WAMBO COAL PTY LIMITED

SOUTH BATES EXTENSION UNDERGROUND MINE

EXTRACTION PLAN
LONGWALLS 17 TO 20

REPORT 2
GROUNDWATER ASSESSMENT REVIEW

Peabody

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DATE: 18 April 2018

TO: Peter Jaeger
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RE: **South Bates Extension Underground Mine Longwalls 17 to 20 Extraction Plan – Groundwater Assessment Review**

OUR REF: HS2018/24

Introduction

This report responds to a request from Wambo Coal Pty Ltd (WCPL) for a groundwater assessment review in support of the Extraction Plan for Longwalls 17 to 20 of the South Bates Extension Underground Mine (**Figure 1**). WCPL has approval for the extraction of nine longwall panels in the Whybrow Seam (Longwalls 17 to 25); however, the Extraction Plan only considers extraction of the first four longwalls (Longwalls 17 to 20) (**Figure 2**).

WCPL is preparing an Extraction Plan for Longwalls 17 to 20. This Extraction Plan outlines the proposed management, mitigation, monitoring and reporting of potential subsidence impacts and environmental consequences from the secondary extraction of Longwalls 17 to 20at the South Bates Extension Underground Mine. Additional information on the Wambo Coal Mine and the South Bates Extension Underground Mine is provided in the main text of the Extraction Plan.

An application to modify the Development Consent (DA 305-7-2003 MOD 17) was lodged in March 2017 to allow an extension to the South Bates Underground Mine to include nine additional longwalls (Longwalls 17 to 25) in the Whybrow Seam and was approved on 20 December 2017.

HydroSimulations (HS) constructed and calibrated a numerical groundwater model that was applied as part of the South Bates Extension Modification Groundwater Assessment (HS, 2017). This report presents a review of the predictions presented in that report and a review of the numerical model outputs, supplemented by recent groundwater monitoring results. There has been no additional numerical modelling or any change in the longwall layout since that assessment.

Scope of Work

Condition 22C, Schedule 4 of the Development Consent, requires the Extraction Plan to "…*provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since this consent*…."

In accordance with this Condition, the Extraction Plan is to include:

- a summary of recent, relevant monitoring data;
- a summary of impacts predicted in the South Bates Extension Modification Groundwater Assessment (Report HC2016/51);
- drawdown contours for the extraction of Longwalls 17 to 20 only; and
- a conclusion about whether the groundwater impacts are likely to be similar to the previously assessed impacts in the South Bates Extension Modification Groundwater Assessment.

Documentation

The following documents have been relied upon as an aid to this groundwater assessment review:

1. HydroSimulations (HS), 2015, *South Bates (Wambo Seam) Underground Mine Modification – Groundwater Assessment*. Report HC2015/026 for Wambo Coal Pty Ltd. July 2015.
2. HydroSimulations (HS), 2016, *South Wambo Underground Mine Modification – Groundwater Assessment*. Report HS2016/01 for Wambo Coal Pty Ltd. March 2016.
3. HydroSimulations (HS), 2017, *South Bates Extension Modification Groundwater Assessment*. Report HC2016/51 for Wambo Coal Pty Ltd. March 2017.
4. Mine Subsidence Engineering Consultants (MSEC), 2017, *South Bates Extension Modification Subsidence Assessment - Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Modification Application for the South Bates Extension Modification for WYLW17 to WYLW25 in the Whybrow Seam*. Report No. MSEC 848. Report prepared for Wambo Coal Pty Ltd, January 2017.
5. Wambo Coal Pty Ltd and Resource Strategies, 2017, *South Bates Extension Modification – Environmental Assessment*. Document WAM-09-15/00826846, March 2017.
6. WCPL, 2015, *Wambo Coal Groundwater Monitoring Program*. Version No. 10, October 2015.
7. WCPL, 2018, *Wambo Coal Groundwater Monitoring Program.* Version No. 12, Draft, April 2018.
8. WCPL, 2018, *South Bates Extension Underground Mine Water Management Plan Longwalls 17-20*. Revision A, April 2018.
9. Australian Mining Engineering Consultants, 2000, *The Influence of Subsidence Cracking on Longwall Extraction beneath Water Courses, Aquifers, Open Cut Voids and Spoil Piles*. Australian Coal Association Research Program (ACARP) Report C5016, August 2000.
10. Coffey, 2000, *Hydrological Response to Mining Panels 9 and 9A in South Wambo Creek*. Report prepared for Wambo Mining Corporation Pty Ltd, January 2000.
11. Ditton, S. and Merrick, N, 2014, *A New Subsurface Fracture Height Prediction Model for Longwall Mines in the NSW Coalfields*. Geological Society of Australia, 2014 Australian Earth Sciences Convention (AESC), Sustainable Australia. Abstract No 03EGE-03 of the 22nd Australian Geological Convention, Newcastle City Hall and Civic Theatre, Newcastle, New South Wales. July 7 - 10. Page 136.

Previous Studies

Background

Substantial coal mining activity has occurred historically and is continuing currently in the vicinity of Wambo, by a number of companies, with development across several coal seams. Coal is extracted by means of both underground and open cut mining methods. Coal mines neighbouring Wambo include United Colliery to the north and east of Wambo, Mt Thorley Warkworth to the south-east, and a number of open cut and underground mines to the north and east within the Hunter Valley Operations (**Figure 2**).

Historical mining at Wambo has involved four seams in the open cuts - Whybrow, Redbank Creek, Wambo and Whynot. WCPL operates five open cut pits: Bates; Bates South; Wombat; Homestead and Montrose. Underground mining has involved recovery from the Wambo and Whybrow seams. The Whybrow seam was mined at the Homestead underground mine between 1979 and 1999, and in the Wollemi underground mine between 1997 and 2002. The North Wambo Underground Mine commenced production (with Longwall 1) in October 2007 and finished in January 2016.

Longwall mining in the Whybrow Seam at the South Bates Underground Mine commenced (with Longwalls 11 to 13) in February 2016 and finished in mid-2017. Longwall extraction from the Wambo Seam commenced in mid-2017. Longwall 14 was completed in late 2017. Longwall 15 is scheduled for completion in April 2018, and Longwall 16 is scheduled for completion in September 2018.

Hydrogeology

As part of the South Bates Extension Modification assessment, HS prepared a groundwater assessment (HS, 2017).

In general, the hydrogeological regime of the Wambo Coal Mine area comprises two main systems:

- a Quaternary alluvial aquifer system of channel fill deposits associated with Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek; and
- underlying Permian strata of low permeability and very low yielding to essentially dry sandstone and lesser siltstone and low to moderately permeable coal seams which are the prime water bearing strata within the Permian sequence.

The flow in North Wambo Creek has been altered by the historical and existing mining operations including the removal of alluvium across the full width of the channel with consequent desaturation of the adjacent upstream and downstream alluvium. A section of North Wambo Creek has been diverted around the open cut pits.

Historical and ongoing open cut and underground mining within the Wambo area (including adjoining mining operations) has created significant groundwater sinks and this has generated a regional zone of depressurisation within the Permian coal measures.

Subsidence

Potential subsidence impacts to the creeks and watercourses directly above and adjacent to Longwalls 17 to 20 have been assessed by MSEC (2017). The maximum predicted additional subsidence is 1.95 m due to extraction of the Whybrow Seam (MSEC, 2017).

Longwall 17 will finish adjacent to a small section of North Wambo Creek Diversion. Longwalls 18 to 20 are generally located outside of the diversion. MSEC (2017) anticipates approximately 0.3 m of vertical subsidence, 25 millimetres per metre (mm/m) of tilt, curvatures greater than 3 km^{-1} and tensile strains greater than 30 mm/m along the North Wambo Creek Diversion.

Surface cracking could happen above the south-western ends of the Longwalls 17 to 20 where the topography steepens (MSEC, 2017).

Above Longwalls 17 to 20 in the Whybrow Seam, the depth of cover is 50 m to 330 m. MSEC (2017) concludes it "*is not expected that there would be a hydraulic connection between the surface and seam over the majority of the mining area, as none was observed after the extraction of the first seven longwalls at the NWUM, which were extracted directly beneath North Wambo Creek at a depth of cover down to approximately 75 m. It is possible that hydraulic connection between the surface and seam could develop above the finishing (i.e. north-eastern) ends of the longwalls, where the depths of cover are less than 100 m…"*

It follows that groundwater levels are likely to be lowered temporarily by strata dilation due to subsidence deformation.

