# 6.7 Historic Heritage

A historical heritage assessment has been prepared for the LWB4-B7 Modification to identify potential impacts on items of known or potential historical heritage. The assessment has been undertaken with consideration of guidelines set out in the NSW Heritage Manual 1996 (Heritage Office and Department of Urban Affairs & Planning), including *Archaeological Assessments, Assessing Heritage Significance, Statements of Heritage Impact* and the principles contained in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013* (Australia ICOMOS 2013) and the *Historical Archaeology Code of Practice* (Heritage Office 2006).

## 6.7.1 Historical Context

As part of NSW heritage assessment procedures it is essential to have a full understanding of a site or item based on its historical and physical context. This section of the EA provides a brief historical context for the LWB4-B7 Modification Area and its broader locality, to provide an understanding of the significance of any heritage sites within the LWB4-B7 Modification Area. The historical context prepared as part of the *Historical Heritage Assessment: Austar Coal Mine Project, Stage 3* (Umwelt 2008b) should also be referred to for the full historical context of the Austar Coal Mine.

The history of the Cessnock region is characterised by pastoral estates and a slow intensification of residential development prior to 1892, with mining then becoming increasingly significant to the region's economy and development; particularly from the 1910s. The history of the Quorrobolong area reflects this, with land first taken up as part of pastoral estates in the late 1820s and early 1830s, then being progressively subdivided for further pastoral use. Mining infrastructure in the Quorrobolong area – for the Pelton, Ellalong, Bellbird and Southland Collieries – dates to the 1910s, resulting in the rapid intensification of use of the local region. As a result of this history, the landscape of the LWB4-B7 Modification Area has undergone modification through extensive pastoral grazing and some residential development, with native vegetation cleared and foreign grasses introduced (Umwelt 2008b).

The LWB4-B7 Modification Area has been utilised for pastoralism and agriculture since the early nineteenth century. The area encompassing the LWB4-B7 Modification Area was originally part of a number of land grants, several of which were between 100 and 2000 acres. Large land grants across the Cessnock, Ellalong and Quorrobolong parishes included those of local landowners such as Jacob Josephson, George Thomas Palmer, John Browne and John Scholey. Smaller land grants of 20 to 40 acres were taken up across all three parishes with reserves set aside for mining purposes also located within the LWB4-B7 Modification Area.

The coal mining industry has played an important role in the development of the wider area since early settlement and has been one of the primary economic and social drivers in the area. In particular, the South Maitland Coalfields played a dominant role in the development of Newcastle and the lower Hunter Valley region. These coalfields have been a constant contributing factor in the establishment of settlement and industry with the local area since the nineteenth century.

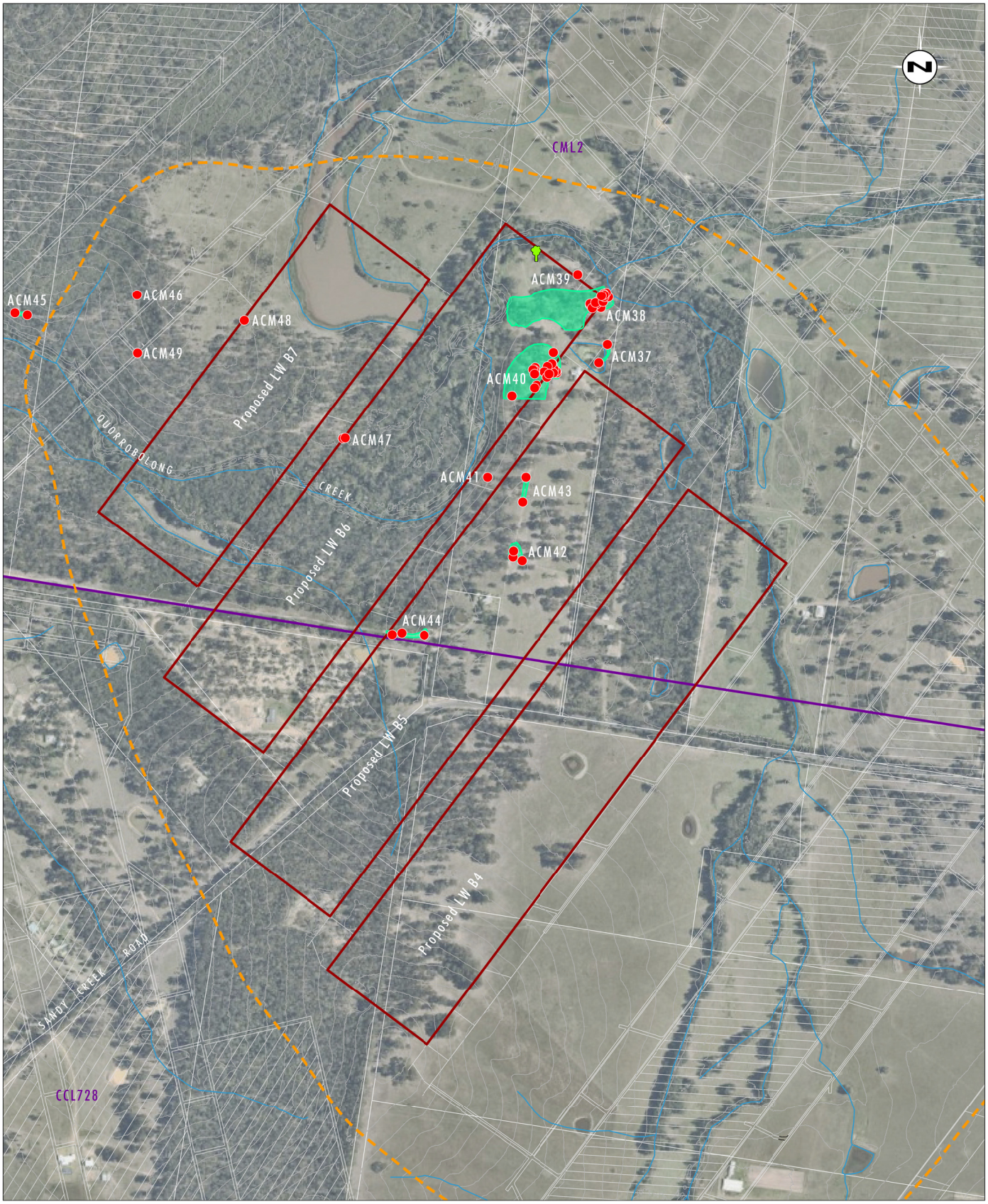


Image Source: Nearmap (2017)
Data Source: Austar Coal Mine (2017)
Note: Contour Interval 2m

