APPENDIX 7

Flood and Drainage Assessment

Austar Coal Mine Pty Ltd

Austar Coal Mine
Flood and Drainage Assessment: Stage 3 Modification

July 2011

Umwelt
Environmental Consultants

Austar Coal Mine
Flood and Drainage Assessment: Stage 3 Modification

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Austar Coal Mine Pty Ltd

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1.0 Introduction

1.1 Background

Austar Coal Mine Pty Ltd (Austar) operates the Austar Coal Mine, an underground mine located approximately 10 kilometres south of Cessnock in the lower Hunter Valley of NSW (refer to **Figure 1.1**). The mine is an aggregate of the former Ellalong, Pelton, Cessnock No. 1 and Bellbird South Collieries and is located in the South Maitland Coalfields. Austar has approval to carry out underground mining in three stages. Mining of Stage 1 is complete. A modification to Stage 2 was approved in June 2008 to allow Longwall Top Coal Caving (LTCC) mining methods to be adopted. A further modification to Stage 2 was approved in November 2010, to allow an additional longwall (Longwall A5a) to be included.

A separate approval enabling longwall mining using LTCC technology in the Stage 3 area (refer to **Figure 1.2**) and construction and operation of a new Surface Infrastructure Site and access road south of Kitchener was granted by the Minister for Planning in September 2009. Underground mining in the Stage 3 area and construction of the new Surface Infrastructure Site are collectively known as the 'Stage 3 Project'.

To enable more efficient and safer extraction of coal from the Stage 3 area, Austar seeks approval to modify Project Approval 08_0111 to allow the longwalls to be reorientated as per **Figure 1.3**. This modification will include removal of longwall A6, and extraction of coal in longwalls A7 to A19, which are a reorientation of longwalls A7 to A17 shown in **Figure 1.2**.

The Stage 3 Modification area is mostly located within the Cony Creek catchment, which forms part of Congewai Creek and Wollombi Brook drainage systems. A small portion of the proposed Stage 3 Modification area is within the Black Creek catchment. The location of the Stage 3 Modification area within the Cony Creek and Black Creek catchments is shown on **Figure 1.4**.

1.2 Scope of Assessment

The primary aims of this flood and drainage assessment are to determine the potential impacts of the proposed Stage 3 Modification mine plan on the flood and drainage behaviour of the surrounding area, in comparison to the estimated response for the previously approved Stage 3 mine plan.

This report has been prepared to support an Environmental Assessment (EA) that is being prepared to identify and assess the potential environmental impacts of the proposed Stage 3 Modification.

1.3 Modelling Approach

The two dimensional (2D) hydrodynamic model previously developed to describe the flood behaviour of the study area was used to assess the potential impacts of the Stage 3 Modification mine plan. The development of the 2D hydrodynamic model is detailed fully in previous reports, including *Flooding Assessment: Longwalls A3, A4 and A5* (Umwelt, 2007) and *Flood and Drainage Assessment: Stage 3* (Umwelt, 2008). The 2D hydrodynamic model was also used in determining the impacts of the previously proposed addition of longwall A5a in *Proposed Stage 2 Extension – Flood and Drainage Assessment for Longwall A5a* (Umwelt, 2010).

The previously developed 2D hydrodynamic model was modified to incorporate the predicted subsidence expected as a consequence of the mining operations proposed in the Stage 3 Modification. This includes the cumulative impacts of subsidence from the earlier mining stages that will be completed prior to mining of Stage 3.

Inflows, boundary conditions, roughness categories and values, and the mesh structure used for the previous studies for this site (i.e. Umwelt, 2007; Umwelt, 2008; and Umwelt, 2010) were again used to model the likely changes to the flood and drainage responses due to the proposed mining operations. Like the previous studies, the 1 year and 100 year Average Recurrence Interval (ARI) design storm events were assessed.

Results from the previous assessment work (Umwelt, 2010) for the modelled maximum flood depths and velocities for the 100 year ARI storm event are shown on **Figures 1.5** to **1.12** for the:

- pre-mining landform (i.e. with no subsidence impacts from Stage 2 or Stage 3) (refer to **Figures 1.5** to **1.8**); and
- previously approved Stage 3 mining landform with predicted subsidence (i.e. Longwalls A3 to A17, including A5a) (refer to **Figures 1.9** to **1.12**).

A series of models were run to generate flood characteristics for the predicted subsidence scenarios for the 100 year and 1 year ARI storm events.

After running the models the output data from the models was loaded into a database. From this database the peak flood depths, elevations and velocities were extracted and flood hazard categories generated according to Appendix G of the *Floodplain Development Manual* (NSW Government, 2005).

Based on the modelling outcomes, the following impacts of the proposed Stage 3 Modification were assessed (refer to **Section 3.0**):

- changes to freeboard at dwellings;
- flood hazard categories for dwellings and private property access routes; and
- potential changes to flood regimes, including impacts on flood prone land, creek channels, flow paths and remnant ponding.

2.0 Subsidence Predictions

In order to model the potential impacts that the proposed mining operations could have on the flood response of the Quorrobolong Valley, predictions of the likely subsidence are required. Subsidence predictions provided by MSEC (2011) for the proposed mining operations were used for this purpose. The subsidence predictions included both the maximum predicted subsidence (most likely subsidence) and the upper bound subsidence (maximum subsidence that can be reasonably expected as a result of the proposed mining operations). These subsidence predictions allow for the Digital Terrain Model (DTM) developed for the site to be modified reflecting the effect that the proposed underground mining operations are likely to have on the landform in the area, for the estimation of the flood response of the area. The use of both the maximum predicted and the upper bound subsidence allows for the incorporation of some of the uncertainty associated with subsidence modelling into the prediction of the flood impact of the proposed underground mining activities.

The subsidence predictions provided by MSEC (2011) indicate that the modification to the Stage 3 mine plan is likely to change the pattern of subsidence within the mining area (refer to Section 5.1.2 of the MSEC report). It is of particular note that the predicted subsidence impacts in the vicinity of Cony Creek are expected to decrease relative to the subsidence impacts previously predicted for the approved Stage 3 mine plans, whilst in the vicinity of Sandy Creek a slight increase in subsidence impacts are predicted. These changes to the predicted subsidence pattern (relative to the previously approved Stage 3 mine plan) have the potential to change the flood and drainage behaviour of the area. This report aims to quantify these changes and assess the potential impacts to the surrounding area, with regard to both natural and built features.

