LW105

END OF PANEL REPORT

NARRABRI MINE

Comments	Author	Authorised By	Date
LW105 End of Panel Report	S Farrar	D Ellwood	September 2016

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1. INTRODUCTION

Narrabri Mine received Subsidence Management Plan (SMP) approval (10/9000) for Longwall Panels (LW) 101 to 105 in April 2012. The SMP was developed as part of the Extraction Plan for LW101 to LW105 at the Narrabri Mine. The Extraction Plan, approved on 27 March 2012, is required by the Department of Planning and Environment's (DP&E) consent (PA 08_0144). This end of panel report has been prepared to satisfy the SMP approval, specifically Condition 18, for the fifth Longwall Panel completed at the Narrabri Mine, known as LW105. The specific requirements of Condition 18 are outlined in Table 1.

Table 1: SMP 10/9000 Approval Conditions

SMP Approval Condition	Section Addressed
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:	This entire document
(a) include a summary of the subsidence and environmental monitoring results for the applicable longwall panel;	Section 3
(b) include an analysis of these monitoring results against the relevant: • impact assessment criteria; • monitoring results from previous panels; and • predictions in the SMP and EA;	Section 4
(c) identify any trends in the monitoring results over the life of the activity; and	Section 5
(d) describe what actions were taken to ensure adequate management of any potential subsidence impacts due to longwall mining.	Section 4

2. BACKGROUND

LW105 at Narrabri Mine was mined over a period of 8 months, from first coal to completion of the panel. Extraction of LW105 commenced in September 2015 and was completed in May 2016. Table 2 provides a summary of the LW105 mining parameters.

Table 2: LW105 Mining Parameters

LW105	Parameters
Target Seam	Hoskissons Seam
Seam Thickness	5.6m to 10.6m
Length	2,961m
Face Width	295.6m
Void	306.4m
Extraction Height	4.3m
Chain Pillar Width	39.5m
Cover Range	190m to 240m
Commenced	10 September 2015
Completed	16 May 2016
Coal Extracted	5.7 Million Tonnes

2.1 Impacts

The surface area affected by the extraction of LW105 comprises mine owned land holdings used historically for livestock grazing and cropping. The surface topography is flat to slightly undulating with slopes of 2˚ – 5˚ and topographic relief ranging from 268m AHD to 306m AHD. Pine Creek (an ephemeral creek) and one of its tributaries was directly impacted by the extraction of LW105, refer to Attachment 1. The mine site infrastructure, Kamilaroi Highway and Northern Branch Railway Line are >2.5km to the east of LW105 and are considered to be outside the limits of far-field displacement and strain as outlined in the Extraction Plan.

The Extraction Plan predicted low impacts to the surface features as a result of mining LW105. Water ponding was predicted to occur above LW105. Initial ponding did occur as predicted during December 2015, which did result in some out-of-bank, refer to Section 4.2.1 for more details. Trees along Greylands Road and along the ephemeral creek have not been impacted by subsidence as occurred in LW101 and LW102, refer to Section 4.2.1 for more details.

3. SUBSIDENCE MONITORING RESULTS

Narrabri Mine has established a subsidence monitoring program, required as part of the Extraction Plan for Longwall Panels LW101 to LW105, to quantify subsidence parameters and to identify subsidence related impacts to environmental and built features. Subsidence monitoring results are reported to the Principal Subsidence Engineer at the Division of Resources and Energy (DRE). The subsidence monitoring program consists of the following elements and is presented as Attachment 2:

- A transverse subsidence line across longwall panels LW101 to LW105;
- A full-length longitudinal line over LW101 and LW102 with reduced monitoring extending over the starting and finishing point of each remaining longwall block (LW103 – LW105);
- A survey line along the riparian management zone of Pine Creek and Pine Creek Tributary No.1;
- Four additional survey cross lines perpendicular to Pine Creek Tributary No 1 to establish lateral movement impacts; and
- Survey markers on the 11kV power poles for monitoring of tilt and strain to poles over LW101 to LW104.

Aerial Laser Scanning (ALS) surveys have been conducted at Narrabri Mine as they are considered to provide a more thorough understanding of subsidence development. The intention is to phase out the longitudinal monitoring with ALS surveys should it prove to be an adequate monitoring technique. To date, Narrabri Mine has completed seven surveys: November 2008 (baseline), 31 December 2012, 25 July 2013, 2 December 2013, 3 October 2014, 25 March 2015 and 6 May 2016. The May 2016 survey imagery is included as Figure 1.

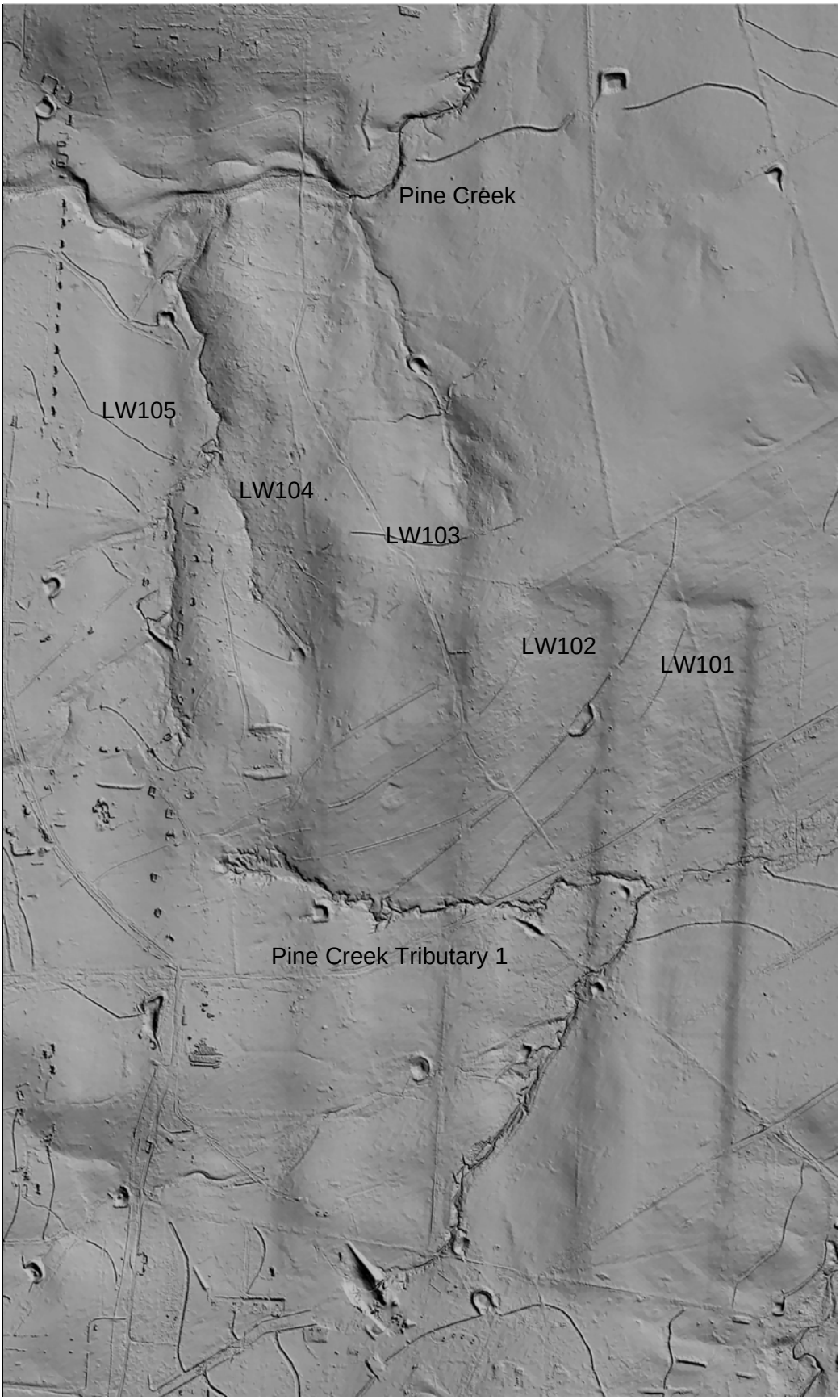


Figure 1: ALS Survey Image of LW101-LW105, May 2016

Table 3 outlines all of the longitudinal surveys undertaken up to 8 August 2016 at the Narrabri Mine.

