

Image Source: Centennial Mandalong Pty Ltd - Aerial Photo  
 Data Source: LPI - Cadastral Boundaries

0 250 500 750m  
 1:15 000

<b>Legend</b> Dwelling Other Structure Cadastral Boundary Layout for Approved Stage 3 Longwall Panels Proposed Extension of Longwalls A7 to A10 Finish Position	<b>Water Depth (m)</b>	
	Range [0.001 : 0.100]	Range [0.900 : 1.100]
	Range [0.100 : 0.300]	Range [1.100 : 1.300]
	Range [0.300 : 0.500]	Range [1.300 : 1.500]
	Range [0.500 : 0.700]	Range [1.500 : 1.700]
	Range [0.700 : 0.900]	Range [1.700 : 1.900]
		Range [1.900 : 8.000]

FIGURE 6.4

Maximum Modelled Flood Depths  
 - Stage 3 Approved  
 using updated mapping algorithm

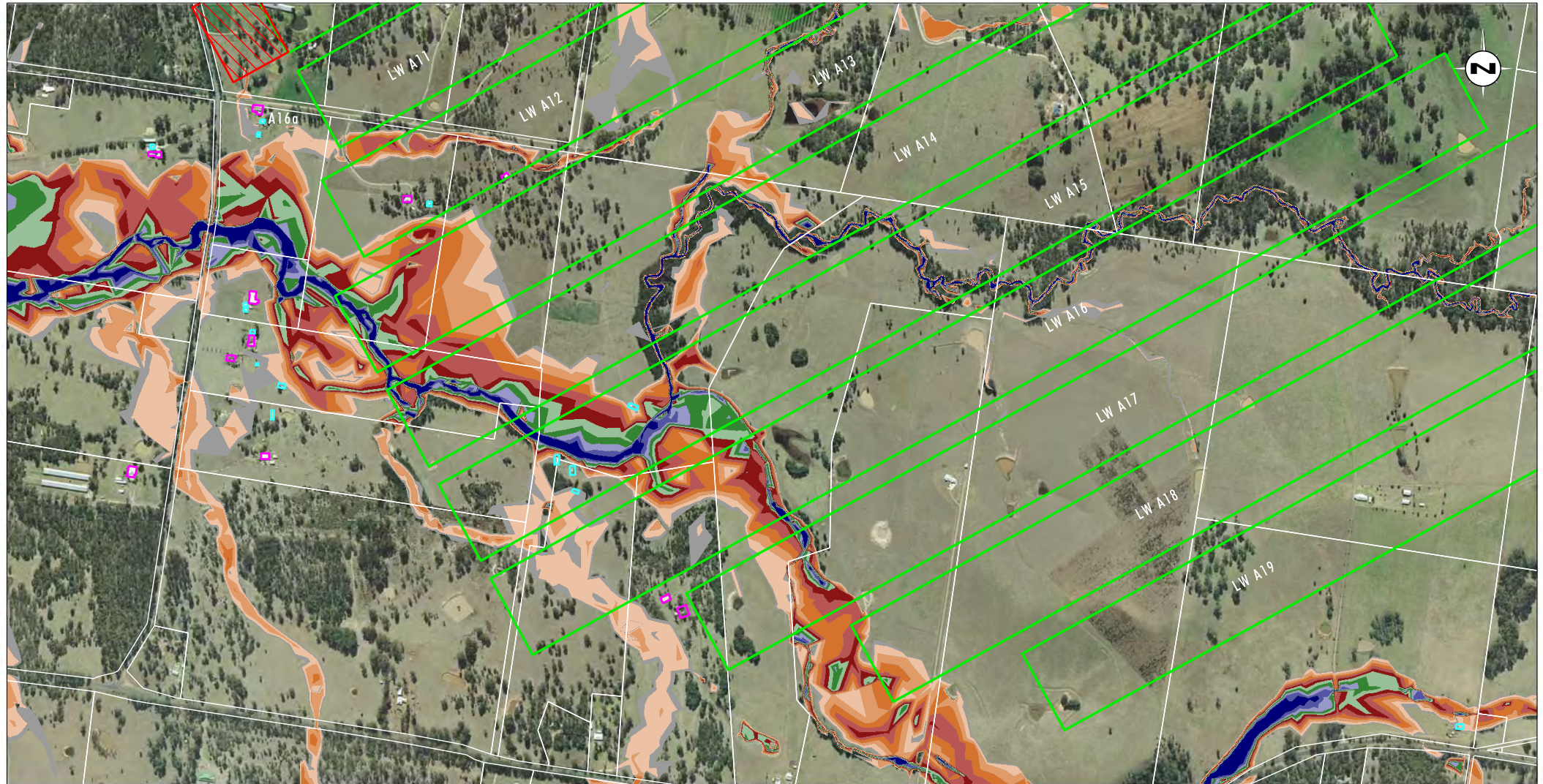


Image Source: Centennial Mandalong Pty Ltd - Aerial Photo  
 Data Source: LPI - Cadastral Boundaries

0 250 500 750m  
 1:15 000

- Legend**
- Dwelling
  - Other Structure
  - Cadastral Boundary
  - Layout for Approved Stage 3 Longwall Panels
  - Proposed Extension of Longwalls A7 to A10 Finish Position

Water Depth (m)	
Range [0.001 : 0.100]	Range [0.900 : 1.100]
Range [0.100 : 0.300]	Range [1.100 : 1.300]
Range [0.300 : 0.500]	Range [1.300 : 1.500]
Range [0.500 : 0.700]	Range [1.500 : 1.700]
Range [0.700 : 0.900]	Range [1.700 : 1.900]
	Range [1.900 : 8.000]

FIGURE 6.5

Maximum Modelled Flood Depths  
 - Stage 3 Proposed

mining area (refer to Umwelt 2012) to explore the potential transient flooding impacts of mining up to longwall A10 at dwelling A16a.

Previous flood modelling indicates that flood levels in Cony Creek in this area are controlled by the Quorrobolong Road crossing. The crossing restricts flows in Cony Creek and causes water to pond creating backwater effects that extend upstream of Quorrobolong Road. The ground elevation at dwelling A16a is approximately 4 metres above the maximum modelled 1 in 100 year ARI flood level in Cony Creek at this location.

The model was used to estimate the 1 in 100 year ARI flood depths within the vicinity of dwelling A16a at the end of mining of Longwall A10 to explore potential transient impacts prior to the downslope landform subsidence resulting from mining of the subsequent Longwalls A11 to A19. By considering the predicted subsidence of the Proposed LWA7–A10 Modification in isolation, the flood modelling assesses the maximum transient changes in slope and the minimum freeboard to the flood backwater within Cony Creek, which are likely to have the greatest impacts on flood depths within the vicinity of dwelling A16a.

The transient flood modelling, combined within the improved flood mapping algorithms, indicates that the maximum modelled flood extent within the vicinity of dwelling A16a is consistent with the modelled flood extents for Stage 2, i.e. the current landform (refer to **Figure 6.6**). The modelling indicates mining of the Proposed LWA7–A10 Modification will have little impact on flood depths within the vicinity of dwelling A16a (refer to **Figure 6.6**), with the residence remaining flood free as a result of the Proposed Modification.

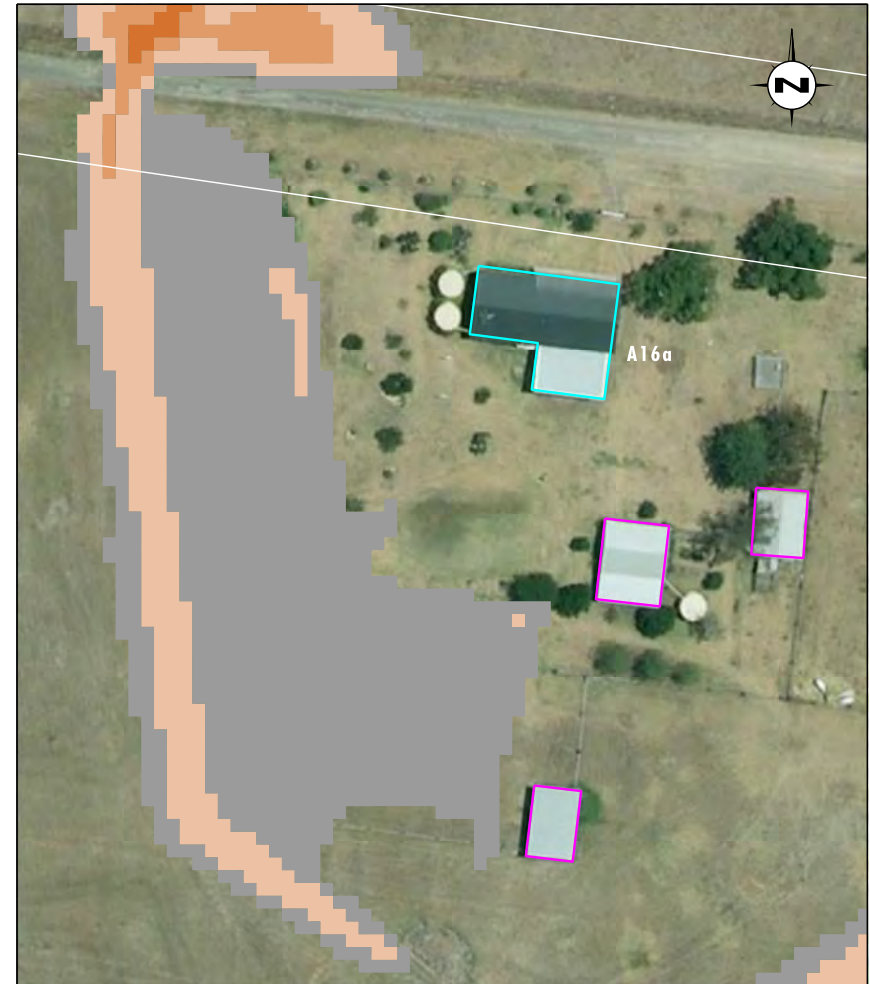
Modelling was also undertaken to explore flooding impacts of the LWA7-A10 Modification at the end of mining longwall A19. Maximum predicted subsidence at dwelling A16a at the end of mining longwall A7 to A19 is approximately 200 millimetres indicating that the dwelling will remain well above the maximum predicted 1 in 100 year flood level in Cony Creek. To verify this, the digital terrain model used in the RMA-2 hydrodynamic flood model (Umwelt, 2011b) has been modified to include the predicted changes to subsidence across Longwall A7 to Longwall A19 as a result of the Proposed LWA7–A10 Modification and flooding impacts have then been subsequently re-assessed. **Figure 6.7** indicates that there is no significant change to the approved 1 in 100 year ARI flooding impacts at dwelling A16A as a result of the Proposed LWA7–A10 Modification and that dwelling A16a remains outside of the maximum modelled 1 in 100 year ARI flood extent.

#### 6.3.4 Summary of Surface Water Impacts

A review of the potential changes in surface water impacts associated with the Proposed LWA7–A10 Modification from those assessed and approved under Project Approval 08\_0111 has been completed. The assessment has been undertaken with consideration to the *Draft Significant Impact Guidelines: Coal Seam Gas and Large Coal Mining Developments – Impacts on Water Resources* (DSEWPAC 2013), and is based on the findings of the revised flood modelling outlined in **Section 6.3.2** and subsidence impact assessments for Stage 3 (MSEC 2011 and 2013). The results of the review are presented in **Table 6.11**.



