Digby Formation and the basalt sill to allow assessment of their influence on roof behaviour during proposed longwall mining.

### 6.3.2 Hoskissons Coal Seam

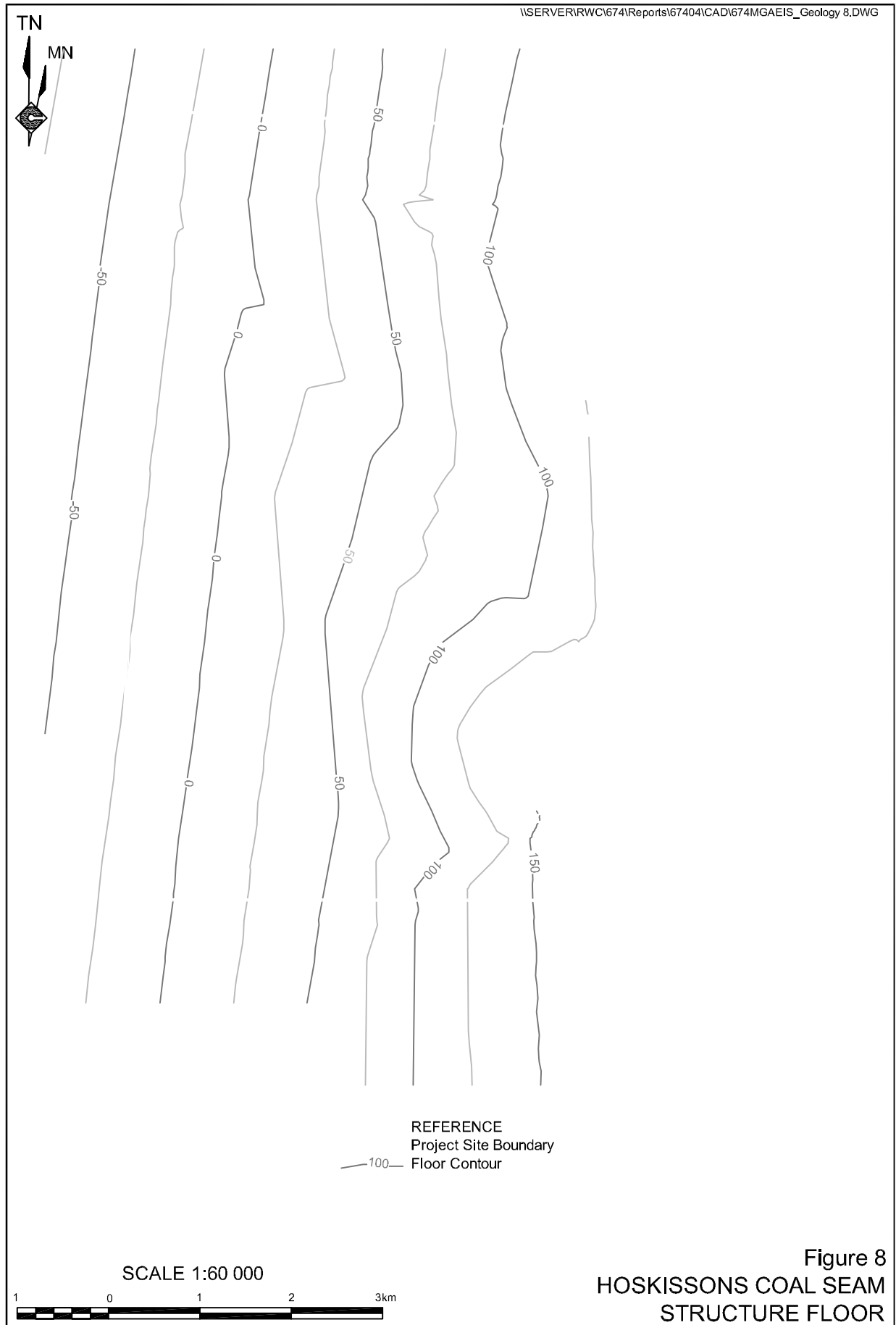
The Hoskissons Coal is between 8 m and 10 m thick over the western half of the EL area. In the eastern part of the EL, the seam is cut off at a depth of approximately 160 m by a low angle unconformity between the coal seam and the overlying Digby Formation. The seam strikes generally north-south, and dips gently to the west.

