AUSTAR COAL MINE

BIODIVERSITY MANAGEMENT PLAN – LWB1-B7

For the LWB1-B3 Extraction Plan and
LWB4-B7 Extraction Plan

FINAL

February 2019

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	**Date**	**Name**	**Date**
V1	G Allan	28/6/2017	B Crossley	28/6/2017
V2	G Allan	13/9/2017	G Allan	13/9/2017
V3*	G Allan	01/02/2019	G Allan	4/02/2019

* Updated to include shortened finishing end of LWB4.

Table of Contents

Figures

Tables

1.0 Introduction

1.1 Background

Austar Coal Mine Pty Ltd (Austar), a subsidiary of Yancoal Australia Limited (Yancoal) owns the Austar Coal Mine, an underground coal mine located approximately 10 kilometres (km) south of Cessnock in the Lower Hunter Valley in New South Wales (NSW) (refer to **Figure 1.1**). The Austar Coal Mine incorporates the former Ellalong, Southland and Bellbird South Collieries and includes coal extraction, handling, processing and rail and road transport facilities.

Extensive longwall mining has been undertaken within the Austar Coal Mine in accordance with a number of approvals. Austar is mining in the Bellbird South area in accordance with DA 29/95 (as modified).

1.2 Purpose and Scope

This Biodiversity Management Plan (BMP) addresses the requirements of DA 29/95 relating to the preparation of an Extraction Plan for the secondary extraction of longwall panels in the Bellbird South area. This BMP has been prepared as a component plan of the LWB1-B3 Extraction Plan and the LWB4-B7 Extraction Plan and should be read in conjunction with those documents.

The purpose of this BMP is to describe the ecological management strategies to monitor and manage the potential environmental consequences of secondary extraction of longwall panels LWB1-B7 on biodiversity values.

This BMP applies to land within the combined LWB1-B3 Extraction Plan Area and the LWB4-B7 Extraction Plan Area (referred to as the LWB1-B7 BMP Area) shown on **Figure 1.2**, this being the land within the predicted 20 millimetre (mm) subsidence contour for LWB1-B7.

The BMP has been prepared in accordance with the Department of Planning and Environment (DPE) draft *Guidelines for the Preparation of Extraction Plans* (V5 unpublished).

This BMP has been prepared with input by ecologists from Umwelt (Australia) Pty Ltd (Umwelt) who were endorsed by the Secretary of the DPE as appropriate experts for the preparation of this management plan.

Austar will make every endeavour to implement the monitoring and management requirements of this BMP; however the land within the Extraction Plan Area is privately owned and may limit the ability to conduct these activities.

1.3 Objectives

The objectives of this BMP include the following:

- to provide a description of the existing biodiversity values present in the LWB1-B7 BMP Area
- to provide a description of the potential environmental impacts and environmental consequences of mining activities on biodiversity within the LWB1-B7 BMP Area
- to provide a monitoring program that:
    - monitors potential impacts of underground mining of LWB1-B7 on biodiversity

- may be evaluated against triggers to implement mitigation strategies to minimise impacts if they occur
- evaluates the effectiveness of mitigation strategies.

- to provide a description of the management measures to be implemented in the event that monitoring identifies potential impacts on biodiversity values within the LWB1-B7 BMP Area.

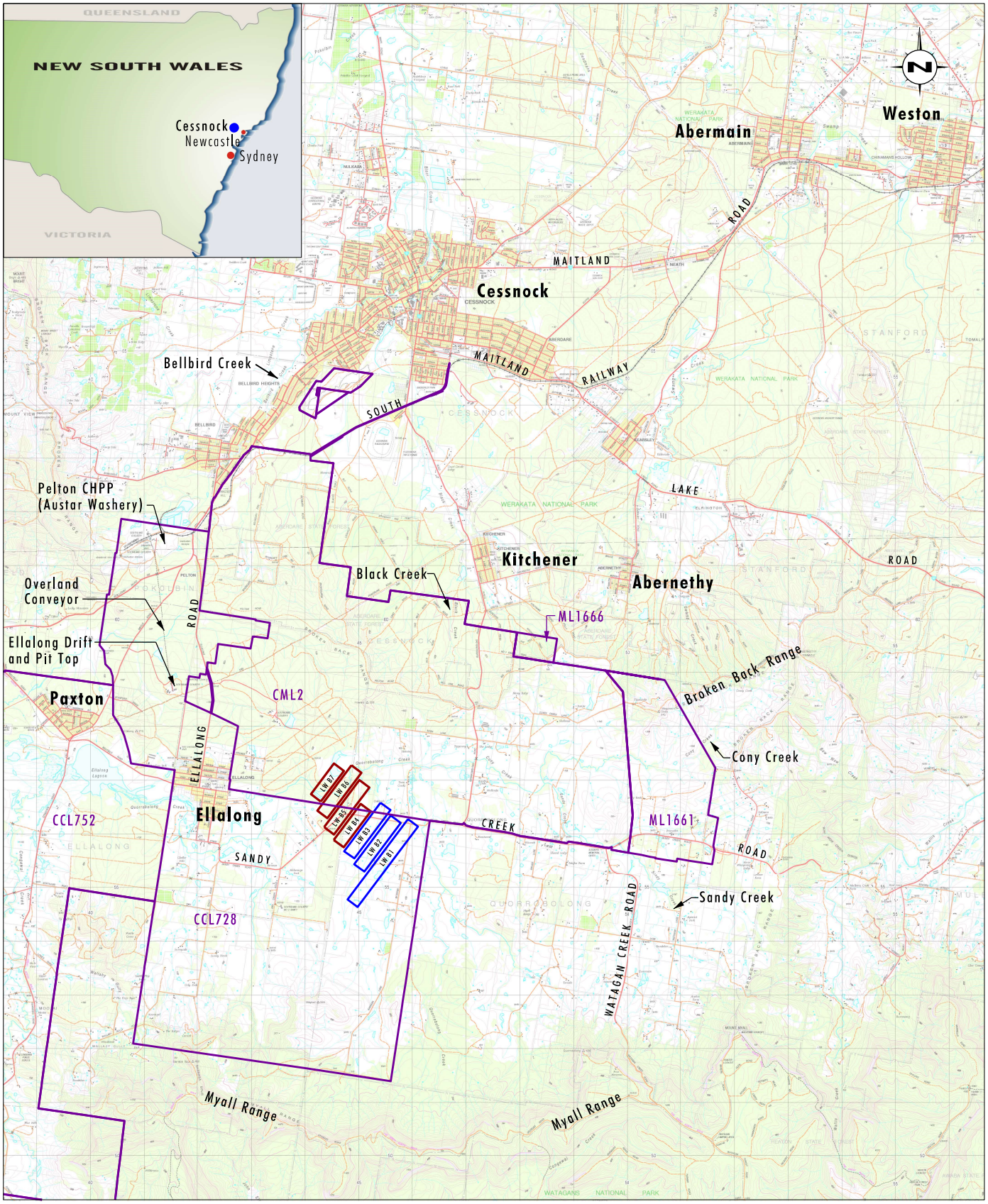

Image Source: LPI NSW (2009)
Data Source: Austar Coal Mine (2018)

0 1.0 2.5 5.0km
1:100 000

Legend

- LWB4-B7 Extraction Plan Longwall Panels
- LWB1-B3 Extraction Plan Longwall Panels
- Mining Lease Boundary

