ASHTON LONGWALL 104 – END OF PANEL REPORT

1 INTRODUCTION

This report has been prepared by Ashton Coal Operations Pty Ltd (ACOL).

The report has been prepared to satisfy the requirements of the "*Subsidence Management Plan Approval ULD Seam Longwalls 1 to 4",* Condition 18:

"Within 4 months of the completion of each longwall panel, an end of panel report must be submitted to the Director General. The end of panel report must:

- *a) include a summary of the subsidence and environmental monitoring results for the applicable longwall panel;*
- *b) include an analysis of these monitoring results against the relevant;*
  - *impact assessment criteria;*
  - *monitoring results from previous panels; and*
  - *predictions in the SMP;*
- *c) identify any trends in the monitoring results over the life of the activity; and*
- *d) describe what actions were taken to ensure adequate management of any potential subsidence impacts due to longwall mining."*

2 BACKGROUND

Longwall 104 (LW104) began extraction on the 23rd of July 2015, and coal production completed on the 11th April 2016 with final support removal on the 25th April 2016. Longwall 104A is 1,674m long, 205m wide. Longwall 104B is 896m long, 150m wide. No unexpected impacts to the surface environment or infrastructure resulted from secondary extraction of LW104.

The effects of subsidence were monitored in accordance with the document "*Ashton Coal Project Upper Liddell Seam Extraction Plan, Longwalls 1 to 8"*; this included regular survey monitoring and visual inspection of environmental, land and infrastructure features.

3 MINE SUBSIDENCE

3.1 LW104 EXTRACTION

The Upper Liddell (ULD) Seam section was mined along the length of LW104 at Ashton Underground Mine. Mining height was nominally in the 2.3m to 2.6m range. The seam dipped to the southwest at a grade of up to 1 in 10. Overburden ranges in thickness from 205m near the start of the longwall panel to 112m at the take-off end. The final extraction void is nominally 216m wide for LW104A and 156m for LW104B. This includes the 5.5m width of development drivage either side of the longwall block. Maingate chain pillars for LW104A are nominally at a centre to centre width and length of 30m and 150m respectively. Maingate chain pillars for LW104B are nominally at a centre to centre width and length of 60.5m and 150m respectively. Tailgate chain pillars are at a centre to centre width and length of 30m and 150m respectively.

Ashton's longwall mining operation commenced in February 2007. Since then 13 panels have previously been extracted. The progress of longwall extraction is shown in **Figure 1**.

3.2 SUBSIDENCE SURVEYS

Ashton Coal has monitored the subsidence movement on the surface during extraction of Longwall's 1-8 in the ULD Seam using longitudinal subsidence lines. These are located over the start and finish lines of each panel, a main cross line extending over all seven southern panels and a dedicated cross line extending over Longwall 6B, 7B and 8. All panels have monitoring data for each start and end lines and various cross lines relevant to the panel, surface features or strata features.

The ULD seam LW104 utilises panel centre lines (CL1 and CL2), the Pikes Gully (PG) seam LW4 panel centre lines and the cross block survey monitoring lines that were used for PG seam longwall. The subsidence monitoring lines relevant to LW104 are LW104-CL1&2, LW4 CL1&2 and XL5 as well as XL10 as shown in **Figure 2.**

The following table (**Table 1**) outlines the maximum subsidence parameters predicted and recorded for LW104 during regular survey of subsidence lines as the longwall passed each location.

Table 1 Subsidence of Longwall Panel 104 - Predicted vs. Actual

Seam	Incremental Subsidence ULD Seam (m)	Max Incremental Tilt (mm/m)	Max Incremental Strain (mm/m)	Maximum Subsidence (m)	Max Tilt (mm/m)	Max Strain (mm/m)
LW104A Prediction[1]	2.4	93	37	3.9	128	51
Measured on LW104CL1	2.3	36	27	3.1	34	21
Measured on XL5	2.2	28	7	3.3	33	9
LW104B Prediction[1]	2.4	110	44	3.9	151	60
Measured on XL10 - stacked	1.9	97	19	3.2	126	27
Measured on LW104CL2 background	1.7	35	8	3.0	39	29
Measured on LW104CL2 stacked	1.8	89	44	2.9	120	59
Measured LW104CL2 at end of mining	1.9	72	31	3.0	104	29

[1] Predictions in SCT Report ASH3657 "Subsidence Assessment for Longwalls Subsidence Assessment for Upper Liddell Seam, Longwalls 1-8 Extraction Plan"

The magnitude of both incremental and vertical subsidence is within predictions.

The actual tilt and strain have not exceeded predictions, are consistent with expectation, and consistent with the results observed above previous ULD seam longwalls.

The tilts and strains vary with the circumstances of goaf interactions and several scenarios can be differentiated:

- Two goafs mined remote from goaf edge effects;
- An offset geometry where the chain pillars are significantly offset;
- A directly stacked goaf edge geometry; and
- A geometry where the overlying solid coal is undercut by a distance less than the separation between the two seams.