The depth of cover above the Whybrow Seam at the North Wambo Creek diversion is approximately 50 m to 70 m and there would be an enhanced hydraulic connection between the seam and the surface in this location.

For reference, Australian Mining Engineering Consultants (2000) presented measured inflow rates at and adjacent to German Creek and Oaky Creek Longwall Mines in the period from 1986 to 1997. Measured inflow rates from surface water sources are summarised in **Table 1**.

Table 1 Measured Inflow Rates at German Creek and Oaky Creek Mines

MINE	DATE	OVERBURDEN THICKNESS (m)	MEASURED INFLOW RATES (L/s)	WATER SOURCE	COMMENTS
Central Colliery	1986	70	25	Tieri Sill Aquifer	Initial flow 25 L/s, Reducing to 9 L/s after 35 days.
Southern Colliery	December 1990	70	140	Pit E surface run-off in final void	Flow down tension cracks in pit floor.
Southern Colliery	September 1991	130 - 140	27	German Creek	Subsidence trough above 603 Panel prior to removal works.
Southern Colliery	December 1993	150 - 160	30	German Creek	Subsidence trough above 604 Panel prior to removal works. Permian rock exposed in creek bed.
Southern Colliery	January 1994	120	45	Cattle Creek	Subsidence trough above 604 Panel prior to remedial works. Eddies above tension cracks.
Oaky No. 1 Underground Mine	January 1996	100 - 168	190	Sandy Creek Diversion Channel Talagai Pit Talagai Spoil Piles	40 L/s 89 L/s 61 L/s
Oaky No. 1 Underground Mine	January 1997	150 - 168	17	Sandy Creek Diversion Channel	From three longwall troughs.

Source: Australian Mining Engineering Consultants (2000).

In addition to the work conducted by Australian Mining Engineering Consultants (2000), mining was conducted under Wambo Creek at similar depths of cover at the nearby Homestead Mine in Longwalls 9 and 9A in the Whybrow Seam. A large flow event in Wambo Creek occurred while mining was occurring in Longwall 9 immediately below the creek. Coffey (2000) reported “a maximum of about 200 L/s of surface flow was being transferred to the mine”.

Subsequent flow monitoring was conducted during the period when Longwall 9A was undermining the creek. This involved pumping water from Wollombi Brook at a measured rate to an un-subsided area between Longwalls 9 and 9A. Outflow to Wollombi Brook, which was monitored by means of a weir, stabilised with a loss through subsidence cracks of 12.4 to 14.1 L/s (1.1 to 1.2 ML/day).

The potential enhanced vertical hydraulic conductivity (K) can be estimated based on reported inflows by Australian Mining Engineering Consultants (2000) and Coffey (2000). The highest inflow reported (by Klenowski) was approximately 16 ML/day (190 L/s), and the reported inflow to the Homestead Mine was approximately 17 ML/day (200 L/s). The portion of Wambo Creek above the Homestead Mine Longwalls 9 and 9A is approximately 500 m long. Assuming a channel width of approximately 5 m, the effective vertical K would have been approximately 7 m/day.

For the North Wambo Creek diversion above the South Bates Underground Mine, using a reach of 250 m (above one longwall), a channel width of 5 m, and a conservative K of 10 m/day, the estimated inflow would be approximately 12.5 ML/day.

It is noted that the vertical K would reduce as sediments flow into subsidence cracks and following remediation.

Groundwater Modelling

An earlier groundwater assessment by HS (2015) included numerical modelling (using MODFLOW-SURFACT software) to assess the potential cumulative impacts on regional and local groundwater resources of the proposed South Bates Longwalls 14 to 16, approved South Bates Longwalls 11 to 13, North Wambo Longwalls 1 to 10A and surrounding mining operations. Since the modelling presented in HS (2015), the model has been converted to MODFLOW-USG for improved mass balance when simulating longwall mining, as well as faster run-times (HS, 2016). The existing rectilinear grid structure of the previous model was retained to enable direct comparison of results. The model was then re-calibrated using the latest data whilst ensuring consistency with previously reported model results. The results of the latest model are presented in HS (2017) for the South Bates Extension Modification.

The model domain is discretised into 320 rows, 380 columns and 18 layers. The dimensions of the model cells are uniformly 50 m in both lateral directions. The model extent is 16 kilometres (km) from west to east and 19 km from south to north, covering an area of approximately 300 square km (**Figure 3**).

The layer definition within the model has allowed the mined coal seams to be represented individually. A single layer of overburden separates each coal seam in the model. The target Whybrow coal seam is layer 3 in the model. The HS (2015) model used a conservative estimate of about 170 m for the fractured zone height (0.67 times the panel width of 250 m). As the depth of cover for the Whybrow Seam across the entire South Bates Underground Mine varies from 54 m to 470 m, fracturing was modelled to reach ground surface over the north-eastern portion of the mine footprint. The HS (2017) model applied the Ditton and Merrick (2014) Geology Model algorithm to obtain a more rigorous estimation of the height of connective fracturing above the mine void. This algorithm includes a procedure for quantifying the effects of multi-seam mining. The reappraisal showed that the extent of previously adopted fracturing in the HS (2015) groundwater model was conservative. Fracturing still is expected to be often to land surface, at the north-eastern ends of longwall panels for 40-50% of panel length. For multi-seam mining at adjacent Wambo mine precincts, the interburden between coal seams is expected to be fully fractured, and is simulated accordingly.

Transient calibration against groundwater levels was carried out with the HS (2016) model for the period January 2003 to December 2014 which includes the period when North Wambo Underground Mine Longwalls 1 to 10 were mined (HS, 2016). The achieved calibration performance measure was 3.9% Scaled Root Mean Square (SRMS) for the calibration period (HS, 2016).

In the groundwater model, as the geometry of strata in the vicinity of a fault is honoured, there is an implicit assumption of coal seam continuity. This acts conservatively to propagate drawdown effects farther than would occur if the fault causes dislocation of the seam.

Data Analysis

Groundwater Monitoring

Groundwater monitoring at Wambo is undertaken in accordance with the approved Groundwater Monitoring Program (GWMP) (WCPL, 2015). The objectives of the GWMP are to establish baseline groundwater quality and water level data and to implement a programme of data collection that can be utilised to assess potential impacts of mining activities on the groundwater resources of the area.

WCPL is proposing a revision to the GWMP (Version No. 12) (WCPL, 2018), which includes additional monitoring in the vicinity of South Bates Extension Underground Mine.

The Wambo groundwater monitoring network currently consists of a network of monitoring bores in the alluvial aquifers associated with the principal drainage pathways, as well as multi-level vibrating wire piezometers (VWPs) installed within the Permian groundwater system (**Figure 4**). A set of four bores (two stacked pairs GW24-25, GW26-27; **Figure 4**) has been drilled recently along the upper reaches of North Wambo Creek over Longwall 25 to monitor potential effects from the extraction of Longwalls 17 to 20. In addition, two recent VWP holes over Longwalls 18/19 and 21/22 (P317 and UG139; **Figure 4**) have been implemented with multiple sensors to provide direct information on potential shallow and deep groundwater effects during extraction.

Consistent with the GWMP, groundwater quality sampling has been undertaken by WCPL in accordance with AS/NZS 5667.11:1998 – *Guidance on Sampling of Ground Waters*. Samples are measured in the field for acidity (pH), electrical conductivity (EC) and temperature (T).

Key Monitoring Bores

The key monitoring bores for this groundwater assessment are:

- GW16 – in alluvium on North Wambo Creek, about 1 km north of Longwall 20;
- GW17 – in weathered rock beneath alluvium on North Wambo Creek, about 1 km north of Longwall 20;
- N5 – a multi-level VWP array adjacent to North Wambo Creek, about 0.7 km north of Longwall 20;
- N3 – a multi-level VWP over Longwall 11 headings, about 0.4 km south of Longwall 17;
- GW21 – in interburden about 1.2 km south of Longwall 17; and
- N2 – a multi-level VWP adjacent to GW21.