FIGURE 1.1

Locality Plan

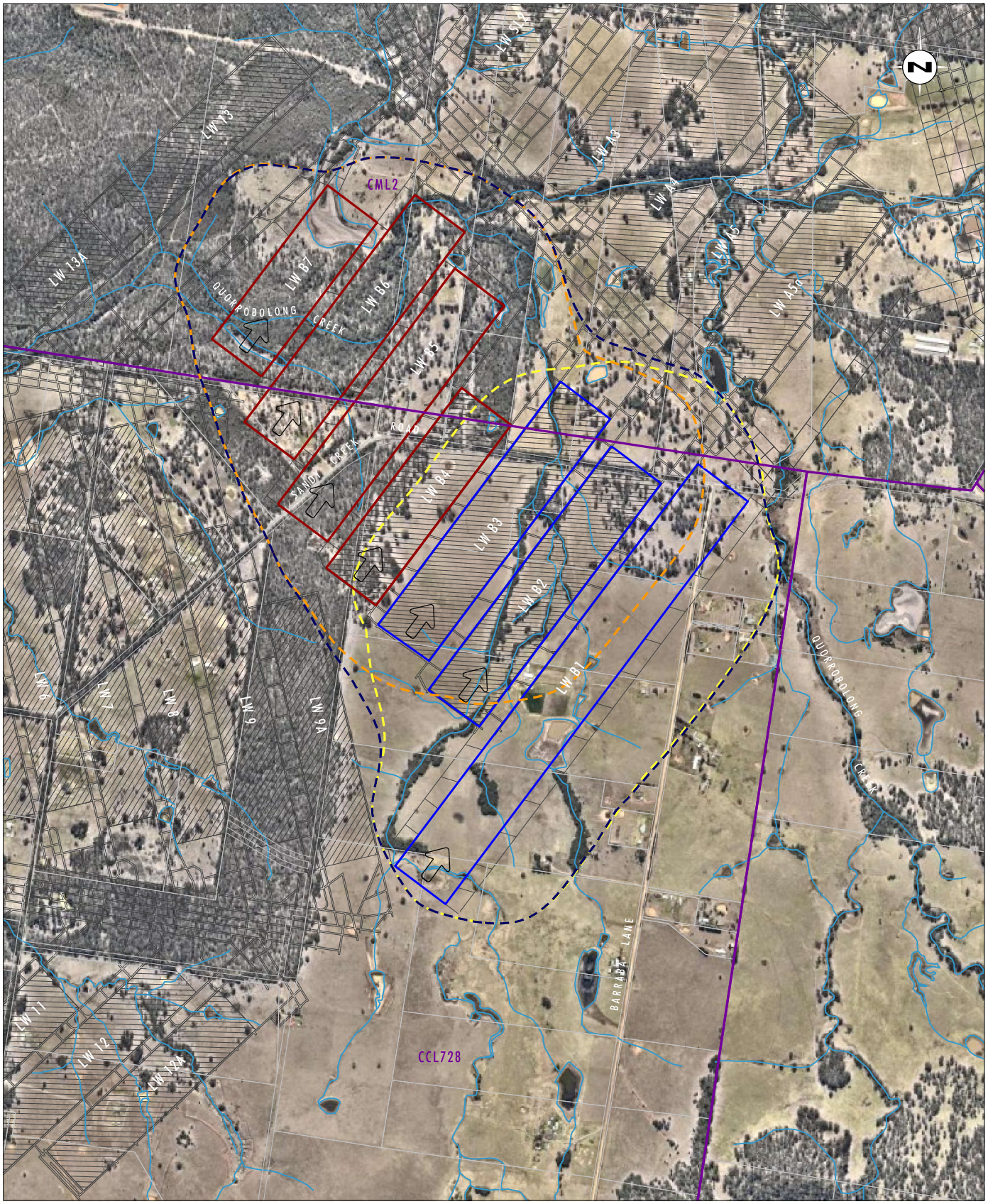

Image Source: NearMap (2018)
Data Source: Austar Coal Mine (2018)

Legend

- LWB1-B7 Biodiversity Management Plan Area
- LWB1-B3 Extraction Plan Longwall Panels
- LWB1-B3 Extraction Plan Area
- LWB4-B7 Extraction Plan Longwall Panels
- LWB4-B7 Extraction Plan Area
- Completed Underground Workings
- Mining Lease Boundary
- Direction of Mining

FIGURE 1.2

LWB1-B7 Biodiversity Management Plan Area

File Name (A4): R012/3900_145.dgn
20190201l 11.20

2.0 Performance Measures

The requirement for this BMP arises from Schedule 3, Condition 3A (e) of DA 29/95 (as modified) which states:

The applicant must prepare an Extraction Plan for all second workings in the active mining areas to the satisfaction of the Secretary. This plan must:

(e) include a:

- *Biodiversity Management Plan, which has been prepared in consultation with OEH, to monitor and manage the potential environmental consequences of second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species and endangered ecological communities.*

Performance measures in relation to impacts to biodiversity within the LWB1-B7 BMP Area are presented in **Table 2.1.**

Table 2.1 Performance Measures in relation to Biodiversity Impacts in the LWB1-B7 BMP Area

Requirement	Performance Measure	Performance Indicator
DA 29/95 Schedule 3, Condition 3A	Preparation of a Biodiversity Management Plan	BMP includes actions to monitor and manage potential biodiversity consequences of longwall mining of LWB1-B3 and LWB4-B7 and has a specific focus on threatened species and endangered ecological communities (EECs).
		BMP is prepared in consultation with OEH.
		BMP is approved by the Secretary.
DA 29/95 Schedule 3, Condition 3D	Biodiversity offsets are provided in the event that mining of LWB1-B7 causes significant adverse impacts to threatened species, populations, habitats or EECs that are irreparable.	Monitoring program is implemented and reported which allows assessment of "significant adverse impact" to threatened species, populations, habitats or EECs.
		Subsidence remediation works are undertaken where required and monitoring undertaken to determine whether remediation activities satisfactorily remediate the impact or environmental consequence.
		Offsets are provided where monitoring establishes that there has been a significant adverse impact to threatened species, populations, habitats or EECs and remediation is not reasonable or feasible or where remediation activities fail to satisfactorily remediate the impact or environmental consequence.
		Offsets provided are to the satisfaction of the Secretary.

Requirement	Performance Measure	Performance Indicator
Schedule 3, Condition 22	Native vegetation is protected	Reasonable measures are taken during rehabilitation activities to protect native vegetation from damage.
	Salvage useable vegetative material	Rehabilitation works undertaken include the salvage and reuse of any cleared usable vegetative material for the purposes of erosion control and/or site rehabilitation.
DA 29/95 Schedule 3, Condition 28	If required, rehabilitation works in native vegetation areas will result in ecosystem function that is self-sustaining comprising flora species selected to re-establish and complement local and regional biodiversity	The rehabilitation management strategy takes into consideration pre-mining ecosystem function, flora species and landscape.
		Rehabilitation monitoring evaluates ecosystem function.
		Monitoring indicates that ecosystem function is self-sustaining and on the same trajectory as pre-mining levels following rehabilitation.
	If required, rehabilitation works in agricultural or pastoral areas will achieve a nominated land capability classification and is self-sustaining	The rehabilitation management strategy takes into consideration pre-mining land capability classification, vegetation species, and landscape. Rehabilitation monitoring evaluates land capability classification. Monitoring indicates that vegetation is self-sustaining and on the same trajectory as pre-mining levels following rehabilitation.
	Following rehabilitation works, if required, condition of watercourses and associated riparian communities is consistent with or better than pre-mining condition	Monitoring indicates no significant impact to the channel condition of Quorrobolong Creek as a result of any required rehabilitation activities.
		Monitoring indicates no significant adverse impact on threatened riparian communities as a result of any required rehabilitation activities.

