YANCOAL
兖煤澳大利亚有限公司

AUSTAR COAL MINE
PART OF THE YANCOAL AUSTRALIA GROUP

LWB4 to LWB7 Coal Resource Recovery Plan

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DOCUMENT CONTROL

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1 INTRODUCTION

This coal resource recovery plan has been prepared as part of the Extraction Plan for Longwall LWB4 to LWB7 following the approved shortening of LWB4 by the Department of Planning and Environment on the 18 September 2018.

1.1 SCOPE & OBJECTIVE

The objective of this Coal Resource Recovery Plan (CRRP) has been prepared to demonstrate the effective recovery of the available resource in the Bellbird South Area within the Greta Seam at Austar Coal Mine using conventional Longwall mining techniques. See **Figure 1**.

This Coal Resource Recovery Plan has been prepared in accordance with Condition 3A(d) of Schedule 3 of DA29/95 (as modified) as a component of the Austar Coal Mine Extraction Plan LWB4 – LWB7.

Therefore, this report provided a description of the:

- Coal resources available within the Bellbird South Area;
- Proposed Mining Method, Schedule and Mine plan;
- Resource recovery and effects on future mining; and
- Justification for the Mine plan.

Graphical Plans (included with the main Extraction Plan) provide supporting information and provide details of the coal resource, existing and proposed workings, and impacted surface features. The plans have been prepared in accordance with the *Guidelines for the Preparation of Extraction Plans (Draft V5)* (Extraction Plan Guidelines) provided to Austar Coal by the Department of Planning and Environment in 2016.

