BAAL BONE COLLIERY
OPERATED BY THE WALLERAWANG COLLIERIES LIMITED

BAAL BONE COLLIERY
LW29-31 SMP Area

Subsidence Management Status Report No.13

for the period

8th December 2011 to 7th April 2012

July 2012

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1 INTRODUCTION

This Subsidence Management Status Report fulfils the requirements of Condition 19 of the Baal Bone Subsidence Management Plan (SMP) Longwalls 29 to 31 Approval Conditions. This is the thirteenth four monthly status report and covers the period 8 December 2011 to 7 April 2012.

Extraction of Longwall 31 (LW31) was completed on 3 September 2011.

Summaries of monitoring results post completion of LW 31 are presented in this report. Subsidence surveys, photographic monitoring and visual inspections were conducted 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 provide a summary of environmental and subsidence monitoring results, impacts, trends, analysis, the implemented management processes and consultation with relevant stakeholders following completion of mining in the LW 29-31area. It also provides the opportunity for relevant stakeholders to provide feedback as required under the relevant approval Condition 19.

3 SUMMARY OF SUBSIDENCE MANAGEMENT ACTIONS

Subsidence management actions undertaken throughout this reporting period are outlined below.

1. Continuation of regular surface inspections.
2. Continuation of ongoing fauna and groundwater quality monitoring programs.
3. Routine monitoring of groundwater piezometer levels.
4. Continuation of stress cell monitoring adjacent to Wolgan Escarpment.
5. Subsidence survey conducted on various lines.
6. Inspection plan for entire surface above LWs 29- 31 developed and implemented to systematically assess all cracking areas in order to develop agreed remediation program with Forests DTIRIS.

4 CONSULTATION WITH STAKEHOLDERS

Consultation has been conducted with the following stakeholders during this reporting period

The 2011 Annual Environmental Management Plan was submitted to the Department of Trade and Investment, Resources and Energy – Environmental Sustainability Unit on 30 March 2012 with copies to the NSW Department of Planning and Infrastructure, NSW Office of Environment and Heritage, NSW Office of Water, Forest NSW, Lithgow City Council and Sydney Catchment Authority.

Notifications under Condition 18(b) of exceedances in zinc and iron analytes above trigger levels and surface cracking.

5 SUMMARY OF SUBSIDENCE IMPACTS

Mining operations for LW31 were completed in September 2011. Mining height was nominally 2.5m while seam thickness varies between 2.1m to 2.3m. Overburden ranges in thickness generally from 190m to 220m. The full extraction void is 220m wide (which includes the 5m width of development drivage both sides of the longwall block).

The only visible impacts associated with LW31 observed was some tension cracking, as predicted, parallel to the gate roads and across the centre of the panel. Notification was provided, as required.

An Inspection Plan was developed, approved and implemented to identify, confirm and classify all cracking over the LW 29-31 area. Inspections were conducted and all cracking identified. A Risk Assessment was then conducted, including all relevant parties.

Following this, a REF is being prepared, including flora and fauna studies and remediation program to be submitted prior to mid August.

Monitoring of groundwater bores for both levels and quality has continued with no observable major impact on groundwater levels due to mining. Exceedances in the following analytes, zinc and iron were registered during 2011 and reported. Notification was provided as required. Studies were conducted and a report from Aurecon provided. These analyte levels returned to “below trigger” values. This is further detailed in **Section 7.8**.

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 generally below predicted levels. Some minor exceedances were noted and are detailed in **Section 6**.

No subsidence impacts were observed outside the nominated angle of draw on LW31.

Visual inspections and photographic monitoring of various surface features, including cliffs, roads, tracks and swamp vegetation were also completed, with no adverse or unpredicted impacts observed.

No subsidence impacts were noted generally in relation to flora and fauna.

6 SUBSIDENCE SURVEY SUMMARY, MONITORING AND ANALYSIS

A record of all completed subsidence surveys during and post LW31 extraction period is shown in **Table 1**. Subsidence, tilt and strain results for the LW31 area were generally within the predicted range. A summary of subsidence, strain and tilt results are also detailed with comparison to the SMP predictions.

The minor exceedance on E Line over LW30 has previously been reported. The survey conducted on 23 September noted that this exceedance had increased to 126mm. The post mining survey conducted on 8 May 2012 noted a further increase of 14mm to a total of 142mm. The distance where this occurred is limited to a length of less than 50 metres.

Table 1 – Summary of Subsidence Survey Results

Line	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
E Line	10-03-2011	1400 – 1600	1638 (LW30)	9 – 21	14.2	32 – 52	27.1	400	216
E Line (LW 31)	12-07-2011		34		9.6		1.0		67
	14-07-2011		32		9.6		1.0		68
	21-07-2011		36		9.6		1.1		68
	26-07-2011		40		9.5		1.0		66
	28-07-2011		44		9.6		1.1		69
	02-08-2011		54		9.8		1.0		66
	05-08-2011		74		9.7		1.0		65
	08-08-2011		84		10.1		1.0		66
	10-08-2011		232		10.4		4.3		123
	12-08-2011		514		9.8		11.2		170
	17-08-2011		1245		9.5		37.5		
	19-08-2011		1340		11.9		42.4		234
	23-08-2011		1397		12.3		43.7		229
	25-08-2011		1415		12.3		43.7		244
	29-08-2011		1436		12.3		43.7		222
	23-09-2011		1726 (LW30)		13.8		43.2		242
	08-05-2012		1742 (LW30)		13.3		43.2		280

Line	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
F Line	21-01-2011	1400 – 1600	1418	9 – 21	12.0	32 – 52	26.1	400	333
	26-09-2011		1434		13.8		26.3		538 (LW29)
G Line	09-03-2011	1400 – 1600	50	9 - 21	2.3	32 – 52	0.9	400	61
	23-09-2011		58		2.5		0.9		44
H Line	21-01-2011	1300 – 1400	5	8 - 14	1.1	27 - 34	0.4	400	24
	06-04-2011		162		1.4		1.8		49
	08-04-2011		199		1.9		2.0		58
	12-04-2011		207		2.5		2.1		64
	15-04-2011		217		3.0		2.1		102
	29-04-2011		234		3.6		2.3		116
	12-05-2011		207		3.7		2.1		94
	26-05-2011		244		3.8		2.4		162
	23-09-2011		251		3.7		2.5		136

Line	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
I Line	21-01-2011	1300 - 1400	5	8 - 14	0.7	27 - 34	0.2		16
	06-04-2011		7		0.9		0.4		13
	08-04-2011		1		0.9		0.3		23
	12-04-2011		4		1.0		0.3		8
	15-04-2011		3		1.0		0.3		16
	29-04-2011		5		1.1		0,2		10
	12-05-2011		4		1.1		0.3		15
	26-05-2011		6		1.1		0.4		30
	23-09-2011		9		0.9		0.2		11

Line	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
J Line	12-07-2011	1300 - 1400	7		0.8		0.5		18
	14-07-2011		4		0.9		0.5		16
	21-07-2011		5		0.9		0.2		27
	26-07-2011		5		0.9		0.3		23
	28-07-2011		8		0.9		0.5		20
	02-08-2011		8		0.9		0.3		38
	05-08-2011		7		0.8		0.3		16
	08-08-2011		7		0.7		0.5		25
	10-08-2011		7		0.8		0.3		120
	12-08-2011		8		0.8		0.3		23
	17-8-2011		12		0.8		0.3		
	19-08-2011		9		0.7		0.4		32
	23-08-2011		8		0.7		0.2		40
	25-08-2011		12		0.9		0.3		17
	29-08-2011		13		0.7		0.3		34
	23-09-2011		15		0.7		0.3		23

Line Northern Pinch Point Reflectors	Survey Date	SMP Prediction Subsidence (mm)	Measured Subsidence (mm)	SMP Prediction Strain (mm/m)	Measured Strain (mm/m)	SMP Prediction Tilt (mm/m)	Measured Tilt (mm/m)	SMP Prediction Horizontal Movement (mm)	Measured Horizontal Movement (mm)
	04-04-2011		+6						12
	12-07-2011		+15						21
	14-07-2011		+14						16
	21-07-2011		+17						17
	26-07-2011		+14						25
	28-07-2011		+19						33
	02-08-2011		+14						43
	05-08-2011		+14						34
	08-08-2011		+17						38
	10-08-2011		+13						34
	12-08-2011		+12						36
	19-08-2011		+14						41
	23-08-2011		+13						39
	25-80-2011		+15						35
	29-08-2011		+14						35
	22-09-2011		+4						45
	08-05-2012		+9						33

Line Northern Pinch Point Prisms	**Survey Date**	**SMP Prediction Subsidence (mm)**	**Measured Subsidence (mm)**	**SMP Prediction Strain (mm/m)**	**Measured Strain (mm/m)**	**SMP Prediction Tilt (mm/m)**	**Measured Tilt (mm/m)**	**SMP Prediction Horizontal Movement (mm)**	**Measured Horizontal Movement (mm)**
	14-07-2011		1						6
	21-07-2011		8						8
	26-07-2011		5						21
	28-07-2011		2						25
	02-08-2011		6						34
	05-08-2011		7						27
	08-08-2011		6						26
	10-08-2011		9						29
	12-08-2011		9						24
	19-08-2011		6						29
	23-08-2011		9						27
	25-08-2011		2						22
	29-08-2011		6						21
	22-09-2011		10						33
	08-05-2012		13						24

Line Southern Pinch Point	**Survey Date**	**SMP Prediction Subsidence (mm)**	**Measured Subsidence (mm)**	**SMP Prediction Strain (mm/m)**	**Measured Strain (mm/m)**	**SMP Prediction Tilt (mm/m)**	**Measured Tilt (mm/m)**	**SMP Prediction Horizontal Movement (mm)**	**Measured Horizontal Movement (mm)**
Reflectors	06-04-2011		14						10
	08-04-2011		14						9
	12-04-2011		14						8
	15-04-2011		17						9
	29-04-2011		14						7
	12-05-2011		12						10
	26-05-2011		15						10
	22-09-2011		14						10
	08-05-2012		14						9
Prisms	06-04-2011		1						8
	08-04-2011		1						7
	12-04-2011		1						6
	15-04-2011		2						7
	29-04-2011		1						4
	12-05-2011		2						5
	26-05-2011		3						9
	22-09-2011		2						9
	08-05-2012		2						8

7 ENVIRONMENTAL MONITORING SUMMARY AND ANALYSIS

7.1 Wolgan Escarpment – Stress Cell Monitoring

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 were monitored using a remote logger as Longwalls 29, 30 and 31 were progressively extracted. Stress cells are logged on a twice daily cycle and the information is downloaded periodically.

Summary of Observations

The strain changes observed at BBO20 (southern pinch point) and BBO23 (northern pinch point) since 1 March 2011 are considered to provide a strong indication of stress changes at both pinch points adjacent to LW 31.