In the eastern part of the EL area, where the conglomerate within the Digby Formation forms the immediate roof to the coal seam, the seam thickness is sensitive to minor differences in the structure contours between the two units. There is a zone between the cut-off point of the coal and the full seam thickness that varies in width from approximately 500 m to approximately 1500 m.

The Hoskissons Coal was modelled as two plies, HC1 and HC2. The lower HC2 ply was identified as the base of the seam up to a maximum thickness of 4.20 m. A working section thickness between 2.00 and 4.20 m was identified in the HC2 ply for the purpose of resource estimation. The upper section of the seam, the HC1 ply, is the coal that would remain in the roof where the seam thickness exceeds 4.20 m.

Raw ash and volatile matter, and floats 1.45 RD ash and yield percentages for the HC2 ply were modelled from the quality data for the Hoskissons Coal Seam.

The HC2 structure contour plan (**Figure 8**) and the HC2 and HC1 isopach plans are presented in **Figures 9** and **10**.



Note: A colour version of this figure is included on the CD for the Narrabri Coal Project

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REFERENCE  
Project Site Boundary  
— 3.0 — HC2 Isopach

SCALE 1:60 000

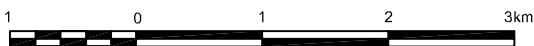
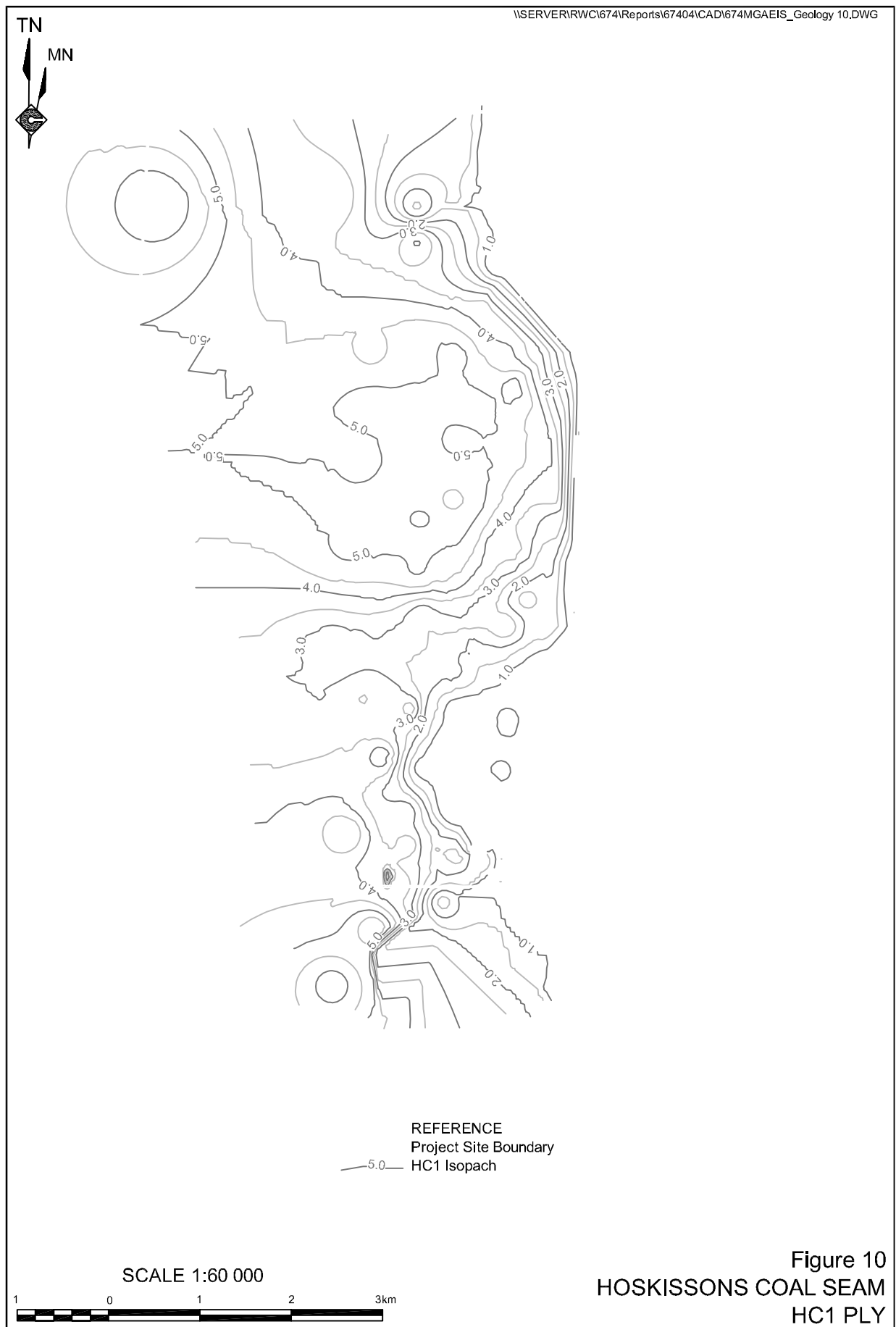