The subsidence monitoring has significantly improved the understanding of the interaction effects between longwalls in multiple seams. Estimation of the tilts and strains was recognised as likely to be more uncertain due to the multi-seam subsidence effects and the lack of previous

experience of monitoring subsidence above multi-seam extraction at that time. For most of the panel, the maximum tilts and strains are much less than the maxima predicted. The predictions were locally exceeded at the stacked geometry near the end of panels 102 and 103, but these high values were not measured above LW104. At this stacked location, the subsidence re-mobilises the previous fractures in the overburden that exist from mining the previous seam. Subsidence effects do not continue past the limit of previous subsidence until the second seam extraction is some 10-30m past the edge of the overlying extraction area. Once past this point, i.e. once the extraction in the underlying seam is past the extraction edge of the overlying seam the subsidence profile returns to a regular profile.

3.3 AUSGRID 132KV POWER TRANSMISSION LINE

To manage subsidence impacts 132kV timber poles above LW101 and LW104 were reassessed and replaced with concrete poles in 2012 and 2014. These powerlines have been fitted with rollers prior to longwall extraction.

Visual and survey monitoring of existing 132kV power transmission structures over LW104 was undertaken regularly during undermining as per the approved subsidence monitoring program. During longwall undermining, Ausgrid 132kV Southern Major Interconnector TARP has been followed as per the Ausgrid Asset Management Plan. There has been no adverse impacts or damage observed on the 132kV powerlines and the powerlines remain serviceable.

3.4 ACCESS ROAD

A section of the Right of Way (RoW) access to Property 130 was undermined by LW104. This section of ROW traversing the active longwall panel was likely to suffer perceptible subsidence impacts (e.g. surface cracking). The alternate RoW was closed off prior to undermining and the primary RoW was utilised. During subsidence of the Primary RoW, where no diversion was possible, frequent monitoring and maintenance kept the road in a serviceable condition. Relevant road users were notified prior to the road closures and maintenance.

Powerline clearance signs within alternate access road were updated prior to alternative RoW closure to ensure the safety for the movement of plant and equipment under and in the vicinity of these overhead lines. Remediation works on the road have been completed and the alternative ROW was reopened.

3.5 TELSTRA PHONE LINE

Two buried Telstra phone cables were undermined by LW104 to ACOL owned properties that are not inhabited. There were no adverse impacts or damage observed on the Telstra cables.

4 LAND MANAGEMENT

Surface subsidence cracks have developed along each edge of the Longwall panel. These generally run parallel to the gate road within the longwall block. Some cracks have also occurred parallel to the retreating face. Where this has occurred the features have usually started from a parallel pillar edge crack and followed an arc around to align with the face.

The maximum subsidence movements detected over Longwall 104 are less than those predicted in the SMP. This occurred for all centreline survey monitoring lines and cross lines. Horizontal movement has occurred in the coal seam up dip direction (North East-East) above each of the Longwall panels. This movement has predominantly occurred within the longwall panels with limited displacement detected outside the panel edge.

Rehabilitation of the surface cracks was completed during extraction of the panel, post settling. The work has been completed by ripping cracks and then rehabilitating the area. The RoW experienced isolated surface cracking which were also repaired.

5 GROUNDWATER MONITORING

Ashton has an extensive monitoring network of piezometers, ground water inflow monitoring and laboratory analysis of water quality for monitoring groundwater pressure, levels and quality. Groundwater monitoring around LW104 was intensified for the period of extraction to identify any potential sudden changes that may occur.

Australasian Groundwater and Environmental (AGE) consultants were engaged to review the groundwater monitoring data and assess the impacts of LW104. The observations from the review were:

- there are no obvious impacts to the groundwater levels, EC and pH measured in site monitoring bores which can be directly attributed to the extraction of LW104;
- there are no impacts to groundwater levels in the Bowmans Creek Alluvium, Glennies Creek Alluvium and Hunter River Alluvium; and
- no reportable exceedances of WMP trigger values occurred during the extraction of LW104.

The report evaluated the impacts of mining on the groundwater in the area and the impacts to date are less than predicted in the Environmental Assessment.

