Appendix C

Geology Reports

Appendix C Geology Reports

GUJARAT NRE COKING COAL LTD
CORPORATE ADDRESS: CNR BELLAMBI LANE & PRINCESS HIGHWAY, RUSSELL VALE. NSW 2517
ABN 77 111 928 762

GUJARAT NRE No. 1 COLLIERY

GEOLOGICAL REPORT ON THE WONGA EAST AREA

GUJARAT NRE COKING COAL LIMITED

Prepared By – NRE Technical Services Department

Date – May 2014

GEOLOGICAL REPORT on the WONGA EAST AREA

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1. INTRODUCTION

Gujarat NRE Coking Coal Ltd owns and operates the NRE No.1 Colliery at Russell Vale which is approximately 8 km north of Wollongong within the Illawarra district of NSW.

The Colliery Holding covers approximately 63 km^2 and topographically the majority of the area west of the escarpment is a plateau of relatively undulating countryside incised by westerly to northwesterly flowing creeks. The major creeks flow into the Cataract Reservoir and Cataract River systems.

The NRE No. 1 colliery was the former South Bulli Colliery and has a long history of operation extending over 120 years. During its history coal extraction has concentrated on the Bulli Seam, the upper most of the coal seams in the Illawarra Coal Measures. Mining in the Balgownie Seam, approximately10 metres below the Bulli Seam, occurred from 1968 to 1982 and also in the period from 2001 to 2003.

Gujarat NRE purchased the mine in 2004 and identified the unmined Wongawilli Seam, some 30 metres below the Bulli seam, as having potential to produce a high quality coking coal with a thermal coal by-product. Development from outcrop on the Illawarra escarpment commenced in 2008 with longwall mining using modern high capacity equipment beginning in 2012.

This report has been compiled to document the current level of knowledge and understanding of the geology of the current mining domain designated as the Wonga East Study Area. Within this area extensive extraction of the Bulli Seam has occurred and also the mining operations within the Balgownie Seam.

2. DEPOSIT GEOLOGY

2.1 Regional Geology

Gujarat NRE No.1 Colliery is located in the Southern Coalfield, which is the southern portion of the Permo-Triassic Sydney Basin, as shown in Figure 1, and contains the Illawarra Coal Measures of Late Permian Age. Overlying the Illawarra Coal Measures are sandstones, shales and mudstones of the Narrabeen Group, which in turn are overlain by the Hawkesbury Sandstone, a massive quartzose sandstone unit. The Wianamatta Group, stratigraphically above the Hawkesbury Sandstone, is the top most unit in the Southern Coalfield.

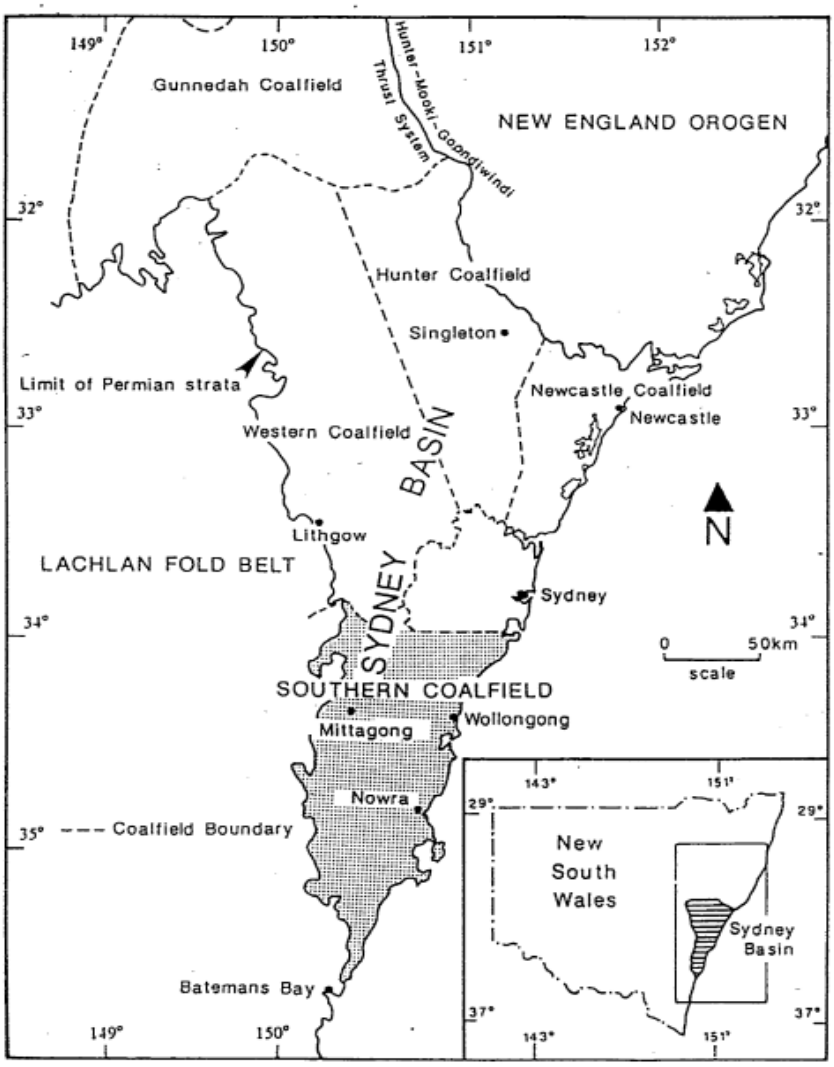


Figure 1 - Location of the Southern Coalfield

Within the Illawarra Coal Measures the Bulli Coal is the uppermost coal member and has been extensively mined across the Southern Coalfield. The Balgownie Coal, stratigraphically around 10 metres below the Bulli Coal has been mined by the longwall method at South Bulli Colliery and in the 2000's by bord and pillar operations (Gibson's Colliery). There are currently no mining operations in the Balgownie Seam within the Southern Coalfield. The Bulli to Wongawilli Coal interval varies from approximately 24 metres to around 35 metres. Although generally consistent in thickness across the Coalfield at 8 to 11 metres, the Wongawilli Seam deteriorates in quality to the north when compared to the southern part of the Coalfield where a basal section is mined at Gujarat's Wongawilli Colliery and BHPB Dendrobium Colliery.

At the broad scale the Southern Coalfield is dominated by a north plunging syncline with associated northwest trending synclines and anticlines, shown in Figure 2. The overall structure of

the Coalfield is defined from the Bulli Coal but the major structural trends of the Bulli Coal are generally thought to be mirrored through the coal measure sequence.

Large displacement faults in the Coalfield consist primarily of normal faults with dips of between 70 to 85 degrees, trending NW or NNW and are the primary set. The exception to this rule is faults found in a NE trending coastal fault zone. West of this zone northeast faulting still occur but at a much wider spacing and as a secondary set (some of these are strike slip faults associated with dykes). The deformational history of the NW fault system is complex and the pattern is the sum of several events that appear to have starting after the Permian although there is evidence of growth faulting indicating structural activity during coal deposition.

