ASHTON LONGWALL 101 – 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 101 (LW101) began extraction on the 5th of August 2012, and extraction works completed on the 20th June 2013. Longwall 101 is 2470m long, 205m wide. No unexpected impacts to the surface environment or infrastructure above resulted from secondary extraction of LW101.

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 LW101 EXTRACTION

The Upper Liddell Seam section was mined along the length of Longwall 101 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 155m near the start of the longwall panel to 80m at the take off end. The final extraction void is nominally 216m wide. This includes the 5.5m width of development drivage either side of the longwall block. Maingate chain pillars are at a centre to centre width and length of 30m 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 9 panels have 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 Pikes Gully (PG) 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 in the PG Seam. 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 Upper Liddell Seam (ULD) Longwall 101 utilises panel centre lines (CL1 and CL2); the same Pikes Gully LW1 panel centre lines and the cross block survey monitoring lines that were used for the Pikes Gully Seam (PG) longwalls. The subsidence monitoring lines relevant to LW101 are LW101-CL1, LW1-CL1, LW101-CL2, LW1-CL2 and XL1, 4, 5, 7 and 8 as shown in **Figure 2.**

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

Survey subsidence monitoring over Longwall 101 consists of regular survey of centreline 1 (LW101 CL1), cross line 1 (XL1) to 5 (XL5). Cross line 2 (XL2) and 3 (XL3) do not extend over the extraction area of LW101, however monitoring was conducted to observe for subsidence impacts outside of the panel towards Glennies Creek. Cross line 4 (XL4) was extended west over the LW101 extraction panel after LW1 extraction. Previous to this XL4 extended to the panel edge of LW1. Therefore the monitoring on cross line 4 only shows cumulative results up to the edge of LW1 and does not represent the multi seam cumulative subsidence beyond this point. The results to the West of LW1 panel edge are only the effects of LW101. The frequency and results of the monitoring has been maintained per monitoring document "*Ashton Mine Subsidence Monitoring Programme Longwall 101 to 104".* This information is being supplied to the Principal Subsidence Engineer. A graph of the vertical subsidence of cross line 5 is shown in **Figure 3**.

No commentary comparing LW101 monitoring results to previous panels has been included in this report as this is the first panel in the Upper Liddell Seam and it is therefore irrelevant to compare this with Pikes Gully monitoring data given the multi-seam effects.

Some exceedences of the EIS criteria have been recorded however this is a function of the lack of data on which to base the predictions at the time (2001). Since then much data has become available and ACOL's own monitoring has refined the predictions which are utilised in the SMP/EP. There are no exceedences of the SMP/EP predictions.

3.3 AUSGRID TRANSMISSION LINES

Visual and survey monitoring of existing 132kV power transmission structure over Longwall 101 was undertaken regularly. The 132kV poles have been referenced as SET21, SET22 and SET23. The 132kV transmission line was surveyed prior to, during and post undermining. Survey data from the 132kV power lines was recorded and supplied to the Principal Subsidence Engineer as per the "*Ashton Mine Subsidence Monitoring Programme Longwall 101".* The effects of subsidence on the 132kV structures can be seen in **Figure 4**. Maximum subsidence measured on power poles (SET21, SET22, and SET23) during Longwall 101 mining was: 0.115m, 2.065m and 0.036m respectively.

Table 1: Subsidence of Longwall Panel 101 to 7/01/12 - Predicted vs. Actual (cumulative)

	Predicted EIS	Predicted EP	Maximum Measured				
Start of LW101			**CL1** Incremental		**CL1-PG**		**CL1-PG** Incremental
Subsidence (mm)	3380	4400	2121		2757		1644
Tilt (mm/m)	122	235	47		60		30
Horizontal Movement (mm)	-	-	435		483		365
Tensile Strain (mm/m)	10	94	17		49		10
Compressive Strain (mm/m)	49	94	22		26		24
Finish of LW101			**CL2** Incremental		**CL2-PG**		**CL2-PG** Incremental
Subsidence (mm)	2600	4400	1813		2911		1466
Tilt (mm/m)	60	235	42		110		35
Horizontal Movement (mm)	-	-	362		620		258
Tensile Strain (mm/m)	10	94	9		38		8
Compressive Strain (mm/m)	49	94	9		41		7
Southern Cross Lines			**XL1**		**XL1** Incremental		**XL4** Incremental
Subsidence (mm)	3380	4400	2494		1323		1822
Tilt (mm/m)	91	235	42		37		49
Horizontal Movement (mm)	-	-	491		215		270
Tensile Strain (mm/m)	10	94	23		17		12
Compressive Strain (mm/m)	49	94	7		5		6
Northern Cross Lines			**XL5**	**XL5** Inc	**XL7** Inc	**XL8**	**XL8** Inc
Subsidence (mm)	3380	4400	3229	2239	1884	2784	1355
Tilt (mm/m)	91	235	101	57	50	136	29
Horizontal Movement (mm)	-	-	733	460	255	560	245
Tensile Strain (mm/m)	10	94	20	18	14	28	6
Compressive Strain (mm/m)	49	94	22	8	4	19	4

