



Austar Coal Mine

Longwalls B4 to B7

Extraction Plan

January 2019



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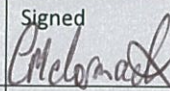
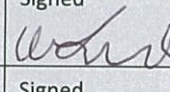
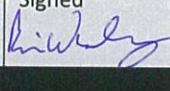
DOCUMENT DETAILS	Title	Austar Coal Mine Longwalls B4-B7 Extraction Plan		
	Applicant	Austar Coal Mine Pty Ltd		
	Name of Mine	Austar Coal Mine		
	Development Consent	DA 29/95 (as modified)		
	Mining Leases	CCL728 & CML2		
	Document Status	Final v2		
	Approval Date	1/2/19		
ORIGINATOR	Daniel Lee	Regional Registered Surveyor	Signed 	Date 1/2/19
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APPROVED	Brian Wesley	Mine Operations Manager	Signed 	Date 1/2/2019
Version	Revision	Revision Details		
0		Original document		
1		Updated following consultation with DPE & DRG and MOD7 approval		
2		Updated following shortening of LWB4		

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Plan 1: LWB4 – LWB7 Existing and Proposed Workings
Plan 2: LWB4 – LWB7 Surface Features
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<i>Plan 4: Not Required (no other seams above or below the Greta Seam)</i>
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APPENDICES

Appendix A	Development Consent Conditions
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1 INTRODUCTION

Austar Coal Mine Pty Ltd (Austar), a subsidiary of Yancoal Australia Limited (Yancoal), owns Austar Coal Mine, an underground coal mine located approximately 10 kilometres south of Cessnock in the Lower Hunter Valley in NSW. The mine is an aggregate of the former Ellalong, Pelton, Cessnock No.1 and Bellbird South Collieries and is located in the South Maitland Coalfields. These operations, including coal extraction, handling, processing and transport, collectively form the Austar Coal Mine Complex.

A modification to the Bellbird South development consent (DA29/95 MOD7) was approved under delegated authority of the Minister for Planning on 25 August 2017. The modification extends the Bellbird South consent area and permits the transfer of coal from four conventional longwall panels (Longwalls B4 to B7) within the Ellalong Colliery and Bellbird South Colliery areas to existing infrastructure for processing and transport of coal.

On the 18 September 2018, the Department of Planning and Environment approved the shortening of Longwall B4 by 279m, due to geological factors and the occurrence of coal burst incidents in the LWB4 panel.

The location of Austar's mining areas, and previous mining is shown with the Austar Mine Complex in **Figure 1.1**.

1.1 SCOPE & OBJECTIVE

The Extraction Plan for Longwalls B4 to B7 has been prepared in accordance with the requirements of Schedule 3, Condition 3A of DA29/95. The objective of this Extraction Plan is to identify the management strategies for subsidence induced impacts on natural and built features from secondary extraction of longwall panels LWB4 to LWB7 within the Greta Seam at Austar using traditional longwall mining techniques (the **Extraction Plan Area** shown as **Figure 1.2**).

The objective of the Extraction Plan will be achieved by:

- Providing an overview of the planned coal resource recovery methods;
- Identifying the predicted subsidence impacts and/or environmental consequences within the Extraction Plan area associated with the planned coal recovery;
- Identifying the management activities (including monitoring and remediation) prepared to address the predicted subsidence impacts from secondary extraction of longwall panels LWB4 to LWB7 within the Greta Seam at Austar; and
- Identifying the review and reporting activities to allow for assessment of the performance of subsidence management measures by Austar, and identification of areas where either continual improvement may be achieved, or management of unpredicted subsidence impacts can be managed.

1.2 DOCUMENT STRUCTURE

The Extraction Plan has been prepared to address conditions of DA 29/95 (as modified), and structured in general 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.

The document structure includes the following elements:

- **Section 2** includes an overview of the mine planning and design, overall subsidence predictions, and performance objectives,
- **Section 3** includes details on the development of the Extraction Plan, including details of consultation with relevant agencies and other stakeholders within the Extraction Plan area;
- **Section 4** provides an overview of and details of subsidence management measures including plans prepared to address impacts to relevant environmental and/or built features. The individual management plans are contained in Appendices to the Extraction Plan;
- **Section 5** addresses the key elements of how the Extraction Plan is implemented, including reporting, regular review and key responsibilities.

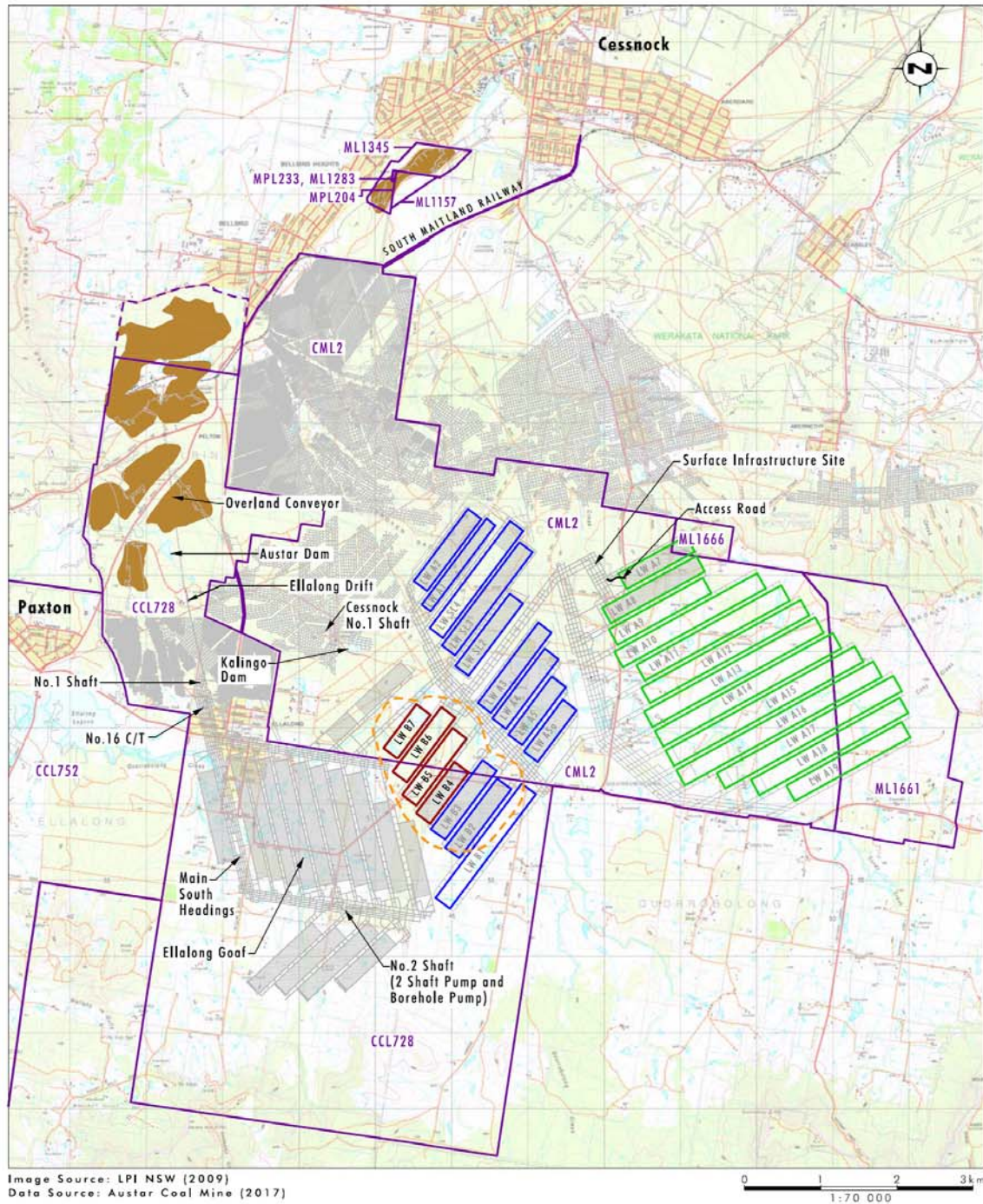
An important component of the Extraction Plan are the key component plans referred to in **Section 4**. These plans described in **Table 1.1**.