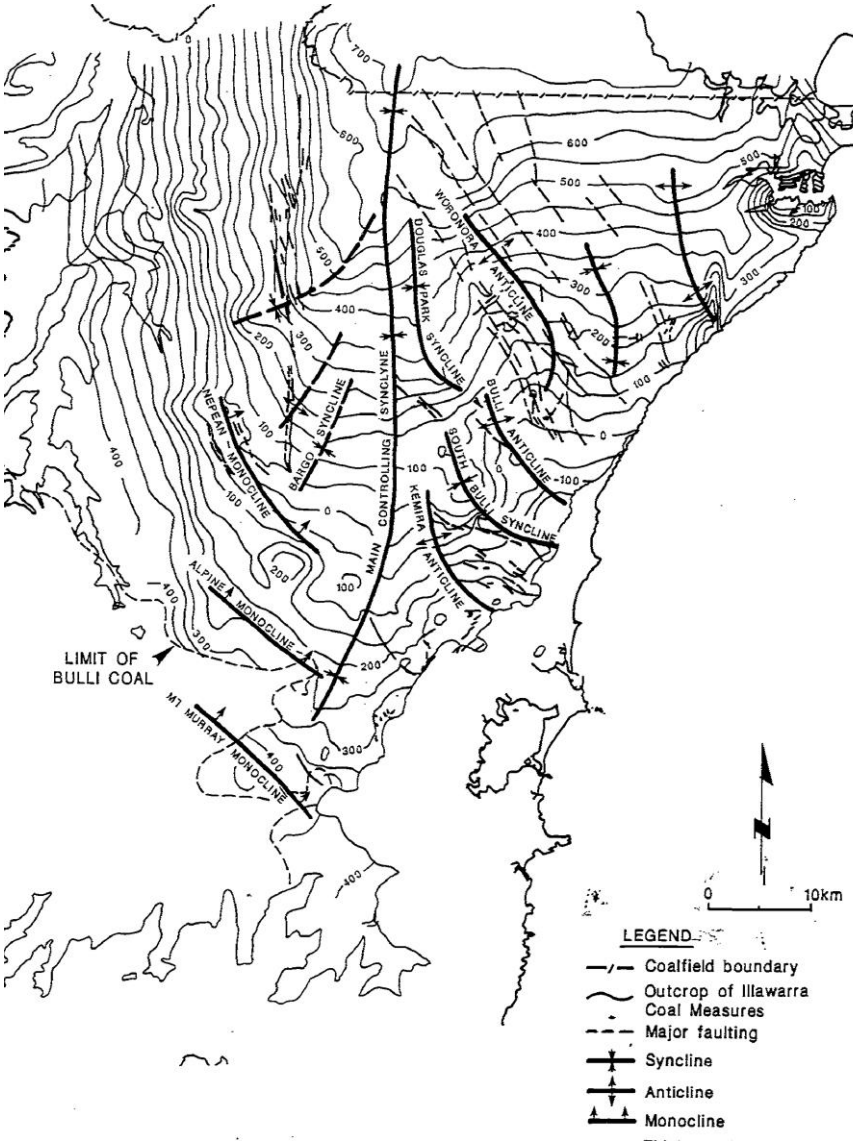


Figure 2 - Structural Elements of the Southern Coalfield

2.2 Stratigraphy

Figure 3 shows the stratigraphy of the Southern Coalfield and gives details of the coal seams present in the Illawarra Coal Measures.

AGE	GROUP	SUB-GRP	CODE	FORMATION & MEMBERS	
TRIASSIC	WIANAMATTA GROUP			BRINGELLY SHALE	
			WMSH	MINCHINBURY SANDSTONE	
				ASHFIELD SHALE	
				MITTAGONG FORMATION	
			HBSS	HAWKSBURY SANDSTONE	
	NARRABEEN GROUP	GOSFORD		NEWPORT FORMATION	
			GRFM	GARIE FORMATION	
		CLIFTON	BACS	BALD HILL CLAYSTONE	
			BGSS	BULGO SANDSTONE	
			SPCS	STANWELL PARK CLAYSTONE	
			SBSS	SCARBOROUGH SANDSTONE	
			WBCS	WOMBARRA CLAYSTONE	
			CCSS	COAL CLIFF SANDSTONE	
PERMIAN	ILLAWARRA COAL MEASURES	SYDNEY	BUSM	BULLI COAL	
			UNM1	LODDON SANDSTONE	
			BASM	BALGOWNIE COAL	
			LRSS	LAWRENCE SANDSTONE	
				BURRAGORANG CLAYSTONE	
			CHSM	ECKERSLEY FORMATION	CAPE HORN
			UNM2		UNNAMED MEMBER 2
					HARGRAVE COAL
					WORONORA COAL
					NOVICE SANDSTONE
			WW01-11	WONGAWILLI COAL	
			KBSS	KEMBLA SANDSTONE	
			ACSM	ALLANS CREEK FORMATION	AMERICAN CK. COAL
			APFM	DARKES FOREST SANDSTONE (APPIN FORMATION)	
				BARGO CLAYSTONE	HUNTLEY CLAYST.
					AUSTIMER SANDST.
			TGSM	TONGARRA COAL	
			WTFM	WILTON FORMATION	
				WOONONA COAL MEMBER	
				ERINS VALE FORMATION	
		CUMBERLAND		PHEASANTS NEST FORMATION	FIGTREE COAL
					UNANDERRA COAL
					BERKELEY LATITE
					MINNAMURRA LATITE
					CALDERWOOD LATITE
					FIVE ISLANDS LATITE
	SHOALHAVEN GROUP			BROUGHTON FORMATION	
				BERRY SILTSTONE	
				NOWRA SANDSTONE	
				WANDRAWANDIAN SILTSTONE	
				SNAPPER POINT FORMATION	
				PEBBLEY BEACH FORMATION	
	TALATERANG			CLYDE COAL MEASURES	
UNDIFFERENTIATED PALAEOZOIC (DEVONIAN, SILURIAN & ORDOVICIAN) ROCKS OF THE BASIN BASEMENT					
Information Sourced From - "Geological Survey Report No. GS1998/277 - R.S. Moffitt"					

Figure 3 - Generalised Stratigraphy of the Southern Coalfield

The following is a brief summary of the stratigraphic units of the Southern Coalfield within the NRE No.1 Colliery holding.

The Wianamatta Group is the uppermost unit in the stratigraphical sequence and is prominent in the north of the Coalfield. Within the lease area of NRE No.1 only two boreholes (SR16 and WB8)

intersected the Wianamatta Shale. Its outcrop is restricted to a very small area in the ar western portion of the lease and well outside of the Wonga East area.