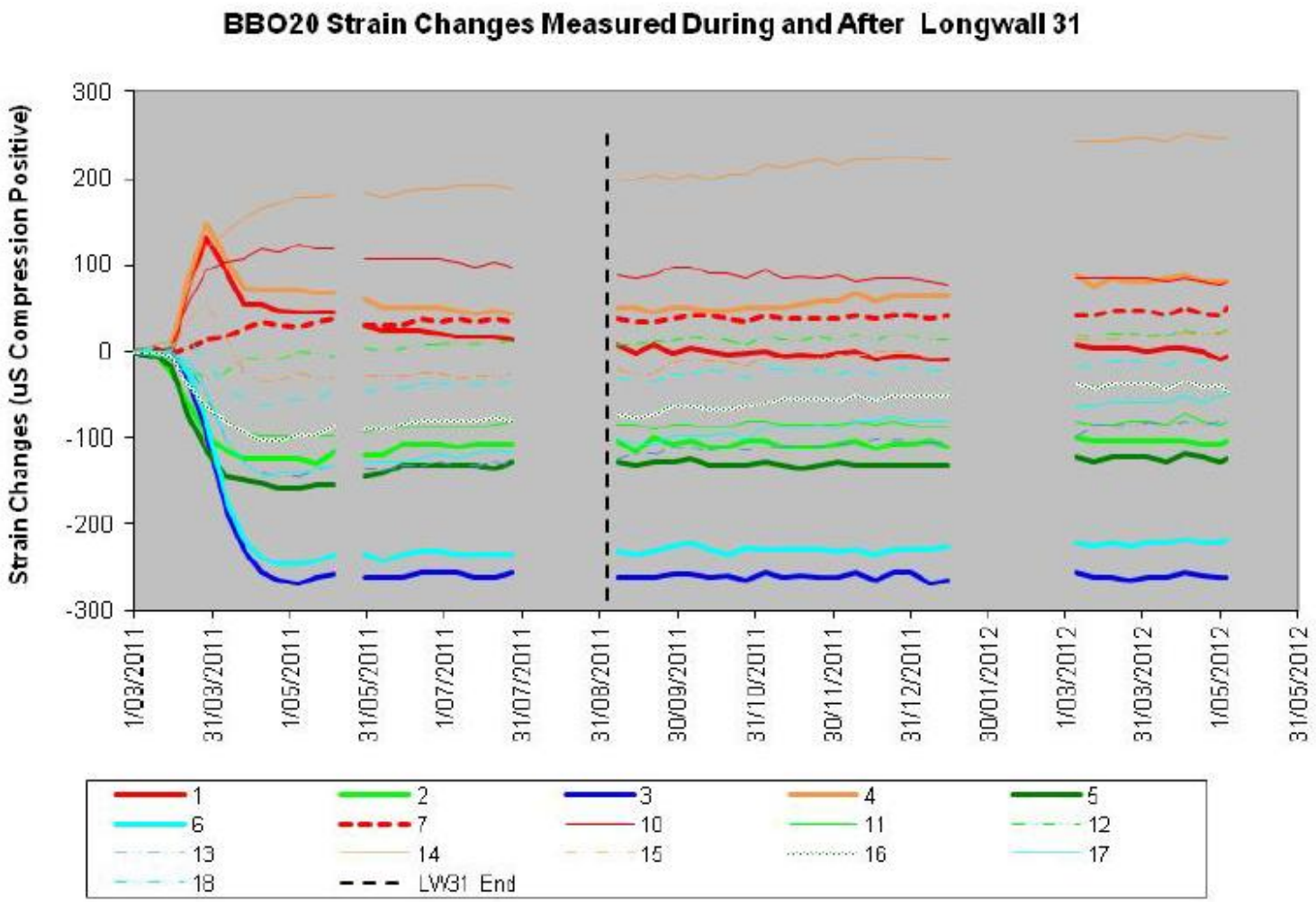
The correlations between independent gauges (0.907 on 12 degrees of freedom for BBO20 and 0.992 on 4 degrees of freedom for BBO23) are consistent with high confidence point measurement of the stress changes at the points of measurement.

BBO20 indicates that the post mining stress patterns continue as previously. Both horizontal principal strains are gradually decreasing over time. The major horizontal principal strain is decreasing at a very small rate. The major principal stress is 0.71MPa down from a peak of 0.92MPa as the longwall passed under the instrument.

BBO23 indicates that the post mining stress patterns continue as previously although a slight increase is now apparent with the benefit of time. The major horizontal principal strain is increasing gradually over time at a rate about four times the rate of decrease observed at the southern pinch point. The major horizontal stress is currently 0.50MPa up from a low of 0.31MPa soon after the longwall passed under the site, but less than the previous peak of 0.56MPa as the longwall passed under the site.

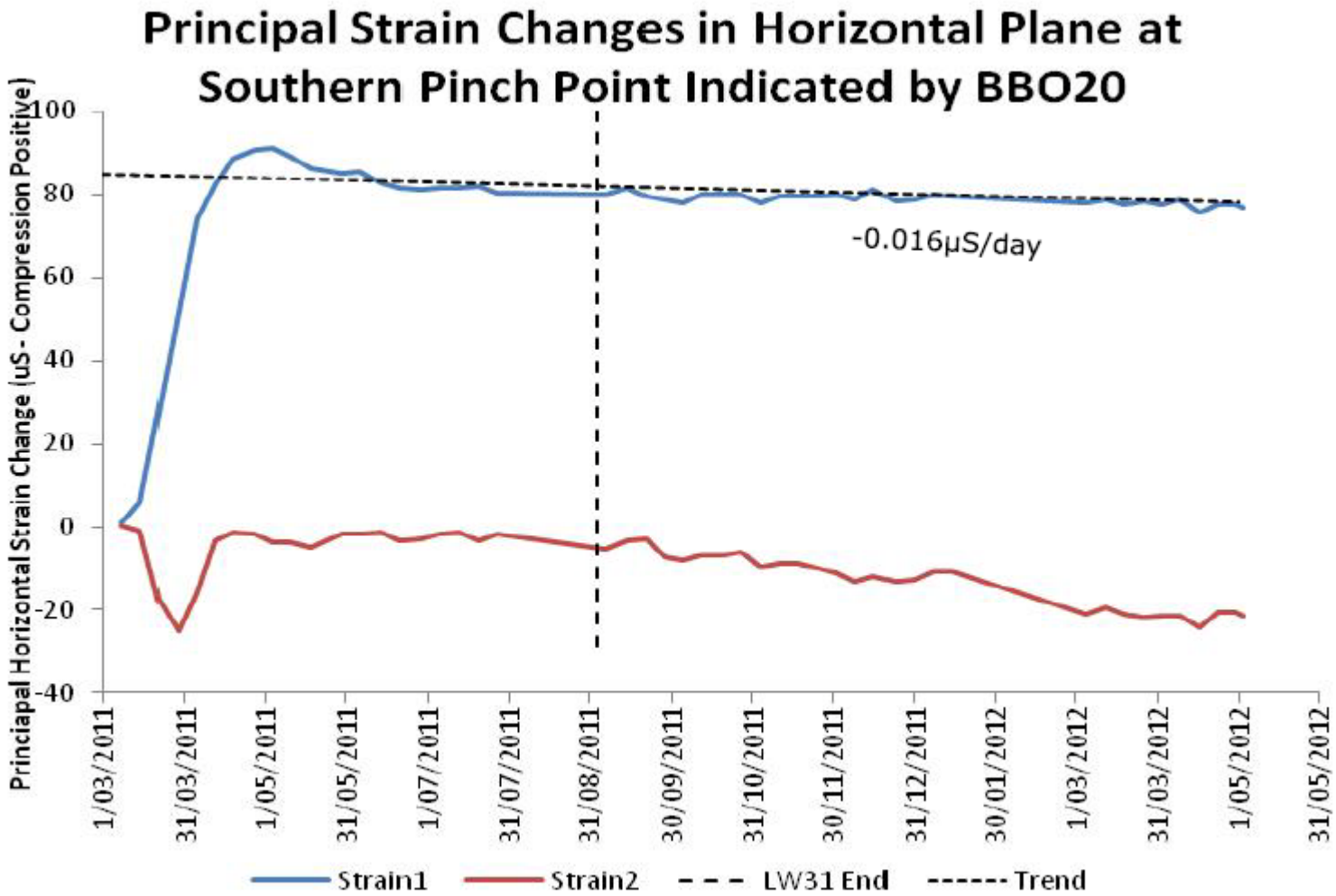
The high resolution prism monitoring indicates ongoing compression at the northern pinch point consistent with the stress monitoring results at BBO23.

Figure 1 - BBO20 Strain Changes Measured During and After Longwall 31



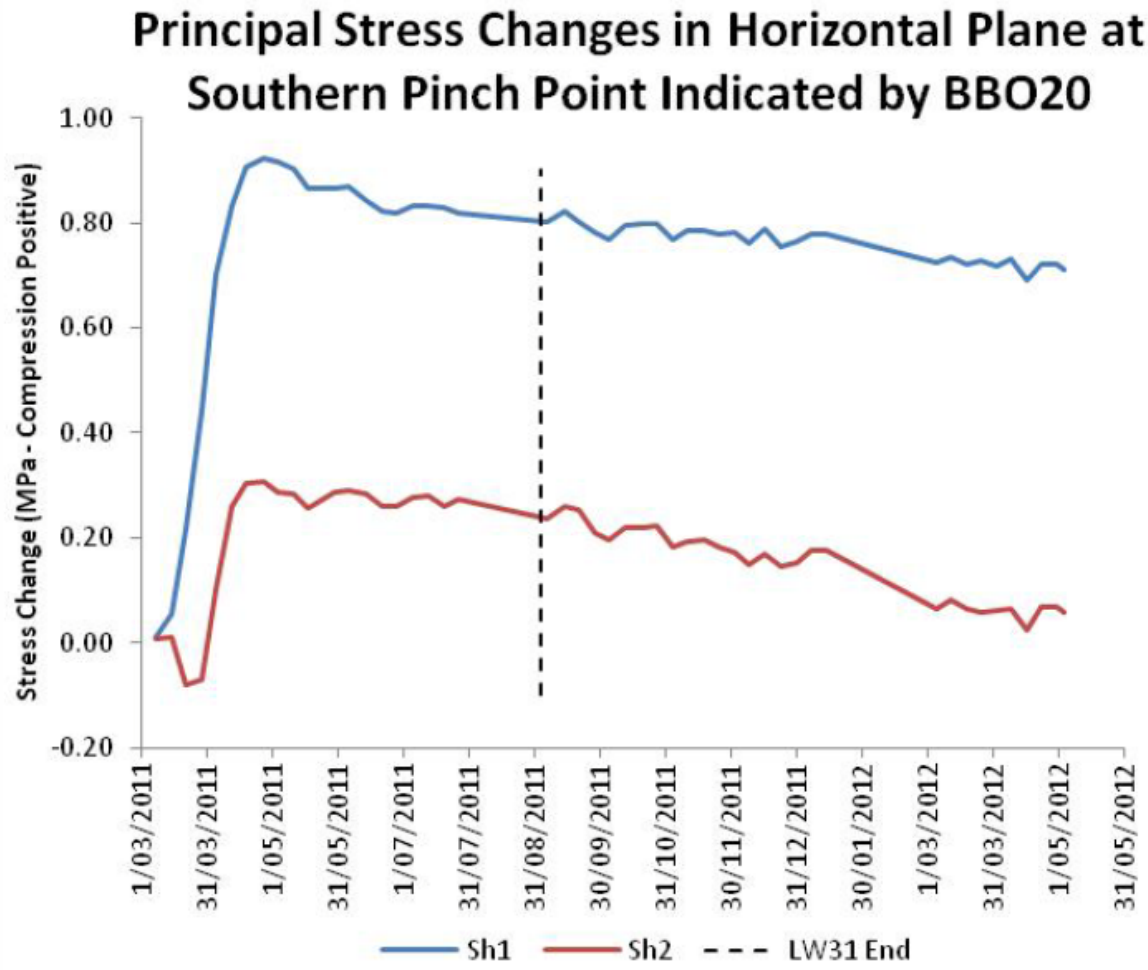
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 2 – Principal Strain Changes in Horizontal Plane at Southern Pinch Point Indicated by BBO20



