BAAL BONE COLLIERY
OPERATED BY THE WALLERAWANG COLLIERIES LIMITED

BAAL BONE COLLIERY
LW29-31 SMP Area

END OF PANEL REPORT – LONGWALL 30

March 2011

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TABLES

1 INTRODUCTION

This Longwall 30 End of Panel Report fulfils the requirements of Condition 20 of the Baal Bone Subsidence Management Plan (Longwalls 29 to 31) Approval Conditions dated 7 December 2007 and variation approved on 24 August 2009.

Extraction of Longwall 30 (LW30) commenced on 11 June 2010 and was completed on 2 February 2011.

A summary of monitoring results for LW 30 are presented in this report. Subsidence surveys, photographic monitoring and visual inspections were conducted over the LW 30 surface area in accordance with the approved Subsidence Monitoring Programs with environmental monitoring conducted in accordance with the approved Environmental Monitoring Programs.

2 PURPOSE AND SCOPE

The purpose of this document is to report the progress of mining, provide a summary of subsidence results, impacts, trends, analysis and the implemented management processes to comply with the relevant approval condition (20) which states:

"Within 6 months of the completion of each longwall panel, an end of panel report must be prepared to the satisfaction of the Director Environmental Sustainability. 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.

(e) be provided to all relevant agencies."

3 SUBSIDENCE AND ENVIRONMENTAL MONITORING PROGRAMS AND MANAGEMENT PLANS

The approved Subsidence Monitoring Program, consisting of a combination of subsidence surveys, stress change and temperature monitoring, has been developed in consultation with and approved by the Principal Subsidence Engineer, Industry & Investment – Mineral Resources for all panels extracted to date. All required subsidence monitoring lines have been installed, subsidence surveys and surface inspections have been completed in accordance with the Subsidence Monitoring Program.

As required under the SMP Approval conditions, an Environmental Monitoring Program was also developed in consultation with and approved by the Director of Environmental Sustainability, Industry & Investment – Mineral Resources. Routine seasonal monitoring of flora and fauna, scientific monitoring of impacts on surface and groundwater regimes, rock features and escarpments have been undertaken in accordance with the Environmental Monitoring Program.

4 SUMMARY OF SUBSIDENCE IMPACTS

Mining operations for LW30 have been completed. Mining height was nominally 2.5m while seam thickness varies between 2.1m to 2.3m. Overburden ranges in thickness from 159m to 232m, this is shown in **Figure 1**. The full extraction void is 250m wide (which includes the 5m width of development drivage both sides of the longwall block). Longwall mining commenced in June 2010 and was completed in February 2011. The progression of LW30 extraction is shown in **Figure 2**.

Some tension cracking, as predicted, has appeared parallel to the gate roads and across the centre of the panel including one crack that exceeded predictions. One compression override approximately 15m long was noted on the final LW 30 panel visual walkover. This was within predictions and does not pose a public safety risk.

In accordance with Condition 18, Incident and Ongoing Management Reporting, of the Baal Bone Colliery Longwalls 29-31 Approval Conditions, notification was provided for the following impacts.

Condition 18(a) requires notification of *any significant unpredicted and/or higher-than-predicted subsidence and/or abnormalities in the development of subsidence.*

The first exceedance reported related to the width of a tension crack around the start of Longwall 30 at Baal Bone Colliery. The Trigger Action Response Plan (TARP), contained within Baal Bone's LW29-31 SMP Land Management Plan (Revision 2, June 2009), states that surface cracking > 200mm in width constitutes a major impact and initially requires notification to the Interagency Committee, the PSE and other appropriate parties under SMP Approval Condition 18.

Condition 18(b) requires notification of *any exceedance of predicted impacts on surface and groundwater resources and/or natural environment that may have been caused (whether partly or wholly) by subsidence*.

The second exceedance reported concerned a minor impact on surface watercourses as defined by the TARP contained with Baal Bone's LW29-31 SMP Environmental Monitoring Program (Revision 1, May 2009). This impact relates to potential bed damage in a watercourse where water is seen to disappear and initially requires notification to the appropriate parties under SMP Approval Condition 18.

It should be noted that both of the subsidence impacts as notified above are related to the same set of circumstances at the start of Longwall 30 (LW30).

Routine inspections of the surface above LW30 first identified initial cracking around the start area on of the 9 July 2010. At that time the width of the crack was within the predicted range, however a file note was made to recheck the area regularly as there was a relatively steep slope below the crack, which also ran in roughly the same direction as the longwall retreat.

Weekly visual monitoring was continued and during the inspection of 23 July 2010 it was confirmed that the width of the crack had developed to a point where it was more than likely going to trigger the TARP. A verbal notification of the situation was subsequently made to the Acting Subsidence Executive Officer (I&I NSW) and a commitment given to lodge a formal written notification in the event that the situation developed further.

Concurrent with an inspection on 30 July 2010, Baal Bone erected additional warning signs in the vicinity and barrier tape was placed along several sections of the crack.

Pre-emptive discussions and a site inspection were conducted with the Soil Conservation Service (Lithgow) to evaluate the most suitable remediation procedure and initial contact was made with Forests NSW (Macquarie Region) to confirm specific approval and/or other requirements they may have in regards to the undertaking of site works.

Dr Ken Mills of SCT Operations Pty Ltd was also contacted and asked to review the location and magnitude of this subsidence crack in the context of experience of subsidence movements and other cracks observed at the mine and elsewhere. Dr Mills provided a report dated 25 August 2010 and in this he noted that:

Our assessment indicates that the location and opening of the subsidence crack at the commencement of Longwall 30 is consistent with the subsidence behaviour expected at the start of a longwall panel in sloping terrain.

At the start of each longwall panel, the two components of horizontal movement occur in the same direction because movement toward the goaf is also the direction of the retreating longwall panel. As a result of the superposition of these horizontal movements, subsidence cracks at the start of each panel are commonly larger than anywhere else in the panel.

Horizontal subsidence movements in sloping terrain are typically observed to occur in a direction toward the valley floor (i.e. a downslope direction). These movements are caused by lateral strata dilation that occurs as the ground subsides vertically. In sloping terrain, this lateral dilation is unopposed on the valley side with the result that the ground moves laterally toward the valley. The magnitude of downslope movements varies with the geological setting and the steepness of the slope but movements of up to 30% of vertical subsidence or 500mm are typical in moderately steep terrain such as that at the beginning of Longwall 30. The mechanism that causes downslope horizontal movements also causes stretching or tensile cracking at the top of slopes and compression, valley closure, and upsidence in the bottom of valleys.

At the start of Longwall 30, the coincidence of a slope in the direction of mining and the start of the panel has led to coincidence of systematic horizontal movements and downslope movements. The observed subsidence cracking is the culmination of these two horizontal movements.

Baal Bone's routine inspection of 27 August 2010 confirmed that the magnitude and extent of impact had increased significantly, and that a major impact, as defined by the TARP in the LW29-31 Land Management Plan, had occurred.

Even though additional signs and barrier tape were installed, due to the location of the area, inspection frequency was increased to three times weekly for a period.

Further, as part of the surface inspection conducted on 27 August 2010, it was confirmed that the same subsidence event(s) has potentially caused a degree of damage to the bed of a small, unnamed ephemeral drainage channel nearby. Water was observed disappearing into a small area of the bed of the channel.

Further responses and action, as defined in the TARP, include a site inspection with specialist soil conservationist, Forests NSW and other relevant Government Departments with the view to discussing and confirming an appropriate level of action/remediation.

Following various meetings, site inspections and consultation a remediation plan, including a review of Environmental Factors was developed and approved in conjunction with officers of Industry and Investment NSW and Forests NSW.

These remediation works are currently being conducted and progress is determined by weather and ground conditions.

All required pre-mining, during-mining and post-mining subsidence surveys were completed in accordance with the Subsidence Monitoring Program. Survey results for subsidence, tilt and strain were below predicted levels with one minor exception.

No subsidence impacts were observed outside the nominated angle of draw on LW30.

5 SUBSIDENCE SURVEY SUMMARY, MONITORING AND ANALYSIS

A record of all completed subsidence surveys is shown in **Table 1**. All subsidence, tilt and strain results were within the predicted range with one minor exception detailed below. A summary of subsidence, strain and tilt results are detailed in **Table 2** with comparison to the SMP predictions and LW29.

A review of subsidence monitoring results was conducted by SCT Operations Pty ltd at the completion of LW 30 and is included as Attachment A. A summary is provided below.

"The subsidence behavior observed above Longwalls 29 and 30 is consistent with previous subsidence behaviour at Baal Bone Colliery with maximum subsidence in the centre of each panel and lower levels of subsidence over the intermediate chain pillars. Maximum subsidence of 1.64m observed over the centre of Longwall 30 is slightly larger than the 1.6m predicted. Such differences can be a result of local topography and natural variation and are not considered to indicate significantly different subsidence behavior."

No vertical subsidence movements have been measured in the vicinity of the Wolgan Escarpment. No significant vertical subsidence movements have been outside 64m from the goaf edge of the longwall, equivalent to an angle of draw of 18 degrees.

At the northern pinch point, low level horizontal movements and strains have been measured between the goaf of Longwall 30 and the Wolgan Escarpment.

At the southern pinch point, subsidence results available at the time fo the review indicate no change in vertical subsidence on any of the lines.

Reflector surveys along the edge of the Wolgan Escarpment did not show any movement during 190m of longwall retreat in the early stages of mining Longwall 30. Although this period is likely to be a period of most horizontal movement, additional surveys will assist to confirm the low levels of ground movement observed in the I Line strain measurements.