The Hawkesbury Sandstone outcrops over most parts of the Coalfield and consists of thickly bedded or massive quartzose sandstone (with grey shale lenses up to several metres thick) with an average thickness of 154m in the lease area.

Within NRE No.1 Colliery the full Narrabeen Group sequence is about 275m thick.

The Gosford Formation (consisting of the Newport Formation of interbedded grey shales and sandstones and the Garie Claystone, a generally hard, grey-brown “oolitic” clay stone) is about 12m thick across the lease area.

The Bald Hill Claystone displays characteristic brownish-red coloured “chocolate shale”, a physically weak but lithologically stable unit about 20m thick. The “chocolate shale” is an easily recognised marker horizon.

The Bulgo Sandstone, averaging 162m thick, consists of strong, thickly bedded, and medium to coarse-grained lithic sandstone with occasional beds of conglomerate or shale.

The Stanwell Park Claystone (thickness average 14m) consists of greenish-grey mudstones and sandstones. This “green shale” is very weak lithologically and frets easily on exposure.

The Scarborough Sandstone, averaging 36m in thickness, consists mainly of thickly bedded sandstone with shale and sandy shale lenses up to several metres thick.

Like the Stanwell Park Claystone the Wombarra Shale (thickness average 20m), consists of greenish-grey mudstones and sandstones. This “green shale” is also very weak lithologically and is prone to fretting on exposure.

The Coal Cliff Sandstone averages 10m in thickness. In the coastal region of the Coalfield the Coal Cliff Sandstone is strong quartzose sandstone. Westward, away from the coast, dominance of the sandstone diminishes and in many areas the original roof strata of the Bulli Seam, a shale / mudstone unit, (which can become laminated in places) is prominent.

The Illawarra Coal Measures consist of interbedded shales, mudstones, lithic sandstones and coal seams of which ten named seams are identified and occur in the Coalfield.

2.2.1 Coal Seams

2.2.1.1 Bulli

The Bulli Seam is the most extensively worked coal seam in the Southern Coalfield, from outcrop mines on the coastal margins to current inland mines of BPB Billiton and Xstrata Coal. The seam produces a high quality hard coking coal (usually needing beneficiating to a coking and energy fraction) to obtain a marketable low ash coking coal. Resources of the Bulli Seam exist in the western portion of NRE No.1 Colliery. Average thickness is 2.2m and thickness variations across the Wonga East Study Area are shown on Figure 4.

2.2.1.2 Balgownie

The Balgownie Seam generally consists of medium to high ash coal with a transitional basal section of varying proportions of carbonaceous shale, mudstone and coal. Seam thickness averages 1.2m (varies from 0.2m to 1.7m) and thickness variations across the Study Area are shown on Figure 5.

Across the colliery the interval separating the Balgownie Coal from the overlying Bulli Coal (Loddon Sandstone) averages 9.5m (varies from approximately 5.2m to 13.8m). Figure 6 shows the thickness variations of the Loddon Sandstone in the Study Area.

2.2.1.3 Cape Horn

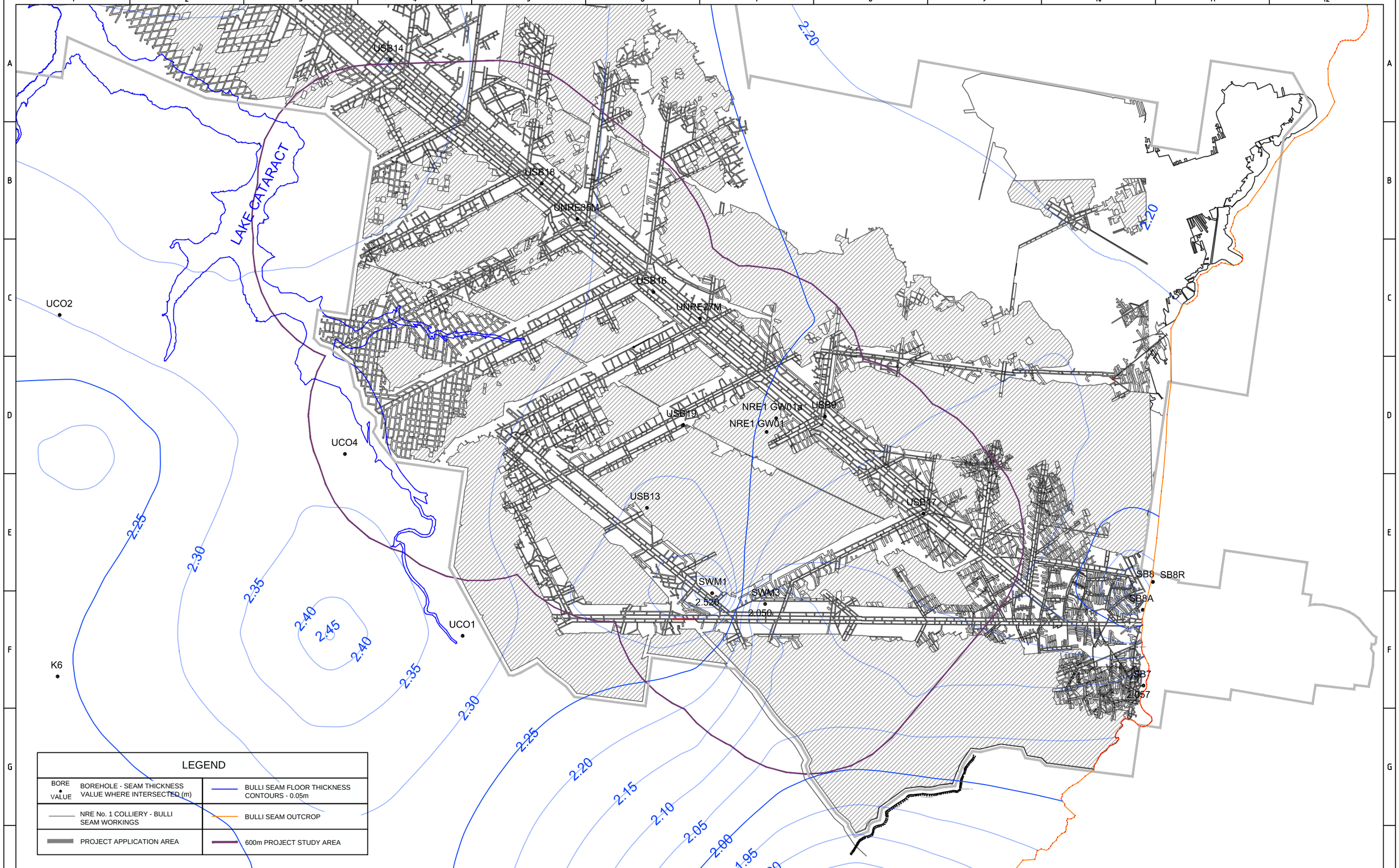
The Cape Horn Seam is uneconomic with thickness typically varying between 0.06m and 0.8m and varying in composition from carbonaceous shale to bright coal. It occurs about 9.5m below the Balgownie Coal and identification is facilitated by the occurrence of the overlying Lawrence Sandstone Member.