[1] XL2, XL3, and XL6 do not extend far enough to register any significant change

[2] XL1 and XL4 may not measure maximum movements as movements are still increasing at end of line.

3.4 ROADS AND MARITIME SERVICES – NEW ENGLAND HIGHWAY

Monitoring of the road cutting on the New England Highway was conducted pre and post extraction of LW101 panel. Monitoring and management of the impacts were completed as per the Asset Management Plan approved by the Roads and Maritime Services. The survey results indicate that there are no subsidence impacts to the cutting or the roadway reserve. The effects of subsidence related ground movement is limited to approximately 160m from the road reserve.

3.5 TELSTRA PHONE LINE

Extraction of LW101 panel subsided a Telstra phone cable. There were no impacts to the serviceability of the cable.

3.6 PROPERTY 130

Management of subsidence impacts on Property 130 were managed as per the asset management plan previously approved by the owner. The Right of Way (ROW) on Property 130 was undermined, during which an access diversion was established. Grading of the road was conducted post subsidence and the access was reinstated.
No subsidence cracks were identified along the ROW to property 130 after remediation works.

An internal fence was re-tensioned and additional droppers added.

3.7 ASHTON ASSETS

Extraction of LW101 impacted Ashton's nitrogen plant. Subsidence surveying of the plant was conducted and no actions were required to maintain the plant in a safe and serviceable condition.

4 LAND MANAGEMENT

Surface subsidence cracks have developed along each gate edge of the Longwall panel. These generally run parallel to the gate road within the longwall block. Cracks are particularly evident on the up-hill side of the panel with some associated stepping. Some cracks and compression lines have occurred parallel to the retreating face. Where this has occurred the features have usually started from a parallel pillar edge crack and continued around to align with the face.

The maximum subsidence movements detected over Longwall 101 are less than those predicted in the SMP. This occurred for all centreline (CL) 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 with a small excavator smoothing over surface cracks. A portion of the works was conducted within the Ashton voluntary conservation area, and as such all work was completed with small equipment to create the smallest disturbance footprint possible. Effected surface roads have only required a grader to smooth compression humps and minor cracks.

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 LW101 was intensified for the period of extraction to identify any potential sudden changes that may occur.

The groundwater monitoring has been reviewed by RPS AquaTerra - independent hydro-geologists. A report on the impacts of extracting LW101 panel has been received and provided the following conclusions:

- Total groundwater inflows into the underground mine have ranged up to 21L/s, but averaged 10.7L/s for the period July 2012 to August 2013, compared with the EIS prediction for Mining Year 10 of 17.8L/s. Accordingly, total groundwater inflows have been below those predicted in the EIS for this stage of mining.
- The Upper Liddell Seam Extraction Plan predicted maximum total inflow rates of 16.1L/s. Averaged inflows during extraction of LW101 were significantly below this prediction at 10.7L/sec.
- There is no observed drawdown in the alluvium east of Glennies Creek attributable to LW101 mining. Groundwater drawdown in the Glennies Creek Alluvium (GCA) has been significantly less than that predicted in the EIS of 2.2m drawdown for the current stage of mining. As of 26 June 2013 groundwater level elevations in the GCA are consistent with pre PG LW1 conditions.
- To date calculated seepage rates from the GCA have been at, or below, the EIS, EA and SMP predictions at all stages of mining. The EIS predicts inflow rates of 3.3L/s in Mining Year 10 (2012), and 5.3L/s in Year 11 (2013). Calculated averaged inflows are below predicted over the LW101 extraction period and inflow water quality suggests that the inflows originate from Permian sources. It is therefore concluded that actual Glennies Creek inflows are below EIS predictions.
- Groundwater levels in the alluvium monitoring bore WML120B were within baseline levels with no drawdown associated with LW101 extraction. Therefore water levels at this location have not been drawn down to the extent predicted in the EIS of 1.3m for this piezometer.
- Mining of LW101 has not resulted in a reduction in Hunter River Alluvium (HRA) storage and consequently, no losses from the HRA to underground workings are likely to have occurred.