Table 1 - Subsidence Monitoring Survey Dates for Longwall 30

Survey / Monitoring Line	Survey / Monitoring Description	Pre Mining Survey	Mining Period (Extraction)	Post Mining Surveys	Monitoring Program Surveys
LW 29 – 31 cross line (E Line)	Subsidence movement in 3 dimensions, tilt and strain	27/05/2009	10/12/2010	10/03/2011	• 50m after LW 30 undermining • Post LW 30
Wolgan Escarpment Southern line (Line H)	Subsidence movement in 3 dimensions, tilt and strain	04/12/2009	N/A LW 30	21/1/2011	• Post LW 30
Wolgan Escarpment Southern line (Line I)	Subsidence movement in 3 dimensions, tilt and strain	04/12/2009	N/A LW 30	21/1/2011	• Post LW 30
Wolgan Escarpment Southern pinch point array	Subsidence movement in 3 dimensions	22/06/2010	N/A LW 30	11/3/2011	• Post LW 30
Wolgan Escarpment Northern line (Line J)	Subsidence movement in 3 dimensions, tilt and strain	04/12/2009	N/A LW 30	9/3/2011	• Post LW 30
Wolgan Escarpment Northern pinch point array	Subsidence movement in 3 dimensions	22/06/2010.	N/A LW 30	4/4/2011	• Post LW 30
Rock Shelter	Subsidence movement in 3 dimensions	10/12/2009	29/10/2010	9/3/2011	• LW 30 > 200m past

Table 2 – Comparison of Subsidence Monitoring Results to SMP Predictions

Panel	Monitoring Item	SMP Prediction	Max. LW 29 End of Panel	Max. LW 29 10/03/11	Max. LW 30 10/03/11
LW 29 cross line (E Line)	Subsidence (mm)	LW 29 1400-1600 LW 30 1300-1600	1400	1487	1638
	Tensile strain (mm/m)	LW 29 9-21 LW 30 8-19	5.7	14.2	14.2
	Tilt (mm/m)	LW 29 32-52 LW 30 28-47	22.3	22.3	27.1
	Horizontal movement (mm)	400	121		
Wolgan Escarpment Southern line (Line H)	Subsidence (mm)		No measurable subsidence		
	Tensile strain (mm/m)				
	Tilt (mm/m)				
	Horizontal movement (mm)				
Wolgan Escarpment Southern line (Line I)	Subsidence (mm)		No measurable subsidence		
	Tensile strain (mm/m)				
	Tilt (mm/m)				
	Horizontal movement (mm)				
Wolgan Escarpment Southern pinch point array	Subsidence		No measurable subsidence		
Wolgan Escarpment Northern line (Line J)	Subsidence		No measurable subsidence		
	Tensile strain (mm/m)				
	Tilt (mm/m)				
	Horizontal movement				
Wolgan Escarpment Northern pinch point array	Subsidence		No measurable subsidence		

6 PHOTOGRAPIC MONITORING AND VISUAL INSPECTION SUMMARY AND ANALYSIS

Dates of photographic monitoring and visual inspections are shown in **Table 3.** No impacts or changes have been noted, in excess of predictions, excepting those previously noted in either photographic monitoring or visual inspections and these results have been detailed in the Subsidence Management Status Reports submitted previously.

Table 3 – Surface Inspection and Photographic Monitoring Dates for LW 30

Monitoring / Inspection	Monitoring / Inspection Description	Pre Mining Inspections / Monitoring	Mining Period Inspections / Monitoring	Post Mining Inspections / Monitoring
Surface Rock Features	Visual inspection	12 May 2009	Weekly	*10 May 2010*
	Photographic	12 May 2009		*15/3/2011 and 4/4/2011*
Roads / tracks	Visual inspection	16 July 2009	Weekly	*4/2/2011*
	Video	16 July 2009		*31/3/2011*
Wolgan Escarpment	Oblique aerial photographic monitoring	17 April 2009	N/A LW 30	*30/3/2011*
Coxs River Swamp	Baseline Photographic monitoring	From 6 June 2007 To March 2010 at regular intervals	Seasonally	*1/4/2011* *BBP4 not photographed as it was inaccessible due to high water levels in the Cox's River Swamp.*
Rock Shelter	Visual inspection	17/7/2010		*17/2/2011*
	Photographic	17/7/2008, 25/6/2010		*1/4/2011*

7 ENVIRONMENTAL MONITORING SUMMARY AND ANALYSIS

Wolgan Escarpment – Stress Cell Monitoring

As part of condition 15 in the SMP approval, Dr Ken Mills of SCT Operations Pty Ltd was commissioned by Baal Bone to prepare a technical review and assessment (SCT Report BBO3432, dated 9 December 2009) of the mine layout and establish scientific confidence in the finish position of the panels. As a result of this review and in direct consultation of the Principal Subsidence Engineer, the width of Longwall 31 was reduced from 25m to 220m to ensure a high level of confidence in the ability of the mine layout to protect the Wolgan escarpment.

Baseline aerial photographic monitoring of the Wolgan Escarpment was completed in accordance with the requirements of the Land Management Plan.

Stress change monitoring instruments have been installed and commissioned in the vicinity of the two pinch points on LW31. Stress changes in the rock strata are being monitored using a remote logger as Longwalls 29, 30 and 31 are progressively extracted. Stress cells are logged on a twice daily cycle and information downloaded periodically for analysis by SCT Operations.

Rock Features

No adverse or unpredicted subsidence impacts occurred on identified rock features in the vicinity of the SMP area. Weekly inspections of the rock features around the LW30 start area continued until the longwall face had retreated at least 250m.

This includes the rock shelter where very little increase in subsidence or horizontal movement has occurred.

Surface Watercourses / Drainage structures

To date there has been one unpredicted subsidence impacts observed on surface drainage depressions within the SMP area, details of which are included in **Section 4.** Monitoring and review of this impact are continuing, with no noticeable increase in flow loss noted. Reassessment fo the impact and requirements for remedial action will be reviewed following the completion of LW 30 extraction. Apart from this incident some minor fractures, within predicted ranges and below TARP trigger values, as identified in the SMP Environmental Monitoring Program, have been identified.

Inspections of the area during or immediately following runoff producing rainfall events (ie. 25mm / 24 hour period) has continued during longwall mining; there has been no observable change to pre-mining flow characteristics and/or stream morphology apart from the area noted in **Section 4**.

Fire Trails and Tracks

To date there have been no subsidence impacts on any fire trails or tracks in the SMP area; ongoing weekly inspections are continuing.

Swamp

Seasonal photographic monitoring of the Coxs River Swamp have continued as scheduled.

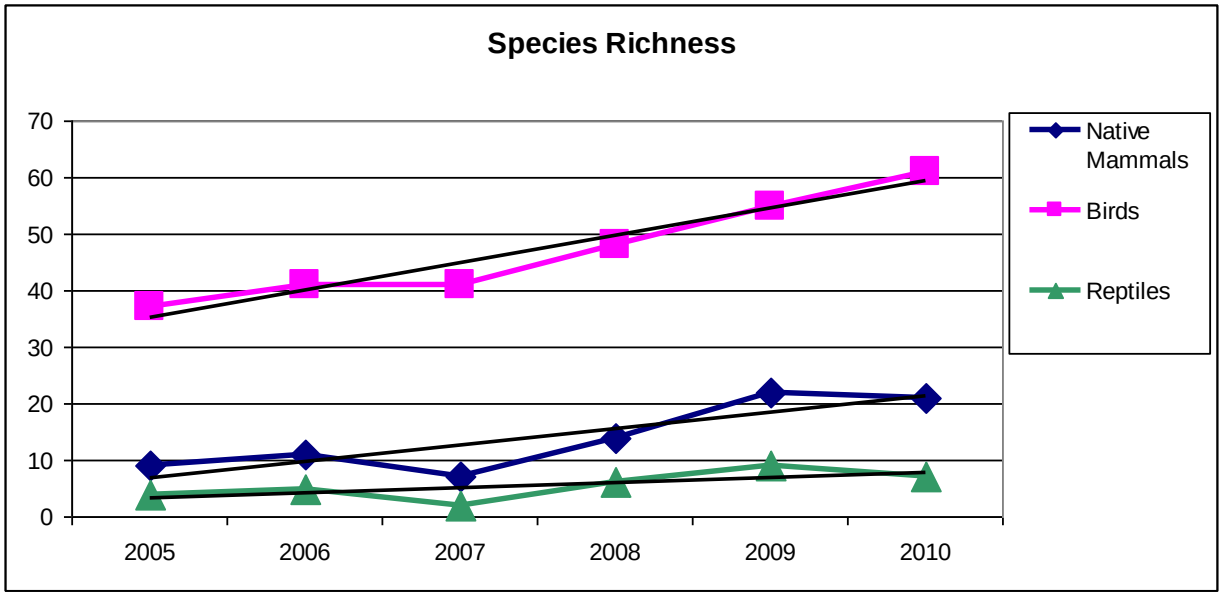
Dates of the baseline seasonal photographic monitoring are detailed in **Table 3, Section 6**.

Seasonal variations in swamp appearance are consistent with those observed during pre-mining assessments, particularly when antecedent ground moisture levels are taken into consideration. These observations are confirmed by the results of the seasonal flora and fauna monitoring programs.

Fauna

Fauna baseline seasonal surveys were undertaken by Biodiversity Monitoring Services. Surveys were undertaken pre, during and post LW 30 extraction. Results from the fauna surveys have indicated that there has been an increase in diversity of birds, terrestrial and arboreal mammals over time. The species richness values during 2009 to 2010, together with the 2005 to 2008 values are shown in the following table.

Table 4 – Species Richness of the Three Major Faunal Groups.



A total of 19 native mammal (plus three introduced), 61 bird, five reptile and three amphibian species have been located within or near Longwall 29-31 SMP Area at Baal Bone Colliery during 2010. At present, 27 native mammal, 86 bird, 12 reptile and five amphibian species are known to occur within the LW29-31 SMP Area.

The number of birds and native mammals located in 2010 was similar to or slightly higher than in earlier years, the number of reptile and amphibian species was lower. As expected with continued surveys, the number of species located within the SMP area has increased over the years,. Changes in species richness and cumulative curves for new species between 2005 and 2010 are shown in **Tables 5** and **6**. It is expected that the number of new species located each year will continue to increase and finally level out. Then the final overall species richness can be calculated from the final slope of the asymptote.

New species located during 2010 are the Eastern Broad-nosed Bat, Fan-tailed Cuckoo, Pallid Cuckoo, Buff-rumped Thornbill, Hooded Robin, Flame Robin and Lesueur's Velvet Gecko.