Approved Stage 2 Modification (Updated)



Proposed Stage 3 Modification (Transient up to LW A10)

Image Source: Google Earth (2009)  
Data Source: LPI - Cadastral Boundaries

Legend		Water Depth (m)	
	Dwelling		Range [0.001 : 0.100]
	Other Structure		Range [0.100 : 0.300]
	Cadastral Boundary		Range [0.300 : 0.500]
			Range [0.500 : 0.700]
			Range [0.700 : 0.900]
			Range [0.900 : 1.100]
			Range [1.100 : 1.300]
			Range [1.300 : 1.500]
			Range [1.500 : 1.700]
			Range [1.700 : 1.900]
			Range [1.900 : 8.000]

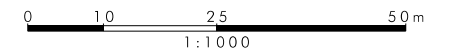
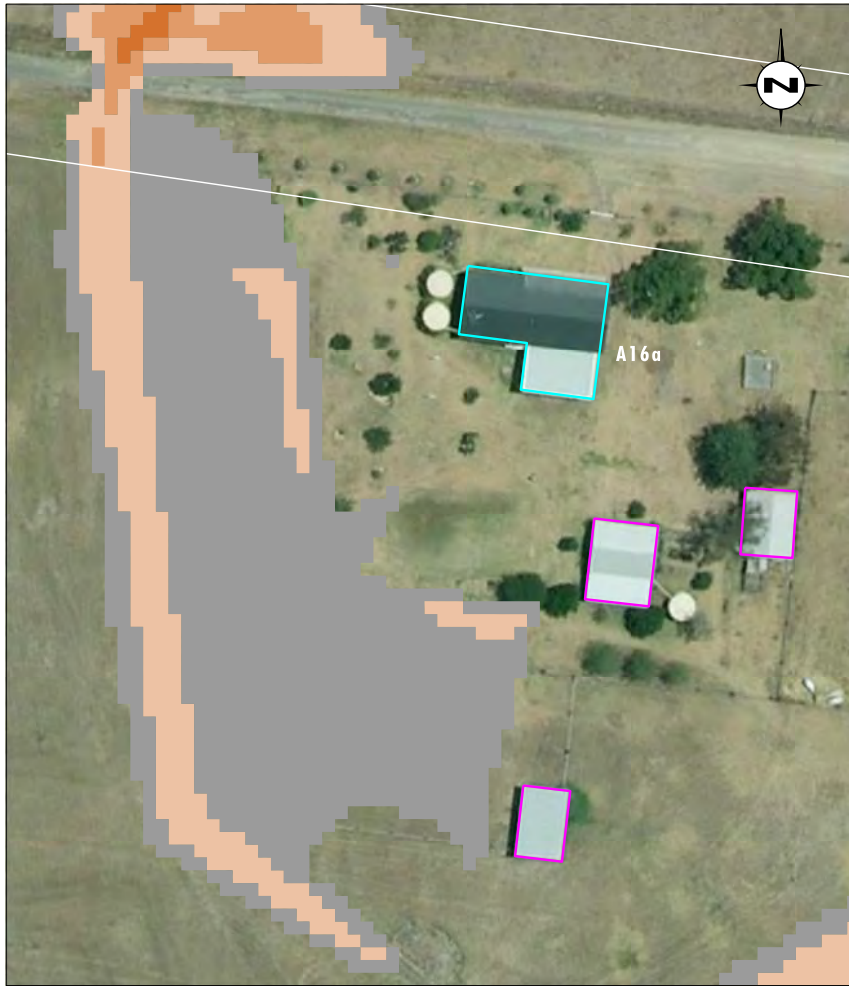
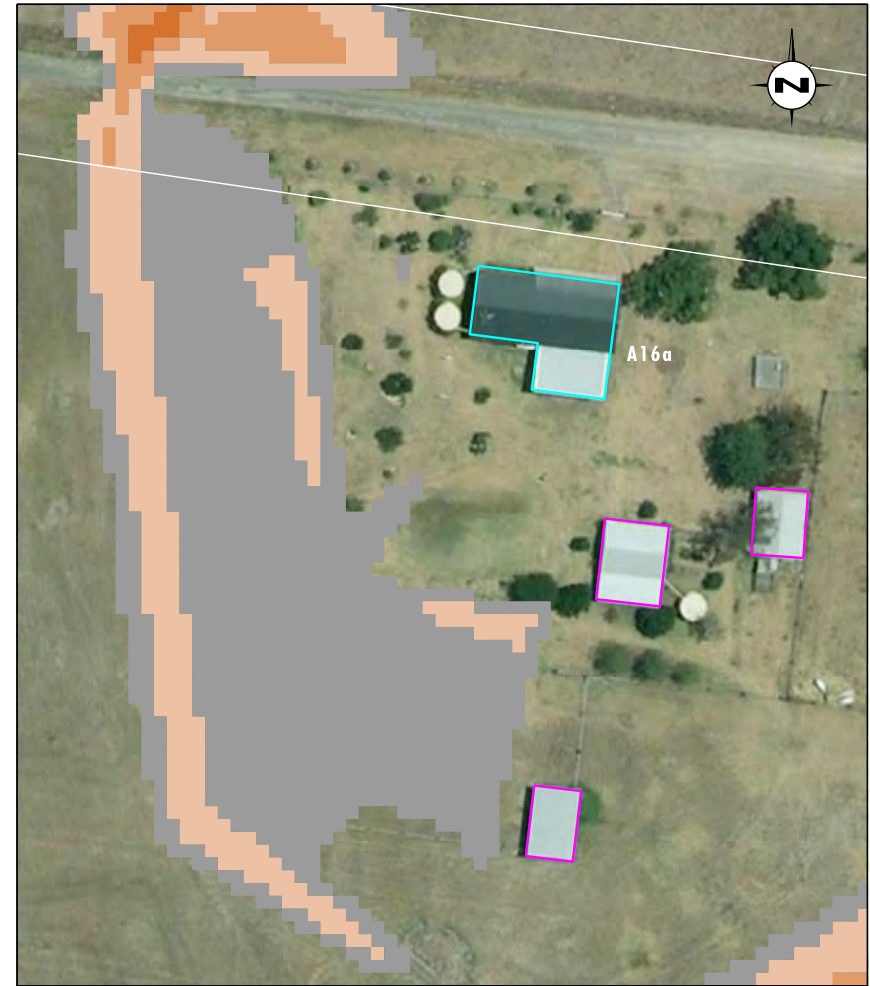


FIGURE 6.6  
Maximum Modelled Flood Depth,  
A16 Residence  
Approved Stage 2 and Proposed Stage 3 Modification up to LW A10



Approved Stage 3 (Umwelt 2011 using updated mapping algorithm)



Proposed Stage 3 Modification

Image Source: Google Earth (2009)  
Data Source: LPI - Cadastral Boundaries

Legend		Water Depth (m)	
	Dwelling		Range [0.001 : 0.100]
	Other Structure		Range [0.100 : 0.300]
	Cadastral Boundary		Range [0.300 : 0.500]
			Range [0.500 : 0.700]
			Range [0.700 : 0.900]
			Range [0.900 : 1.100]
			Range [1.100 : 1.300]
			Range [1.300 : 1.500]
			Range [1.500 : 1.700]
			Range [1.700 : 1.900]
			Range [1.900 : 8.000]

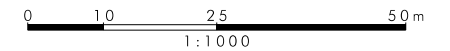


FIGURE 6.7  
Maximum Modelled Flood Depths  
A16 Residence  
Approved Stage 3 and Proposed Modification up to LW A19

**Table 6.11 – Summary Surface Water Impact Assessment**

<b>Aspect</b>	<b>Assessment of Impact</b>
Flow Regimes	The Proposed LWA7–A10 Modification is unlikely to cause significant changes to flow regimes from that approved under Project Approval 08_0111 due to the minor nature of the change in subsidence impact in the vicinity of the floodplain. Changes to flood extent and flow regimes will be negligible and there is minimal potential for channel realignment to occur. The potential for mining to result in stream capture within Quorrobolong and Cony Creeks is also considered negligible. The location of the Proposed LWA7–A10 Modification in the upslope areas of the catchment, away from the floodplain, indicates that the Proposed LWA7–A10 Modification will not impact significantly on the floodplain or alter flow regimes from those previously approved under Project Approval 08_0111. Further information on flooding and drainage is provided in <b>Section 6.3</b> .
River/floodplain connectivity	No significant changes to river/floodplain connectivity are predicted as a result of the LWA7-A10 Modification. The predicted subsidence indicates negligible changes to the remnant surface ponding in the area to be undermined are likely.
Impact on water users	The Proposed LWA7–A10 Modification will not significantly change water availability surface water users from that predicted for the approved Stage 3 mine plan. Previous modelling undertaken for the Stage 3 Project indicates that longwall extraction will not have a significant impact on runoff or flow regimes in the Sandy Creek and Cony Creek systems, and the potential for mining to result in stream capture within these systems is negligible.
Flooding	Subsidence impacts associated with Proposed LWA7–A10 Modification are located outside the maximum modelled 1 in 100 year ARI flood extent for Cony Creek and Black Creek and are therefore expected to have a negligible impact on flooding in these catchments. A comparison with the 1 in 100 year ARI flood extent for Project Approval 08_0111 indicates that the proposed modification does not significantly alter the approved flood impacts within the Cony Creek catchment. The Proposed LWA7–A10 Modification is also unlikely to have an adverse flooding impact on dwellings or other infrastructure within or adjacent to the Cony Creek floodplain.
Flood hazard	Subsidence impacts associated with the Proposed LWA7-A10 Modification will not change flood hazard from that approved under Project Approval 08_0111.

### 6.3.5 Surface Water Management and Monitoring

No significant change to the approved surface water impacts of the Stage 3 Project are anticipated as a result of the LWA7-A10 Modification. Therefore no change is proposed to the existing approved management and monitoring strategies set out in the Austar Site Water Management Plan (Austar 2013b) and Environmental Monitoring Program (Austar 2013d). With the continued implementation of these existing approved management strategies, it is unlikely that there would be any adverse impacts on surface water as a result of the Proposed LWA7-A10 Modification.

## 6.4 Groundwater

A detailed Groundwater Impact Assessment for Stages 2 and 3 of Austar Coal Mine was undertaken by Connell Wagner (October 2007). Key aspects of Connell Wagner (October 2007) relevant to the proposed modification development, are summarised below.

## 6.4.1 Existing Groundwater Resources

There are three potential sources of groundwater that form an integral part of the local hydrogeological regime in this area:

- alluvial aquifers;
- fractured rock aquifers (including coal seam aquifers); and
- abandoned coal mines.

The distribution, characteristics and importance of these water sources are summarised in the following subsections.

### 6.4.1.1 Alluvial Aquifers

The alluvial aquifers in proximity to the Proposed LWA7–A10 Modification Area are associated with Quorrobolong Creek and its tributaries which flow in a general westerly direction to the south of the LWA7–A10 Modification Area. The tributaries to the south of the LWA7–A10 Modification Area, including Sandy Creek and Cony Creek, are second to fifth order streams, and comprise a series of intermittent creeks, which only flow after consistent or heavy rainfall. These creeks have shallow alluvium-filled valleys ranging in width up to 400 metres and support shallow, low yielding groundwater resources that exhibit no major water bearing zones. Due to the very low vertical permeability of the underlying rock strata, there is very little vertical leakage of groundwater from the alluvium, and it is essentially isolated hydraulically from the rest of the hydrogeological regime.

The extent of the defined alluvium associated with this creek system in relation to the LWA7–A10 Modification Area is shown on **Figure 6.8**. The proposed extension of Longwall A10 is located greater than 300 metres north of the alluvial area and at a depth of approximately 550 metres, well below the shallow alluvial deposits.

The variable composition and excessive fines content in the alluvium indicate that its overall permeability is not likely to be high, and yields from any water bores would generally be expected to be low. The limited data available also suggests that the groundwater quality is normally fair, and generally suitable for stock use but not domestic consumption. Consequently, as an aquifer, the alluvium is of limited use as a groundwater resource. This is supported by a lack of registered bores in the area. The NSW Water Information database of groundwater bores indicates that there are no registered bores within the local area that extract water from the shallow alluvial deposits of Quorrobolong or Cony Creeks.

Monitoring of the Quorrobolong Creek/Cony Creek alluvial groundwater resource has been undertaken by Austar as part of Stage 2 mining. Four monitoring piezometers are located within the alluvium in the Stage 2 area (AQD1073A, WBH1, WBH2 and WBH3 shown on **Figure 6.8**). Monitoring results during Stage 2 mining have shown no identifiable impact of mining on the shallow or alluvial aquifers (Austar 2012).

### 6.4.1.2 Fractured Rock Aquifers

Permian strata overlying the coal measures in the Newcastle Coalfield generally have very low permeability ( $<10^{-8}$  m/s). Fractured rock aquifers generally comprise localised jointed or fractured zones, often adjacent to major faults.

Fractured rock aquifers have the potential for high flows, since they are confined aquifers and are at a relatively high pressure. Nevertheless, flows are often small in these zones, and water quality is generally poor and suitable only for stock use at best. Due to the very low