Table 1.1 Extraction Plan Key Component Plans

Plan	Description	Location
Water Management Plan	To manage the potential environmental consequences of second workings on surface and ground water	Appendix E
Land Management Plan	To manage the potential environmental consequences of second workings on steep slopes and land in general	Appendix F
Biodiversity Management Plan	To manage the potential environmental consequences of second workings on aquatic and terrestrial flora and fauna	Appendix G
Built Features Management Plan	To manage the potential environmental consequences of second workings on any built feature	Appendix H
Public Safety Management Plan	To ensure public safety in the Extraction Plan area	Appendix I
Subsidence Monitoring Program	A program to collect actual measured subsidence data, and conduct inspections for environmental consequences of subsidence to compare against predicted impacts which may trigger a response, or set of responses	Appendix J

Plan	Description	Location
Coal Resource Recovery Plan	To demonstrate effective recovery of available resources obtained through underground mining activities	Appendix K

Graphical Plans which are required by the Extraction Plan Guidelines, and referred to in this Extraction Plan, are included as **Graphical Plans** at the end of the Main Extraction Plan text.



Legend

- LWB4-B7 Extraction Plan Longwall Panels
- LWB4-B7 Extraction Plan Area
- Bellbird South LWB1-B3 Extraction Plan, Stage 1, Stage 2 and Southland Longwall Panels (DA 29/95)
- Stage 3 Longwall Panels (PA08_0111)
- Approved Reject Emplacement Areas
- Completed Underground Workings
- Mining Lease Boundary
- Austar owned CHPP Land

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FIGURE 1.1
Austar Coal Mine Complex

Figure 1.1 Austar Coal Mine Complex

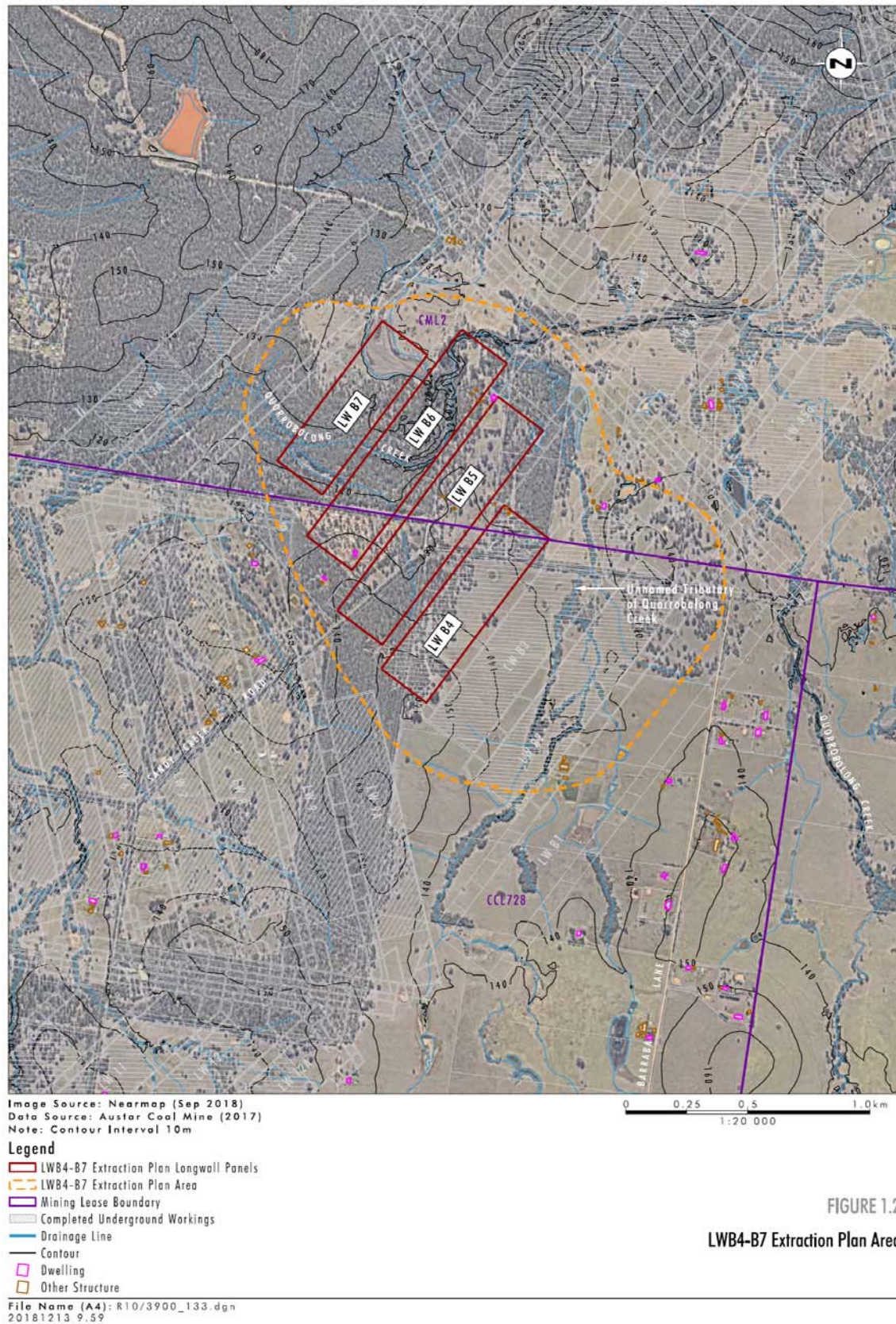


Figure 1.2 Extraction Plan Area

2 OVERVIEW

2.1 ENVIRONMENTAL CONTEXT

2.1.1 Environmental Setting

The Extraction Plan Area surface expression is approximately 277 ha and is located in the suburbs of Quorrobolong and Ellalong, approximately three kilometres east of the township of Ellalong in the lower Hunter Valley of NSW.

The landform within the Extraction Plan Area is situated within the Quorrobolong Creek Catchment, a sub-catchment to the larger Wollombi Brook and ultimately the Hunter River catchment. Quorrobolong Creek forms part of the Congewai Creek Management Zone of the Upper Wollombi Water Source within the Hunter Unregulated and Alluvial Water Sources Water Sharing Plan area. Quorrobolong Creek crosses the northern portion of Extraction Plan Area above the proposed LWB6 and LWB7 and flows west towards Ellalong Lagoon. Quorrobolong Creek is ephemeral, however localised areas of ponding occur along its alignment. An unnamed tributary of Quorrobolong Creek drains in a northerly direction through the Extraction Plan Area above LWB1 to LWB4, converging with Quorrobolong Creek upstream of LWB5.

The topography of the Extraction Plan Area is generally characterised by low undulating hills and creek flats associated with Quorrobolong Creek and its unnamed tributaries. Elevations within the area range from approximately 115 metres to 160 metres Australian Height Datum (AHD).

The climate of the region is classified as warm temperate, characterised by seasonal variations from hot wet summers to mild dry winters. Rainfall is summer dominant, often occurring as short duration high intensity storms, with an average of 800 to 950 millimetres of rain falling in the region per annum.

2.1.2 Land Ownership and Tenure

Land ownership within and proximate to the Extraction Plan Area is shown in **Figure 2.1** and is mix of Austar owned land, privately owned rural land and Crown landholdings.