Figure 5 and **Figure 6** display fluctuating and smoothed groundwater level hydrographs at GW16 and GW17, respectively, as well as the residual mass curve (RMC) and the commencement dates of North Wambo Underground and South Bates Underground longwall panels. Both GW16 and GW17 show strong correlation with the RMC until mid-2012, after which a pronounced decline in water levels occurred despite fairly average weather conditions. This is attributed to the northwards progression of nearby open cut mining. Since mid-2012 groundwater levels have increased in response to large rainfall events (March 2013, January-March 2015, January 2016), but the long decline in groundwater level from May 2013 to March 2015 is due to open cut mining. With sustained wetter conditions, groundwater levels recover to normal levels, as occurred during 2015. Strong declines in groundwater level during 2016 and 2017 are likely due to the commencement of mining at South Bates Underground and the encroaching open cut, as water levels dropped despite wetter conditions.

Although bores GW16 and GW17 are only 250 m apart, and both are alongside North Wambo Creek, their salinities are quite different. The water at GW16 has always been less than 1,000 µS/cm (**Figure 5**) while the water at GW17 is typically about 5,000 µS/cm (**Figure 6**). While both bores were previously classified as 'alluvial', analysis of the driller logs indicates that GW16 is likely screened in alluvium while GW17 is likely screened in Permian overburden.

Figure 7 shows groundwater levels at GW21 in the Permian coal measures, as well as the RMC and the commencement dates for North Wambo Underground and South Bates Underground longwall panels. Due to a water level decline occurring in a wet period commencing mid-2011, a mild mining effect is posited at GW21, located between North Wambo Underground Longwall 1 and South Bates Underground Longwall 13. As this occurred at the time of North Wambo Underground Longwall 5 (1.5 km distant), the effect is more likely due to open cut mining (0.5 km away). Mining at South Bates Underground appears to have had no effect, suggestive of the mitigating effect of the fault between GW21 and South Bates Underground. Although GW21 went dry during 2017, this hole has been close to "dry" for the entire period of record.

Overall, interburden salinities are quite variable in magnitude and temporal pattern. High values of about 16,000 µS/cm have been recorded at GW21.

VWP responses are shown in **Figure 8**, **Figure 9** and **Figure 10** for bores N2, N3 and N5, respectively. At N2 and N3, the Wambo Seam heads are similar (-10 to -20 mAHD) with substantial pressure heads (60 to 70 m). The Whybrow Seam heads also are similar at both locations (near 0 mAHD), again with substantial pressure heads (15 to 35 m). The sensor in the interburden between the two seams records a higher head at each location than observed in the Whybrow Seam (about 15 mAHD), whereas at N5 the head is very similar to that in the Whybrow Seam. This suggests mining-induced lateral depressurisation in the two seams, with less effect in the interburden. At N2 there is some drawdown due to South Bates Underground Longwall 11 in the upper three piezometers, with no clear effect in the lower three piezometers which all show positive pressure head. This could be due to protection provided by the fault between South Bates Underground Longwall 13 and North Wambo Underground Longwall 1. At N3, the four lowest piezometers were destroyed on 25 May 2016 as South Bates Underground Longwall 11 approached. The upper two piezometers, however, are still functioning, although both have heads at or near the respective sensor elevations. At N5, the three lowest piezometers show a continually declining head due primarily to adjacent open cut mining; at this stage, there is no clear effect from South Bates Underground Longwalls 11-15.

The influence of geological structures on groundwater flow, such as the Redmanvale Fault, is not known with certainty. However, it is likely that the structures would act as barriers to local groundwater flow rather than conduits, as evidenced by the lack of response at GW21 to South Bates Underground mining to date. The faults are relatively small, normal features that include a number of sealing clay layers. The 'basic' igneous nature of the dykes means that they would tend to weather to impermeable clays. Larger, continuous faults and dykes are only present within the southern and eastern parts of the study area, which are located away from the environmental receptors and proposed mine development areas.

Groundwater Modelling Results

The groundwater model developed using MODFLOW-USG software (HS, 2016) has been used to predict responses to South Bates Underground Mine extraction for the Extension Modification with an additional nine longwall panels in the Whybrow Seam (Longwalls 17 to 25).

The length of the model stress period (SP) has been set up as yearly during the mining period. The relevant Longwalls 17 to 20 for this Extraction Plan are proposed to be mined from 2018 to 2020 (SP32 to SP36). As Longwall 21 and part of Longwall 22 also are simulated to be mined during SP36, this complicates the ability of the model to output results precisely at the conclusion of Longwall 20. To be conservative, the effects of stresses active in SP36 are included in this assessment review.

Of most relevance to this groundwater assessment are the predicted maximum drawdowns in model layer 3 for the Whybrow Seam during Longwall 17 to Longwall 20 mining. The predicted maximum drawdowns are cumulative as they include the effects of concurrent open cut mining. The incremental maximum drawdowns are defined relative to all other approved mining simulated by the groundwater model. Due to the unavoidable inclusion of Longwall 21 and part of Longwall 22, the results reported for Longwalls 20 to 22 are necessarily overestimates.

Figure 11 shows the predicted cumulative maximum drawdown in the Whybrow Seam following completion of mining (between SP32 and SP36). **Figure 12** shows the difference in maximum drawdown between the Approved Scenario and the Modification Scenario from SP32 to SP36. As the incremental drawdown was calculated as Approved Scenario *minus* Modification Scenario groundwater level elevations, this definition means that a *negative* value is a reduction in predicted drawdown (that is, a benefit), whereas a *positive* value is an increase in predicted drawdown (that is, a disadvantage).

In the Whybrow Seam, mining is expected to generate cumulative maximum drawdowns of up to 200 m over the South Bates Extension Longwalls 17 to 20, and also over the South Bates Underground Longwalls 11 to 13 and part of the Wambo Open Cut footprint during the years 2017 to 2020 (**Figure 11**). Comparison of the predicted difference between the maximum drawdown for the Approved and Modification Scenarios (**Figure 12**) shows that only the drawdown in the Whybrow Seam over the South Bates Underground Extension Longwalls is attributable to the Modification.

HS (2017; Figure 58) shows that negligible incremental drawdown is predicted in alluvium for the entire duration of the South Bates Extension Modification.

HS (2017; Figure 39) shows that there would be negligible reduction in baseflow to North Wambo Creek, where it crosses Longwalls 23 to 25, during the years 2017 to 2020 when Longwalls 17 to 20 were planned to be extracted.

Conclusion

The key findings of this groundwater assessment review are:

1. The alluvium adjacent to the South Bates Extension footprint has been disconnected from the regional alluvial system due to the removal of alluvium downstream of the longwalls by the approved open cut mining operations (and associated construction of the North Wambo Creek Diversion).
2. The alluvium adjacent to the South Bates Extension footprint has been affected by open cut mining activities, with several metres of drawdown in the alluvium observed to date.
3. There is expected to be negligible impact on the highly productive alluvium associated with the Wollombi Brook and Hunter River as a result of extraction of Longwalls 17 to 20.
4. Extraction of Longwalls 17 to 20 would not result in reduced beneficial uses of the alluvium (from a water quality perspective).
5. There are no bores above the South Bates Extension footprint that are used for irrigation, domestic or stock use. There are no private registered bores that would be likely to be affected by 2 m drawdown or more if Longwalls 17 to 20 were to occur in isolation.
6. Drawdowns up to 200 m, due to extraction of Longwalls 17 to 20, are expected in the Whybrow Seam in accordance with the depth of cover.
7. Extraction of Longwalls 17 to 20 would not have a significant impact on water levels in the Permian coal measures from a regional perspective due to the regional zone of depressurisation within the Permian coal measures created by historical and ongoing open cut and underground mining.
8. Extraction of Longwalls 17 to 20 would not lower the beneficial use category of the groundwater within the Permian aquifers, as there would be no migration of groundwater away from the underground mining areas in the Permian aquifers either during mining or following completion of mining activities.
9. There is an expectation of enhanced leakage from the North Wambo Creek Diversion if the creek happens to flow during the period of extraction of Longwall 17 beneath the Diversion.
10. Negligible loss of baseflow to the natural North Wambo Creek is expected due to extraction of Longwalls 17 to 20.

The groundwater data analysis, based on currently available records, has shown that there are no observed material impacts from longwall mining beyond what was foreseen for the cumulative impacts described in the South Bates Extension Modification – Groundwater Assessment (HS, 2017). Revision of the potential environmental consequences of Longwalls 17 to 20 is not required, because no material changes have been made to the groundwater model since the Modification application and no unforeseen impacts have been observed that would warrant review of the model,.