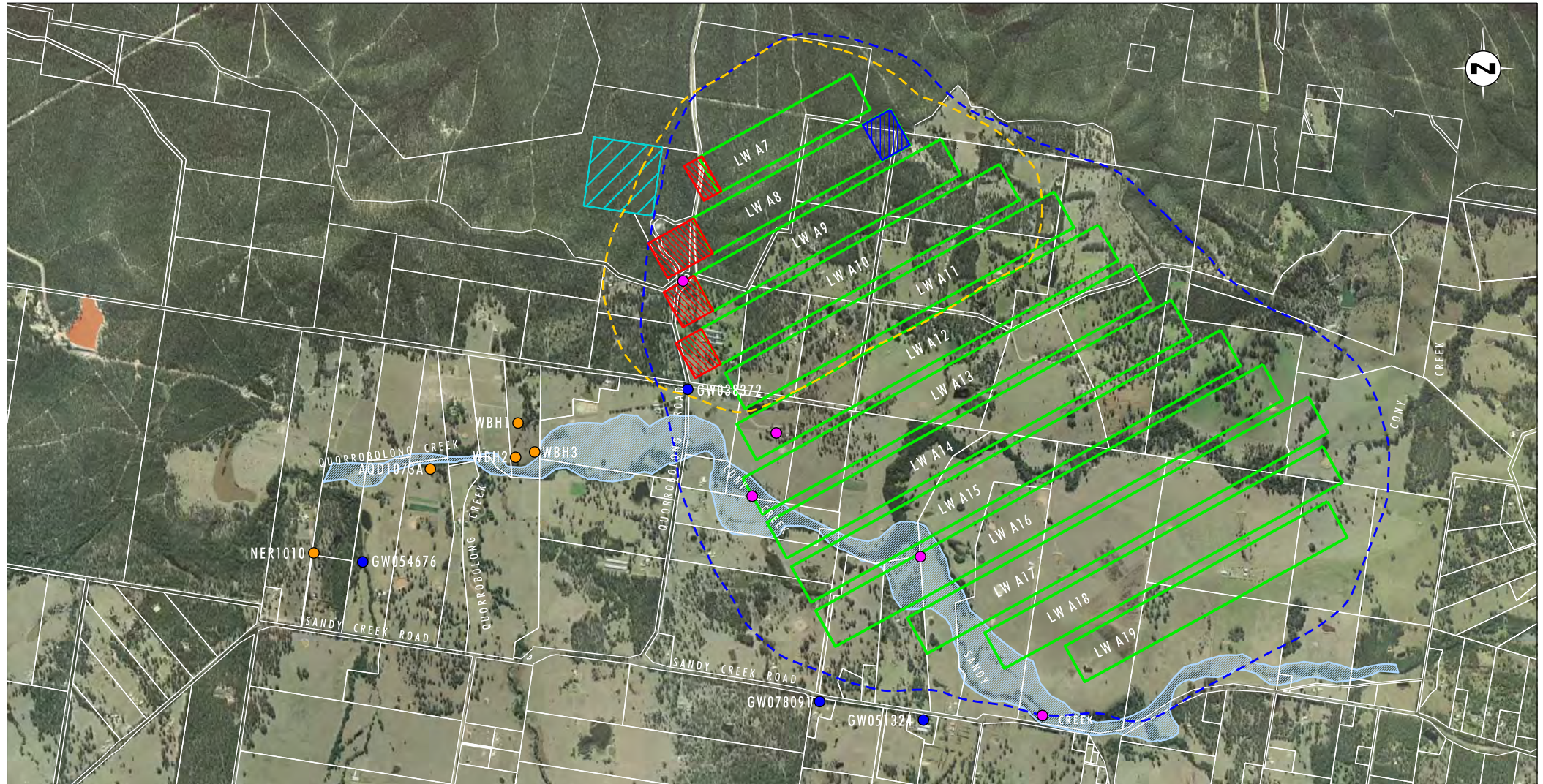


Image Source: AAM Hatch (2006)  
 Data Source: Austar Coal Mine (2013), LPI NSW (2009)

0 0.5 1 1.5 km  
 1:32 000

- Legend**
- Layout for Approved Stage 3 Longwall Panels
  - 20mm Subsidence Contour for Approved Stage 3 Longwall Layout
  - Proposed LW A7-A10 Modification Area
  - Approved Surface Infrastructure Site
  - Proposed Retraction of Longwall A8 Start Position
  - Proposed Extension of Longwalls A7 to A10 Finish Position
  - Alluvial Area
  - Existing Austar Monitoring Locations
  - Groundwater Bore Locations
  - Proposed Groundwater Monitoring Sites (Stage 3)

**FIGURE 6.8**  
 Extent of Alluvium and  
 Groundwater Monitoring Locations



vertical permeability of the Permian strata, there is very little leakage between any water-bearing zones or aquifers.

The occurrence of fractured rock aquifers overlying the Stage 3 mining area comprise those associated with the Branxton Formation and those associated with Greta Coal Seam.

The Branxton Formation contains few if any major fractured rock aquifers due to its massive nature. The permeability of the Branxton Formation strata is very low and not likely to provide a viable source of groundwater. Drilling indicates potential water-bearing zones in the Branxton Formation at a depth of 70 to 100 metres below the surface in the vicinity of Stage 2 and Stage 3 mining areas, however Connell Wagner (2007) conclude that the importance of this groundwater as a water resource is likely to be minimal, since the water quality in these water-bearing zones is poor and the yield low.

There are three registered bores within the near vicinity of the Stage 3 longwall panels that intersect the Branxton Formation strata. These bores range in depth from 9.1 to 55 metres and all three attempt to tap fractured zones in the upper Branxton Formation. All three bores are low yielding and poor quality. The poor groundwater quality in the Branxton Formation is largely due to the fact that the rocks were formed in a marine environment.

Previous experience in the Newcastle Coalfield has shown that the permeability of the strata in the Branxton Formation is normally very low. The sandstone is generally strong and massive with a silica and/or clay matrix. As a result, the interstitial permeability is negligible, and any measured permeability derives from fractures and joints.

Monitoring of the fractured rock aquifer has been undertaken by Austar as part of Stage 2 mining. One monitoring piezometer is located within the fractured rock aquifer in the Stage 2 area (NER1010 shown on **Figure 6.8**). Monitoring results during Stage 2 mining have shown no identifiable impact of mining on the fractured rock aquifers (Austar 2012).

#### **6.4.1.3 Coal Measures**

Like the Permian strata, the rocks in the Greta Coal Measures also have very low permeability ( $<10^{-8}$  m/s). The coal seams are normally the water-bearing zones in the coal measures due to the presence of cleats and fractures in the rock mass. Hitchcock (1995) concludes that the coal measures in the Newcastle Coalfield 'have a poor resource potential with low yielding aquifers of high salinity'.

Permeability of the Greta Seam decreases with depth. The importance of the seam as an aquifer is minimal, as it contains poor quality groundwater.

#### **6.4.1.4 Abandoned Mine Workings**

As shown on **Figure 2.1** there are several abandoned collieries adjacent to the Austar mine which are partially filled with groundwater. In addition to normal groundwater percolation into these workings, they also receive water from several other mine related sources. The quality of the water contained in the abandoned mine workings is extremely poor.

### **6.4.2 Groundwater Impact Assessment**

A review of the potential change in groundwater impacts associated with the Proposed LWA7–A10 Modification from those assessed and approved under Project Approval 08\_0111 has been completed. The assessment has been undertaken with consideration to the *Draft Significant Impact Guidelines: Coal Seam Gas and Large Coal Mining Developments – Impacts on Water Resources* (DSEWPAC 2013), and is based on the findings of the Stage 3 Groundwater Impact Assessment (Connell Wagner 2007) and Stage 3 subsidence impact assessments (MSEC 2011 and 2013). The results of the review are presented in **Table 6.12**.

**Table 6.12 – Groundwater Impact Assessment**

<b>Aspect</b>	<b>Assessment of Impact</b>
Recharge Rates	In the case of underground mining, the most likely cause of impact to recharge rates is surface cracking. Only minor surface cracking is expected to occur in the LWA7-A10 Modification Area due to low levels of tensile strain predicted to occur (Connell Wagner, 2007; MSEC, 2013). Subsidence monitoring in the Stage 2 area and the Subsidence Assessment completed by MSEC (2013) indicate that tensile strain and surface cracking are likely to be consistent with that previously predicted for the Stage 3 area, and observed cracking from similar mining elsewhere in the Austar Mining Complex supports subsidence predictions and assessment by MSEC.
Aquifer pressure or pressure relationships between aquifers	The Proposed LWA7–A10 Modification will not significantly change aquifer depressurisation from that predicted for the approved Stage 3 mine plan. The total underground storage void created by Stage 3 mining will remain consistent with that previously approved under Project Approval 08_0111. No significant changes to groundwater inflow beyond that approved under Project Approval 08_0111 are predicted as a result of the Proposed LWA7-A10 Modification.
Groundwater table levels	Due to the geomorphology of the area, including broad and relatively shallow valleys and no confined gorges or deep valleys, and the massive structure of the Branxton Formation that extends from the Greta Coal Seam to the surface, the potential for upsidence or valley closure impacts to occur, or to adversely impact on groundwater in the shallow alluvium of the LWA7-A10 Modification Area is considered to be negligible. A comprehensive monitoring program for the alluvium in the Stage 2 area has not shown any indication of loss of water from the alluvium as a result of mining (Austar 2012).
Groundwater/surface water interactions	The Proposed LWA7–A10 Modification is unlikely to change fracturing height above the proposed mine workings compared to predictions for the approved longwall layout. Based on modelling and assessment work by MSEC (2013) and Connell Wagner (2007) and monitoring of fracture heights within the Stage 2 mining area, the height of the fracture zone above longwalls is estimated to be between approximately 245 to 285 metres. Given the minimum depth of cover within the Proposed LWA7-A10 Modification Area of 455 metres, interaction between surface water and mine workings is unlikely.
Inter-aquifer connectivity	As noted above, the Proposed LWA7–A10 Modification is unlikely to change fracturing height above the proposed mine workings compared to predictions for the approved longwall layout. Based on modelling and assessment work by MSEC (2013) and Connell Wagner (2007), the shallow and alluvial aquifers will remain unaffected by hydraulically interconnected cracking above the proposed mine workings.
Impact on water users	The Proposed LWA7–A10 Modification will not significantly change impacts on groundwater users from that predicted for the approved Stage 3 mine plan. There is a general lack of groundwater bores within the LWA7-A10 Modification Area, reflecting the low yielding and poor quality of the shallow alluvial and fractured rock aquifers present (Connell Wagner 2007). The potential for underground mining to impact on groundwater in the alluvium or shallow rock aquifers, including groundwater levels, is considered negligible (Connell Wagner 2007).

### 6.4.3 NSW Aquifer Interference Policy

Predicted groundwater impacts associated with the Proposed LWA7–A10 Modification have been assessed in relation to the NSW Aquifer Interference Policy which requires any mining activity to consider ‘Minimal Impact Considerations’ with respect to groundwater sources. Key criteria to demonstrate minimal impact include:

- less than 10 per cent variation in the water table within the alluvial lands;
- a maximum 2 metre decline at any water supply work; and
- no mining activity to be within 200 metres laterally from the top of high bank or 100 metres vertically beneath of a highly connected surface water source that is defined as a ‘reliable water supply’.

All three of the above criteria are satisfied by the Project and, as discussed above, the potential for underground mining to impact on groundwater in the alluvium associated with Quorrobolong Creek and Cony Creek, or the shallow rock aquifers, is considered negligible.

### 6.4.4 Groundwater Management and Monitoring

As described above and in Connell Wagner (2007), the potential for underground mining to impact on groundwater in the alluvium or shallow rock aquifers is considered negligible, and this has been supported by monitoring data to date. As a precautionary measure water levels in the shallow aquifers and the alluvium will continue to be monitored on a regular basis, in accordance with the existing Site Water Management Plan (Austar 2013b) and Environmental Monitoring Program (Austar 2013d).

The monitoring and management regime outlined in the Site Water Management Plan (Austar 2013b) and Environmental Monitoring Program (Austar 2013d) is considered appropriate for the LWA7-A10 Modification.

## 6.5 Ecology

An ecological survey and assessment has been prepared for the Proposed LWA7–A10 Modification by Umwelt and is included as **Appendix 4**, and a summary of the assessment is provided below.

An extensive level of ecological survey and assessment has occurred across the broader Stage 3 Project area and Austar Mine Complex, including those undertaken for the Stage 3 Project and subsequent modification. Further ecological survey conducted for the Proposed LWA7–A10 Modification was therefore designed to build on the extensive existing information available within the area, to ground truth existing vegetation mapping and identify any potential threatened species and habitats present, or with the potential to occur in the LWA7–A10 Modification Area. The methodology included a review of existing relevant vegetation mapping, reports and literature, as well as searches of relevant ecological databases. The field inspection was conducted over one day in September 2013 by two ecologists and consisted of flora and fauna surveys. Further details of the survey methodology are provided in **Appendix 4**.

## 6.5.1 Existing Environment

### 6.5.1.1 Flora

Extensive ecological surveys of the Austar Mine Complex, including those completed for the approved Stage 3 Project (Umwelt 2008c and 2011c) and the current survey undertaken for the proposed modification, have recorded a total of 317 flora species within and in the vicinity of the Stage 3 mining area. Given the similarities in habitat and the overlap of the project area boundaries, it is considered likely that many of these flora species would occur within the Proposed LWA7–A10 Modification Area. Of the 317 species recorded, 274 are native and 43 are introduced.

Two threatened flora species have been recorded within the previously assessed Stage 3 Area, heath wrinklewort (*Rutidosia heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). Both species were recorded in the northern portions of the LWA7-A10 Modification Area, and both are listed as vulnerable under the TSC Act and the EBPC Act.

One additional probable threatened species was also recorded within the Proposed LWA7–A10 Modification Area, netted bottle-brush (*Callistemon linearifolius*). Confirmation of this species is pending from the Royal Botanic Gardens and, if confirmed, is listed as vulnerable under the TSC Act.

The location of the three recorded threatened species within the LWA7–A10 Modification Area is shown on **Figure 6.9**. It is noted that some of the threatened flora species recorded within the Kitchener Surface Infrastructure Site have since been removed as a result of clearing for construction of this facility in accordance with Project Approval 08\_0111.

A review of threatened flora species compiled from ecological database searches and a literature review identified a further four threatened flora species with the potential to occur within the LWA7–A10 Modification Area, however as none of these species had been recorded and the Proposed LWA7–A10 Modification will not modify any habitat requirements for these species, there was not considered to be any potential for a significant impact on these species.

### 6.5.1.2 Vegetation Communities

The vegetation communities of the LWA7–A10 Modification Area are shown on **Figure 6.9**. The area is dominated by Spotted Gum – Ironbark Forest EEC occupying the northern and central parts of the LWA7–A10 Modification Area. The community occupies the dry slopes and crests where soil is relatively infertile and is widespread within the local area, being the dominant community in the Werakata National Park and State Conservation Area to the north. The net area of this community potentially impacted by subsidence will increase by approximately 16.7 hectares as a result of the LWA7-A10 Modification.