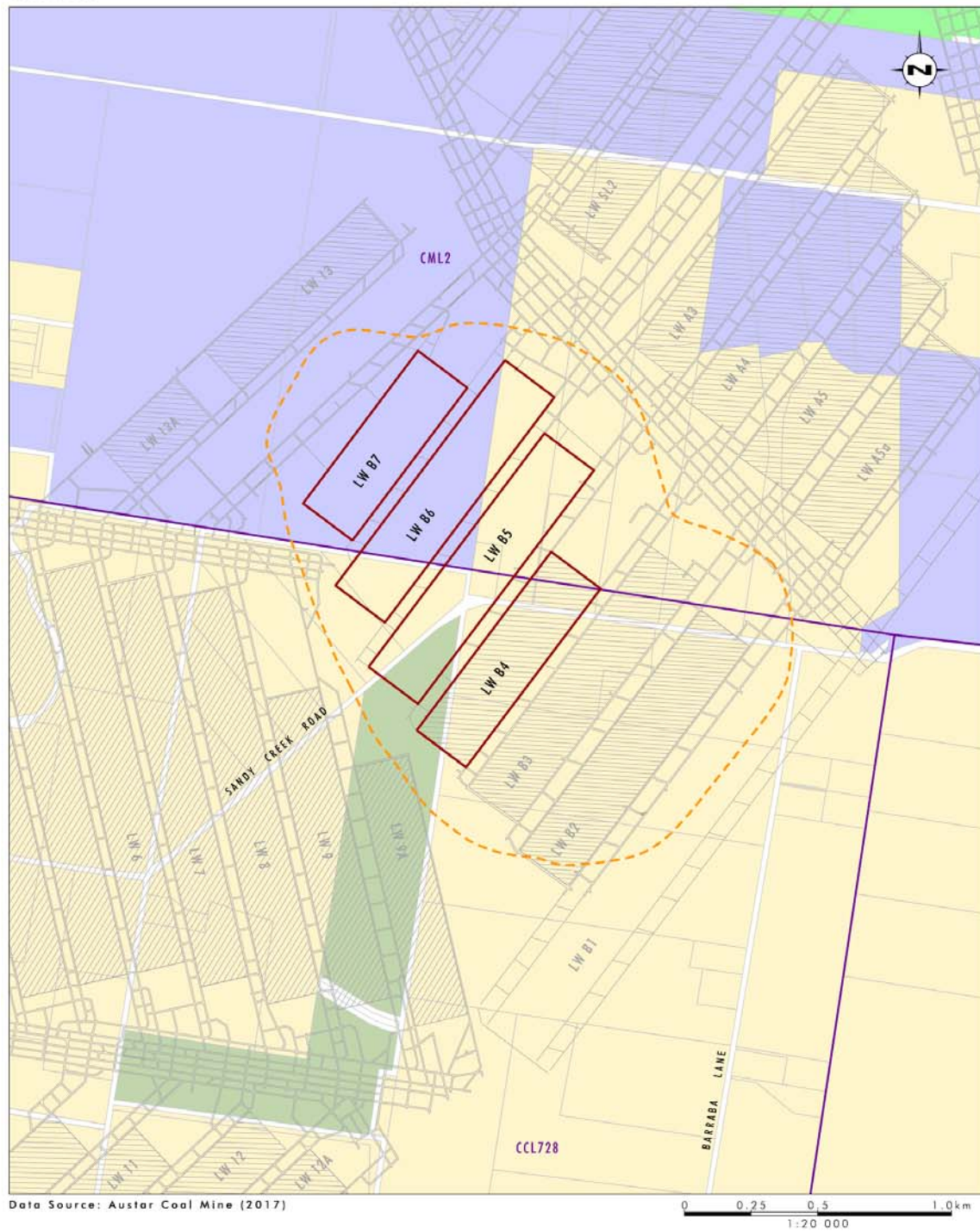
The primary land use within the Extraction Plan Area is rural and agricultural grazing including cattle and goat grazing on private landholdings in the south and east of the modification area. Five rural dwellings are located on the private landholdings within the Extraction Plan Area. Land within the north and west of the area is owned by the Crown and Austar and is currently vacant supporting remnant and regrowth vegetation.

Land use surrounding the Extraction Plan Area is primarily rural and is dominated by cleared grazing land. Vegetated land to the northwest is owned by Austar and utilised for a variety of surface infrastructure associated with the Mine. This Austar owned land connects to the north with the Werakata State Conservation Area which is dominated by vegetation. Other land uses in the surrounding area include rural residential, roads, underground mining and surface mining infrastructure associated with the Austar Coal Mine. The small township of Ellalong is located

approximately 2 kilometres west of the extraction Plan Area and the villages of Kitchener and Pelton are located approximately 4 kilometres to the northeast and northwest respectively. The Watagans National Park is located approximately 4 kilometres south and the Werakata State Conservation Area is located approximately one kilometre to the north.

The Extraction Plan Area is located beneath Sandy Creek Road, with LWB4 and LWB5 passing beneath the road. Barraba Lane and its intersection with Sandy Creek Road is located just outside the south-eastern corner of the Extraction Plan Area. Both Sandy Creek Road and Barraba Lane are local Council roads. Two unformed road reserves also occur within the Extraction Plan area north and south of Sandy Creek Road.

The Extraction Plan Area is located within Consolidated Coal Lease 728 (CCL728) and Consolidated Mining Lease 2 (CML2) (refer to **Figure 1.1** and **Graphical Plan 5**).



Legend

- LWB4-B7 Extraction Plan Longwall Panels
- LWB4-B7 Extraction Plan Area
- Mining Lease Boundary
- Completed Underground Workings
- Austar Owned Land
- Privately Owned Land
- Crown Land

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FIGURE 2.1
Land Ownership

Figure 2.1 Extraction Plan Area Land Ownership

2.1.3 Natural and Built Features within Extraction Plan Area

Natural features within the Extraction Plan Area include:

- Quorrobolong Creek and associated ephemeral drainage lines and an unnamed tributary (**Graphical Plan 2**);
- Threatened Species Conservation Act listed native vegetation including:
 - Melaleuca shrub with emergent Eucalypts potential EEC;
 - Spotted Gum Ironbark Forest and Riparian Cabbage Gum Open Forest EEC; and
 - Threatened flora species (Netted Bottlebrush, Heath Wrinklewort, Small flower Grevillea).
- Riparian Swamp Oak Open Forest;
- Grazing pasture lands; and
- An Aboriginal Archaeological Site and areas of artefact scatters (**Graphical Plan 2**).

Built features within the Extraction Plan Area are shown on **Graphical Plan 2** and include:

- Public roads, culverts (Sandy Creek Road, and Barraba Lane);
- Communications infrastructure (local copper cables);
- Ausgrid above ground powerlines;
- Groundwater bores;
- Rural property infrastructure (Private dwellings, private access tracks, sheds, tanks, a swimming pool, gas and fuel storage, farm dams, fences); and
- Permanent Marks and State Survey marks (PM's and SSM's).

2.2 MINE PLANNING, DESIGN AND RESOURCE RECOVERY

2.2.1 Extraction Plan Area

The Extraction Plan Area under consideration is that area likely to be affected by the mining of Longwalls B4 to B7 in the Greta coal seam. The **Extraction Plan Area** (**Figure 1.2** also shown as **Extraction Plan Area** in **Graphical Plans**) is defined as the surface area enclosed by the predicted limit of vertical subsidence, taken as the 20mm subsidence contour resulting from the extraction of the proposed Longwalls B4 to B7.

2.2.2 Mining Domains

Longwalls B4 to B7 are within the Bellbird South mining area (as modified). This is a continuation of Austar's longwall mining activities within the Bellbird South mining area (panels B1 to B3, Stage 1 (panels A1 and A2), Stage 2 (panels A3, A4, A5 and A5a)) and Stage 3 mining area (panels A7 and A8).

The area has a long history of coal extraction. Previous longwall mining includes the Bellbird South-Southland longwall panels (SL1 to SL4) and Ellalong longwall panels (LW1 to LW13). These longwall panels and surrounding historical bord and pillar extraction workings can be seen in **Figure 1.1** in relation to the Extraction Plan Area and Austar's other longwall mining activities.

The Extraction Plan Area is located within Mining Leases CML2 and CCL728.

2.2.3 Mining Method

Austar intends to mine the Greta seam by conventional retreating longwall mining methods. Retreat will be from the western end of each panel in a north-easterly direction to the nominated finish position at which point the equipment will be relocated to the following panel. Seam thickness varies between 3.7 to 4.8m within the extraction area. Extraction height will typically be 3.4m.

Development roadways are generally driven at 3.2m high x 5.4m wide by single pass continuous miners. Coal quality, geotechnical, geological and equipment issues will be the main drivers for variation in development or longwall extraction heights.

2.2.4 Mining Parameters

No other economic seams exist above or below the Greta coal seam within the Extraction Plan Area. The Pelton seam lies at the top of the Paxton formation above the Greta seam and within the Extraction Plan Area is less than 1.0m thick. This is sub-economic to extract. Thus no other seams within the Extraction Plan Area are proposed to be extracted now or into the future.

The estimated recovery of the resource within the Extraction Plan Area is provided in **Table 2.1**.