Figure 9  
HOSKISSONS COAL SEAM  
HC2 ISOPACH

Note: A colour version of this figure is included on the CD for the Narrabri Coal Project



Note: A colour version of this figure is included on the CD for the Narrabri Coal Project

### 6.3.3 The Digby Formation

The Digby Formation is divided into two units, the lower Digby Conglomerate and the upper Ulinda Sandstone. In the EL area, the Ulinda Sandstone is either not present or the boundary between the two units is not clear, with interbedded sandstone and conglomerate towards the top of the unit. Consequently, the whole unit has been identified as Digby Conglomerate.

The Digby Conglomerate is a medium to thickly bedded polymictic partly matrix supported pebble conglomerate. The pebbles are well rounded and poorly to moderately well sorted. The clasts include volcanic, metasedimentary and jasper pebbles. The matrix is generally greater than 25 percent of the rock. The matrix is medium to fine grained, poorly sorted with a lithic to clayey composition.

The conglomerate varies in thickness from approximately 10 m to nearly 25 m, with an average thickness of approximately 15 m.

The Digby Conglomerate unconformably overlies the Black Jack Group. In the east of the EL area, the unconformity cuts off the Hoskissons Coal Seam as a low angle unconformity. Towards the west, the conglomerate overlies sedimentary rocks of the Black Jack Group and appears locally as a bedding parallel unconformity.

The isopach plan for the Digby Formation is presented in **Figure 11**.

### 6.3.4 Basalt Sill.

A basalt sill is present in the stratigraphy over most of the EL area. It is located in the lower part of the Napperby Formation and is typically about 35 m above the top of the Digby Conglomerate. The sill varies in thickness from 0 to 29 m in thickness. It is typically 15 m to 20 m in thickness. The basalt is a dark green alkali basalt and is similar in appearance and composition to the Garrawilla Volcanics. The sill has a well developed subvertical fracture pattern with the fractures commonly infilled with secondary chlorite, zeolite and quartz.

The sill was modelled separately because of its potential to affect roof behaviour in a longwall mining operation.

The isopach plan for the sill is presented on **Figure 12**.

## 7 COAL QUALITY

The Hoskissons Coal Seam is a low cleat dull lustrous coal with very few or no bright bands developed. The seam deteriorates upward from a low ash, medium volatile coal to stony coal and tuffaceous clay bands in the upper part of the seam. The basal 4 m to 5 m of the seam generally averages 8 to 10 percent raw ash. Isopachs of the raw ash within the basal section are shown on **Figure 16**. Coal quality for the proposed working section is presented on **Figure 17** and **Tables 3, 4 and 5**.