The following general observations can be drawn from the monitoring data regarding the groundwater conditions at the site:

- Historical extraction of the PG seam and associated subsidence has caused depressurisation of overlying coal seams, namely Lemington 19 and the overlying Lemington 15. Lemington 10 has also been impacted in some areas.
- Extraction of the ULD seam and associated subsidence has caused the depressurisation of overlying Arties seams. This depressurisation is ongoing and the seam has not been completely depressurised.
- All of the seams between the Lemington seams and the currently mined ULD seam are undergoing depressurisation at a constant rate. This depressurisation is a site wide response, which is more related to general mining at the site rather than the extraction of individual longwall panels.
- The underlying seams have not been impacted and maintain their natural state confinement, with the exception of the Upper Lower Liddell (ULLD) seam in the vicinity of VWP installation – WMLC334. Data pertaining to the ULLD seam at WMLC334 shows the seam is completely depressurised at this location. WMLC334 is located adjacent the southern end of LW101 and has shown a constant rate of depressurisation since its installation in early 2012, which coincides with the beginning of mining in the ULD seam. This is not an expected response to longwall mining and the phenomenon was noted in the RPS end of panel report (2014).
- The observed impacts to the groundwater regime at Ashton at the end of mining in LW104 are in line with approved impacts as outlined in the 2001 environmental impact study and the 2009 Bowmans Creek environmental assessment.

Figures

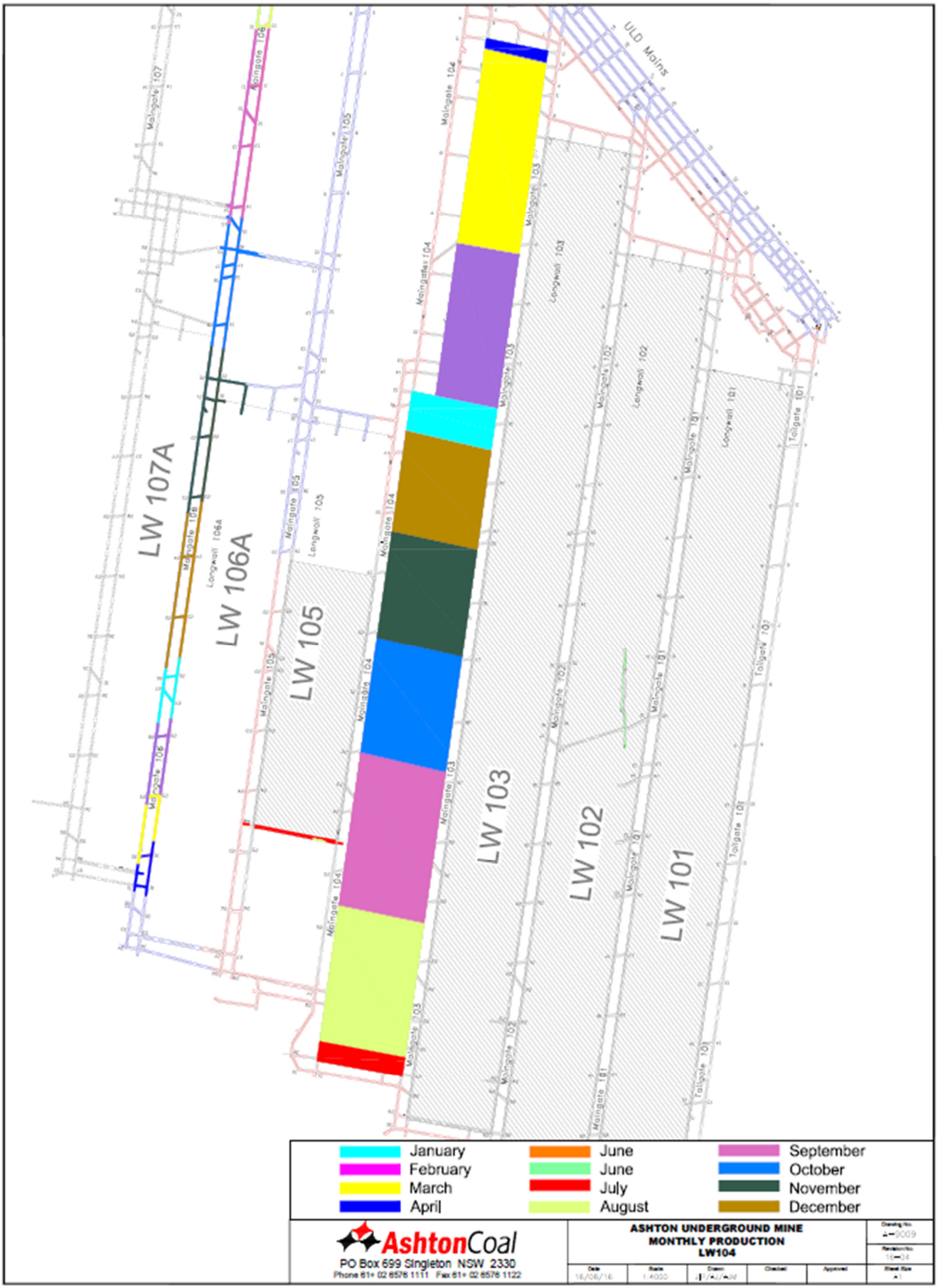

Figure 1 Progression of Longwall Extraction in the Pikes Gully and Upper Liddell Seams

Figure 2 Plan Location of Subsidence Monitoring Lines