ENCLOSURE A

FIGURES

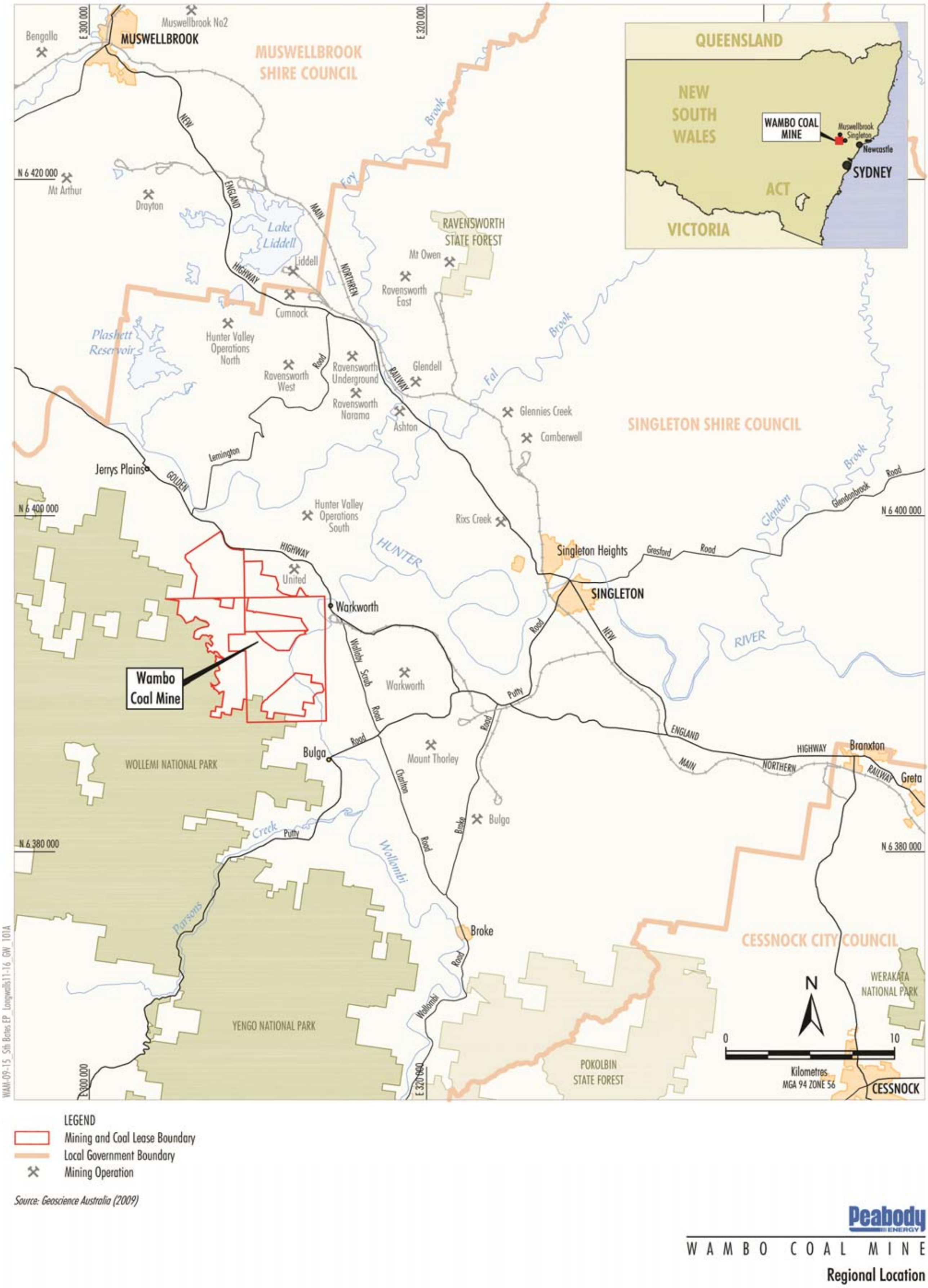

Figure 1

Figure 1. Regional Location

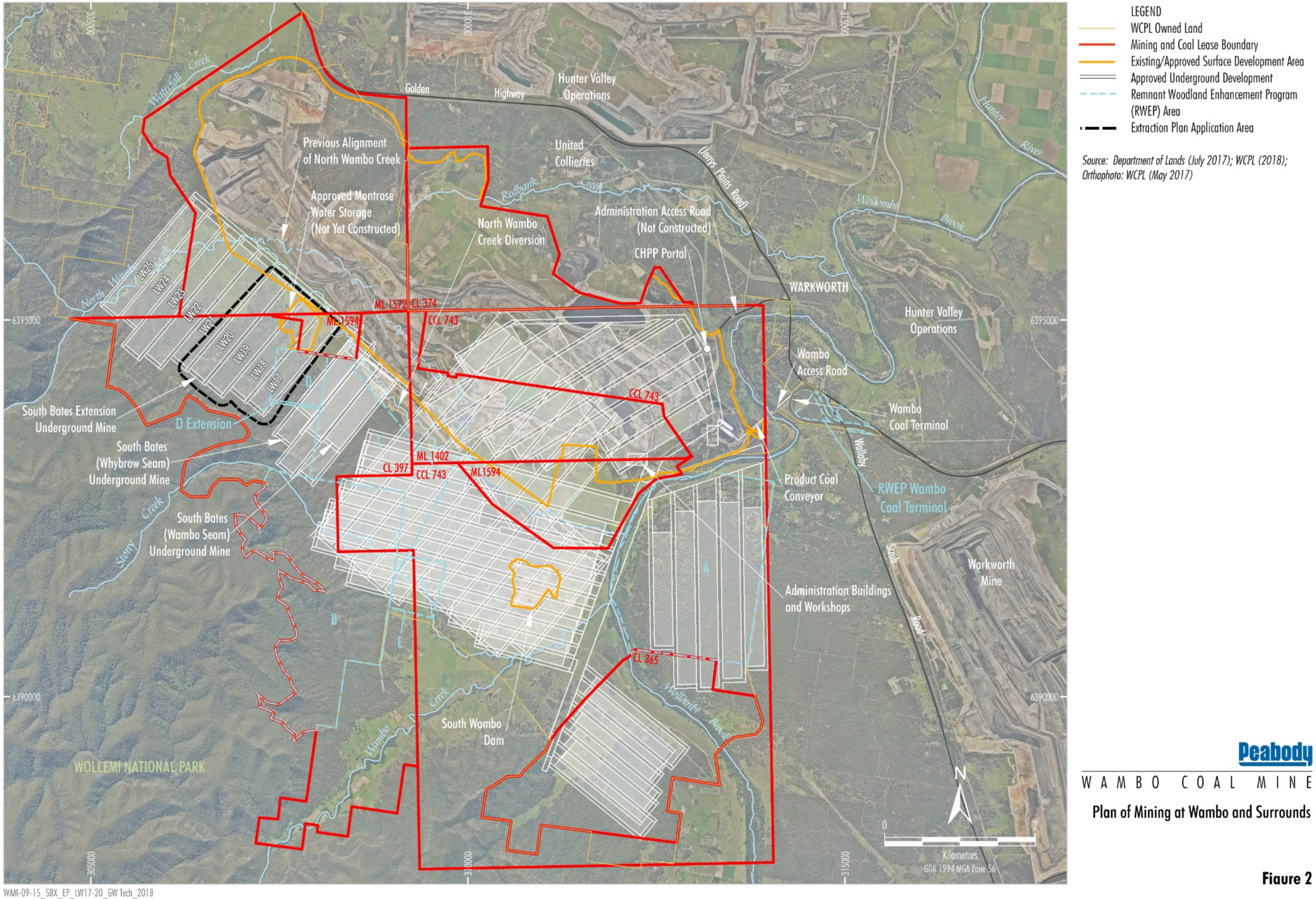

Figure 2. Plan of Mining at Wambo and Surrounds