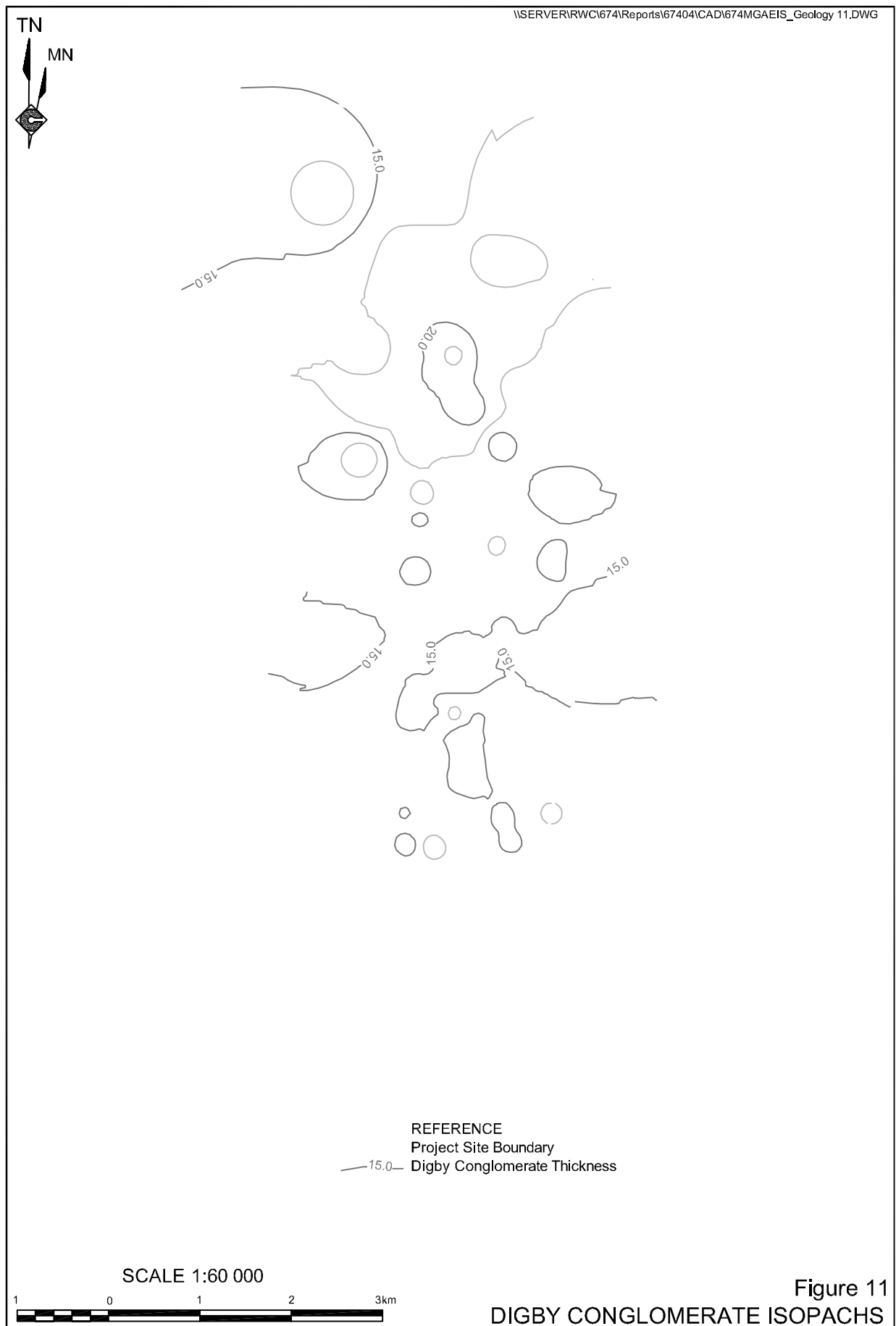


Figure 11  
DIGBY CONGLOMERATE ISOPACHS

Note: A colour version of this figure is included on the CD for the Narrabri Coal Project