Table 2.1 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 longwall panel is given in **Table 2.2**.

Table 2.2 Individual Longwall Tonnages

Panel	LW Length (m)	LW Block Width Void (m)	Average Extraction Height (m)	LW ROM Tonnes (Mt)
LWB4	845	237	3.4	0.88
LWB5	1,105	237	3.4	0.99
LWB6	1,065	237	3.4	0.97
LWB7	725	237	3.4	0.65

Table 2.3 Longwall Mining 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

Table 2.4 Longwall Geological Attributes

Panel	Depth of Cover (m)	Seam Thickness (m)	Roof and Floor Conditions	Geological Anomalies
LWB4	495 - 505	3.8 – 4.5	Distal from geological anomalies the roof is expected to be competent with some zones of potentially soft floor.	The Swamp Fault Zone is located at the outbye ends of the gateroads in LWB4. The Barraba Fault Zone is anticipated to be greater than 50m inbye of LWB4.
LWB5	440 - 495	3.8 – 4.8	Distal from geological anomalies the roof is expected to be competent with some zones of potentially soft floor.	The Swamp Fault Zone is located at the outbye ends of the gateroads in LWB5. The Barraba Fault Zone is anticipated to be greater than 50m inbye of LWB5.
LWB6	415 - 470	3.7 – 4.7	Distal from geological anomalies the roof is expected to be competent with some zones of potentially soft floor.	The Swamp Fault Zone is expected in the outbye end of LWB6. The Barraba Fault Zone is anticipated to be greater than 50m inbye of LWB6.
LWB7	400 - 450	3.8 – 4.8	Distal from geological anomalies the roof is expected to be competent with some zones of potentially soft floor.	The Swamp Fault Zone is expected in the outbye end of LWB7. The Barraba Fault Zone is anticipated to be greater than 50m inbye of LWB7.

2.2.5 Mine Design In Relation to Subsidence Management

Geological and geotechnical information across the Bellbird South mining area has been drawn from a number of historical boreholes and mining information compiled during development in the area.

The alignment of longwall orientation with the principal stress direction (being sub parallel) is favourable geotechnically, as this minimises the “stress notching” effect on longwall retreat.

Longwall panels have been located and aligned favourably to known geologically structured zones, namely the Swamp Fault and Barraba Fault zones.

Primary subsidence and environmental management strategies within the mine design involve the panel and chain pillar width design and the avoidance of large geological features (faults) that have the potential to create abnormal localised subsidence. The large depth of cover and massive sandstone overburden (Branxton Formation) creates a somewhat different subsidence development profile than typical shallower, weaker overburden, underground coal mines in the region. The thickness, strength and lack of discontinuities in the Branxton Formation (refer **Graphical Plan 6**)

mean that the subsidence is controlled by the compression of the strata above and around the chain pillars with minimal inter-panel flexure of the overburden between the chain pillars. Consequently subsidence is largely controlled by the stability and size of the chain pillars and limited deformation in the Branxton formation as it spans the chain pillars. Design of the panel width and chain pillar width thus has been a primary consideration and input into the subsidence and impact assessment whilst still allowing safe and productive mining. The parameters used for LWB4 to LWB7 are:

- Panel width (void) = 237m
- Minimum Chain Pillar width (solid) = 44.6m

Chain pillar lengths are nominally 150m, however a small number of pillars of shorter length will also be used. As the length of these pillars are greater than the above stated minimum widths, the variations in lengths are expected to have minimal subsidence impact, as it will be the minimum pillar widths that have the most impact on subsidence levels.

The two main geological features within the mining area are known as the Swamp and Barraba Fault Zones (refer to **Graphical Plan 3**).

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 1.5 m in the LWB2 maingate. It is expected that the displacement of the Swamp faulting system will increase to approximately 3m towards the north. 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 excess of 3m in the Bellbird South Mining Zone.

Large faulting has the potential to cause abnormal local subsidence, tilt and strain on the surface. As further exploration information becomes available on the exact location of these structures adjustments to the start and finishing positions of the longwalls may occur to minimise mining and subsidence impact risks and maximise resource recovery.

2.3 SUBSIDENCE PREDICTIONS

2.3.1 Prediction Method and Reliability

Subsidence predictions for the Extraction Plan Area have been provided by Mine Subsidence Engineering Consultants Pty Ltd (MSEC) using the calibrated Incremental Profile Method. Detailed description of the prediction technique used, factors that may affect the development of subsidence, and the relevance of input data are provided in Report Nos. MSEC903 (2017) and MSEC966 (2018).

The Incremental Profile Method was originally calibrated for the local conditions at the Mine during the preparation of the Subsidence Management Plan Application for Longwalls A3 to A5 in Stage 2. The calibration was based on the available ground monitoring data at that time, which included: eight monitoring lines above Longwalls SL1 to SL4 and Longwalls 1 to 13A at Ellalong Colliery; and three monitoring lines above Longwalls A1 and A2 in Stage 1 of the Mine.

Subsequent to the calibration, Austar has extracted Longwalls A3 to A5A in Stage 2 and Longwalls A7 and A8 in Stage 3 and Longwall B2 in the Bellbird South mining area. The mine subsidence movements were monitored along four monitoring lines above Longwalls A3 to A5A, four monitoring lines above Longwalls A7 and A8 and three monitoring lines above Longwall B2. The comparisons between the observed and predicted movements showed that the observed vertical subsidence, tilts and strains were typically less than those expected. These were provided in the End of Panel subsidence review reports for each of these Longwalls.

It is considered that the calibrated Incremental Profile Method has provided reasonable, if not, conservative predictions for the monitoring lines above the Longwalls extracted in Stages 1 to 3 and in the Bellbird South mining area at the Mine. It has not been considered necessary to undertake any further refinement of the subsidence prediction model based on the available results. It is expected that the calibrated Incremental Profile Method would provide reasonable, if not, slightly conservative predictions for the proposed Longwalls B4 to B7.

2.3.2 Extraction Plan Area Subsidence Predictions

The following sections provide the maximum predicted conventional subsidence parameters resulting from the extraction of Longwalls B4 to B7.

Austar has extracted Longwall B2 and Longwall B3 to the shortened finishing ends of these longwalls as indicated in the approved Extraction Plan for Longwalls B1 to B3. Austar also now proposes to extract Longwall B1 after the completion of Longwalls B2 to B7. The predicted subsidence parameters and the impact assessments for the natural and built features are provided in MSEC903 (2017) in **Appendix C**. A review of subsidence effects, subsidence impacts and environmental consequences due to the shortening of Longwall B4 are provided in MSEC966 (2018) in **Appendix C**.

Subsidence report MSEC903 (2017) and MSEC966 (2018) in **Appendix C** provides updated subsidence predictions and impact assessments for Longwalls B4 to B7, based on the shortened finishing ends of Longwalls B2, B3 and B4 and the modified mining sequence. The layout of Longwalls B1 to B7 (including the shortened finishing ends of Longwalls B2, B3 and B4) has been used to provide updated subsidence predictions within the LWB4-B7 Extraction Plan area, and for the combined extraction of Longwalls B1 to B7 based on the change in mining sequence.

The predicted subsidence, tilt and curvature have been obtained using the Incremental Profile Method, which has been calibrated and reviewed based on the local mining conditions, as described in **Section 2.3.1**. The predicted strains have been determined by analysing the strains measured at the Mine.

The maximum predicted subsidence parameters and the predicted subsidence contours provided in MSEC903 (2017) in **Appendix C**, describe and show the conventional movements and do not include the valley related upsidence and closure movements, nor the effects of faults and other geological structures. Such effects have been addressed separately in the impact assessments for each feature provided in MSEC903 (2017) and MSEC966 (2018) in **Appendix C**.

2.3.2.1 Maximum Predicted Conventional Subsidence, Tilt and Curvature

A summary of the maximum predicted incremental subsidence effects due to the extraction of LWB4 only, based on the previous and proposed modified extents of this longwall, is provided in **Table 2.5**. The incremental values are the additional movements due to the extraction of LWB4 only.