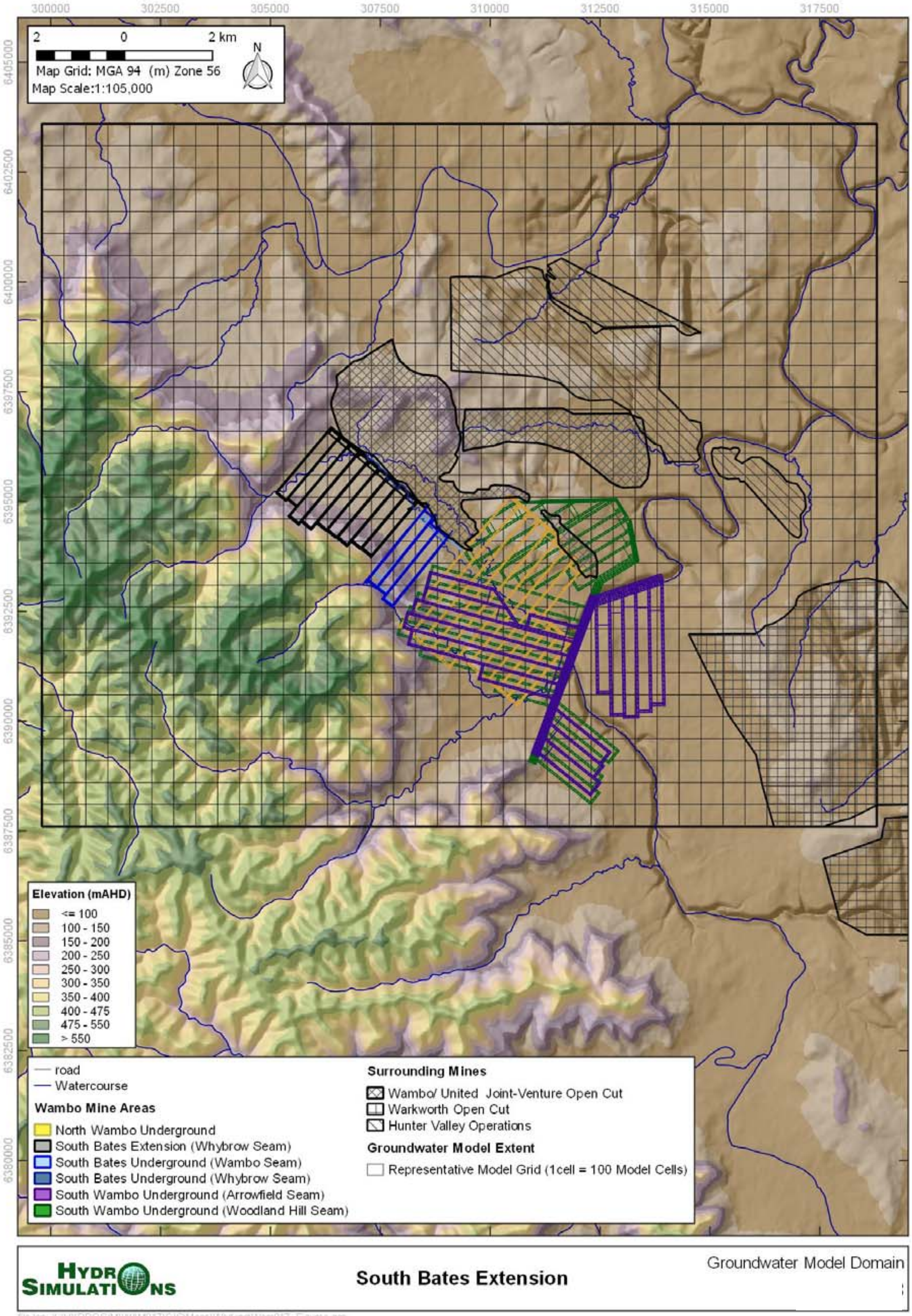

Figure 3. Model Domain

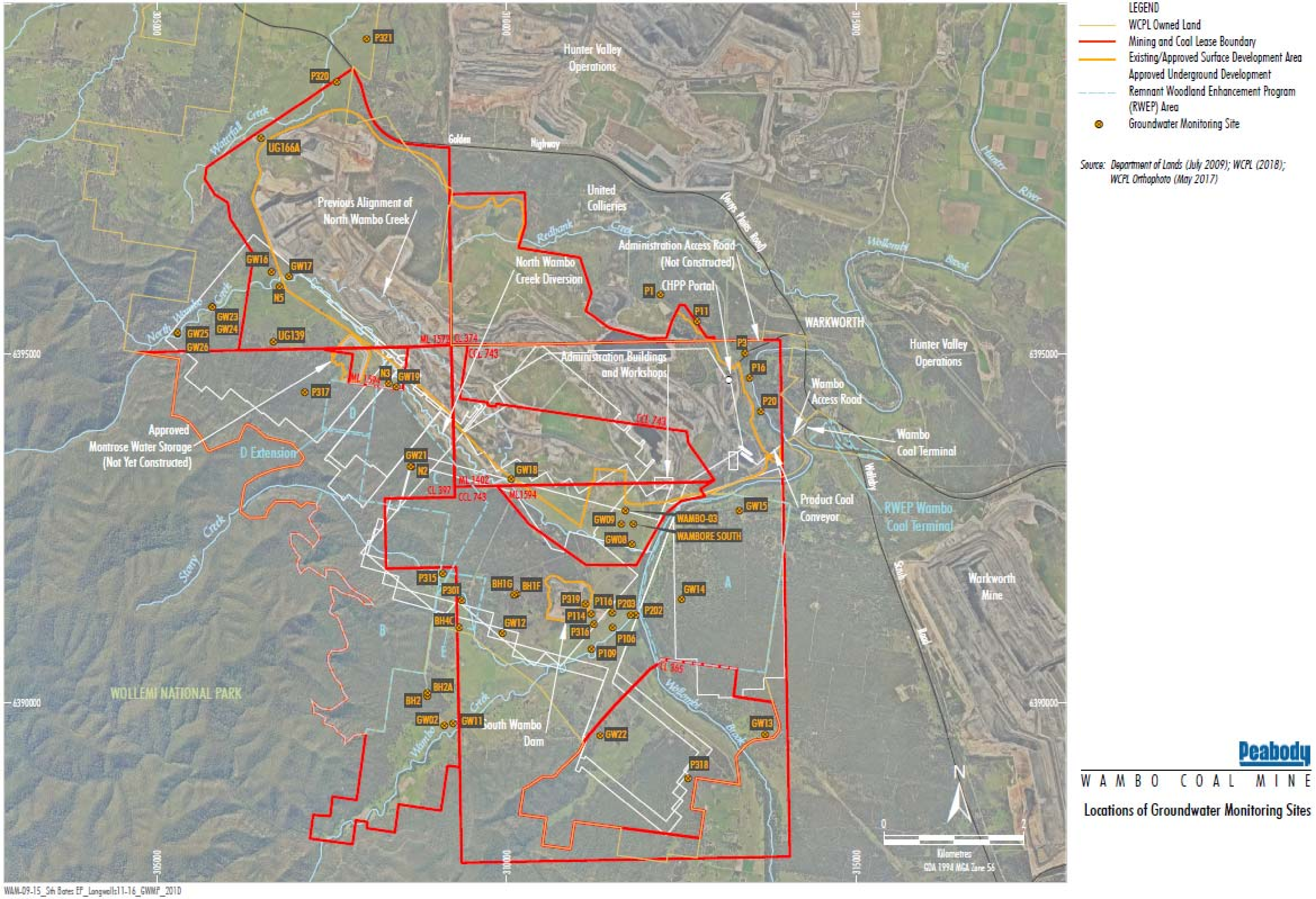

Figure 4. Groundwater Monitoring Network

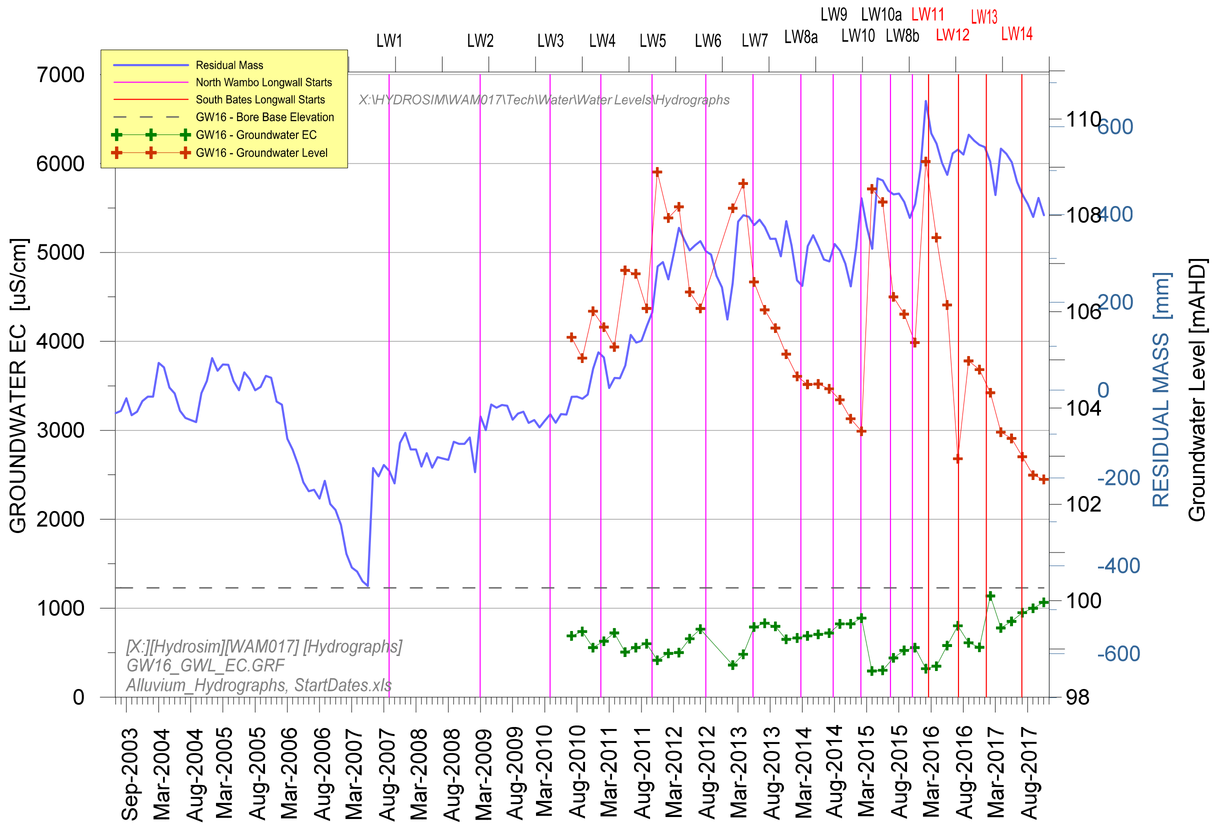

