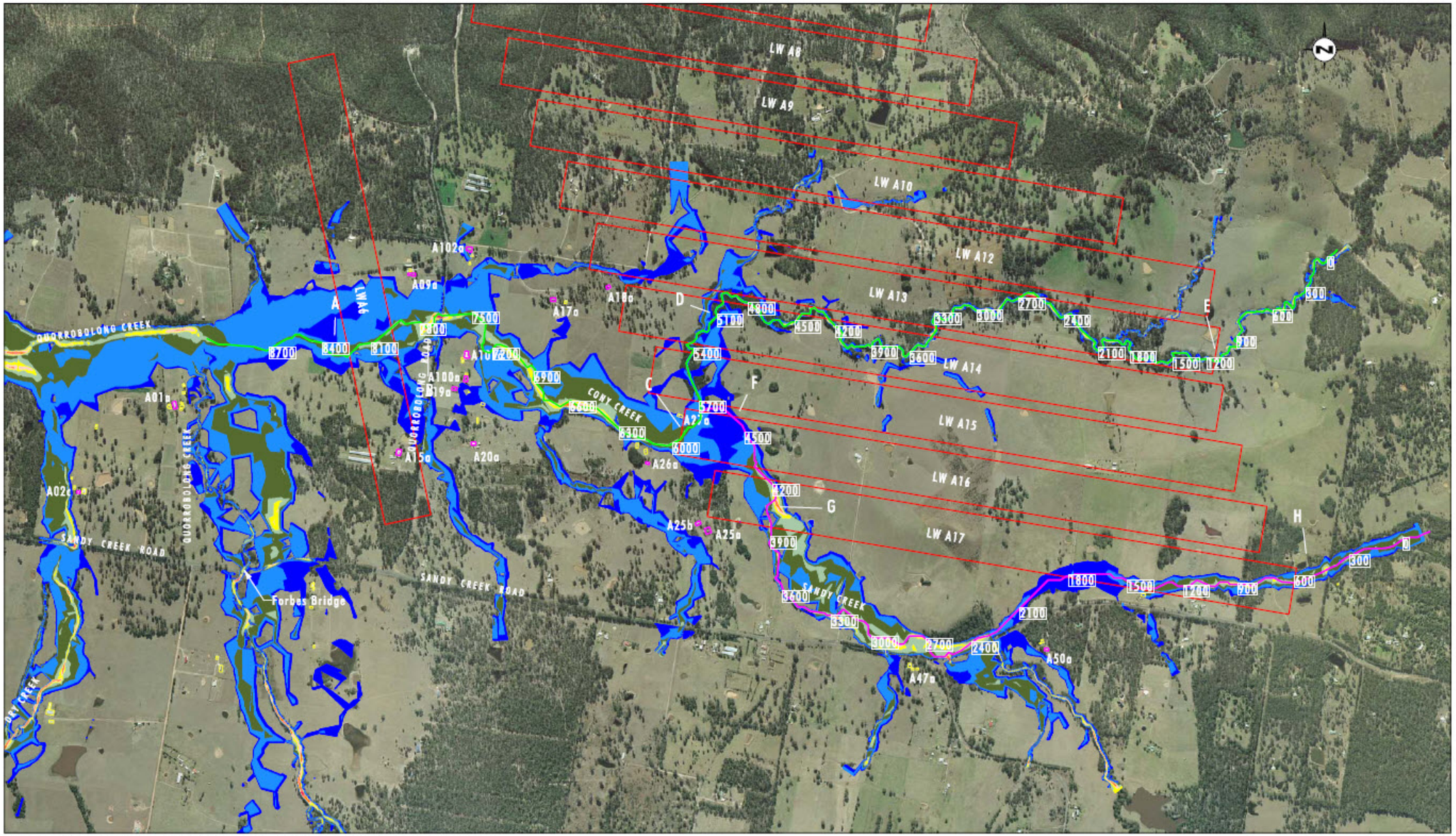


Source: Longwall Layout: Austar Coal Mine, Aerial Photography: AAM Hatch 2006
Note: Dwellings only shown for flood model extent

Legend

- Conceptual Layout for Stage 3 Longwall Panels
- Building
- Dwelling
- A01a Dwelling Reference Number
- Longsection 1
- Longsection 2
- 1000 Longsection Chainage