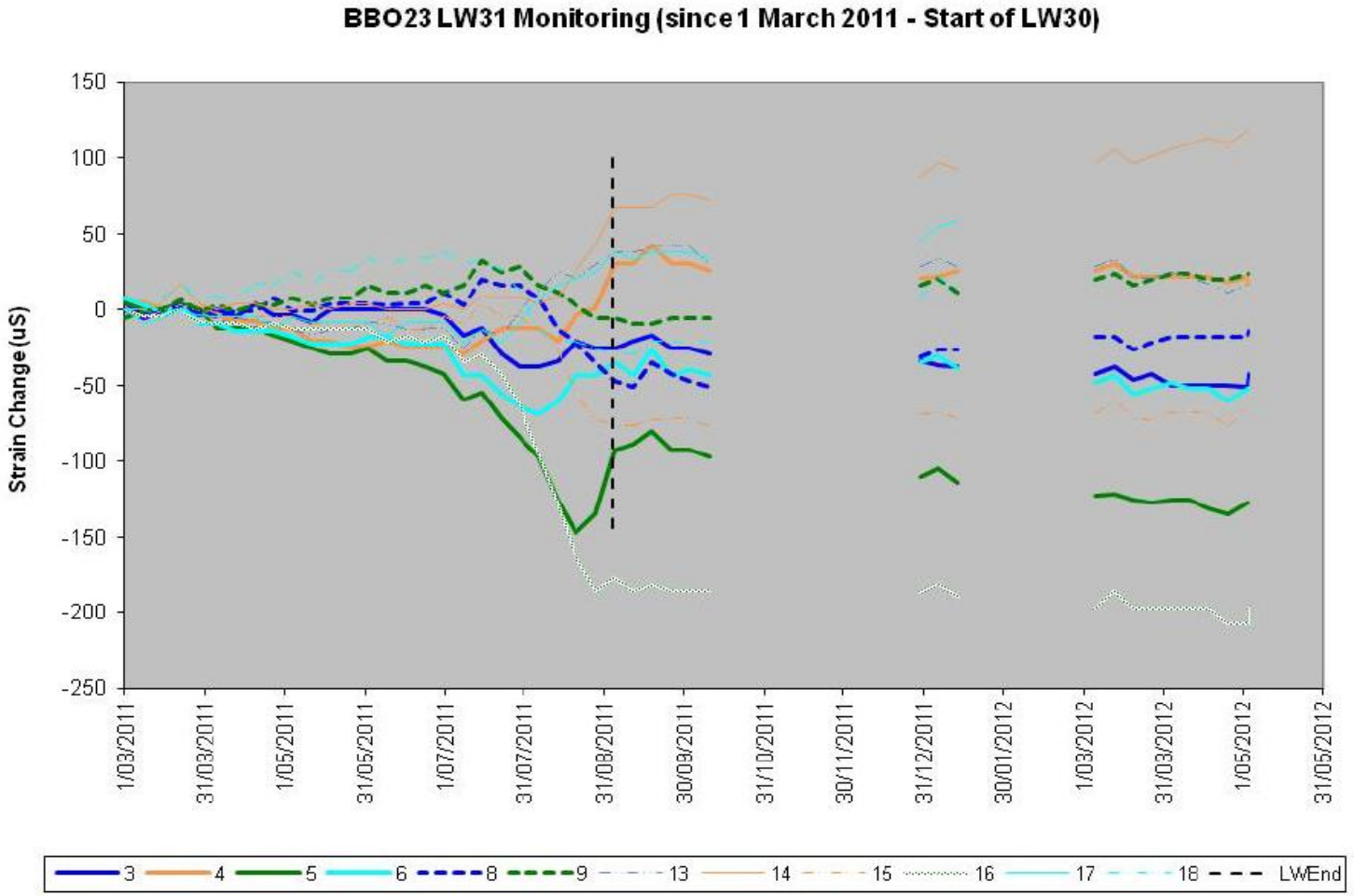
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 3 – Principal Stress Changes in Horizontal Plane at Southern Pinch Point Indicated by BBO20



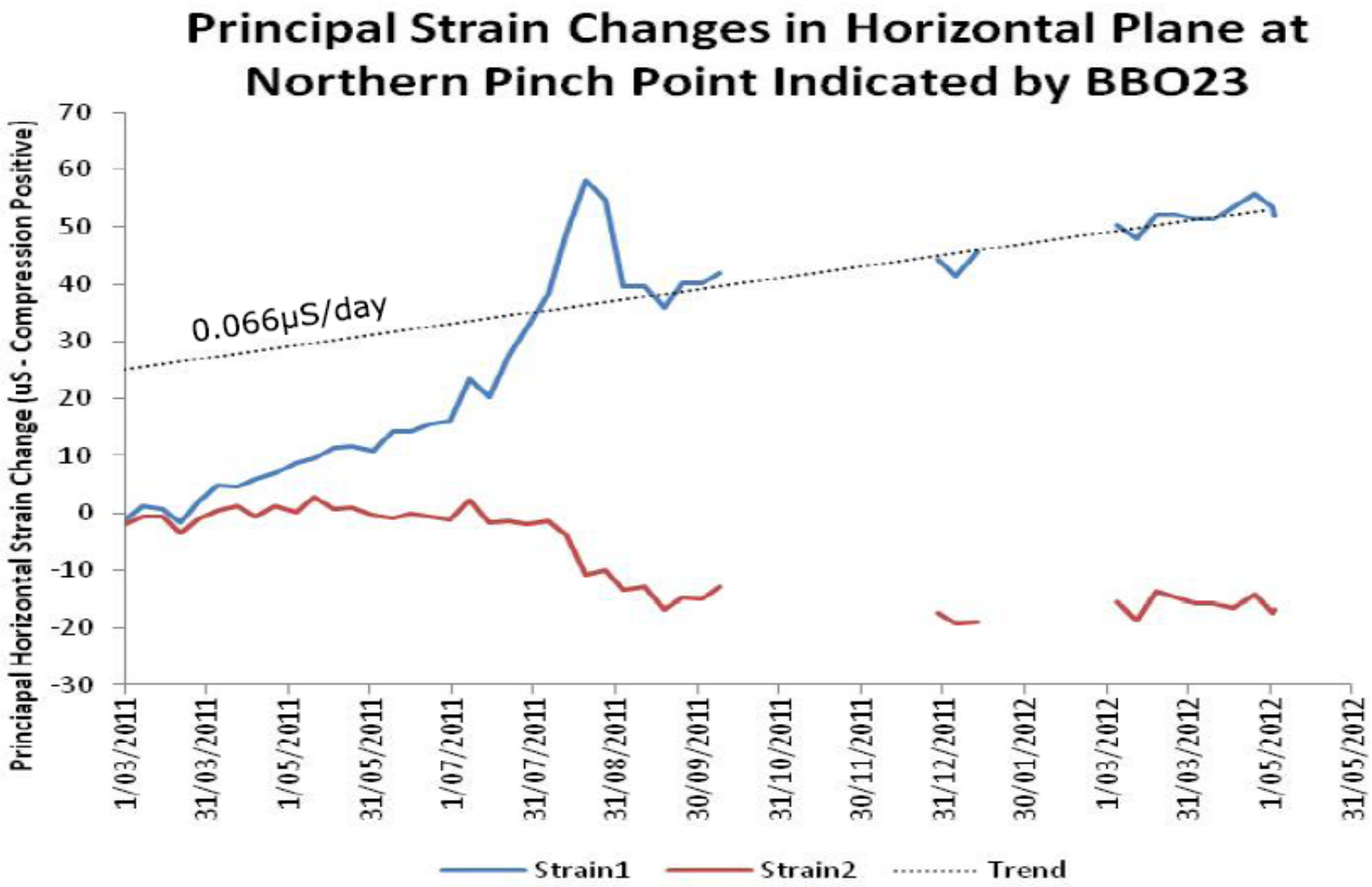
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 4 – BBO23 LW31 Monitoring Since 1 March 2011



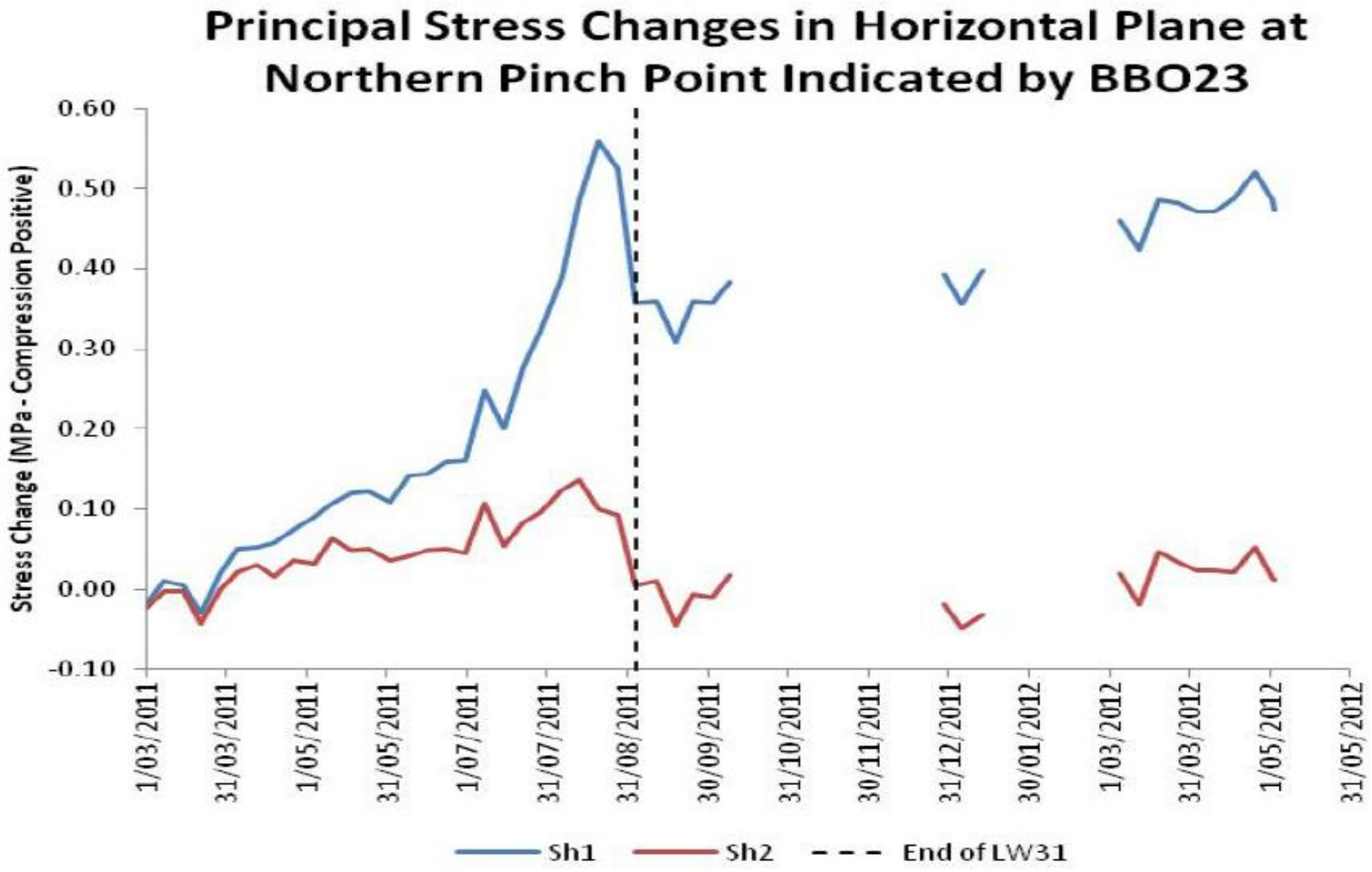
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 5 – Principal Strain Changes in Horizontal Plane at Northern Pinch Point Indicated by BBO23