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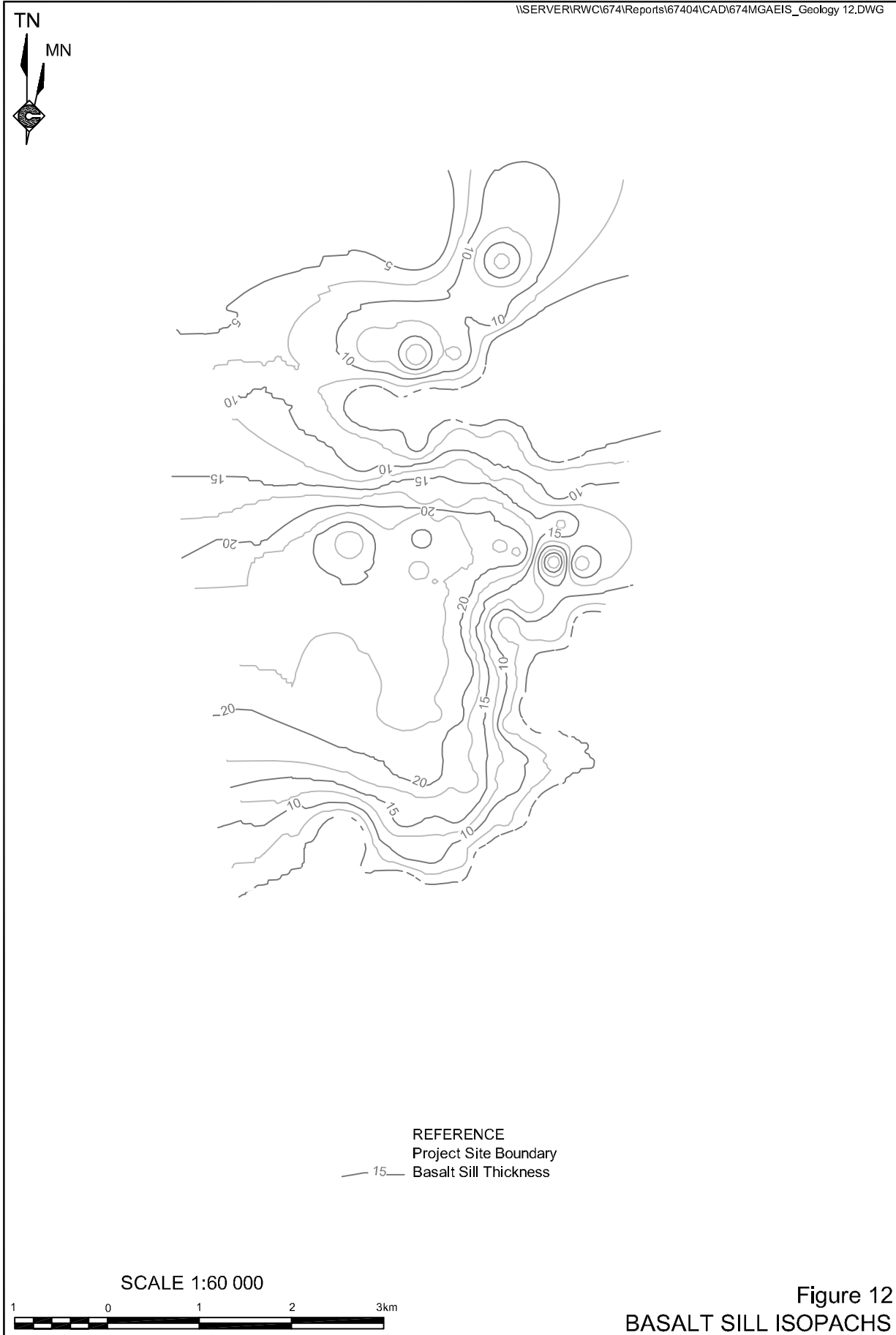


Figure 12  
BASALT SILL ISOPACHS

Note: A colour version of this figure is included on the CD for the Narrabri Coal Project