3.0 Model Outcomes

3.1 Predicted Impacts of Modified Stage 3

The potential impacts of underground mining of Longwalls A7 to A19 (i.e. Stage 3 Modification) were determined. The outcomes of the assessment are summarised in **Sections 3.1.1** to **3.1.5**.

Figures 3.1 and **3.2** describe the modelled maximum flood depths and velocities for the 100 year ARI storm event with the maximum predicted subsidence for the Stage 3 Modification. **Figures 3.3** and **3.4** describe the modelled maximum flood depths and velocities for the 1 year ARI storm event with the maximum predicted subsidence for the Stage 3 Modification. **Figure 3.5** shows flow hydrographs derived for the 100 year flood event downstream of the approved Stage 2 mining area. **Figure 3.6** shows the potential changes to remnant ponding as a result of the proposed underground mining of the Stage 3 Modification.

3.1.1 Flood Depths

A comparison of the modelled flood response for the maximum predicted subsidence for Stage 3 Modification (i.e. Longwalls A7 to A19) with those previously modelled for the maximum predicted subsidence for Stage 3 (i.e. Longwalls A3 to A17, including A5a), indicated that the Stage 3 Modification could potentially reduce flood levels at the junction of Cony Creek and Sandy Creek to a level closer to the pre-mining flood levels (refer to **Figures 1.5** and **3.1**) for both the 100 year and 1 year ARI storm events. The maximum modelled decrease was in the order of 500 millimetres with an average decrease of 200 millimetres for the 100 year ARI storm event.

In the sections downstream from the junction of Cony Creek and Sandy Creek, modelling indicated an increase in the modelled maximum flood depths with the Stage 3 Modification. These predicted increases in maximum flood depths typically occur along Cony Creek in the vicinity of the western end Longwall A13, within an area that was not previously proposed to be mined. The maximum modelled increase in flood depth was in the order of 500 millimetres, with an average increase for this area in the order of 200 millimetres for the 100 year ARI storm event.

In the upper reaches of Cony Creek, modelled maximum flood depths typically remain within 50 millimetres of those estimated for the previously approved Stage 3 mine plan (for the 100 year ARI event). The sections of Cony Creek that are predicted to experience approximately 50 millimetres increased maximum flood depth (compared to the previously approved Stage 3 impacts) are typically limited to areas that are adjacent to the

Stage 3 Modification longwalls, and are therefore within the predicted subsidence bowl. Reductions in the predicted flood depth are generally within areas that are no longer undermined as part of the proposed Stage 3 Modification.

In terms of out of channel flooding, modelling indicates that during the 1 year ARI storm event for the pre-Stage 3 mining landform (refer to **Figure 1.7**) are typically in the order of up to 300 millimetres. These levels are predicted to increase by up to 180 millimetres for the post-mining condition with the approved maximum predicted subsidence (refer to **Figure 1.11**). With the proposed modification it is estimated that predicted increase in flood levels will be similar to the pre-mining levels with out of channel flooding typically in the order of up to 300 millimetres. These increases are typically predicted to occur in the vicinity of the western end of Longwall A13.

3.1.1.1 Flood Depths at Dwellings

The modelling indicates that the maximum predicted flood depth that occurs within the vicinity of most of the dwellings identified within the study area remains below the estimated floor level. This is consistent with previous flood modelling of the area. Dwellings that are of particular concern with respect to flood levels are discussed in more detail below.

The predicted maximum flood extent for the proposed Stage 3 modification is predicted to extend closer to dwelling A17a than was previously modelled for the approved Stage 3 mine plans (refer to **Figures 1.5** and **3.1**). A closer inspection of the flood extent adjacent to dwelling A17a indicates that the edge of the predicted flood extent immediately adjacent to dwelling A17a, the predicted flood extent does not extend to include the dwelling itself. Maximum predicted flood depths were found to be no greater than 100 millimetres within approximately 10 metres of the dwelling, with predicted depths not exceeding 300 millimetres within approximately 30 metres of the dwelling. The increase in the predicted maximum 100 year ARI flood depths are therefore not anticipated to have a significant impact on the amenity of dwelling A17a. It is also understood that dwelling A17a is located on wooden stumps above the natural ground level.

The maximum predicted flood depths and extents within the vicinity of dwellings A100a and A19a were found to decrease as a result of the Stage 3 modification, compared to the previously approved Stage 3 flooding impacts as well as the pre-Stage 2 conditions (refer to **Figures 1.5** and **3.1**).

The predicted maximum flood extent and depths for the 100 year ARI flood at dwelling A102a were found to change negligibly as the result of the Stage 3 modification, compared to the previously approved Stage 3 flood impacts (refer to **Figures 1.5** and **3.1**).

Elsewhere within the modelled area, access to properties were predicted to have only minor changes in maximum flood depths, with negligible changes to flood durations and hazard categories (refer to **Section 3.1.3**) expected to impact on the accessibility of these properties.

3.1.2 Flow Velocities

The modelling indicates that for most of the area proposed to be undermined by Stage 3, the maximum flood velocities predicted for the Stage 3 Modification are generally similar to the previously modelled maximum flood velocities estimated for the approved Stage 3 mine plan. Downstream of the Quorrobolong Road crossing over Cony Creek, the changes in the predicted maximum velocities for the approved Stage 3 and Stage 3 Modification are negligible (refer to **Figures 1.6** and **3.2**).

The lower reaches of Sandy Creek near the confluence with Cony Creek were found to experience a minor increase in the peak flow velocity from approximately 0.5 m/s to approximately 1.0 m/s (for the 100 year ARI event) compared to the approved Stage 3 impacts (refer to **Figures 1.6** and **3.2**). This increase is however expected to be limited to the lower reaches of Sandy Creek, and is still within the range of velocities naturally experienced within other nearby sections of Sandy Creek.