Table 2.5 Maximum Predicted Incremental Subsidence Effects due to the Extraction of LWB4 Only

Longwall	Layout	Maximum Predicted Incremental Vertical Subsidence (mm)	Maximum Predicted Incremental Tilt (mm/m)	Maximum Predicted Incremental Hogging Curvature (km ⁻¹)	Maximum Predicted Incremental Sagging Curvature (km ⁻¹)
LWB4	Approved (MSEC903)	675	3.5	0.03	0.06
	Modified (MSEC966)	675	3.0	0.03	0.06

The predicted total conventional subsidence contours due to the extraction of Longwalls B1 to B7 are shown in Drawing MSEC966-06 in **Appendix C**.

A summary of the maximum predicted total subsidence effects due to the extraction of LWB1 to LWB7, based on the previous and modified layouts is provided in **Table 2.6**. The total values are the maximum accumulated movements due to the extraction of LWB1 to LWB7.

Table 2.6 Maximum Predicted Total Conventional Vertical Subsidence, Tilt and Curvature after the Extraction of Each of the Proposed Longwalls

Longwall	Layout	Maximum Predicted Total Vertical Subsidence (mm)	Maximum Predicted Total Tilt (mm/m)	Maximum Predicted Total Hogging Curvature (km ⁻¹)	Maximum Predicted Total Sagging Curvature (km ⁻¹)
LWB1 to LWB7	Approved (MSEC903)	1,350	5.5	0.05	0.06
	Modified (MSEC966)	1,275	5.0	0.04	0.06

The maximum predicted total vertical subsidence resulting from the extraction of the Longwalls B1 to B7 is 1,275 mm, which represents 38% of the proposed extraction height of 3.4 metres. The maximum predicted subsidence occurs directly above the approved Longwall B4.

The maximum predicted total conventional tilt is 5.0 mm/m (i.e. 0.50 %), which represents a change in grade of 1 in 200. The maximum predicted total conventional curvatures are 0.04 km⁻¹ hogging and 0.06 km⁻¹ sagging, which represent minimum radii of curvatures of 25 kilometres and 17 kilometres, respectively.

2.3.2.2 Strains

Adopting a linear relationship between curvature and strain provides a reasonable estimate for the conventional tensile and compressive strains. The locations that are predicted to experience hogging or convex curvature are expected to be net tensile strain zones and locations that are predicted to experience sagging or concave curvature are expected to be net compressive strain zones.

In the Newcastle Coalfield a factor of 10 is generally used to predict the conventional strains from curvatures. It has been found, however, that a factor of 15 provides a better prediction of the conventional strains at Austar Coal Mine based on reviews of the available ground monitoring data. The maximum predicted conventional strains for Longwalls B4 to B7, adopting a factor of 15, are 1 mm/m tensile and compressive.

2.3.2.3 Horizontal Movements

The predicted conventional horizontal movements above Longwalls B4 to B7 are calculated by applying a factor to the predicted conventional tilt values. The comparisons between observed and back-predicted strains along the monitoring lines above the previously extracted Longwalls at the Mine indicates that a factor of 15 provides a better correlation for the prediction of conventional horizontal movements at Austar Coal Mine.

The maximum predicted conventional tilt within the Extraction Plan Area, at any time during or after the extraction of Longwalls B4 to B7, is 5.0 mm/m. The maximum predicted conventional horizontal movement is, therefore, approximately 75 mm, i.e. 5.0 mm/m multiplied by a factor of 15.

Conventional horizontal movements do not directly impact on natural and built features, rather impacts occur as the result of differential horizontal movements. Strain is the rate of change of horizontal movement. The impacts of strain on the natural and built features are addressed in the impact assessments for each feature which have been summarised in the Land Management Plan (**Appendix F**) and the Built Features Management Plan (**Appendix H**).

2.3.2.4 Far Field Movements

The predicted far-field horizontal movements resulting from the extraction of Longwalls B4 to B7 are very small and could only be detected by ground surveys. Such movements tend to be bodily movements towards the extracted goaf area, and are accompanied by very low levels of strain, which are generally less than the order of survey tolerance (i.e. less than 0.3 mm/m).

The potential impacts of far-field horizontal movements on the natural and built features within the vicinity of the proposed longwall are not expected to be significant. It is not considered necessary, therefore, that monitoring be established to measure the far-field horizontal movements resulting from these longwalls.

2.3.2.5 Valley Related Movements

Quorrobolong Creek and the drainage lines located within the Extraction Plan Area have shallow incisions into the natural surface soils. It is unlikely, therefore, that these watercourses would experience any significant valley related movements resulting from the extraction of the proposed Longwalls.

2.4 PERFORMANCE OBJECTIVES

Performance objectives in relation to subsidence impacts at Austar are presented in **Table 2.7**. These objectives have been used when developing management strategies of this Extraction Plan.

Table 2.7 Performance Objectives from DA29/95

Condition No.	Condition Requirement
Schedule 3, Condition 2	<p>Subsidence Impact Assessment Criteria</p> <p>If the subsidence generated by the development results in damage to any residence on privately-owned land (excluding the land listed in Table 1) that in the opinion of the SA NSW exceeds safe, serviceable and repairable criteria, the Applicant shall, upon receiving a written request for acquisition from the landowner, acquire the land in accordance with the procedures in conditions 3 to 5 of Schedule 4.</p> <p>However, the Applicant does not have to act on any such request if:</p> <p>(a) the Applicant has a current written negotiated agreement with the landowner in regard to the management of subsidence-related impacts, and a copy of this agreement has been forwarded to the Department by the Applicant; or</p> <p>(b) the landowner has agreed to the SA NSW purchasing the land under the Mine Subsidence Compensation Act 1961.</p>
Schedule 3, Condition 3D	<p>Provision of Biodiversity Offsets</p> <p>If subsidence impacts associated with the active mining areas cause significant adverse impacts to threatened species, populations, habitats and/or endangered ecological communities and the Secretary determines that:</p> <p>(a) it is not reasonable or feasible to remediate the impact or environmental consequences; or</p> <p>(b) remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence,</p> <p>then the Applicant must provide a suitable offset to compensate for the impact or environmental consequence, to the satisfaction of the Secretary.</p> <p><i>Note: An offset required under this condition must be proportionate with the significance of the impact or environmental consequence.</i></p>
Schedule 3, Condition 28	<p>Rehabilitation Objectives</p> <p>The Applicant must rehabilitate the site to the satisfaction of DRG. This rehabilitation must be generally consistent with the proposed rehabilitation strategy described in the documents listed in condition 2 of Schedule 2, and comply with the objectives in Table 6.</p>