0 100 250 500m
1:10 000

## Legend

- Proposed LWB4-B7 Longwall Panels
- LWB4-B7 Modification Area
- Mining Lease Boundary
- Complete Underground Workings
- Archaeological Site Area
- Artefact Location
- Tree with Non-cultural Scarring

FIGURE 6.10

**Location of Newly Recorded Aboriginal Archaeological Sites within LWB4-B7 Modification Area**

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20170516 9.02

### 6.7.2 Heritage Searches

As part of the historical heritage assessment of the LWB4-B7 Modification Area, a review of relevant heritage databases was undertaken including:

- Cessnock Local Environment Plan (LEP) 2011.
- NSW State Heritage Register
- State Heritage Inventory
- Australian Heritage Database (including Commonwealth and National Heritage lists and the Register of the National Estate).

The database review identified one locally listed heritage item located partially within the north-western portion of the LWB4-B7 Modification Area. A small portion of the extensive listing comprising the Collieries of the South Maitland Coalfields/Greta Coal Measures locally listed Item I215 is located within the north-western portion of the LWB4-B7 Modification Area (refer to **Figure 6.11**). The Collieries of the South Maitland Coalfields/Greta Coal Measures is listed under Schedule 5 of the Cessnock LEP 2011 as being of local heritage significance and comprises multiple sites throughout the Cessnock local government area.

### 6.7.3 Site Visit

A visual inspection of the LWB4-B7 Modification Area was undertaken on 7 and 8 February 2017 by Joshua Madden, Senior Archaeologist Umwelt. No structures relating to the Collieries of the South Maitland Coalfields/Greta Coal Measures locally listed item (I215) were identified during the site inspection, however a number of remnant rural infrastructure items were identified including a former timber cattle yard and a former brick creek crossing (refer to **Plate 6.1** – **Plate 6.3**). The heritage significance of these structures is assessed in **Section 6.7.4**.

**Plate 6.1 View of the former cattle yard within the LWB4-B7 Modification Area**

**Plate 6.2 View northeast overlooking dam and location of former crossing**

© Umwelt, 2017

**Plate 6.3 Close up of the bricks used for the crossing**

© Umwelt, 2017


Image Source: Nearmap (2017)
Data Source: Austar Coal Mine (2016)

0 0.25 0.5 1.0km
1:20 000

## Legend

- Proposed LWB4-B7 Longwall Panels
- LWB4-B7 Modification Area
- Completed Underground Workings
- Cessnock LEP Item I215 - Collieries of the South Maitland Coalfields/Greta Coal Measures

FIGURE 6.11

**Listed Heritage Items**

### 6.7.4 Significance Assessment

The Collieries of the South Maitland Coalfields/Greta Coal Measures (item I215) is listed under Schedule 5 of the Cessnock LEP 2011 as being of local heritage significance.

The land in the area of item I215 is owned by Austar Coal Mine and is the site of the former Cessnock No. 1 Colliery (also known as Kalingo Colliery). Infrastructure relating to the Cessnock No. 1 Colliery is located mainly near a mine water management Kalingo Dam, which is currently in use for the Austar Coal Mine. The Cessnock No. 1 infrastructure items are outside the LWB4-B7 Modification Area.

It is noted that the South Maitland Coalfields, being one of Australia's richest coal deposits (at the time), provided the economic base for the region and led to the establishment of a number of towns in the area. The colliery sites are identified as significant as they provide evidence of the former wealth and activity of the area, and also the extent of demolition that occurred to mine complexes in the 1970s.

An assessment of the heritage significance of the former cattle yard and the brick creek crossing found these to be common items of rural infrastructure found across the Hunter Valley region. As such, both of the former cattle yard and the brick creek crossing are not considered to be of either local or state significance as they do not meet the requirements of the State Heritage Inventory on a local or state level.

### 6.7.5 Impact Assessment

The significance assessment found that the Collieries of the South Maitland Coalfields/Greta Coal Measures is of local heritage significance and no structures relating to the listing were identified within the Modification Area. No other items of heritage significance are located within the LWB4-B7 Modification Area.

The portion of the modification area that is partly located within the mapped area of the Collieries of the South Maitland Coalfields/Greta Coal Measures (Item I215) is very small, and the land is undeveloped and comprises forest vegetation. The LWB4-B7 Modification does not involve any additional surface development and therefore will have no direct impact on the locally listed heritage item. There is also not predicted to be any indirect impacts on the locally listed heritage item as a result of subsidence or alteration of view corridors to or from the listed item. Therefore, the proposed LWB4-B7 Modification will not impact on the significance of The Collieries of the South Maitland Coalfields/Greta Coal Measures.

The LWB4-B7 Modification Area is typical of a rural landscape within the Hunter Valley region. There is not expected to be any perceptible impacts to the open rural nature of the landscape as a result of the modification.

### 6.7.6 Management Strategies

The LWB4-B7 Modification will not impact on the significance of any known or potential heritage items.

No change to the existing historical heritage management measures outlined in the Austar Historic Heritage Management Plan (Austar 2014) is required for the modification.

## 6.8 Land Resources and Agriculture

As discussed in **Section 1.3**, one soil landscape type is found within the LWB4-B7 Modification Area, being the Quorrobolong soil landscape (Kovac and Lawrie 1991) (refer to **Figure 1.6**). The main soils within this landscape are prairie soils occurring in drainage depressions and on lower slopes. They are generally poorly drained, have moderate permeability and the upper horizon has moderate erodibility (Kovac and Lawrie 1991). The soils are moderately fertile and the main land use is generally grazing on unimproved pasture.