Other communities present within the LWA7–A10 Modification Area include derived grassland with scattered canopy trees and derived grassland with pasture. These communities are associated with private rural landholdings in the south which have been cleared for grazing. A small area of Riparian Red Gum Forest is present immediately to the east of longwall A10 associated with drainage flats in this location (refer to **Figure 6.9**). The Riparian Red Gum Forest has strong floristic similarities with River-Flat Eucalypt Forest EEC and the geomorphology of the area in which this community is mapped is also consistent with the River-Flat Eucalypt Forest EEC, hence the Riparian Red Gum Forest in this location has been mapped as the EEC. No change to the extent or nature of subsidence impacts on this community is predicted as a result of the Proposed LWA7–A10 Modification.

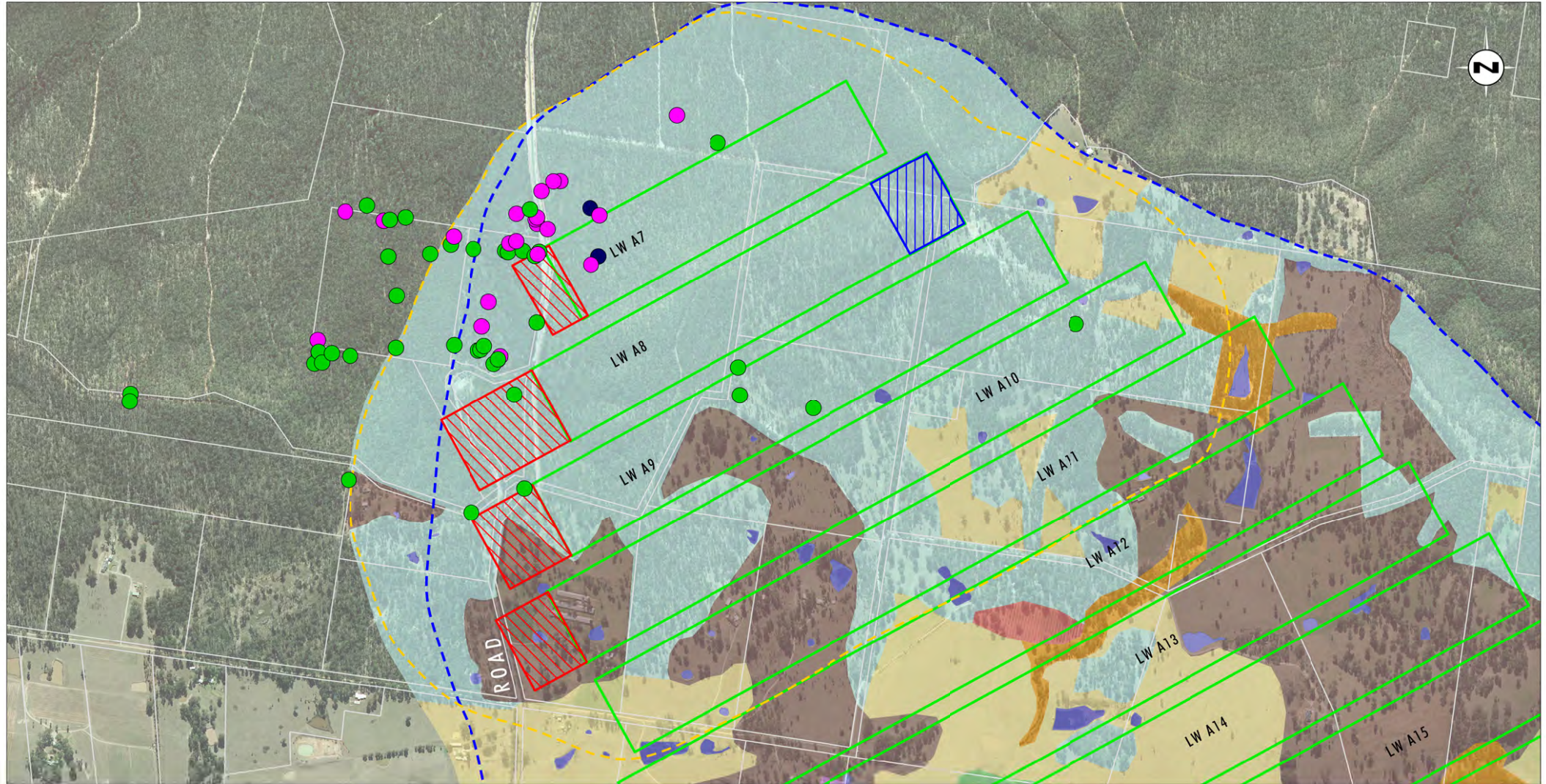


Image Source: AAM Hatch (2006)  
 Data Source: Austar Coal Mine (2013), LPI NSW (2009)

0 200 400 800m  
 1:16 000

**Legend**

- |  |  |   |
|--|--|---|
| Layout for Approved Stage 3 Longwall Panels                  | Cultivated                                     | Swamp Oak Riparian Forest                     |
| 20mm Subsidence Contour for Approved Stage 3 Longwall Layout | Dam  | Woollybutt Open Forest Remnant                |
| Proposed LW A7-A10 Modification Area                         | Derived Grassland / Pasture                    | <i>Rutidosia heterogama</i>                   |
| Proposed Retraction of Longwall A8 Start Position            | Derived Grassland with Scattered Canopy Trees  | <i>Grevillea parviflora subsp. parviflora</i> |
| Proposed Extension of Longwalls A7 to A10 Finish Position    | Riparian Red Gum Forest - EEC                  | <i>Callistemon prob. linearifolius</i>        |
|  | Lower Hunter Spotted Gum Ironbark Forest - EEC |   |

FIGURE 6.9

**Vegetation Communities and Threatened Species Records**

### 6.5.1.3 Fauna

A total of 125 fauna species have been recorded during surveys undertaken for the Stage 3 Project, including 17 recorded opportunistically during surveys undertaken for the currently proposed modification. It is considered likely that the majority of these 125 species are present within the LWA7–A10 Modification Area, particularly within the higher quality area of habitat within Werakata State Conservation Area.

Two broad fauna habitat types occur within the LWA7–A10 Modification Area, open forest and derived grassland. The open forest habitat occurs on the drier slopes and crests within the northern and central portions of the LWA7–A10 Modification Area, providing foraging and roosting habitat for a variety of small woodland birds, mammals, micro-bats and reptiles. A few larger hollow bearing trees provide limited nesting habitat for hollow-dependent fauna. Much of the southern portion of the LWA7–A10 Modification Area consists of open grassland habitats which have been heavily cleared and grazed. These areas provide foraging habitat for some micro-bats, macropods and some bird species.

A total of 13 threatened fauna species have been previously recorded within the broader Stage 3 Project area. None of these species were considered to have the potential to be impacted by the Proposed LWA7–A10 Modification as the project is not considered likely to modify the habitat requirements of these species.

Consideration was also given to threatened species with the potential to occur within the LWA7–A10 Modification Area based on database searches and literature review. Of the threatened species with the potential to occur, none were considered to have the potential to be impacted by the Proposed LWA7–A10 Modification. In relation to the Commonwealth listed swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera Phrygia*), a precautionary approach was undertaken with a full assessment of significance completed for these species. The swift parrot is listed as endangered under the TSC Act and EPBC Act, while the regent honeyeater is listed as critically endangered under the TSC Act and endangered under the EPBC Act. Each of these species were assessed in accordance with the requirements of the TSC Act and EPBC Act (refer to **Section 6.5.2**).

### 6.5.1.4 Aquatic Ecology

A number of small farm dams located within the southern portion of the LWA7–A10 Modification Area were inspected and found to have very little edging vegetation and considered to provide little value for native fauna species.

A small number of unnamed ephemeral tributaries were also inspected and while the vegetation in these areas tended to have greater densities of paperbark (*Melaleuca* spp.) and sedge species, the vegetation was not substantially different from that of surrounding vegetation. No permanent areas of aquatic habitat were identified along these tributaries.

## 6.5.2 Ecological Impact Assessment

### 6.5.2.1 Potential Impacts

The proposed modification does not involve any vegetation clearing. The principal potential surface impact resulting from the Proposed LWA7–A10 Modification is subsidence, the extent of which is dependent on a number of factors including the depth of the coal seam worked, the design and location of the mine, the topography of the landscape, the nature of the overlying rock stratum, the width of the chain pillars and the ratio of the depth of overburden to the longwall panel width (NSW Scientific Committee 2005). Subsidence relating to longwall mining may result in secondary impacts, which typically impact greatest

on riparian ecosystems and potential cliff line habitat for specific fauna species. Broadly, potential changes to riparian environments that may be expected to occur as a result of longwall mining include:

- changes to runoff and flow volumes through subsidence induced changes to catchment boundaries;
- changes to bank stability and channel alignment;
- changes to in-channel and out of channel ponding through changes to the bed profile of the creeks which may result in drying or waterlogging of root systems; and
- loss of water to near-surface groundwater flows due to subsidence-induced cracks occurring beneath a stream or other surface water body (valley closure).

Due to the geology of the area, the mine layout and the depth of cover to the coal seam (approximately 455 to 575 metres) within the LWA7–A10 Modification Area, the subsidence predicted to occur as a result of the proposed longwall mining is not expected to significantly impact on runoff regimes, bank stability, channel alignment, in-channel and out of channel ponding or groundwater availability. There are also no cliff lines located within the Proposed LWA7-A10 Modification Area. Subsidence predictions indicate that as for the approved Stage 3 Mining Area, subsidence will occur reasonably consistently. The Proposed LWA7–A10 Modification is predicted to result in similar subsidence, tilt and curvature to that approved under Project Approval 08\_0111. As a result the subsidence, flood and drainage predictions are very similar to those documented for the approved Stage 3 Project (Umwelt 2008a and 2011a). Consequently, subsidence impacts are not expected to have a significant impact on the ecology of the area.

Given the predicted subsidence impacts on the landform surface are expected to be minimal, as are secondary impacts on flooding and drainage, the potential impacts on the overlying natural ecosystems are expected to be very minor.

#### 6.5.2.2 Threatened Species, Endangered Populations and Threatened Ecological Communities

The threatened species and threatened ecological communities identified as occurring within the LWA7–A10 Modification Area or potentially impacted by the proposed modification are summarised in **Table 6.13**.

**Table 6.13 – Threatened Species and Threatened Ecological Communities occurring within or potentially impacted by the Proposed LWA7–A10 Modification**

	Species	Legal Status	Status within LWA7–A10 Modification Area
<b>Threatened Species</b>	heath wrinklewort (Rutidosis heterogama)	Vulnerable (TSC Act) Vulnerable (EPBC Act)	Confirmed occurrence
	small-flower grevillea (Grevillea parviflora subsp. parviflora)	Vulnerable (TSC Act) Vulnerable (EPBC Act)	Confirmed occurrence
	Callistemon prob. linearifolius	Vulnerable (TSC Act)	Probable occurrence
	swift parrot (Lathamus discolor)	Endangered (EPBC Act)	Potential to occur
	regent honeyeater (Anthochaera phrygia)	Endangered (EPBC Act)	Potential to occur
<b>Threatened Ecological Communities</b>	Lower Hunter Spotted Gum – Ironbark Forest	Endangered Ecological Community (TSC Act)	Confirmed occurrence
	River-Flat Eucalypt Forest	Endangered Ecological Community (TSC Act)	Confirmed occurrence

An assessment of the potential impacts of the Proposed LWA7–A10 Modification on each of the threatened species and ecological communities listed in **Table 6.13** was undertaken (refer to **Appendix 4**). This assessment concluded that the Proposed LWA7–A10 Modification is unlikely to have a significant impact on surface vegetation (including threatened species and EECs) or habitats of any threatened fauna species due to the Proposed LWA7–A10 Modification not involving any vegetation clearing and the subsidence predicted to be relatively minor and even across the surface of the LWA7–A10 Modification Area, and therefore unlikely to disrupt the condition of vegetation present.

### 6.5.3 Ecological Management and Monitoring

Flora and fauna within the Proposed LWA7-A10 Modification Area is managed in accordance with the Austar Coal Mine Biodiversity Management Plan (Umwelt 2013). As the level of subsidence impact within the Proposed LWA7-A10 Modification Area is predicted to be similar to that for the approved mine plan, and the Proposed LWA7–A10 Modification is unlikely to result in a significant impact on surface vegetation or habitats of threatened fauna species, no change to the existing management strategies outlined in the Biodiversity Management Plan (Umwelt 2013b) are proposed as a result of the LWA7-A10 Modification.

The existing ecological monitoring program will continue to be implemented as part of the Stage 3 Project in accordance with the Biodiversity Management Plan (Umwelt 2013b). This program includes bi-annual targeted threatened species and EECs monitoring within longwall panels A7 to A10. If the presence of threatened flora species netted bottle-brush (*Callistemon linarifolius*) is confirmed, the Biodiversity Management Plan and Consolidated Environmental Monitoring Program will be revised to reflect any additional monitoring requirements for this species.