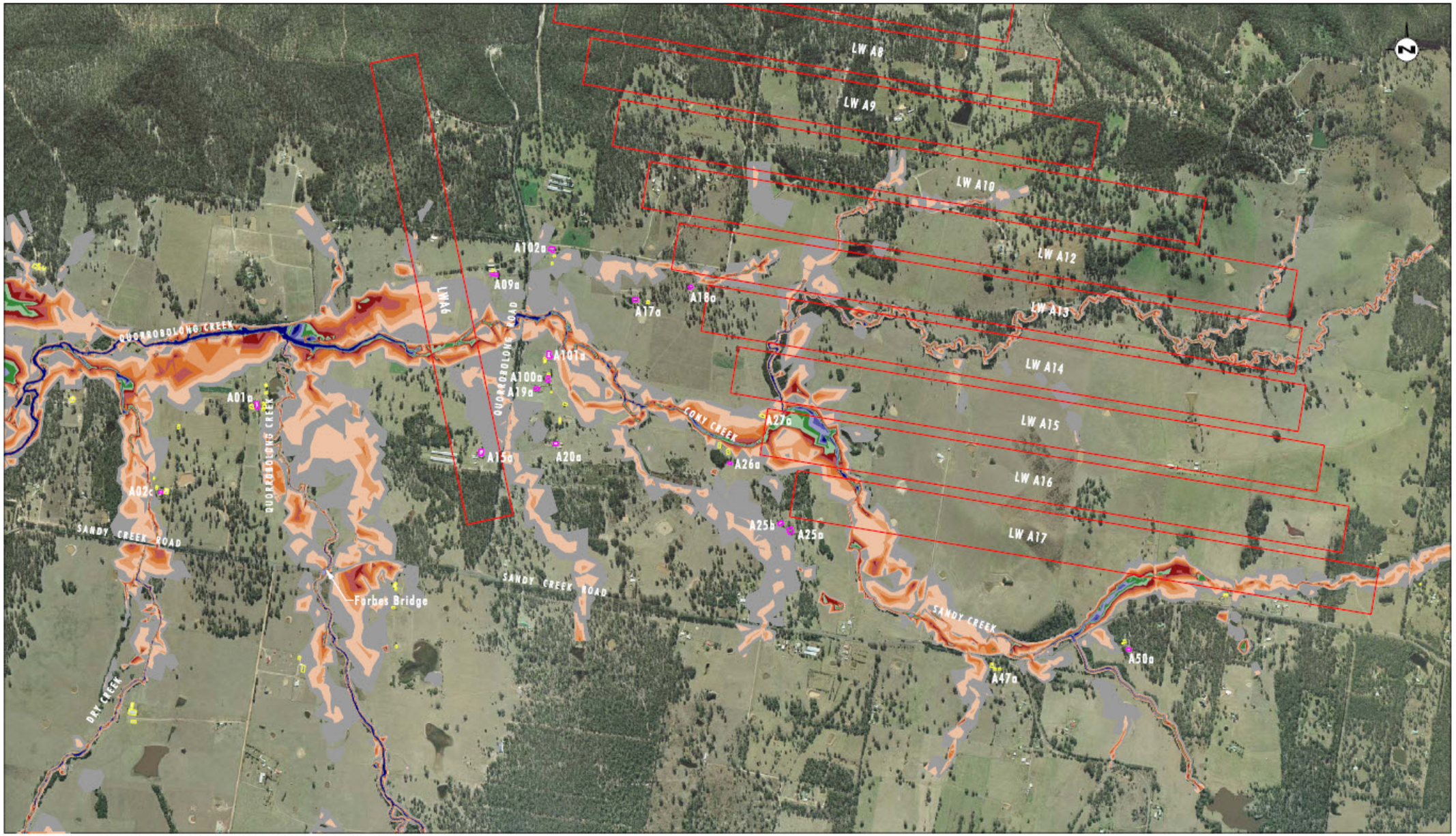
Velocity (m/s)