2.2.1.4 Hargrave

This seam is separated from the overlying Cape Horn Seam by about 2.5m of shale or mudstone and is not economic, varying in thickness from 0.1m to 0.50m and in composition from bright coal to carbonaceous shale.

2.2.1.5 Wongawilli

The Wongawilli Seam varies in thickness from 7.7m to 11.9m across the Colliery and consists of interbedded bands of brown mudstone or grey shales and coal plies.



REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

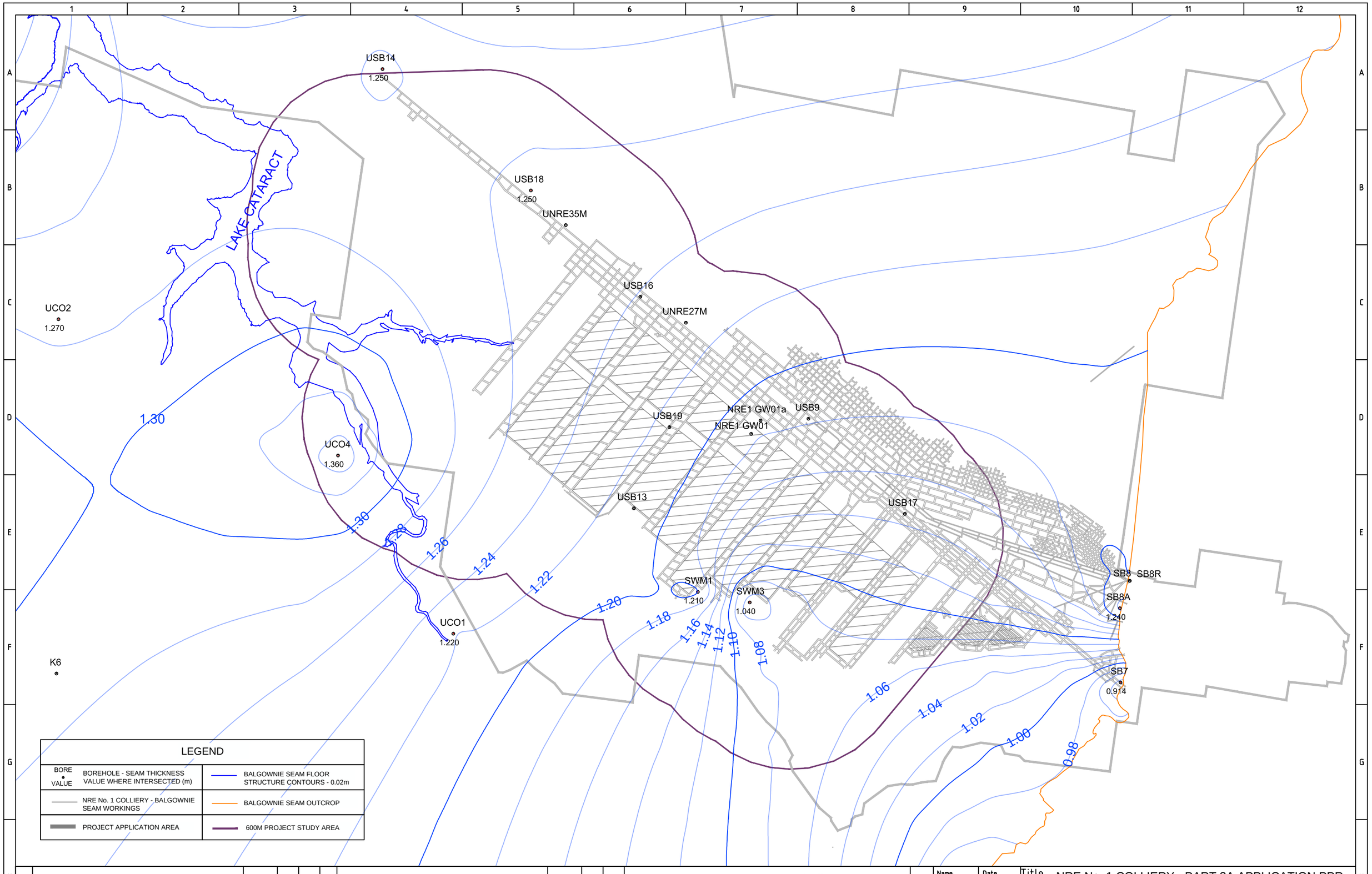
Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

	Name	Date
DRN	RC	30.07.13
CKD		
APP	BC	
SCALE	1:15000	

Title: NRE No. 1 COLLIERY - PART 3A APPLICATION PPR
BULLI SEAM THICKNESS
AREA - WONGA EAST

DRAWING NUMBER: FIGURE 4

REV: 0



REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

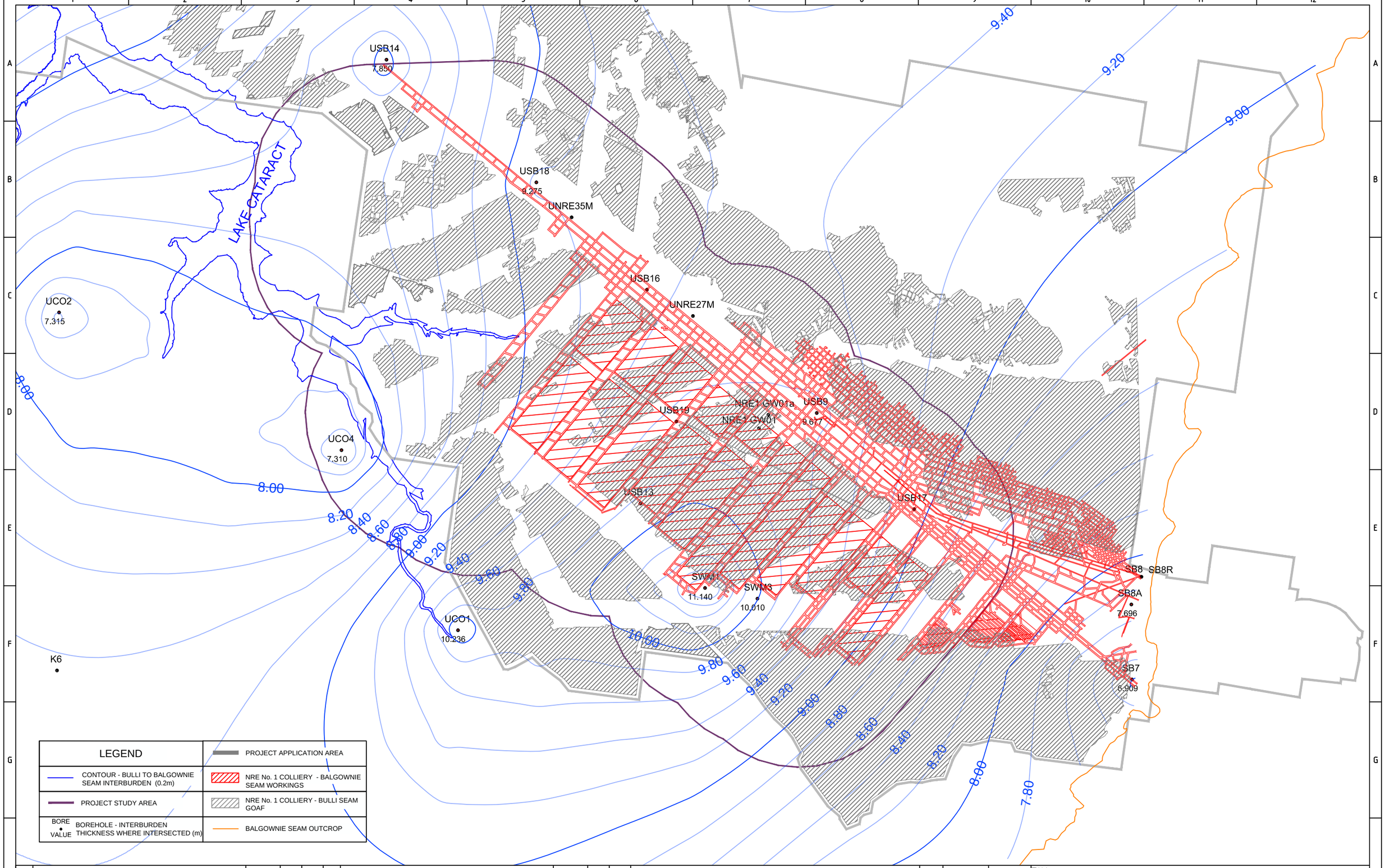
Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