3.0 Baseline Ecological Environment

The LWB1-B7 BMP Area and its surrounds are within the Cessnock-Kurri vegetation area in the Lower Hunter Valley, as defined by Bell and Driscoll (2008).

3.1 Flora

A full list of flora species recorded in the LWB1-B3 Extraction Plan Area and LWB4-B7 Extraction Plan Area is provided in Appendix B of the respective Ecological Assessments for these longwall panels (Umwelt 2015, Umwelt 2017). The following section provides a discussion of the flora species of the combined LWB1-B7 BMP Area as a whole.

A total of 220 flora species were recorded, of which 175 species are native and 45 are introduced. Four species were from the Class Filicopsida (ferns), and 216 from Magnoliopsida (flowering plants) (of which 67 were from sub-class Liliidae (monocots) and 149 from sub-class Magnoliidae (dicots)). Flora species were recorded from 69 plant families, the most speciose being Poaceae (grasses), Asteraceae (daisies), Fabaceae (legumes) and Myrtaceae (eucalypts, Melaleucas and Leptospermums).

Of the flora species identified within the LWB4-B7 BMP Area, three are listed as threatened species; being the netted bottlebrush (*Callistemon linearifolius*), small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) and heath wrinklewort (*Rutidosis heterogama*). Locations of threatened species are provided on **Figure 3.1**. Each of these species is listed as vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act), with the heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) also listed as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

3.2 Vegetation Communities

A total of 10 vegetation communities were identified in the LWB1-B7 BMP Area (**Figure 3.1**). These are all low-lying communities (between 130 and 163 metres AHD) as no hilltops or ridges are present within the LWB1-B7 BMP Area. The extent of each vegetation type within the LWB1-B7 BMP Area is shown in **Figure 3.1** and the status of that vegetation is presented in **Table 3.1**.

Table 3.1 Vegetation Communities within the LWB1-B7 BMP Area

Vegetation Community	Status
Riparian Swamp Oak Open Forest	-
Riparian Cabbage Gum Open Forest	River-flat Eucalypt Forest EEC (BC Act)
Coastal Foothills Transition Forest	Lower Hunter Spotted Gum – Ironbark Forest EEC (BC Act)
Coastal Foothills Transition Forest – underscrubbed	
Spotted Gum Ironbark Forest	
Modified Spotted Gum Ironbark Forest	
Spotted Gum Ironbark Forest - underscrubbed	
Melaleuca Shrubland with Emergent Eucalypts	Potential Quorrobolong Scribbly Gum Woodland EEC (BC Act)[1]
Grassland	-
Planted Vegetation	-

Note: [1] Potential EEC however could not be confirmed without further detailed sampling.
EEC endangered ecological community BC Act *Biodiversity Conservation Act 2016*

3.3 Fauna

A full list of fauna species recorded in the LWB1-B3 Extraction Plan Area and LWB4-B7 Extraction Plan Area is provided in Appendix C of the respective Ecological Assessments for these longwall panels (Umwelt 2015, Umwelt 2017). The following section provides a discussion of the fauna species of the combined LWB1-B7 BMP Area as a whole.

A total of 123 fauna species were confidently recorded in the LWB1-B7 BMP Area, of which 15 are listed as threatened species. Fauna species identified comprised:

- Eleven amphibian species, including the following commonly identified species, bleating tree frog (*Litoria dentata*), eastern dwarf tree frog (*Litoria fallax*), Peron's tree frog (*Litoria peroni*), Gunther's frog (*Litoria latopalmata*), Tyler's tree frog (*Litoria tyleri*) and the striped marsh frog (*Limnodynastes peroni*). All of these species are considered to be locally common.

- Eleven reptile species, including the eastern water-skink (*Eulamprus quoyii*), pale-flecked garden sunskink (*Lampropholis guichenoti*), water dragon (*Intellagama lesueurii*), eastern snake-necked turtle (*Chelodina longicollis*), Jacky dragon (*Amphibolurus muricatus*), southern rainbow-skink (*Carlia tetradactyla*) and the delicate garden skink (*Lampropholis delicata*). All of these species are considered to be locally common.

- A total of 74 bird species. Species recorded typically associated with open woodland and grassland habitats, such as the Australian magpie (*Gymnorhina tibicen*), noisy miner (*Manorina melanocephala*), masked lapwing (*Vanellus miles*) and Australian magpie-lark (*Grallina cyanoleuca*). The most commonly encountered bird family was Meliphagidae (honeyeaters). Three threatened bird species was recorded within the LWB4-B7 Extraction Plan Area, being the grey-crowned babbler (*Pomatostomus temporalis temporalis*), varied sittella (*Daphoenositta chrysoptera*) and the white-bellied sea eagle (*Haliaeetus leucogaster*). These species are listed as vulnerable under the BC Act. The locations of threatened fauna species are shown on **Figure 3.1**.

- A total of 27 mammal species were confidently recorded within the LWB4-B7 Extraction Plan Area, with a further 11 (micro-bat) species that could not be confidently (either identified as a possible record or as part of a species group due to the echolocation recordings). Commonly recorded species included common brush-tail possum (*Trichosurus vulpecula*) and common ring-tailed possum (*Pseudocheirus peregrinus*).

- Seven threatened mammal species, squirrel glider (*Petaurus norfolcensis*), grey-headed flying fox (*Pteropus poliocephalus*), little bentwing-bat (*Miniopterus australis*), east-coast freetail-bat (*Mormopterus norfolkensis*), yellow-bellied sheathtail bat (*Saccolaimus flaviventris*), large-eared pied bat (*Chalinolobus dwyeri*) and greater broad-nosed bat (*Scoteanax rueppellii*) were confidently identified, with in the eastern falsistrelle (*Falsistrellus tasmaniensis*), eastern bentwing-bat (*Miniopterus schreibersii oceanensis*), southern myotis (*Myotis macropus*), and eastern cave bat (*Vespadelus troughtoni*) identified as possible record. All threatened mammals species identified are listed as vulnerable under the BC Act, with the large-eared pied bat (*Chalinolobus dwyeri*) and grey-headed flying-fox (*Pteropus poliocephalus*) additionally listed as vulnerable under the EPBC Act. Although not recorded during surveys undertaken by Umwelt, a single record of the koala (*Phascolarctos cinereus*) has also been identified from Atlas records (BioNet 2015). This species is listed as vulnerable under the BC Act and EPBC Act.