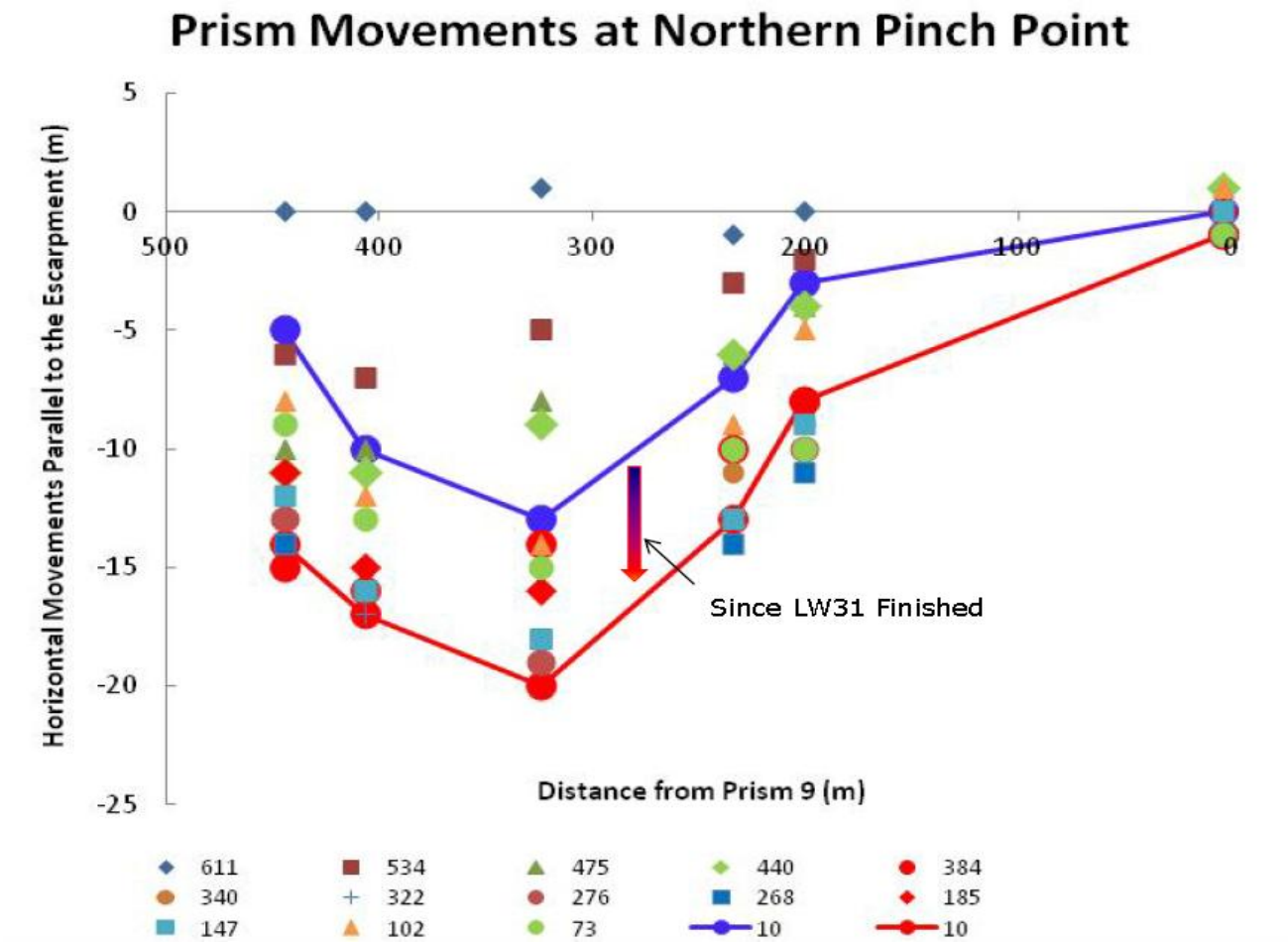
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 6 – Principal Stress Changes in Horizontal Plane at Northern Pinch Point Indicated by BBO23



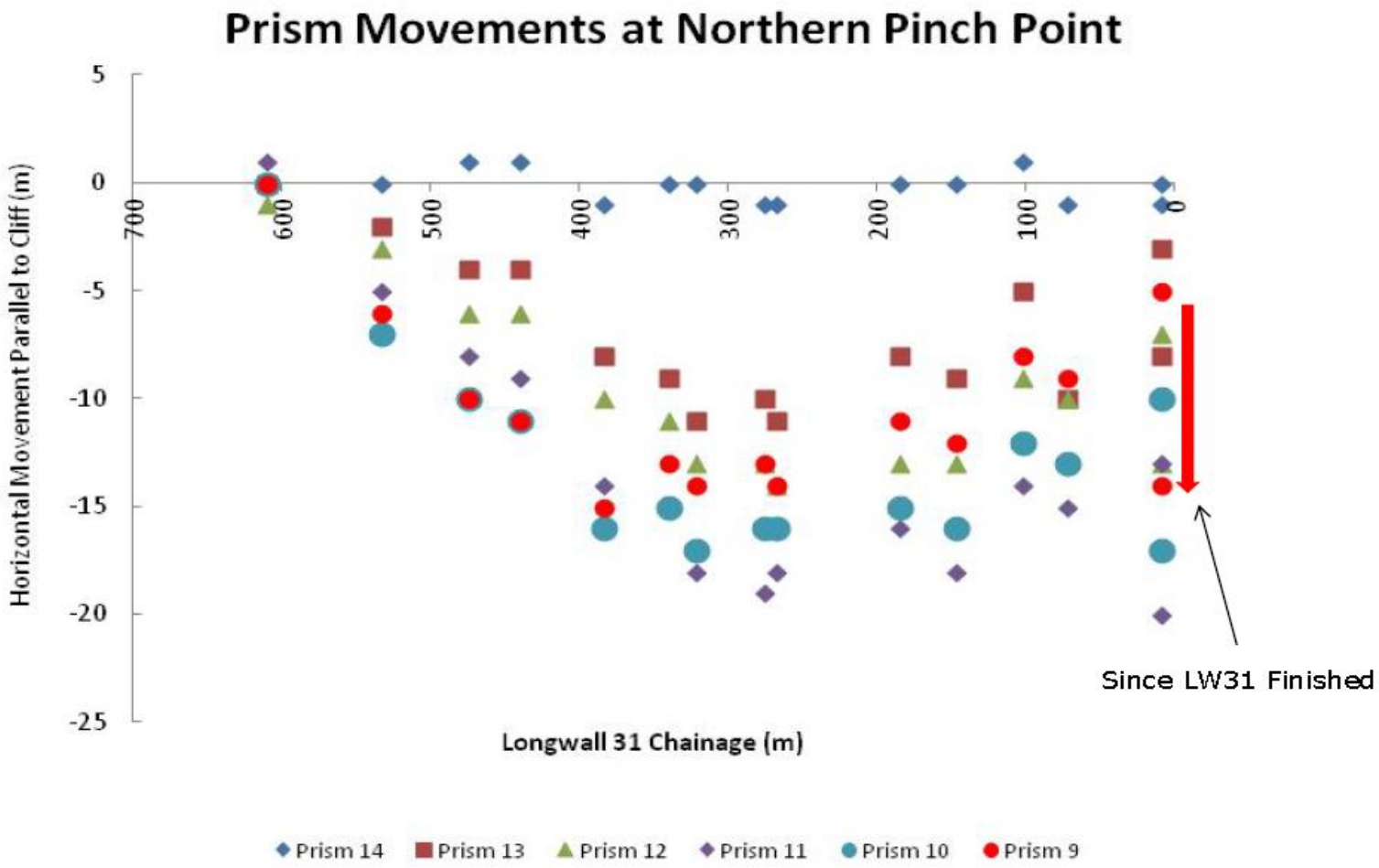
Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 7 – Prism Movements at Northern Pinch Point



Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

Figure 8 – Prism Movements at Northern Pinch Point



Source: Update to 3 May 2012 of Stress Cell Monitoring – LW31 at Baal Bone Colliery – Ken Mills (SCT Operations)

7.2 Rock Features

To date there have been no adverse or unpredicted subsidence impacts on identified rock features in the vicinity of the SMP area.

7.3 Surface Drainage Depressions

To date there has been one unpredicted subsidence impact observed on surface drainage depressions within the SMP area, in LW 30, details of which were included in previous Status and End of Panel Report**.** 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) continued during longwall mining; there has been no observable change to pre-mining flow characteristics and/or stream morphology during this reporting period.

Monitoring will continue now LW 31 is complete and any subsidence / upsidence impacts and/or required remediation on the stream will be reassessed.

7.4 Fire Trails and Tracks

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

7.5 Swamp

As scheduled in the LW29-31 SMP - Environmental Monitoring Program, seasonal photographic monitoring of the Coxs River Swamp has been discontinued since the cessation of mining.

Monitoring completed to date indicate that 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.

7.6 Fauna

Four sites within and near the Baal Bone Colliery Longwall 29-31 SMP Area were surveyed for fauna by Biodiversity Monitoring Services during September 2011. Three of these sites have been surveyed since 2005.

Listed below is a summary of the 2011 fauna monitoring.

A total of 20 native mammal (plus three introduced), 58 bird, five reptile and three amphibian species have been located within or near Longwall 29-31 SMP Area at Baal Bone Colliery during 2011. The list of fauna species located during the 2011 surveys in the SMP Area provides a total assemblage of species located within Baal Bone Colliery and LW29-31 SMP Area over the years. At present, 30 native mammal, 95 bird, 14 reptile and six amphibian species are known to occur within the LW29-31 SMP Area.

The number of birds, native mammals, reptile and amphibian species located in 2011 was similar to that located in earlier years. As expected with continued surveys, the number of species located within the SMP area has increased over the years. 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 2011 are the Eastern Pygmy-possum, House Mouse, Large Forest Bat, White-necked Heron, Buff-banded Rail, Golden-headed Cisticola, Beautiful Firetail, White's Rock-skink, Bibron's Toadlet and the Giant Dragonfly.

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 2011, the following threatened species were located: Gang-gang Cockatoo, Scarlet Robin, Varied Sittella, Eastern Pygmy-possum, Little Pied Bat, Eastern False Pipistrelle, Eastern Bent-wing Bat, Greater Broad-nosed Bat. The first three 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.

Two new threatened species were located during the 2011 surveys, the Eastern Pygmy-possum and the Giant Dragonfly. Both were associated with Long Swamp, with the Eastern Pygmy-possum pit-trapped in a stand of banksia close to the swamp and at least five Giant Dragonflies were observed flying over Long Swamp close to piezometer BBP5.

The Giant Dragonfly is listed as Endangered under the NSW TSC Act.

Table 2: Result from Analysis of Data from 2006 to 2011

BIODIVERSITY INDICES	SIGNIFICANT DIFFERENCES BETWEEN PRE AND POST MINING
Species richness of faunal groups	NO
Diversity indices of faunal groups	NO
Capture rates of individual species	NO
Contribution to the faunal assemblages by species dependant upon woodland	NO
Contribution to the faunal assemblages by species declining in the Central West	NO
Habitat complexity scores	NO

Conclusions

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.

The accumulation of data from the on-going surveys makes it possible to track changes to the terrestrial vertebrate fauna within the Baal Bone Colliery SMP Application Area during and after mining activities. At present, there appears to be no evidence of any significant effects from subsidence upon the fauna diversity at Baal Bone Colliery.

It should be noted that a number of Giant Dragonflies were located at Long Swamp during the 2011 surveys. The combination of wet weather and warm conditions during this year's summer would have encouraged the breeding of this endangered species. Long Swamp and the adjoining littoral vegetation can be considered to be of importance in terms of the number of threatened species located there (six in 2011).

7.7 Flora

Systematic vegetation monitoring quadrats were established within the SMP area in January 2007.

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.

No survey was conducted during this reporting period. A summary of the 2011 results is included.