	Name	Date
DRN	RC	30.07.13
CKD		
APP	BC	
SCALE	1:15000	

Title: NRE No. 1 COLLIERY - PART 3A APPLICATION PPR
BALGOWNIE SEAM THICKNESS
AREA - WONGA EAST

DRAWING NUMBER: FIGURE 5

REV: 0



REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

	Name	Date
DRN	RC	30.07.13
CKD		
APP	BC	
SCALE	1:15000	

Title: NRE No. 1 COLLIERY - PART 3A APPLICATION PPR
LODDON SANDSTONE THICKNESS VARIATION
AREA - WONGA EAST

DRAWING NUMBER: FIGURE 6

REV: 0

In the NRE No.1 Wonga East Study Area there is a basal mining section varying between 2.6m to 2.8m that has been identified as the economic longwall mining section. Figure 7 details the mining section thickness across the Wonga East area.

The interval between the Bulli Seam and the roof of the Wongawilli mining section averages around 32m in the NRE No.1 lease area. Figure 8 details this interburden thickness.

2.2.1.6 American Creek

Occurring about 10m below the Wongawilli Seam the seam varies between 0.4m and 3.6m thick, consisting mainly of carbonaceous and coaly shale and is uneconomic.

2.2.1.7 Tongarra

Occurs about 33m below the American Creek Seam the Tongarra Seam has no economic potential, consisting mainly of carbonaceous shale and mudstone bands with thin coaly plies. Averages thickness is about 1.8m.

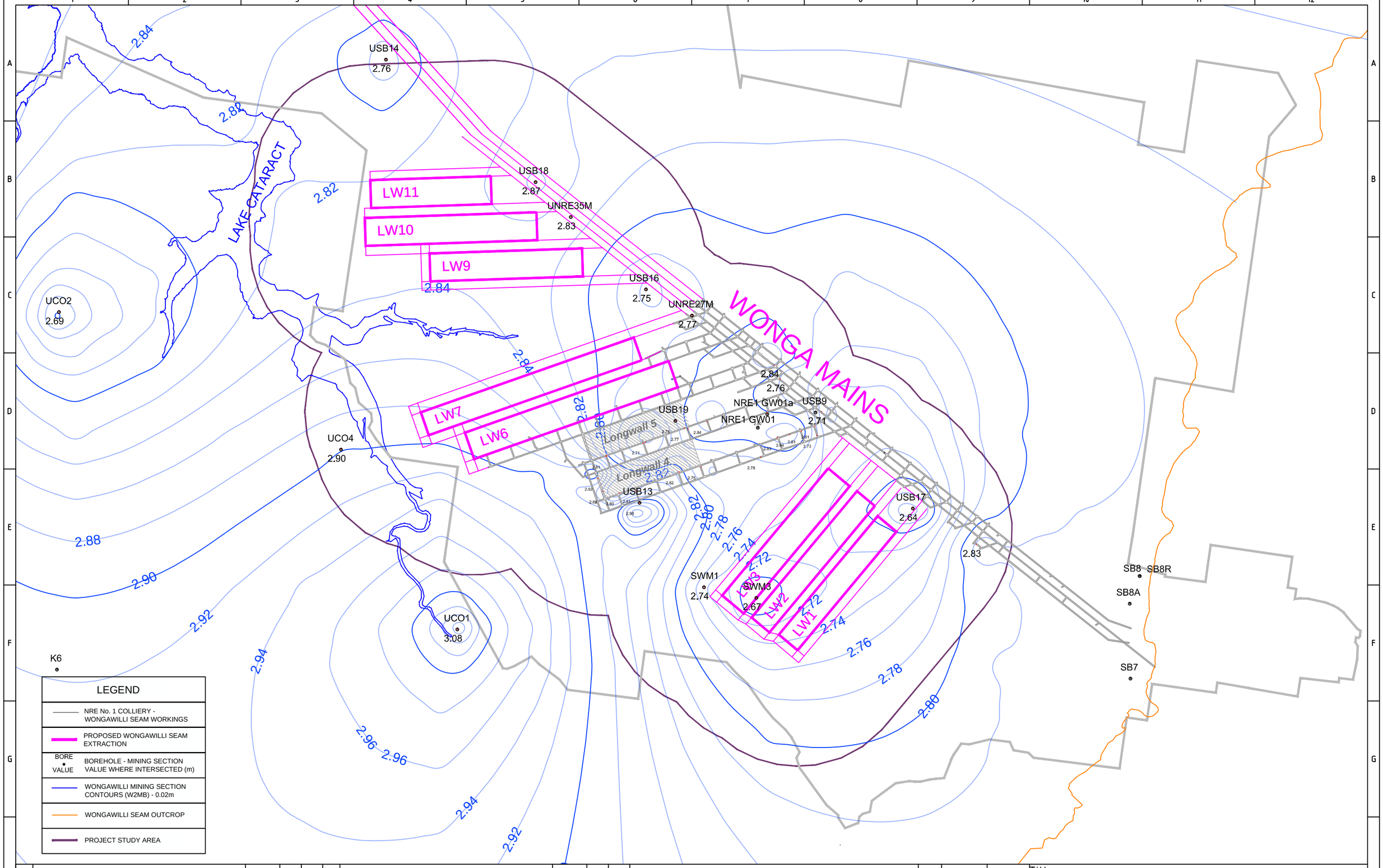
2.2.1.8 Other Seams

Three other seams are known to occur below the Tongarra Seam, namely the Woonona, Figtree and Unanderra Seams. Occurring about 17m below the Tongarra Seam the Woonona Seam is about 0.40m thick. Approximately 40m below the Woonona, the Figtree Seam is about 0.1m thick. The Unanderra Seam generally consists of numerous splits over an interval thickness of 9.5m and occurs some 17m below the Figtree Seam.