Downstream of the confluence of Cony Creek and Sandy Creek, the peak modelled flow velocities were found to decrease from approximately 1.7 m/s to approximately 1.1 m/s (for the 100 year ARI event) compared to the previously approved Stage 3 mine plan and the pre-Stage 2 landform (refer to **Figures 1.6** and **3.2**).

An area of open paddock area north of Cony Creek, upstream of Quorrobolong Road, which was not expected to be subject to significant flood depths under the approved Stage 3 mine plan (refer to **Figures 1.5** and **3.1**), was found to now expect maximum flow velocities of approximately 0.2 m/s for the 100 year ARI event, due to the increase in typical flood depths from approximately 100 millimetres (under the approved Stage 3 conditions) to approximately 300 millimetres.

Analysis of the modelling results for Sandy Creek, Cony Creek and Quorrobolong Creek system indicate that maximum modelled velocities will remain within non-scouring ranges for the 100 year event following the Stage 3 Modification. Therefore, no significant changes due to velocity induced scouring or erosion are expected as a result of the proposed Stage 3 Modification.

The upper reaches of Cony Creek are expected to experience little change in the predicted maximum flow velocities within the creek section compared to the approved Stage 3 impacts (refer to **Figures 1.6** and **3.2**). This is despite the Stage 3 Modification no longer undermining this section of Cony Creek.

Modelling indicates that maximum velocities for the 1 year ARI storm event within Cony Creek would range from 0.6 m/s to 1.2 m/s for the pre-Stage 3 mining conditions (refer to **Figure 1.8**). Similarly modelling indicates that maximum velocities for the 1 year ARI storm event within Sandy Creek would range from 0.2 m/s to 0.6 m/s for the pre-Stage 3 mining conditions. With the currently approved mine plan, decreases in maximum velocities in Cony Creek of the order of 0.2 m/s to 0.3 m/s and increases in maximum velocities in Sandy Creek of the order of 0.2 m/s were predicted. With the proposed Stage 3 Modification, it is predicted that maximum velocities in Cony Creek will decrease by up to approximately 0.3 m/s and maximum velocities in Sandy Creek will increase by up to approximately 0.3 m/s relative to the pre-mining conditions (refer to **Figures 1.8** and **3.4**). However, the analysis indicates that the maximum velocities will remain within non-scouring ranges for the 1 year event following the Stage 3 Modification. No significant changes due to velocity induced scouring or erosion are expected as a result of the proposed Stage 3 Modification.

3.1.3 Flood Hazard

In order to assess the potential flood hazards associated with the proposed underground mining associated with the Stage 3 Modification area, the flood hazard categories outlined in Appendix G of the *Floodplain Development Manual* (2005) were utilised. The four flood hazard categories, in order of increasing hazard, are:

- unclassified;
- vehicles unstable;
- wading unsafe (and vehicles unstable); and

- damage to light structures.

Modelling indicated that negligible changes to the maximum flood hazard categories along access routes to dwellings would occur with the maximum predicted subsidence for the Stage 3 Modification (i.e. Longwalls A7 to A19) compared to the maximum predicted subsidence for the previously approved Stage 3 (i.e. Longwalls A6 to A17). **Table 3.1** compares the flood hazard categories along the access routes for the various dwellings potentially affected by flooding during the 100 year ARI storm event.

Table 3.1 – Flood Hazard Categories for Dwelling Access Routes 100 year ARI Storm Event[1]

Dwelling Access Route	Modelling Scenario		
	Pre Stage 3 Mining	**Approved Stage 3 (Predicted)**	**Stage 3 Modification (Predicted)**
A17a	Unclassified	Unclassified	Unclassified
A18a	Wading Unsafe	Wading Unsafe	Wading Unsafe
A19a	Unclassified	Unclassified	Unclassified
A20a	Vehicles Unstable	Vehicles Unstable	Vehicles Unstable
A100a	Vehicles Unstable	Vehicles Unstable	Unclassified
A101a	Vehicles Unstable	Vehicles Unstable	Vehicles Unstable
A102a	Unclassified	Unclassified	Unclassified

[1] Only dwellings with access routes within the flood extent are listed

Modelling also indicated that no changes to the maximum flood hazard categories during the 100 year ARI storm event at dwellings would occur with the maximum predicted subsidence for the Stage 3 Modification (i.e. Longwalls A7 to A19) compared to the maximum predicted subsidence for the previously approved Stage 3 (i.e. Longwalls A6 to A17).

3.1.4 Flood Duration and Remnant Ponding

Flood model hydrographs immediately downstream of the Stage 3 Modification (refer to **Figure 3.5**) are comparable to the flood hydrographs derived previously for the approved Stage 3 mine plan, indicating that the proposed underground mining will have negligible effect on the flood response downstream of the Stage 3 Modification mining area during the 100 year ARI storm event.

The maximum predicted subsidence as a result of the proposed underground mining of Stage 3 Modification indicates negligible changes to the remnant surface ponding in the area to be undermined are likely (refer to **Figure 3.6**). As can be seen by the analysis, the potential impacts on remnant ponding were confined to existing flow paths, paddocks and dams, with no predicted impact on access routes to, or within, the properties along Cony Creek.

Analysis of the upper bound predicted subsidence attributed to the Stage 3 Modification indicates that an increase to remnant surface ponding is possible. This increase in remnant ponding would occur in the paddock areas immediately downstream of the Cony Creek and Sandy Creek junction in the vicinity the western end of Longwalls A13, A14 and A15.

3.1.5 Potential Impacts on Stream Flow and Channel Stability

The flood modelling analysis indicates that the Stage 3 Modification is unlikely to have a significant impact on the flow regime of the Cony Creek and Quorrobolong Creek systems, with only minor changes predicted in runoff regimes and peak discharges.

Based on the subsidence predictions (refer to **Section 2.0**), the maximum predicted subsidence associated with the mining operations of the Stage 3 Modification will result in maximum changes in grade of 0.3 per cent, 0.8 per cent and 0.3 per cent respectively within Quorrobolong Creek, Cony Creek and Sandy Creek, compared to the existing channel conditions (refer to **Figures 3.7** and **3.8**). This predicted maximum change in grade is similar to the change in grade predicted to occur as a consequence of the approved Stage 3 mine plan.