In summary, the report confirmed that groundwater monitoring shows that the impact of LW101 was less than that predicted in the EIS, EA and the LW101 extraction plan. The monitoring data does not show any indication of an affect on the Hunter River Alluvium or the Glennies Creek Alluvium from secondary extraction of the LW101 panel.

6 ADEQUACY OF THE MINE PLAN

The subsidence data and the groundwater monitoring data both show that the effects of multi seam extraction of LW101 are within the predictions of the EIS and the SMP. The offset layout of the multi seam panels has, to date, shown results that are less than those effects that were predicted. The results also show consistency across different monitoring sites indicating that the multi seam response is predictable.

Visual observation on the surface indicates that deformation from the subsidence is as expected with surface cracks occurring in similar locations as the single seam extraction with respect to the extraction panel edges. Underground observations show minimal effects from the overlying extraction in the Pikes Gully seam. These results are less than anticipated, indicating that the approach to mine design, operation and management of the multi seam extraction has been effective.

Figures

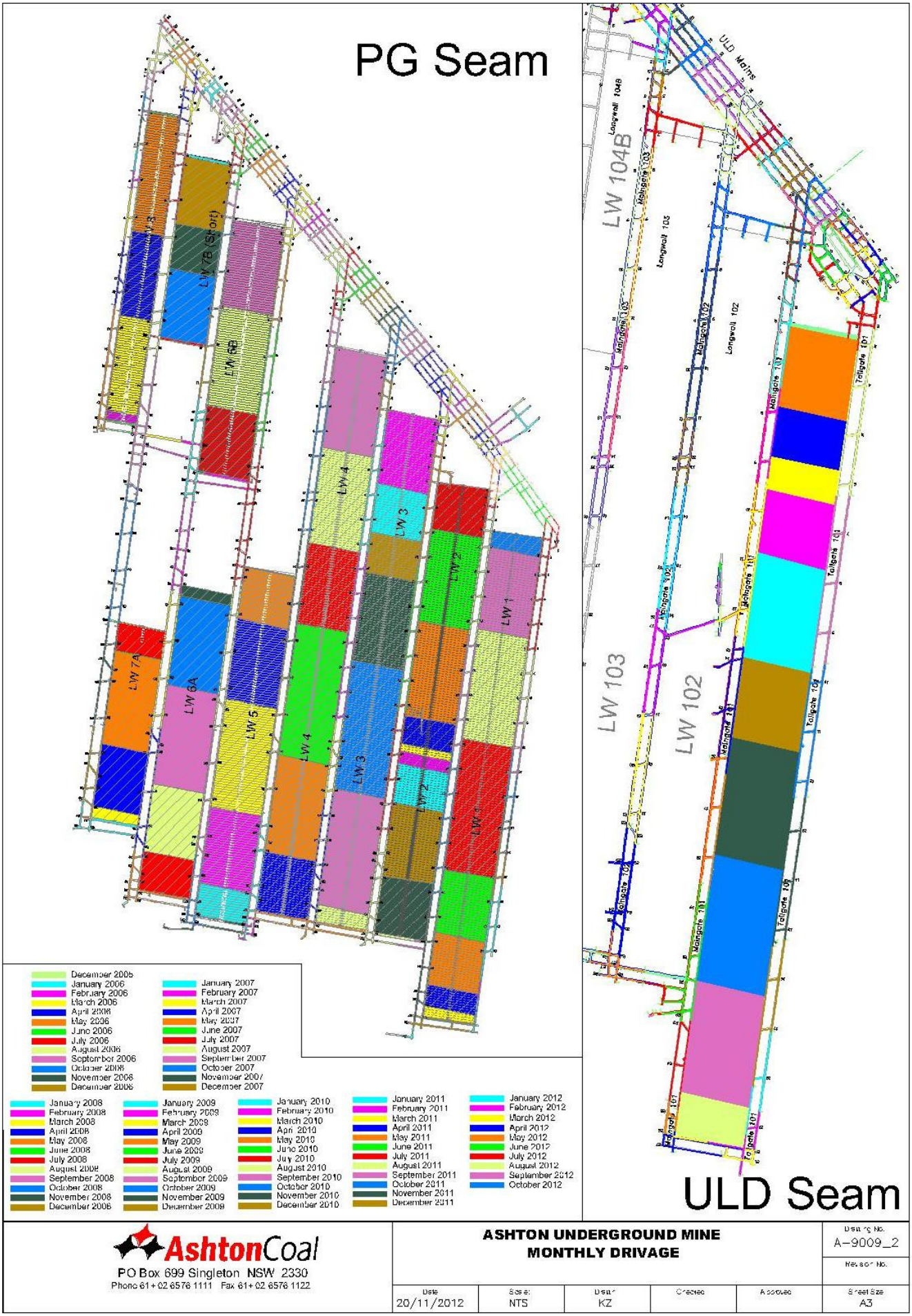

Figure 1: Progression of Longwall Extraction in the Pikes Gully and Upper Liddell Seams