- 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 8.8

100 year ARI Storm: Maximum Water Velocities - Upper Bound Subsidence

File Name (A3): R16_V1/2274_231.dgn



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

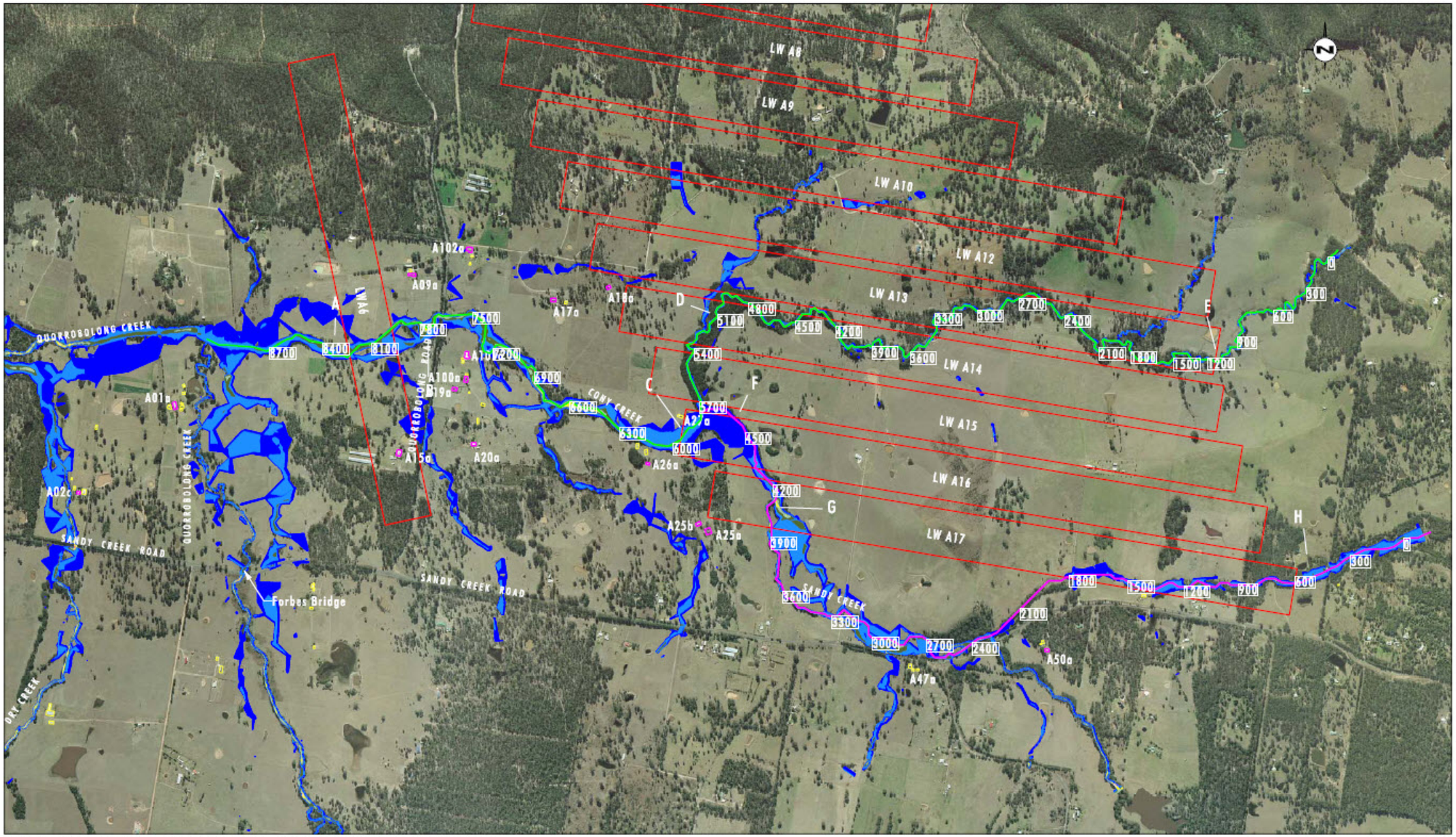
- Conceptual Layout for Stage 3 Longwall Panels
- Building
- Dwelling
- A01a Dwelling Reference Number

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 8.9

1 year ARI Storm: Maximum Water Depths - Upper Bound Subsidence



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

Legend

- Conceptual Layout for Stage 3 Longwall Panels
- Building
- Dwelling
- A01a Dwelling Reference Number
- Longsection 1
- Longsection 2
- 1000 Longsection Chainage