As the predicted changes in in-channel grade are small and are considered to lie within the natural variations in grade of the creek lines of the Quorrobolong Valley, it is considered that the Stage 3 Modification will not significantly alter the flow capacity or stream velocities within the existing channels. It is also considered that there is minimal potential for channel realignment to occur as a result of the Stage 3 Modification. As it has been established that the modelled changes to the creek slope and maximum flood depths is consistent with the ranges that occur naturally within the Quorrobolong Valley, the potential for changes to the bed shear stress within these creek systems is expected to be minimal.

The potential to increase erosion on the landform is also expected to be minimal due to the relatively small predicted changes in landform grades combined with the high level of groundcover limited amount of exposed soils that exist in the area.

3.2 Impact of Removal of Longwall A6 on Flooding in the Stage 2 Area

The removal of Longwall A6 from the Stage 3 mine plan will result in a decrease in flood depths immediately downstream of Quorrobolong Road during the 100 year ARI storm event.

In addition, the removal of Longwall A6 will have only minor impacts on the flood depths and velocities and access routes in the Stage 2 mining area as discussed in **Section 3.1**. The analysis also indicates that there will be negligible impacts to flood hazard categories in the Stage 2 mining area as a result of the proposed Stage 3 Modification.

As indicated on **Figure 3.6** there are no predicted impacts to ponding downstream of Quorrobolong Road as a result of the proposed Stage 3 Modification. Further information on changes in subsidence over the Stage 2 mining area as a result of the removal of Longwall A6 is provided in MSEC (2011).

4.0 Summary and Conclusions

Analysis indicates that the maximum predicted subsidence associated with the proposed Stage 3 Modification would have only minor impact to the flood response in the surrounding area compared to the previously approved Stage 3 mine plan. The main area that is likely to be affected by changes to the flooding response is in the vicinity of Longwalls A13, A14 and A15, with an increase in depth and velocity modelled for the section of Cony Creek downstream of the junction with Cony Creek and Sandy Creek, compared to the maximum depths previously expected as a result of the approved Stage 3 mine plan.

The modelling indicates that the natural flow constriction within Cony Creek downstream of the confluence of Cony Creek and Quorrobolong Creek would remain a point of flow control, with the maximum predicted subsidence due to the underground mining of the Stage 3 Modification modifying the flooding response upstream and downstream of this location in such a way as to closely resemble the flood response estimated for the pre-mining landform (i.e. prior to any mining of Stage 2 and Stage 3).

The modelled changes to the flood hazard categories and flood extents as a result of the proposed Stage 3 Modification were negligible compared to the response estimated for the previously approved Stage 3 mine plan. No access routes to private properties were found to be affected by the maximum predicted subsidence associated with the proposed Stage 3 Modifications.

The upper bound predicted subsidence associated with Longwalls A7 to A19 was predicted to result in significant changes to remnant ponding in the area to be undermined. Areas of additional remnant ponding were predicted to occur in the section of Cony Creek, upstream of Quorrobolong Road, in the vicinity of Longwalls A13, A14 and A15. The additional predicted remnant ponding was limited to existing flowpaths, paddocks and dams. It should be noted that the subsidence assessment report (MSEC, 2011) indicates that the likelihood of the upper bound subsidence occurring is minimal, as comparisons of observed subsidence in earlier stages of the Austar Coal Mine have been less than the maximum predicted subsidence.

5.0 References

Institute of Engineers Australia, 1987. Australian Rainfall and Runoff.

MSEC, 2011. *Austar Coal Mine: Stage 3 - Longwalls A7 to A19, Subsidence Predictions and Impact Assessments for Natural Features and Surface Infrastructure in Support of a Modification to the Development Consent*, prepared for Austar Coal Mine Pty Ltd.

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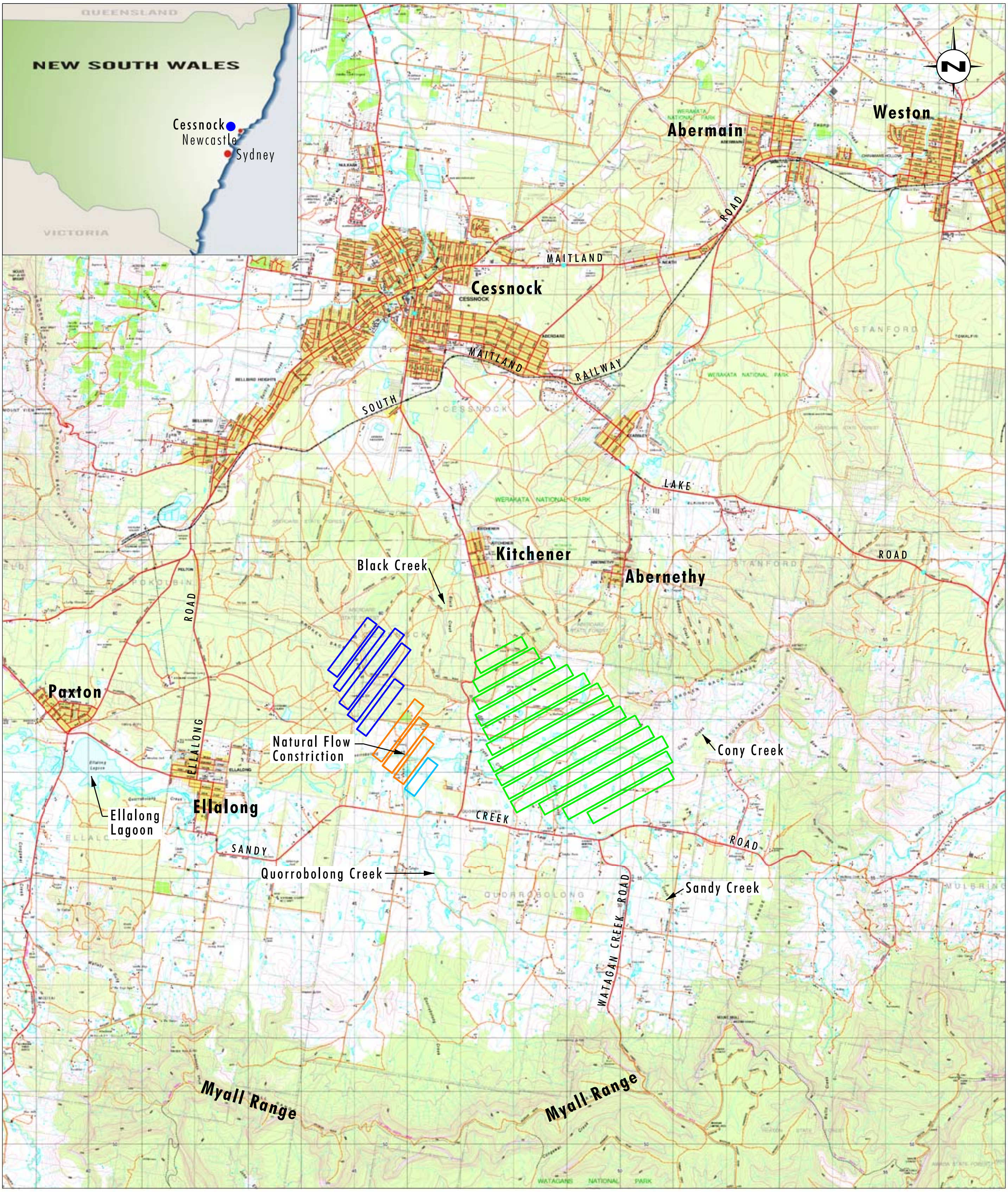