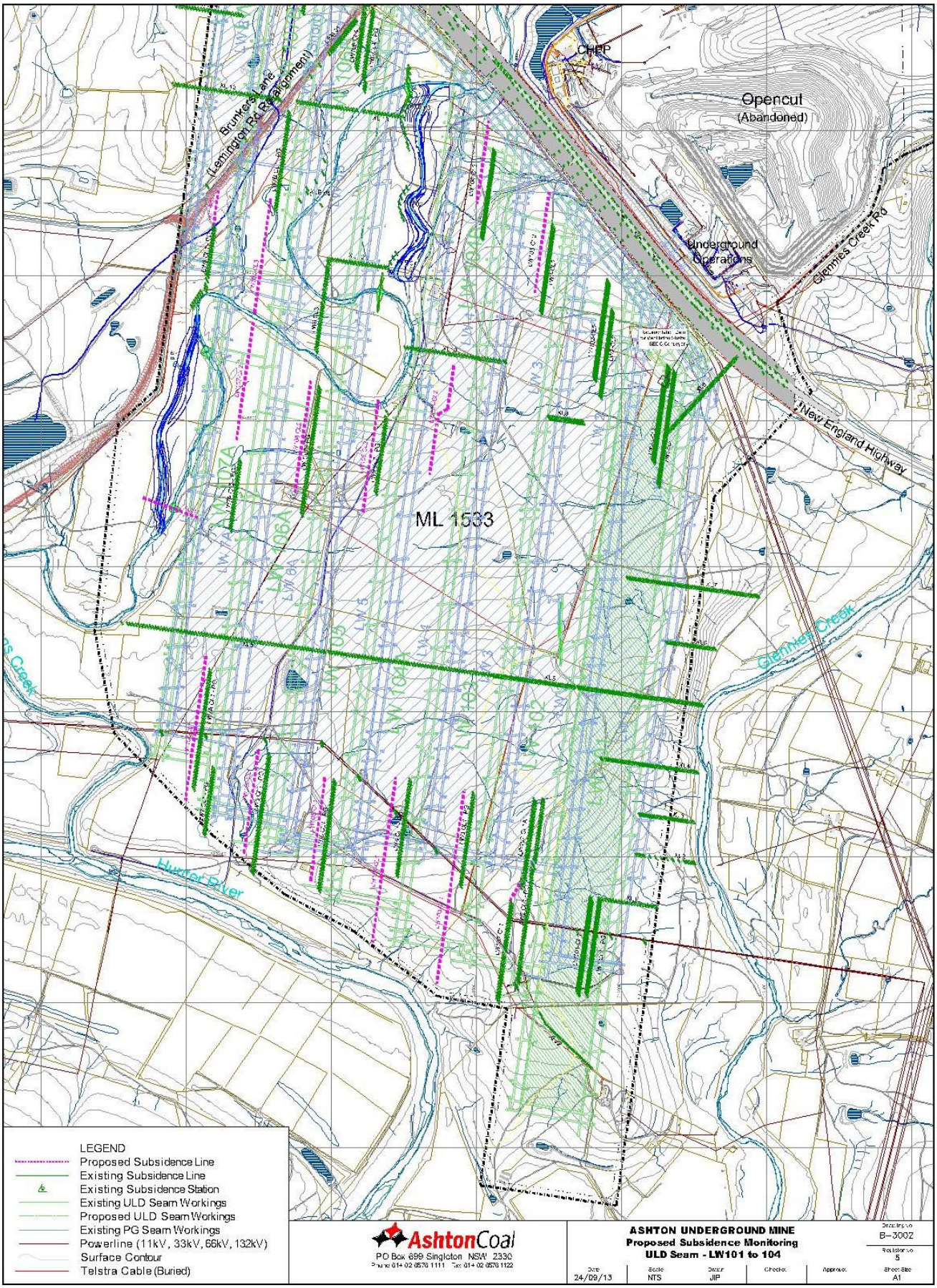

Figure 2: Plan location of Monitoring Cross Lines. Also shown is the 132kV transmission lines.