2.3 Depth of Cover

Topographic relief over NRE No.1 Wonga East Study Area consists of a series of ridges and plateaux that slope down into the Cataract Reservoir and its tributaries which incise the landscape. Figure 9 details the surface topography of the Study Area.Over the Study Area the depth of cover varies from around 225m toward the escarpment to over 350m in the northwest of the Wonga East area. The attached depth of cover plan, Figure 10, is to the roof of the Bulli Seam.

Depth of cover for the lower seams has similar trends to the Bulli Seam with the roof of the Balgownie Seam some 11.7m deeper than the Bulli Seam floor. For the Wongawilli Seam depth of



LEGEND

- NRE No. 1 COLLIERY - WONGAWILLI SEAM WORKINGS
- PROPOSED WONGAWILLI SEAM EXTRACTION
- BORE / VALUE — BOREHOLE - MINING SECTION VALUE WHERE INTERSECTED (m)
- WONGAWILLI MINING SECTION CONTOURS (W2MB) - 0.02m
- WONGAWILLI SEAM OUTCROP
- PROJECT STUDY AREA

REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

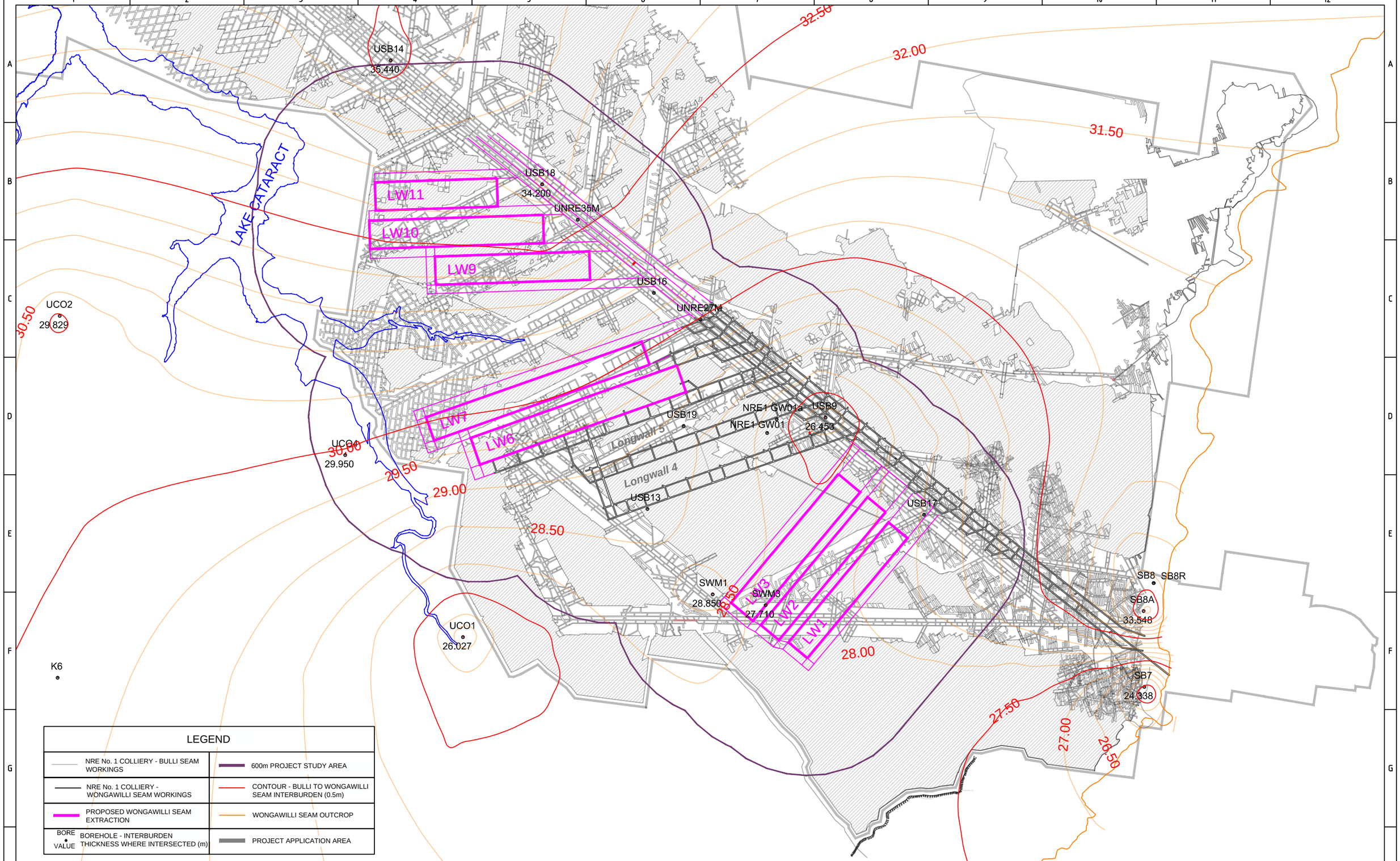
Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

	Name	Date
DRN	RC	30.07.13
CKD		
APP	BC	
SCALE	1:15000	

Title: NRE No. 1 COLLIERY - PART 3A APPLICATION PPR
WONGAWILLI SEAM - MINING SECTION THICKNESS (W2MB)
AREA - WONGA EAST

DRAWING NUMBER: FIGURE 7

REV: 0



LEGEND

NRE No. 1 COLLIERY - BULLI SEAM WORKINGS	600m PROJECT STUDY AREA
NRE No. 1 COLLIERY - WONGAWILLI SEAM WORKINGS	CONTOUR - BULLI TO WONGAWILLI SEAM INTERBURDEN (0.5m)
PROPOSED WONGAWILLI SEAM EXTRACTION	WONGAWILLI SEAM OUTCROP
BORE ● VALUE BOREHOLE - INTERBURDEN THICKNESS WHERE INTERSECTED (m)	PROJECT APPLICATION AREA

REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

	Name	Date
DRN	RC	30.07.13
CKD		
APP	BC	
SCALE	1:15000	

Title: NRE No. 1 COLLIERY - PART 3A APPLICATION PPR
BULLI - WONGAWILLI SEAM INTERBURDEN
AREA - WONGA EAST

DRAWING NUMBER: FIGURE 8

REV: 0

LAKE CATARACT

PICTON ROAD

MT OUSLEY ROAD

LW11

LW10

LW9

LW7

LW6

LW3

LW2

LW1

LEGEND

- 600M PROJECT STUDY AREA
- SURFACE CONTOURS - 5m INTERVAL
- PROPOSED WONGAWILLI SEAM EXTRACTION
- SURFACE CREEKS
- SEALED ROAD
- PROJECT APPLICATION AREA

REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

	Name	Date
DRN	RC	30.07.13
CKD		
APP	BC	
SCALE	1:15000	

Title: NRE No. 1 COLLIERY - PART3A APPLICATION PPR
TOPOGRAPHIC DETAILS & SURFACE CREEKS
AREA - WONGA EAST

DRAWING NUMBER: FIGURE 9

REV: 0

LAKE CATARACT

USB14
USB18
286.000
UNRE85M
USB16
UNRE27M
USB19
NRE1 GW01a
NRE1 GW01
USB9
USB13
315.000
USB17
SWM1
310.730
SWM3
293.500
SB8
SB8R
SB8A
SB7
UCO1
232.000
UCO2
331.000
UCO4
260.000
K6

LEGEND

- BULLI SEAM DEPTH OF COVER CONTOURS - 5m
- NRE No. 1 COLLIERY - BULLI SEAM WORKINGS
- PREFERRED APPLICATION AREA
- BORE / VALUE — BOREHOLE - BULLI SEAM DoC VALUE WHERE INTERSECTED (m)
- 600m PROJECT STUDY AREA

REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

	Name	Date
DRN	RC	10.07.13
CKD		
APP	BC	
SCALE	1:15000	

Title: NRE No. 1 COLLIERY - PART 3A APPLICATION PPR
BULLI SEAM - DEPTH OF COVER
AREA - WONGA EAST

DRAWING NUMBER: FIGURE 10

REV: 0

cover is taken to the top of the planned longwall extraction height which is 2.8m. Depth to the mining roof for the Wongawilli Seam from the Bulli Seam floor averages 32.5m.

2.4 Surface Geology

Surface geology in the Wonga East Study Area has been reviewed through ground proofing traverses, detailed Lidar topographic data at 1.0m contour intervals and aerial photography. Figure 11 details the understanding of the surface geology to date and the following section discusses the interpretation.

Dominant over the plateaux and ridges is the Hawkesbury Sandstone forming prominent cliff lines in some areas. Descending into the Cataract Reservoir foreshore the Hawkesbury Sandstone is still prominent on the eastern Reservoir shoreline where alluvium and colluvial deposits cover any outcrop of the lower stratigraphy. This colluvial deposit is still prominent toward Cataract Creek until the Gosford Formation, likely the lower Garie Formation, becomes evident. Further east along Cataract Creek the Bald Hill Claystone becomes evident in the creek bed. Approximately 800m west of Mt. Ousley Road the Bulgo Sandstone becomes evident in the creek bed. The Bulgo Sandstone appears to have undergone a small amount of erosion given the proximity of the Bald Hill Claystone boundary. The outcrop of the Bulgo Sandstone remains east of Mt. Ousley Road within the base of the Cataract Creek for about 500m, often covered by Bald Hill Claystone derived alluvium. East of Mt. Ousley Road the Bald Hill Claystone is prominent in the main tributaries of the Cataract Creek before ascending through the Gosford Formation to the widespread Hawkesbury Sandstone.

Figure 12 details two cross-sections within the Study Area, their traces are shown on Figure 11 as section lines A – A and B – B. These cross-sections show consistency in strata thickness across the Study Area with section B – B indicating a slight anticline across the northern section of the project area.

2.5 BULLI SEAM STRUCTURE

The contours of the floor level of the Bulli Seam (AHD) are based on surface drilling and Colliery workings and are shown in Figure 13. The extensive workings of the Bulli Seam and information from surrounding collieries (Bulli, Cordeaux and Corrimal) have been used to develop an understanding of

D11
D13
D12
D8
D10
D9
D3
D7
D2
D6
D1
D5
D4
F7
F6
F5
Woonona Fault
F4
Rixon Pass Fault
F2
F1
F2
WONGA EAST CROSS SECTION A - A
LAKE CATARACT
WONGA EAST CROSS SECTION B - B
WONGA EAST ACCESS ROAD
CORRIMAL FAULT - SURFACE PROJECTION
CORRIMAL FAULT - COAL SEAM
PICTON ROAD
300
320
340
360
380
400

LEGEND

PROJECT APPLICATION AREA	SEALED ROAD	HAWKESBURY SANDSTONE OUTCROP
SURFACE CONTOURS - 5m INTERVAL	DYKE INTRUSION	BALD HILL CLAYSTONE OUTCROP
SURFACE CREEKS	FAULT	GOSFORD FORMATION OUTCROP
PROPOSED WONGAWILLI SEAM EXTRACTION	BULGO SANDSTONE OUTCROP	COLLUVIAL / TALUS DEPOSITS

REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

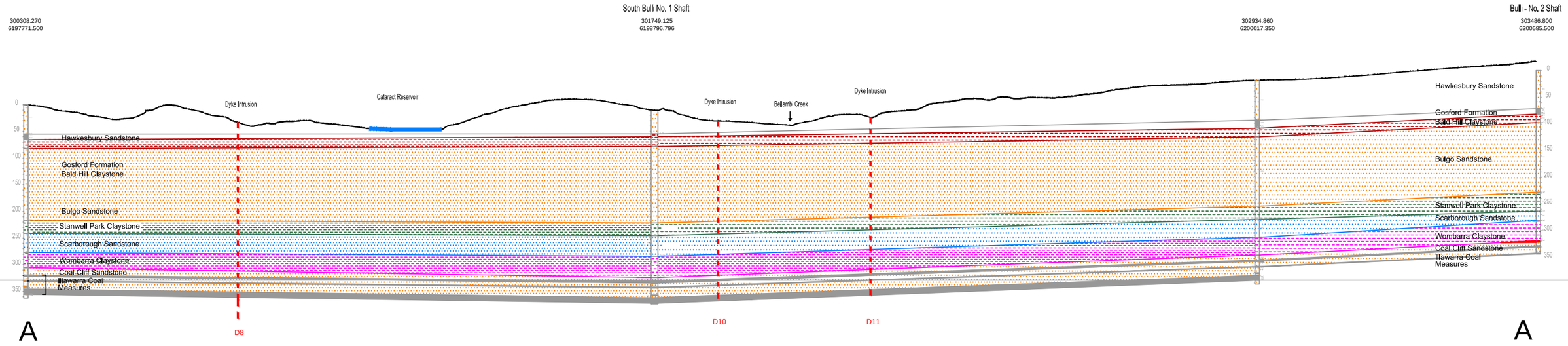
Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