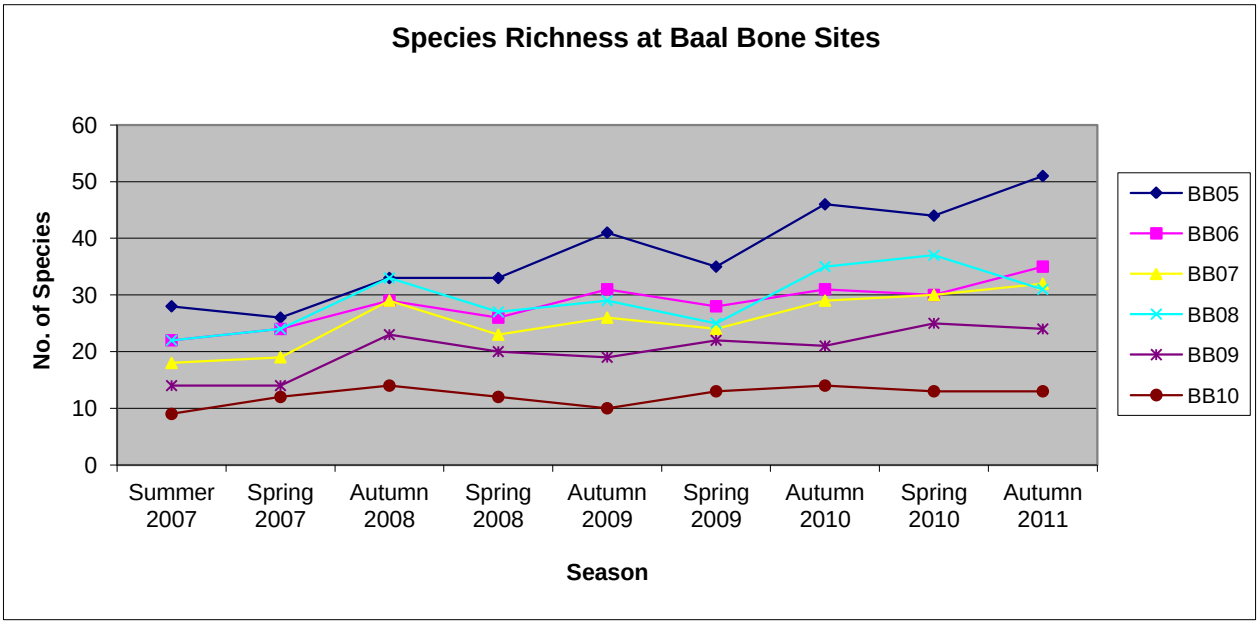
Each seasonal survey involves recording of vegetation structure, dominant species, estimated cover and height for each stratum, full floristics, an estimated cover abundance for each species using the modified Braun-Blanquet scale and condition of common species using the condition scale. Observations of general condition of the surface environment, stream water flow and quality are also made where relevant.

Results

Plant Species Diversity

Species diversity results show that levels of species diversity recorded in 2011 were at the higher end or above the previously recorded range at each site. **Table 3** shows species richness recorded across all sites during spring and autumn since the baseline data was obtained.

Table 3 - Species Richness at Baal Bone Vegetation Monitoring Sites



Discussion

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. These indicators are:

- a decline in diversity and abundance of plant species which typically are associated with wet, sheltered areas
- an increase in diversity and abundance of plant species which typically occur in forests or woodlands in locations initially supporting species characteristic of more sheltered communities
- an increase in diversity and abundance of exotic species or native species favoured by disturbance
- unusual variation in species diversity
- decline in condition of plant species known to be sensitive to changes in water availability.

Changes in these indicators may also result from prevailing climatic conditions and other disturbances independent of mining such as bushfires, logging operations, recreational activities and feral animals.

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.

The levels of species richness and weed growth are all consistent with a response to rainfall. There has been no evidence which would indicate an effect of subsidence on vegetation distribution and abundance at the monitoring sites.

7.8 Groundwater

Aurecon monitors data loggers in the six piezometers on a regular basis to gather baseline data regarding groundwater level fluctuations in the vicinity of the Coxs River Swamp. Baseline data obtained prior to

commencement of mining confirms a strong correlation between groundwater levels and prevailing climatic conditions, most particularly the relationship to rainfall.

Rainfall was slightly below average in April and May.

Groundwater levels have remained reasonably level overall. Piezometers BBP1, 5 and 6 have all remained stable, while a decrease in level was observed in BBP2, 3 and 4 commencing around 10 March, corresponding with the drier weather pattern.

Piezometers BBP5 and 6, which are installed within bores in the centre of the swamp, have maintained their long term groundwater level approximately at ground level.

The north and south downstream groundwater gradient has been maintained over the current period (highest level observed in BBP1and lowest level in BBP4), indicating that flow has been maintained down through the swamp. The swamp has remained very wet with surface water observed over the majority of the swamp. The water flow down through the channel that exists just north of BBP5 appears to have returned back to normal levels, after the high flows observed earlier.

All groundwater levels appear to be approximately at (or above) pre-mining levels with the exception being BBP1, where a groundwater has restabilised at RL 956 (approximately 5m below pre-mining level).

There is no observable impact on groundwater due to mining for the reporting period.

Exceedances in the following analytes, zinc and iron were registered during 2011 and reported. Notification was provided as required. Studies were conducted and a report from Aurecon provided. These analyte levels returned to “below trigger” values.

The Aurecon report entitled ‘Groundwater Level and Water Quality Changes compared to TARP Trigger Values in and around the Coxs River Swamp from 2009 to 2011 for SMP area LW29-31’ notes the following:

“Although minor and major changes were noted for pH and the trace metals at some bores, at no stage did the conductivity exceed its trigger level nor did it approach the ANZECC (2000) guideline for upland rivers. This indicates that the local groundwater has a very low salinity and is consistent with the local background.

Other than the major changes for copper and iron, the other changes were minor in terms of duration above the trigger levels. These minor changes can occur by chance in the variable conditions of rainfall and the resulting groundwater level changes. This is the reason why short term exceedance of the 80th percentile baseline have been allowed for in the TARP trigger values.

It is considered unlikely that the major changes in copper noted in the background bore BBP 4 were due to the release of metal into the groundwater from the nearby wetland by natural processes. Wetlands are known to accumulate trace metals from catchment rainfall runoff in their soils and to release them again under the conditions observed at the Coxs River Swamp (Maltby 2009).

Iron is abundant in the groundwater in the area, as indicated by the pre-mining 80th percentile baseline of 12m/L for all the bores. The water level changes, caused by drought conditions just before and during mining, did not occur during the pre-mining period of 2008/09, which was used to establish the baseline conditions and the trigger levels. The bore BBP3 exceedance of even the major level of 24.27 mg/L by the increase to36 mg/L, during the change from dry to wet conditions, shows how naturally abundant iron is in this area.

As the mining did not affect the water levels in the wetland bores or bore BBP3, the changes noted at these bores are representative of the variable dry weather and wet weather conditions experienced in the area. Although bores BBP1 and 2 were affected by mining, the water quality and trace metals were

indicated as unaffected because they did not exceed the minor trigger values. These observations are in agreement with the SMP report's expectations that the potential for significant changes in water quality is minimal. In addition, the SMP considered it to be highly unlikely that cracking would occur below the Coxs River Swamp, so water quality in the swamp was expected to be unaffected.

The detection of the major exceedances of copper and iron by the TARP trigger values, and the subsequent investigations of the causes, shows that the trigger values adequately addressed the water quality and trace metal changes observed.

In the case of iron, other than noting that that the iron levels may increase to higher than 24.27 mg/L during the wet periods following prolonged dry conditions, existing levels remain appropriate. This is supported by the fact that iron at the background bore, BBP4, did not exceed even the minor trigger value at any stage.

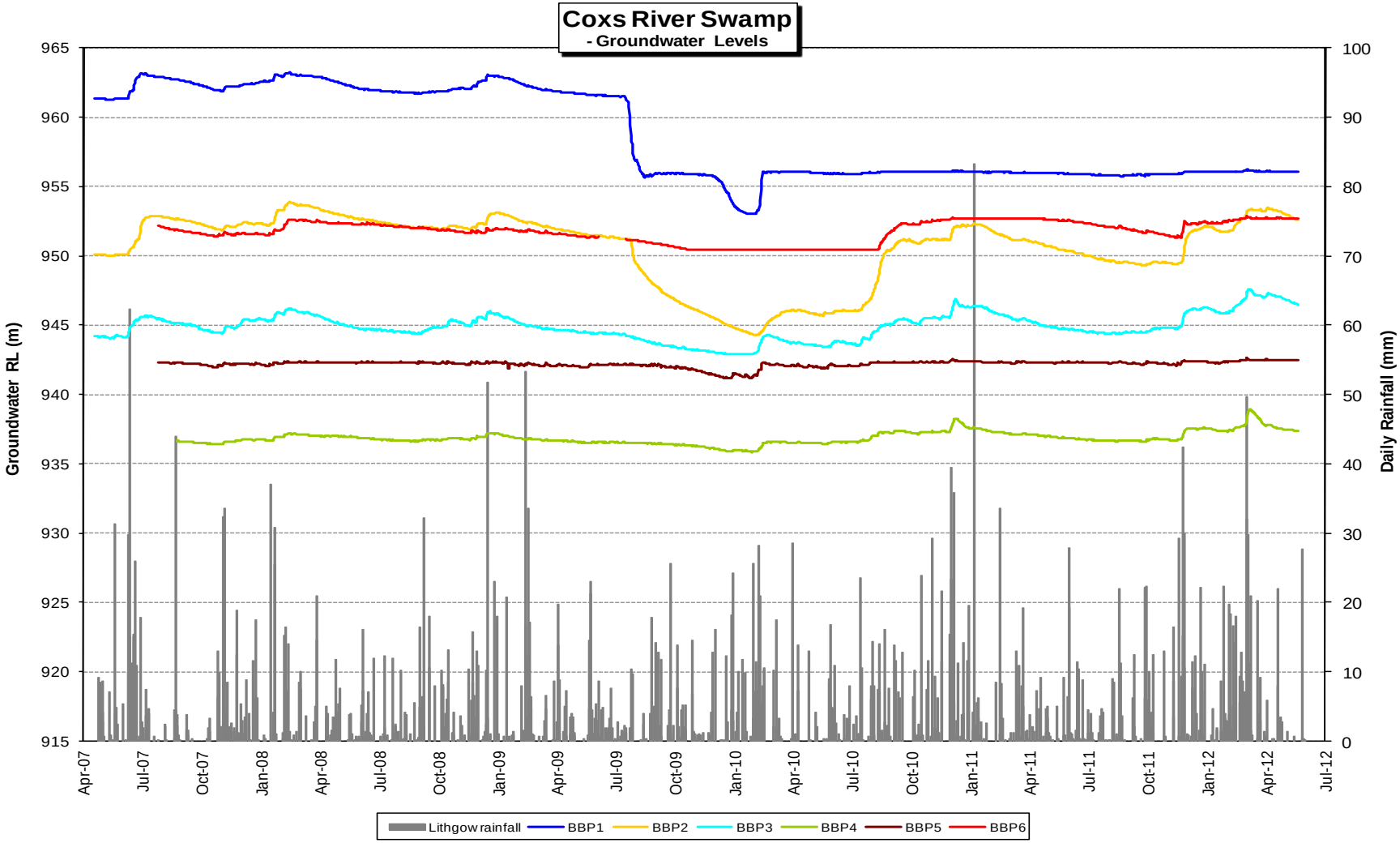
The copper increase at the background bore was due to natural processes, whereas the trigger values are intended to detect mining effects. Accordingly, the copper trigger values are also appropriate. All other changes in water quality were adequately categorised as minor by the TARP trigger values".