The land and soil capability mapping undertaken for the Upper Hunter SRLUP 2012 indicates the LWB4-B7 Modification Area is mapped as Class 2, Class 4 and Class 5 Land and Soil Capability (refer to **Figure 6.12**). Class 2 land is considered to be capable of a wide variety of uses such as cropping, grazing, horticulture, forestry or nature conservation. Class 4 and 5 land is considered to be land capable of a variety of land uses, such as cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry and nature conservation (OEH 2012). The definition for each class identified is provided in **Table 6.6**

**Table 6.6 Land and Soil Capability Classes (OEH 2012)**

| LSC Class | General Definition |
|---|---|
| Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation) | |
| 2 | Very high capability land (slight but significant limitation): Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation. |
| Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation) | |
| 4 | Moderate capability land: Land has moderate to high limitations for high impact land uses. Will restrict land management options for regular, high impact land uses such as cropping, high intensity grazing and horticulture. These limitations can only be managed by specialized management practices with a high level of knowledge, expertise, inputs, investment and technology. |
| 5 | Moderate-low capability land: Land has high limitations for high impact uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long term degradation. |

Assessment of the potential subsidence impacts on the land surface and hydrological regime conclude that the risk of surface cracking is low, as is the potential for adverse impacts on water availability or erosion. Given the minimal impacts predicted to the land surface and hydrological regime, it is unlikely that the LWB4-B7 Modification would have any impact on the current or future land and soil capability of the LWB4-B7 Modification Area.

Visual monitoring of the land surface within the LWB4-B7 Modification Area will be undertaken before, during and following mining to determine the need for any subsidence management or remediation measures, as described in **Section 6.2.4** and **Section 7.1**. The objective of any subsidence management or remediation measures would be to return the land to pre-mining condition or better.

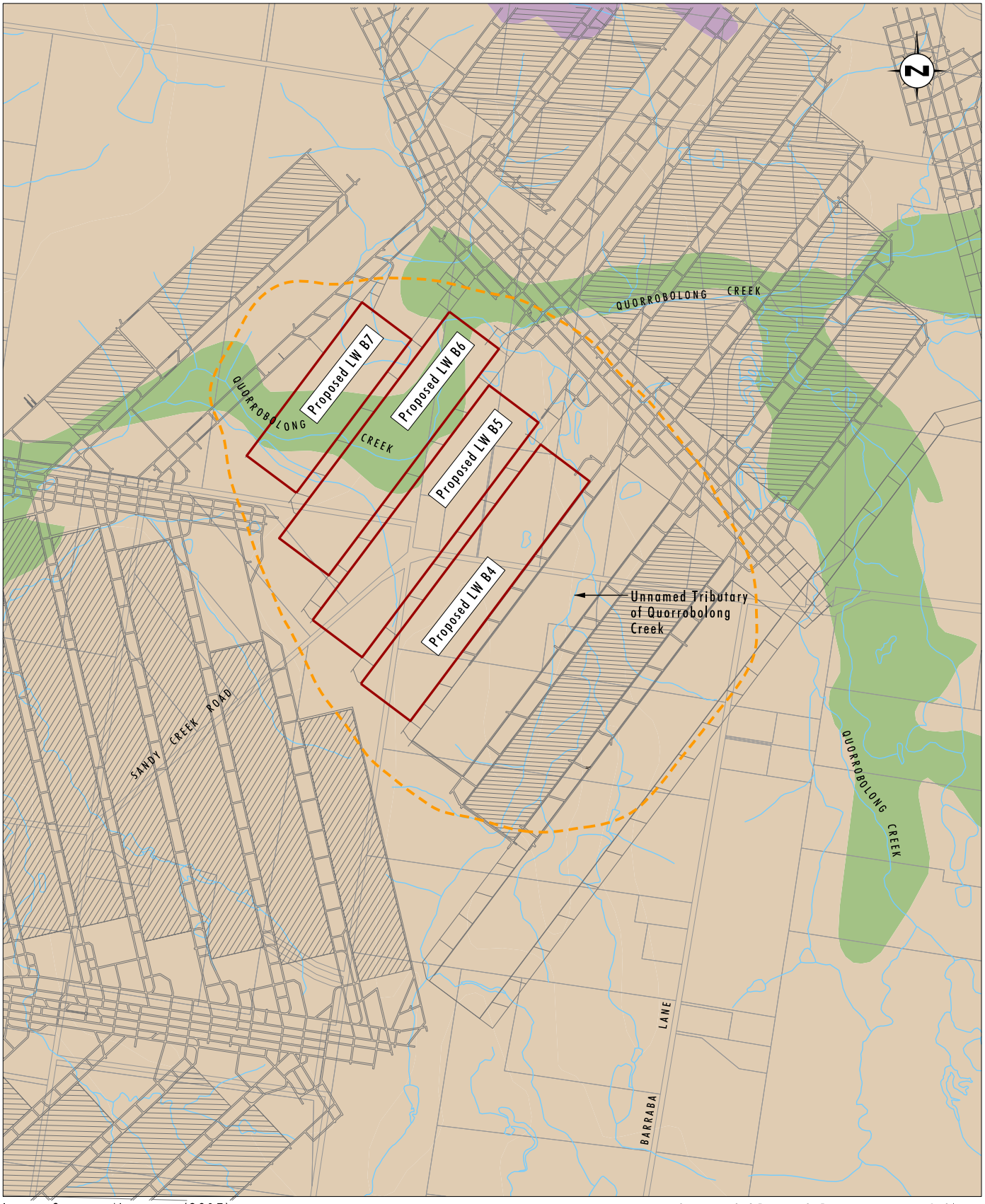


Image Source: Nearmap (2017)
Data Source: Austar Coal Mine (2016), NSW Department of Environment, Climate Change and Water (2010)

0 0.25 0.5 1.0km
1:20 000

## Legend

- Proposed LWB4-B7 Longwall Panels
- LWB4-B7 Modification Area
- Class 2 - Suitable for Regular Cultivation
- Class 4 - Suitable for Grazing with Occasional Cultivation
- Class 5 - Suitable for Grazing with No Cultivation
- Completed Underground Workings
- Drainage Line

FIGURE 6.12

**Land Capability**

### 6.8.1 Agricultural Impacts

Portions of the LWB4-B7 Modification Area are currently used for agricultural purposes, including grazing, with some rural residential use. The LWB4-B7 Modification is not expected to restrict the ongoing use of the land for agricultural or rural residential purposes as all residential and rural structures are expected to have manageable minor impacts and the risk of surface cracking is low. Further, the potential for adverse impacts on water availability and farm dams is minimal. There are no registered active private bores located within the LWB4-B7 Modification Area and there is not predicted to be any significant impact on the storage capacities of farm dams. In the unlikely event that the proposed modification were to result in cracking or leakage of water from a farm dam wall, this could be readily repaired. Land is expected to remain safe for continued grazing and agricultural use throughout mining (refer to **Section 6.2**).