Table 5 - Species Richness Over Time for the Three Major Faunal Groups

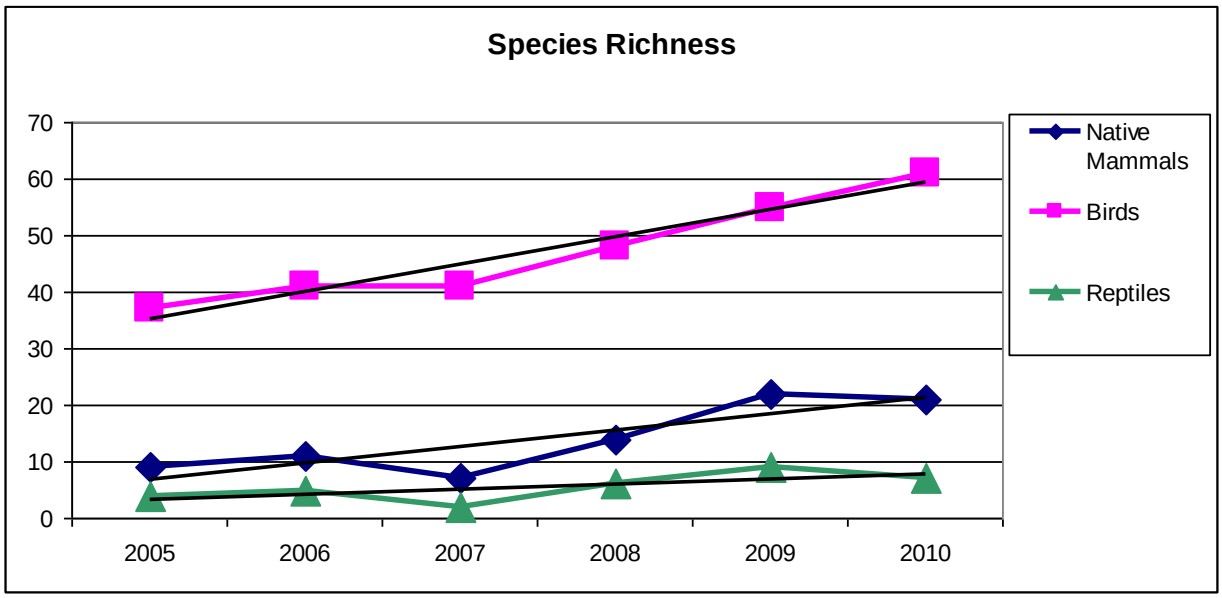
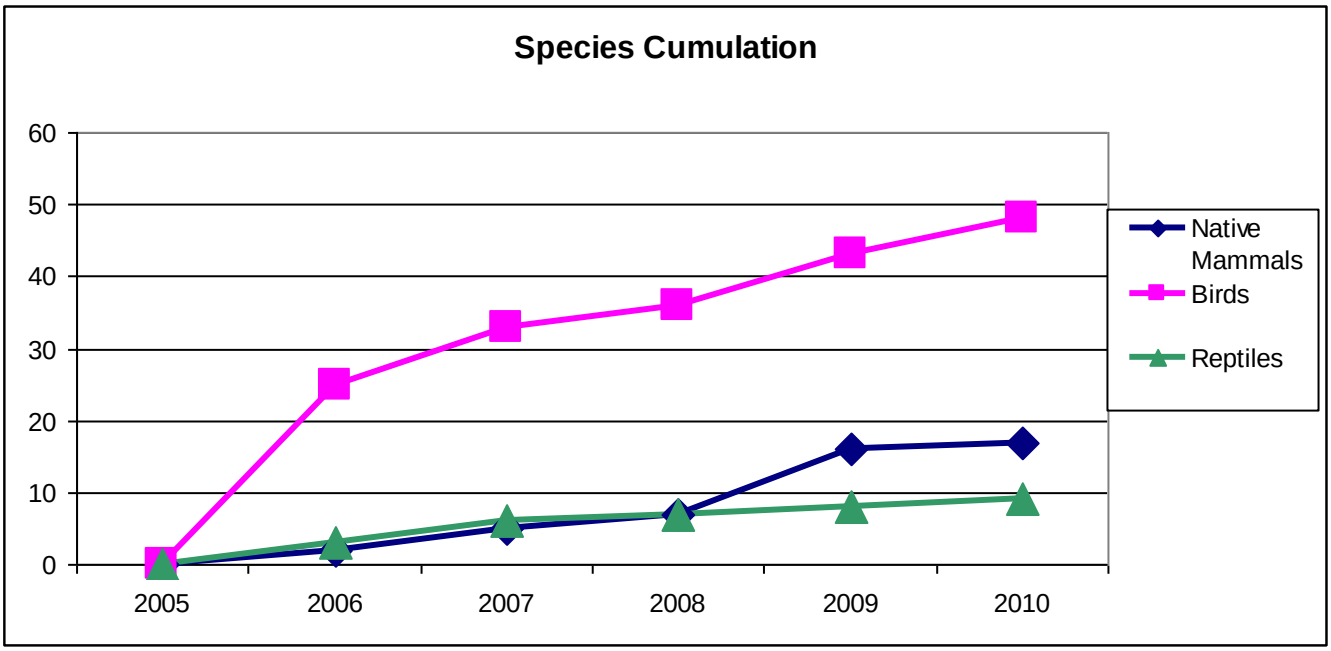


Table 6 - Number of New Species Located Since 2005



Over time, there has been an increase in species richness (upwards trend lines for all groups) and an increase in new species located. The cumulative new species curve will eventually level off and the derived asymptote will provide an estimate of the total number of species likely to occur in the area.
Overall there have been 11 threatened species located within the LW29-31 SMP Application Area at Baal Bone Colliery as a result of surveys since 2005. In 2010, the following threatened species were located: Gang-gang Cockatoo, Brown Treecreeper, Scarlet Robin, Flame Robin, Hooded Robin, Varied Sittella, Little Pied Bat, Eastern False Pipistrelle, Eastern Bent-wing Bat and Greater Broad-nosed Bat. The first

six species are part of a suite of threatened species that are listed partly because of their declining population status within the western slopes of NSW. This area (called the sheep-wheat belt) has undergone extensive clearing and much of the woodland habitat preferred by these species has been lost. However, in the Newnes Plateau region woodland habitat has been retained (albeit logged), and such bird species are still to be located. None of these threatened bird species would be directly affected by subsidence-induced changes to their preferred habitat.

Species Richness of Faunal Groups

The number of species within each faunal group provides an index of it's biodiversity. The higher the species richness, the higher the biodiversity. A high biodiversity index indicates an area containing a variety of natural habitats in good condition. The species richness values for the three surveys during 2010 are given in **Table 7**, together with the overall species richness for 2005 to 2009. These values are graphed in **Table 5**.

Table 7 - Species Richness of the Three Main Faunal Groups

Species Richness	Overall 2010	Overall 2009	Overall 2008	Overall 2007	Overall 2006	Overall 2005
Birds	61	55	48	41	41	37
Native Mammals	19	22	14	7 (no bats)	11	9
Reptiles	7	9	6	2	5	4

A non-parametric Kruskal-Wallis One Way Analysis of Variance on Ranks shows that there are no statistical differences between the species richness values over the six years.

Diversity Indices of Faunal Groups

As discussed, a diversity index combines species richness and individual numbers to provide a better indication of biodiversity. The closer the Simpson's Index of Diversity is to one, the higher the biodiversity and, by implication, the better the area for fauna. Simpson's Index of Diversity and Evenness for birds and native mammals are given in Table 8 (there is insufficient data to analyse reptile numbers).

Table 8 - Diversity Indices for Two Faunal Groups

Evenness						
	2005	2006	2007	2008	2009	2010
Birds	0.87	0.87	0.86	0.88	0.81	0.85
Mammals	0.91	0.73	0.9	0.91	0.81	0.88
Simpson's Index of Diversity						
	2005	2006	2007	2008	2009	2010
Birds	0.93	0.94	0.93	0.95	0.93	0.96
Mammals	0.81	0.71	0.79	0.85	0.81	0.82

Table 9 - Simpson's Index of Diversity Between 2005 and 2010

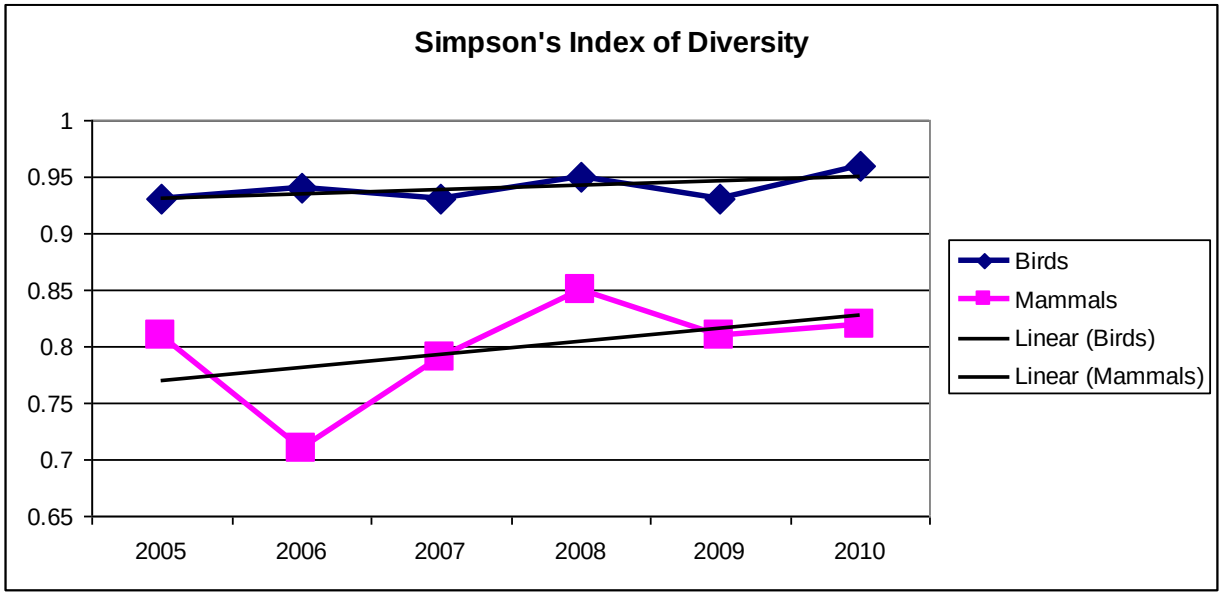
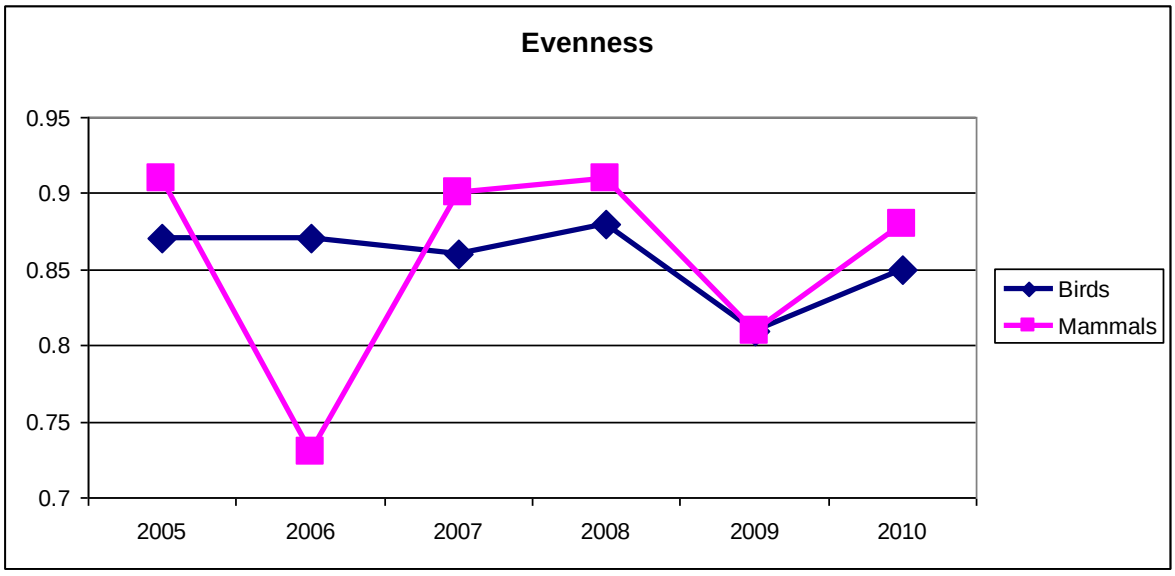


Table 10 - Evenness Scores Between 2005 and 2010



It is now possible to assess any differences in the biodiversity and habitat condition of those sites sampling an area that has been subject to underground mining and shows signs of subsidence activity. This comparison showed that there are no significant differences in the biodiversity and habitat complexity over the years.