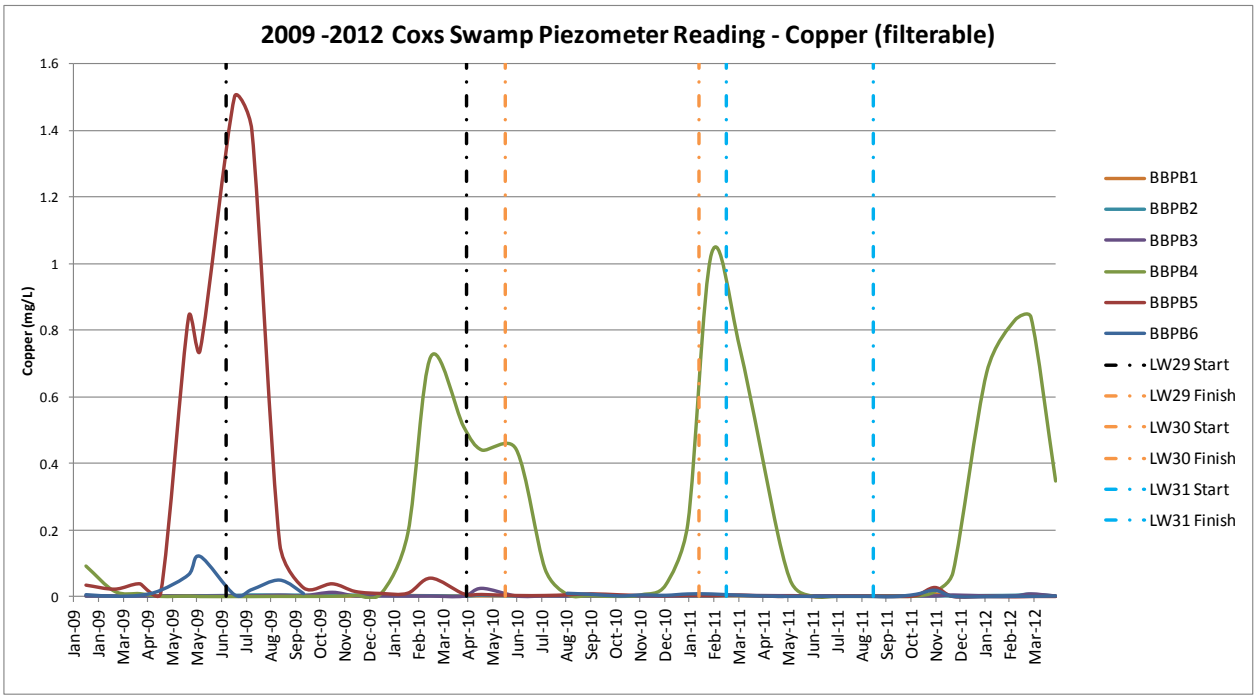
The Aurecon report concludes that:

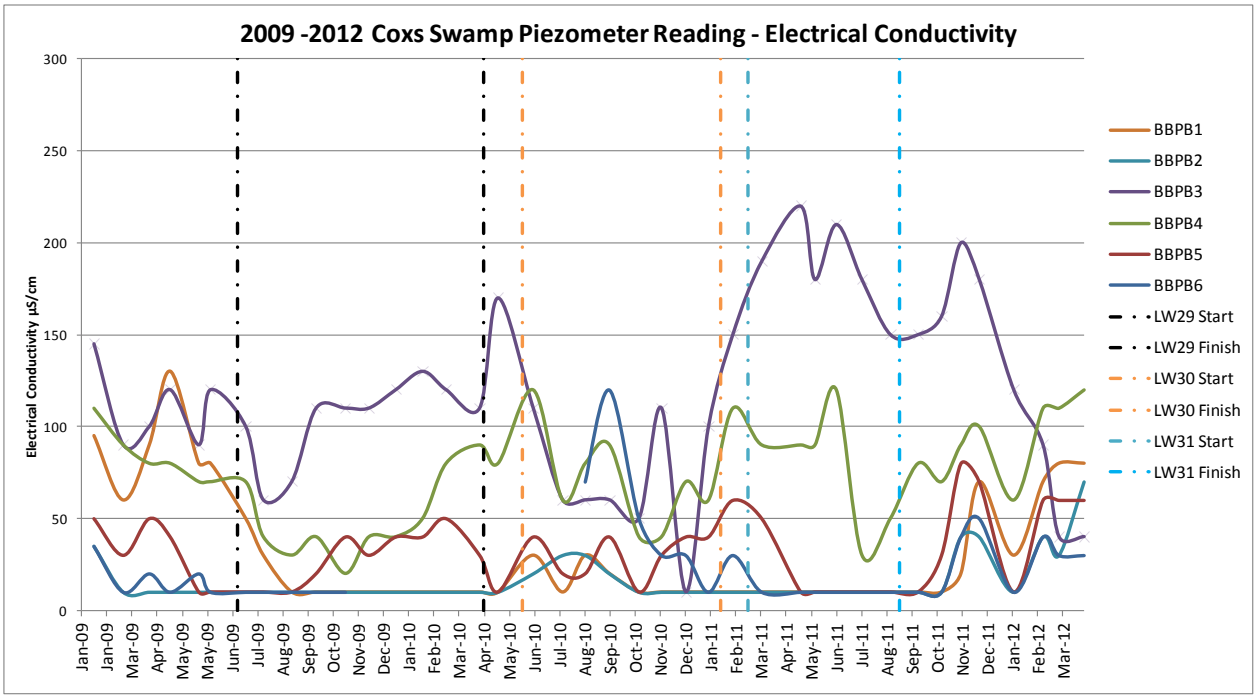
"From the assessment of the groundwater levels, water quality and trace metal changes at the Coxs River Swamp and surrounding area, it is concluded that:

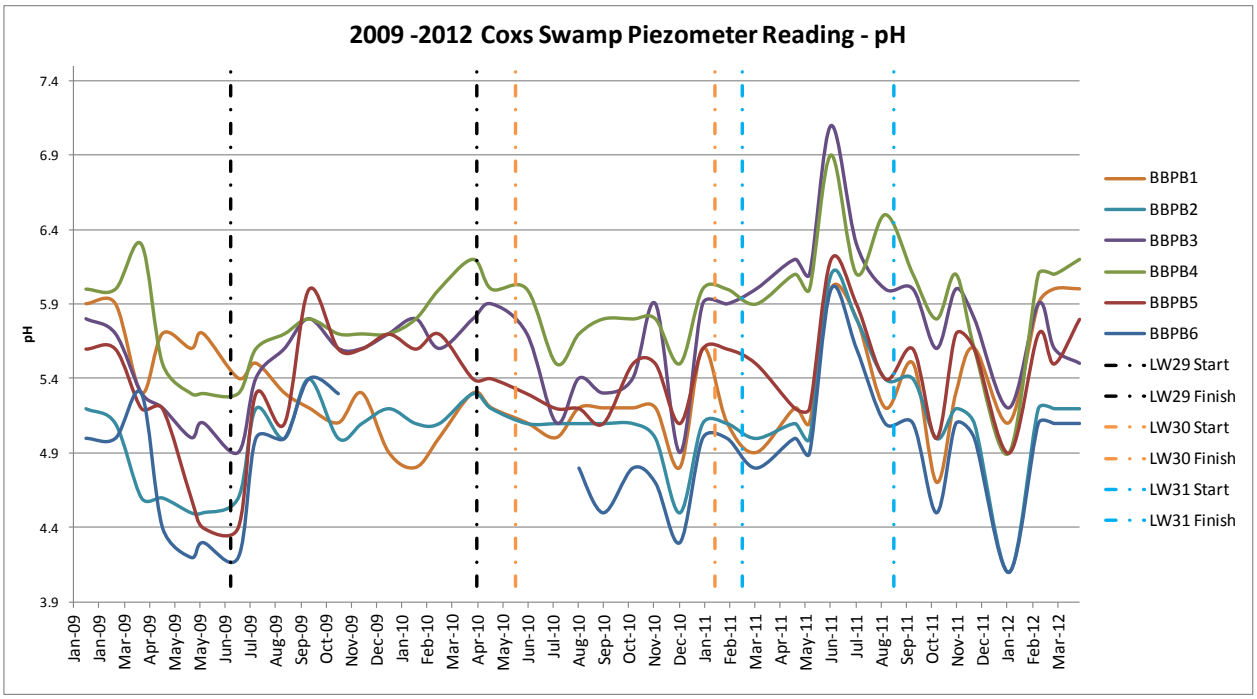
- *Mining effects on water levels at bores BBP1 and 2 did not affect the water quality and trace metal concentrations.*
- *Mining did not affect groundwater levels, water quality or trace metals in the Coxs River Swamp.*
- *Copper changes in the background bore were due to natural process in the nearby wetland.*
- *There is no need to update the TARP trigger values other than to note that natural iron concentrations in the area have the potential to exceed the trigger value".*

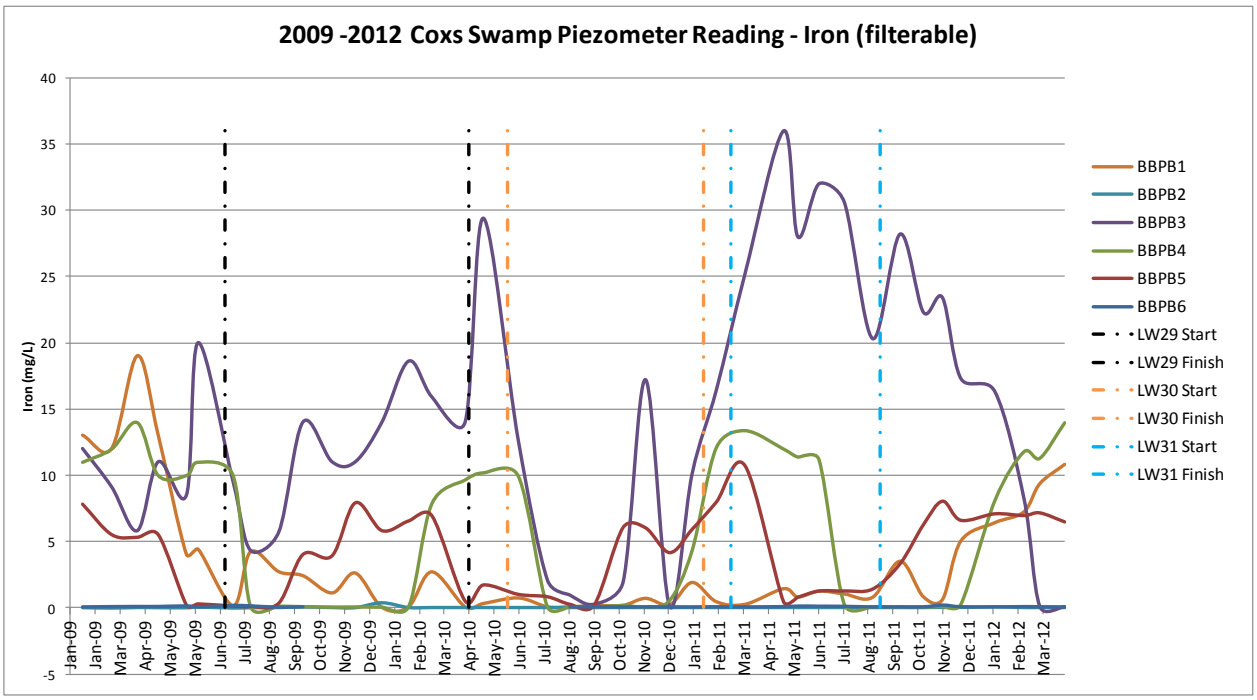
Figure 9 – Coxs River Swamp Groundwater Levels