Visual monitoring of the natural and built features within the LWB4-B7 Modification Area will be undertaken before, during and following mining to determine the need for any subsidence management measures, as described in **Section 6.2.4**.

Any subsidence related impacts to rural buildings, fences or farm dams will be repaired in accordance with individual Built Features Management Plans to be prepared in consultation with potentially affected landholders.

### 6.8.2 Compatibility with Surrounding Land Uses

The LWB4-B7 Modification Area is located within a rural environment. The dominant land use within and surrounding the modification area is grazing and mining, with some rural residential use. The small township of Ellalong is located approximately 2 kilometres west of the LWB4-B7 Modification Area and the villages of Kitchener and Pelton are located approximately 4 kilometres to the northeast and northwest respectively (refer to **Figure 1.1**).

As previously discussed, the LWB4-B7 Modification does not involve any additional surface development and due to the predicted minimal impacts on the ground surface associated with subsidence, is unlikely to have any adverse impacts on current land uses. Austar Coal Mine has coexisted with existing and previous land uses since it recommenced mining in Bellbird South in 2005 and the LWB4-B7 Modification is also considered compatible with existing surrounding land uses.

### 6.8.3 Management and Monitoring

The predicted impact of subsidence on land and agricultural resources is minimal, with impacts likely to be less than that previously experienced in the Stage 2 and Stage 3 LTCC extracted areas. Based on this outcome, Austar will continue to implement the management strategies currently in place at the Austar Coal Mine, consistent with those outlined in the approved LWB1-B3 Extraction Plan Land Management Plan (Austar, 2016a). An Extraction Plan Land Management Plan that includes the LWB4-B7 Modification Area will be prepared as part of the Extraction Plan process for LWB4-B7.

## 6.9 Greenhouse Gas and Energy Assessment

A detailed greenhouse gas and energy assessment (GHGEA) has been prepared for the LWB4-B7 Modification by Umwelt. The findings of the GHGEA are provided below.

### 6.9.1 Assessment Methodology

The GHGEA framework is based on the methodologies and emission factors contained in the National Greenhouse Accounts Factors 2016. The assessment framework also incorporates the principles of The Greenhouse Gas Protocol 2004.

The Greenhouse Gas Protocol (The Protocol) provides an internationally accepted approach to greenhouse gas accounting. The Protocol provides guidance on setting reporting boundaries, defining emission sources and dealing with issues such as data quality and materiality. The Protocol defines three 'Scopes' of emissions for greenhouse gas accounting and reporting purposes. These scopes are briefly outlined below (WRI/WBCSD 2004):

**Scope 1** emissions are direct emissions which occur from sources owned or controlled by the proponent, over which they have a high level of control (such as fuel use).

**Scope 2** emissions are those generated from purchased electricity consumed by the proponent, which can be easily measured and can be influenced through energy efficiency measures. Scope 2 emissions physically occur at the facility where electricity is generated (i.e. the power station).

**Scope 3** emissions are indirect emissions that are a consequence of the activities of the proponent, but occur at sources owned or controlled by another reporting entity (e.g. outsourced services). Scope 3 emissions can include emissions generated upstream of the facility by providers of energy, materials and transport. Scope 3 emissions can also include emissions generated downstream of the facility by providers of product transport.

Scope 1 and 2 emissions were calculated based on the methodologies and emission factors provided by the National Greenhouse Accounts Factors 2016 (DEE 2016). Consistent with the National Inventory Report 2012 (DIICCSRTE 2014), ventilation fugitive emissions were forecast using an implied emissions factor, which was derived from site specific National Greenhouse and Energy Reporting data.

Scope 3 emissions associated with product transport were calculated based on emission factors contained in the National Greenhouse Gas Inventory: Analysis of Recent Trends and Greenhouse Gas Indicators (AGO 2007). Other Scope 3 emissions were calculated using methodologies and emission factors contained in the National Greenhouse Accounts Factors 2016 (DEE 2016).

### 6.9.2 Assessment Assumptions

To complete the greenhouse gas and energy calculations, the following assumptions were made consistent with existing and approved operations at Austar Coal Mine (noting that operations may vary up to approved limits in response to operational requirements):

- the LWB4-B7 Modification will recover an additional 3.65 million ROM tonnes of coking coal over three years
- diesel use intensity, electricity use intensity and fugitive emissions intensity of the LWB4-B7 Modification will be similar to Austar Coal Mine's operations between July 2012 and June 2016
- product yield will average 90 per cent
- average methane percentage of ventilations will not exceed 0.1%, and therefore will not trigger the use of post mining fugitive emission factors

- the rail distance from Austar Coal Mine to Newcastle is approximately 75 kilometres
- all product railed to Newcastle will be exported and shipped an average distance of 9,500 kilometres
- 10,000 tonne of product per annum will be trucked to Newcastle and shipped 1,095 kilometres to Tasmania, consistent with existing approvals
- the return road distance to Newcastle is 100 kilometres
- diesel will be supplied from Newcastle.

## 6.9.3 Assessment Results

The greenhouse emissions associated with the LWB4-B7 Modification were calculated as follows:

- approximately 315,000 tonnes carbon dioxide equivalent (t $CO_2$-e) of Scope 1 emissions from combusting diesel and releasing fugitive emissions
- approximately 132,000 t CO2-e of Scope 2 emissions from consuming electricity
- approximately 9,480,000 t CO2-e of Scope 3 emissions generated by third parties who transport and consume coal products.

Scope 3 emissions dominate the greenhouse gas emissions attributable to the LWB4-B7 Modification. Approximately 95 per cent of the proposed modification's greenhouse gas emissions will occur either upstream or downstream of the Austar Coal Mine and outside the direct operational control of Yancoal. Approximately 5 per cent of the greenhouse gases associated with the LWB4-B7 Modification is related to on-site energy use and fugitive emissions (Scope 1 and 2 emissions).

Scope 1 emissions are expected to contribute 3.2 per cent of total emissions due to the relatively low diesel demands of an underground mine and the relatively low methane content of the coal reserves within the Austar Coal Mine. The coal reserves within the Austar Coal Mine are part of the Newcastle Coalfields, which generally exhibit lower fugitive emissions than the Southern, Hunter and Bowen Coalfields (National Inventory Report 2011). The average methane gas content of ventilation emissions from the Austar Coal Mine during 2015/16 was approximately 0.048% (Austar 2016b).