**Table 3 Raw Coal Analyses Hoskissons Coal Seam**

Hole ID	Top	Base	Thick	%Moist.	%Vol.	%Ash	%S	SE (ad)	SE (daf)	RD
NC-002	216.43	220.85	4.42	3.59	29.12	8.63	0.35	29.0	32.7	1.39
NC-005	185.38	189.70	4.32	5.08	29.31	8.29	0.37	28.8	33.0	1.39
NC-006	268.33	272.60	4.27	5.84	28.28	9.47	0.35	28.7	33.6	1.43
NC-009	229.57	233.80	4.23	3.80	29.10	8.55	0.36	28.8	32.7	1.41
NC-010	180.17	184.55	4.38	5.19	29.22	7.47	0.39	29.2	33.3	1.40
NC-011	257.88	261.95	4.07	5.57	27.42	8.94	0.23			
NC-014	204.21	208.50	4.29	4.50	28.40	9.80				1.40
NC-016	236.12	240.32	4.20	2.73	22.76	20.26				1.54
NC-018	192.59	196.80	4.21	4.30	27.50	11.80				1.45
NC-019	178.33	179.70	1.37	3.20	27.70	8.60				1.41
NC-020	233.85	238.05	4.20	3.30	27.40	9.50				1.42
NC-021	208.35	212.55	4.20	4.20	27.70	11.70				1.45
NC-026	175.99	180.20	4.21	4.40	27.40	10.30				1.42
NC-027	148.60	151.55	2.95	4.30	26.30	13.20				1.45
NC-035	259.40	263.60	4.20	2.90	26.40	13.30				1.47
NC-036	214.95	219.15	4.20	3.20	28.30	9.10				1.42
NC-051	228.83	232.20	3.37	3.07	28.61	11.99				1.46
NC-069	220.65	224.85	4.20	3.90	27.77	7.27				1.41
NC-081	220.37	224.60	4.23	3.47		8.57				1.44
Average				4.03	26.25	10.35	0.34	28.9	33.1	1.43

**Table 4 Washed Coal Analyses Hoskissons Coal Seam**

Hole ID	F1.45 Yld	F1.45 Ash	CF1.60 Yld	CF1.60 Ash	CS1.60 Yld	CS1.60 Ash
NC-002	91.0	6.40	93.9	6.75	100.0	7.88
NC-005	92.9	6.38	97.4	6.90	100.0	7.55
NC-006	92.8	6.75	95.4	7.06	100.0	8.52
NC-009	92.3	6.29	95.9	6.71	100.0	7.91
NC-010	97.3	5.89	100.3	6.28	100.0	7.28
NC-014	90.8	7.10	94.8	7.44	100.0	9.24
NC-016	79.8	8.29	90.7	9.74	100.0	13.82
NC-018	87.3	6.80	91.0	7.22	100.0	11.92
NC-019	93.5	6.60	97.3	6.99	100.0	8.44
NC-020	90.8	6.70	94.6	7.11	100.0	9.16
NC-021	78.4	8.20	89.8	9.16	100.0	12.36
NC-026	91.4	8.40	95.4	8.89	100.0	10.58
NC-027	82.9	8.60	90.8	9.53	100.0	13.78
NC-035	81.9	8.50	89.3	9.55	100.0	12.92
NC-036	90.8	6.70	95.2	7.20	100.0	8.73
NC-051	85.5	6.09	88.9	6.43	100.0	11.24
NC-081	74.8	7.53	95.4	9.23	100.0	10.57
Average	87.9	7.1	93.9	7.8	100.0	10.1

**Table 5 Typical Ultimate Analyses Hoskissons Coal Seam**

	NARRABRI NC-010		NARRABRI NC-011		
Plies 2 & 3 F1.40 Composites		Plies 4 & 5 F1.40 Composites	Plies 2 & 3 F1.40 Composites		Plies 4 & 5 F1.40 Composites
	(%)	(%)		(%)	(%)
Moisture	4.0	4.2	Moisture	4.20	4.20
Carbon	76.6	77.5	Carbon	77.50	76.90
Hydrogen	4.74	4.69	Hydrogen	4.54	4.59
Nitrogen	1.68	1.63	Nitrogen	1.74	1.66
CSN	0	0	CSN	0.00	0.00
<b>Ash Analysis</b>	<b>(%d)</b>	<b>(%d)</b>	<b>Ash Analysis</b>	<b>(%d)</b>	<b>(%d)</b>
- SiO2	54.2	59.9	- SiO2	53.50	61.90
- Al2O3	27.4	27.7	- Al2O3	25.20	28.30
- Fe2O3	7.5	4.4	- Fe2O3	11.90	3.00
- CaO	1.6	1.1	- CaO	2.10	0.96
- MgO	0.89	0.80	- MgO	1.40	0.55
- Na2O	0.49	0.53	- Na2O	0.54	0.48
- K2O	0.27	0.25	- K2O	0.20	0.26
- TiO2	1.8	2.1	- TiO2	1.70	1.80
- Mn3O4	0.63	0.03	- Mn3O4	0.60	0.04
- P2O5	0.01	0.01	- P2O5	0.01	0.01
- SO3	1.8	0.07	- SO3	1.60	0.75
- SrO	0.63	0.07	- SrO	0.07	0.60
- BaO	0.07	0.07	- BaO	0.07	0.05
- ZnO	0.04	0.05	- ZnO	0.04	0.05
- V2O5	0.03	0.04	- V2O5	0.03	0.05