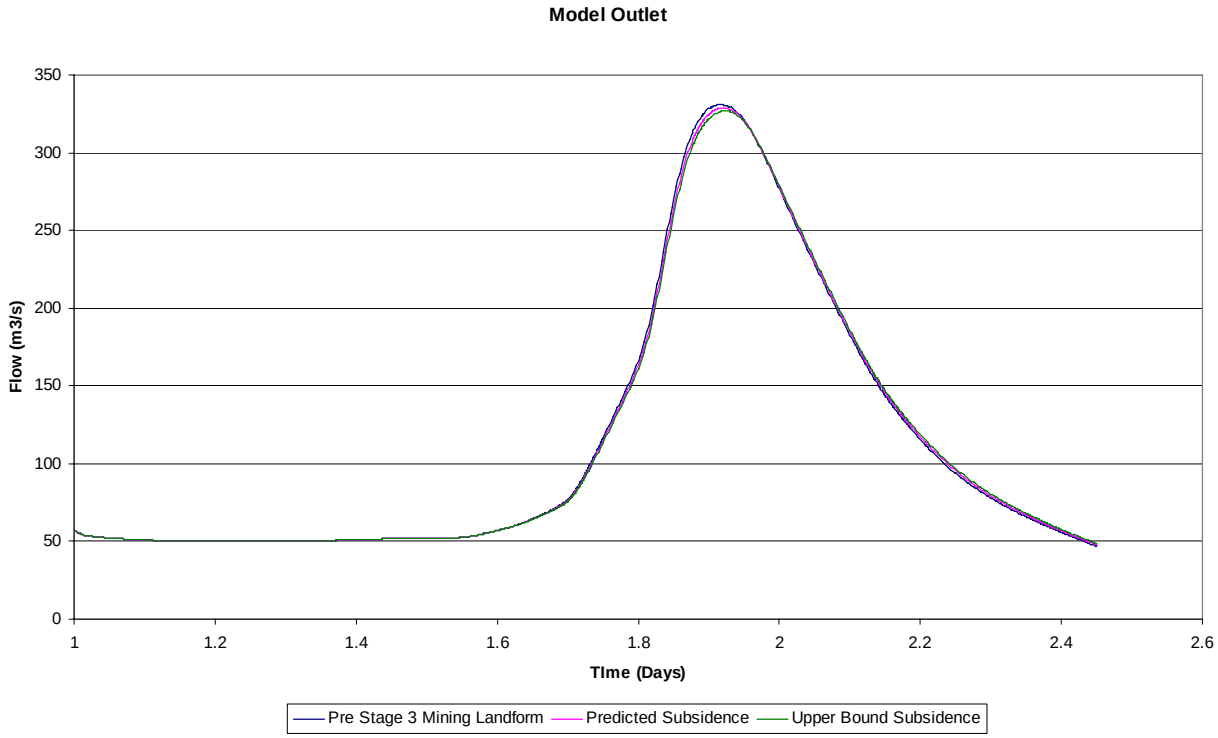
Velocity (m/s)