## 6.6 Aboriginal Cultural Heritage

A preliminary Aboriginal Cultural Heritage and Archaeological Assessment has been prepared for the Proposed LWA7–A10 Modification by Umwelt and is included as **Appendix 5**. The assessment is subject to consultation with the Registered Aboriginal Parties (RAPs). A summary of the assessment is provided below.

The Austar Coal Mine has been the subject of a number of previous Aboriginal cultural heritage assessments and investigations (Umwelt 2008d; 2008e; 2010b; 2011d; 2011e; 2011f; 2013a). These investigations and assessments have included the Proposed LWA7-A10 Modification Area, and the area was included in extensive consultation undertaken with the RAPs to identify the cultural values of the broader Stage 3 Project area and surrounds. As the LWA7-A10 Modification Area has been subject to survey during previous assessments (Umwelt 2008e; 2011d), additional archaeological survey was not considered necessary. This assessment therefore summarises the results of previous investigations as they relate to the LWA7-A10 Modification Area. Consultation with the RAPs in relation to the preliminary Aboriginal Cultural Heritage and Archaeological Assessment is underway and comments received during consultation will be integrated into a final Aboriginal Cultural Heritage and Archaeological Assessment which will be provided to DP&I and OEH. Further detail regarding the consultation process is provided in **Appendix 5**.

### 6.6.1 Archaeological Context

A search of the Aboriginal Heritage Information Management System (AHIMS) database conducted on 16 September 2013 identified 11 known archaeological sites located within the broader LWA7-A10 Modification Area, including six isolated finds, three artefact scatters, one scarred tree and one grinding groove and isolated find. There are no recorded sites



immediately above the proposed longwall panel extension areas and none in the additional subsidence area outside of the previously approved subsidence area. The location of known archaeological sites is shown on **Figure 6.10**.

Artefact scatters and isolated finds were recorded at relatively low densities throughout the LWA7-A10 Modification Area. Most isolated finds were recorded within 25 metres of a watercourse and no sites contained more than four artefacts. Site condition and integrity was generally low and the range of artefacts types and raw materials present are characteristic of the Hunter Valley. The low site and artefact density within the LWA7-A10 Modification Area suggests that although there is evidence of use of this area by Aboriginal people, there is no evidence it was used intensively.

The Aboriginal cultural and archaeological significance of the known sites within the Proposed LWA7–A10 Modification Area is summarised in **Table 6.14**.

**Table 6.14 – Significance of Known Aboriginal Archaeological Sites within the Proposed LWA7–A10 Modification Area**

AHIMS #	Site Name	Type	Aboriginal Cultural Significance	Archaeological Significance
37-6-1886	ACM2 (Quorrobolong)	Artefact Scatter	Culturally Important	Low
37-6-1888	ACM4 (Quorrobolong)	Isolated Find	Culturally Important	Low
37-6-1889	ACM5 (Quorrobolong)	Isolated Find	Culturally Important	Low
37-6-1892	ACM8 (Quorrobolong)	Artefact Scatter	Culturally Important	Low
37-6-1895	ACM11 (Quorrobolong)	Isolated Find	Culturally Important	Low
37-6-1897	ACM13 (Quorrobolong)	Isolated Find	Culturally Important	Low
37-6-2753	ACM18 (Quorrobolong)	Artefact Scatter	Culturally Important	Low
37-6-2757	ACM22 (Quorrobolong)	Isolated find	Culturally Important	Low
37-6-2758	ACM23 (Quorrobolong)	Isolated find	Culturally Important	Low
37-6-2756	ACM21 (Quorrobolong)	Scarred tree	High	Low
37-6-1890	ACM6 (Quorrobolong)	Grinding Groove & Isolated Find	Extremely high cultural importance	Low-moderate

## 6.6.2 Impact Assessment

The potential changes to the land surface from subsidence associated with the Proposed LWA7–A10 Modification have been assessed by MSEC (refer to **Appendix 3**). The assessment indicates that five of the 11 known Aboriginal archaeological sites within the LWA7-A10 Modification Area are located within the zone expected to experience changes to the previously predicted subsidence parameters. The sites affected by a change in predicted subsidence are outlined in **Table 6.15** and shown on **Figure 6.10**. There is no change to the predicted subsidence impact at the remaining six known Aboriginal archaeological sites within the LWA7-A10 Modification Area, including no change to approved impacts on the grinding groove site, ACM6.

As shown in **Table 6.15**, maximum predicted subsidence movements for the Proposed LWA7–A10 Modification are predicted to be similar to those predicted for the approved mine plan.

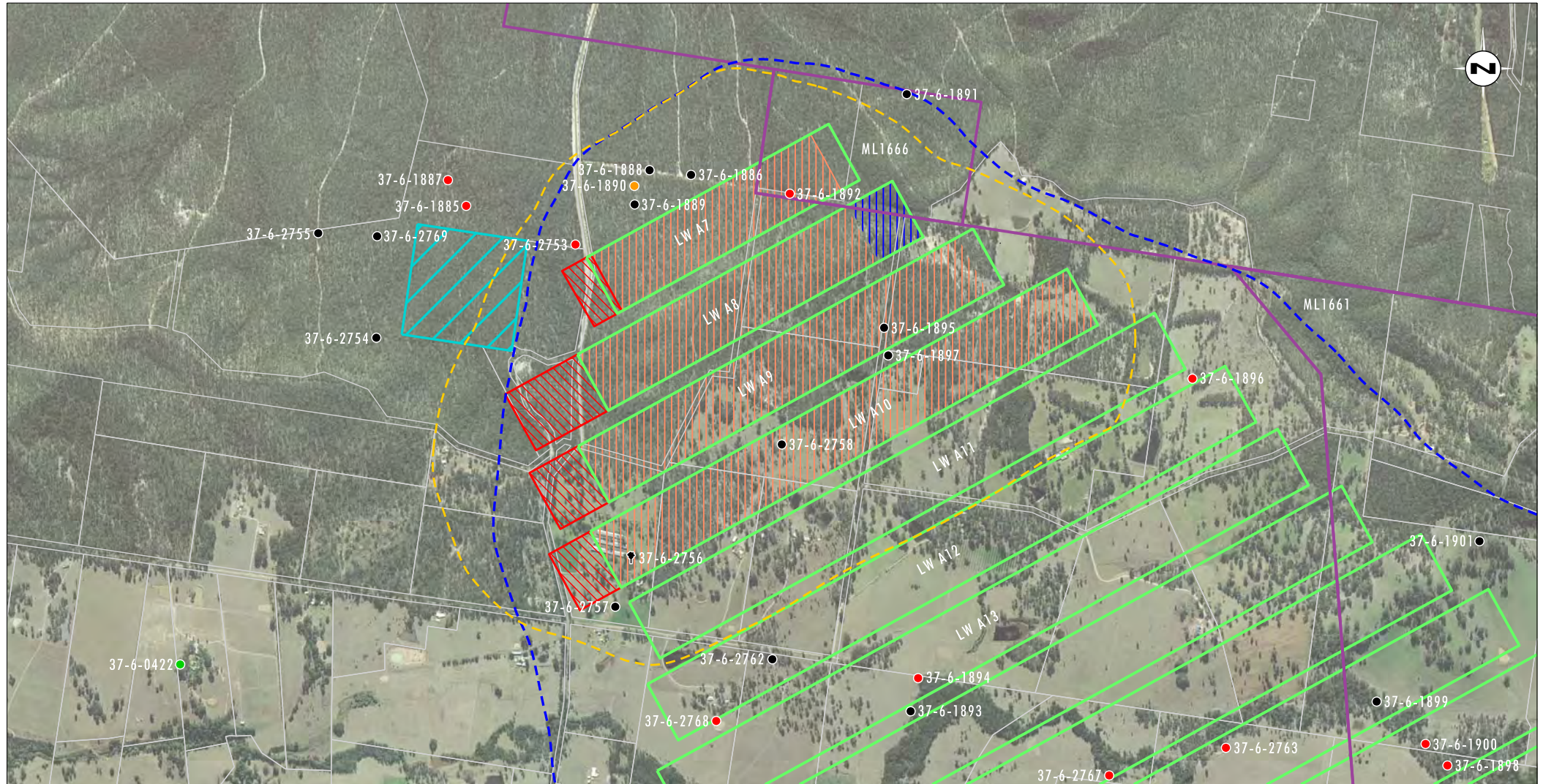
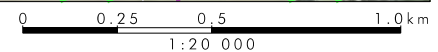


Image Source: AAM Hatch 2006  
 Data Source: Longwall Layout: Austar Coal Mine (2013), Cadastre: LPI NSW



**Legend**

- ▭ Layout for Approved Stage 3 Longwall Panels
- - - 20mm Subsidence Contour for Approved Stage 3 Longwall Layout
- - - Proposed LW A7-A10 Modification Area
- ▨ Approved Surface Infrastructure Site
- ▭ Mining Lease Boundary
- ▨ SMP Approved Longwall Layout
- ▨ Retraction of Longwall A8 Start Position
- ▨ Proposed Extension of Longwalls A7 to A10 Finish Position
- Isolated Find
- Isolated Find and Grinding Groove
- Artefact Scatter
- Open Camp Site
- ♣ Carved Tree

**FIGURE 6.10**  
**Recorded Archaeological Sites**

**Table 6.15 – Aboriginal Archaeological Sites within the Proposed LWA7–A10 Modification Area where a Change in Maximum Subsidence Parameters Predicted**

AHIMS #/Site Name	Layout	Max. Predicted Total Subsidence (mm)	Max. Predicted Total Tilt (mm/m)	Max. Predicted Total Hogging Curvature (km <sup>-1</sup> )	Max. Predicted Total Sagging Curvature (km <sup>-1</sup> )
37-6-1892/ ACM8	Approved	1200	5.0	<0.01	0.03
	LWA7-A10 Modification	1075	4.5	0.02	0.03
37-6-1895/ ACM 11	Approved	1650	1.0	<0.01	0.07
	LWA7-A10 Modification	1625	1.5	0.02	0.07
37-6-2753/ ACM18	Approved	125	1.0	0.01	<0.01
	LWA7-A10 Modification	225	2.0	0.01	0.01
37-6-2756/ ACM 21	Approved	900	6.0	0.03	0.02
	LWA7-A10 Modification	1225	5.0	0.02	0.04
37-6-2757/ ACM22	Approved	325	2.5	0.03	<0.01
	LWA7-A10 Modification	450	3.0	0.02	0.01

### 6.6.2.1 Artefact Scatters and Isolated Finds

Aboriginal archaeological sites comprising artefact scatters and isolated finds have the potential to be impacted by subsidence related surface cracking in the soil. However, due to the depth of mining within the LWA7-A10 Modification Area and the relatively small magnitude of predicted ground curvatures and strains, surface cracking is expected to be minor and isolated, and unlikely to directly or adversely impact on artefact scatters or isolated finds (MSEC 2013). The extent and nature of surface cracking predicted as a result of the Proposed LWA7–A10 Modification is consistent with that of the approved Stage 3 Project.

### 6.6.2.2 Scarred Tree

Scarred trees can potentially be impacted by large ground deformations, however this type of impact has only been observed for mining at very shallow depths of cover, in the order of 100 metres or less, or in very steep terrain (MSEC 2013). The scarred tree within the LWA7-A10 Modification Area (ACM21) has fallen, its roots are completely exposed and tree has been partially cut for firewood. Given the current condition of the tree, the depth of cover in excess of 550 metres, the nature of the topography and the predicted subsidence parameters for the scarred tree, it unlikely the Proposed LWA7–A10 Modification will result in any adverse impacts to the site.

## 6.6.3 Management Strategies

Aboriginal cultural heritage and archaeological sites within the LWA7-A10 Modification Area are managed in accordance with the approved Austar ACHMP (Umwelt 2013a). As the level of subsidence impact to known Aboriginal archaeological sites within the LWA7-A10 Modification Area is predicted to be similar to that of the approved mine plan and unlikely to result in any adverse impact on archaeological sites, no change to the existing management

strategies outlined in the Austar ACHMP (Umwelt 2013a) are proposed as a result of the LWA7-A10 Modification.

Nevertheless, an addendum to the existing ACHMP will be prepared to specifically address the slightly modified impacts to the recorded sites in the Proposed LWA7-A10 Modification. This will be prepared in consultation with the RAPs and provided to OEH and DP&I for approval.

## 6.7 Historic Heritage

A comprehensive Historic Heritage Assessment has previously been prepared as part of the approved Stage 3 Project (Umwelt 2008f) and, in accordance with the conditions of Project Approval 08\_0111, a Heritage Management Plan (Umwelt 2013c) has been prepared and implemented for Stage 3 operations.

Six potential historic heritage items have been previously identified within the Proposed LWA7–A10 Modification Area. One additional historical heritage item (Item 23) falls within the Proposed LWA7–A10 Modification Area. The predicted mine subsidence parameters for the Proposed LWA7–A10 Modification are consistent with those predicted for the approved Stage 3 Project.

### 6.7.1 Heritage Items

**Table 6.16** lists the potential heritage items assessed as part of the 2008 historical heritage assessment (Umwelt 2008f) which are located within the LWA7–A10 Modification Area (refer also to **Figure 6.11**).