The configuration of survey sites established in previous years adequately samples the three major environments within Baal Bone SMP Application Area i.e. woodland, swamp and creekline. These sites

will provide the best possible data for the long-term monitoring of terrestrial vertebrates. The survey techniques used have been successful in locating a wide range of species, including new records for the Newnes Plateau region.

As data continues to accumulate from the on-going surveys, it will be possible to track changes to the terrestrial vertebrate fauna within the Baal Bone Colliery SMP Application Area. At present, there appears to be no evidence of any significant effects from subsidence upon the fauna diversity at Baal Bone Colliery.

Flora

Gingra Ecological Surveys submitted their Spring 2010 survey on 8 December 2010; the results of which are reported below.

Prior to the establishment of monitoring sites, the SMP area was the subject of a flora survey conducted over a 3 day period in October 2005.

Systematic vegetation monitoring quadrats were established within the SMP area in January 2007. The spring survey took place on 29th October and 17th November 2010.

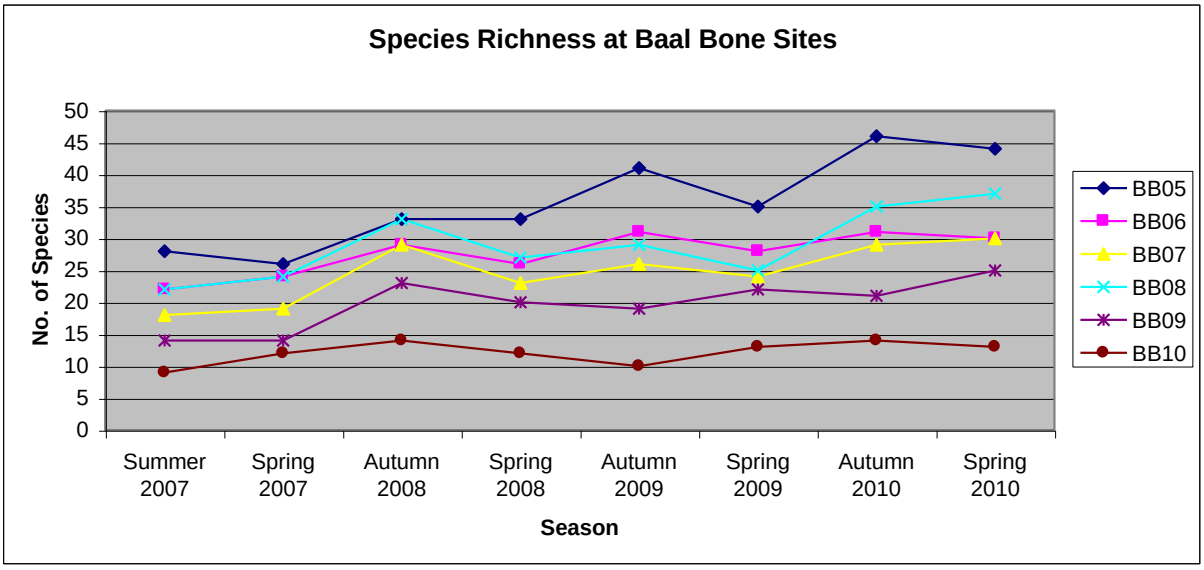
Plant Species Diversity

Species diversity records for the Baal Bone Colliery sites are presented graphically in **Table 6** below. The results show that levels of species diversity recorded in 2010 were at or above the previously recorded range at each site. Figure 1 shows total number of species recorded across all sites during spring and autumn monitoring since the baseline data was obtained.

At the woodlands sites BB07 and BB08, and the swamp site, BB09, species diversity in spring 2010 was higher than at any other sampling over the monitoring period.

The species count for the Tablelands Sheltered Valley Woodland at BB05 is consistently higher than for other sites reflecting higher productivity at that site related to soil fertility and water availability.

Table 11 - Species Richness at Baal Bone Vegetation Monitoring Sites



Weed Species

Four exotic species, Yorkshire Fog (*Holcus lanatus*), Catsear (*Hypochaeris radicata*), Fleabane (*Conyza* sp.) and Spear Thistle (*Cirsium vulgare*) have been recorded over a total of five sites.

Yorkshire Fog has increased in abundance at Long Swamp over the monitoring period (2007 to 2010). This appears to be related to improved seasonal conditions. Catsear has now been recorded at five sites. This also is related to improved seasonal conditions, in particular the break from the long term drought in south-eastern Australia. Similar observations have been recorded at other sites in the Great Lithgow area.

No exotic species were recorded at BB06 over the monitoring period.

Changes in Plant Species Distribution and Abundance

A number of species were recorded for the first time from individual quadrats in 2010. Many of these were orchids and other herbaceous species which are difficult to detect when not flowering. Rainfall during 2009 and 2010 is believed to have triggered growth and flowering of these species. They include the following species in woodland quadrats; Mosquito Orchid (*Acianthus* sp.), Fairy Orchid (*Caladenia* sp.), Hyacinth Orchid (*Dipodium punctatum*), a pennywort (*Hydrocotyle peduncularis*), *Nertera granadensis*, *Pratia surrepans*, Spreading Fan-fern (*Sticherus lobatus*), Button Everlasting (*Coronidium scorpioides*), a bluebell (*Wahlenbergia luteola*) and *Senecio prenanthoides,* and the swamp species; *Euchiton involucratus*, *Dichelachne parva*, Gunn's Willow-herb (*Epilobium gunnianum*) and *Galium gaudichaudii*.

The vegetation monitoring being undertaken is conducted in a manner which allows assessment against a number of indicators which may provide evidence of an effect of subsidence.

Gross species diversity records do not necessarily provide a clear indication of an effect of mining. Experience from other mines in the Lithgow area indicates that there is a seasonal response, with grasses, orchids and other ground layer plants being detected in spring, summer and autumn, but not winter. Periods of relatively low rainfall, such as that experienced in 2006 and for periods in 2007, including July to October, may result in a seasonal failure in growth of these groups of plants, leading to lower rates of species diversity than in seasons of average or above average rainfall. The return to average or above average rainfall during 2009 and 2010 has facilitated growth of these species. This is reflected in species richness at the woodland and swamp sites with higher levels recorded during 2010 in comparison to those recorded in 2007 and 2008.

There has an increase in the detection of weed species, with Yorkshire Fog being more abundant in 2009 and 2010, than recorded in 2007 and Catsear recorded at more sites (but with low abundance at each of these sites). In the case of the study area the response related to increased rainfall rather than an impact of subsidence.

The results from sampling of vegetation at Long Swamp survey sites in autumn and spring 2010 do not indicate any effect of subsidence on plant species diversity, plant species composition or weed invasion. The swamp was wetter in spring 2010 than at any time during the monitoring period (2007-2010).

Groundwater

Ian Forster from Aurecon monitors data loggers in the six piezometers on a bimonthly basis to gather baseline data regarding groundwater level fluctuations in the vicinity of the Coxs River Swamp (**Figure 4**). To date, the data obtained confirms a strong correlation between groundwater levels and prevailing climatic conditions; most particularly the relationship to rainfall. 2009 to 2010 results are shown in the following figures.

A summary of information relating to groundwater levels since 2009 is presented below.

Groundwater levels earlier in 2009 had not reached pre-mining levels, part of the reason was considered to be the below average rainfalls. More importantly it was observed that the pattern of groundwater response to rainfall had returned to normal in BBP2 and BBP3. The latest data has confirmed this contention.

In October and November 2009 the rainfall in this area was above average. In October the 70mm at Lithgow was only just above average, while the 99mm in November was well above the average of 69mm.