- 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 8.10

1 year ARI Storm: Maximum Water Velocities - Upper Bound Subsidence

File Name (A3): R16_V1/2274_233.dgn



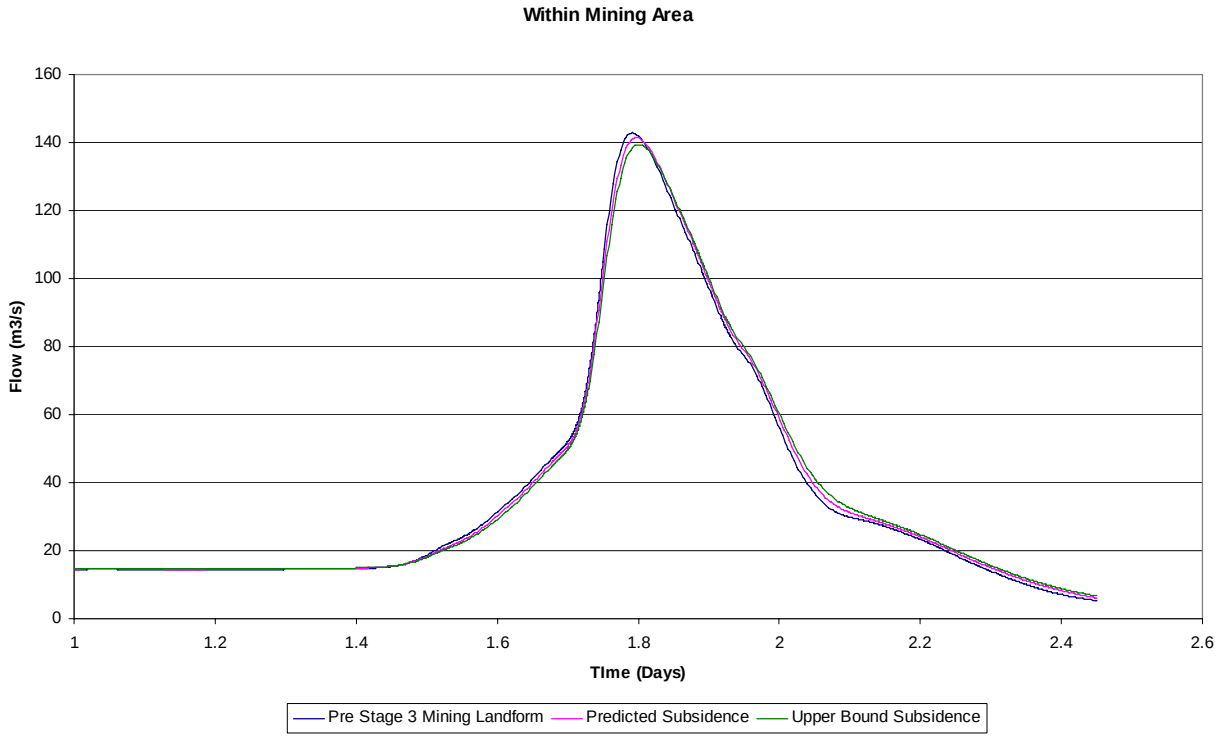
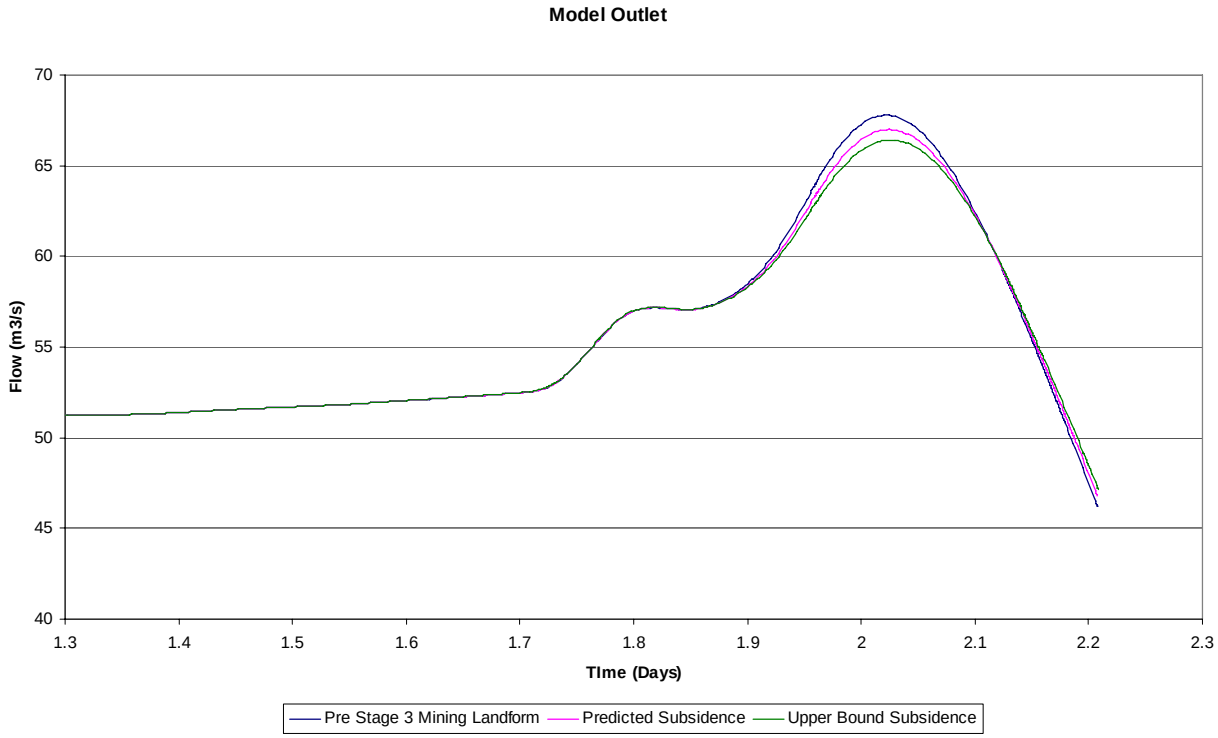