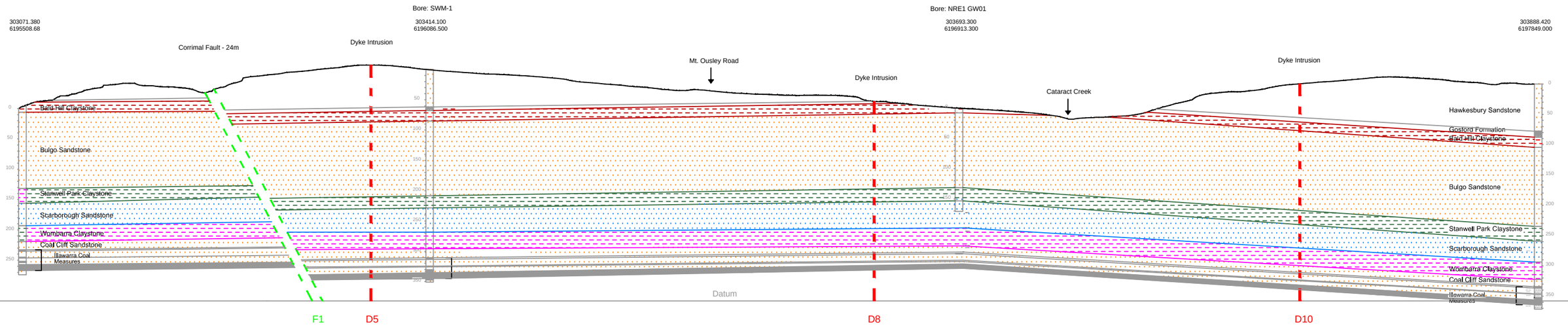
	Name	Date
DRN	RC	10.07.13
CKD		
APP	BC	
SCALE	1:15000	

Title: NRE No. 1 COLLIERY - PART 3A APPLICATION PPR
TOPOGRAPHIC DETAILS, SURFACE FEATURES & GEOLOGY
AREA - WONGA EAST

DRAWING NUMBER: FIGURE 11

REV: 0





REV	DESCRIPTION	DATE	DRN	CKD	REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

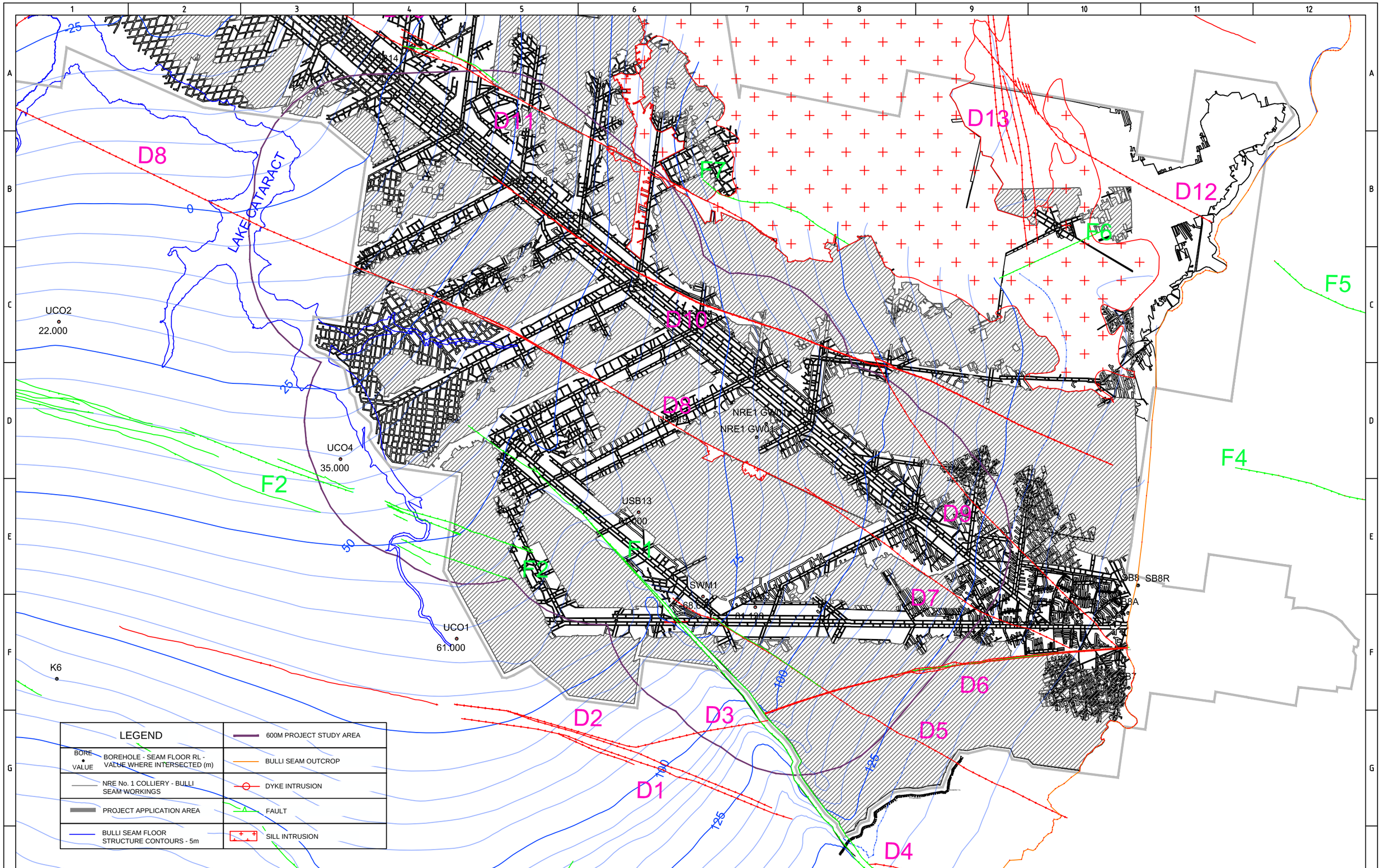
Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

	Name	Date
DRN	RC	05.07.13
CKD		
APP		
SCALE	SHOWN	

Title: NRE No. 1 COLLIERY - PART 3A APPLICATION PPR
SECTION OF STRATA
AREA: WONGA EAST

DRAWING NUMBER: FIGURE 12

REV



REV	DESCRIPTION	DATE	DRN	CKD

NRE No. 1 Colliery

GUJARAT NRE Coking Coal Pty Ltd

Princess Highway & Bellmabi Lane, Russell Vale, NSW. 2517
ABN 28 111 244 896

	Name	Date
DRN	RC	10.07.13
CKD		
APP	BC	
SCALE	1:15000	

Title: NRE No. 1 COLLIERY - PART 3A APPLICATION PPR
BULLI SEAM STRUCTURE
AREA - WONGA EAST

DRAWING NUMBER: FIGURE13

REV: 0