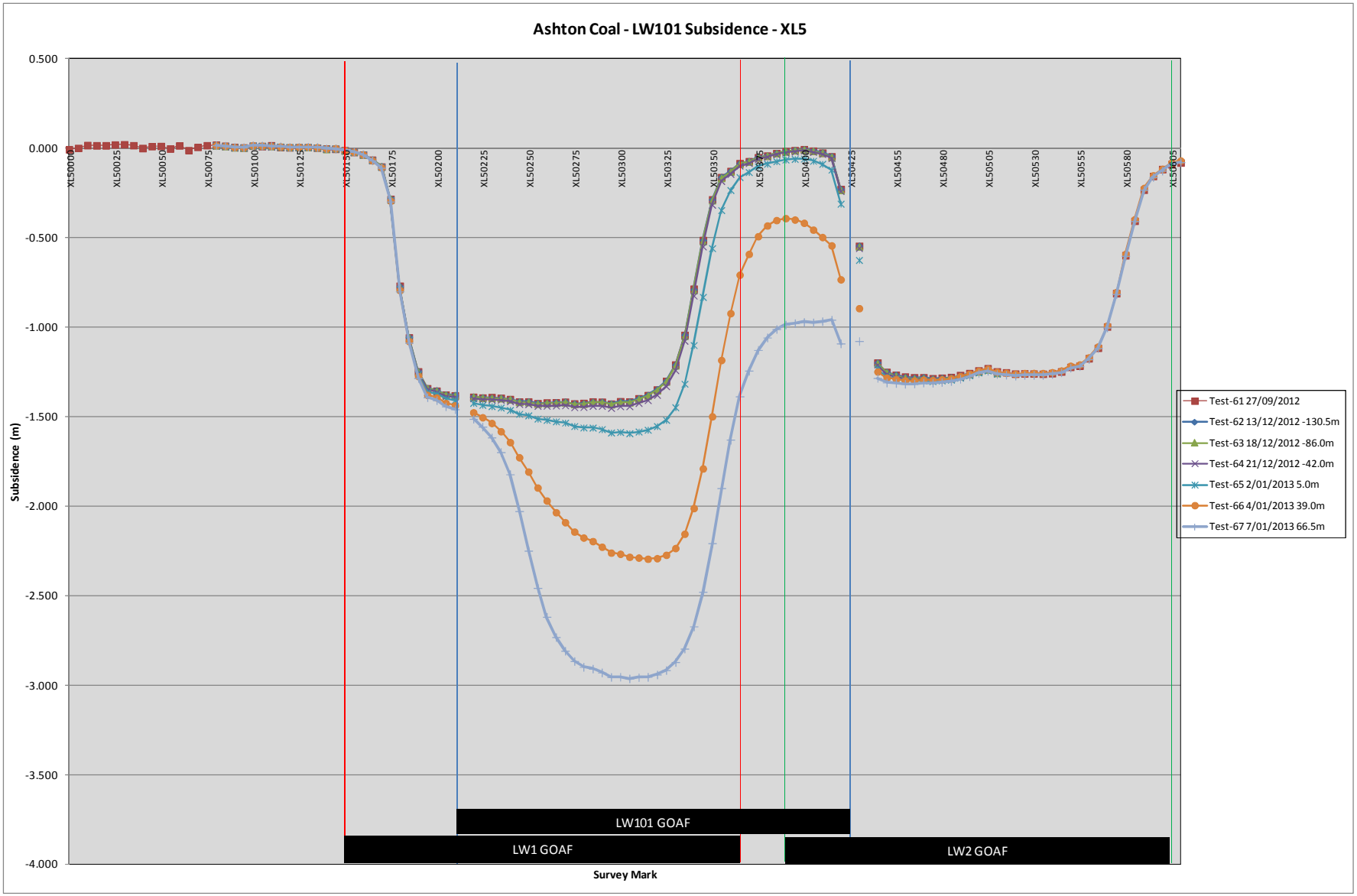

Figure 3: Vertical subsidence of XL5 – Pre and Post LW101