Condition No.	Condition Requirement																										
	<p><i>Table 6: Rehabilitation Objectives</i></p> <table> <tr> <th>Domain</th><th>Rehabilitation Objective</th></tr> <tr> <td>All areas affected by the development</td><td> <ul style="list-style-type: none"> • Safe • Hydraulically and geotechnically stable • Non-polluting • Fit for the intended post-mining land use(s) </td></tr> <tr> <td>Areas proposed for native ecosystem re-establishment</td><td> <ul style="list-style-type: none"> • Establish self-sustaining ecosystems comprising flora species selected to re-establish and complement local and regional biodiversity </td></tr> <tr> <td>Areas proposed for agricultural or pastoral use</td><td> <ul style="list-style-type: none"> • Nominated land capability classification is achieved and is self-sustaining </td></tr> <tr> <td>Other areas affected by the development</td><td> <ul style="list-style-type: none"> • Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of local native plant species appropriate for the intended post mining land use(s) (unless DRG agrees otherwise) </td></tr> <tr> <td>Built features damaged by mining operations</td><td> <ul style="list-style-type: none"> • Repair/restore/replace to pre-mining condition or equivalent unless the: <ul style="list-style-type: none"> ▪ owner agrees otherwise; or ▪ damage is fully restored, repaired or compensated for under the Mine Subsidence Compensation Act 1961 </td></tr> <tr> <td>Final landforms</td><td> <ul style="list-style-type: none"> • Consistent with surrounding topography to minimise visual impacts • Incorporate relief patterns and design principles consistent with natural drainage </td></tr> <tr> <td>All watercourses subject to mine-water discharges and/or subsidence impacts from the development</td><td> <ul style="list-style-type: none"> • Hydraulically and geomorphologically stable • Aquatic ecology and riparian vegetation that is the same or better than prior to mining </td></tr> <tr> <td>Water quality</td><td> <ul style="list-style-type: none"> • Surface water retained on site is fit for the intended post mining land use(s) </td></tr> <tr> <td>Cliffs, minor cliffs and steep slopes</td><td> <ul style="list-style-type: none"> • No additional risk to public safety compared to prior to mining </td></tr> <tr> <td>Community</td><td> <ul style="list-style-type: none"> • Ensure public safety • Minimise adverse socio-economic effects associated with mine closure </td></tr> <tr> <td></td><td></td></tr> <tr> <td></td><td></td></tr> </table>	Domain	Rehabilitation Objective	All areas affected by the development	<ul style="list-style-type: none"> • Safe • Hydraulically and geotechnically stable • Non-polluting • Fit for the intended post-mining land use(s) 	Areas proposed for native ecosystem re-establishment	<ul style="list-style-type: none"> • Establish self-sustaining ecosystems comprising flora species selected to re-establish and complement local and regional biodiversity 	Areas proposed for agricultural or pastoral use	<ul style="list-style-type: none"> • Nominated land capability classification is achieved and is self-sustaining 	Other areas affected by the development	<ul style="list-style-type: none"> • Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of local native plant species appropriate for the intended post mining land use(s) (unless DRG agrees otherwise) 	Built features damaged by mining operations	<ul style="list-style-type: none"> • Repair/restore/replace to pre-mining condition or equivalent unless the: <ul style="list-style-type: none"> ▪ owner agrees otherwise; or ▪ damage is fully restored, repaired or compensated for under the Mine Subsidence Compensation Act 1961 	Final landforms	<ul style="list-style-type: none"> • Consistent with surrounding topography to minimise visual impacts • Incorporate relief patterns and design principles consistent with natural drainage 	All watercourses subject to mine-water discharges and/or subsidence impacts from the development	<ul style="list-style-type: none"> • Hydraulically and geomorphologically stable • Aquatic ecology and riparian vegetation that is the same or better than prior to mining 	Water quality	<ul style="list-style-type: none"> • Surface water retained on site is fit for the intended post mining land use(s) 	Cliffs, minor cliffs and steep slopes	<ul style="list-style-type: none"> • No additional risk to public safety compared to prior to mining 	Community	<ul style="list-style-type: none"> • Ensure public safety • Minimise adverse socio-economic effects associated with mine closure 				
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Note: These rehabilitation objectives apply to all subsidence impacts and environmental consequences caused by the development and to all surface infrastructure components of the development. Where remediation of watercourses is likely to cause environmental consequences greater than those that require rehabilitation, alternative equivalent works may be undertaken within the affected watercourse.

3 DEVELOPMENT

3.1 EXTRACTION PLAN TEAM

The team that prepared the original Extraction Plan was endorsed by the Director, Resource Assessments of the Department of Planning and Environment (DPE) on 11 August 2017. The Extraction Plan Team is presented in **Table 3.1**.

Table 3.1 Extraction Plan Team

Extraction Plan Component	Team Members
Extraction Plan coordination and preparation	Austar/Yancoal: <ul style="list-style-type: none"> Gary Mulhearn – Environment & Community Manager Daniel Lee – Regional Registered Surveyor NSW Tony Sutherland – Technical Services Manager
Built Features Management Plan	Austar/Yancoal – Gary Mulhearn, Daniel Lee, Tony Sutherland
Public Safety Management Plan	Austar/Yancoal – Gary Mulhearn, Daniel Lee, Tony Sutherland
Land Management Plan	Austar/Yancoal – Gary Mulhearn, Daniel Lee, Tony Sutherland
Coal Resource Recovery Plan	Austar/Yancoal – Daniel Lee, Tony Sutherland
Biodiversity Management Plan	Umwelt – Chloe Parkins, Rebecca Vere, Gabrielle Allan
Water Management Plan	Umwelt/Engeny Water Management – Susan Shield Umwelt – Gabrielle Allan Dundon Consulting Pty Ltd – Peter Dundon Austar – Gary Mulhearn
Subsidence Predictions	Mine Subsidence Engineering Consultants – James Barbato

The following additional team members were involved in this revision of the Extraction Plan (v2):

- Carly McCormack – Environment & Community Superintendent, replacing Gary Mulhearn;
- William Farnworth – Technical Services Manager, replacing Tony Sutherland.

3.2 AGENCY CONSULTATION

3.2.1 Department of Planning and Environment

The Extraction Plan is required to be completed to the satisfaction of the Secretary of the DPE.

3.2.2 Division of Resources and Geosciences

There are several components of the Extraction Plan that are required to be completed to the satisfaction of the DRG. These components include:

- A detailed plan for the second workings;
- A Coal Resource Recovery Plan;
- Revised predictions of subsidence effects and impacts; and
- Subsidence Monitoring Program.

Austar is also required to consult with DRG on the Extraction Plan Public Safety Management Plan.

Austar provided a copy of the Longwalls B4-B7 Extraction Plan to DRG on 17 August 2017. DRG provided a letter to Austar on 6 September 2017 indicating their satisfaction with the Coal Resources Recovery Plan, the predictions of subsidence effects and subsidence impacts. DRG also noted that the proposed Subsidence Monitoring Program is generally adequate for managing risks of subsidence and recommended that the Subsidence Monitoring Program be regularly reviewed and revised (if required). The Extraction Plan includes processes for review and revision of all management plans. DRG also made comment on safety related management processes in relation to subsidence hazards, which have been considered in preparation of the Public Safety Management Plan. DRG provided a further letter on 12 September 2017 indicating their satisfaction with Public Safety Management Plan and Built Features Management Plan submitted by Austar on 17 August 2017 in relation to public safety on Council owned Sandy Creek Road.

3.2.3 Office of Environment & Heritage

OEH has provided comment during the environmental assessment for the LWB4-LWB7 Modification Environmental Assessment process during 2017 in relation to biodiversity matters including the intention to prepare a Biodiversity Management Plan and to undertake a monitoring program on vegetation communities over the Extraction Plan Area. The BMP included in this Extraction Plan includes a combination of monitoring for LWB1-LWB7 and uses the same management strategies as previously adopted and approved for the LWB1-B3 Extraction Plan Area after consultation with OEH, but extends monitoring to include the LWB4-B7 Extraction Plan Area.

3.2.4 Department of Primary Industries - Water

DPI-Water has provided comment during the environmental assessment for the LWB4-LWB7 Modification Environmental Assessment process during 2017 in relation to water matters, including the intention to prepare a Water Management Plan and to undertake a monitoring program on alluvial groundwater over the Extraction Plan Area. The WMP included in this Extraction Plan includes a combination of monitoring for LWB1-LWB7 and uses the same management strategies as previously adopted and approved for the LWB1-B3 Extraction Plan Area after consultation with DPI-Water, but extends monitoring to include the LWB4-B7 Extraction Plan Area.

3.2.5 Subsidence Advisory NSW

Subsidence Advisory NSW (SANSW) has been consulted in the preparation of the process for Built Features Management Plans in the Stage 2 and 3 Mining Areas, and in the early parts of the Bellbird South Mining Area. SANSW has been consulted with during the preparation of the LWB4-B7 Modification, will be advised of the proposed timing of extraction within LWB4 – B7 longwall panels, and will continue to be consulted during preparation of individual Built Features Management Plans in conjunction with the Built Feature owners.

3.3 LANDHOLDER CONSULTATION

As indicated previously, the Extraction Plan area includes land owned by private landholders, Council and Department of Industry – Lands & Forestry.

The land above the Extraction Plan area is largely privately owned rural holding zoned RU2. This permits development of similar structures to that currently existing which are manageable under the systems and procedures outlined in this management plan. There will be a process included in the individual Built Features Management Plans for landholders to make Austar aware of any new developments planned for prior to extraction.

3.3.1 Crown Land

The Department of Industry – Lands & Forestry have been consulted regarding the Extraction Plan process including the preparation of individual Built Features Management Plans, which will be developed prior to subsidence impacts occurring.

3.3.2 Private Landholders

The Bellbird South LWB4 – B7 modification application was submitted in May 2017. During the modification process, landholders within the Bellbird South LWB4 – B7 area were consulted via mail, individual meetings, and through the Austar Community Consultative Committee.

Within the Extraction Plan Area, Austar reached agreement with several private landholders to allow Austar to undertake environmental assessments for the modification process. The timing of mining is also discussed during this consultation process.