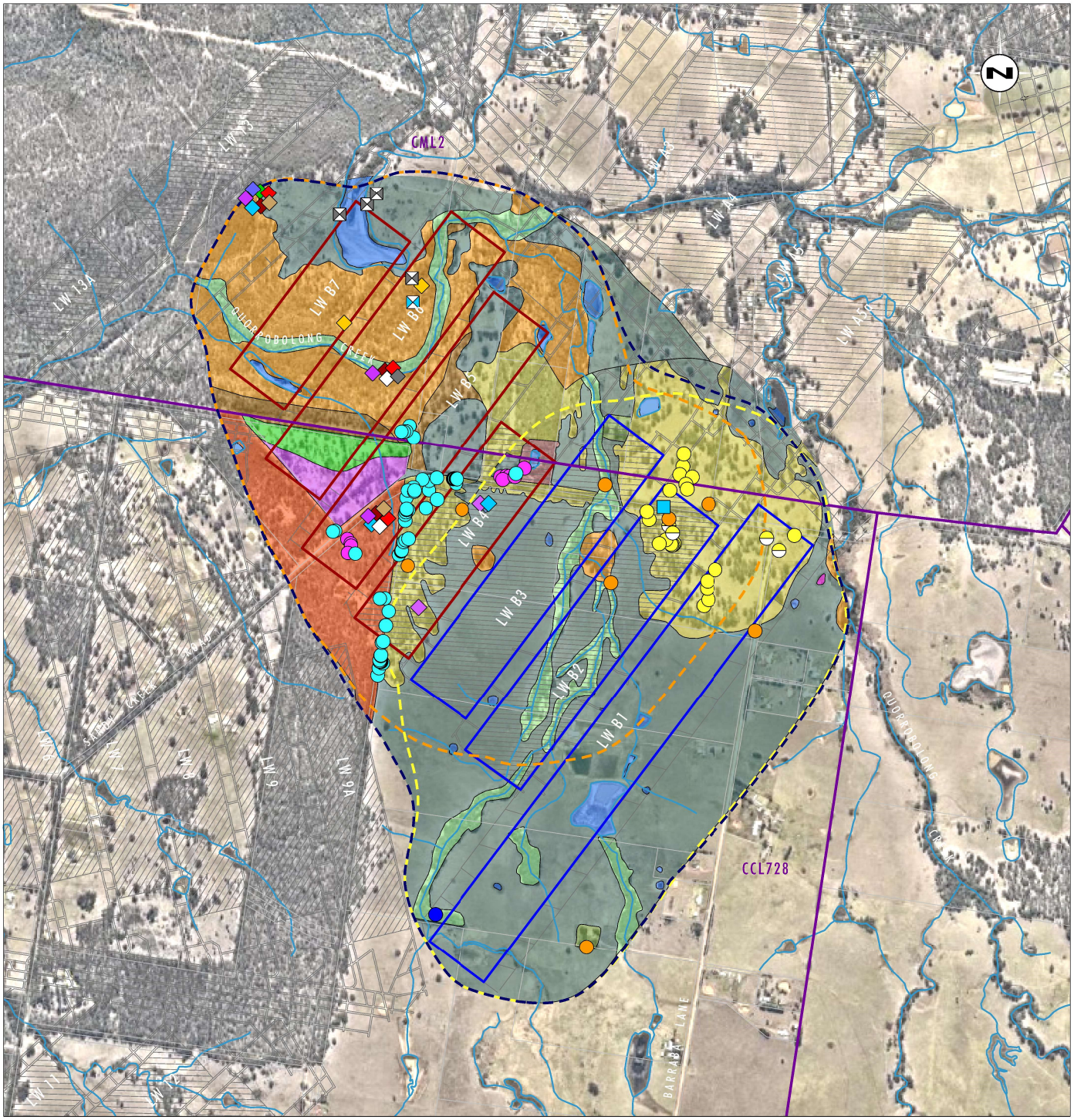

Image Source: NearMap (2018)
Data Source: Austar Coal Mine (2018)

0 0.25 0.5 1.0km
1:20 000

Legend

- LWB1-B7 Biodiversity Management Plan Area
- LWB1-B3 Extraction Plan Longwall Panels
- LWB1-B3 Extraction Plan Area
- LWB4-B7 Extraction Plan Longwall Panels
- LWB4-B7 Extraction Plan Area
- Completed Underground Workings
- Mining Lease Boundary
- Modified Grassland
- Planted Vegetation
- Water Body
- Riparian Swamp Oak Open Forest

River Flat Eucalyptus Forest EEC:

- Riparian Cabbage Gum Open Forest

Lower Hunter Spotted Gum-Ironbark Forest EEC:

- Coastal Foothills Transition Forest
- Coastal Foothills Transition Forest - underscrubbed
- Spotted Gum Ironbark Forest
- Modified Spotted Gum Ironbark Forest
- Spotted Gum Ironbark Forest - underscrubbed

Potential Quorrobolong Scribbly Gum Woodland EEC:

- Melaleuca Shrubland with Emergent Eucalypts
- East-coast freetail-bat (Definite)
- Eastern bentwing-bat (Species Group)
- Eastern cave bat (Species Group)
- Eastern false pipistrelle (Species Group)
- Grey-crowned babbler (eastern subspecies)
- Grey-crowned babbler nests
- Grey-headed flying-fox
- Large-eared pied bat
- Greater broad-nosed bat (Species Group)
- Little bentwing-bat (Species Group)
- Little bentwing-bat (Probable)
- Squirrel glider
- Southern myotis (Species Group)
- Varied sittella
- White-bellied sea eagle
- White-bellied sea eagle Nest
- Yellow-bellied sheathtail-bat (Probable)
- *Callistemon linearifolius*
- *Grevillea parviflora* subsp. *parviflora*
- *Rutidosis heterogama*

FIGURE 3.1

Vegetation Communities and Threatened Species Records

File Name (A4): R11/3900_145.dgn
20190201 11.28

3.4 Groundwater Dependent Ecosystems

The groundwater resources present in the LWB1-B7 BMP Area occur in the shallow alluvial aquifers associated with Quorrobolong Creek and its unnamed tributary, within shallow water bearing zones in the massive sandstones of the Branxton Formation and within the deeper Newcastle Coal Measures.

There are no known GDEs within the LWB4-B7 Extraction Plan Area that rely on groundwater within the Branxton Formation or Coal Measures. However, it is highly likely that within the LWB1-B7 BMP Area, the riparian vegetation comprising Riparian Swamp Oak Open Forest and Riparian Cabbage Gum Open Forest is at least partially dependent upon shallow alluvial groundwater sources during periods of reduced surface water flow.

A small wet soak area is also present approximately 40 m west of Quorrobolong Creek as it flanks the north-east of the LWB1-B3 Extraction Plan Area. The soak is approximately 15 m in diameter and is dominated by perennial wetland groundcover plants. While not listed as a groundwater dependent ecosystem (GDE) or high priority GDE by the BoM Atlas or Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009, this soak is expected to comprise an area of groundwater seepage and is therefore likely to comprise a GDE.

3.5 Aquatic Ecosystems

The aquatic habitats of the LWB1-B7 BMP Area comprise Quorrobolong Creek and its tributaries. Quorrobolong Creek crosses the northern portion of the LWB4-B7 Extraction Plan Area (refer to **Figure 1.2**) and flows west into Ellalong Lagoon approximately 3.5 km to the west. An un-named tributary of Quorrobolong Creek runs from south to north across the LWB1-B7 BMP Area prior to joining Quorrobolong Creek. Quorrobolong Creek and the unnamed tributary are ephemeral; however localised areas of ponding occur along their alignments.

Surface water quality monitoring is undertaken in Quorrobolong Creek upstream and downstream of the LWB1-B7 BMP Area since 2010 and has shown no observable impact on water quality as a result of mining. Similarly, monitoring of riparian vegetation and condition undertaken within the Stage 2 and LWB1-B3 area has shown no observable impact from mining to date.

In general the aquatic habitats are of a higher quality in the north than the south of the LWB1-B7 BMP Area (generally differentiated by Sandy Creek Road), as these areas are subject to fewer disturbances as a result of cattle grazing. Northern (upstream) reaches of Quorrobolong Creek have a greater diversity of native emergent as well as macrophytic aquatic vegetation as well as greater habitat diversity present (such as snags etc.). It is relatively un-impeded and was classified as providing Class 2 or moderate fish habitat.