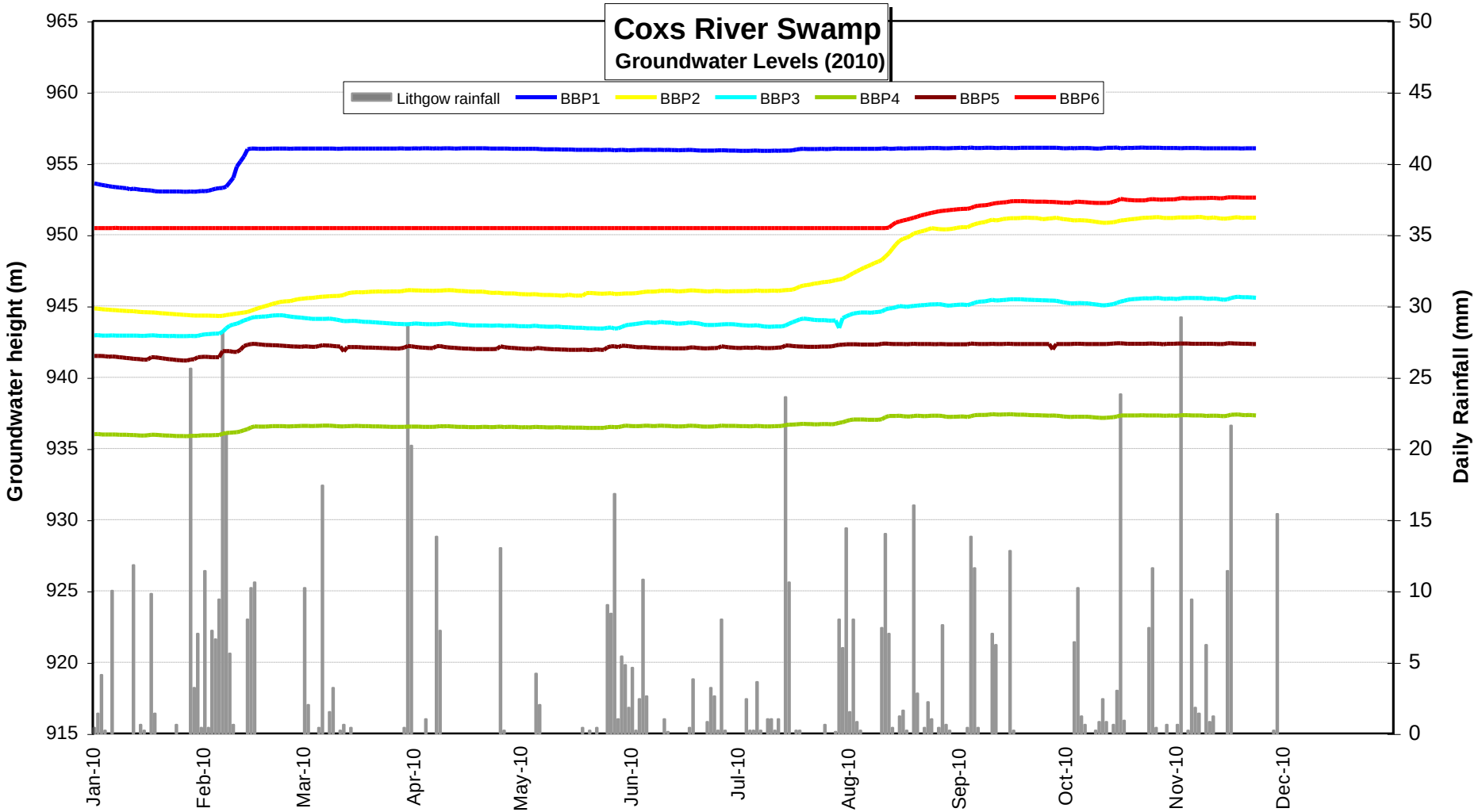
This rainfall has produced rising groundwater levels in all of the bores except BBP1, which has shown a stable groundwater level since February 2010. There is obviously still some influence from the fault zone at this site as the groundwater level is below pre-mining levels. The fault zone lies between the BBP1 and the swamp, so there is unlikely to be any hydraulic connection between the zone of depleted groundwater and the swamp. The groundwater level at BBP1 is still higher than the groundwater level in the swamp so that even if there is a connection across the fault, groundwater flow would still be towards the swamp.

The groundwater level in BBP2 has recovered significantly since February 2010 and is now at the same level a sit was just before mining commenced. Above average rainfall in August 2010 has raised the groundwater level more than would be normally expected, which indicates that the excess infiltration appears to have replaced the groundwater drained. More importantly the pattern of groundwater response to rainfall is still normal and any remaining deficiency in the groundwater caused by the activity on the fault will be replaced by excess infiltration from future rainfall events. The groundwater level behaviour also indicates that clearly that there has been negligible drainage of groundwater into the goaf. If a connection between the goaf and the aquifer was responsible for the initial drop in groundwater level there would have been no recovery in the groundwater level in this bore.

BBP3 shows a groundwater level that is above its pre-mining level and responds to rainfall event in an identical fashion to that displayed before mining. There is no evidence of any mining impact sat this site. BBP4 is well downstream and was not impacted by mining. It continues to show normal groundwater behaviour.

Both of the bores in the swamp (BBP5 and BBP6) now have groundwater levels that are higher than previously measured in the period since monitoring commenced, and are responding normally to the climatic conditions. This is due to the consistent rainfall conditions over the past 6 months. The monitoring data confirms that there has been no measurable impact from mining on the swamp.

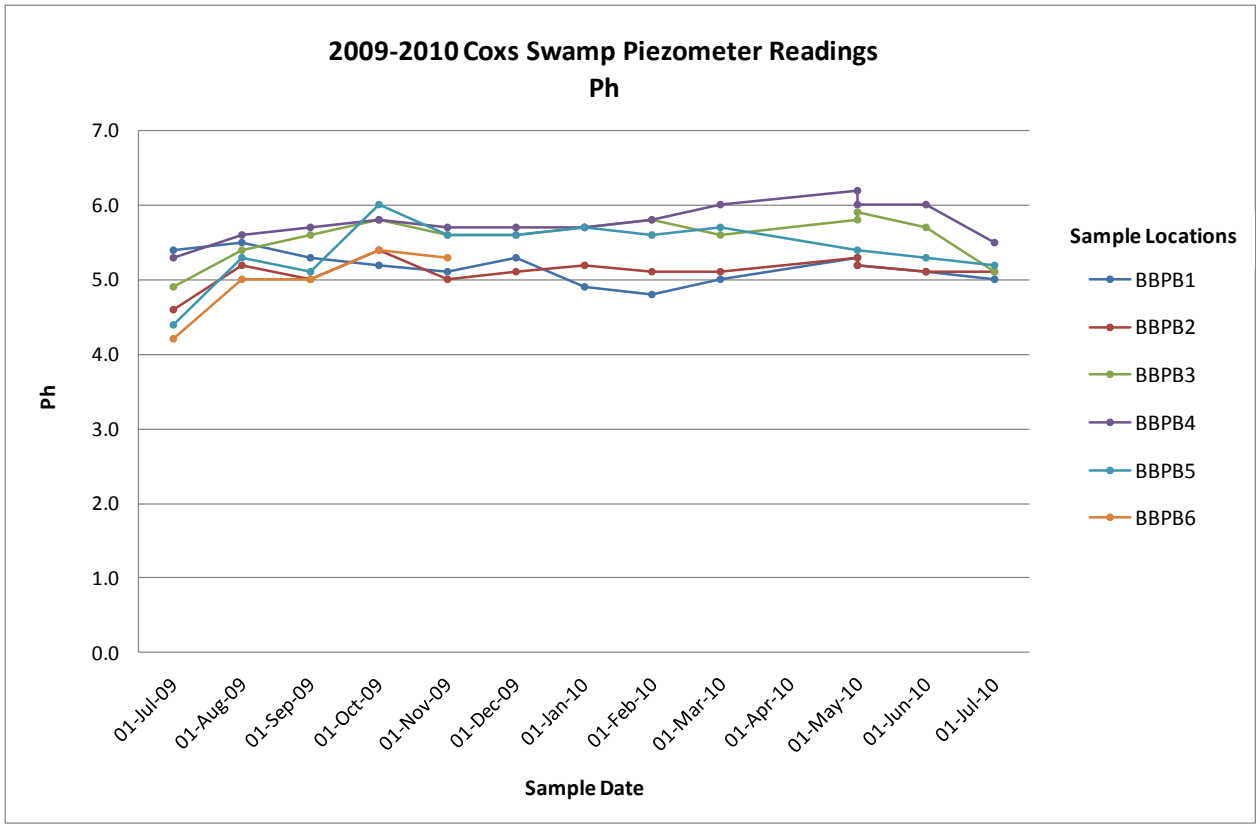
Table 12 - Coxs River Swamp Groundwater Levels