FIGURE 8.11

100 year ARI Flood Duration



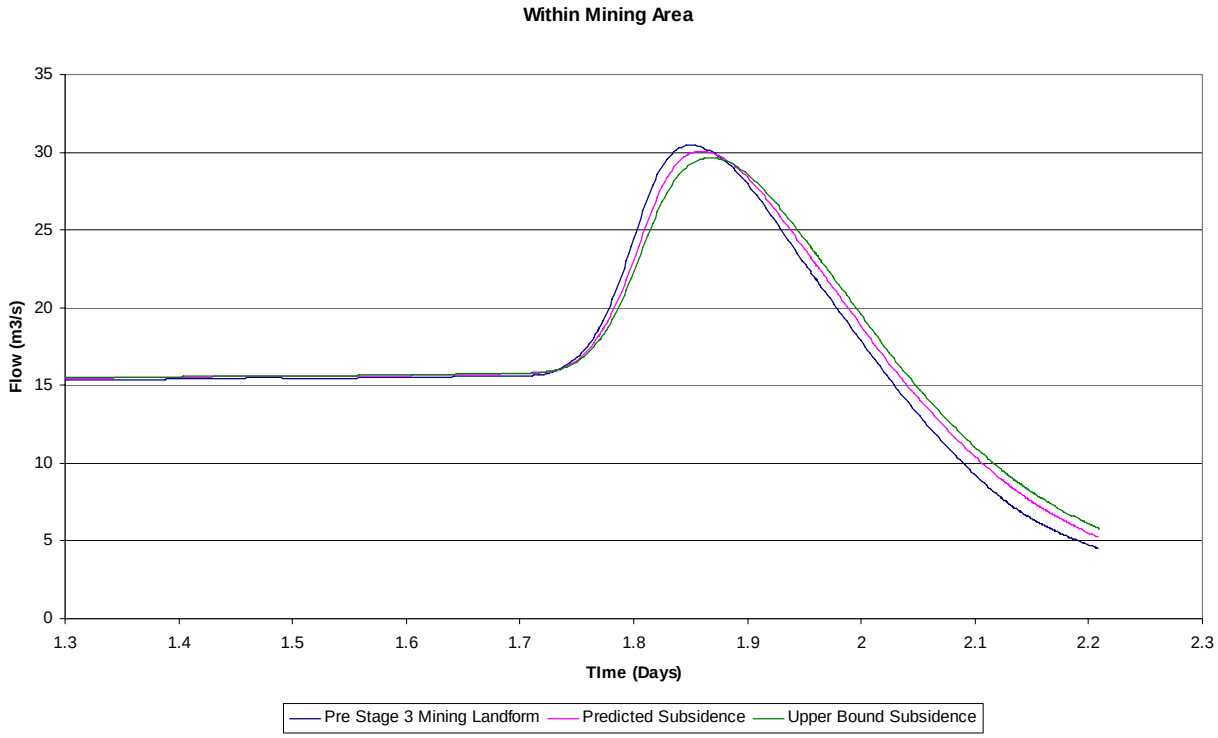


FIGURE 8.12

1 year ARI Flood Duration

of the pre Stage 3 mining operations modelled maximum velocities. This modelled change for maximum in channel flows is in the order of +/- 0.5 m/s.

The results obtained for the upper bound subsidence landform case for particular locations are discussed in the following sections and are compared to the pre Stage 3 mining operations modelled velocities.

8.4.2.1 Cony Creek

Modelling indicates that maximum velocities in Cony Creek over proposed Longwall A6 (denoted in **Figures 7.2** and **8.1** as Point A) would be in the order of 0.8 m/s to 1.1 m/s for pre Stage 3 mining conditions during a 100 year ARI storm event. These maximum velocities are predicted to decrease in the order of 0.2 m/s as a result of predicted upper bound subsidence.

The maximum velocities for the 1 year ARI storm event were found to decrease by approximately 0.1 m/s to 0.2 m/s (refer to **Figures 7.4** and **8.6**).

The reach of Cony Creek immediately downstream of Quorrobolong Road Bridge (denoted in **Figures 7.2** and **8.1** as Point B) is predicted to experience increases in maximum velocities of up to approximately 0.2 m/s to a maximum of approximately 1.6 m/s for a length of approximately 200 metres during the 100 year ARI storm event as a result of upper bound subsidence.

In the reaches of Cony Creek to be undermined by Longwalls A14 and A15 (denoted in **Figures 7.2** and **8.1** as Point D) the maximum pre Stage 3 mining velocities are in the order of 0.8 m/s to 1.2 m/s. These maximum velocities are predicted to decrease by up to 0.2 m/s for the 100 year ARI storm event.

Maximum velocities are expected to decrease by up to 0.6 m/s over the chain pillar on the western end of Longwall A16 (denoted by Point C in **Figures 7.2** and **8.1**).

Modelling indicates that maximum velocities for the 1 year ARI storm event would range from 0.6 m/s to 1.2 m/s for the pre Stage 3 mining conditions and are predicted to decrease with the upper bound subsidence by up to 0.2 m/s over Longwalls A14 and Longwall A15 and 0.3 m/s over Longwall A16 (denoted in **Figures 7.2** and **8.1** by Points D and C respectively).