Southern watercourses (unnamed tributary of Quorrobolong Creek mostly occurring south of Sandy Creek Road) contained moderate amounts of woody debris and tree roots which would provide moderate habitat and refugia for aquatic fauna; however are more susceptible to trampling by cattle. The unnamed tributary has several barriers to fish passage, mostly in the form of sand/silt bars and was assessed as providing Class 3 or minimal fish habitat.

All watercourses provide habitat for small aquatic fauna species and small fish (all fish identified were small (less than 10 cm long)), such as the introduced mosquito fish (*Gambusia holbrooki*). The mosquito fish were identified in abundance throughout the watercourses and are likely to be impeding colonisation by native fish species.

Watercourses are all sinuous, and both banks and the substrate were comprised of silt/clay/sands with no gravel beds identified. Some bank erosion was present in the form of under-cutting; however this was minor and tended to occur along bends in areas where cattle grazing was more intense.

Out of a score of 200 (200 being high quality and 0 being low quality), the Riparian, Channel and Environmental inventory (RCE) assessments provided a score of:

- 138 for the west-most point of Quorrobolong Creek assessed
- 154 for Quorrobolong Creek as it occurs over LWB7
- 141 for northern Quorrobolong Creek over LWB6
- 119 for the unnamed tributary of Quorrobolong Creek as it occurs to the east of the LWB4-B7 Extraction Plan Area over LWB1;and
- 136 for southern reaches of the eastern-most unnamed tributary of Quorrobolong Creek north of Sandy Creek Road above LWB3.

Riparian channel condition scores of which are considered to indicate sub-optimal physical and biological conditions, with the exception of the north-western sections of Quorrobolong Creek which are in moderate condition.

Typically encountered fringing flora species included narrow-leaved typha (*Typha domingensis*) and the introduced sharp rush (*Juncus acutus)*; and typically encountered aquatic vegetation included water ribbons (*Triglochin procerum*) and nardoo (*Marsilea mutica*). No threatened aquatic species listed as threatened under the BC Act, EPBC Act or *Fisheries Management Act 1994* (FM Act) were identified or considered likely to occur.

4.0 Predicted Biodiversity Impacts

The potential impacts of the secondary extraction of LWB1-B7 on the biodiversity values of the LWB1-B7 BMP Area were assessed as part of the respective Environmental Assessments for the longwall panels (Umwelt 2015, Umwelt 2017).

There are no direct surface disturbance activities or vegetation clearing associated with the development of LWB1-B7. The potential impacts of the project on flora and fauna are therefore limited to impacts associated with subsidence, including surface remediation works and subsidence related hydrological changes. Based on the findings of the Environmental Assessments (Umwelt 2015, Umwelt 2017) and previous experience within the Austar Coal Mine, the potential for subsidence related impacts to occur have been assessed as low. There is the potential for minor changes to the extent of remnant ponding around some existing flow paths and farm dams, however given the nature of the communities potentially affected, the potential for these changes to result in secondary impacts on ecological values is considered low.

It is therefore unlikely that the secondary extraction of LWB1-B7 will result in an adverse impact to the biodiversity values identified in the LWB1-B7 BMP Area and negligible changes to flora and fauna species diversity, vegetation community extent and aquatic species and habitat complexity are predicted.

Potential subsidence impacts and their likely environmental consequences are provided in **Table 4.1**.

Table 4.1 Predicted Biodiversity Impacts of Mining LWB1-B7

Predicted Subsidence Impact	Likelihood	Environmental Consequence
Surface cracking	Low chance of occurrence	Erosion causes significant loss of vegetation
		Cracking causes disruption to hydrological flows
Subsidence remediation works are required to ensure public or livestock safety, or to prevent an adverse impact or environmental consequence	Low chance of being required	Clearing of vegetation leading to significant disruption of the ecosystem present. Rehabilitation of disturbed area would be required.
Hydrological changes resulting in secondary impacts to ecological values	Unlikely	Changes to runoff and flow volumes through subsidence induced changes to the land surface resulting in substantial loss of vegetation due to dieback.
	Unlikely	Changes to bank stability and channel alignment resulting in adverse impacts on riparian vegetation and/or aquatic ecosystems.
	Minor changes to the extent of ponding likely, however low likelihood of these changes resulting in adverse impacts to ecological values	Changes to in-channel and out of channel ponding through changes to the bed profile of the surface water bodies resulting in substantial loss of vegetation due to drying or waterlogging of root systems

Predicted Subsidence Impact	Likelihood	Environmental Consequence
	Unlikely	Redirection of water from current near-surface groundwater flows due to subsidence-induced cracking resulting in an adverse impact on groundwater dependent ecosystems.
	Unlikely	Riparian habitats experiences substantial vegetation loss as a consequence of changes to hydrological regimes

5.0 Biodiversity Monitoring

Although longwall mining is not expected to have a significant impact on biodiversity value, a monitoring program has been designed to evaluate potential impacts to the biodiversity values (in this instance threatened species and EECs).

Specifically, monitoring works will be undertaken to identify substantial ecological impacts that may require rehabilitation works. The need to undertake rehabilitation works will be based upon compliance with performance indicators specified in **Table 2.1.**

Monitoring will be undertaken on an annual basis for areas of Lower Hunter Spotted Gum – Ironbark Forest and areas of potential Quorrobolong Scribbly Gum Woodland. Bi-annual (6 monthly) monitoring will be undertaken for the River-flat Eucalypt Forest monitoring site above LWB6/B7 in order to more closely monitor the influence of any changes in ponding on the understorey vegetation composition of this community.

Monitoring will include a baseline event prior to longwall extraction beneath the monitoring location. Baseline monitoring within the LWB1-B3 Extraction Plan Area was completed in spring 2016. Baseline monitoring within the LWB4-B7 Extraction Plan Area was completed in spring 2017.

Monitoring will cease 12 months after the cessation of mining, once subsidence monitoring reveals no further significant ground movement.

Table 5.1 and **Figure 5.1** present the proposed ecological monitoring sites for the LWB1-B7 BMP Area.

Given the results of vegetation monitoring undertaken within subsidence affected areas of the Austar Coal Mine since 2007 do not show any evidence of adverse impacts on vegetation, the monitoring of threatened flora species, including the netted bottlebrush (*Callistemon linearifolius*) population, heath wrinklewort (*Rutidosis heterogama*) population, and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) population, is not proposed. Similarly, as historical monitoring has not identified any adverse impact on water quality, riparian vegetation or stream condition within the Austar Coal Mine as a result of mining, aquatic monitoring within Quorrobolong Creek is not proposed.

5.1 Subsidence Monitoring

The impacts of subsidence on existing natural features are monitored and managed generally in accordance with the Subsidence Monitoring Program for the LWB1-B3 Extraction Plan and the LWB4-B7 Extraction Plan.

The need to remediate subsidence impacts will be assessed on a case by case basis and take into consideration potential risks to public safety and the environment. If subsidence impacts require remediation, the management strategies outlined in this LWB1-B7 BMP will be utilised.