Figure 5. North Wambo Creek Observed and Smoothed Hydrographs and EC at Monitoring Bores GW16

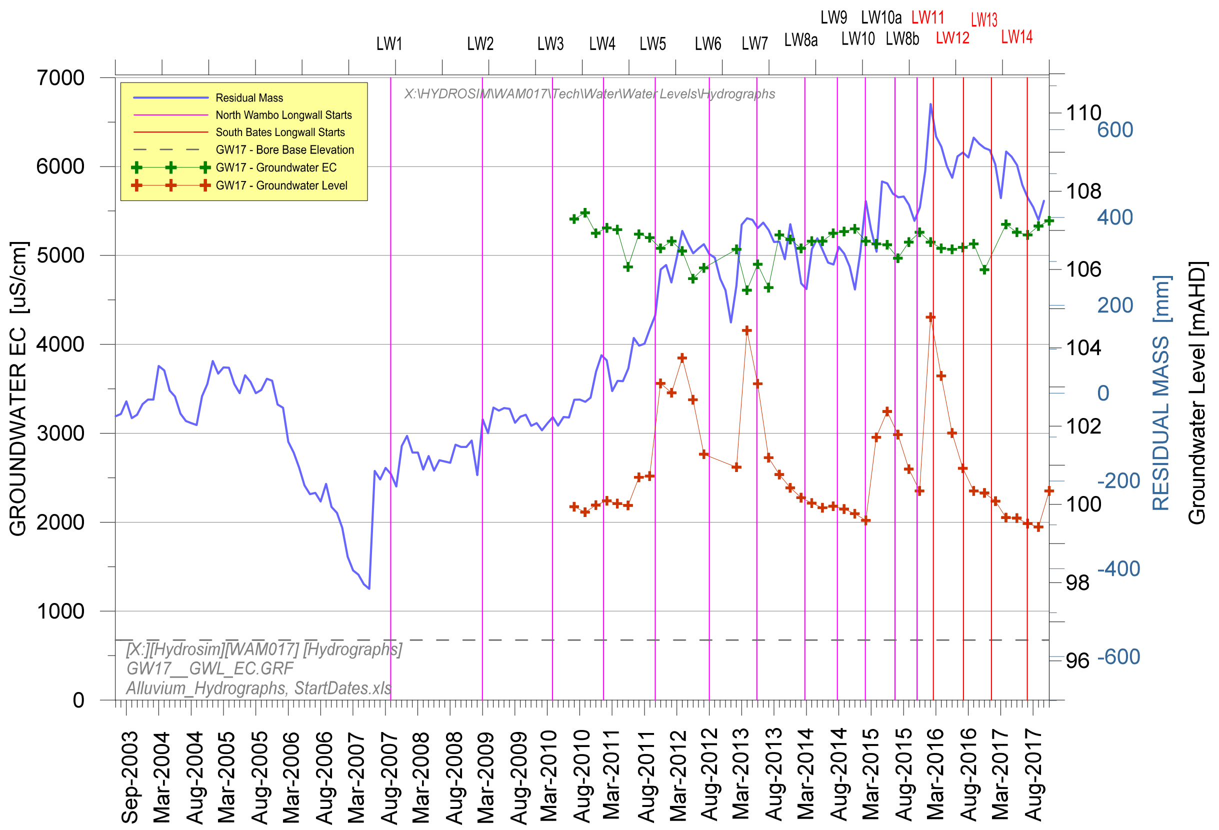

Figure 6. North Wambo Creek Observed and Smoothed Hydrographs and EC at Monitoring Bores GW17