8.4.2.2 Sandy Creek

Along Sandy Creek in the area to be undermined by Longwalls A16 and A17 (denoted in **Figures 7.2** and **8.2** as Points F and G respectively), modelling indicates that the maximum pre Stage 3 mining velocities are predicted to be in the order of 0.8 m/s to 1.7 m/s for the 100 year ARI storm event. With the upper bound subsidence, modelling indicates that these maximum velocities are expected to increase by up to approximately 0.35 m/s for a short section over Longwall A17 and decrease by up to approximately 0.4 m/s over Longwall A16 (refer to **Figures 7.2** and **8.8**).

Modelling indicates that for the 1 year ARI storm event, maximum velocities at Points F and G are predicted to increase in the order of 0.2 m/s over Longwall A17 and decrease in the order of 0.4 m/s over Longwall A16 (refer to **Figure 8.10**).

In the upper reaches of Sandy Creek to be undermined by the eastern section of Longwall A17 (denoted in **Figures 7.2** and **8.2** as Point H), modelling indicates that the maximum pre Stage 3 mining velocities are currently in the order of 0.6 m/s to 1.1 m/s in the 100 year ARI

storm event. These maximum velocities are predicted to increase by up to 0.2 m/s with the upper bound subsidence landform.

Modelling indicates that for the 1 year ARI storm event, maximum velocities are expected to increase from the pre Stage 3 mining levels of 0.2 m/s to 0.6 m/s by up to 0.2 m/s.

Analysis of the modelling results indicates that maximum velocities will remain within non-scouring levels for both the 100 year and 1 year ARI storm events following the Stage 3 mining operations.

8.4.3 Flood Hazards

In order to assess the potential flood hazards associated with underground mining in the Stage 3 Mining 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.

The flood hazard categories along dwelling access roads associated with flooding during the 100 year ARI storm event for the maximum predicted subsidence and upper bound subsidence cases with the proposed Stage 3 mining operations are listed in **Table 8.1** (for dwelling locations refer to **Figure 7.1**).

Table 8.1 – Flood Hazard Categories for Dwelling Access Routes[1]

Dwelling Access Route	Modelling Scenario		
	Pre Stage 3 Mining Landform	With Maximum Predicted Subsidence	With Upper Bound Subsidence
A17a	Unclassified	Unclassified	Unclassified
A18a	Wading Unsafe	Wading Unsafe	Wading Unsafe
A19a	Unclassified	Unclassified	Unclassified
A20a	Vehicles Unstable	Vehicles Unstable	Vehicles Unstable
A26a	Unclassified	Unclassified	Unclassified
A27a	Unclassified	Unclassified	Unclassified
A29a	Wading Unsafe	Wading Unsafe	Wading Unsafe
A33a	Unclassified	Unclassified	Unclassified
A65a	Wading Unsafe	Wading Unsafe	Wading Unsafe
A83a	Wading Unsafe	Wading Unsafe	Wading Unsafe
A100a	Vehicles Unstable	Vehicles Unstable	Vehicles Unstable
A101a	Vehicles Unstable	Vehicles Unstable	Vehicles Unstable
A102a	Unclassified	Unclassified	Unclassified

Note: Only dwellings with access routes within the flood extent are listed

The results presented in **Table 8.4** indicate that the flood hazard categories are not predicted to increase for any of the dwelling access routes within the modelled floodplain.

8.4.4 Flood Duration

The modelling indicates no discernible change in flow rates or hydrograph shape at Ellalong Bridge for the 100 year ARI storm event (refer to **Figure 8.11**). The modelling also indicates a potential decrease after mining in peak flow rates during the 1 year ARI storm event at the model outlet (refer to **Figure 8.12**).

The area at the confluence of Sandy Creek and Cony Creek is proposed to be undermined during Stage 3 mining operations by Longwall A16. The maximum predicted subsidence in this area ranges between 1000 mm and 2000 mm. The modelled flow hydrographs for this location for the 100 year and 1 year ARI storm event are shown on **Figures 8.11** and **8.12** respectively. The modelling indicates that during the 100 year ARI storm event there will be no increase the duration of peak flows for either the maximum predicted subsidence or upper bound subsidence cases.