Table 5.1 Proposed Ecological Monitoring Schedule for Longwall Panels

Monitoring Site	Site Description	Relevant Longwall Panel	Season	Monitoring Required			
				Floristic	Condition Assessment	Habitat Assessment	Photo Monitoring
EEC Monitoring Sites							
Site BS1[1]	Spotted Gum Ironbark Forest	LWB1	Spring	400 m² flora plot monitored for vascular flora species cover-abundance on standard proforma for comparability.	Ecological condition will be assessed at each of the monitoring sites using a simplified scoring system for 17 attributes (as per existing monitoring) on a standard proforma for comparability	Assessment of habitat values within flora plot by identifying terrestrial and arboreal nesting and roosting sites, food and water resources, habitat structure and habitat deficiencies on standard proforma for comparability.	From each of the plot corners three photos will be taken (i.e. corner 1 to 2, corner 1 to 3, corner 1 to 4, etc.).
Site BS2[1]	River Flat Eucalypt Forest	LWB2	Spring				
Site BS4[1]	Spotted Gum Ironbark Forest	LWB5	Spring				
Site BS5	River Flat Eucalypt Forest	LWB6	Spring				
Site BS6	River-flat Eucalypt Forest	LWB6	Spring and Autumn				
Site BS3[2]	Potential Quorrobolong Scribbly Gum Woodland	LWB4	Spring	Not practical without access	Modified condition assessment proposed to suit access restrictions	Modified habitat assessment proposed to suit access restrictions	Two photo monitoring points proposed from Sandy Creek Road

NOTE:

[1] Although Austar will endeavour to undertake Ecological monitoring of these sites, their locations are on privately owned or Crown land and may be subject to access constraints

[2] Access to site BS3 has not been possible to date due to a lack of access to privately owned land. In the absence of site access, a modified assessment methodology is proposed to allow for monitoring from public access locations along Sandy Creek Road.

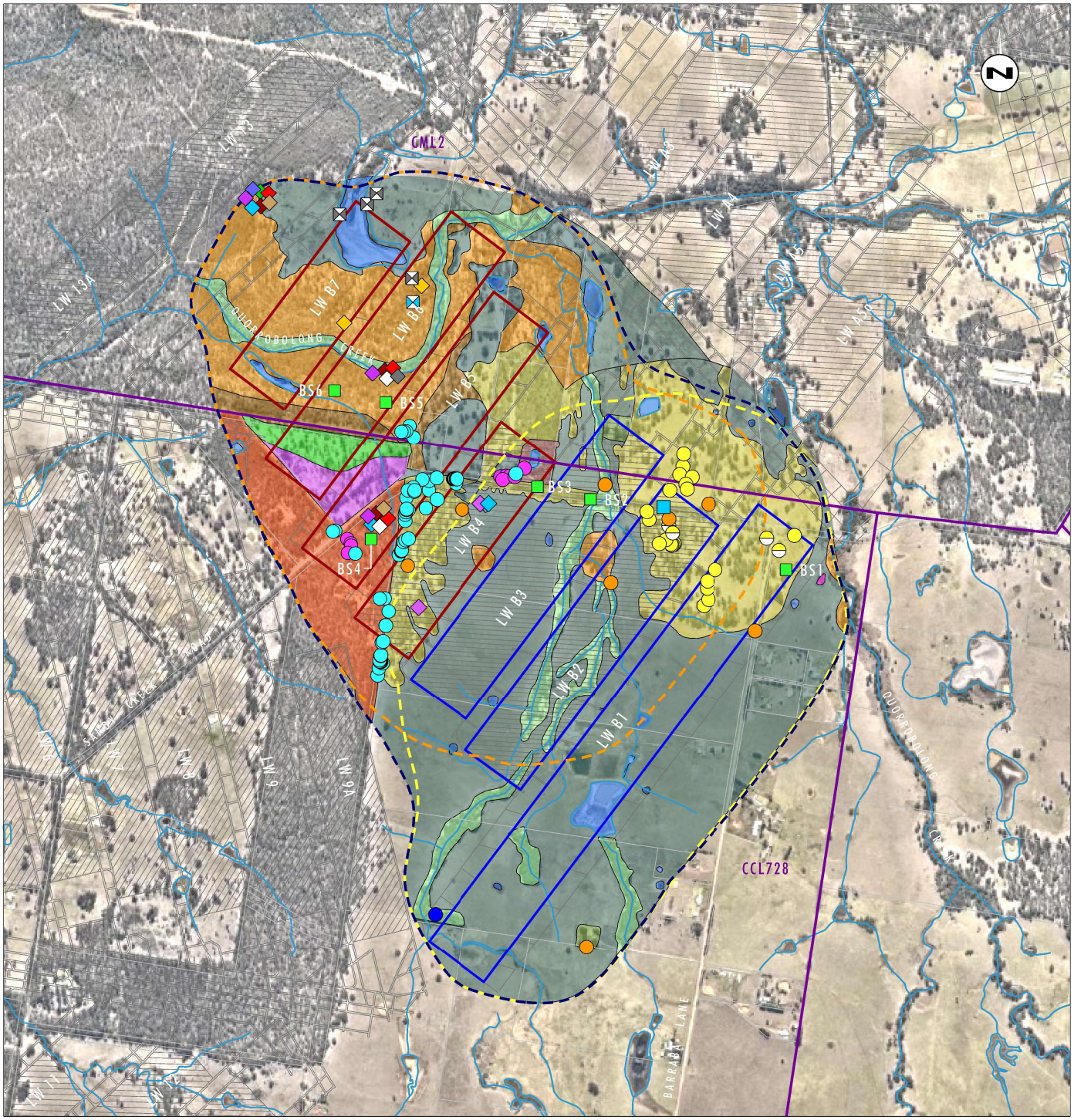

Image Source: NearMap (2018)
Data Source: Austar Coal Mine (2018)

0 0.25 0.5 1.0km
1:20 000

Legend

- LWB1-B7 Biodiversity Management Plan Area
- LWB1-B3 Extraction Plan Longwall Panels
- LWB1-B3 Extraction Plan Area
- LWB4-B7 Extraction Plan Longwall Panels
- LWB4-B7 Extraction Plan Area
- Completed Underground Workings
- Mining Lease Boundary
- Ecological Monitoring Site
- Modified Grassland
- Planted Vegetation
- Water Body
- Riparian Swamp Oak Open Forest

River Flat Eucalyptus Forest EEC:
- Riparian Cabbage Gum Open Forest

Lower Hunter Spotted Gum-Ironbark Forest EEC:
- Coastal Foothills Transition Forest
- Coastal Foothills Transition Forest - underscrubbed
- Spotted Gum Ironbark Forest
- Modified Spotted Gum Ironbark Forest
- Spotted Gum Ironbark Forest - underscrubbed

Potential Quorrobolong Scribbly Gum Woodland EEC:
- Melaleuca Shrubland with Emergent Eucalypts
- East-coast freetail-bat (Definite)
- Eastern bentwing-bat (Species Group)
- Eastern cave bat (Species Group)
- Eastern false pipistrelle (Species Group)
- Grey-crowned babbler (eastern subspecies)
- Grey-crowned babbler nests
- Grey-headed flying-fox
- Large-eared pied bat
- Greater broad-nosed bat (Species Group)
- Little bentwing-bat (Species Group)
- Little bentwing-bat (Probable)
- Squirrel glider
- Southern myotis (Species Group)
- Varied sittella
- White-bellied sea eagle
- White-bellied sea eagle Nest
- Yellow-bellied sheathtail-bat (Probable)
- *Callistemon linearifolius*
- *Grevillea parviflora* subsp. *parviflora*
- *Rutidosis heterogama*

FIGURE 5.1

Proposed Biodiversity Monitoring

File Name (A4): R12/3900_147.dgn
20190201 11.30

6.0 Biodiversity Management

Mining activities are not expected to have a significant impact on the ecological values of the LWB1-B7 BMP Area. The secondary extraction of LWB1-B7 will not result in the loss of vegetation communities or the floristic composition of vegetation communities; fauna species or habitat; or threatened species, populations and EECs or their habitat.