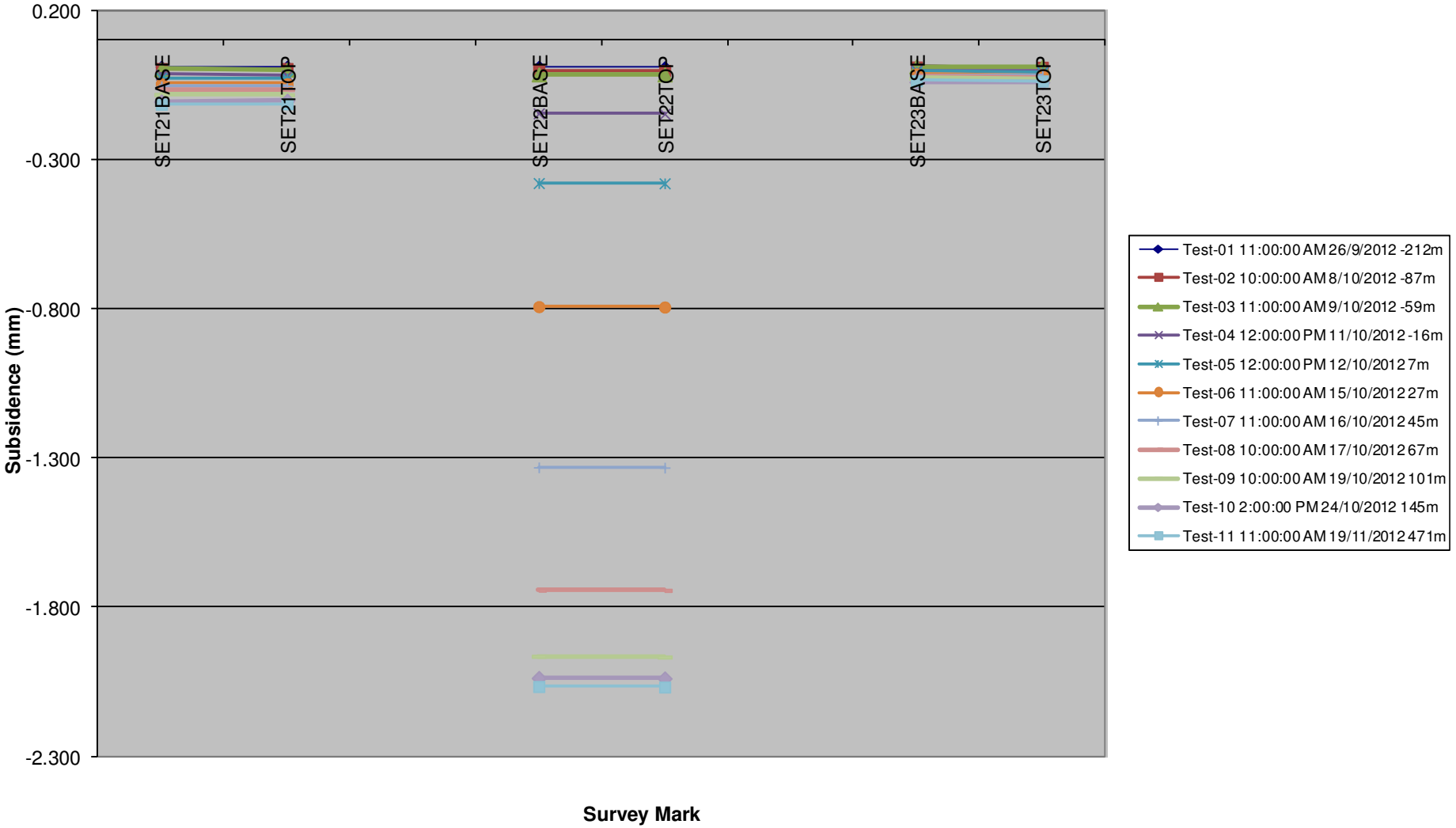

Figure 4: Subsidence Monitoring Data 132kv Power Poles