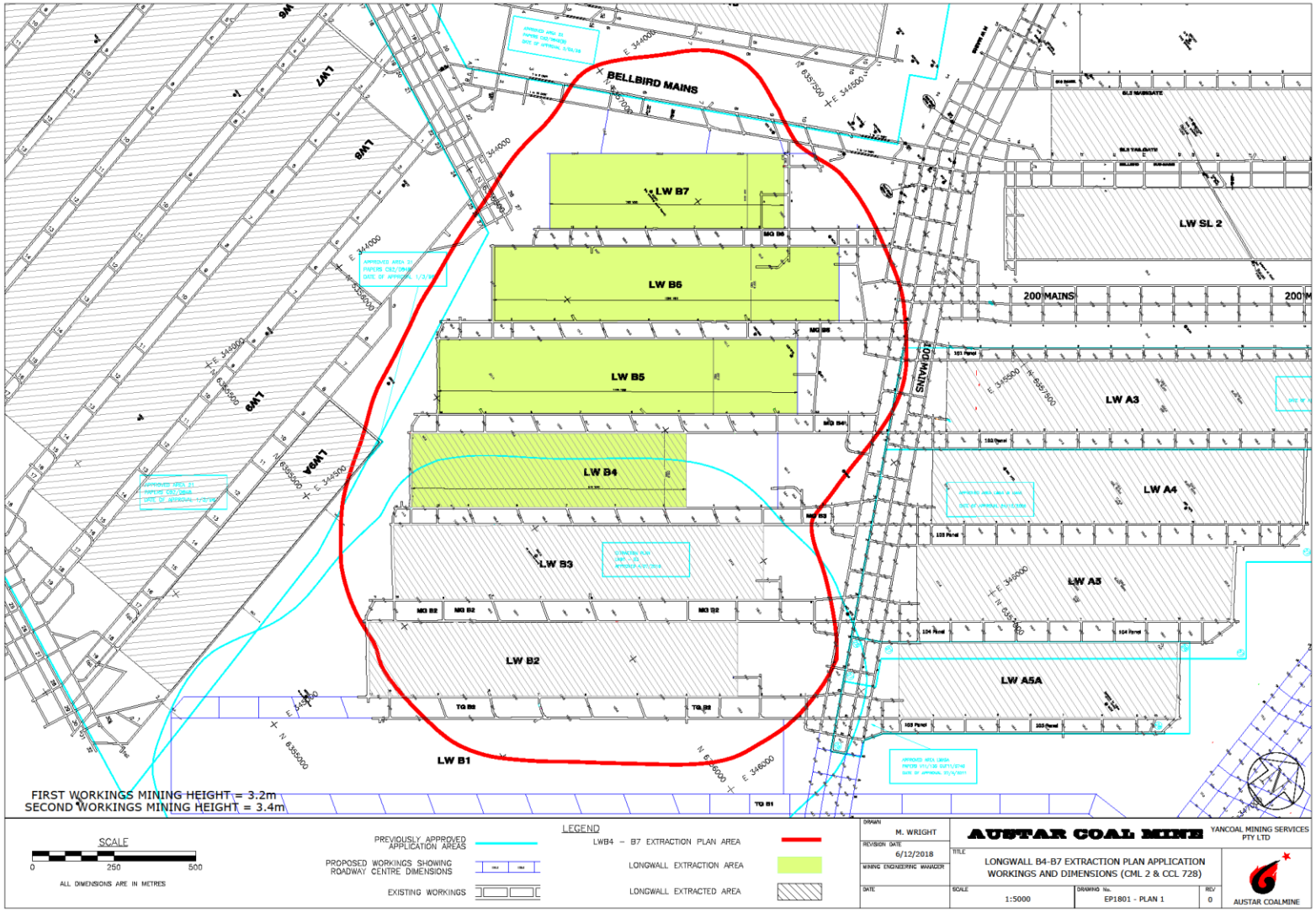

Figure 1 – Longwalls B4 – B7

2 RESOURCE DESCRIPTION

2.1 SITE CONDITIONS

The Austar Underground Mine lies in the Newcastle Coalfield, within the Northern Sydney Basin. Austar Coal Mine is proposing to extract LWB4 – LWB7 using conventional longwall mining methods within the Greta Seam. The Extraction Plan Area is bounded by LWB3 panel to the south and the previously extracted Ellalong workings to the west.

2.2 OVER BURDEN STRATIGRAPHY

The Extraction Plan Area lies in the Newcastle Coalfield, within the Northern Sydney Basin. A typical stratigraphic section of the Newcastle Coalfield (after Ives et al, 1999, Moelle and Dean-Jones, 1995, Loehe and Dean-Jones, 1995, Loehe and Allan, 1995) is shown in **Table 1**. The strata shown in this table were laid down between the Early Permian and the Middle Triassic Periods.

Longwalls B4 to B7 are proposed to be extracted within the Greta Seam, which is located within the Kitchener Formation of the Greta Coal Measures. The overlying strata comprise the Paxton Formation, which consists of interbedded sandstone and siltstone layers up to 20 metres thick. The uppermost layer in the Greta Coal Measures is the Pelton Seam, which is less than 1.0 metre thick. The underlying strata comprise the Kurri Kurri Conglomerate and the Neath Sandstone. Strong and thick strata consisting of conglomerate and sandstone are typically observed within these formations.

The main sequence overlying the Greta Coal Measures is the Branxton Formation, which is part of the Maitland Group sediments from the mid Permian period. The Maitland Group comprises, in order of deposition, the Branxton Formation, Muree Sandstone and Mulbring Siltstone. The Branxton Formation immediately overlies the Greta Coal Measures and is made up of a substantial thickness of sedimentary rocks. The lithology of the Branxton Formation generally consists of the coarser sandstone and conglomerate rocks at the base of the formation, grading to finer deposits of silty sandstone and siltstone at the top of the formation. The upper part of the formation contains a unit known as Fenestella Shale that contains numerous fossils of marine invertebrate fauna.

The Newcastle region is characterised by a complex geological setting, with a great variety of rock types occurring over short lateral and vertical distances (Moelle and Dean-Jones, 1995). Folds, normal faults and dykes dominate the region and generally trend north-west to north-north-west (Lohe and Dean-Jones, 1995).