Table 3: Subsidence Monitoring Lines

Monitoring Line	Panel	Installation Date	Survey Date(s)	Survey(s) Completed	Comments
101 –Centreline	101	April & May 2012	9/08/2012, 17/08/2012, 27/08/2012, 6/09/2012, 2/10/2012, 9/10/2012, 6/11/2012, 10/12/2012, 15/01/2013, 18/02/2013, 22/03/2013, 11/04/2013, 6/05/2013, 26/09/2013, 12/03/2014, 10/09/2014, 17/03/2015	17	All points surveyed
102 – Centreline	102	April & May 2012	31/07/2013, 6/08/2013, 9/08/2013, 19/08/2013, 22/08/2013, 26/08/2013, 25/09/2013, 24/10/2013, 19/11/2013, 31/12/2013, 21/01/2014, 4/03/2014, 6/11/2014, 21/05/2015	14	All points surveyed
103 North – Centreline	103	April & May 2012	11/03/2014, 17/03/2014, 24/03/2014, 31/03/2014, 8/04/2014, 5/05/2014, 3/11/2014, 5/06/2015, 13/07/2016	9	All points surveyed
103 South - Centreline	103	April & May 2012-	2/10/2014, 7/10/2014, 23/10/2014, 29/04/2015, 19/11/2015, 13/07/2016	6	All points surveyed
104 North – Centreline	104	August 2014	10/12/2014, 17/12/2014, 23/12/2014, 29/12/2014, 6/01/2015, 15/01/2015, 15/07/2015, 15/07/2016	8	All points surveyed
104 South – Centreline	104	December 2013 & January 2014	17/07/2015, 20/07/2015, 6/08/2015, 2/09/2015, 15/10/2015, 15/07/2016	6	All points surveyed
105 North – Centreline	105	December 2013 & January 2014	22/09/2015, 28/09/2015, 2/10/2015, 6/10/2015, 12/10/2015, 8/08/2016	6	All points surveyed
105 South – Centreline	105	December 2013 & January 2014	29/04/2016, 2/05/2016, 3/05/2016, 16/05/2016, 6/06/2016	5	All points surveyed

Monitoring Line	Panel	Installation Date	Survey Date(s)	Survey(s) Completed	Comments
A - Crossline	101 – 106	April & May 2012	13/11/2012, 3/12/2012, 14/12/2012, 7/02/2013, 21/2/2013, 13/08/2013, 19/09/2013, 1/10/2013, 23/10/2013, 31/10/2013, 6/11/2013, 28/04/2014, 24/06/2014, 7/07/2014, 25/07/2014, 12/08/2014, 28/10/2014, 28/05/2015, 4/06/2015, 18/01/2016, 20/04/2016	21	All points surveyed
B – Pine Creek Tributary 1 (PC1)	101 – 103	April & May 2012	21/11/2012, 3/12/2012, 4/01/2013, 18/06/2013, 21/10/2013, 11/11/2013, 2/12/2013, 13/05/2014, 16/09/2014, 30/09/2014, 30/10/2014, 30/04/2015, 19/11/2015, 16/06/2016	14	All points surveyed
C – Dam Wall	REMOVED				
D – Pine Creek (PC)	104 & 105	December 2013 & January 2014	24/12/2014, 29/12/2014, 6/01/2015, 15/07/2015, 8/10/2015, 12/10/2015, 20/10/2015, 12/07/2016, 20/07/2016, 27/07/2016	10	All points surveyed
E – PC1 Crossline 1	101 & 102	April & May 2012	4/01/2013, 7/01/2013, 16/01/2013, 18/06/2013, 17/10/2013, 21/10/2013, 23/10/2013, 13/05/2014, 30/10/2014, 30/04/2015	10	All points surveyed
F – PC1 Crossline 2	102	April & May 2012	11/02/2013, 21/02/2013, 25/02/2013, 18/06/2013, 31/10/2013, 6/11/2013, 11/11/2013, 13/05/2014, 30/10/2014, 30/04/2015, 16/06/2016	11	All points surveyed
G – PC1 Crossline 3	102 & 103	April & May 2012	18/06/2013, 25/11/2013, 2/12/2013, 4/12/2013, 13/05/2014, 9/09/2014, 11/09/2014, 16/09/2014, 30/04/2015, 16/06/2016	10	All points surveyed
Power Poles	101 – 105	19 & 21 March 2013	29/04/2013, 1/05/2013, 6/05/2013, 13/05/2013, 17/05/2013, 26/08/2013, 19/09/2013, 29/10/2013, 18/11/2013, 9/12/2013, 16/12/2013, 24/12/2014, 31/12/2014, 2/01/2014, 20/01/2014, 17/09/2014, 3/10/2014, 8/10/2014, 14/10/2014, 22/09/2015	20	Pole 2 to Pole 7

Table 4 compares the predicted subsidence parameters to all of the measured subsidence parameters for data available to 8 August 2016.

Table 4: Subsidence Parameters – Predicted and Measured

Longwall Panels (LW) 101 to 105		
	Maximum Predicted Extraction Plan	Maximum Measured
Line 101 – Centre of LW101		
Subsidence (m)	2.69	2.633
Tilt (mm/m)	47	29.1 – 46.3
Tensile Strain (mm/m)	12.5 – 25^	8.7 – 20.7
Compressive Strain (mm/m)	16 – 32^	7.5 – 26.6
Angle of Draw (°, Degrees)	22.5 – 26.5	20.2
Line 102 – Centre of LW102		
Subsidence (m)	2.69	2.694
Tilt (mm/m)	45	43.7
Tensile Strain (mm/m)	11.5 – 23^	20.5
Compressive Strain (mm/m)	15 – 30^	46.7
Angle of Draw (°, Degrees)	22.5 – 26.5	20.8
Line 103 – Centre of LW103 – Northern		
Subsidence (m)	2.75	2.729
Tilt (mm/m)	34	40.2
Tensile Strain (mm/m)	8 – 16^	18.8
Compressive Strain (mm/m)	10 – 20^	27.9
Angle of Draw (°, Degrees)	22.5 – 26.5	18.1
Line 103 – Centre of LW103 – Southern		
Subsidence (m)	2.75	2.575
Tilt (mm/m)	34	30.3
Tensile Strain (mm/m)	8 – 16^	9.3
Compressive Strain (mm/m)	10 – 20^	9.6
Angle of Draw (°, Degrees)	22.5 – 26.5	22.8
Line 104 – Centre of LW104 – Northern		
Subsidence (m)	2.75	2.794
Tilt (mm/m)	34	48.4
Tensile Strain (mm/m)	8 – 16^	42.6
Compressive Strain (mm/m)	20 – 40^	42.3
Angle of Draw (°, Degrees)	22.5 – 26.5	18.7
Line 104 – Centre of LW104 – Southern		
Subsidence (m)	2.75	2.690
Tilt (mm/m)	34	31.2
Tensile Strain (mm/m)	8 – 16^	8.1
Compressive Strain (mm/m)	20 – 40^	6.7

Longwall Panels (LW) 101 to 105		
	Maximum Predicted Extraction Plan	Maximum Measured
Angle of Draw (°, Degrees)	22.5 – 26.5	13.2
Line 105 – Centre of LW105 – Northern		
Subsidence (m)	2.75	2.663
Tilt (mm/m)	30	46.3
Tensile Strain (mm/m)	6.5 – 13	17.7
Compressive Strain (mm/m)	17 – 34	44.6
Angle of Draw (°, Degrees)	22.5 – 26.5	17.9
Line 105 – Centre of LW105 – Southern		
Subsidence (m)	2.75	2.614
Tilt (mm/m)	30	30.3
Tensile Strain (mm/m)	6.5 – 13	7.5
Compressive Strain (mm/m)	17 – 34	6.1
Angle of Draw (°, Degrees)	22.5 – 26.5	14.4
Line A – Cross Panel Survey Line		
Subsidence (m)	2.75	2.655*
Tilt (mm/m)	47	56.3*
Tensile Strain (mm/m)	12.5 – 25^	19.1*
Compressive Strain (mm/m)	20 – 40^	26.7*
Angle of Draw (°, Degrees)	22.5 – 26.5	24.2*
Line B – Pine Creek Tributary 1		
Subsidence (m)	2.75	2.589*
Tilt (mm/m)	47	54.8*
Tensile Strain (mm/m)	12.5 – 25^	13.1*
Compressive Strain (mm/m)	20 – 40^	11.0*
Gradient Change (%)	Up to 6	5.47*
Line D – Pine Creek		
Subsidence (m)	2.75	2.809*
Tilt (mm/m)	47	45.5*
Tensile Strain (mm/m)	12.5 – 25^	10.7*
Compressive Strain (mm/m)	20 – 40^	15.2*
Gradient Change (%)	Up to 6	4.54*
Line E – Pine Creek Tributary 1 Crossline 1		
Subsidence (m)	2.44	1.013*
Tilt (mm/m)	47	26.9*
Tensile Strain (mm/m)	11 – 22^	9.2*
Compressive Strain (mm/m)	14 – 28^	2.9*
Line F – Pine Creek Tributary 1 Crossline 2		
Subsidence (m)	2.75	2.698*