**Table 6.16 – Heritage Items within the Modification Area**

Item	Description	Significance
2	Quarry 1	Nil
3	Quarry 2	Nil
5	Culvert 1	Nil
6	Culvert 2	Nil
7	Culvert 3	Nil
10	Fencing 2	Nil

As a result of the Proposed LWA7–A10 Modification, one addition potential heritage item (Item 23 Potential Homestead Site) has been identified within the Proposed LWA7-A10 Modification Area. The potential homestead site has not been inspected due to access limitations, and therefore the heritage significance of the site cannot be confirmed. However, on the basis of land use history and previous significance assessments (Umwelt 2008f), it is assessed as potentially being of local significance with no or low research potential.

### 6.7.2 Heritage Impact Statement

**Table 6.17** provides a heritage impact statement and management strategy for the heritage sites/items inspected as part of the 2008 assessment and located within the Proposed LWA7–A10 Modification Area.

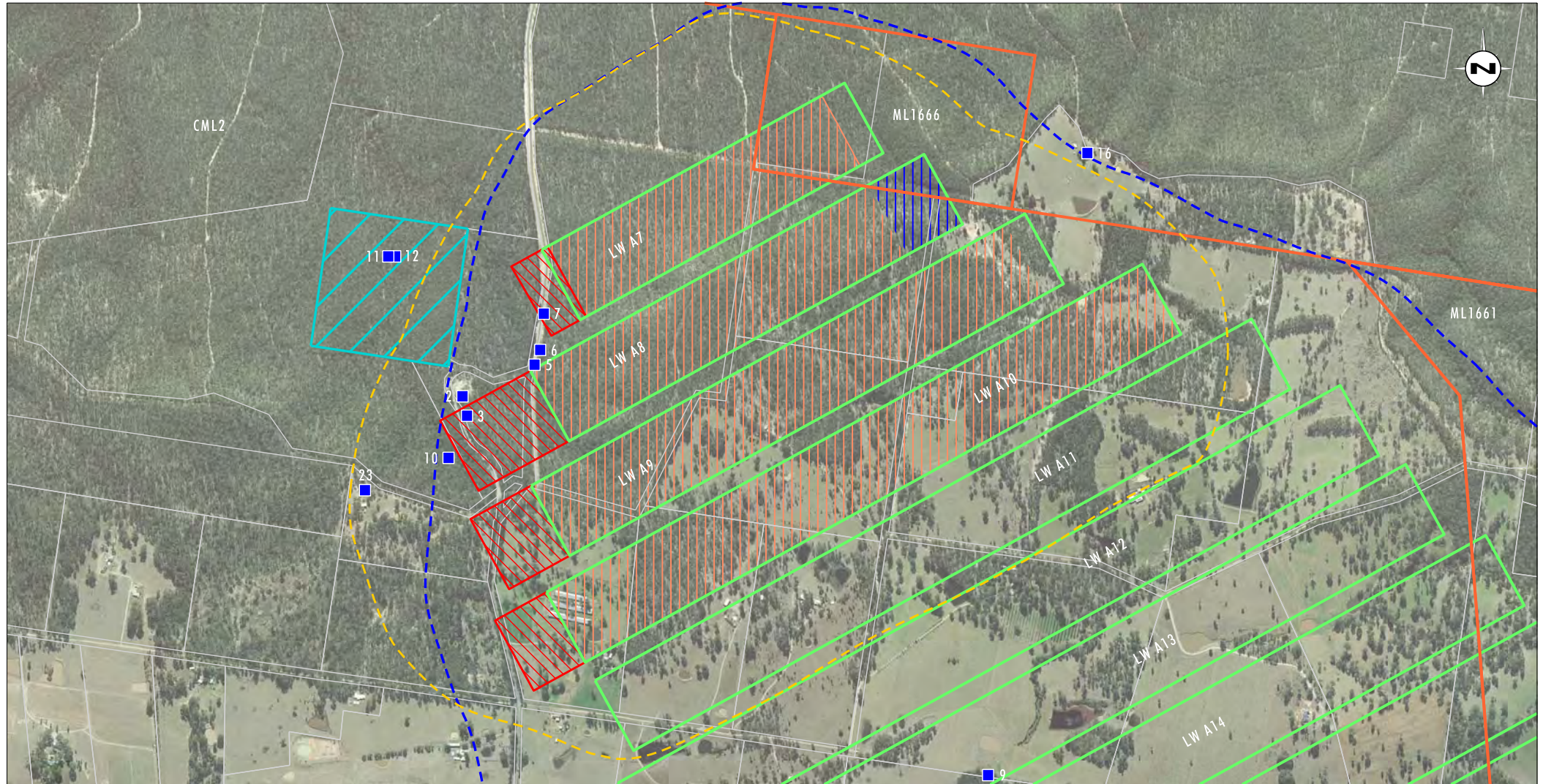


Image Source: AAM Hatch (2006)  
 Data Source: Aустar Coal Mine (2013), LPI NSW (2009)

0 200 400 800m  
 1:16 000

**Legend**

- ▭ Layout for Approved Stage 3 Longwall Panels
- - - 20mm Subsidence Contour for Approved Stage 3 Longwall Layout
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- ▭ Mining Lease Boundary
- ▨ SMP Approved Longwall Layout
- ▭ Proposed Retraction of Longwall A8 Start Position
- ▨ Proposed Extension of Longwalls A7 to A10 Finish Position
- Potential Heritage Item

FIGURE 6.11

Historic Heritage Items

**Table 6.17 – Heritage Impact Statement and Management Strategy for Heritage Items**

Item	Description	Heritage Impact Statement
2 and 3	Quarry 1 and 2	There are unlikely to be any significant impacts to Quarries 1 and 2 resulting from the extraction of the proposed longwalls. The quarries have been assessed as having no significance and no research potential (Umwelt 2008f). On this basis, no further heritage management of these items is recommended during the proposed works.
5 to 7	Culvert 1, 2 and 3	Culverts 1 to 3 are located above the southwest end of Longwall A7. Subsidence movements could result in some minor cracking which could be readily repaired. Culverts 1 to 3 have been assessed as having no significance or research potential (Umwelt 2008f). On this basis, no further heritage management of these items is recommended during the proposed works.
10	Fencing 2	Fencing site 10 comprises a single timber post and is not expected to be impacted by subsidence movements. The site has been assessed as having no significance and no research potential (Umwelt 2008f). On this basis, no further heritage management of these items is recommended during the proposed works.

Subsidence impacts predicted as part of the Proposed LWA7–A10 Modification are similar with those previously assessed. The items located within the LWA7–A10 Modification Area have previously been assessed as having no heritage significance or research potential. Accordingly, the proposed modification will not have a significant impact on historic heritage items.

Item 23 Potential Homestead Site is predicted to experience minimal subsidence impacts (60mm) and is likely to remain safe and serviceable at all times (MSEC 2013). Subject to landholder agreement, further assessment of the heritage significance of this potential homestead site will be undertaken by a qualified heritage consultant as part of the existing Built Features Management Plan process. The need for and scope of any additional management strategies will be guided by the outcomes of this process.

### 6.7.3 Management Strategies

#### 6.7.3.1 Management of Previously Identified Potential Heritage Items

Historic heritage items are managed in accordance with the Austar Historic Heritage Management Plan for Stage 3 (Umwelt 2013c). As subsidence impacts predicted as part of the Proposed LWA7–A10 Modification are similar with those previously assessed, and the previously identified sites within the Proposed LWA7-A10 Modification Area have been assessed as having no historic heritage significance, no change to the existing management strategies for these items is proposed.

#### 6.7.3.2 Management of Additional Potential Heritage Item 23

In accordance within existing management procedures, a Built Features Management Plan will be prepared for all built features, including Item 23, prior to subsidence impacts occurring. The preparation of this plan will include an engineering inspection (following landholder agreement) and assessment. Item 23 will also be inspected by a qualified

heritage consultant at the time of the Built Features Management Plan inspections to clarify its likely heritage significance (with landholder agreement). If assessed as having no significance or research potential, no further heritage management of this item is required.

If confirmed to likely be of local significance, a site specific heritage impact assessment will be prepared by a qualified heritage consultant (in accordance with Heritage Council guidelines *Statements of Heritage Impact*) prior to subsidence impacts occurring.

The results of the heritage impact assessment will be reported in the Austar Coal Mine Annual Environmental Management Report (AEMR).

### 6.7.3.3 Austar Historic Heritage Management Plan

No change the scope of existing management measures approved by the Austar Historic Heritage Management Plan (Umwelt 2013c) is proposed as a result of the Proposed LWA7-A10 Modification. Nevertheless, the Austar Historic Heritage Management Plan for Stage 3 (Umwelt 2013c) will be updated to reflect the slight changes in predicted subsidence at previously identified historic heritage items within the Proposed LWA7-A10 Modification Area and the addition of the potential Heritage Item 23.

## 6.8 Cumulative Impacts

The assessment of environmental impacts undertaken for the Proposed LWA7-A10 Modification is provided in **Sections 6.1 to 6.7** above. The Proposed LWA7-A10 Modification will result in a slight increase (1.8%) in the overall area of impact of underground mining in the approved Stage 3 mining area at the western ends of LWA7 to LWA10. The subsidence impacts on natural and built features of the Proposed LWA7-A10 Modification remain similar, or at worst, slightly greater than those approved under Project Approval 08\_0111. The cumulative impacts of the subsidence associated with the Proposed LWA7-A10 Modification have been assessed in the context of the broader Stage 3 mine plan and subsidence predictions reflect this cumulative approach. Houses and other built infrastructure, including rural buildings, are predicted to remain safe, serviceable and compatible with existing land uses.

The flooding assessment presented in **Section 6.3** has included consideration of Stage 2 subsidence impacts and the cumulative impact of Stage 3 subsidence in the flood modelling, ensuring consideration of the cumulative landform changes associated with mining in these areas. The groundwater assessment reviewed in **Section 6.4** considers the potential cumulative impacts of previous underground mining in the region when assessing the impact on groundwater inflows into the Stage 3 area.

The ecological assessment presented in **Section 6.5** indicates that the level of subsidence impact within the Proposed LWA7-A10 Modification Area is predicted to be similar to that approved under Project Approval 08\_0111, and that the Proposed LWA7-A10 Modification is unlikely to result in a significant impact on surface vegetation or habitats of threatened fauna species. Therefore the potential cumulative impact of the Proposed LWA7-A10 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 6.6** indicates that the predicted impacts of the Proposed LWA7-A10 Modification on Aboriginal archaeological sites will be similar to those previously approved under Project Approval 08\_0111. The Proposed LWA7-A10 Modification is therefore unlikely to result in an increase in the cumulative impact on Aboriginal archaeological sites within the area.

Overall, the Proposed LWA7-A10 Modification will have a low to very low cumulative impact.

## 7.0 Revised Statement of Commitments

As a result of the Proposed LWA7-A10 Modification and the environmental assessment presented in **Section 6.0**, the following plans are proposed to be updated to reflect the LWA7-A10 Modification:

- Austar Coal Mine Longwalls A7 to A10 Extraction Plan, including:
  - Built Features Management Plan;
  - Subsidence Monitoring Program;
  - Biodiversity Management Plan; and
  - Heritage Management Plan (Aboriginal Cultural Heritage Management Plan).
- Aboriginal Cultural Heritage Management Plan; and
- Historic Heritage Management Plan

No change to the existing Statement of Commitments presented in Project Approval 08\_0111 is proposed as a result of the Proposed LWA7-A10 Modification.

The following section provides a copy of the Statement of Commitments made by Austar Coal Mine for Project Approval 08\_0111.

If approval is granted under Part 3A of the EP&A Act for the proposed modification, Austar Coal Mine will commit to the following controls:

### 1.1 Compliance with the EA

Operation of the Stage 3 development will be undertaken in accordance with the environmental controls and commitments as described in the EA or as specified in this Statement of Commitments.

### 1.2 Life of Stage 3 Concept Mine Plan

#### Project Life

- 1.2.1 The project approval life will be until 31 December 2030. Closure and rehabilitation activities may continue beyond this period and will be undertaken in accordance with an approved Mining Operations Plan.

#### Production Limits

- 1.2.2 Underground mining in Stage 3 will produce up to 3.6 Mtpa ROM coal by LTCC methods. This coal will be conveyed, handled, processed and transported using Austar Mine Complex infrastructure.

#### Hours of Operation

- 1.2.3 Mining and associated activities for the Stage 3 Project may be undertaken 24 hours a day, seven days a week.



## Refinement of Mine Plan

- 1.2.4 Any material changes to the concept mine plan outlined in this EA report will be detailed and assessed as part of Extraction Plans (EPs) and Mining Operations Plan (MOP) prepared by Austar Coal Mine.
- 1.2.5 Mining parameters for the proposed mine plan as detailed in the EP will be designed to ensure that predicted systemic subsidence in terms of subsidence, tilt, tensile strain and compressive strain will comply with or be less than the Upper Bound predictions detailed in the EA. Those being:
- 3000 mm subsidence;
  - 11 mm/m tilt;
  - 0.09 km<sup>-1</sup> total conventional hogging curvature; and
  - 0.15 km<sup>-1</sup> total conventional sagging curvature.
- 1.2.6 The locations of any minor surface infrastructure that may be required to implement the project will be detailed and assessed as part of MOP's prepared by Austar Coal Mine.