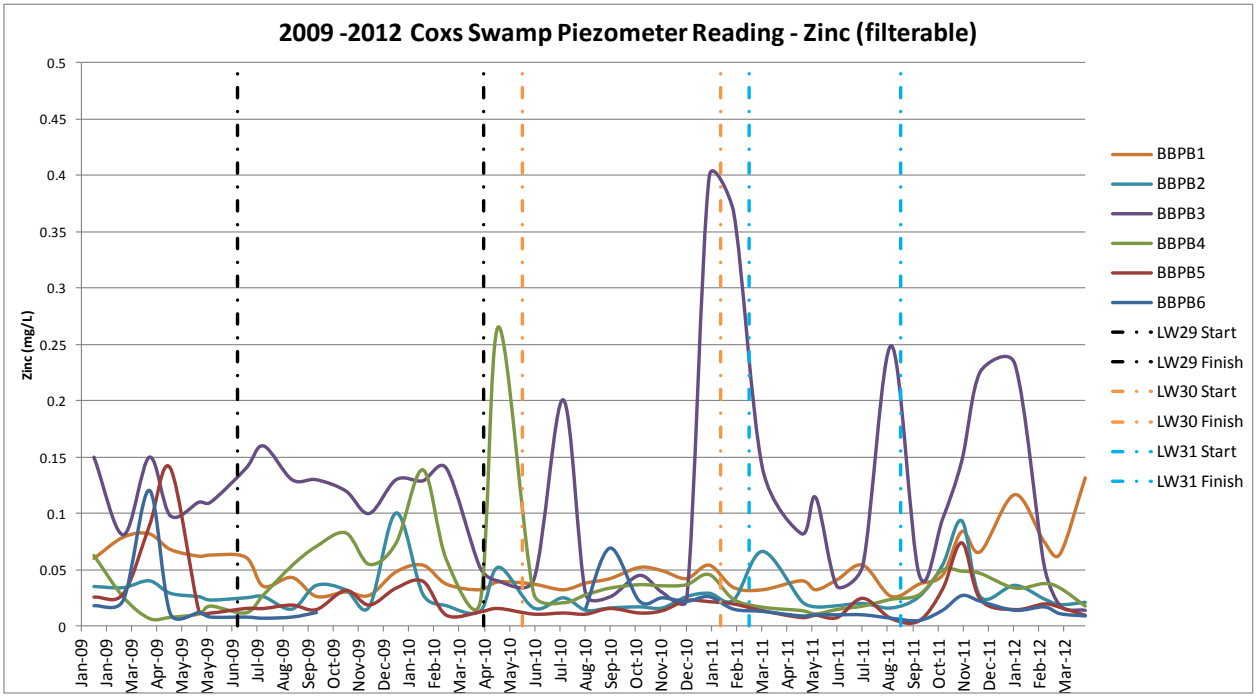



2009 -2012 Coxs Swamp Piezometer Reading - Copper (filterable)
Copper (mg/L)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Jan-09 Jan-09 Mar-09 Apr-09 May-09 May-09 Jun-09 Jul-09 Aug-09 Sep-09 Oct-09 Nov-09 Dec-09 Jan-10 Feb-10 Mar-10 Apr-10 May-10 Jun-10 Jul-10 Aug-10 Sep-10 Oct-10 Nov-10 Dec-10 Jan-11 Feb-11 Mar-11 Apr-11 May-11 Jun-11 Jul-11 Aug-11 Sep-11 Oct-11 Nov-11 Dec-11 Jan-12 Feb-12 Mar-12
BBPB1
BBPB2
BBPB3
BBPB4
BBPB5
BBPB6
LW29 Start
LW29 Finish
LW30 Start
LW30 Finish
LW31 Start
LW31 Finish


2009 -2012 Coxs Swamp Piezometer Reading - Electrical Conductivity
Electrical Conductivity µS/cm
300
250
200
150
100
50
0
Jan-09 Jan-09 Mar-09 Apr-09 May-09 May-09 Jun-09 Jul-09 Aug-09 Sep-09 Oct-09 Nov-09 Dec-09 Jan-10 Feb-10 Mar-10 Apr-10 May-10 Jun-10 Jul-10 Aug-10 Sep-10 Oct-10 Nov-10 Dec-10 Jan-11 Feb-11 Mar-11 Apr-11 May-11 Jun-11 Jul-11 Aug-11 Sep-11 Oct-11 Nov-11 Dec-11 Jan-12 Feb-12 Mar-12
BBPB1
BBPB2
BBPB3
BBPB4
BBPB5
BBPB6
LW29 Start
LW29 Finish
LW30 Start
LW30 Finish
LW31 Start
LW31 Finish


2009 -2012 Coxs Swamp Piezometer Reading - pH
pH
7.4
6.9
6.4
5.9
5.4
4.9
4.4
3.9
Jan-09 Jan-09 Mar-09 Apr-09 May-09 May-09 Jun-09 Jul-09 Aug-09 Sep-09 Oct-09 Nov-09 Dec-09 Jan-10 Feb-10 Mar-10 Apr-10 May-10 Jun-10 Jul-10 Aug-10 Sep-10 Oct-10 Nov-10 Dec-10 Jan-11 Feb-11 Mar-11 Apr-11 May-11 Jun-11 Jul-11 Aug-11 Sep-11 Oct-11 Nov-11 Dec-11 Jan-12 Feb-12 Mar-12
BBPB1
BBPB2
BBPB3
BBPB4
BBPB5
BBPB6
LW29 Start
LW29 Finish
LW30 Start
LW30 Finish
LW31 Start
LW31 Finish


2009 -2012 Coxs Swamp Piezometer Reading - Iron (filterable)
Iron (mg/L)
40
35
30
25
20
15
10
5
0
-5
Jan-09 Jan-09 Mar-09 Apr-09 May-09 May-09 Jun-09 Jul-09 Aug-09 Sep-09 Oct-09 Nov-09 Dec-09 Jan-10 Feb-10 Mar-10 Apr-10 May-10 Jun-10 Jul-10 Aug-10 Sep-10 Oct-10 Nov-10 Dec-10 Jan-11 Feb-11 Mar-11 Apr-11 May-11 Jun-11 Jul-11 Aug-11 Sep-11 Oct-11 Nov-11 Dec-11 Jan-12 Feb-12 Mar-12
BBPB1
BBPB2
BBPB3
BBPB4
BBPB5
BBPB6
LW29 Start
LW29 Finish
LW30 Start
LW30 Finish
LW31 Start
LW31 Finish



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. Elevated analytes in groundwater quality relating to zinc and iron have returned to below “trigger levels”.

Pre, during and post Longwall 31 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 been two minor exceedances relating to subsidence and horizontal movement, these have been located over LWs 29 and 30. Monitoring results over LW31 were within expected / predicted parameters and displayed no discernable trends.

9 ADEQUACY, QUALITY AND EFFECTIVENESS

The adequacy, quality and effectiveness of the implemented management response processes, based on compliance with approval conditions, are considered to be satisfactory to date. Notification, consultation and development of an inspection program and remediation program with regard to the surface cracking are also considered to be appropriate and effective.

10 PROPOSED ADDITIONAL / OUTSTANDING MANAGEMENT ACTIONS

REF, including flora and fauna studies and remediation program for surface cracking to be completed and submitted prior to mid August.

11 CONCLUSIONS

During the reporting period:

Routine scientific and survey monitoring of impacts on rock features, escarpments, and surface and groundwater regimes continued.

Anomalous groundwater behaviour in several monitoring bores as reported previously appears to have stabilised and is showing signs of normalising. Elevated analytes in groundwater quality relating to zinc and iron have returned to below “trigger levels”.

The minor exceedance, relating to subsidence over LW30 has increased slightly.

Notifications under Condition 18(b) of exceedances in zinc and iron analytes above trigger levels and surface cracking.

Inspection plan for entire surface above LWs 29- 31 developed and implemented to systematically assess all cracking areas in order to develop agreed remediation program with Forests DTIRIS.

All other monitoring results are within expected / predicted parameters and displayed no discernable trends.

The following routine and scheduled seasonal monitoring is proposed:

- Visual inspections in general surface area with particular emphasis on the rehabilitated area.
- Groundwater monitoring to continue until the next Status report and then to be reviewed in consultation with the Environmental Branch DTIRIS.
- One further seasonal flora and fauna survey to be conducted and then monitoring to be reviewed in consultation with the Environmental Branch DTIRIS.

Figure 10 - Subsidence Survey and Data Monitoring Locations (Source: *Baal Bone Colliery LW29-31 SMP Subsidence Monitoring Program*)

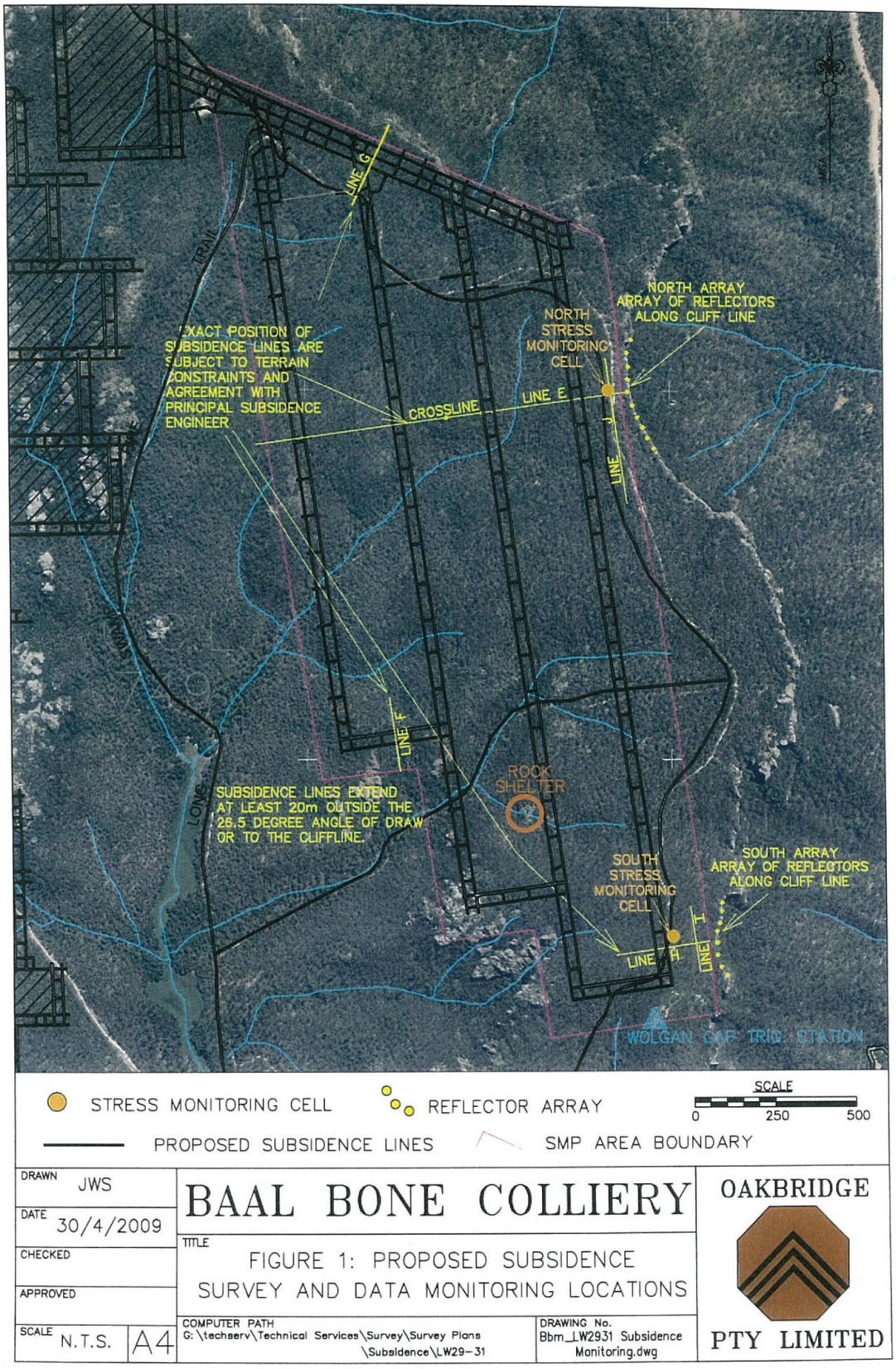
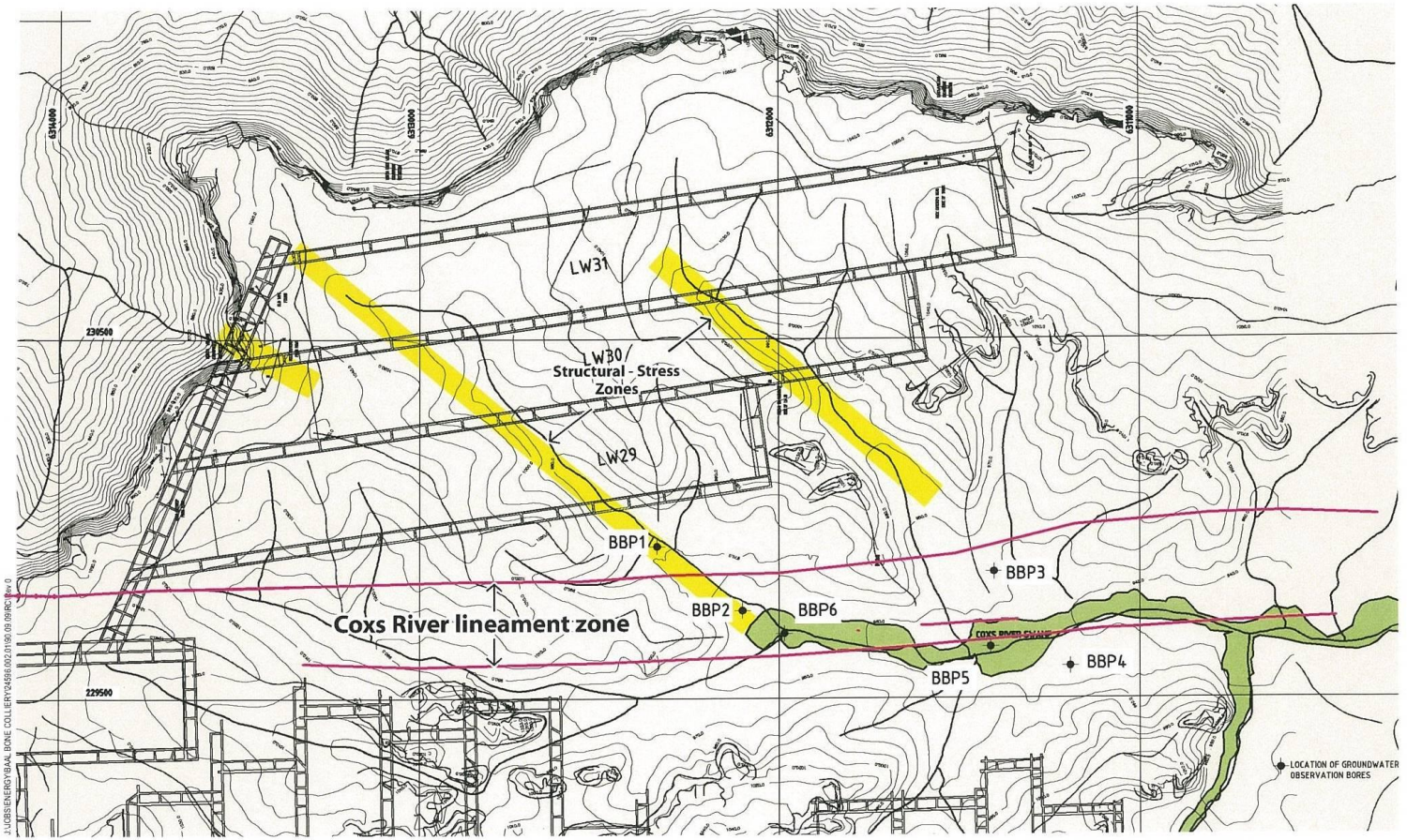