Longwall Panels (LW) 101 to 105		
	Maximum Predicted Extraction Plan	Maximum Measured
Tilt (mm/m)	47	59.1*
Tensile Strain (mm/m)	12.5 – 25^	6.6*
Compressive Strain (mm/m)	20 – 40^	22.5*
Line G – Pine Creek Tributary 1 Crossline 3		
Subsidence (m)	2.75	1.419*
Tilt (mm/m)	47	29.2*
Tensile Strain (mm/m)	12.5 – 25^	12.0*
Compressive Strain (mm/m)	20 – 40^	11.9*
Power Poles		
Pole 2		
Subsidence (m)	0	0.046
Dynamic Tilt (mm/m)	0	9.09
Final Tilt (mm/m)	0	8.44
Conductor length change between poles 2-3 (m)	0.13	-0.59
Conductor Clearance Loss (m)	0.77	+0.56
Pole 3		
Subsidence (m)	2.18	2.085
Dynamic Tilt (mm/m)	30	66.3
Final Tilt (mm/m)	12	53.1
Conductor length change between poles 3 - 4 (m)	0.28	-0.81
Conductor Clearance Loss (m)	1.10	1.52
Pole 4		
Subsidence (m)	2.11	2.063
Dynamic Tilt (mm/m)	25	74.23
Final Tilt (mm/m)	15	32.8
Conductor length change between poles 4 - 5 (m)	0.13	0.48
Conductor Clearance Loss (m)	0.07	+1.20
Pole 5		
Subsidence (m)	0.31	0.238
Dynamic Tilt (mm/m)	2	25.66
Final Tilt (mm/m)	2	24.35
Conductor length change between poles 5 - 6 (m)	0.024	0.97
Conductor Clearance Loss (m)	0.30	+1.84
Pole 6		
Subsidence (m)	1.41	1.645

Longwall Panels (LW) 101 to 105		
	Maximum Predicted Extraction Plan	Maximum Measured
Dynamic Tilt (mm/m)	27	132.48
Final Tilt (mm/m)	27	132.48
Conductor length change between poles 6 - 7 (m)		1.03
Conductor Clearance Loss (m)	1.30	1.01
Pole 7		
Subsidence (m)	2.42	2.614
Dynamic Tilt (mm/m)	3	215.91
Final Tilt (mm/m)	3	24.88
Conductor Clearance Loss (m)	1.71	-

* - subsidence development incomplete.

^ - values for 'smooth' and 'discontinuous' (i.e. crack affected) subsidence profiles.

Based on Table 4, several subsidence prediction exceedances have occurred above LW105 as follows:

- The maximum subsidence measurements for the northern and southern monitoring lines in LW105 were within the predicted value of 2.75 m with a maximum measured value of 2.663 m, refer to Figure 2 and Figure 3.
- The maximum tilt measurements recorded for LW105 exceeded the maximum predicted value of 30 mm/m, refer to Figure 4 and Figure 5. However, 97% of all values were within the predicted range.
- The maximum tensile strain measurements for LW105 exceeded the range of predicted values of 6.5 mm/m (smooth profile) and 13 mm/m (discontinuous or crack affected profiles), refer to Figure 6 and Figure 7. However, 98% of the recorded values were within the predicted range.
- The maximum compressive strain measurements for LW105 exceeded the range of the predicted values of 17 mm/m (smooth profile) and 34 mm/m (discontinuous or crack affected profiles), refer to Figure 6 and Figure 7. However, 99% of the recorded values were within the predicted range.