### 6.9.3.1 Energy Use

The LWB4-B7 Modification is forecast to require approximately 701,000 gigajoules (GJ) of energy from diesel and grid electricity.

The industry average energy use for underground coal mines in Australia ranges between 140 and 490 Megajoules (MJ)/Product tonne (Energetics 2009). The energy use intensity of the LWB4-B7 Modification is expected to average 213 MJ/Product tonne, which sits within the normal operating range for Australian underground coal mines.

## 6.9.4 Impact Assessment

The greenhouse gas emissions generated by the LWB4-B7 Modification have the potential to impact the physical environment and the greenhouse gas reduction objectives of national and international governing bodies. The following assessment makes the distinction between environment impacts and impacts on policy objectives.

#### 6.9.4.1 Impact on the Environment

The LWB4-B7 Modification's greenhouse gas emissions will have a disperse impact as they are highly mobile and are generated up and down the supply chain. The accumulation of greenhouse gases or carbon in 'carbon sinks' is the primary impact of greenhouse gas emissions. Since the industrial revolution, anthropogenic greenhouse gas emissions have accumulated in three major carbon sinks - the ocean (30%), terrestrial plants (30%) and the atmosphere (40%) (BOM and CSIRO, 2014).

The accumulation of greenhouse gases in the atmosphere is an important driver of global warming; sea level rise and climate change (IPCC 2013). Sea level rise and climate change may have many ramifications for the natural and built environment. The accumulation of greenhouse gases in the ocean is an important driver of ocean acidification (IPCC 2013).

The LWB4-B7 Modification's direct emissions are forecast to be approximately 105,000 t $CO_2$–e per annum.

To put the LWB4-B7 Modification's emissions into perspective, under current policy settings, global greenhouse gas emissions are forecast to reach 56,200,000,000 t $CO_2$-e per annum by 2025 (UNEP 2016). During operation, the LWB4-B7 Modification will contribute approximately 0.00019 per cent to global emissions per annum (based on its projected Scope 1 emissions). The Scope 2 and 3 emissions associated with the LWB4-B7 Modification will be generated by greenhouse gas sources outside the LWB4-B7 Modification boundary and are attributable to other projects / facilities.

#### 6.9.4.2 Impact on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) define climate change as a change in the state of the climate that can be identified by changes in the mean and/or variability of its properties, and persists for an extended period, typically decades or longer (IPCC 2007).

Climate change is caused by changes in the energy balance of the climate system. The energy balance of the climate system is driven by atmospheric concentrations of greenhouse gases and aerosols, land cover and solar radiation (IPCC 2007).

Climate change models forecast many different climate change impacts, which are influenced by future greenhouse gas emission scenarios. Climate change forecasts also vary significantly from region to region.

A qualitative assessment of climate change requires a regional reference and future emission trajectory assumptions. The LWB4-B7 Modification, in isolation, is unlikely to influence global emission trajectories. Future emission trajectories will largely be influenced by global scale issues such as; technology, population growth and greenhouse gas mitigation policy. NSW climate change projections have been modelled by the NSW and ACT Regional Climate Modelling (NARCliM) project. NARCliM has modelled climate change projections for 2030 and 2070, using the IPCC high emissions A2 emission trajectory scenario. The A2 scenario assumes (IPCC 2000):

- Relatively slow demographic transition and relatively slow convergence in regional fertility patterns.
- Relatively slow convergence in inter-regional GDP per capita differences.
- Relatively slow end-use and supply-side energy efficiency improvements (compared to other storylines).
- Delayed development of renewable energy.

- No barriers to the use of nuclear energy.

The LWB4-B7 Modification is consistent with the A2 emissions trajectory scenario; therefore the climate change projections developed by NARCliM seem a reasonable basis for a qualitative climate change impact assessment. NARCliM makes the following climate change projections for NSW:

- Maximum temperatures are projected to increase
- Minimum temperatures are projected to increase
- The number of hot days will increase
- The number of cold nights will decrease
- Rainfall is projected to decrease in spring and winter
- Rainfall is projected to increase in summer and autumn
- Average fire weather is projected to increase in summer and spring
- Number of days with severe fire danger is projected to increase in summer and spring (Adapt NSW 2016).

The extent to which global emissions and atmospheric concentrations of greenhouse gases have a demonstrable impact on climate change will be largely driven by the global response to reducing total global emissions that includes all major emission sources and sinks.

#### 6.9.4.3 Impact on Policy Objectives

The United Nations Framework Convention on Climate Change (UNFCCC) is the leading international forum for setting climate change targets and objectives. In 2015 the UNFCCC successfully negotiated an international climate change agreement between 195 countries (the Paris Agreement). The Paris Agreement aims to:

- hold the increase in the global average temperature to well below 2°C above pre-industrial levels, and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels
- increase the ability [of nations] to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production, and
- make finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.

The Paris Agreement seeks to meet its objectives by developing programs and mechanisms that:

- require participating Parties to prepare and communicate greenhouse gas mitigation contributions. Parties are expected to set mitigation targets for 2020, and then develop new targets every five years. Each successive target is expected to represent a larger mitigation effort than the previous target
- promote climate change resilience and adaptation
- provide mitigation and adaptation funding to developing countries

- foster mitigation and adaptation technology transfer between Parties, and
- require participating Parties to report progress towards their mitigation contributions on an annual basis.

Australia's commitment to the Paris Agreement includes reducing greenhouse gas emissions by 26 – 28 per cent, on 2005 levels, by 2030 (Commonwealth of Australia, 2015). To meet the requirements of the Paris Agreement, Australia will also have to develop interim targets for 2020 and 2025.

While the LWB4-B7 Modification is likely to increase the mitigation effort required to reach the 2020 target to some minor extent, the LWB4-B7 Modification itself is unlikely to prevent the Federal Government achieving its national greenhouse gas targets.

### 6.9.5 Greenhouse Gas and Energy Management and Monitoring

Austar has incorporated measures into the proposed modification's design which aim to minimise potential greenhouse gas emissions and improve energy efficiency. The proposed modification requires only minimal additional mine development works and utilises existing infrastructure. Through this efficiency of mine development, the modification inherently minimise greenhouse gas emissions from the mining operations.