Figure 11 - Location of Groundwater Observation Bores and Geological Structures

aurecon



Baal Bone Colliery Groundwater Response Strategy

FIGURE: Location of Groundwater Observation Bores and Geological Structures

Figure 12 - Survey Monitoring and Stress Cell Location North Pinch Point Area

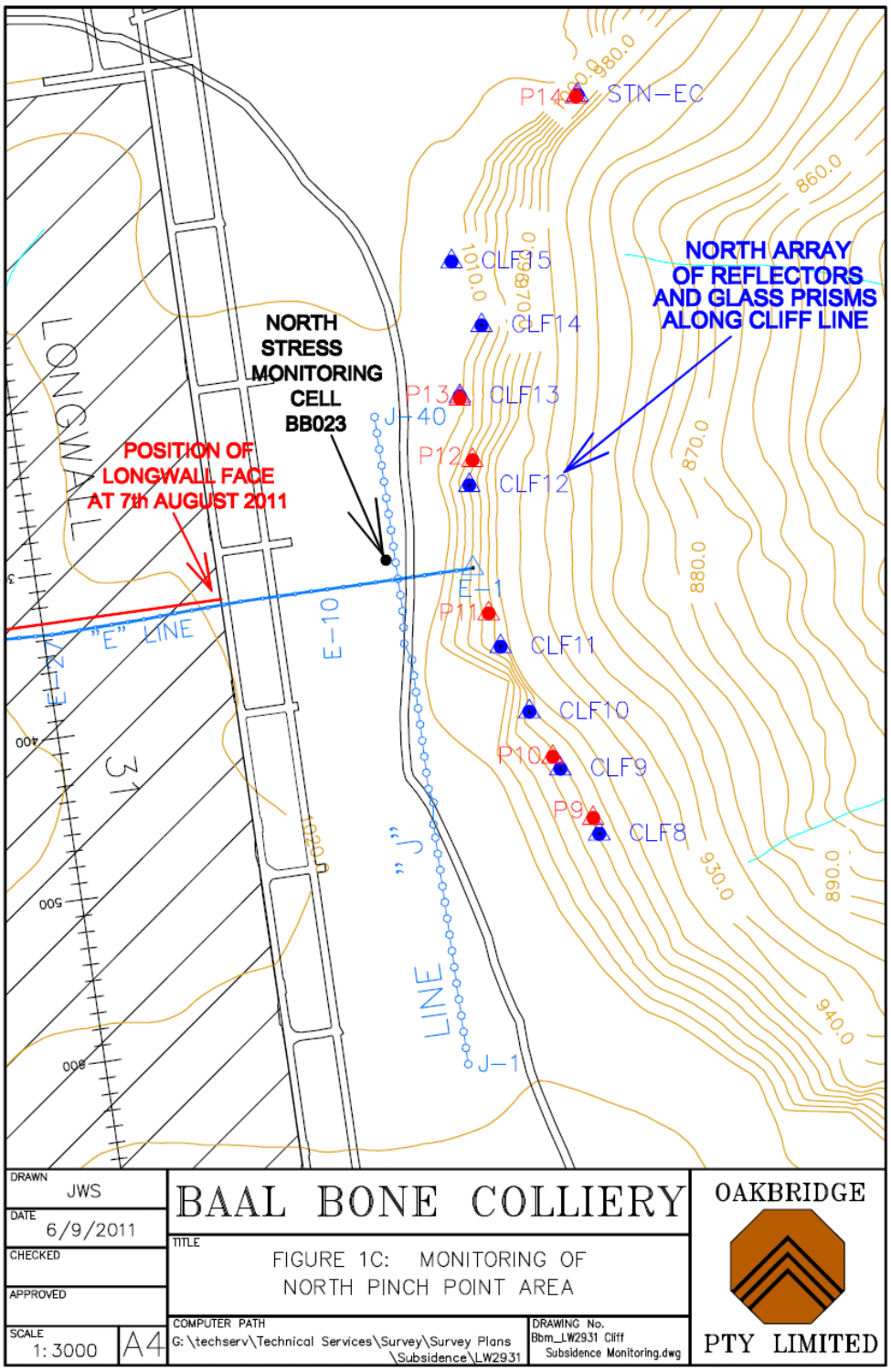


Figure 13 - Survey Monitoring and Stress Cell Location South Pinch Point Area

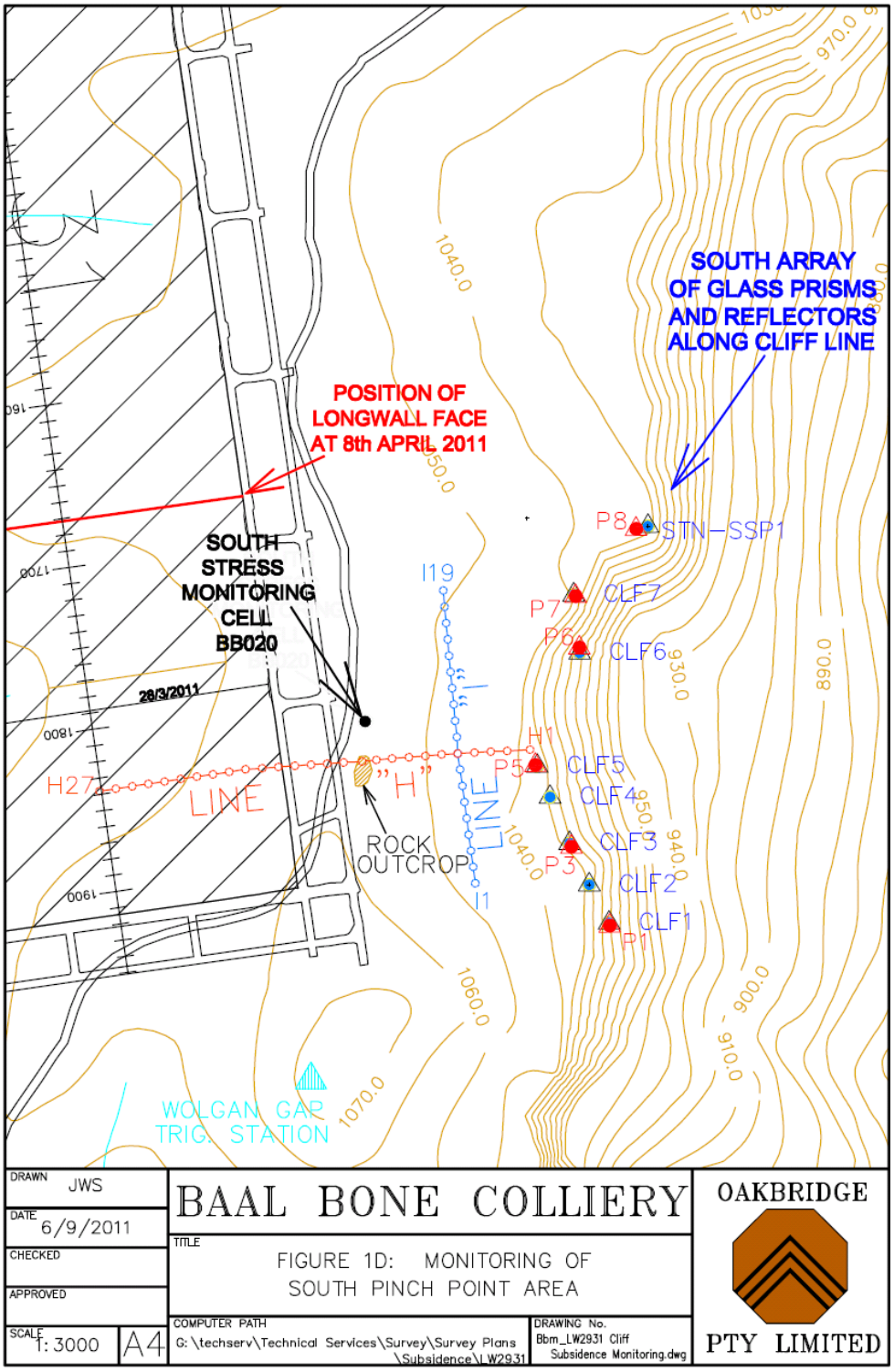


Figure 14 – Longwall Extraction Timing