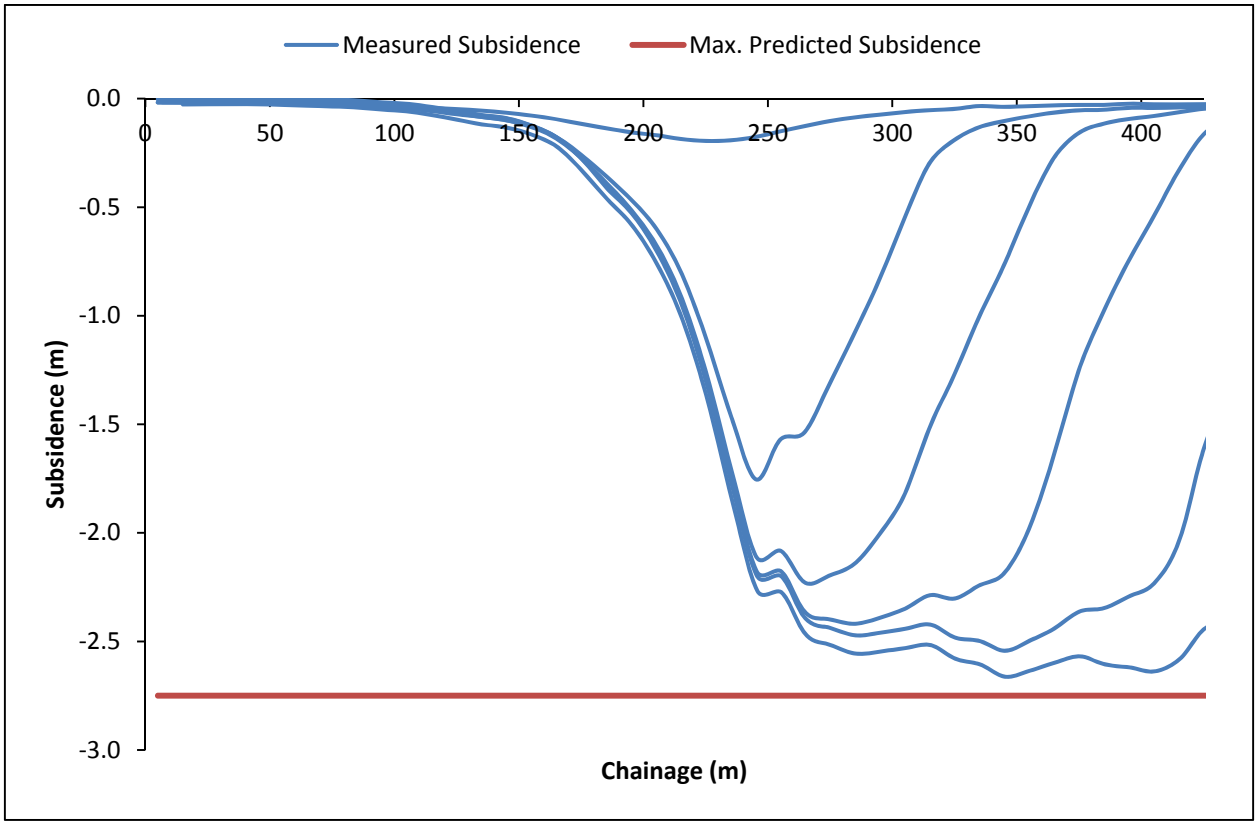


Figure 2: LW105 (North) Subsidence

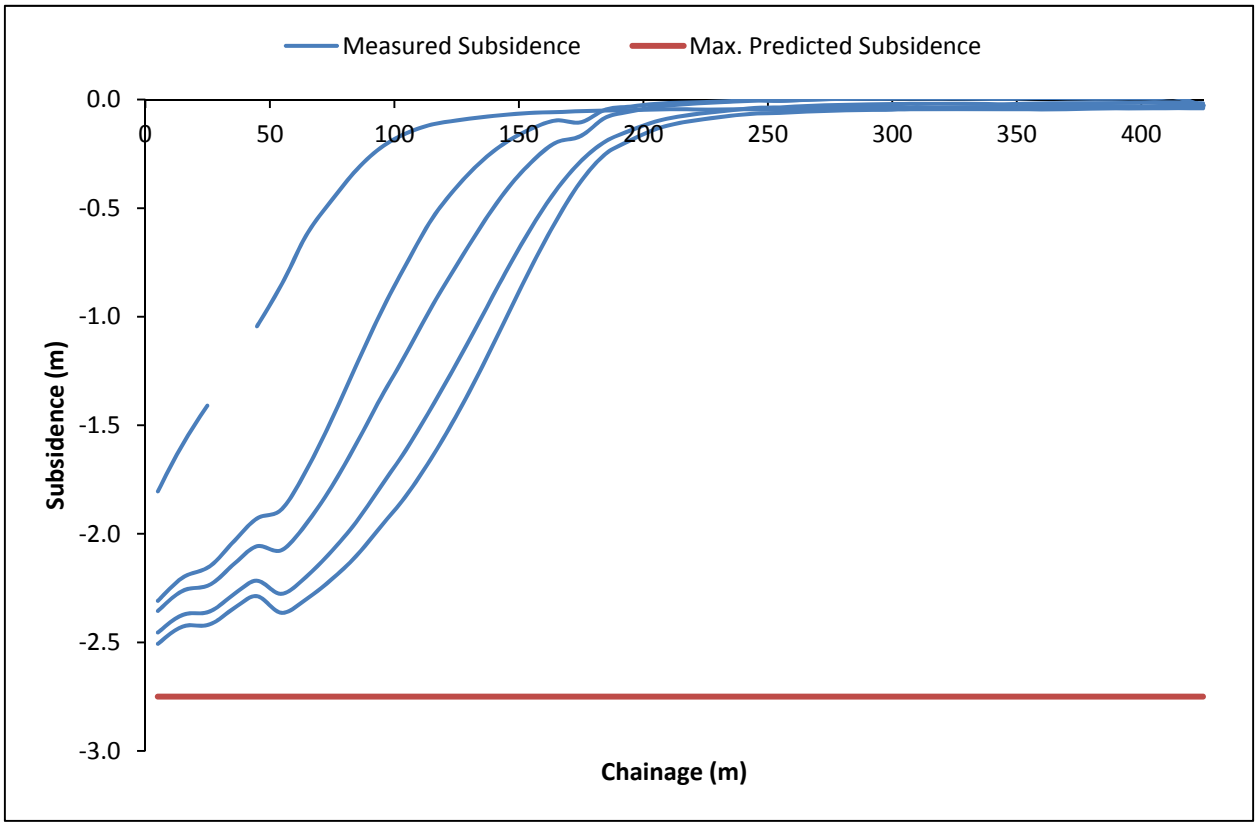


Figure 3: LW105 (South) Subsidence

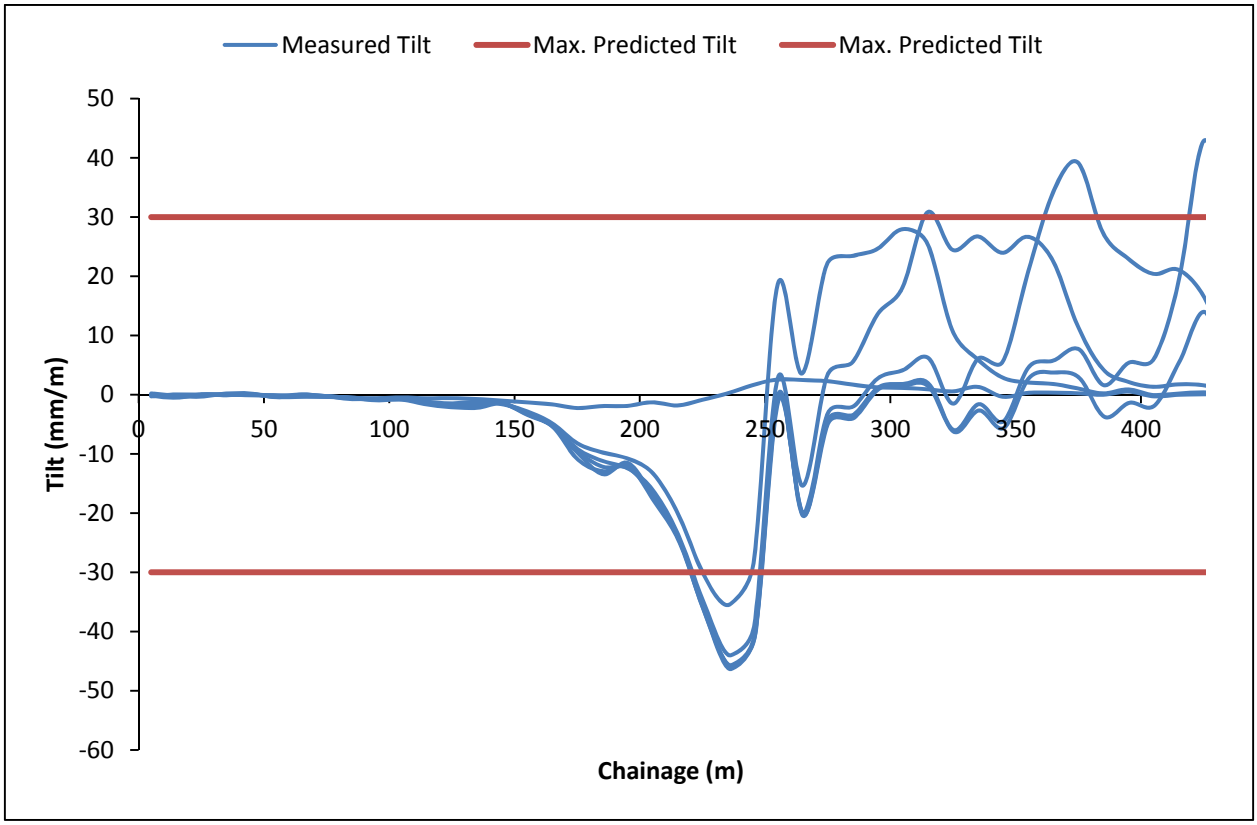


Figure 4: LW105 (North) Tilt

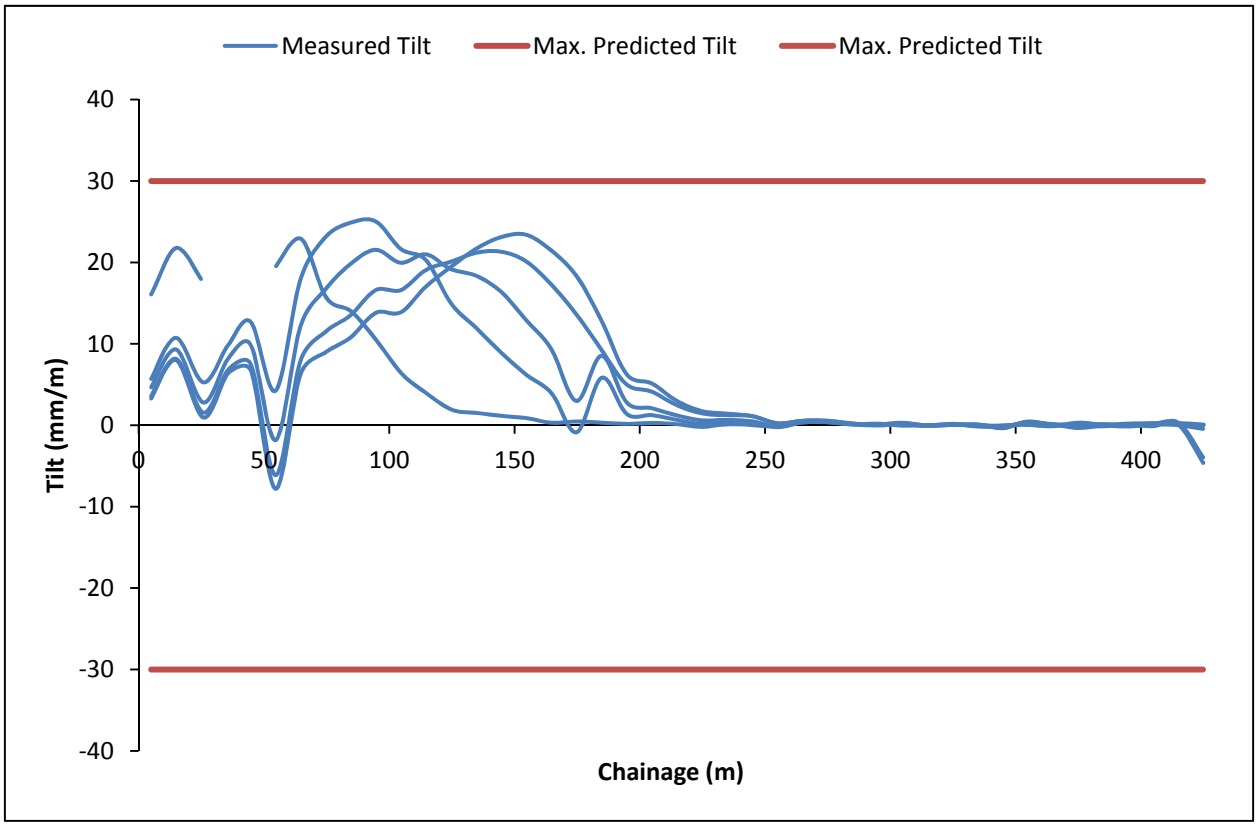


Figure 5: LW105 (South) Tilt

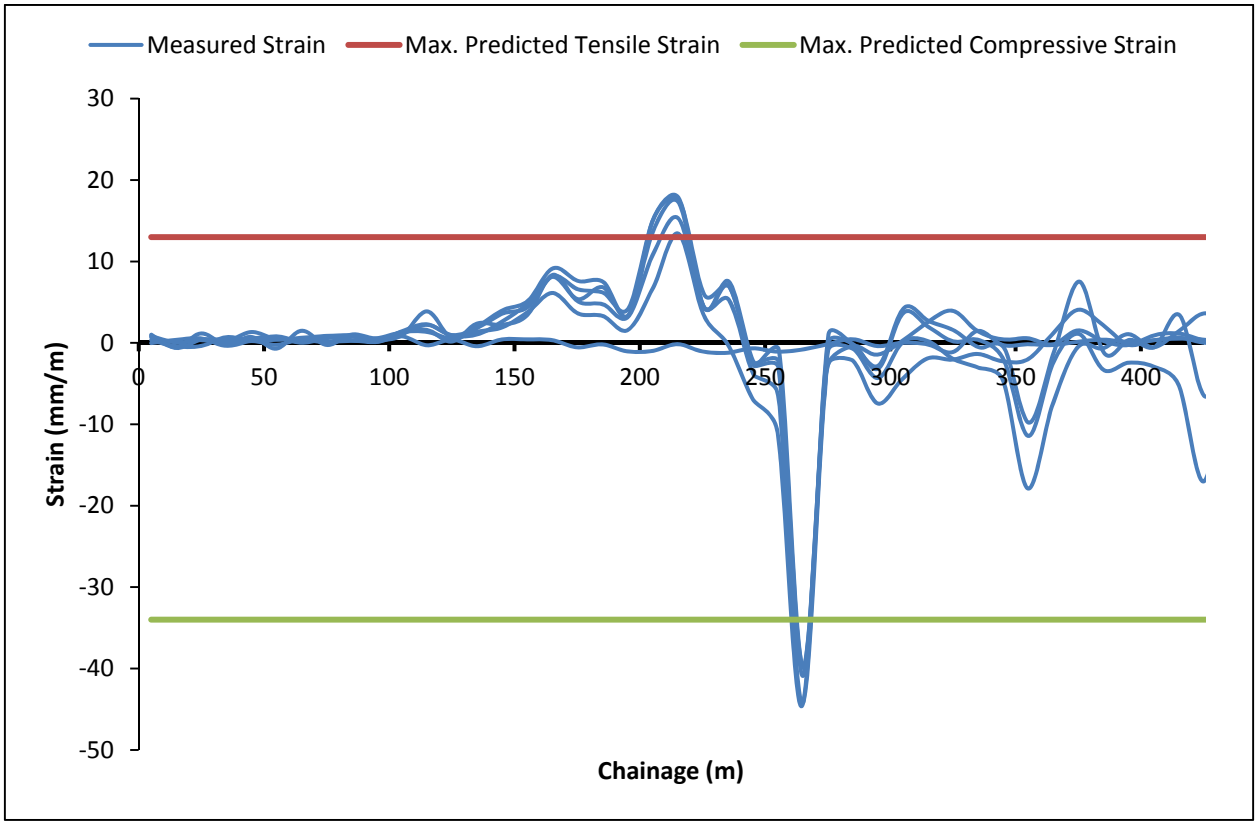


Figure 6: LW105 (North) Strain

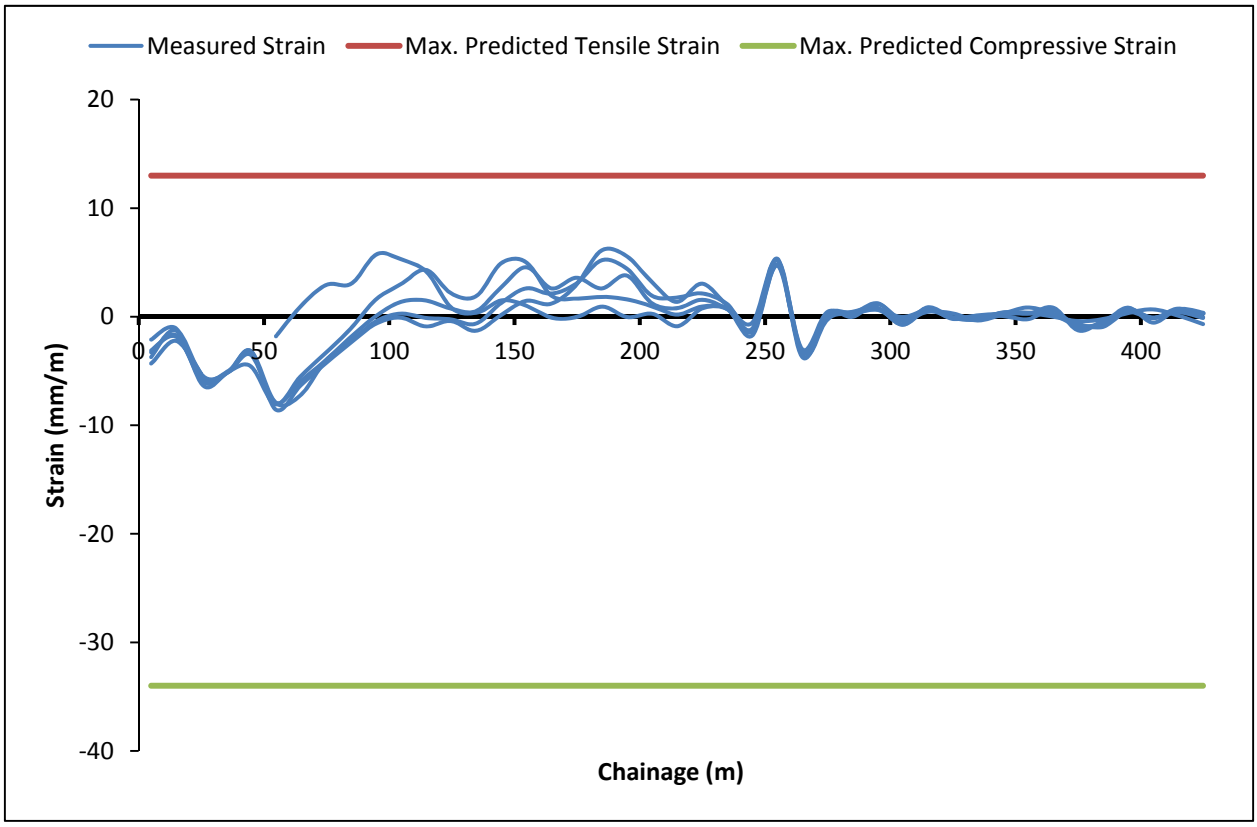


Figure 7: LW105 (South) Strain

4. SUBSIDENCE IMPACTS

4.1 Monitoring Results from Previous Panels

Refer to Table 3 and Table 4 for the subsidence monitoring undertaken above LW101 to LW105 up to and following the extraction of LW105. Measured maximum subsidence results are as follows: LW101 was recorded to be 2.633m; LW102 was recorded to be 2.694m; LW103 was recorded to be 2.729m; LW104 was recorded to be 2.794m; and LW105 was recorded to be 2.663m. The maximum tensile strains for LW101 to LW105 ranged from 7.5 – 42.6 mm/m; the maximum compressive strains for LW101 to LW105 ranged from 6.1 – 46.7 mm/m; and the maximum tilts for LW101 to LW105 ranged from -29.1 – 48.4 mm/m. The maximum subsidence results to date show general consistency between LW101-LW105.

4.2 Predictions in the SMP and EA

4.2.1 Natural Features

Pine Creek and Tributaries

Water ponding has been observed in LW105 in Pine Creek, refer to Photo 1. The ponding was predicted to occur in the Environmental Assessment for the Narrabri Mine, and is generally limited to within the banks of the ephemeral creeks, although some out of bank ponding has occurred.

The mine is continuing the current management measures for ponding areas at the mine which is pump the water downstream. Water quality samples are collected monthly from the ponded water. The results are monitored to ensure parameters are not increasing above the baseline levels in the ponded water as this may affect the soils in the area. The results indicate water quality parameters, including pH, EC, TSS, Oil & Grease, and turbidity, are within the range of background levels for the mining area.

A ponding management plan is being developed, with OEH attending site during August 2016 to view the ponding and proposed management measures first hand. Finalising the plan will depend on comments made by OEH following this visit which are yet to be received.

Photo 1: Ponding at LW105 within Pine Creek

For the ponding of water in LW105 it is expected that the system will naturally re-adjust to changes as a result of subsidence to reach a dynamic equilibrium. Maximum gradient change measured along Pine Creek is 4.54%. Small reaches of the creek have increased or decreased in gradient at the upstream and downstream extent of ponding but the channel bed appears stable (relative to the natural system). Some trees are stressed as a result of water ponding

Groundwater Resources

Narrabri Mine has an extensive groundwater monitoring program consisting of 56 monitoring wells. The monitoring can be summarised as follows:

- Nine licenced production wells that Narrabri Mine monitors for water levels and/or water quality in the Namoi River alluvium (WB2, WB3a, WB3b, WB4, WB5a, WB5b, WB6a, WB6b and WB7);
- Thirty six standpipe piezometers that Narrabri Mine monitors for water levels and quality within and surrounding the mining lease (P1-P19, P28-P34, P39A&B, P43, P47, P50A-C & P51-P53); and
- Eleven vibrating wire piezometers (VWP) that Narrabri Mine monitors for water levels within and surrounding the mining lease (P21-P27, P35-P37, P40 & P44-P46).

The eleven VWP's include four life-of-mine groundwater monitoring wells that have been installed as required by the Water Management Plan for the Longwall Project. P39A&B,

P43 and P47 are life-of-mine standpipe piezometer targeting the Garrawilla Volcanics, Watermark and alluvium on and surrounding the mine. There are two more VWP's to be installed as part of the life-of-mine monitoring program.

A calibration of the groundwater model developed as part of the Groundwater Assessment undertaken as part of the Stage 2 Longwall Project EA was undertaken and report in May 2015. The calibration report concluded the following:

- All Hoskissons Seam vibrating wire hydrographs show a strong effect from the NM. The sharp decline in water level is clear at the monitoring sites P21, P22, P23, P24, P25, P26, P27, P35, P36, P37, P38 and P40. The measured water level in these bores reveals that the mining induced the water level to fall more than 100 m from the start of the main heading until the end of extraction of LW101 and LW102.
- Multi-level vibrating wires P40, P44, P45 and P46 were installed in 2012. The lower depths in P40 at 346 m and 357 m (Hoskissons Seam and Arkarula Formation) show mining effects. Also, P44 at depth 134 m (Digby Formation) shows a decline in the water level due to mining from 225 mAHD in August 2012 to 218 mAHD in August 2014. The Napperby and Pamboola Formations are unaffected at this location.
- The calibration results of the simulation model show that the model performs reasonably well in representing the values and the patterns of the groundwater level for both steady state and transient conditions.
- The model replicates very well the water level in all Hoskissons Seam monitoring sites that recorded the largest mining-induced drawdown effects to date.
- The predicted average mine inflows to LW101, LW102 and LW103 are expected to be around 0.5, 0.7 and 1.0 ML/day respectively. These rates agree very well with the average measured mine inflows of 0.6 and 1.0 ML/day for the mining periods April 2012 to March 2013 and April 2013 to March 2014, respectively.
- The model results reveal that the NM has no discernible impact on stream base flow and the variations are due almost entirely to natural conditions.
- The previous prediction of the effects of brine re-injection is unlikely to be materially different, due to similarity of hydraulic conductivities in the previous model and the current model, and good prediction of mine inflows with the previous model.