The Austar Coal Mine Air Quality and Greenhouse Gas Management Plan reviewed potential for fugitive methane emission management controls for pre-drained coal mine waste gas and ventilation air methane. Technologies such as flaring, methane capture, on-site energy production and thermal flow reversal reactors were all evaluated in 2013, however, the naturally low methane concentrations available in coal mine waste gas and ventilation streams challenged the technical feasibility of all technologies (Austar 2013).

Managing energy use is the primary greenhouse gas management control option at the Austar Coal Mine (Austar 2013). Austar will continue to seek operational energy use efficiencies where commercially feasible.

## 6.10 Cumulative Impacts

The assessment of environmental impacts undertaken for the LWB4-B7 Modification is provided in **Sections 6.1** to **6.9** above. The LWB4-B7 Modification is located within an area surrounded by previous underground mine workings. The potential subsidence impacts of the proposed modification on natural and built features have been assessed and found to be less than those previously experienced in the Stage 2 and Stage 3 LTCC extracted areas. The cumulative impacts of the subsidence associated with the LWB4-B7 Modification Area have been assessed in the context of approved mining within the LWB1-B3 and Stage 3 areas and predicted cumulative subsidence has been found to be less than that predicted for approved Stage 2 and Stage 3 mining areas. Houses and other built infrastructure, including rural buildings, are predicted to remain safe, serviceable and compatible with existing land uses.

The flood modelling results presented in the flooding and drainage assessment (refer to **Section 6.3** and **Appendix 3**) has included consideration of the cumulative impact of all approved mining within the LWB1-B3, Stage 2 and Stage 3 areas in the flood modelling, ensuring consideration of the cumulative landform changes associated with mining in these areas. The cumulative impacts of the LWB4-B7 Modification with all approved mining have been found to be minimal.

The groundwater assessment summarised in **Section 6.4** considers the potential cumulative impacts of previous underground mining in the region when assessing the potential impact on groundwater and found the potential for adverse impact to also be minimal.

The ecological assessment presented in **Section 6.5** concludes that the LWB4-B7 Modification is unlikely to result in a significant impact on vegetation or the habitats of threatened fauna species. Therefore the potential cumulative impact of the LWB4-B7 Modification on the ecological values of the area is not expected to be significant.

The assessment of impacts on Aboriginal cultural heritage presented in **Section 6.5** concludes the LWB4-B7 Modification is unlikely to impact on the archaeological sites identified within the modification area and is therefore unlikely to result in an increase in the cumulative impact on Aboriginal cultural heritage within the area.

The cumulative impact of the LWB4-B7 Modification with surrounding historical and approved mining activities has been considered in the context of land and agricultural capability (refer to **Section 6.8**). Given the minimal land surface and hydrological impacts predicted, it is unlikely to impact on the current or future land and soil capability of the modification area and is considered compatible with existing agricultural, rural residential and mining land uses within the modification area.

The greenhouse gas emissions generated by the proposed modification have been assessed cumulatively in the context of national and global emissions. Consideration of the impact of these emissions on climate change, national policy objectives and international objectives found the proposed modification is unlikely to prevent the Federal Government achieving its objectives.

Overall, the cumulative impact of the LWB4-B7 Modification is considered to be low.

# 7.0 Summary of Management and Monitoring

## 7.1 Subsidence

7.1.1 Austar will submit an Extraction Plan for LWB4-B7 for approval by the Secretary of the Department of Planning and Environment prior to the commencement of secondary extraction of LWB4-B7. The Extraction Plan will incorporate the following management plans:

- Water Management Plan
- Land Management Plan
- Biodiversity Management Plan
- Built Features Management Plan
- Subsidence Monitoring Program
- Public Safety Management Plan.

7.1.2 Where a potential subsidence impact is identified on private property, Austar will prepare a Built Features Management Plan in consultation with the property owner. This plan will clearly outline potential impacts of mining on the property and the management and remediation measures to be implemented.

7.1.3 Subsidence management measures to be implemented as part of the proposed modification will include (where access to private landholdings allow):

- subsidence monitoring lines to be located as determined as part of the Extraction Plan process
- visual assessment of natural features before, during and following mining to detect any subsidence impacts such as surface cracking, irregularities in the subsidence profile, erosion, changes in drainage patterns or loss of water from drainage structures
- detailed subsidence monitoring in accordance with DPE – Resources and Energy requirements
- remediation and rehabilitation of subsidence impacts will be carried out, where required, as soon as practicable following subsidence using methods specified in the Extraction Plan
- building structures located within the LWB4-B7 Modification Area will be inspected by a structural engineer prior to and after undermining and appropriate management measures implemented

- farm dams or water bores within the LWB4-B7 Modification Area will be monitored during and following undermining to ensure they remain in a safe and serviceable condition. Remediation works will be undertaken as required by the Subsidence Advisory NSW in consultation with the landowner

- in the event of any significant loss of water from a privately-owned farm dam, Austar will provide an alternate source of water, as required, until the dam is repaired.

7.1.4 Austar will, prior to undermining of Sandy Creek Road, prepare and implement a Built Features Management Plan to manage any subsidence impacts on the roads and associated culverts in consultation with Cessnock City Council.

7.1.5 Austar will prepare management plans in consultation with relevant service providers (Ausgrid, Telstra), for the protection of infrastructure and services within the LWB4-B7 Modification Area to ensure these remain in a safe and serviceable condition throughout the mining period. These plans will be prepared as part of the Extraction Plan prior to undermining of the services in the LWB4-B7 Modification Area.

7.1.6 Austar will prepare and implement a Built Features Management Plan with DPI Water to manage any subsidence impacts on DPI Water monitoring bores in consultation with DPI Water.

## 7.2 Surface Water and Drainage

7.2.1 Austar will prepare a Water Management Plan that includes the LWB4-B7 Modification Area for approval as part of the Extraction Plan process, in consultation with DPI Water.

7.2.2 Drainage lines will be monitored and any subsidence related impacts effectively remediated, where access is granted, such that there is no significant impact on downstream water users and environmental flows. The Water Management Plan to be prepared as part of the Extraction Plan process will guide the monitoring and management of subsidence impacts and drainage line remediation works on surface water systems, where required. The Water Management Plan will include:

- a monitoring program, including a channel stability monitoring program for those reaches of Quorrobolong Creek where velocity and tractive stress changes have been predicted by the modelling

- a program to complete drainage remediation works in a timely manner where required, post-subsidence

- rehabilitation objectives for drainage line remediation works (if required) such that the rehabilitated drainage lines maintain a similar channel form and sinuosity to the pre-mining environment.