Table 1 Stratigraphy of the Newcastle Coalfield

Stratigraphy			Lithology
Group	Formation	Coal Seams	
Narrabeen Group	Clifton		Sandstone, siltstone, mudstone, claystone
Newcastle Coal Measures	Moon Island Beach	Vales Point Wallarah Great Northern	Sandstone, shale, conglomerate, claystone, coal
	Awaba Tuff		Tuff, tuffaceous sandstone, tuffaceous siltstone, claystone, chert
	Boolaroo	Fassifern Upper Pilot Lower Pilot Hartley Hill	Conglomerate, sandstone, shale, claystone, coal
	Warners Bay Tuff		Tuff, tuffaceous sandstone, tuffaceous siltstone, claystone, chert
	Adamstown	Australasian Montrose Wave Hill Fern Valley Victoria Tunnel	Conglomerate, sandstone, shale, claystone, coal
	Nobbys Tuff		Tuff, tuffaceous sandstone, tuffaceous siltstone, claystone chert
	Lambton	Nobbys Dudley Yard Borehole	Sandstone, shale, minor conglomerate, claystone, coal
	Waratah Sandstone		Sandstone
Tomago Coal Measures	Dempsey		Shale, siltstone, fine sandstone, coal, and minor tuffaceous claystone
	Four Mile Creek	Upper Donaldson Lower Donaldson	
	Wallis Creek		
Maitland Group	Mulbring Siltstone		Siltstone
	Muree Sandstone		Sandstone
	Branxton		Sandstone, and siltstone
Greta Coal Measures	Paxton	Pelton	Sandstone, conglomerate, and coal
	Kitchener	**Greta**	
	Kurri Kurri	Homeville	
	Neath Sandstone		Sandstone
Dalwood Group	Farley		Shale, siltstone, lithic sandstone, conglomerate, minor marl and coal, and interbedded basalts, volcanic breccia, and tuffs
	Rutherford		
	Allandale		
	Lochinvar		
Seaham Formation			

2.3 LITHOLOGICAL AND GEOTECHNICAL CHARACTERISTICS (IMMEDIATE ROOF STRATA)

The immediate roof of the Greta Seam consists of thickly bedded and massive sandstone and conglomerate units which are in turn overlain by the Pelton Seam.

Below the Pelton Seam, sandstone and siltstone units show more frequent bedding, with units becoming generally weaker and more laminated. This sequence is referred to as the Paxton formation. There appears to be a general reduction in average strength of a strata unconfined compressive strength (UCS) sample set with a reduction in grain size.

Immediate roof strata in the extraction area consists of approximately 10 – 30m of sandstone and coarse grained sandstone/conglomerate in the north east, overlain by the thin coal and carbonaceous bands of the Pelton Seam. Towards the south west the sandstone and coarse grained sandstone/conglomerate units above the Greta Seam thin to approximately 10m, being overlain by the 0.8m thick coal seam referred to as the Pelton Seam.

The immediate roof strata ranges from 5 – 40MPa with some stronger units occurring in places. Above the 2m horizon, the strata generally ranges from 20 – 80MPa with the lower limit increasing further away from the seam (i.e. higher into the roof).

2.4 LITHOLOGICAL AND GEOTECHNICAL CHARACTERISTICS (IMMEDIATE FLOOR STRATA)

The immediate floor of the extraction area shows a weak mudstone, typically between 0.3m and 1.0m thick, underlain by stronger sandstone units which range from 20 – 40MPa in UCS.

2.5 GEOLOGICAL STRUCTURES

Two main geological features exist proximal to the Bellbird South mining area. The first of these is present to the west of the mining zone and is known as the Barraba Fault. The second is known as the Swamp Fault Zone, and exists in the eastern area of the longwall extraction block foot prints.

The Swamp Fault Zone consists of a number of closely spaced normal faults with a typical orientation of NNW-SSE and displacements down to the ENE. To date, the maximum displacement of a fault intersected within the Swamp Fault Zone, in the Bellbird South mining area has been 2.5m in the MGB5. It is expected that the displacement of the Swamp faulting system is projected to be approximately 2.0m in MGB6. A 4.8m displacement fault has been mapped within the Swamp Fault Zone, in the Bellbird Mains.

The Barraba Fault Zone consists of a number of faults orientated NNW – SSE. The fault zone has been projected to rotate from intersections in the Ellalong LW9 gateroads where measured fault displacements ranged from 0.1m to 7.2m. It is expected to be in the order of 15m in the Bellbird South Mining Zone.