The results of life-of-mine water level monitoring required by the Water Management Plan for the Longwall Operation are provided in Appendix 1. The results indicate that the extraction of the LW105 has not impacted upon water levels surrounding the mine site.

Groundwater inflow monitoring results are described in the Narrabri Mine 2015-2016 Annual Review (AR). Groundwater inflows are predicted to increase as the mine continues west, peaking at approximately 3.77 ML/day in 2023 and then decreasing as the mine progresses back to the east. During the AR reporting period the inflow totalled approximately 451ML, with a modelled prediction for the 2015 calendar year of 588ML. It should also be noted that the mine has consulted with DPI-Water during the reporting period and have agreed that a calculation can be used to determine the amount of recycled

water from the operation, making the total take for the reporting period approximately 265ML.

Threatened or Protected Species

No threatened or protected species were impacted by the extraction of LW105.

Natural Vegetation

As reported previously, large trees have been impacted by subsidence above LW101 and LW102. Narrabri Mine can report that at the time of preparing this document no trees have been impacted above LW105. Some trees are also showing signs of stress from the ponded water in LW105 however, the mine is continuing to pump the ponded water downstream.

Land Surface

Informal visual observations in the subsidence area were undertaken as part of general duties. Surface cracks observed were typically 50mm to 100mm wide with some cracks widths up to 200 mm. The cracks were within the predicted range. No areas of LW105 have been ploughed however when conditions improve areas will be ploughed and seeded as per the Extraction Plan.

4.2.2 Public Utilities

Roads

Greylands Road was undermined during the extraction of LW105. The road is now owned by the mine and is permanently closed to the public. Any repairs required for trafficability for mine personnel were undertaken as required. The management plan developed for Greylands Road, known as the Greylands Road Management Plan (GRMP), is no longer in effect.

Culverts

No culverts were undermined during the extraction of LW105.

Electricity Transmission Lines

The 11kV power line that traverses LW101 to LW105 was decommissioned during January 2016 with the power line conductors and poles removed. Essential Energy approved this work and as such, the Essential Energy Management Plan and its monitoring requirements are no longer in effect.

Telecommunications Lines

No telecommunications infrastructure exists within the Extraction Plan area for LW101 to LW105.

4.2.3 Farm Land and Facilities

Agricultural Utilisation or Agricultural Suitability of Farm Land

No areas of LW105 were ploughed during the extraction of LW105, refer to Section 4.2.1. No other areas of agricultural utilisation were impacted during the extraction of LW105 as no agricultural activities are undertaken above LW105.

Farm Buildings or Sheds

One mine-owned house on the "Barton Hedge" property was undermined during the extraction of LW105. The house was vacated prior to undermining with access restricted as required by the Extraction Plan. The house will be assessed to determine its future use. Some damage was noted, i.e. cracking of brick work and sagging roof, refer to Photo 2. Subsidence at the house was measured to be 2.22m.

Photo 2: Damaged brick work "Barton Hedge"

One shed was undermined during the extraction of LW105. The shed is located on the "Barton Hedge" property with subsidence measured to be 2.29m. Damage to the shed appears to be minimal and the mine will assess whether it can be used for future operational purposes.

Fences

Fences and gates were undermined during the extraction of LW105. Narrabri Mine has excluded all stock from the active mining area by erecting a fence outside of the subsidence zone to the east of LW101. Any fences/gates required post-mining will be reinstated.

Farm Dams

Two small farms dam were undermined in LW105. Rainfall in late August 2016 at the mine refilled these dams refer to Photo 3. Subsidence has not impacted on the function of these dams.

Photo 3: Farm Dam above LW105 following rainfall

Soil Conservation Works

Six contour banks, or parts thereof, were undermined during the extraction of LW105. The subsidence impacts to the contour banks did not affect their functionality. However, should remediation works be required, Narrabri Mine will either reinstate the contour banks or remove a section to avoid water ponding.

Wells or Bores

The groundwater data indicates that no private wells were impacted by the extraction of LW105 (refer to Section 4.2.1). Two mine installed monitoring bores were directly impacted by the extraction of LW105 being P14 and P15. P14 has been dry since April 2012, i.e. before longwall production commenced. P15 recorded impacts following development of the roadways underground and then recovered to near historic levels. It has again reduced in water level following longwall extraction. The mine will continue to monitor P14 and P15 now that extraction has been completed in this area.

Access Tracks

Access tracks were impacted by the extraction of LW105 however most were in relation to access for mine infrastructure such as boreholes, which are now decommissioned. Access tracks along the perimeter of former farm paddocks will be reinstated once mining is complete.

4.2.4 Industrial, Commercial and Business Establishments

Mine Infrastructure

Pipelines connecting gas drainage wells were undermined during the extraction of LW105 however no impacts on this infrastructure were recorded. All gas drainage infrastructure in the active mining area is inspected and maintained to ensure subsidence does not adversely impact this equipment. Narrabri Mine also decommissions gas drainage infrastructure when it is no longer required. The Personal Emergency Device (PED) cable buried around LW101 to LW105 was undermined during the extraction of LW105 but no impacts were recorded for this equipment.

4.2.5 Other Significant Features

Areas of Archaeological and/or Heritage Significance

Eight previously identified cultural heritage sites are located above LW105 being Sites 5-9, 10a and 11. Sites 5-7, 10a and 11 are artefacts scatters containing up to 11 artefacts. Sites 8-9 are isolated artefacts. All sites are located adjacent to the ephemeral creeks.

The Extraction Plan developed for LW101 to LW105 outlines that the artefact scatters and isolated artefacts occur on actively degrading surfaces and it is assumed that most of the artefacts have already been displaced by slope-wash, stock movement, land clearance, ploughing, harrowing and vehicular traffic. There would be very few artefacts in their original depositional context or provenance and the direct impact of subsidence (vertical or horizontal displacement) is likely to be minimal. The plan outlines that the main impact may occur as a result of subsidence remediation works.

The sites outlined above have not been impacted by subsidence apart from vertical displacement and as described above, the artefacts are considered unlikely to be located in their original positions.

5. TRENDS IN MONITORING RESULTS

Subsidence monitoring results for LW101 to LW105 show that measured subsidence is closer to 64% of the cutting height of 4.3m with no exceedances of the revised maximum subsidence of 2.75m measured over LW105. The results also indicate that the Garrawilla Volcanics and Basalt Sill have not reduced subsidence through spanning behaviour.

6. CONSULTATION

Narrabri Mine received approval for the revision to include LW106 in the existing Extraction Plan on 18 May 2016. During the plans development and review the mine consulted with the following organisations:

- Division of Resources and Energy (DRE);
- Department of Planning and Environment (DP&E);
- Office of Environment and Heritage (OEH);
- Narrabri Shire Council (NSC);
- NSW Maritime and Road Services (RMS);
- Essential Energy; and
- The Registered Aboriginal Parties (RAPs).

In addition, Narrabri Mine also undertook the following consultation:

- NSW Crown Lands (part of NSW Trade and Investment) in relation to the purchase of the portion of Greylands Road that traverses the mine site;
- Narrabri Mine Community Consultative Committee (CCC) which includes providing subsidence measurement results; and
- DRE in relation to subsidence results.

A high risk notification for the extraction of LW106 was also submitted to the DRE as required by the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*. No comments were received during the notification period.

On 4 August 2016 a representative from DRE attended site to undertake an Annual Review (AR) inspection. During this inspection the representative was taken to the subsidence area and observed the impacts that have occurred above LW101 to LW105.

The mine has finalised the purchase of the portion of Greylands Road that traverses the mine site and as such, the Greylands Road Management Plan is no longer in effect. The power line that traverses LW101 to LW105 was decommissioned during January 2016 with the approval of Essential Energy and as such, the Essential Energy Management Plan and the associated monitoring are no longer required.

6.1 Community Complaints

No community complaints were received in relation to subsidence and subsidence related impacts during the extraction of LW105.