7.2.3 Monitoring results will be reported annually in the Annual Environmental Management Report.

## 7.3 Groundwater

7.3.1 A groundwater monitoring program will be implemented for the LWB4-B7 Modification as outlined in **Appendix 4.** The groundwater monitoring program will be reflected in the Extraction Plan Water Management Plan and will include:

- continued monitoring of water level and water quality in shallow piezometers within the Stage 2 and LWB1-B3 mining area in accordance with the existing Site Water Management Plan (Austar 2013b) and Environmental Monitoring Program (Austar 2013c)

- Establishment of one shallow groundwater monitoring bore in the alluvial area of Quorrobolong Creek at a location above LWB6 or LWB7, and monitoring of water level and electrical conductivity (EC) on a regular basis

- reconcile groundwater monitoring data against rainfall records to assess whether groundwater level changes are the result of longwall mining impacts

- review of the results of groundwater monitoring on a three-monthly basis and report results annually in accordance with Annual Environmental Management Report requirements, consistent with the requirements of the existing Site Water Management Plan (Austar 2013b).

7.3.2 In the unlikely event that damage occurs to DPI Water monitoring bores in the vicinity of the modification area, the bores would be repaired or replaced as required in consultation with DPI Water.

## 7.4 Ecology

7.4.1 Austar will prepare a Biodiversity Management Plan that includes the LWB4-B7 Modification Area for approval as part of the Extraction Plan process.

7.4.2 Ecological monitoring will be undertaken of the River-flat Eucalypt Forest EEC vegetation occurring within the predicted additional 1.5 hectares area of ponding; Lower Hunter Spotted Gum – Ironbark Forest EEC and potential Quorrobolong Scribbly Gum Woodland EEC vegetation (subject to landholder access being granted).

7.4.3 Ecological monitoring will be undertaken of the heath wrinklewort (*Rutidosis heterogama*) population, small-flower grevillea (*Grevillea parviflora subsp. parviflora*) population and the netted bottlebrush (*Callistemon linearifolius*) population, where EEC monitoring indicates further surveys of threatened flora species populations is required.

## 7.5 Heritage

7.5.1 Austar will continue to implement the management strategies that are currently in place at the Austar Coal Mine, including those in the ACHMP (Austar 2017). The ACHMP will be updated to include provisions for the monitoring of identified archaeological sites within the LWB4-B7 Modification Area.

## 7.6 Land Resources and Agriculture

7.6.1 Austar will prepare a Land Management Plan that includes the LWB4-B7 Modification Area for approval as part of the Extraction Plan process.

## 7.7 Greenhouse Gas and Energy

7.7.1 Austar will continue to seek operational energy use efficiencies, where commercially feasible, in accordance with the existing Austar Coal Mine Air Quality and Greenhouse Gas Management Plan.

## 7.8 Vibration

7.8.1 Austar will continue to implement the vibration management strategies that are currently in place at the Austar Coal Mine, including those in the existing Austar Noise and Vibration Management Plan. Vibration monitoring will be undertaken to monitor the potential vibration impacts of the LWB4–B7 Modification, subject to landholder access.

## 7.9 Community

7.9.1 Austar will continue to operate the established Community Consultative Committee. Austar will provide the Community Consultative Committee with regular information regarding the environmental management performance of the LWB4-B7 Modification and any relevant matters regarding community relations.

7.9.2 Austar will notify relevant landholders prior to the commencement of any secondary extraction that could potentially impact their property, in accordance with agreed communication protocols set out in an individual Built Features Management Plan. Regular updates will also be provided as part of the Extraction Plan process.

7.9.3 Austar will maintain a 24 hour per day community information and complaint line.

7.9.4 Austar will provide regular updates of mine development and monitoring on the Austar Coal Mine website.

## 7.10 Environmental Management, Monitoring and Reporting

7.10.1 In addition to specific reporting requirements that may described in the Extraction Plan for LWB4-B7 (should the modification be approved), Austar will incorporate a summary of the subsidence monitoring results into the Annual Environmental Management Report for Austar Coal Mine.

# 8.0 Conclusion

This section provides a conclusion discussing the justification for the proposed modification, taking into consideration the environmental impacts of the proposal and the suitability of the site, to assist the consent authority to determine whether or not the proposed modification is in the public interest.

## 8.1 Environmental Impacts

The potential environmental impacts of the LWB4-B7 Modification have been identified through a preliminary environmental risk assessment process involving:

- assessment of the site characteristics
- review of existing expert technical assessments, management plans and historical monitoring data
- consultation with government agencies and the community
- expert technical advice.

The key issues identified were the subject of comprehensive technical assessment to identify and assess the potential impacts of the LWB4-B7 Modification on the existing environment and community. The results of these assessments are detailed in **Section 6**.

The detailed impact assessments undertaken for the LWB4-B7 Modification conclude that the proposed modification is likely to result in minimal environmental impacts. This is primarily due to the following factors:

- the characteristics of the site
- the depth of cover to proposed mining areas (minimum of 400 metres)
- the panel dimensions and extraction height (about 3.4 metres)
- experience to date in monitoring and management of subsidence in the Stage 2, Stage 3 and LWB1-B3 mining areas
- predicted subsidence parameters and impacts from conventional longwall mining will be less than those previously experienced in Stage 2 and Stage 3 LTCC extracted areas.

## 8.2 Suitability of the Site

The LWB4-B7 Modification Area is located in an area of existing mining leases with an extensive history of underground mining. Access to the LWB4-B7 Modification Area is provided by existing underground mine workings and coal extracted from LWB4-B7 can be transported and processed utilising existing infrastructure within the Austar Coal Mine.

The LWB4-B7 Modification Area is located beneath a mix of Austar owned land, privately owned rural land, and Crown landholdings. The primary land use within and surrounding the modification area is agricultural grazing, with six private rural dwellings located within the area. The topography of the land is generally characterised by low undulating hills and creek flats, with no steep slopes or cliffs. The LWB4-B7 Modification does not involve any additional surface development and due to the predicted minimal impacts on the ground surface associated with subsidence, is unlikely to have any adverse impacts on current land uses. Existing management and monitoring programs will be extended to the LWB4-B7 Modification Area in order to identify and manage potential impacts on these land uses.