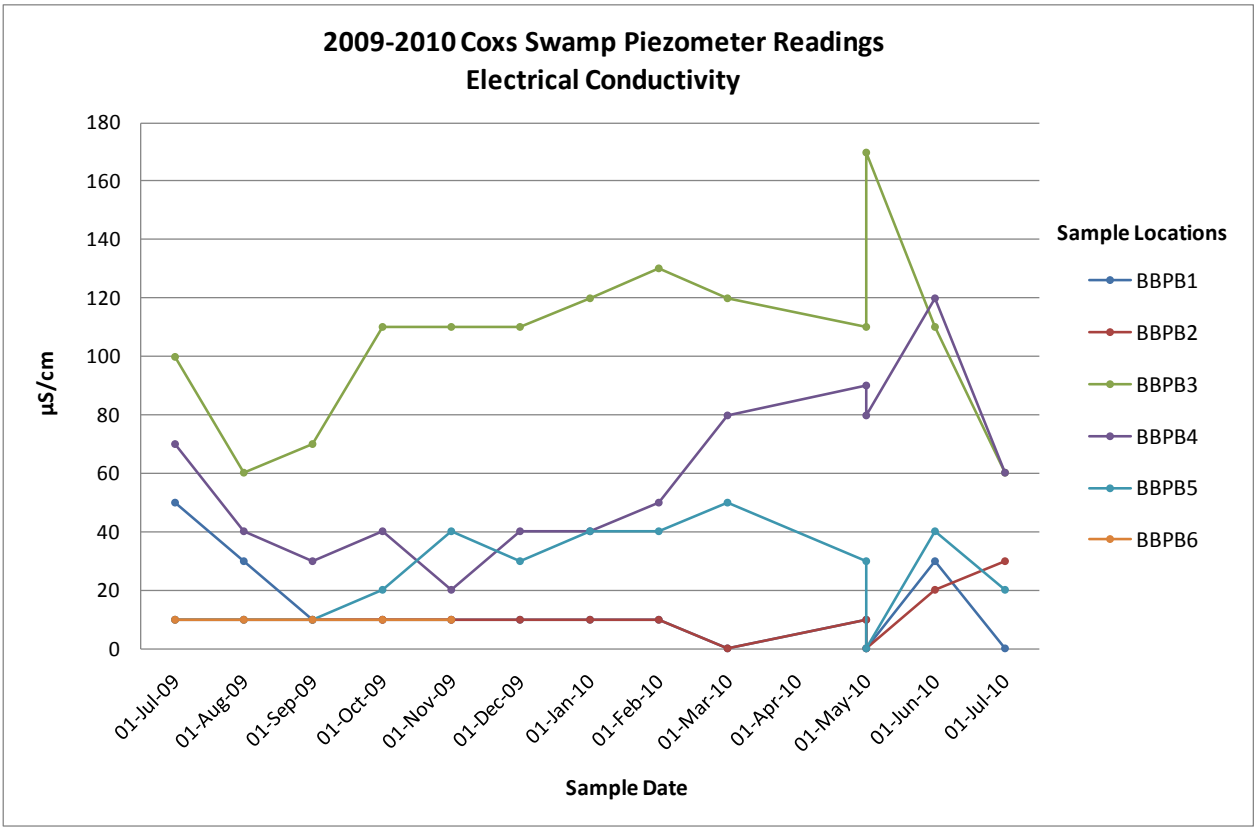


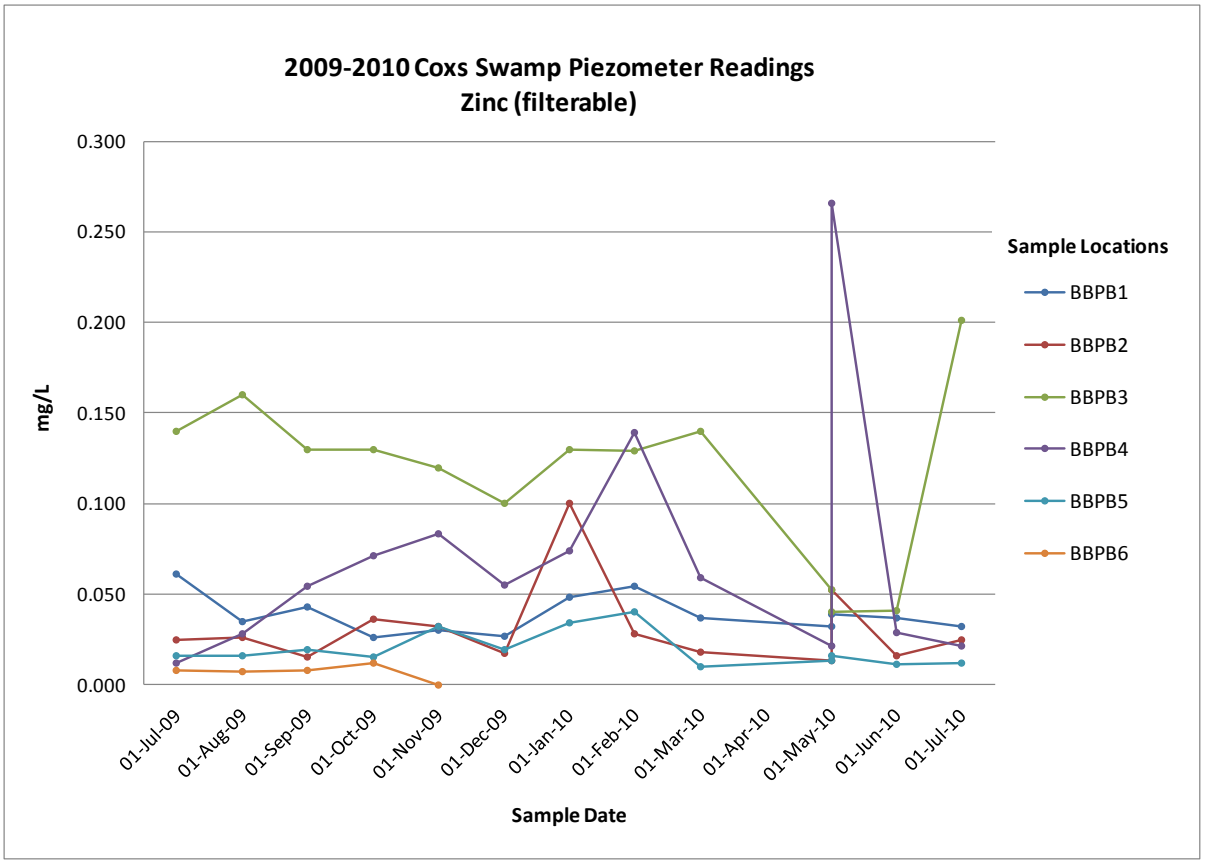
Groundwater Quality

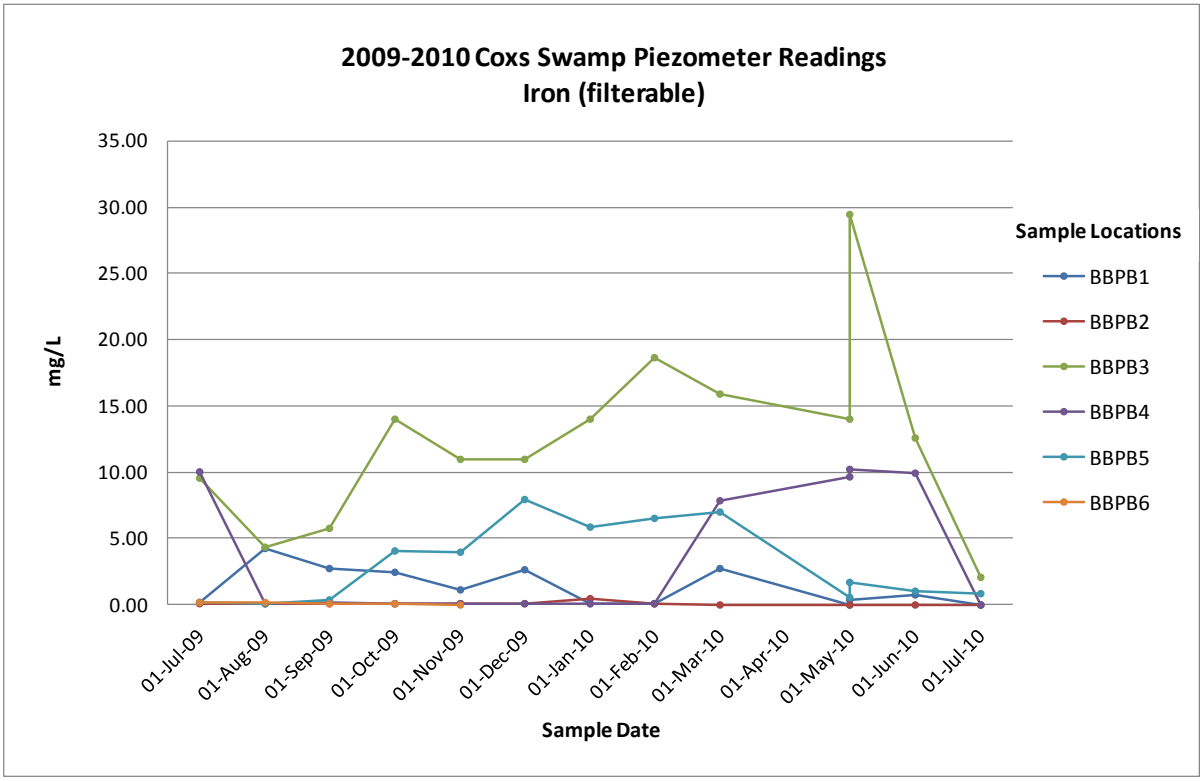
Baseline groundwater quality monitoring commenced in September 2008. Results had shown slightly elevated iron and copper levels, and slightly lower pH levels in several of the swamp piezometers, presumably due to the lower inflows received during the drier months. All levels are within TARP trigger levels and are in line with the normal range or expected response to climatic conditions.

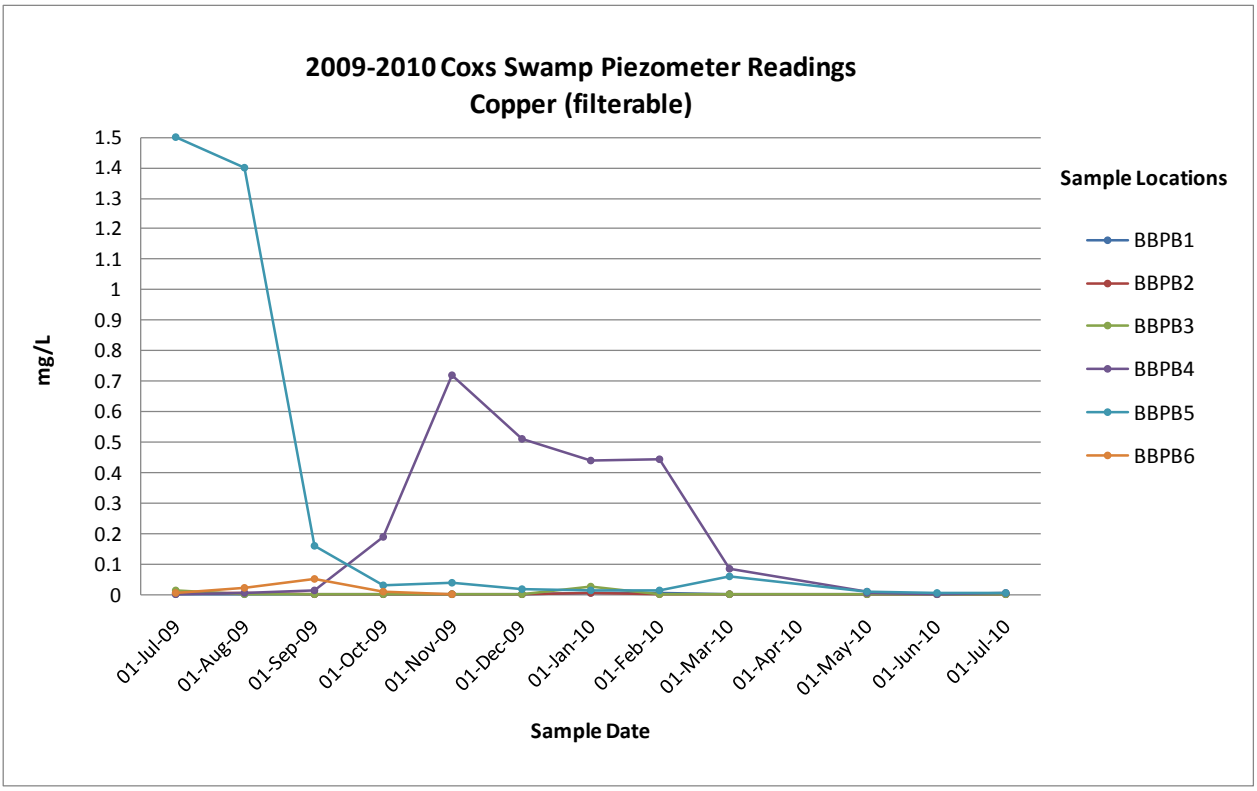
The 2009 to 2010 piezometer readings for pH, electrical conductivity, zinc, iron and copper are shown in the following figures. The ongoing response of the ground water quality levels is currently as expected and responding to the weather conditions.