6.2 Narrabri Mine Community Consultative Committee

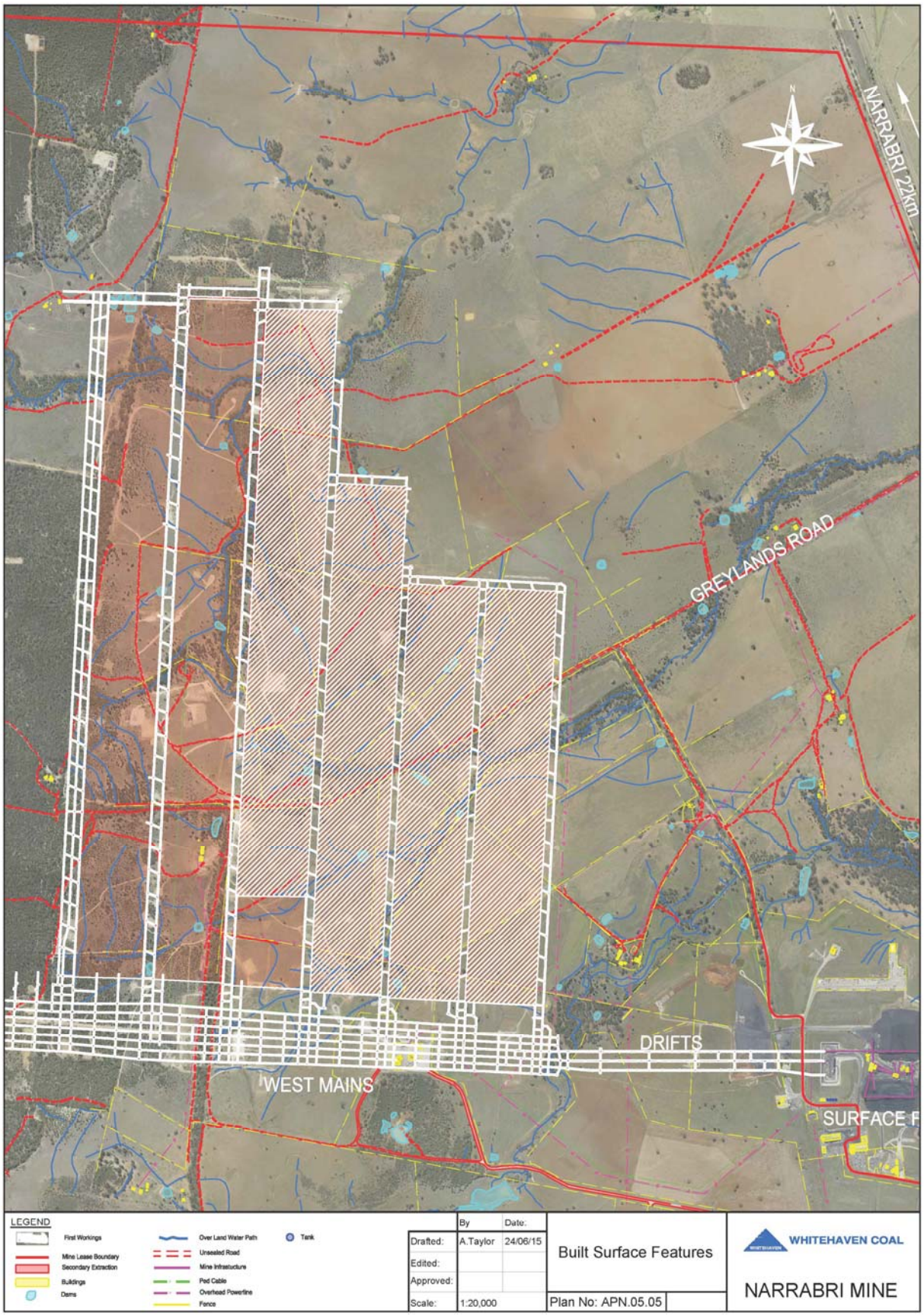
Narrabri Mine's Community Consultative Committee (CCC) receives updates on the progress of the mine at the quarterly meetings including subsidence levels and impacts.

Copies of the Narrabri Mine CCC meeting minutes are available on the Whitehaven Coal website.

7. Final End of Panel Report

This End of Panel report for LW105 at the Narrabri Mine will be the final End of Panel report developed in accordance with SMP approval 10/9000. The SMP approval covers the longwall area from LW101 to LW105 with future mining areas, i.e. LW106 and beyond, authorised under a high risk activity notification, required by the *Work Health and safety (Mines and Petroleum) Regulation 2014*.