## 8 COAL RESOURCES

A coal resource of 404 million tonnes, in the Hoskissons Coal Seam within the proposed Narrabri Coal Project – Stages 1 and 2 mining area of EL 6243 has been estimated from the geology model. Of this coal, 216 million tonnes is contained within the lower HC2 ply which constitutes the proposed mining section from 2.00m to 4.20 m in thickness.

Coal resources for HC1 and HC2 plies recorded in **Table 6** were calculated from the JB Mining Services model. Due to the drillhole coverage, resources were only calculated for the Stage 1 and Stage 2 mining area. The areal distribution of the resource blocks is shown on **Figure 15**.

The resources were divided into two blocks, less than and greater than 250m depth of cover. The depth of cover division basically correlates with the division between a measured and indicated resources area and an inferred resources area as shown on the resource confidence level plan.

**Table 6 Hoskissons Coal Seam – Coal Resources Summary**

<b>NARRABRI COAL PROJECT</b>															
<b>Assumptions / Notes</b>															
<b>Geology model</b>		Based on drillhole data and assay data supplied by Jeff Beckett													
<b>Seam limits</b>		Limited to a minimum 2m thick lower ply (HC2) Extended to proposed longwall area (refer plot) Divided into two blocks - less than and greater than 250m depth (refer plot)													
<b>Insitu Moisture</b>		assumed to be 9%													
<b>RD</b>		RD(ad) adjusted to insitu based on Preston & Sanders formulae													
<b>Quality</b>		No quality for upper HC1 ply - RD(is) guessed at 1.35													
<b>Tonnes</b>		Good drillhole coverage to 250m depth, with limited data past this depth													
<b>Block</b>	<b>Avg Depth</b>	<b>Seam</b>	<b>Area km<sup>2</sup></b>	<b>TK m</b>	<b>Vol Mm<sup>3</sup></b>	<b>M Tonnes (insitu)</b>	<b>RD(is)</b>	<b>RD(ad)</b>	<b>IM%</b>	<b>Ash%</b>	<b>VM%</b>	<b>Yld(F1.45)</b>	<b>Ash (F1.45)</b>	<b>Yld (F1.60)</b>	<b>Ash (F1.60)</b>
150m to 250m	196	HC1	18.1	2.85	51.6	69.7	1.35	1.40							
150m to 250m		HC2	18.1	3.90	70.7	98.6	1.39	1.42	4.2	10.2	28.0	89.8	6.9	94.4	7.4
250m to 350m	289	HC1	20.0	4.37	87.5	118.2	1.35	1.40							
250m to 350m		HC2	20.0	4.20	84.0	117.8	1.40	1.43	4.2	10.7	27.6	89.1	7.0	93.8	7.5
<b>TOTAL / AV.</b>		<b>HC1</b>	38.1	3.65	139.1	188.0	1.35	1.40							
<b>TOTAL / AV.</b>		<b>HC2</b>	38.1	4.06	154.7	216.4	1.40	1.43	4.2	10.5	27.8	89.4	6.9	94.1	7.4
<b>TOTAL</b>		<b>HC1&amp;2</b>	38.1	7.71	293.8	404.3	1.38	1.41							



## **9. REFERENCES**

Department of Mineral Resources, Gunnedah Coalfield Regional Geological 1:100 000 Map Series – Northern Sheet.

Pratt, W. 1998. *Gunnedah Coalfield*. Notes to accompany Gunnedah Coalfield Regional Geological 1:100 000 Map Series.

Tadros, V. 1993. *Gunnedah Coalfield*. Geological Survey, Department of Mineral Resources.

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