Biodiversity management activities will be limited to the reparation of subsidence related impacts (refer to **Section 5.1**) and ongoing ecological monitoring (refer to **Section 5.0**) (undertaken to identify compliance with performance measures specified in **Table 2.1**). Where no significant adverse ecological impacts are identified through monitoring, no management measures will be required.

In the event that subsidence monitoring identifies an impact that requires remediation, a range of management measures will be implemented. These management measures are outlined in **Sections 6.1** to **6.4** and include pre-rehabilitation strategies, rehabilitation management strategies, monitoring of rehabilitation undertaken and post-remediation management.

6.1 Pre-Remediation Management

6.1.1 Due Diligence Requirements

Where it is necessary to disturb areas of native vegetation for the purposes of subsidence remediation works, a due diligence assessment will be undertaken in accordance with the vegetation clearance procedure outlined below. In the first instance any disturbance will be minimised by way of utilisation of existing access tracks and avoidance of significant vegetation where possible. Due diligence requirements will address the performance indicators in **Table 2.1** that directly relate to the protection of native vegetation (as specified in Schedule 3, Condition 22).

Ecological due diligence will involve a pre-clearing assessment and will generally involve:

- clear demarcation of the disturbance area
- inspection by a suitably qualified and experienced person with specific activity recommendations to be made to the Environment and Community Superintendent, including regarding landuse and identification or absence of existing vegetation communities to enable appropriate species selection for rehabilitation works
- where relevant, identification and mark-up of tree hollows to be salvaged and habitat trees for which tree-felling supervision is required (**Section 6.2.1**).

6.2 Remediation Management

The following management measures relate to the undertaking of remediation works. These measures will address the performance indicators in **Table 2.1** that directly relate to the ecological impacts of subsidence remediation works (Schedule 3, Condition 3D), protection of native vegetation (as specified in Schedule 3, Condition 22) and rehabilitation objectives (Schedule 3, Condition 28).

6.2.1 Tree Felling

After the pre-clearance inspection has been completed, the clearing of vegetation will be undertaken in accordance with a Tree Felling procedure which includes the following:

- prior to clearing, the Environment and Community Superintendent (or delegate) will contact a suitably qualified wildlife rescue professional and have them on standby should the need arise to recover any fauna from the felled habitat trees

- all non-habitat trees will be cleared first, taking care to avoid all marked habitat trees (as identified during pre-clearing surveys, refer to **Section 6.1.1**). Providing that pre-clearing inspections have been completed, it is not necessary for a wildlife rescue professional to be present while clearing non-habitat trees

- within one to two days following the clearing of non-habitat trees, habitat trees will be cleared in the presence of a suitably qualified person. Before clearing and where practicable, the trunk of the hollow-bearing tree will be shaken vigorously with heavy machinery then shaking will be paused for 30 seconds to allow fauna to escape, prior to felling of the tree. The machinery operator will then push the tree over as slowly as possible, so as to minimise the intensity of impact when hitting the ground. Trees may alternately be felled by way of limb removal by an arborist

- once the tree has been felled, the qualified person will inspect the tree (particularly hollows) for signs of any trapped or injured fauna. Any injured fauna will be carefully captured by the qualified and experienced person, and taken to a wildlife carer or veterinary clinic

- where possible, cleared vegetation is proposed to be either mulched for use in subsidence remediation/rehabilitation activities or used directly for the purposes of brush matting.

6.2.2 Erosion and Sediment Control

Where erosion and sediment control works are required, these will be implemented and managed in accordance with the Austar Site Water Management Plan.

6.2.3 Vegetation Species Selection for Rehabilitation

Pasture grassland species will be selected in consultation with the landholder for grazing or cropping landuse areas. For riparian or native bushland areas, flora species appropriate to that area will be used for rehabilitation. Riparian or native bushland flora species will primarily be selected based on endemic flora species identified in Appendix B of the LWB1-B3 Modification Ecological Assessment (Umwelt 2015) and Appendix B of the LWB4-B7 Modification Ecological Assessment (Umwelt 2017).

6.3 Rehabilitation Monitoring

Locations within the LWB1-B7 BMP Area where rehabilitation or remediation works have been undertaken will be monitored on a regular basis until they are identified as being on the same trajectory as pre-mining levels following rehabilitation .

Monitoring of these areas will include visual inspections and photo monitoring and will focus on the following:

- germination rates
- success rates of tubestock (where used)

- weed infestation
- general condition
- whether post-rehabilitated agricultural or pastoral areas have:
    - vegetative ground cover and condition with a trajectory towards pre-mining levels
    - land capability classification with a trajectory towards pre-mining levels.
- whether post-rehabilitated native vegetation areas have:
    - a native floristic condition and diversity with a trajectory towards pre-mining levels
    - threatened flora abundance and health with a trajectory towards pre-mining levels
    - an availability and type of fauna habitats with a trajectory towards pre-mining levels
    - an availability and type of aquatic habitats with a trajectory towards pre-mining levels
    - GDEs with a structure and condition with a trajectory towards pre-mining levels.

6.4 Post-Remediation Management

6.4.1 Weed Management

In the event that subsidence remediation works are required that cause soil disturbance activities, the following weed management will be undertaken:

- the implementation of weed management measures
- monitoring and inspections of areas to assess the effectiveness of the weed control activities and to ascertain the requirement for further work
- subject to consultation with a qualified ecologist in areas known to contain threatened flora records.

All weed management activities undertaken in EECs or in areas known to contain threatened flora records (particularly small-flower grevillea (*Grevillea parviflora* subsp*. parviflora),* heath wrinklewort (*Rutidosis heterogama*) or netted bottlebrush (*Callistemon linearifolius*)) will be subject to consultation with a qualified ecologist, with any works required undertaken by the appropriately qualified personnel.

6.4.2 Management of Threatened Species Habitat and EECs

In the event that unpredicted, adverse impacts on small flower grevillea (*Grevillea parviflora* subsp. *parviflora*), heath wrinklewort (*Rutidosis heterogama*) or netted bottlebrush (*Callistemon linearifolius*) are identified during management and monitoring of the LWB1-B7 BMP Area, Austar will investigate appropriate remediation and mitigation requirements (refer to **Section 6.5**).

There are not expected to be any significant impacts to EECs (in particular Lower Hunter Spotted Gum Ironbark Forest, River Flat Eucalypt Forest or Quorrobolong Scribbly Gum Forest) as a result of the secondary extraction of LWB1-B7. Ongoing monitoring of the EECs (as detailed in **Section 5.0**) will be undertaken to ensure that no significant impacts are occurring as a result of the continued mining operations. If negative impacts to the EECs are identified during management and monitoring of the LWB1-B7 BMP Area, Austar will investigate appropriate remediation and mitigation requirements.

6.5 Trigger, Action, Response Plan

Austar has developed a response protocol in relation to the potential impacts or environmental consequences from mining operations to the ecological values of the surrounding environment.

This protocol has been developed by identifying triggers based on potential impacts on ecological values in the Extraction Plan Area, and outlining the actions required in accordance with development consent conditions.

