BAAL BONE COLLIERY

OPERATED BY THE WALLERAWANG COLLIERIES LIMITED

BAAL BONE COLLIERY
Subsidence Management Status Report
LW 29 - 31

Four Monthly Update

REPORT No. 11

For the period:
8th April 2011 to 7th August 2011

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FIGURES

TABLES

1 INTRODUCTION

This Subsidence Status Management Report fulfils the requirements of Condition 19 of the Baal Bone Subsidence Management Plan (SMP) Longwalls 29 to 31 Approval Conditions. This is the eleventh report and covers the period 8th April 2011 to 7th August 2011.

2 PURPOSE AND SCOPE

The purpose of this document is to report the progress of mining, provide a summary of subsidence impacts, the implemented management processes and consultation with relevant stakeholders. It also provides the opportunity for relevant stakeholders to provide feedback as required under Condition 19.

3 FACE POSITION OF THE LONGWALL

Longwall 31 production continued during the reporting period. The faceline has retreated 1338m, from chainage 1671m to chainage 333m. As of 7 August 2011, the faceline of LW31 has retreated a total of 1593m.

4 SUMMARY OF SUBSIDENCE MANAGEMENT ACTIONS

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

1. Continuation of weekly surface inspections.
2. Continuation of ongoing flora, 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. Minor subsidence track works conducted.

5 CONSULTATION WITH STAKEHOLDERS

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

Chris Rudens – Environmental Sustainability Branch, Department of Trade and Industry, Regional Infrastructure and Services, Andrew Helms – Regional Operations Officer, Office of Environment & Heritage and Rebecca Pagan – Environment & Compliance Officer Forests NSW relating to LW 30 subsidence crack remediation works, including inspection undertaken on 27 July 2011.

Ken Mills – Senior Geotechnical engineer, SCT Operations Pty Ltd

Aboriginal Community Stakeholders – Consultation for the revised 2011 Aboriginal Cultural Heritage management Plan (ACHMP) began in June 2011 with letters sent out to the Aboriginal stakeholder groups advising them of an AHWG meeting to be held on 7th July 2011 at the Lithgow Workers Club. This meeting was designed to allow stakeholders to give input into the newly revised ACHMP and discuss best future management methods for the BBC-RS1 site. Attendees included;

- Lyn Syme – North East Wiradjuri Co
- Kevin Syme - North East Wiradjuri Co
- Wendy Lewis - Warrabinga Native Title Claimants Aboriginal Corporation
- Shaun Brown - Gundungurra Tribal Council Aboriginal Corporation

6 SUBSIDENCE DEVELOPMENT, OBSERVED SUBSIDENCE IMPACTS & MONITORING RESULTS

6.1 Surface Subsidence Impacts

LW31 face has retreated a total of 1593m from the start of the panel. Some tension cracking has occurred within the predicted ranges.

There have been no subsidence impacts observed outside the nominated angle of draw.

6.1.1 Wolgan Escarpment

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.

Summary of Observations

The strain gauges observed on BBO20 & BBO23 since 1 March 2011 are considered to provide a strong indication of stress changes at the two sites.

At BBO20 provide good correlation between gauges on opposite sides of the borehole and axial (external) show little change consistent with expectation.

The correlation between independent gauges (0.965 on 6 degrees of freedom) is consistent with a meaningful point measurement of the stress gauges at the point of measurement.

BBO20 indicates that the stresses parallel to the escarpment continue to decrease slowly over time and are currently at 0.91Mpa.

BBO23 indicates that the major horizontal stress sub-parallel to the escarpment has increased to 0.44Mpa and is continuing to increase at a steady rate.

The orientation of the principal stress change remains approximately aligned with the in situ stress field measured prior to the start of the mine (330 degrees GN). Currently stress sis aligned at 340 degrees GN.

The measured stress change (0.44Mpa) remains relatively small (19%) compared to the insitu stress measured by overcoring prior to the commencement of mining in the area, and has exceeded the 0.21Mpa stress relief that occurred in this direction on 1 December 2010 during mining of Longwall 30.

The high resolution prism monitoring indicates a linear and steadily increasing compression parallel to the escarpment that is consistent in nature and magnitude with the stress changes observed at BBO23.