Source: Topo Maps: LPI NSW, Longwall Layout: Austar Coal Mine

0 1.0 2.0 4km
1:100 000

Legend

- Layout for Stage 1 Longwall Panels
- Layout for Stage 2 Longwall Panels
- Layout for Stage 2 Extension Longwall Panel
- Proposed Stage 3 Modification Longwall Layout

FIGURE 1.1

Locality Plan

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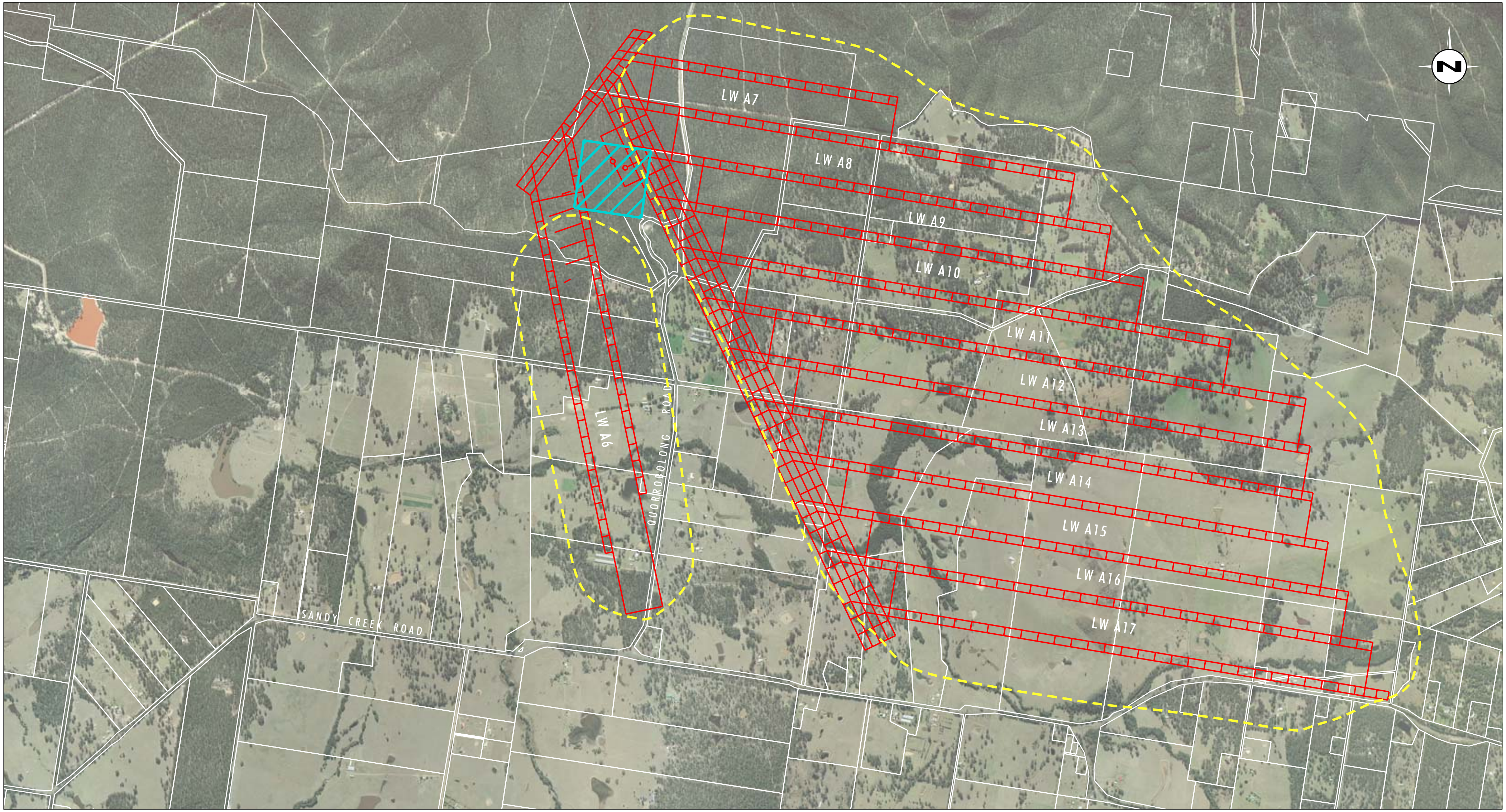

Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW,
Aerial Photography: AAM Hatch 2006, Subsidence Contours: MSEC

0 0.5 1 1.5km
1:32 000

Legend

Conceptual Layout for Stage 3 Longwall Panels as Approved
20mm Subsidence Contour for Conceptual Layout as Approved
Approved Surface Infrastructure Site