2009-2010 Coxs Swamp Piezometer Readings
Electrical Conductivity
µS/cm
180
160
140
120
100
80
60
40
20
0
01-Jul-09
01-Aug-09
01-Sep-09
01-Oct-09
01-Nov-09
01-Dec-09
01-Jan-10
01-Feb-10
01-Mar-10
01-Apr-10
01-May-10
01-Jun-10
01-Jul-10
Sample Date
Sample Locations
BBPB1
BBPB2
BBPB3
BBPB4
BBPB5
BBPB6


2009-2010 Coxs Swamp Piezometer Readings
Zinc (filterable)
mg/L
0.300
0.250
0.200
0.150
0.100
0.050
0.000
01-Jul-09
01-Aug-09
01-Sep-09
01-Oct-09
01-Nov-09
01-Dec-09
01-Jan-10
01-Feb-10
01-Mar-10
01-Apr-10
01-May-10
01-Jun-10
01-Jul-10
Sample Date
Sample Locations
BBPB1
BBPB2
BBPB3
BBPB4
BBPB5
BBPB6


2009-2010 Coxs Swamp Piezometer Readings
Iron (filterable)
mg/L
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
01-Jul-09
01-Aug-09
01-Sep-09
01-Oct-09
01-Nov-09
01-Dec-09
01-Jan-10
01-Feb-10
01-Mar-10
01-Apr-10
01-May-10
01-Jun-10
01-Jul-10
Sample Date
Sample Locations
BBPB1
BBPB2
BBPB3
BBPB4
BBPB5
BBPB6


2009-2010 Coxs Swamp Piezometer Readings
Copper (filterable)
mg/L
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
01-Jul-09
01-Aug-09
01-Sep-09
01-Oct-09
01-Nov-09
01-Dec-09
01-Jan-10
01-Feb-10
01-Mar-10
01-Apr-10
01-May-10
01-Jun-10
01-Jul-10
Sample Date
Sample Locations
BBPB1
BBPB2
BBPB3
BBPB4
BBPB5
BBPB6

8 TRENDS IN MONITORING RESULTS

Anomalous groundwater behaviour in several monitoring bores as reported previously appears to have stabilised and is showing signs of normalising.

Pre, during and post Longwall 30 extraction, routine scientific and survey monitoring of impacts on rock features, escarpments, and surface and groundwater regimes continued, as did seasonal monitoring of flora and fauna. Though there have two impacts which have resulted in exceedances requiring notification and, in the case of one surface crack, remedial works the greater majority of monitoring results were within expected / predicted parameters and displayed no discernable trends. Routine and scheduled seasonal monitoring will continue for Longwall 31.

9 MANAGEMENT ACTIONS

Actions taken to ensure adequate management of any potential subsidence impacts due to mining include:

- Continuation of various monitoring programs (flora, fauna and groundwater), subsidence surveys, visual surface inspections, photographic monitoring to detect any impact;
- Routine monitoring of groundwater piezometer levels.
- Continuation of stress cell monitoring adjacent to Wolgan Escarpment.
- Survey conducted on monitoring points adjacent to rock shelter.
- Continuing consultation with landholders and infrastructure owners relating to asset and property management procedures and plans;
- Notification under Condition 18(a) of surface cracking associated with the extraction of LW 30 and also under Condition 18(b) relating to impact of minor cracking in the bed of a small ephemeral watercourse. Continued inspections, various meetings, advice and consultation with the landowner and appropriate departments to develop an acceptable and approved remediation program.
- The first notification related to the width of a tension crack around the start of Longwall 30 at Baal Bone Colliery. The Trigger Action Response Plan (TARP), contained within Baal Bone's LW29-31 SMP Land Management Plan (Revision 2, June 2009), states that surface cracking > 200mm in width constitutes a major impact and initially requires notification to the Interagency Committee, the PSE and other appropriate parties under SMP Approval Condition 18.
- The second notification related to a minor impact on surface watercourses as defined by the TARP contained with Baal Bone's LW29-31 SMP Environmental Monitoring Program (Revision 1, May 2009). This impact relates to potential bed damage in a watercourse where water is seen to disappear and initially requires notification to the appropriate parties under SMP Approval Condition 18.

  Consultation has been conducted with the following stakeholders during this reporting period in relation to the notification under Condition 18(a) and (b).

  Dr Gang Li – Principal Subsidence Engineer, Industry & Investment NSW - Notification

  Chris Rudens – Environmental Sustainability Branch, Industry & Investment NSW - Notification, inspections and meetings.

Dan Kirby – Environment Compliance Officer and Gavin Jeffries – Regional Manager, Forests NSW - - Notification, inspections and meetings.

Mark Mignanelli – Manager, Major Projects and Mining Assessments – NSW Office of Water – Notification

Andrew Helms – Regional Operations Manager, Department of Environment, Climate Change and Water - Notification

Ian Landon-Jones – Executive Director Dam Safety – Sydney Catchment Authority - Notification,

Bruce Hundy – Senior Operations Manager, Soil Conservation Service of NSW – Notification, inspection and meeting.

Additionally correspondence received from Blue Mountains Conservation Society Inc, Dr Brian Marshall, relating to requests for additional information and providing comments on Subsidence Management Reports 6-8 and End of Panel Report – Longwall 29. Several of these comments are addressed in this report with the remainder currently being reviewed and response prepared.

- Erection of additional warning signs and barrier tape associated with the above cracking and also around the perimeter of the mining area and at strategic points along the various forest tracks that traverse the SMP area; due to loss of signs by theft.

FIGURE 1: Depth of Cover for SMP LW 29-30 Southeast Area.