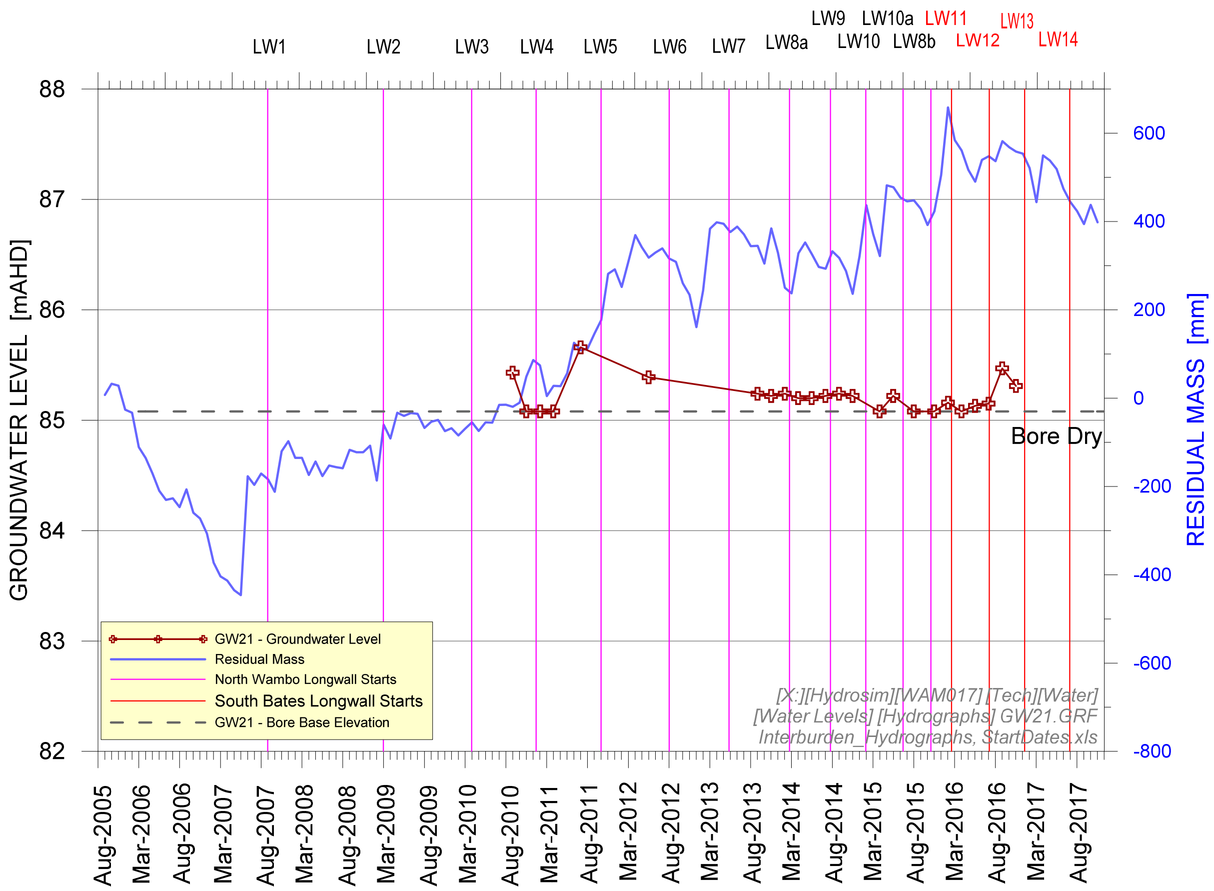

Figure 7. Interburden Observed Hydrograph at Monitoring Bore GW21

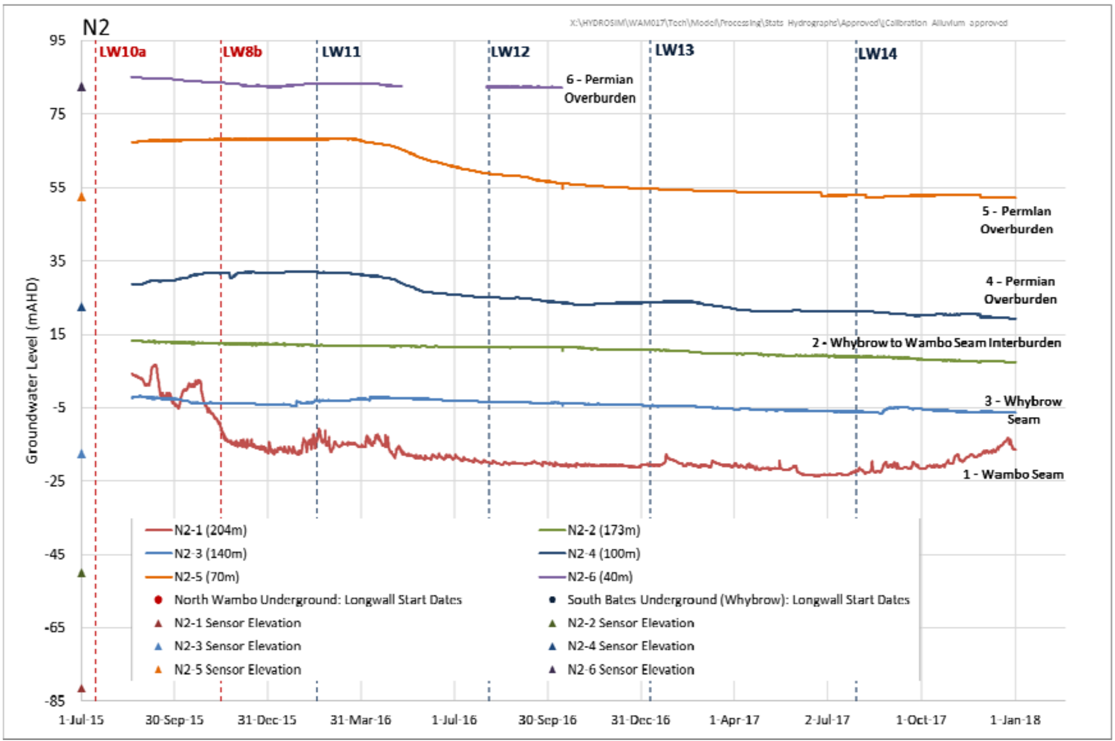

Figure 8. Observed Hydrographs at VWP Monitoring Bore N2

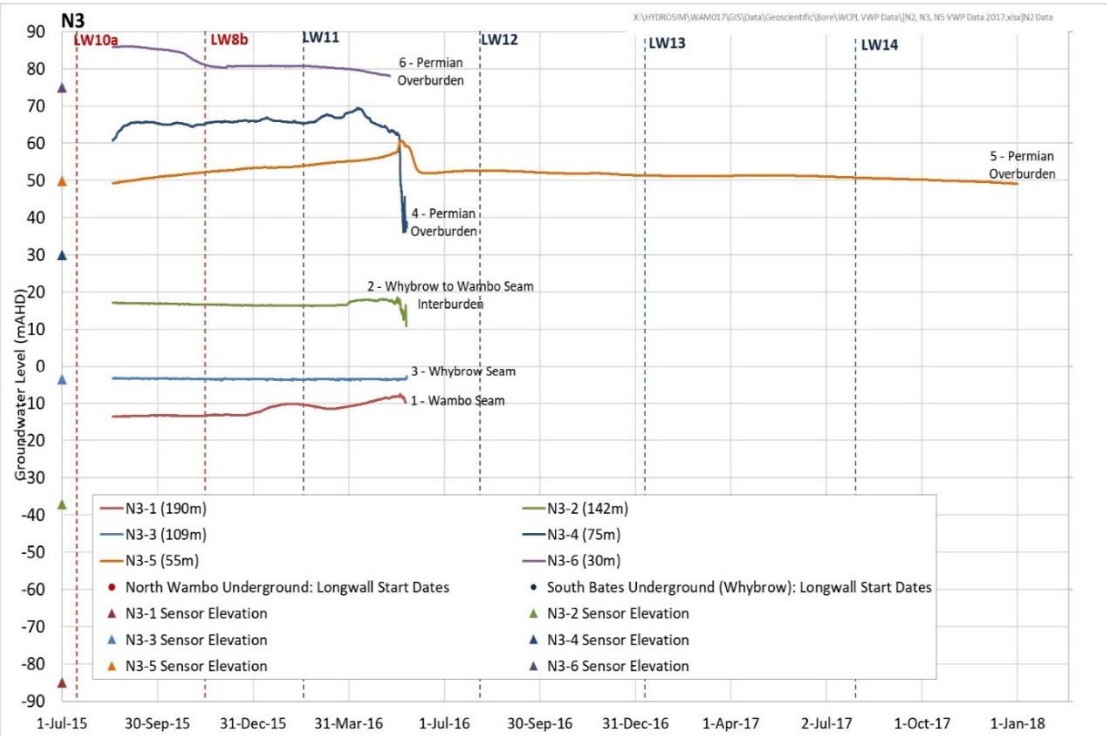

Figure 9. Observed Hydrographs at VWP Monitoring Bore N3

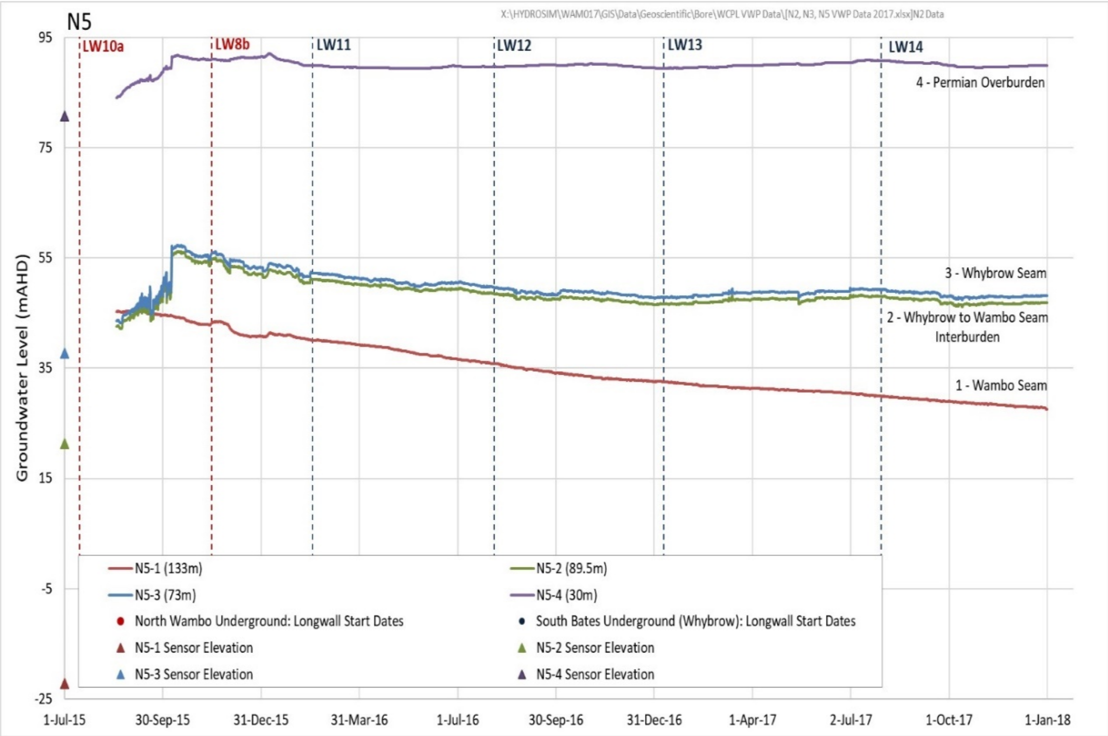