FIGURE 1.2

Approved Stage 3 Mine Plan

File Name (A4): R68_V1/2274_937.dgn

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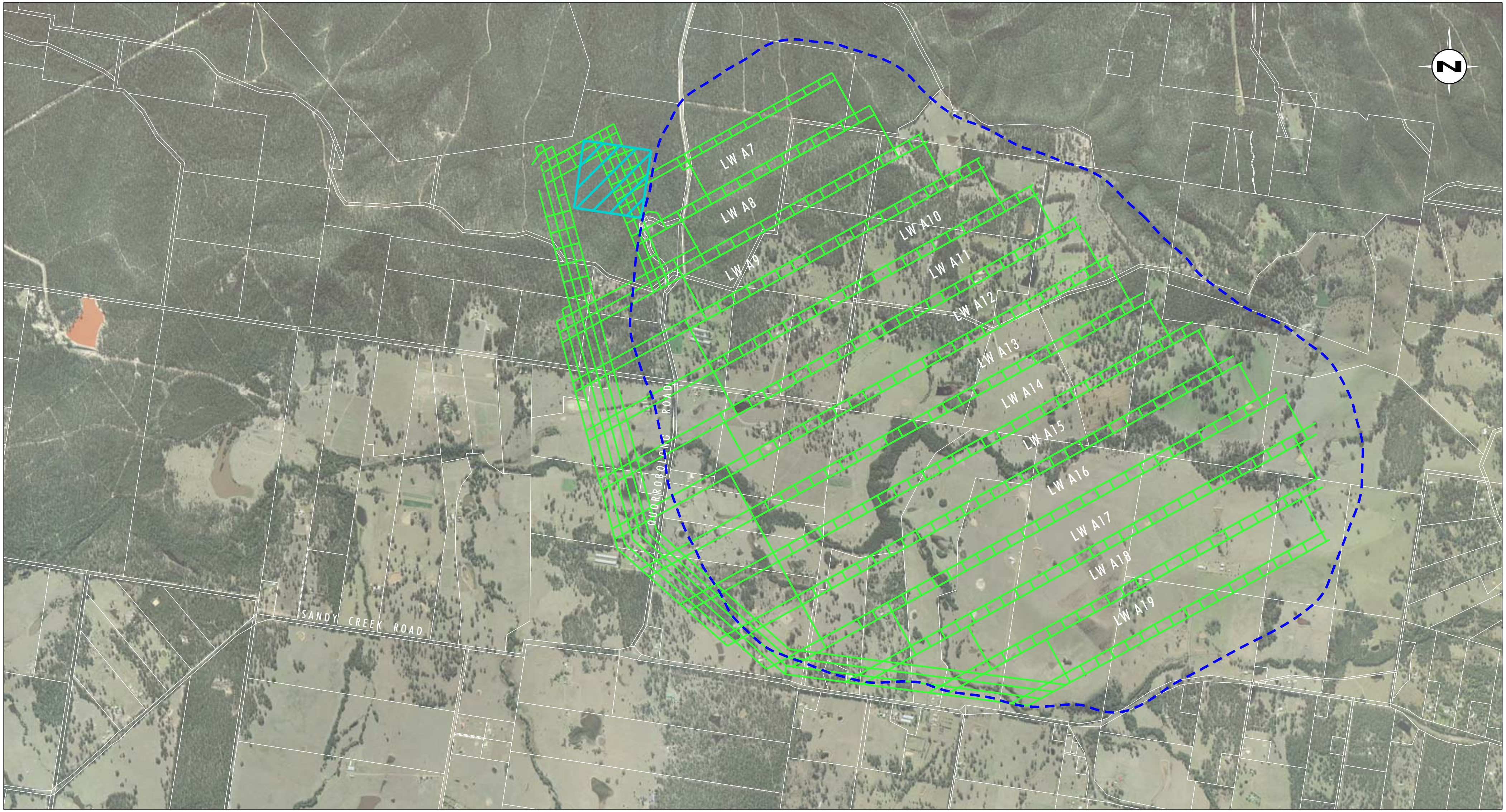

Source: Longwall Layout: Austar Coal Mine, Cadastre: LPI NSW,
Aerial Photography: AAM Hatch 2006, Subsidence Contours: MSEC

0 0.5 1 1.5km
1:32 000

Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Approved Surface Infrastructure Site