2.6 STABILITY OF UNDERGROUND WORKINGS

The proposed pillars in the application area are designed to provide stable underground workings for the period of development and subsequent extraction. As such, pillars are designed with an appropriate Factor of Safety and width to height ratio for their purpose.

Detail on predicted subsidence impacts, the associated method of prediction and relevant subsidence parameters can be found in the Extraction Plan main report.

Accompanying the designed mining layout is a monitoring program whose objective is to monitor roadways, pillars and panel performance, to ensure the adequacy of the design. The monitoring program comprises a combination of tell-tales, gel extensometers, borescopes, and visual inspections. Monitoring is conducted during both development and secondary extraction.

3 MINING SYSTEMS AND RESOURCE RECOVERY

3.1 MINING GEOMETRY

The layouts of the proposed longwall panels LWB4 – LWB7 within the Greta Seam are shown in **Figure 1**. A summary of the proposed dimensions of these panels is provided in **Table 2**. It is proposed that the longwalls would be extracted in order of LWB4, LWB5, LWB6 and LWB7.

Table 2 Geometry of the Proposed Panels LWB4 to LWB7

Panel	Overall Void Length Including Installation Heading (m)	Overall Void Width Including First Workings (m)	Overall Tailgate Chain Pillar Width (m)
LWB4	845	237	45
LWB5	1,105	237	50
LWB6	1,065	237	45
LWB7	725	237	45

3.2 DEPTH OF COVER

The depth of cover to the Greta Seam directly above the proposed longwalls varies between a minimum of 400 metres above the maingate of Longwall B7 and a maximum of 500 metres above the north-eastern corner of Longwall B4. The seam floor within the proposed mining area dips from the west to the east, having an average gradient of around 8 %, or 1 in 12.

The variations in the surface and seam levels across the mining area are illustrated along Cross-sections 1 in **Figure 2**.

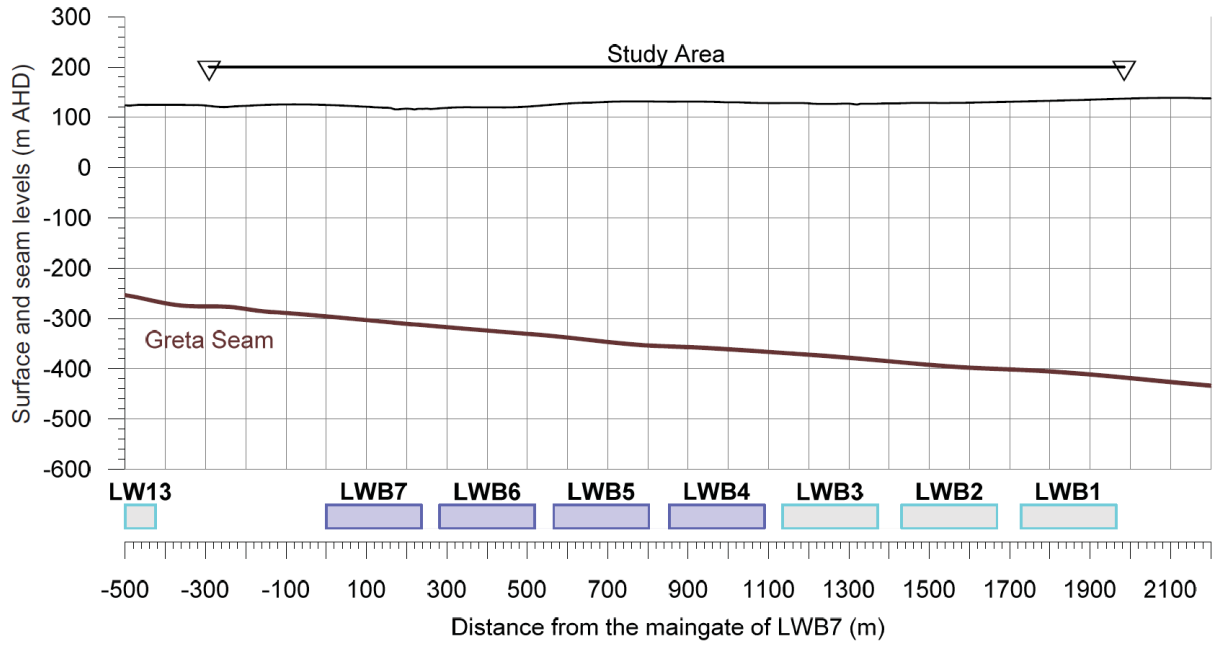

Figure 2 Surface and Seam levels along Cross-section 1 (MSEC903)

3.3 MINING METHOD

Austar will use the conventional longwall method of mining the Greta Seam within the application area.