## **1.3 Subsidence**

- 1.3.1 Austar Coal Mine will manage the impacts of mining subsidence as required by the conditions of the consent, conditions of the ML and other DRE conditions.
- 1.3.2 The Mine Plan submitted as part of the EP for longwall extraction will take into consideration monitoring results from previous Austar Mine Complex operations and will be designed to ensure that subsidence as a result of mining does not exceed Upper Bound predictions as set out in the EA for subsidence, tilt, tensile strain and compressive strain. Those being:
- **Maximum Upper Bound** subsidence ranges from approximately 825 mm for LWA7 to approximately 3000 mm for LWA19.
  - **Maximum Upper Bound** tilt ranges from approximately 4.0 mm/m for LWA7 to approximately 11 mm/m for LWA19.
  - **Maximum Upper Bound** conventional hogging curvature ranges from approximately 0.2 mm/m for LWA7 to approximately 0.09 km<sup>-1</sup> for LWA19.
  - **Maximum Upper Bound** conventional sagging curvature ranges from approximately 0.06 km<sup>-1</sup> for LWA7 to approximately 0.15 km<sup>-1</sup> for LWA19.
- 1.3.3 Where a potential subsidence impact is identified on private property, Austar Coal Mine will prepare a Built Features Management Plan in consultation with the property owner. This plan will clearly outline impacts of mining on the property and the management and remediation measures to be implemented.

- 1.3.4 Subsidence management measures to be implemented as part of the project will include:
- subsidence monitoring lines to be located as determined as part of the EP process where access is granted;
  - visual assessment of all natural features and items of surface infrastructure before, during and following mining to detect subsidence impacts such as surface cracking, irregularities in the subsidence profile, erosion, damage to structures, changes in drainage patterns or loss of water from drainage structures where access is granted;
  - detailed subsidence monitoring in accordance with DRE requirements. This data will be utilised to regularly update the subsidence predictions for Stage 3;
  - remediation and rehabilitation of subsidence impacts will be carried out, where required, as soon as practicable following subsidence using methods specified in the EP where access is granted;
  - building structures located within the subsidence affectation area will be inspected by a structural engineer prior to and after undermining and appropriate management measures implemented where access is granted;
  - informing all relevant service providers of the potential impacts of mining subsidence on services;
  - farm dams within the subsidence affectation area will be monitored during and following undermining where access is granted, to ensure they remain in a safe and serviceable condition. Remediation works will be undertaken as required;
  - in the event of any significant loss of water from a privately-owned farm dam, Austar Coal Mine will provide an alternate source of water, as required, until the dam is repaired where access is granted; and
  - any privately-owned bores within the subsidence affectation area will be monitored during and following undermining where access is granted. If the capacity of any utilised private bore is reduced to unacceptable level as a result of subsidence, Austar Coal Mine will provide an alternative supply of water until such time as the MSB re-establishes or replaces the bore.
- 1.3.5 Austar Coal Mine will, prior to undermining of Quorrobolong Road, Nash Lane and Coney Creek Lane prepare and implement a Traffic Management Plan to manage any subsidence impacts on the roads and associated culverts and bridges in consultation with Cessnock City Council and DRE and to the satisfaction of the Director-General.
- 1.3.6 Austar Coal Mine will prepare management plans in consultation with relevant service providers, for the protection of infrastructure and services within the potential Stage 3 mine subsidence area to ensure these remain in a safe and serviceable condition throughout the mining period. These plans will be submitted to the Director General for approval as part of the EP prior to undermining of the services.

## 1.4 Ecology

- 1.4.1 Austar Coal Mine will establish and manage the proposed Biodiversity Offset Area (refer to Figure 7.1) to protect and enhance its ecological values in perpetuity, to the satisfaction of the Director-General.
- 1.4.2 A Weed Management Plan will be developed for the Surface Infrastructure Site.
- 1.4.3 The Austar bushfire management strategy will be revised to include the specific requirements of the Surface Infrastructure Site during the construction and operation phases.
- 1.4.4 Prior to the commencement of construction of the Surface Infrastructure Site (other than for those works identified in the Shaft Construction Management Plan), an Austar Mine Complex Ecological Management Plan which integrates management of ecological issues associated with construction of the Surface Infrastructure Site, Stage 3 underground mining and with the remainder of Austar Coal Mine operations will be submitted to the Director-General for approval. This will include:
- clearing procedures for establishment of the Surface Infrastructure Site and associated access road/services easement;
  - replacement of arboreal habitat within surrounding areas or within the Biodiversity Offset Area, should the removal of any hollow-bearing trees be required; and
  - extension of the existing Austar Coal Mine ecological monitoring program to include monitoring of vegetation condition within subsidence affected areas.
- 1.4.5 Clearing of vegetation will be restricted to the minimum area necessary to construct the proposed infrastructure and provide adequate fire protection and will be undertaken in accordance with the tree felling procedure outlined in Section 7.5.3 of the EA.
- 1.4.6 An appropriate speed limit on access roads will be implemented to minimise the risk of vehicle collision with ground-dwelling fauna dispersing between adjacent habitats.
- 1.4.7 An appropriately designed nest box will be erected (either within remaining bushland areas or within the Biodiversity Offset Area) for the compensation of each tree hollow removed as a result of clearing required for construction of the proposed Surface Infrastructure Site.
- 1.4.8 Any outbreaks of invasive weeds observed on the property boundary will be appropriately controlled to avoid their escape into the surrounding Werakata State Conservation Area and subsequently competing with threatened flora species. Early detection will ensure the management required is not extensively onerous.
- 1.4.9 Any landscaping undertaken around infrastructure areas will use only locally occurring native plant species to reduce the risk of invasive plant species escaping into the adjacent reserve and competing with threatened flora species. Particular care will be taken to avoid planting species which are known to escape and naturalise into native bushland.

## 1.5 Heritage

- 1.5.1 An Aboriginal Cultural Heritage Management Plan (ACHMP) will be prepared for the Austar Mine Complex to outline all Aboriginal heritage management strategies for the project, responsibilities of all parties and the timeframe for required heritage works.
- 1.5.2 Austar will make a monetary contribution of \$100,000 to an Aboriginal project or program (to be decided by Aboriginal stakeholders) as an offset for any subsidence impacts that affect the grinding groove site. Austar will make this contribution when all necessary government approvals for the Project have been obtained.
- 1.5.3 No Aboriginal archaeological site be visited, or have works done there, without Aboriginal stakeholders in attendance.
- 1.5.4 Known sites on accessible properties will be included in a monitoring program. This will involve recording each site before and after subsidence to identify any impacts. This will be done by an archaeologist and Aboriginal stakeholders.
- 1.5.5 Aboriginal stakeholders (and an archaeologist if requested by Aboriginal stakeholders) will provide relevant Austar personnel with a cultural heritage awareness training session.
- 1.5.6 If any additional sites are found within the Project area, these will be inspected by an archaeologist and Aboriginal stakeholders where access is granted to assess the site and decide on how it should be managed.
- 1.5.7 If remediation works are required on any of the creeklines within the Stage 3 area, an archaeological survey with Aboriginal stakeholders will be undertaken prior to commencement of any works where access is granted.
- 1.5.8 Historic Heritage Management Plan incorporating all of Austar Mine Complex will be developed.

## 1.6 Surface Water and Drainage

- 1.6.1 Austar will develop a detailed Soil and Water Management Plan for the Surface Infrastructure Site prior to commencement of construction.
- 1.6.2 Erosion and sediment control measures will be designed and implemented for construction of surface infrastructure to a standard consistent with Managing Urban Stormwater: Soils and Construction (NSW Landcom 2004) (the Blue Book) and Guidelines for Establishing Drainage Lines on Rehabilitated Minesites (Draft) (DLWC 1999).
- 1.6.3 Any subsidence impacts on drainage lines will be effectively remediated where access is granted such that there is no significant impact on downstream water users and environmental flows. Drainage line monitoring and remediation protocols will be developed as part of the EP process, and in consultation with NOW, to guide the management of subsidence impacts and drainage line remediation works on surface water systems. The drainage line monitoring and remediation protocols will include:
  - detailed monitoring protocols;

- a program to complete drainage remediation works in a timely manner, post-subsidence to limit the potential for surface water capture;
- details of the design of drainage line remediation works such that the rehabilitated drainage lines maintain a similar channel form and sinuosity to the pre-mining environment, to ensure that the overall erosive power of the creek system is consistent with that existing pre-mining;
- assessment of the viability and benefits of applying proactive measures such as the installation of liners or geo-fabrics in drainage lines prior to subsidence; and
- the existing Austar Site Water Management Plan will be extended to include the Surface Infrastructure Site and Stage 3 underground mining. The plan will be updated in consultation with NOW and DRE and submitted to the Director-General prior to the commencement of construction of the Surface Infrastructure Site.

1.6.4 Surface water monitoring results will be reported annually in the Annual Environmental Management Report.

## 1.7 Groundwater

1.7.1 A groundwater monitoring program will be implemented for the project as outlined in Appendix 14, or as otherwise agreed by the Director-General in consultation with NOW.

1.7.2 The results of groundwater monitoring and a comparison of measured and predicted impacts will be reported annually in the Annual Environmental Management Report.

1.7.3 Impacts on privately-owned bores will be assessed by monitoring where access is granted and in the event that any utilised privately-owned bore is significantly affected, an alternative water supply will be provided by Austar Coal Mine until such time as the bore is re-established or replaced.

1.7.4 An annual analysis of surface and groundwater monitoring data will be undertaken and will include:

- comparison of groundwater levels with rainfall information;
- identification of any changes or long-term trends in groundwater levels; and
- visual inspection of creeks and drainage lines.

1.7.5 The monitoring results and analysis findings will be reported in the Annual Environmental Management Report.

## 1.8 Noise and Blasting

1.8.1 Unless otherwise agreed with the landowner, Austar Coal Mine will manage operations associated with the Stage 3 underground mining and Surface Infrastructure Site such that the noise emissions from these operations comply with the noise criteria included in **Table 1.1** at surrounding residences for the range of meteorological conditions modelled in the EA.

**Table 1.1 – Project Specific Noise Criteria**

Location	Period	Intrusiveness Criteria $L_{Aeq(15minute)}$	Amenity Criteria $L_{Aeq(Period)}$	Project Specific Noise Criteria $L_{Aeq(15minute)}$
Kitchener Residences	Day	38 dBA	50 dBA	38 dBA
	Evening	35 dBA	45 dBA	35 dBA
	Night	35 dBA	40 dBA*	35 dBA
Serradilla Residence, Kauter Residence, Penney and Linton Property	Day	37 dBA	50 dBA	37 dBA
	Evening	37 dBA	45 dBA	37 dBA
	Night	35 dBA	40 dBA	35 dBA

- 1.8.2 Unless otherwise agreed with the landowner, Austar Coal Mine will manage the construction phase of the Surface Infrastructure Site in accordance with the requirements of DECCW's Interim Construction Noise Guideline (2009).
- 1.8.3 Acoustic bunding will be constructed to a height of 3.5 metres above ground level along the northern boundary adjacent to the car park and bathhouse.
- 1.8.4 The ventilation fan outlet will be directed to the west.
- 1.8.5 Man and materials winder and second egress winder motors will be enclosed.
- 1.8.6 Blasting will generally take place only once per day and will be undertaken between the hours of 9.00 am to 5.00 pm Monday to Saturday with no blasting on Sundays or Public Holidays.
- 1.8.7 Airblast overpressure from blasting associated with shaft development at the Surface Infrastructure Site when measured at residences not associated with the development will not exceed a maximum of 120 dBL Linear Peak at any time and will not exceed 115 dBL for more than 5% of blasts over a 12 month period.
- 1.8.8 Peak particle velocity from blasting associated with shaft development at the Surface Infrastructure Site when measured at residences not associated with the development will not exceed a maximum of 10 mm/s at any time and will not exceed 5 mm/s for more than 5% of blasts over a 12 month period.

## 1.9 Air Quality

- 1.9.1 Austar Coal Mine will manage operations associated with the operation of the Surface Infrastructure Site so that dust deposition as a result of the development does not exceed levels set out in **Table 1.2** at nearest non-project related residences.

**Table 1.2 – Dust Deposition Criteria**

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited dust	Annual	2 g/m <sup>2</sup> /month	4 g/m <sup>2</sup> /month

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, 1991, AS 3580.10.1-1991: **Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited Matter - Gravimetric Method.**

- 1.9.2 Austar Coal Mine will expand the existing dust monitoring network to include dust deposition gauges at locations to the south and north of the proposed Surface Infrastructure Site. Dust monitoring findings relating to the Surface Infrastructure Site will be reported annually in the Annual Environmental Management Report.