The Trigger Action Response Plan (TARP) process outlined in **Table 6.1** will be followed within the LWB1-B7 BMP Area.

Table 6.1 Impacts to Biodiversity TARP

Trigger	Action
Biodiversity monitoring/walkover inspection indicates no significant impacts that could be attributed to impacts or environmental consequences of subsidence.	• Continue with monitoring program (up to 12 months post completion of longwall mining in LWB1-B7 BMP Area) if no significant adverse impacts relating to mining are identified.
Biodiversity monitoring/walkover inspection indicates potential adverse impacts (i.e. dieback/tree falls in EEC or threatened species deaths).	• Notify the Austar Environment and Community Superintendent. • Review recent monitoring results against historical monitoring data. • Investigate the potential cause of any die back/tree falls and whether this could be linked to subsidence in the area or other effects. • Assess whether significant adverse impacts have occurred in consultation with the relevant specialists as required. • Continue with monitoring/reporting program up to 12 months post completion of longwall mining in the LWB1-B7 BMP Area if no significant adverse impacts related to mining are identified.
Significant adverse impacts to threatened species, populations, habitats, and/or EECs are identified which may be remediated (under a reasonable and feasible test).	• Notify DPE and OEH of an incident in accordance with the Austar Environmental Management Strategy. • Commission assessment of possible remediation options, including an assessment of whether such remediation is reasonable or feasible. • Where remediation is reasonable and feasible, consult with OEH on the remediation strategy and implement. • Monitor the effectiveness of the success of the remediation of the impacts against the Performance Indicators in this LWB1-B7 BMP.
Remediation works undertaken for significant adverse impacts to biodiversity values have been unsuccessful (as evidenced by monitoring).	• Implement any corrective actions required to progress remediation towards satisfying Performance Indicators in this LWB1-B7 BMP. • Continue rehabilitation area monitoring program.
Remediation works (including any corrective actions applied) undertaken for significant adverse impacts to biodiversity values have been unsuccessful over 5 years and do not show evidence of progressing towards the Performance Indicators (as evidenced by monitoring of rehabilitation area).	• Quantify magnitude of impacts that have occurred and on what values. • Commission suitably qualified personnel to investigate appropriate offsets (which must be proportionate with the significance of the impact or environmental consequence). • Identify suitable offsetting mechanism and seek approval of the offset from the Secretary of DPE. • Provide agreed offset to compensate for impacts identified in the LWB1-B7 BMP Area.
Significant adverse impacts to threatened species, populations, habitats, and/or EECs are identified which may not be remediated (under a reasonable and feasible test).	• Quantify magnitude of impacts that have occurred and on what values. • Commission suitably qualified personnel to investigate appropriate offsets (which must be proportionate with the significance of the impact or environmental consequence). • Identify suitable offsetting mechanism and seek approval of the offset from the Secretary of DPE. • Provide agreed offset to compensate for impacts identified in the LWB1-B7 BMP Area.

6.6 Adaptive Management

The results of the ecological monitoring will be reviewed annually and reported in the Annual Review. Management measures will be adapted, as required, on the basis of monitoring outcomes. Amendments to management processes may be undertaken in light of any findings of the ecological monitoring identified in **Section 5.0.**

7.0 Reporting and Review

7.1 Environmental Incidents

Austar's Environmental Management Strategy includes an environmental incident management process to:

- manage environmental hazards and incidents to minimise damage to people, environment, community and other assets
- facilitate reporting of environmental incidents
- identify factors that contributed to incidents through an investigation process and to learn from those events and prevent reoccurrence.

Significant adverse impacts to biodiversity values as a result of Austar operations that exceed the performance criteria of the consent will be treated as an environmental incident, and a written report will be provided to any relevant government agencies in accordance with the Austar Environmental Management Strategy.

7.2 Community Complaints

All community complaints relating to biodiversity will be managed in accordance with the Austar Environmental Management Strategy, which outlines the procedures to receive, handle, respond to and record complaints.

7.3 External Reporting

The results of the ecological monitoring associated with this LWB1-B7 BMP will be reported in the Annual Review. This will provide a comparison of the data collected with previous results and the performance objectives of this LW1-B7 Biodiversity Management Plan.

In addition, all environmental incidents, community complaints and non-compliances with statutory requirements in relation to biodiversity will be reported annually in the Annual Review.

7.4 Review

The Environment and Community Superintendent (or delegate) will review this LWB1-B7 BMP on an annual basis or earlier in the event of modifications to the development consent or biodiversity related incidents. Where relevant changes made to the LWB1-B7 BMP as a result of the review will be made in consultation with relevant government authorities and will be supplied to the Secretary of the DPE for approval.

8.0 Accountabilities

The relevant accountabilities to this LWB1-B7 BMP are provided in **Table 8.1**.

Table 8.1 Accountabilities for this Document

Role	Accountabilities for this Document
Operations Manager	• Approve appropriate resources for the effective implementation of this Plan.
Environment and Community Superintendent (or delegate)	• Coordinate the implementation of biodiversity management controls and strategies in accordance with this Plan. • Coordinate the ecological monitoring requirements of this plan, and evaluate and report monitoring results as required. • Coordinate biodiversity related incident investigations and reporting as required by legislation and internal standards and guidelines and TARP process outlined in **Section 6.5**. • Coordinate the review of this plan in accordance with the requirements of the development consent.
All employees and contractors	• Comply with all requirements of this plan. • Report all potential environmental incidents to their supervisor immediately. • Seek approval from the Environment and Community Superintendent prior to any clearance activities.

9.0 References

Austar, 2014. Austar Annual Environmental Management Report July 2013 – June 2014.

Bell, S A J & Driscoll, C, 2008. *Vegetation of the Cessnock-Kurri Region, Cessnock LGA, New South Wales: Survey, Classification & Mapping*. Prepared for the Department of Environment and Conservation, Newcastle.

Bionet 2015. Bionet – the website for the NSW Atlas of Wildlife. http://www.bionet.nsw.gov.au/

Chessman B, Growns J, Kotlash A 1997. *Objective Derivation of macroinvertebrate family sensitivity grade numbers for the SIGNAL Biotic index: application to the Hunter River system, NSW*. Marine and Freshwater Research 49, 159-72.

Department of Environment and Conservation (DEC), 2006. *Lower Hunter Regional Conservation Plan 2006 (LHRCP)*.

Department of Planning and Environment (Unpublished). Draft *Guidelines for the Preparation of Extraction Plans* - Version 5.

Dundon, P, (2015). Austar Coal Mine – LWB1-B3 Modification – Groundwater Assessment.

MSEC, 2015. Austar Coal Mine: Longwalls B1 and B2 Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Environmental Assessment for a Section 75W Modification Application for the Inclusion of the Proposed Longwalls B1 and B2 at the Austar Coal Mine.

MSEC, 2018. Austar Coal Mine: Modified finishing end of LWB4. Review of subsidence effects, subsidence impacts and environmental consequences.

Petersen R 1992. *The RCE: a Riparian, Channel, and Environmental Inventory for small streams in the agricultural landscape*. Freshwater Biology. Volume 27, Issue 2, April 1992, Pages 295–306.

Umwelt (Australia) Pty Limited, 2015. *LWB1-B3 Modification Ecological Assessment*. Prepared on behalf of Austar Coal Mine Pty Limited.

Umwelt (Australia) Pty Limited, 2017. *LWB4-B7 Modification Ecological Assessment*. Prepared on behalf of Austar Coal Mine Pty Limited.