Figure 10. Observed Hydrographs at VWP Monitoring Bore N5

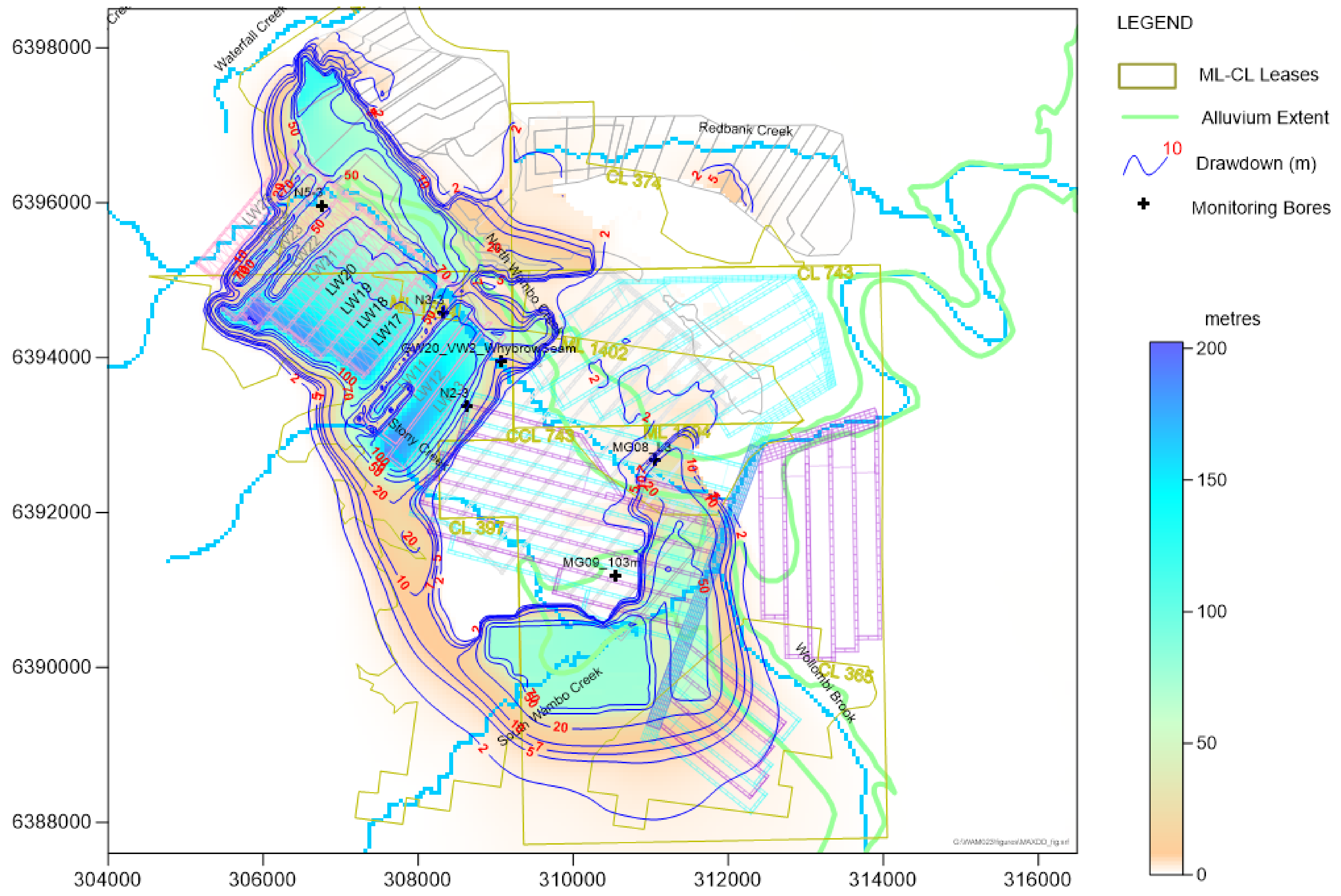

Figure 11. Cumulative Maximum Drawdown (m) in Whybrow Seam during Longwalls 17 to part of 22 Mining (SP32-SP36)

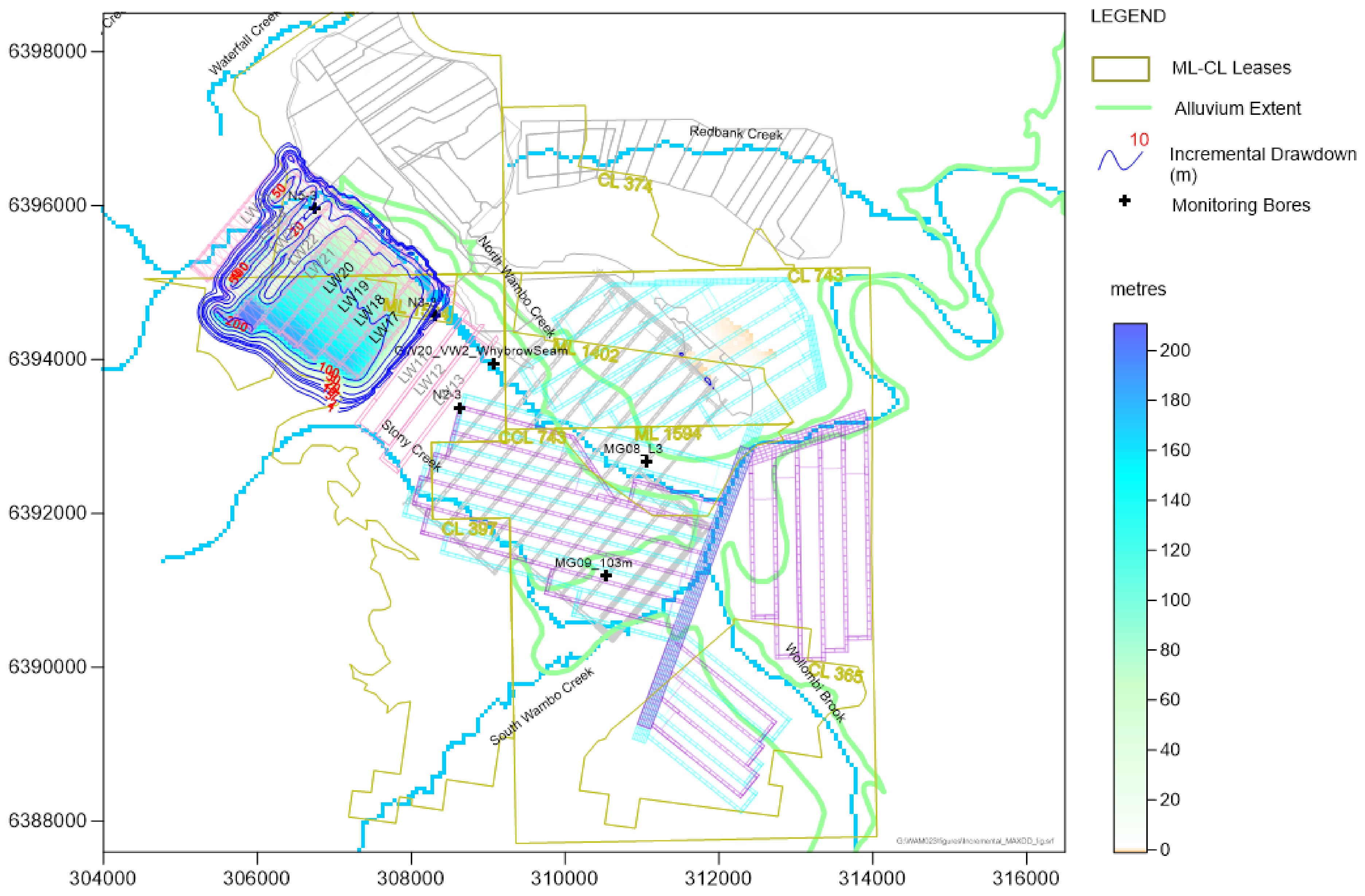

Figure 12. Incremental Maximum Drawdown (m) in Whybrow Seam during Longwalls 17 to part of 22 Mining (SP32-SP36)