Austar continues to liaise with other landholders through the Extraction Plan process. All landholders have been advised of the LWB4 – B7 modification application. Landholders have been advised that individual Built Features Management Plans will be prepared in consultation with each of the landholders prior to subsidence impacts occurring. The individual BFMPs also will include details of remediation strategies to land (should they be required). The benefit of the access arrangements ahead of mining is to streamline any land remediation works to be undertaken by Austar (that are not covered by SANSW).

Regular updates on the status of mining progression and environmental performance, including results of subsidence monitoring, and timing for mining will be provided directly to landholders above the Extraction Plan area, and is presented to the Austar Community Consultative Committee, with minutes of these meetings uploaded to the Austar website (www.austarcoalmine.com.au).

3.4 INFRASTRUCTURE OWNER CONSULTATION

In accordance with the Built Features Management Plan development, Austar has consulted with infrastructure owners, and will continue to consult with these stakeholders during the development individual Built Features Management Plans to manage potential subsidence effects. Owners include:

- Roads (Cessnock City Council);
- Water NSW;
- Telstra; and
- Ausgrid.

Each of the infrastructure owners are consulted with during updates to the Extraction Plan and preparation of the individual Built Features Management Plans.

3.5 RISK ASSESSMENT

A risk assessment was conducted on 6 June 2017 to identify, assess and review any potential subsidence impacts to the surface and sub-surface as a result from the mining of the proposed Extraction Plan application area at Austar. A copy of the risk assessment is included in **Appendix D**.

The risk assessment was facilitated by HMS Consultants and involved a team consisting of members of Austar staff, Yancoal and a specialist consultant in subsidence.

A key step in the process was the gathering of data related to the application to present to the team. Once the scope and mandate of the team was determined a number of tools were used to identify issues relating to the application and identify risks as a result of the mining process. Whilst worst case scenarios were discussed by the risk assessment team, the worst-case scenario was not necessarily the consequence severity chosen for risk ranking. The risk assessment team used their industry and site experience, as well as their knowledge of the effectiveness of the actual Austar controls, to choose the most appropriate consequence severity for risk ranking. The losses were ranked according to their likelihood and consequences with quantification where possible. Once this

had been completed current and additional controls were identified, followed by nominated further actions in order to eliminate or control the identified risk issue to an acceptable level.

In total twenty six (26) risk issues were identified. Of those risks assessed, there was one (1) “High” risks identified by the risk assessment team. One (1) risk was assessed as having a potentially “Major” consequence. The high risk issue is shown in **Table 3.2** with the risk assessed as having a potentially “Major” consequences being risk SP#2.01.01.

Table 3.2 High Risk

SP#	Risk Issue	Existing Control	Further Actions
2.01.01	<p>Injury to road user due to impact of mine subsidence on Sandy Creek Road.</p> <p>Note: Speed limit on this road is 100kph</p>	<ol style="list-style-type: none"> 1. Subsidence impact assessment predicts minor and manageable impacts to road surface, even if the strains exceed predictions by a factor of 2. 2. Flooding and drainage assessment indicates road is already subject to flooding, and there will be no change in flood hazard category. 3. Past experience mining in area shows no impact to Nash Lane or Quorrobolong Road with mining conducted to date. 4. Sandy Creek Road has been previously managed during longwall mining by Ellalong Colliery. 5. Extensive mining has occurred in the Southern Coalfields at similar depths of cover which have been manageable in a safe and serviceable condition during mining. 	<ol style="list-style-type: none"> 1. Pre-mining condition inspection of road 2. Subsidence monitoring program to include visual inspection of road surface and survey monitoring 3. Public Safety Management Plan to include mitigation of identified public safety hazards immediately. 4. Built Features Management Plan – Council to be prepared in consultation with Cessnock City Council and SA-NSW.

The risk assessment identified existing controls but also highlighted a number of additional controls or further actions that the team thought necessary to manage subsidence.

The full risk assessment report including a full list of risks in assessment order, risk rank order and consequence order respectively are shown in **Appendix D**.

4 SUBSIDENCE MONITORING AND MANAGEMENT

4.1 FRAMEWORK

The overall framework for subsidence monitoring and management of impacts of this Extraction Plan may be described as:

- A **Subsidence Monitoring Program** (actual measured subsidence, and inspections for environmental consequences of subsidence to compare against predicted impacts) which may trigger a response, or set of responses.

The response is commensurate with the nature of the measurement or the impact which has been identified. The Extraction Plan relies on a set of individual management plans which are intended to address impacts to particular environmental or built features within the Extraction Plan Area. These plans include:

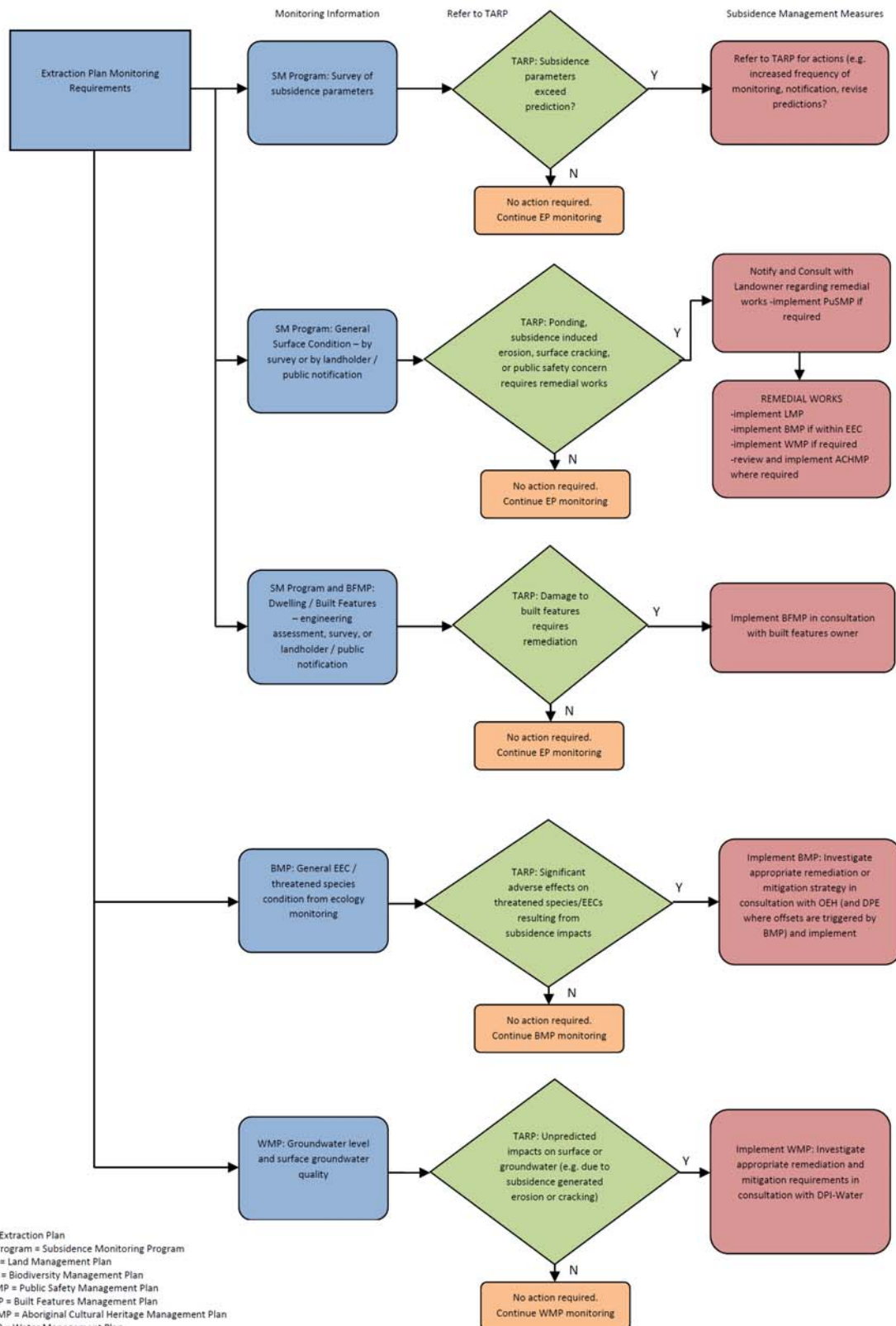
- **Water Management Plan** – to manage the potential environmental consequences of second workings on surface and groundwater;
- **Land Management Plan** – to manage the potential environmental consequences of second workings on steep slopes and land in general;
- **Biodiversity Management Plan** – to manage the potential environmental consequences of second workings on aquatic and terrestrial flora and fauna (additional **monitoring** specific to Biodiversity is also collected to assess impact);
- **Built Features Management Plan** – to manage the potential environmental consequences of second workings on any built feature; and
- **Public Safety Management Plan** – to ensure public safety in the Extraction Plan area.