Attachment 1: Narrabri Mine LW101 to LW105 Extraction Plan Area



Attachment 2: Narrabri Mine Subsidence Monitoring Lines LW101 to LW105

Appendix 1: Narrabri Mine Groundwater Monitoring Results

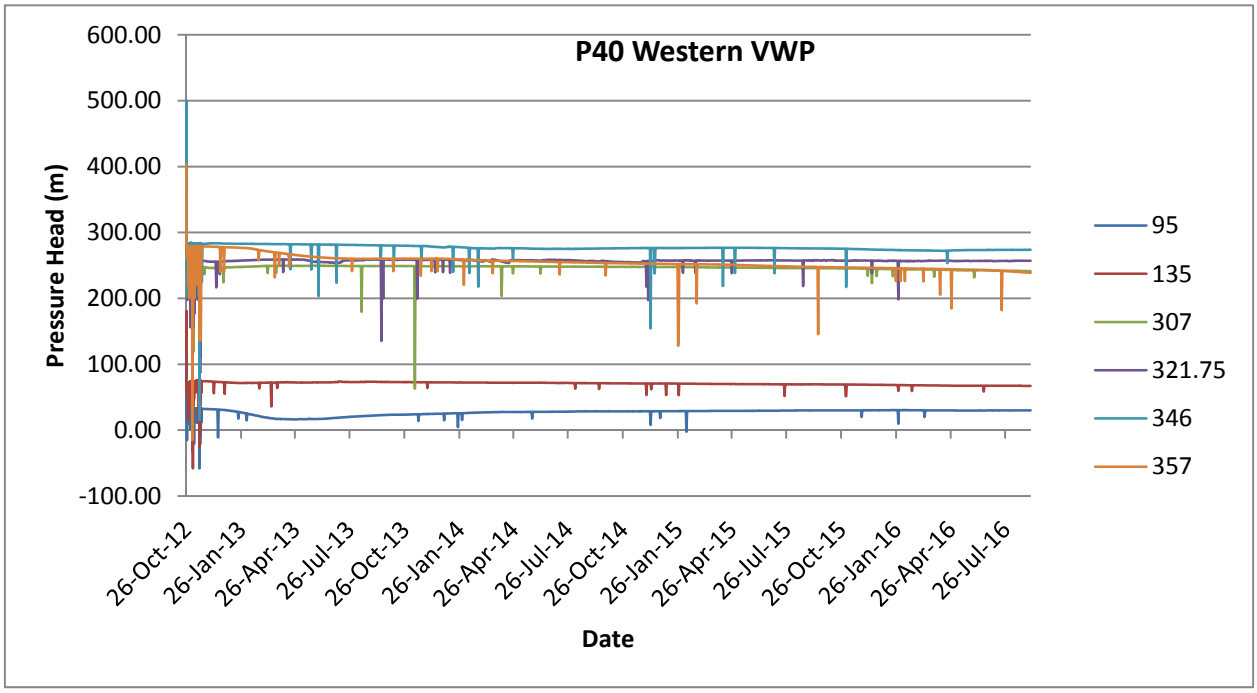


Figure 1: P40 Monitoring Results

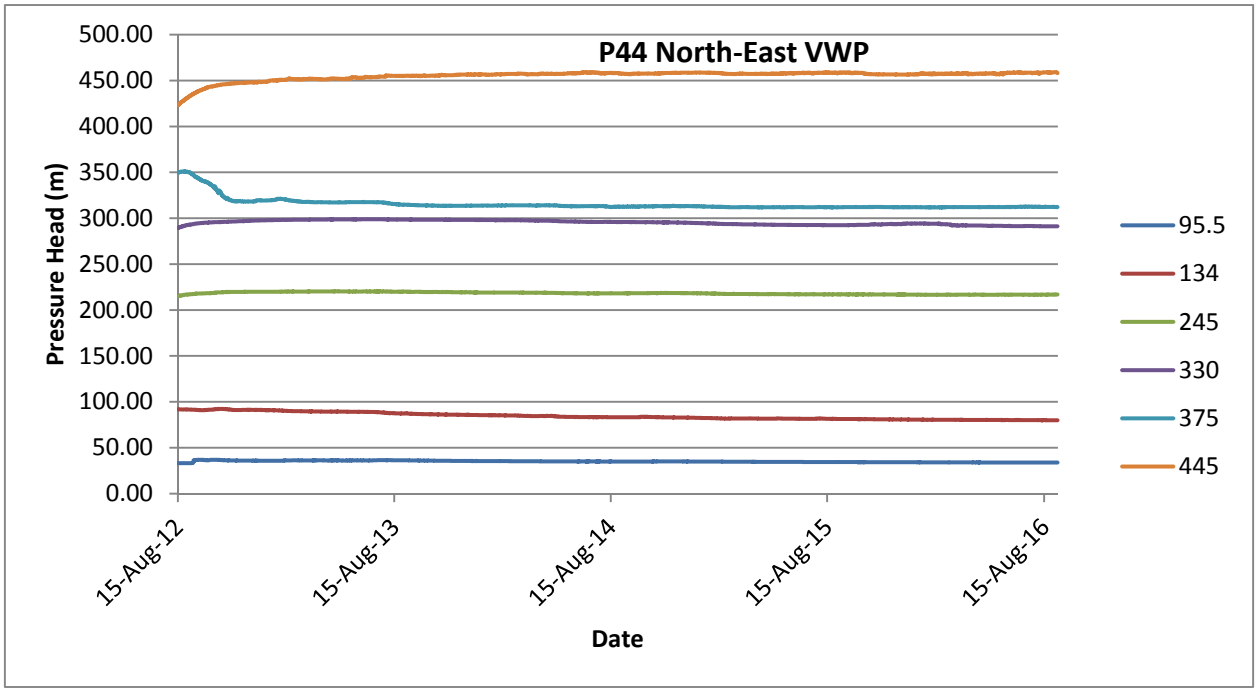


Figure 2: P44 Monitoring Results

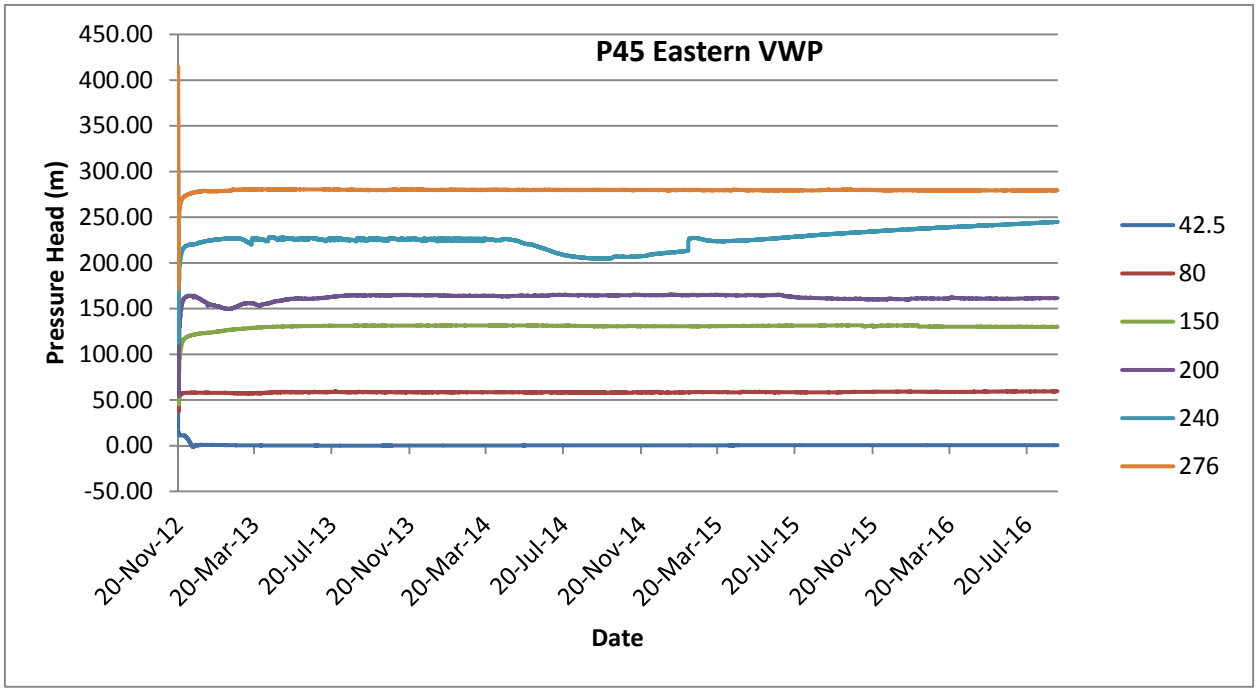


Figure 3: P45 Monitoring Results

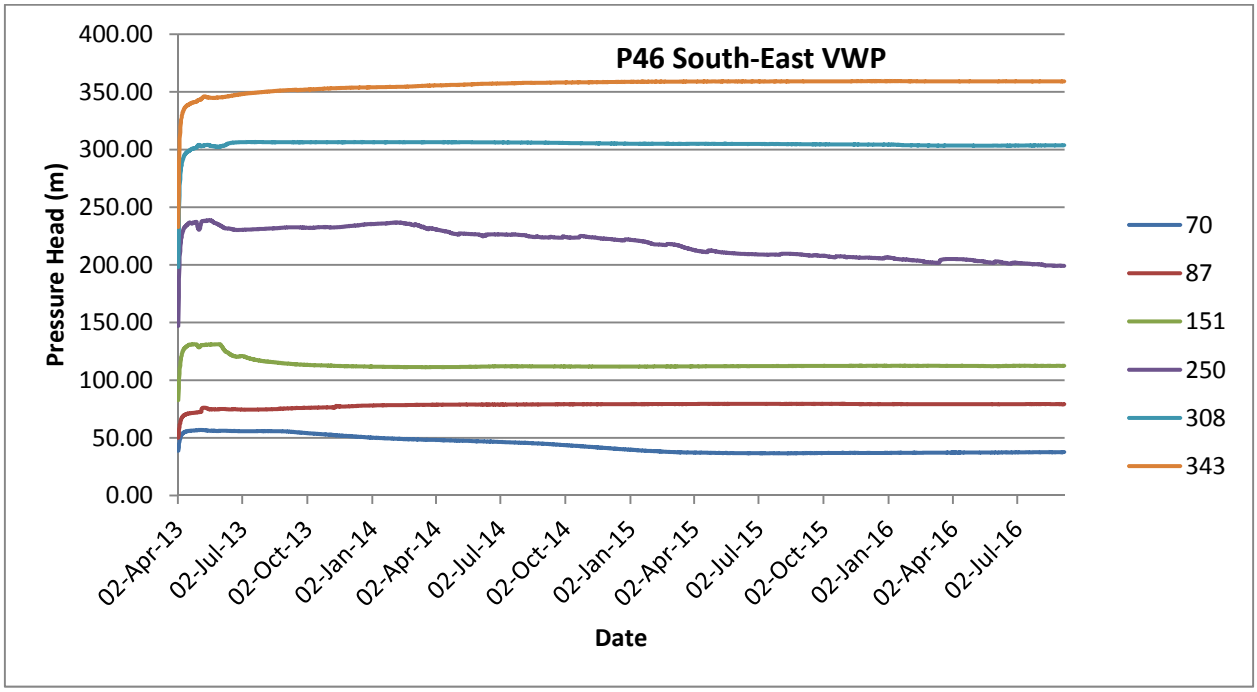


Figure 4: P46 Monitoring Results

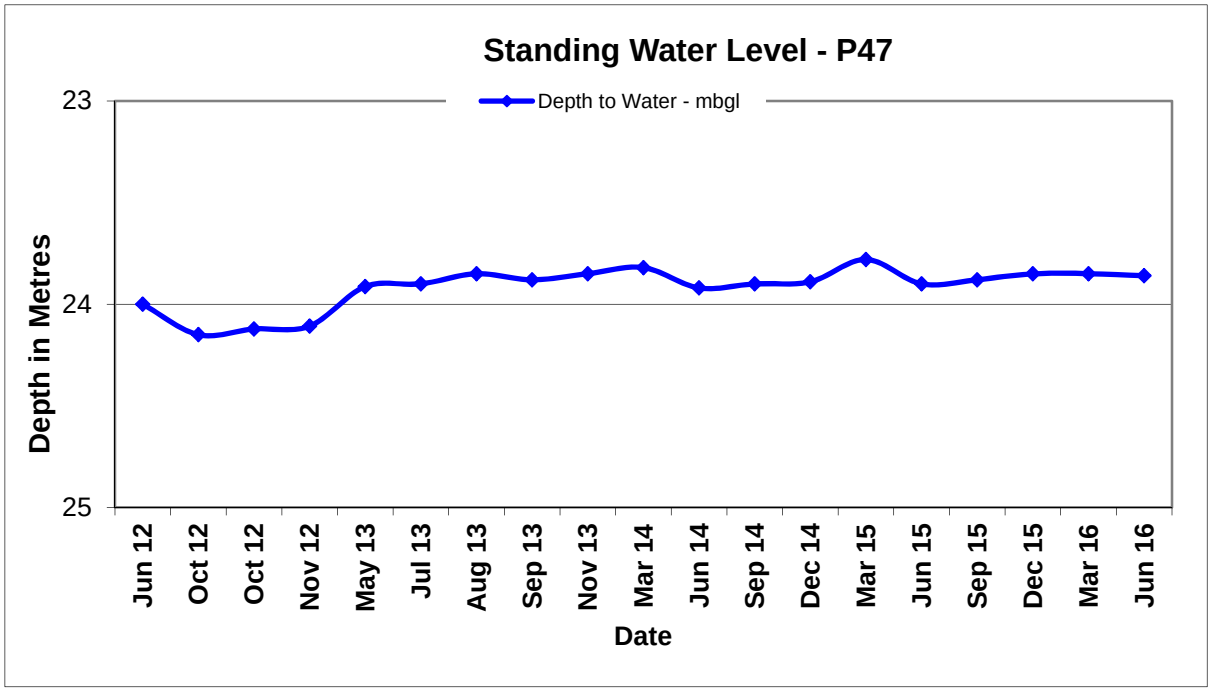


Figure 5: P47 Monitoring Results