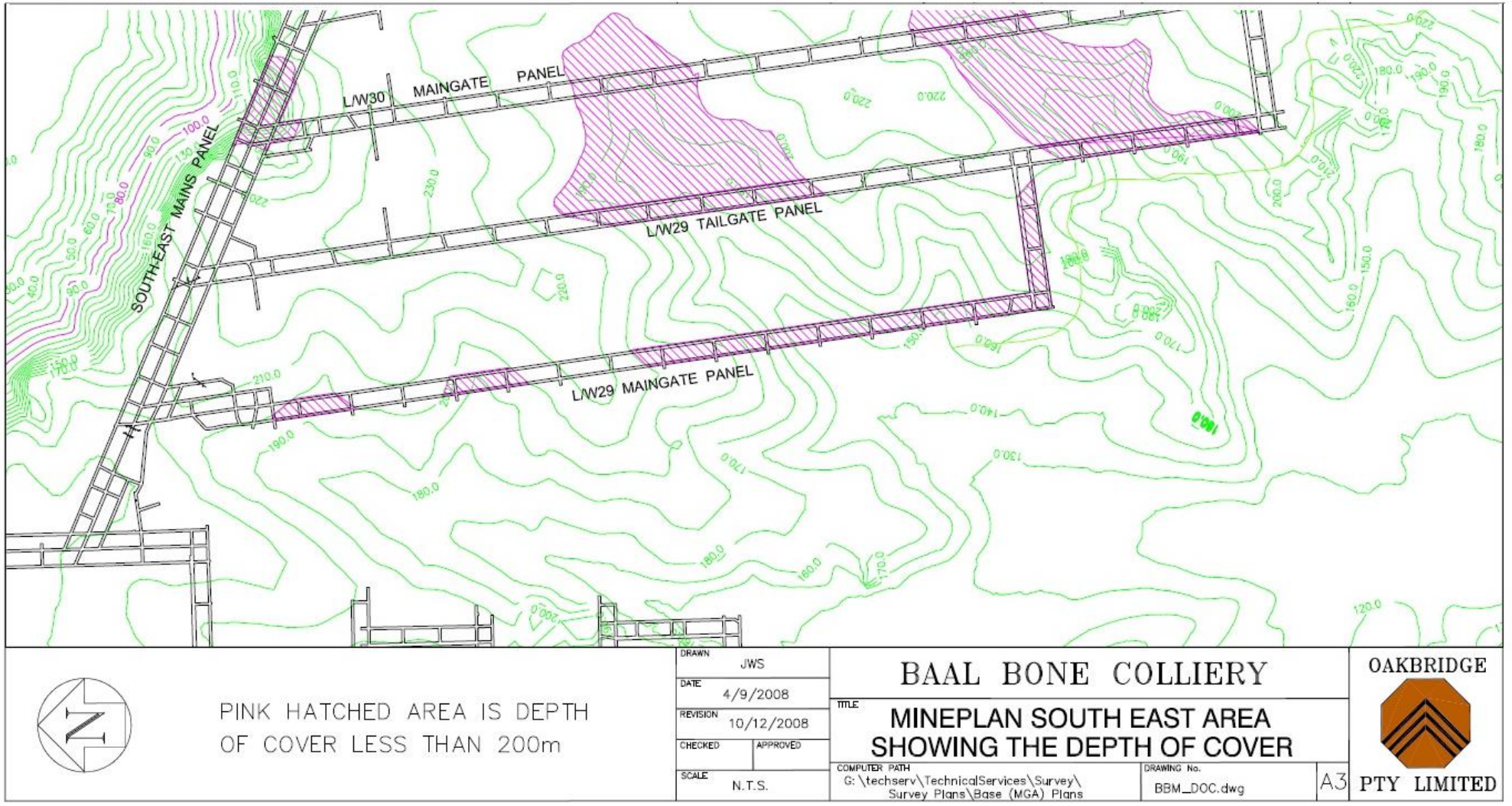


FIGURE 2: Progression of Longwall 30 Extraction

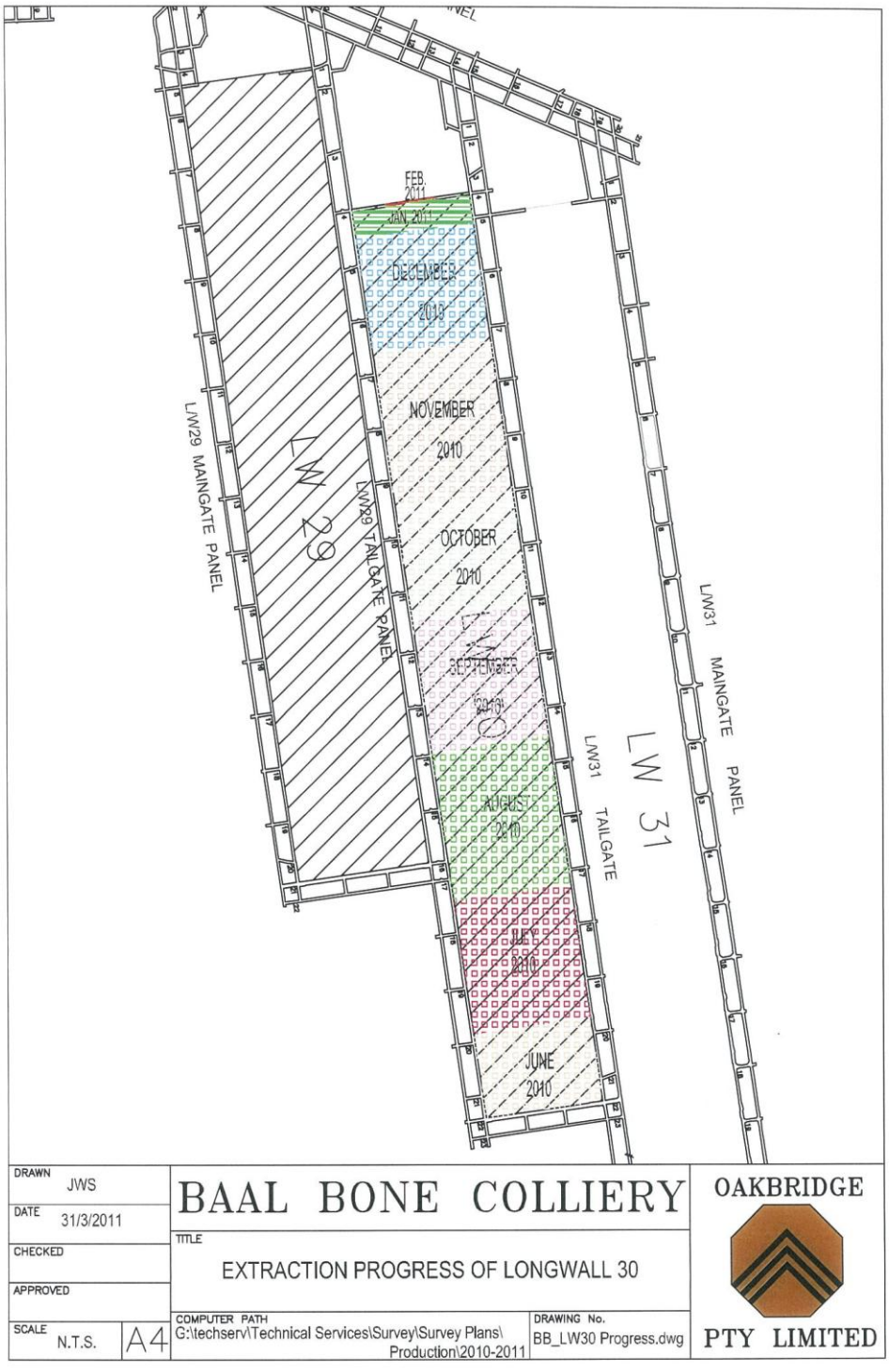


FIGURE 3: Proposed Subsidence Survey and Data Monitoring Locations (Source: *Baal Bone Colliery LW29-31 SMP Subsidence Monitoring Program*)

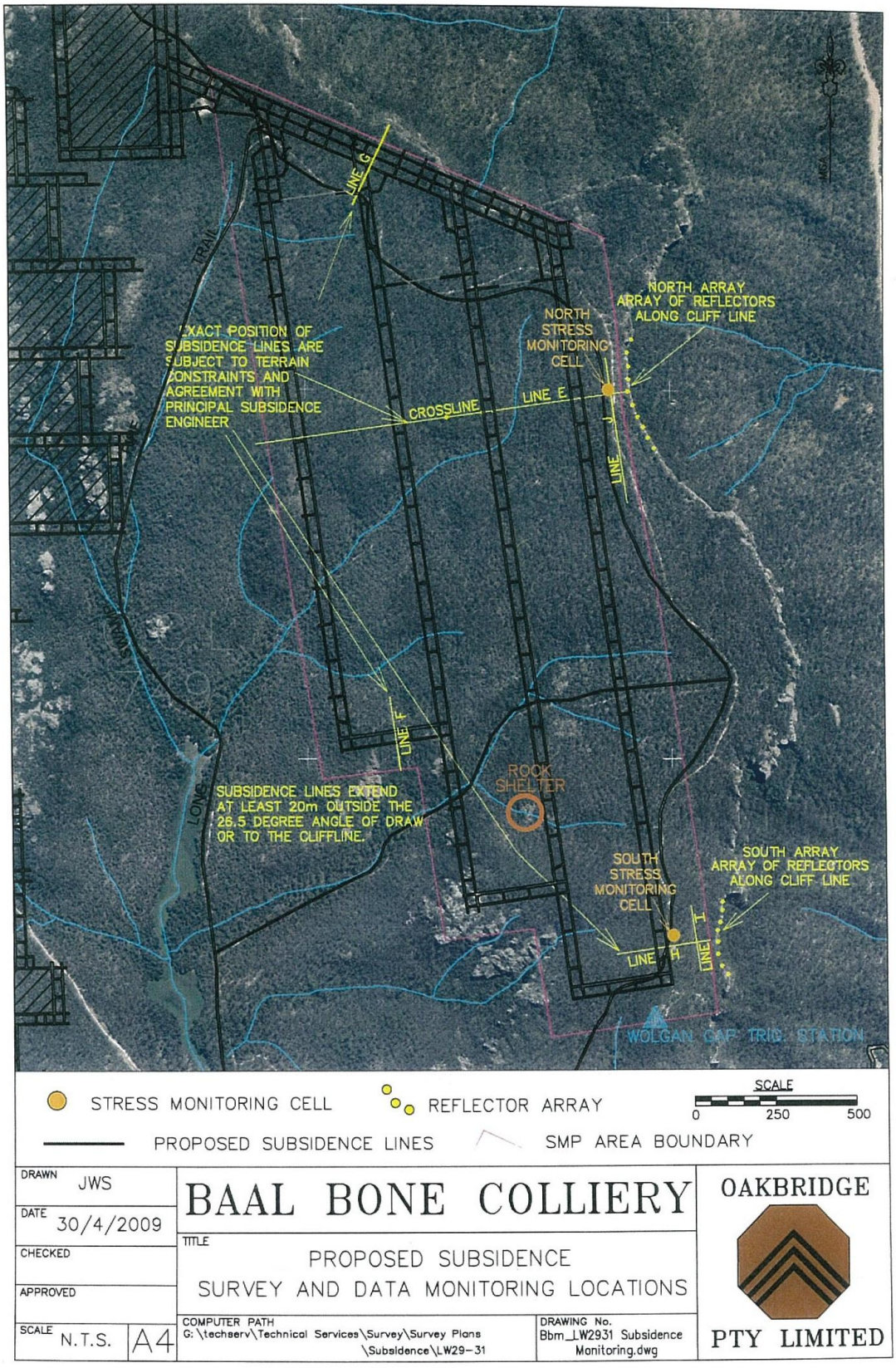
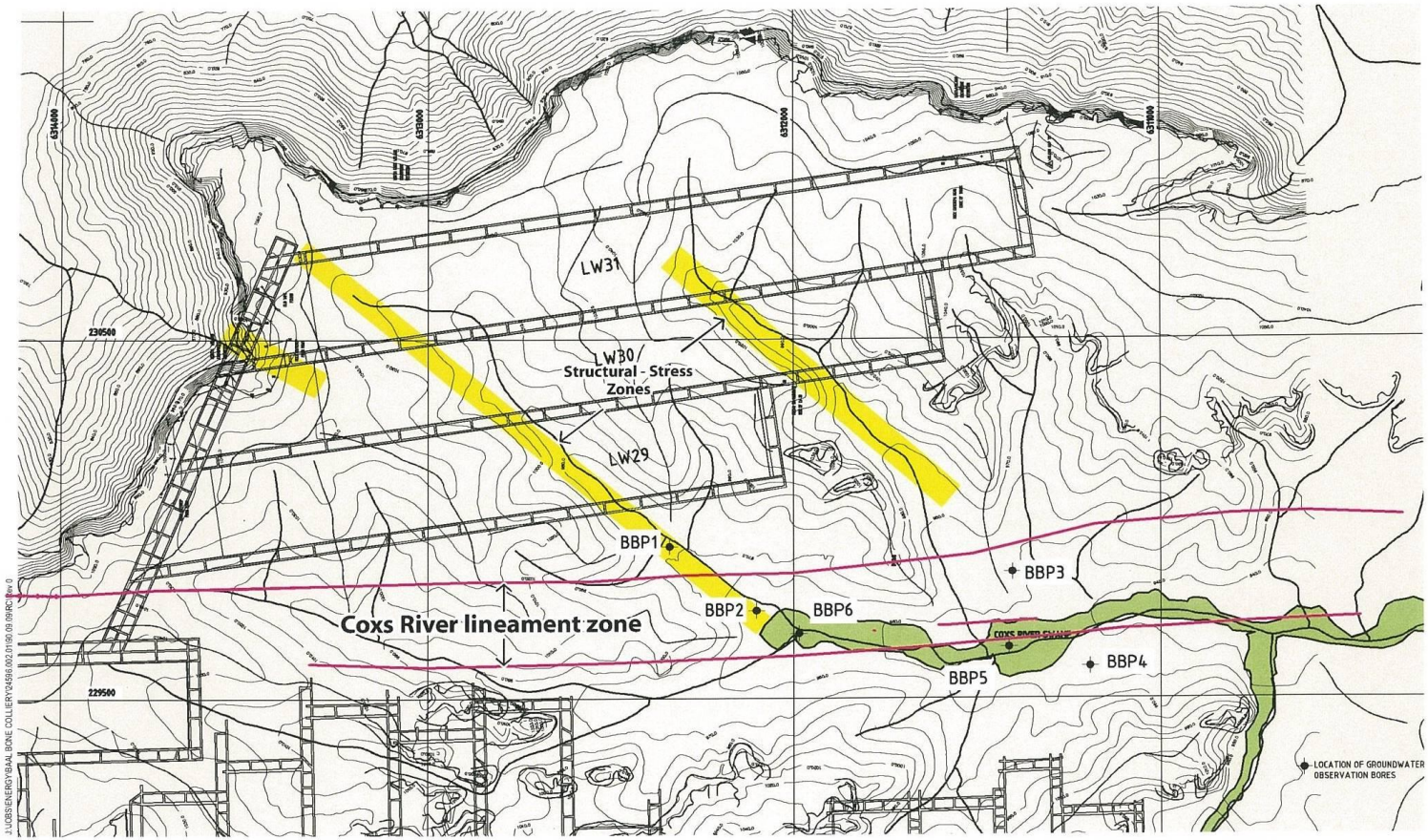


FIGURE 4: Location of Groundwater Observation Bores and Geological Structures



Baal Bone Colliery Groundwater Response Strategy

FIGURE: Location of Groundwater Observation Bores and Geological Structures