The thickness of the Great Seam within the proposed mining area varies between 3.7 metres and 4.8 metres. It is proposed that a constant thickness of 3.4 metres will be extracted using conventional longwall mining techniques.

Extraction will take place generally in a southwest to northeast direction towards the 100 Mains Headings.

Long term mains development pillars are designed to be long term stable and hence not cause subsidence, thus rendering the roads serviceable for the life of the mine.

Development roads will nominally be driven at a width of up to 5.4 metres using single pass continuous miners.

3.4 SCHEDULE

The mining schedule for the Extraction Plan Area is shown in **Table 3**. Extraction will progress in a north eastern direction towards the 100 Mains Headings in each Panel commencing with LWB4. Development rates are budgeted from 8 to 10 metres per continuous miner shift dependent on geological conditions and support regime. Longwall extraction will typically produce in the order of 3,000 to 4,000 tonnes per shift.

Normally operations are carried out 24 hours per day seven days per week. Generally, maintenance operations (e.g. stonedusting, roadway maintenance etc) are undertaken on Wednesdays.

The anticipated start and completion dates are summarised in **Table 3**.

Table 3 Panel Extraction Rate and Sequence

Panel	Start Date	End Date	Estimate Duration (Days)
LWB4	October 2017	November 2018	400
LWB5	January 2019	June 2019	180
LWB6	August 2019	January 2020	150
LWB7	March 2020	May 2020	120

3.5 FUTURE MINING

There are no other seams considered economically mineable within the Extraction Plan Area.

3.6 RESOURCE RECOVERY

The method of extraction selected allows for maximum resource recovery whilst providing safety for the workforce. There are no significant environmental impacts that preclude longwall extraction within the Extraction Plan Area.

In the initial planning of the area an option study was conducted whereby a number of alternative mine plans were considered having regard to the lease boundaries, exploration geological data and initial environmental assessment details. The plan and layout have been continually reassessed and reviewed as additional exploration, geological, and environmental data have become available.

The resultant mine plan provides for optimum resource recovery within the bounds created by geological and previous mining constraints. It is considered to be a layout which will result in subsidence being completed in accordance with DA29/95 conditions.

The estimated recovery of the resource for the Extraction Plan Area is provided in **Table 4**.

Table 4 Extraction Plan Area Estimated Resource Recovery

Total tonnes of coal (Resource within extraction area)	13.2Mt
Total tonnes extracted through development	0.27Mt
Tonnes extracted by Longwall	3.5Mt
Percentage recovery	28%

Particulars relating to each Panel is given in **Table 5**.

Table 5 Estimated Individual Panel Tonnages

Panel	Panel Length (m)	Panel Width (void m)	Average Extrcation Height (m)	Panel Extraction Tonnes (Mt)
LWB4	845	237	3.4	0.88
LWB5	1,105	237	3.4	1.00
LWB6	1,065	237	3.4	0.97
LWB7	725	237	3.4	0.66

3.7 JUSTIFICATION

The layout, as indicated on **Figure 1**, has been developed based on extensive drilling, environmental investigation and assessment and consultation with relevant authorities.

The layout and method also provide an extraction layout which maximises the efficient use and management of resources through maximising resource utilisation within an area of historical underground workings and using well established surface facilities. There are no significant environmental impacts that preclude longwall mining within the Extraction Plan Area.

The subsidence monitoring program contained within the Extraction Plan summarises the overall monitoring of mining impacts on the natural and built environments, with management actions detailed in the relevant environmental management plan(s) or Built Features Management Plan.