FIGURE 1.3

Proposed Stage 3 Modification Mine Plan

File Name (A4): R68_V1/2274_938.dgn

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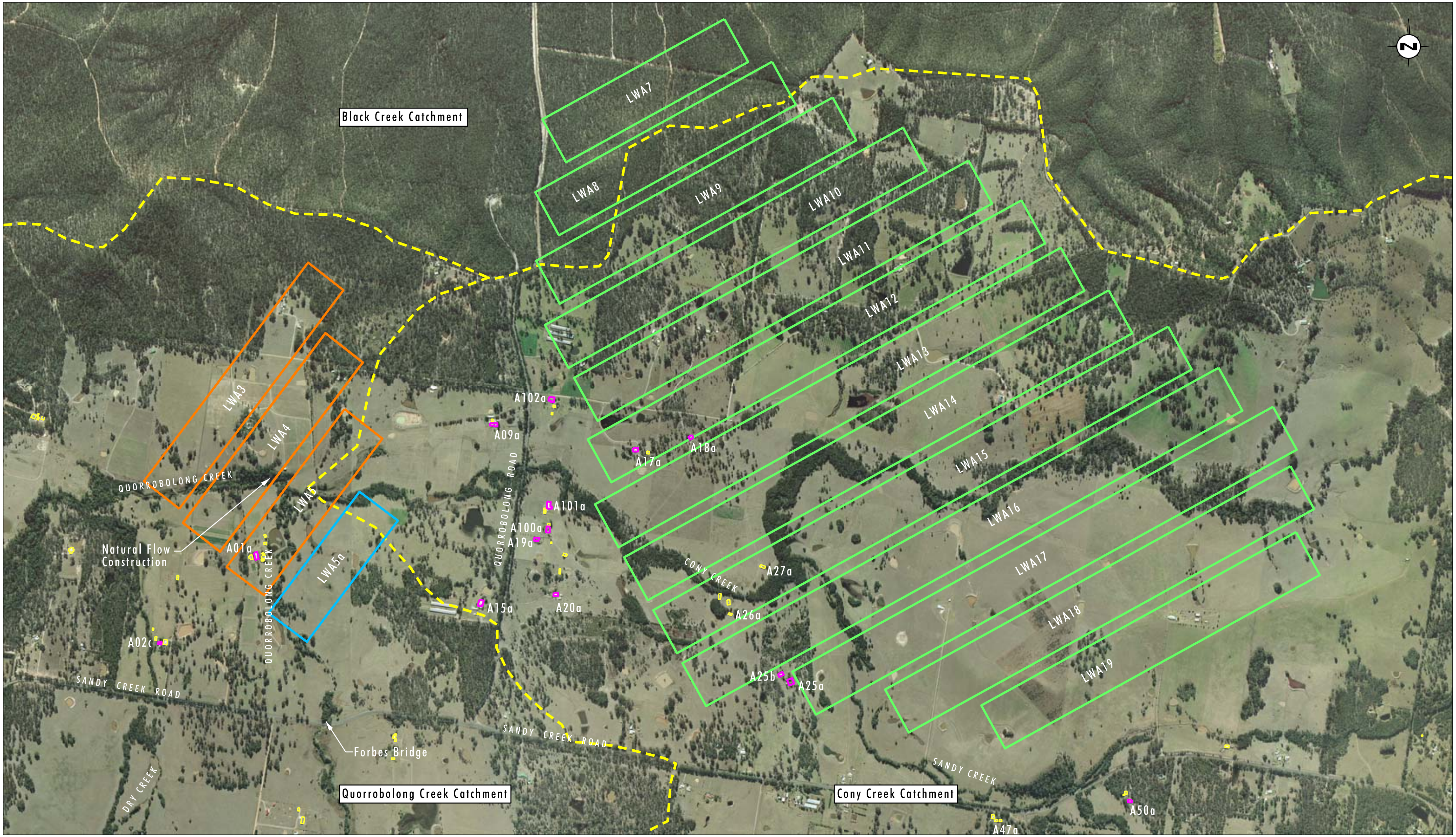


Source: Longwall Layout: Austar Coal Mine, Aerial Photography: AAM Hatch 2006
Note: Dwellings only shown for flood model extent

0 300 600 900m
1:18 000

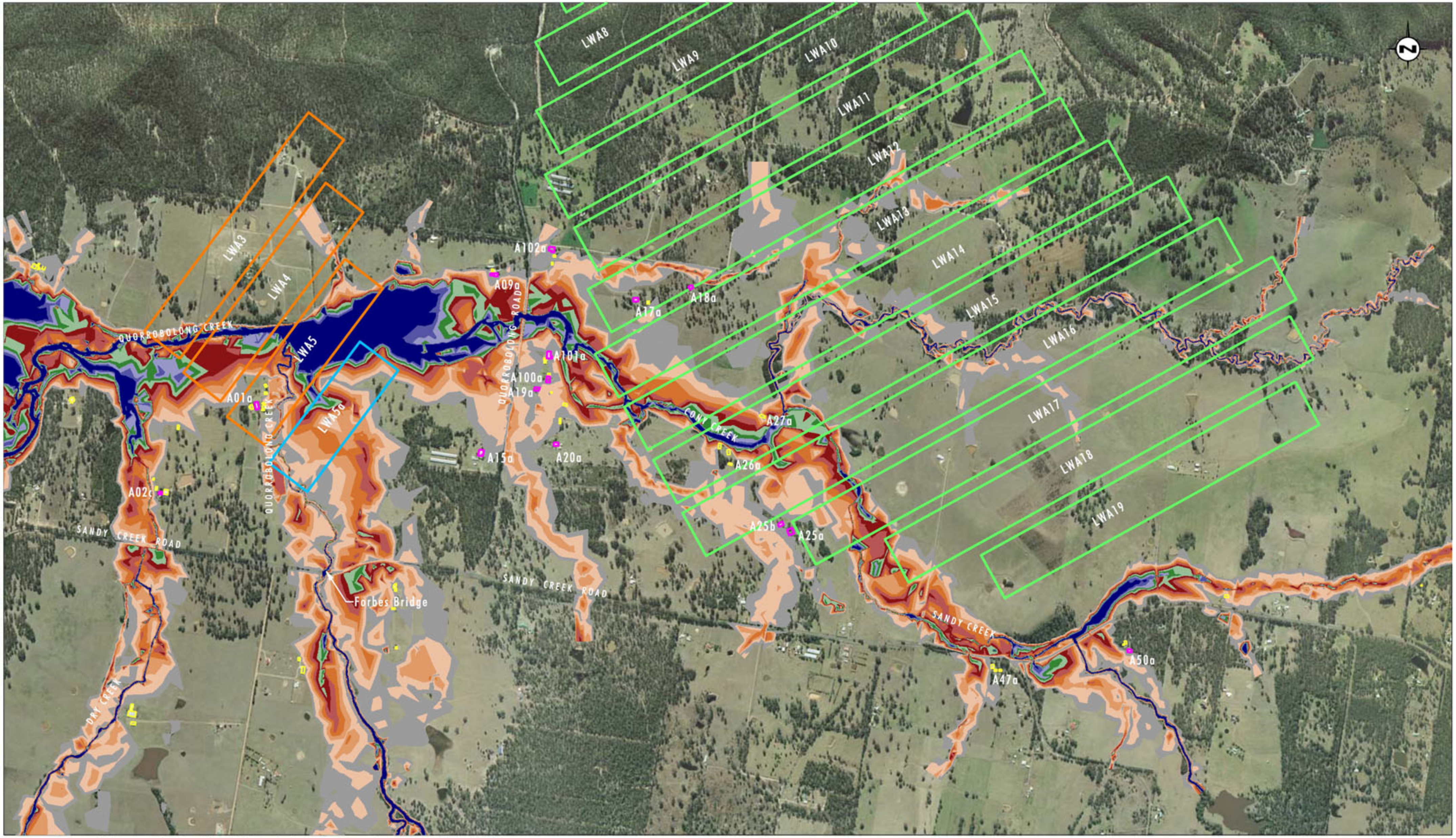
Legend

- Layout for Stage 2 Longwall Panels
- Layout for Stage 2 Extension Longwall Panel
- Layout for Proposed Stage 3 Modification Longwall Panels
- Building
- Dwelling
- A01a Dwelling Reference Number
- Catchment Boundary