An analysis of the 100 year ARI storm event modelling results in the area near the confluence of Sandy Creek and Cony Creek indicates that inundation of the overbank areas to the south of the confluence will occur for approximately 27 hours for the pre Stage 3 mining landform. Analysis of the modelling indicates that the ponding duration for the 100 year ARI storm event may increase to the order of 35 hours due to the maximum predicted subsidence and 39 hours due to the upper bound subsidence. This increase in the duration of inundation is not expected to be of sufficient duration to adversely impact on grasses or riparian vegetation in the area.

Similarly analysis of the modelling results for the 1 year ARI storm event indicates that overbank ponding occurs for a period of approximately 19 hours for the pre Stage 3 mining landform. The analysis of the modelling results indicates that this may increase to the order of 28 hours for the maximum predicted subsidence case and 33 hours for the upper bound subsidence case.

Although the analysis indicates potential increases in flooding durations immediately upstream of the junction of Cony Creek and Sandy Creek, the predicted increases in flooding durations with the Stage 3 mining operations for the 1 year and 100 year ARI storm events are considered to be relatively small compared to the storm durations and not likely to significantly impact on grasses or riparian vegetation in the area.

9.0 Summary and Conclusions

Analysis indicates that only very minor changes in the location of overland flowpaths may occur as a result of maximum predicted subsidence and upper bound subsidence. Analysis of the subsided landforms for the maximum predicted and upper bound subsidence cases and associated modelled velocities indicate there is minimal potential for channel realignment to occur as a result of proposed Stage 3 mining operations. The potential for subsidence to increase erosion on the landform surface is also expected to the minimal due to the small changes predicted in overland flow velocities and relatively small predicted changes in the grades of the landform as a result of mining.

Analysis of the in-channel grade changes for both the maximum predicted subsidence and upper bound subsidence cases indicates that localised minor increases in in-channel grade may occur with the Stage 3 mining operations. Analysis also indicates that the maximum predicted subsidence and upper bound subsidence will have only a minor impact on the extent of in-channel and out of channel ponding.

As the predicted changes as a result of Stage 3 mining in in-channel grades are small and are considered to lie within the natural variations in grades of the creeklines within this section of the Quorrobolong Valley, it is considered that the Stage 3 mining operations will not significantly alter the flow capacity of the existing channels. This is supported by predicted changes in velocity which are also small and localised.

The flooding assessment of Longwalls A6 to A17 indicates that flood depths will be typically increased in the mining area by approximately 90 mm over Longwall A6 and 40 mm over the flooded sections of Longwalls A7 to A17 if the upper bound subsidence occurs. The maximum predicted increase in flood depth is near the confluence of Sandy and Cony Creeks with a predicted increase in maximum out of channel flood depth during a 100 year ARI storm event for the pre Stage 3 mining landform from approximately 950 mm to post-mining flood depths in the order of 1560 mm (refer to **Section 8.4.1**).

The modelling results indicate that during the 100 year ARI storm event longwall mining of Longwalls A6 to A17 will not increase flood depths at dwellings within the Quorrobolong Valley. Modelling indicates that the maximum flood depth during a 1 in 100 year ARI storm event at the ground surface adjacent to dwelling A102a will be approximately 70 mm (refer to **Section 7.1**). Modelling of flooding for the maximum predicted and upper bound subsidence cases indicate that there will be no increase in flood depth at this location during a 1 in 100 year ARI storm event with the floor level of this dwelling being in excess of 400 mm above the ground level at this location (refer to **Section 8.4.1.1**).

The predicted impact on flow velocities is low with maximum flow velocities predicted to typically change by approximately – 0.2 m/s to + 0.3 m/s during the 100 year ARI storm event (refer to **Section 8.4.2**) with a similar range of changes predicted for the 1 year ARI storm event. As a result it is considered that subsidence associated with proposed Stage 3 mining is unlikely to significantly increase erosion or scour potential or decrease channel stability within the Quorrobolong Creek system.

The flooding assessment also indicates that the subsidence associated with mining in Stage 3 will not result in any increase in flood hazard categories during the 100 year ARI storm event on access routes to dwellings within the floodplain.

Analysis indicates that subsidence associated with the proposed Stage 3 mining could result in an increase in the duration of flooding upstream of the confluence of Cony Creek and Sandy Creek. This is due the topography and proposed longwall layout at the confluence.

At this location analysis indicates that flood durations may increase from 27 hours for the 100 year ARI storm event up to 37 hours with the upper bound subsidence. Similarly flood durations in this area may increase from 19 hours during the 1 year ARI storm event up to 33 hours with the upper bound subsidence. These predicted increases in flood duration are not expected to adversely impact on grasses or riparian vegetation in proximity to the area of increased inundation.

10.0 References

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