## 8.3 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) is one of a number of objectives of the EP&A Act and is defined by Section 6(2) of the *Protection of the Environment Administration Act 1991*. ESD requires the integration of economic and environmental considerations in decision making processes. ESD can be achieved through the implementation of the following principles and programs:

- the precautionary principle
- inter-generational equity
- conservation of biological diversity and ecological integrity
- improved valuation, pricing and incentive mechanisms.

These principles which are discussed further in **Sections 8.3.1** to **8.3.4** have been incorporated into planning and assessment of the LWB4-B7 Modification.

### 8.3.1 The Precautionary Principle

Environmental assessment involves the prediction of potential environmental outcomes of a development. The precautionary principle reinforces the need to take risk and uncertainty into account, especially in relation to threats of irreversible environmental damage.

A preliminary environmental risk analysis was undertaken for the LWB4-B7 Modification to identify key areas for further impact assessment. The results of the risk assessment are summarised in **Section 6.1**. A review of appropriate mitigation measures and strategies was also undertaken as a part of the detailed impact assessment process. The Precautionary Principle has therefore been applied to the assessment of the LWB4-B7 Modification through:

- careful design and review of the proposed modification
- identification of the potential impacts and the likelihood and consequences of these impacts
- identification of management and mitigation measures that are designed to address the potential environmental impacts of the proposed modification
- implementation of monitoring and reporting mechanisms for the modification.

Mitigation and monitoring measures will be set out in the Extraction Plan and associated management plans. Where residual risks are identified, contingency controls have been considered and will be further refined during preparation of the Extraction Plan for the LWB4-B7 Modification Area.

### 8.3.2 Intergenerational Equity

Intergenerational equity is based on the principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. The principles of intergenerational equity are addressed by the LWB4-B7 Modification through the development and implementation of management and mitigation measures that are designed to address the potential environmental impacts of the proposed modification.

### 8.3.3 Conservation of Biological Diversity

A detailed assessment of the ecological and biodiversity impacts of the LWB4-B7 Modification has been undertaken and concluded that the proposed modification will result in minimal adverse impact to the land surface or ecological values of the area.

Austar will continue to implement the management measures currently in place within the Austar Coal Mine, and those proposed as part of a LWB4-B7 Biodiversity Management Plan, to minimise potential impacts on the ecological values of the modification area. Environmental monitoring will be undertaken to determine whether the environmental control measures are operating effectively and enable timely detection of issues and implementation of appropriate management measures if and where required.

### 8.3.4 Valuation and Pricing of Resources

The efficient and non-wasteful management of resources to maximise the welfare of society, both now and for future generations is central to ESD. The modification maximises the efficient use and management of resources through maximising resource utilisation and the recovery of coal that is readily accessible within existing mining leases and with relatively minimal additional development time and cost. In addition the modification maximises the use of existing infrastructure and facilities.

## 8.4 Conclusion

Austar proposes to modify the Bellbird South Consent to allow the transfer and processing of coal from four additional longwalls within the Austar Coal Mine. This EA has been prepared to support the LWB4-B7 Modification application under section 75W of the EP&A Act.

The LWB4-B7 Modification is proposed in order to provide business continuity for the Austar Coal Mine in the medium term. The modification will facilitate the recovery of approximately 3.65 Mt of additional ROM coal and maximises the use of existing infrastructure and facilities. The LWB4-B7 Modification is located within an area surrounded by historical mine workings and will be supported by existing surface infrastructure.

The detailed impact assessments undertaken for the LWB4-B7 Modification conclude that the proposed modification is likely to result in minimal environmental impacts. This is primarily due to the significant depth of cover above the coal seam and panel dimensions, the overlying site characteristics and proposed implementation of existing subsidence monitoring, management and mitigation measures.

The LWB4-B7 Modification is not anticipated to have a significant adverse impact on the land surface, natural or built features or on existing land uses within the modification area.

This EA demonstrates that with the continued implementation of existing management and mitigation measures, the proposed modification can proceed within acceptable environmental standards.

# 9.0 References


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# 10.0 Abbreviations

| | |
|---|---|
| µS/cm | Micro siemens per centimetre |
| AEMR | Annual Environmental Monitoring Report |
| AEP | Annual Exceedance Probability |
| AHD | Australian Height Datum |
| AHIMS | Aboriginal Heritage Information Management System |
| Austar | Austar Coal Mine Pty Ltd |
| BoM | Bureau of Meteorology |
| BMP | Biodiversity management plan |
| CCL | Consolidated Coal Lease |
| CHPP | Coal Handling and Preparation Plant |
| DA | Development Application |
| EA | Environmental Assessment |
| EEC | Endangered ecological community |
| EC | Electrical conductivity |
| EP&A Act | NSW Environmental Planning and Assessment Act 1979 |
| EPA | NSW Environment Protection Authority |
| EPBC Act | Commonwealth Environment Protection and Biodiversity Conservation Act 1999 |
| EPL | Environment Protection Licence |
| ESD | Ecologically Sustainable Development |
| GDE | Groundwater dependent ecosystem |
| GHGEA | Greenhouse Gas and Energy Assessment |
| ha | Hectare |
| ICOMOS | International Council on Monuments and Sites |
| IPCC | Intergovernmental Panel on Climate Change |
| Km | kilometres |
| LEP | Local Environmental Plan |

| | |
|---|---|
| LGA | Local Government Area |
| L/s | Litres per second |
| LTCC | Longwall Top Coal Caving |
| LW | Longwall |
| m | metres |
| mm | millimetres |
| MJ | Mega joule |
| ML | Mining Lease |
| MOP | Mining Operations Plan |
| MSEC | Mine Subsidence Engineering Consultants |
| Mt | Million tonnes |
| Mtpa | Million tonnes per annum |
| NT Act | Commonwealth Native Title Act 1993 |
| OEH | NSW Office of Environment and Heritage |
| PA | Project Approval |
| PMF | Probable Maximum Flood |
| PoEO Act | NSW Protection of the Environment Operations Act 1997 |
| RMS | Roads and Maritime Services |
| ROM | Run of Mine |
| SEPP | State Environmental Planning Policy |
| SRLUP | Strategic Regional Land Use Plan |
| TEC | Threatened ecological community |
| Umwelt | Umwelt (Australia) Pty Limited |
| UNFCCC | United National Framework Convention on Climate Change |
| WM Act | NSW Water Management Act 2000 |
| WSP | Water Sharing Plan |
| Yancoal | Yancoal Australia Limited |