FIGURE 1.4

Catchment Context

File Name (A3): R68_V1/2274_863.dgn



Source: Longwall Layout: Austar Coal Mine, Aerial Photography: AAM Hatch 2006
Note: Dwellings only shown for flood model extent

Legend

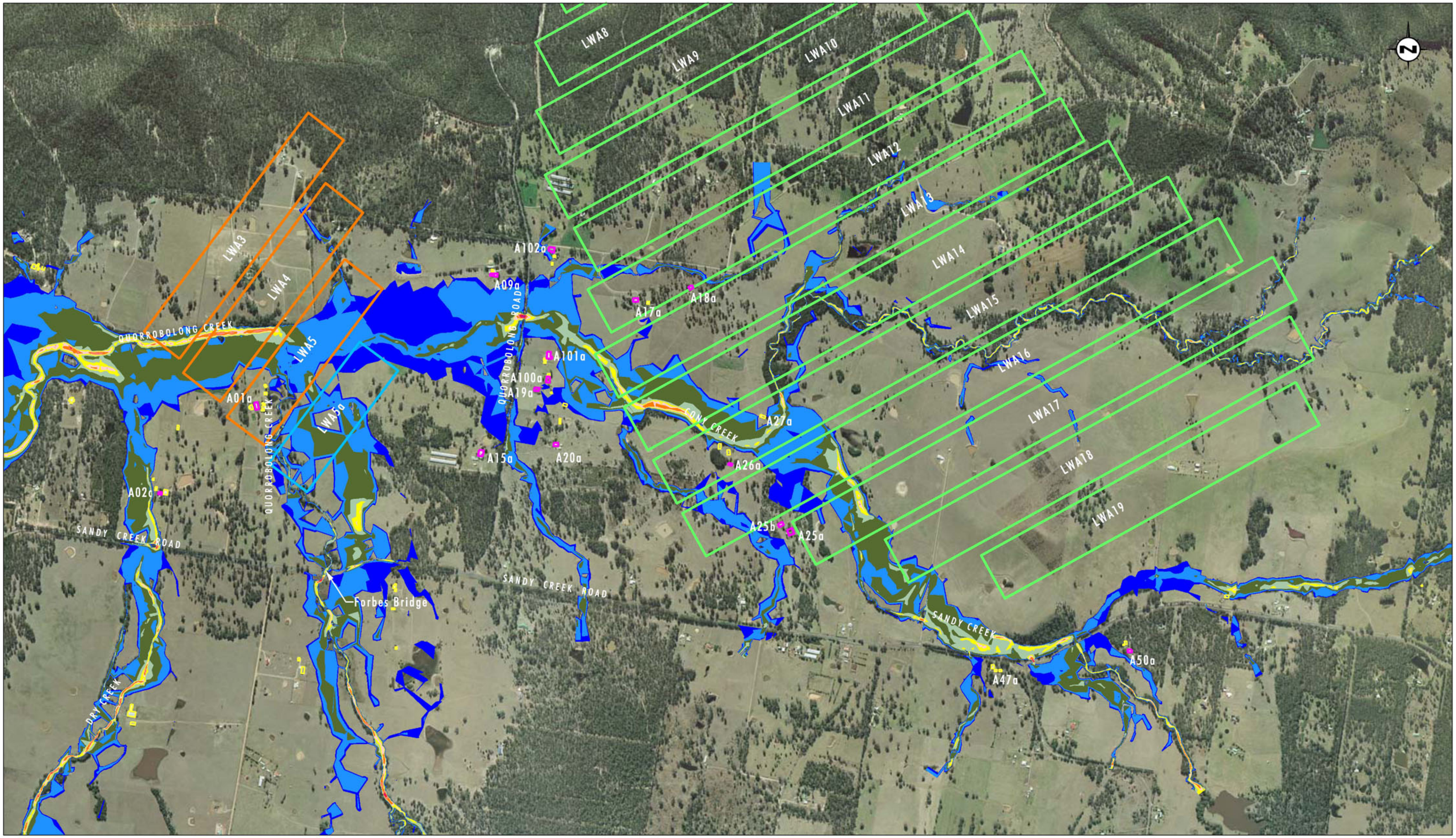
- Layout for Stage 2 Longwall Panels
- Layout for Stage 2 Extension Longwall Panel
- Layout for Proposed Stage 3 Modification Longwall Panels
- Building
- Dwelling
- A01a Dwelling Reference Number

Water Depth (m)

- Range [0.001 : 0.100]
- Range [0.100 : 0.300]
- 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]

FIGURE 1.5

100 year ARI Storm: Maximum Water Depths
Pre Stage 2 Mining Landform



Source: Longwall Layout: Austar Coal Mine, Aerial Photography: AAM Hatch 2006
Note: Dwellings only shown for flood model extent

0 300 600 900m
1:18 000

Legend

- Layout for Stage 2 Longwall Panels
- Layout for Stage 2 Extension Longwall Panel
- Layout for Proposed Stage 3 Modification Longwall Panels
- Building
- Dwelling
- A01a Dwelling Reference Number

Velocity (m/s)

- Range [0.100 : 0.250]
- Range [0.250 : 0.500]
- Range [0.500 : 0.750]
- Range [0.750 : 1.000]
- Range [1.000 : 1.250]
- Range [1.250 : 1.500]
- Range [1.500 : 1.750]
- Range [1.750 : 2.000]
- Range [2.000 : 2.250]
- Range [2.250 : 3.500]

FIGURE 1.6

100 year ARI Storm: Maximum Modelled Water Velocities for Pre Stage 2 Mining

File Name (A3): R68_V1/2274_895.dgn