## **1.10 Energy and Greenhouse Gas**

- 1.10.1 Austar Coal Mine will develop and maintain an internal energy and GHG management plan for Stage 3 operations in accordance with Austar Coal Mine requirements. This will include reviewing:
- energy efficiency in plant and equipment procurement, consideration be given to the life cycle costs advantages obtained by using energy efficient components;
  - the opportunity to install additional sub-metering for offices, workshops and winders;
  - operational initiatives such as turning off idling plant equipment;
  - control and temperature settings for air conditioning units in offices and switchrooms;
  - automatic control of external and internal lighting;
  - potential energy efficiency opportunities in water pumping and dust suppression systems (for example, variable speed drive pumps);
  - review changes in power consumption with installation of new equipment and install power factor correction equipment to suit; and
  - review workshop and bathhouse lighting and office and high bay lighting.

## **1.11 Visual**

- 1.11.1 Austar Coal Mine will implement the following visual controls to screen or reduce the visual impact from views of the Surface Infrastructure Site from residential areas and public road locations:
- Maintain a vegetative screen along the edges of the access road to the Surface Infrastructure Site.
  - Limit clearing on the Surface Infrastructure Site to that required for construction and bushfire protection purposes.
  - Use appropriate natural tones on the winder building to ensure that it blends into the backdrop of native forest when viewed from Kitchener and sections of Quorrobolong Road.
  - Direct night-time security lights into the site and ensure that all lighting is located and directed so as to not directly impact on residential or road locations. Lighting will be designed to minimise excessive night glow in a manner consistent with AS 4282 Control of the Obtrusive Effects of Outdoor Lighting.

- All buildings potentially visible to the public to be coloured in suitable natural tones.

## 1.12 Transport

- 1.12.1 To mitigate potential traffic impacts associated with the development of the Surface Infrastructure Site, Austar Coal Mine will:
- Construct an Austroads type AUR intersection treatment with an auxiliary passing lane for through traffic on Quorrobolong Road around right turning traffic at the proposed Surface Infrastructure Site access.
  - Provide lighting at the proposed pit top facility access intersection on Quorrobolong Road.
  - Erect a left side road junction (W2-4) warning sign for northbound traffic approaching the proposed Surface Infrastructure Site access intersection to compensate for less than desirable Safe Intersection Site Distance (SISD).
  - Prepare a traffic management plan for oversize and heavy vehicle movements to and from the Surface Infrastructure Site during construction of the Stage 3 development. This Plan will take into consideration specific measures that may be required in regard to address school bus movements on Quorrobolong Road during the construction phase.

## 1.13 Community

- 1.13.1 Austar Coal Mine will work with Cessnock City Council, the Department and Community Consultative Committee to incorporate representatives from the Stage 3 Project area. Austar Coal Mine will provide the Community Consultative Committee with regular information regarding the environmental management performance of the Stage 3 Project and any relevant matters regarding community relations.
- 1.13.2 Maintain a 24 hour per day community information and complaint line.
- 1.13.3 Provide regular updates of mine development and monitoring on the Austar Coal Mine website.
- 1.13.4 Austar Coal Mine will in consultation with Cessnock City Council contribute to the upgrade of the Wollombi Road/West Avenue intersection prior to commissioning of the Surface Infrastructure Site to provide a designated right turn lane into West Avenue to formalise traffic movements in this area and improve existing traffic problems associated with the right turn movement using the through lane and through vehicles passing in the bicycle lane/parking area.
- 1.13.5 Install a type F flashing light control at the Vincent Street railway level crossing.
- 1.13.6 Provide support to Kitchener Public School through the provision of sporting equipment and contributions to school/community projects.
- 1.13.7 Contribute to the ongoing maintenance of Poppet Head Reserve, Kitchener.



## **1.14 Decommissioning and Rehabilitation**

- 1.14.1 A decommissioning plan will be prepared for the Surface Infrastructure Site as part of the MOP process and submitted to the DRE for approval approximately five years prior to the commencement of decommissioning works.

## **1.15 Continuous Improvement of Existing Operations**

- 1.15.1 Austar Coal Mine will review and extend its current Site Water Management Plan for Austar Mine Complex to include Stage 3 operations and operation of the Surface Infrastructure Site. The water performance of the water management system will be reported in the Annual Environmental Management Report.
- 1.15.2 Activities within Austar Mine complex will be undertaken in accordance with approved Mining Operation Plan that will be reviewed and updated at least every seven years.
- 1.15.3 Austar Coal Mine will continue to implement the voluntary Noise Pollution Reduction Program for Pelton CHPP in consultation with OEH.
- 1.15.4 Austar Coal Mine will commit to a Noise Management Plan that incorporates current noise monitoring, the voluntary Noise Pollution Reduction Program and associated noise management for Austar Mine Complex operations and will investigate reasonable and feasible noise mitigation strategies where appropriate.
- 1.15.5 Austar Coal Mine will investigate opportunities for reduction in energy use and greenhouse gas emissions from the Austar Mine Complex. This will include:
- ongoing review of emissions monitoring and management technology;
  - review of coal operations and potential for improvement as part of producing clean coal through coal preparation to reduce moisture and ash content, sulphur, nitrogen and other contaminants. This results in reduced emissions of greenhouse gases and other pollutants when the coal is used; and
  - consider the application of the in-force National Greenhouse and Energy Reporting System (NGERS) and the Carbon Pollution Reduction System (CPRS) on Austar operations.

## **1.16 Environmental Management, Monitoring, Auditing and Reporting**

- 1.16.1 Austar Coal Mine will incorporate the Stage 3 Project into the Annual Environmental Management Report for Austar Mine Complex.
- 1.16.2 Three years after commencement of the Stage 3 Project, and every three years thereafter, Austar Coal Mine will commission and pay the full cost of an Independent Environmental Audit of the project in consultation with the Director-General of the Department. A copy of the audit report will be provided to the Director-General of the Department and DRE, OEH, NOW, Cessnock City Council, and members of the Community Consultative Committee for the Stage 3 Project. This audit may be combined with other independent environmental audits required by the Director-General of the Department.

## 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 proposed 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
- expert technical assessments.

The key issues identified were the subject of comprehensive technical assessment to identify and assess the potential impacts of the Proposed LWA7–A10 Modification on the existing environment and community. The results of these assessments are detailed in **Section 6.0**.

The characteristics of the Stage 3 Area, the depth of cover to proposed mining areas (minimum of 455 metres) and experience to date in progression of Stage 3 mining enable the proposed modifications to LWA7-A10 to occur with minimal environmental impacts. In addition, as Austar has a range of well established and effective measures to minimise and manage impacts associated with the LWA7–A10 Modification, it is anticipated that the proposed modification can proceed within acceptable environmental standards.

### 8.2 Suitability of the Site

The proposed modification involves extending the length of existing approved longwalls into adjacent coal reserves. The LWA7–A10 Modification Area is located in an area with an extensive history of underground coal mining and within the existing approved Austar Stage 3 underground mining area. The Austar Mine Complex is a well established mining operation situated within the South Maitland Coalfield of the Maitland Group which forms part of the Newcastle Coalfields.

The LWA7–A10 Modification Area is located beneath land reserved as a state conservation area, private rural land holdings and Quorrobolong Road. The extent of additional impacts on public and private assets, infrastructure or environmental features is limited and consistent with those previously approved under 08\_0111. The Proposed LWA7–A10 Modification will not limit the continued use of private landholdings for agricultural or residential purposes, nor will it materially impact the biodiversity values of the state conservation area. Existing management and monitoring programs are in place to identify and manage the potential impacts on these land uses.

The modified mine plan allows for the efficient recovery of a valuable resource by maximising resource utilisation and use of existing infrastructure, thereby reducing capital costs and minimising environmental impacts.

### 8.3 Ecologically Sustainable Development

For the purposes of this EA, the definition of Ecologically Sustainable Development (ESD) as set out in Section 6(2) of the *Protection of the Environment Administration Act, 1991* and adopted by the EP&A Act, has been used. ESD requires the integration of economic and environmental considerations in decision making processes. The following ESD principles are integral to the Stage 3 Project:

- a) the precautionary principle;
- b) inter-generational equity;
- c) conservation of biological diversity and ecological integrity; and
- d) improved valuation, pricing and incentive mechanisms.

These principles which are discussed further in **Sections 8.4.1 to 8.4.4**, have been incorporated into planning and assessment of the Stage 3 Project and the subsequent modifications through:

- incorporation of risk assessment and analysis within the environmental assessment and decision-making processes for the modification;
- adoption of environmental assessment and management procedures that are cautious, well understood, predictable and result in high standards for environmental and occupational health and safety performance. This includes site specific calibration of the subsidence prediction model using in excess of five years of subsidence measurements specific to the Greta Coal Seam and Branxton Formation;
- ongoing consultation with regulatory authorities and community stakeholders since 2005 when Austar purchased the mine and through subsequent modifications to the development consents for Stages 1, 2 and 3, development of associated Subsidence Management Plans and Property Subsidence Management Plans and consultation with government agencies, Aboriginal stakeholders, land holders and community stakeholders;
- optimisation of resource utilisation and the economic benefits to the State and community arising from the development of the Stage 3 Project through:
  - refinement of the conceptual mine plan for Stage 3 to optimise coal extraction while minimising risks to the longwall operation, thus enabling the extraction of coal resources to the west of the previously approved Stage 3 longwall layout that would be otherwise sterilised if not extracted as a part of Stage 3 underground mining;
- refining the design of the Stage 3 mine plan to ensure minimal short term and long term impacts through an iterative process involving:
  - assessing potential impacts through consideration of land use, water management, cultural heritage, ecology and land resources;
  - review and refinement of previously proposed environmental control measures in consultation with the relevant government agencies to mitigate adverse impacts and monitor the performance of underground mining; and
  - review and refinement of contingency measures that can be implemented if unforeseen or unpredicted impacts occur.

Environmental assessment undertaken as part of the Proposed LWA7–A10 Modification indicates that the proposed modification is a refinement of the underground mining component of the Stage 3 Project approved under Project Approval 08\_0111. The proposed mine plan modification is anticipated to provide for more continuing production with less interruption, whilst having no significant increase in overall environmental impact levels. Underground mining can be undertaken in accordance with ESD principles through the application of identified mitigation and management measures to minimise environmental impacts.

### 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 comprehensive definition of the precautionary principle is as follows:

that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and an assessment of the risk-weighted consequences of various options.

An environmental risk analysis was undertaken for the LWA7–A10 Modification. The results of the risk assessment are summarised in **Section 6.1**. Key areas for further impact assessment were identified and assessed as set out in **Section 6.0**. The 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 LWA7–A10 Modification.

Key components of the project to minimise the potential for serious irreversible environmental damage include:

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

A range of mitigation measures have already been incorporated into the Stage 3 Project to minimise the potential for serious irreversible damage to the environment, including the development of environmental management and monitoring measures. These mitigation measures are set out in the LWA7 to A10 Extraction Plan (Austar 2013a) and associated management plans. Where residual risks are identified, contingency controls have been considered and will be further refined during review of Extraction Plans and preparation of Built Features Management Plans for the 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. Intragenerational equity is applied within the same

generation. The principles of generational equity are addressed by the Proposed LWA7–A10 Modification through:

- optimisation of the Stage 3 mine plan to ensure minimum risk to the operation, thus enabling underground mining to operate more safely and reducing the potential interruptions to the continuity of the longwall operation and therefore reducing the amount of time longwall impacts are experienced by all landholders being undermined;
- refinement of environmental management and monitoring measures identified for the Stage 3 Project to minimise potential environmental impacts; and
- the development and implementation of management and mitigation measures that are designed to address the potential environmental impacts of the project.

### **8.3.3 Conservation of Biological Diversity**

A detailed assessment of the ecology and biodiversity of the landform within the Modification Area has been undertaken for this EA, and supports previous comprehensive ecological studies undertaken within the surrounding area. The Proposed LWA7–A10 Modification will be conducted underground with negligible detrimental impact to the land surface which is substantially consistent with those approved under Project Approval 08\_0111.

A range of environmental control measures already proposed for the Stage 3 Project have been reviewed to ensure their continuing suitability for the LWA7–A10 Modification. 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 through the movement of longwall finish lines to the west, thereby allowing recovery of high quality coal resources that would otherwise be sterilised.

## **8.4 Conclusion**

The Proposed LWA7-A10 Modification provides an opportunity to avoid business interruption associated with structural constraints within the approved mine plan. The proposed modification also maximises the efficient recovery of an additional 1.05 million tonnes of high quality thick seam coal resource that can be undertaken without significantly increasing the environmental impacts of the existing approved operations.

The Proposed LWA7–A10 Modification will result in a minor increase of 1.8 per cent in the total area of subsidence affectation associated with the Stage 3 Project. The range of predicted subsidence impacts within this additional area of subsidence affectation are consistent with those approved under Project Approval 08\_0111, with no significant increase in environmental impacts predicted. The Proposed LWA7-A10 Modification is not anticipated to have a significant adverse impact on the land surface, natural or built features located within the Modification Area, and will not have a significant adverse impact on existing land uses. No change to existing suite of approved management measures are considered necessary as a result of the proposed modification.

The comprehensive environmental impact assessment therefore demonstrates that with the continued implementation of existing management and mitigation measures, it is anticipated that the proposed modification can proceed within acceptable environmental standards, without significantly increasing the environmental impacts of the Stage 3 Project.

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