4.2 EXTRACTION PLAN TARP

Austar has developed an overall subsidence management **LWB4 to LWB7 Extraction Plan Trigger Action Response Plan** (TARP) to manage subsidence within the Extraction Plan Area. This TARP is included in **Appendix B** and includes individual triggers to instigate actions, including public safety activities, remedial works or review of subsidence predictions. The TARP also specifically includes both adaptive and contingency management based on results of the Subsidence Monitoring (SM) Program and specific management plans.

4.3 EXTRACTION PLAN SUBSIDENCE MONITORING AND MANAGEMENT FLOWCHART

Austar has developed a **flowchart** to illustrate the mechanics of how the relevant Subsidence Monitoring Program, sub-management plans, and the TARP are used at Austar to manage subsidence impacts. The flowchart is provided below and is included in **Appendix B** with the TARP.

EXTRACTION PLAN SUBSIDENCE MONITORING & MANAGEMENT FLOWCHART – LWB4 to LWB7


5 PLAN IMPLEMENTATION

5.1 REPORTING FRAMEWORK

5.1.1 Annual Review / Annual Environmental Management Report (AEMR)

The Annual Review / AEMR is prepared to summarise Austar's environmental performance for the reporting year and is prepared in accordance with Schedule 5 Condition 5 of DA29/95 and to satisfy Mining Lease conditions.

In relation to the Extraction Plan, the Annual Review/AEMR will:

- (a) Describe the development (including any rehabilitation) that was carried out in the past year to 30 June, and the development that is proposed to be carried out over the next year to 30 June;
- (b) Include a comprehensive review of the monitoring results and complaints records of the development over the previous year to 30 June, which includes a comparison of these results against:
 - the relevant statutory requirements, limits or performance measures/criteria;
 - requirements of any plan or program required under DA29/95 MOD7;
 - the monitoring results of previous years; and
 - the relevant predictions in the documents listed in condition 2 of Schedule 2;
- (c) Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- (d) Identify any trends in the monitoring data over the life of the development;
- (e) Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
- (f) Describe what measure will be implemented over the next year to improve the environmental performance of the development.

The Annual Review / AEMR will be published on the Austar website upon completion and submission to DPE and DRG.

5.1.2 Regular Stakeholder Extraction Plan Update Reporting

The results of monitoring undertaken in accordance with this Extraction Plan will be provided on a quarterly basis to the Austar Coal Mine Community Consultative Committee. The results will also be published on the Austar website.

Landholders and stakeholders within the affected Extraction Plan area will be provided with regular updates on the progress of mining, results of subsidence monitoring, and of any particular subsidence induced consequences and the remediation measures employed. The frequency of reporting will occur nominally on a monthly basis.

5.1.3 Incident Reporting

In accordance with Condition 4 Schedule 5 of DA 29/95 Austar will provide a report to the DPE and any other relevant agencies, of any non-compliance or exceedance of performance criteria associated with the Extraction Plan performance at the mine complex within 7 days of detecting the exceedance/incident.

Where the incident also classes as an actual or potential “material harm” incident as defined in the *Protection of the Environment Operations Act*, the Austar Pollution Incident Response Management Plan (PIRMP) will be triggered and the EPA will be notified immediately.

5.2 REVIEW OF THE EXTRACTION PLAN

Review of the Extraction Plan is required periodically to ensure that strategies, plans and programs are regularly updated. Specifically, DA29/95 requires that within 3 months of:

- (a) the submission of an incident report under Section 5.1.3;
- (b) the submission of an Annual Review under Section 5.1.1;
- (c) the submission of an Independent Environmental Audit report as required by DA29/95; and
- (d) the approval of a modification to the conditions of development consent DA29/95,

Austar must review the strategies, plans and programs of the Extraction Plan, to the satisfaction of the Secretary. Austar must notify DPE in writing of any such review being undertaken. Where this review leads to revisions in any such document, then within 6 weeks of the review the revised document must be submitted for the approval of the Secretary.

In addition to the above specified review requirements, Austar may at any time submit revised strategies, plans or programs for the approval of the Secretary.

5.3 COMPLAINTS HANDLING

Complaints in relation to the management of subsidence will be managed using the established protocols in the Austar Environmental Management System.

5.4 EXTRACTION PLAN ROLES AND ACCOUNTABILITIES

Detailed below are key personnel involved with implementing this Extraction Plan to manage subsidence, their roles and responsibilities.

Role	Responsibilities
Operations Manager (OM)	<ul style="list-style-type: none"> • Make appropriate resources available for the implementation of this Extraction Plan • Conduct underground mining activities in accordance with the Extraction Plan Coal Resource Recovery Plan. • Notify and liaise with DRG Inspectors (if required)
Environment and Community Superintendent (ECS)	<ul style="list-style-type: none"> • Owner of the Extraction Plan • Ensure that all environmental monitoring and reporting is undertaken in accordance with the Extraction Plan and sub environmental management plans • Manage / implement subsidence management actions required by the Extraction Plan in relation to Built Features and general landform • Train remediation contractors on mitigation measures within the Extraction Plan for remedial works • Liaise with Subsidence Advisory NSW in relation to Built Features impacts • Liaise with Government Agencies in relation to environmental consequences of subsidence and proposed management strategies • Liaise with Landholders in relation to environmental consequences of subsidence and in relation to access for the Extraction Plan monitoring program and any remediation works • Notify and liaise with neighbours and community in relation to mining timing and monitoring performance • Review and update the Extraction Plan and sub plans as required

Role	Responsibilities
Technical Services Manager (TSM)	<ul style="list-style-type: none"> • Liaise with Government Agencies and Community members in relation to subsidence matters and the Extraction Plan subsidence predictions and monitoring program • Coordinate Mine Surveyor to ensure subsidence monitoring is undertaken in accordance with the Extraction Plan • Provide training for subsidence impact measurements and observations in accordance with SM program • Review subsidence monitoring data against predictions and TARPs in order to trigger any actions required on the basis of subsidence results • Manage / implement subsidence management actions required by the Extraction Plan in relation to Infrastructure • Review subsidence predictions based on monitoring information and the TARPs • Provide support and guidance in relation to subsidence effects to Environment & Community Superintendent
Mine Surveyor	<ul style="list-style-type: none"> • Ensure that all subsidence monitoring is completed to the requirements of the Subsidence Monitoring Program and provided to the TSM for review • Liaise with the Environment & Community Superintendent to gain required access for subsidence monitoring • Provide training for subsidence impact measurements and observations in accordance with SM program

6 REFERENCES

MSEC (2017), *Longwalls B4 to B7, Subsidence Predictions and Impact assessments for the Natural and Built Features in Support of the Extraction Plan for Longwalls B4 to B7 at the Austar Coal Mine*, Report No. MSEC903, Revision A.

MSEC (2018), Austar Coal Mine – Modified Finishing End of LWB4, *Review of Subsidence Effects, Subsidence Impacts and Environmental Consequences*, Report No. MSEC966.

Umwelt (2017), *Austar Coal Mine – LWB4-B7 Modification, Environmental Assessment*, May 2017.

Graphical Plans

Appendices

Appendix A

Development Consent Conditions

Appendix B

Extraction Plan Flowchart & TARP

Appendix C

MSEC Subsidence Reports

Appendix D

Extraction Plan Area Risk Assessment

Appendix E

Water Management Plan

Appendix F

Land Management Plan

Appendix G

Biodiversity Management Plan

Appendix H

Built Features Management Plan

Appendix I

Public Safety Management Plan

Appendix J

Subsidence Monitoring Program

Appendix K

Coal Resource Recovery Plan