A series of Figures follows :

Figure 1 – BBO20 Strain Changes
Figure 2 – BBO20 Strain Changes With LW31 Void Length
Figure 3 – BBO23 LW31 Strain Changes Since 1 March 2011
Figure 4 – Change in Principal Stress With Void Length and Time
Figure 5 – Prism Movements at Northern Pinch Point
Figure 6 – Prism Movements at Northern Pinch Point For Various Longwall Positions

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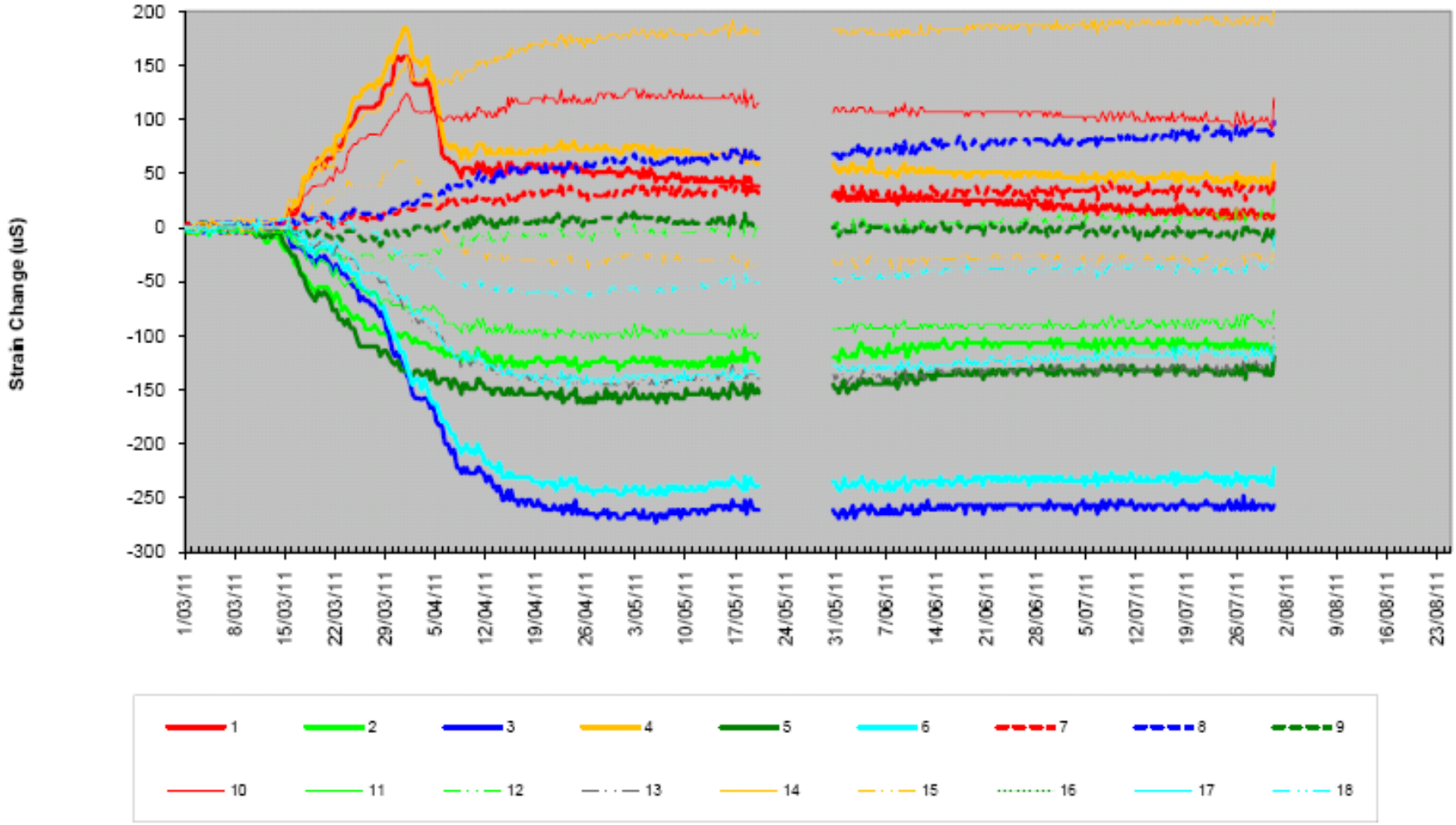
BBO20 Strain Changes



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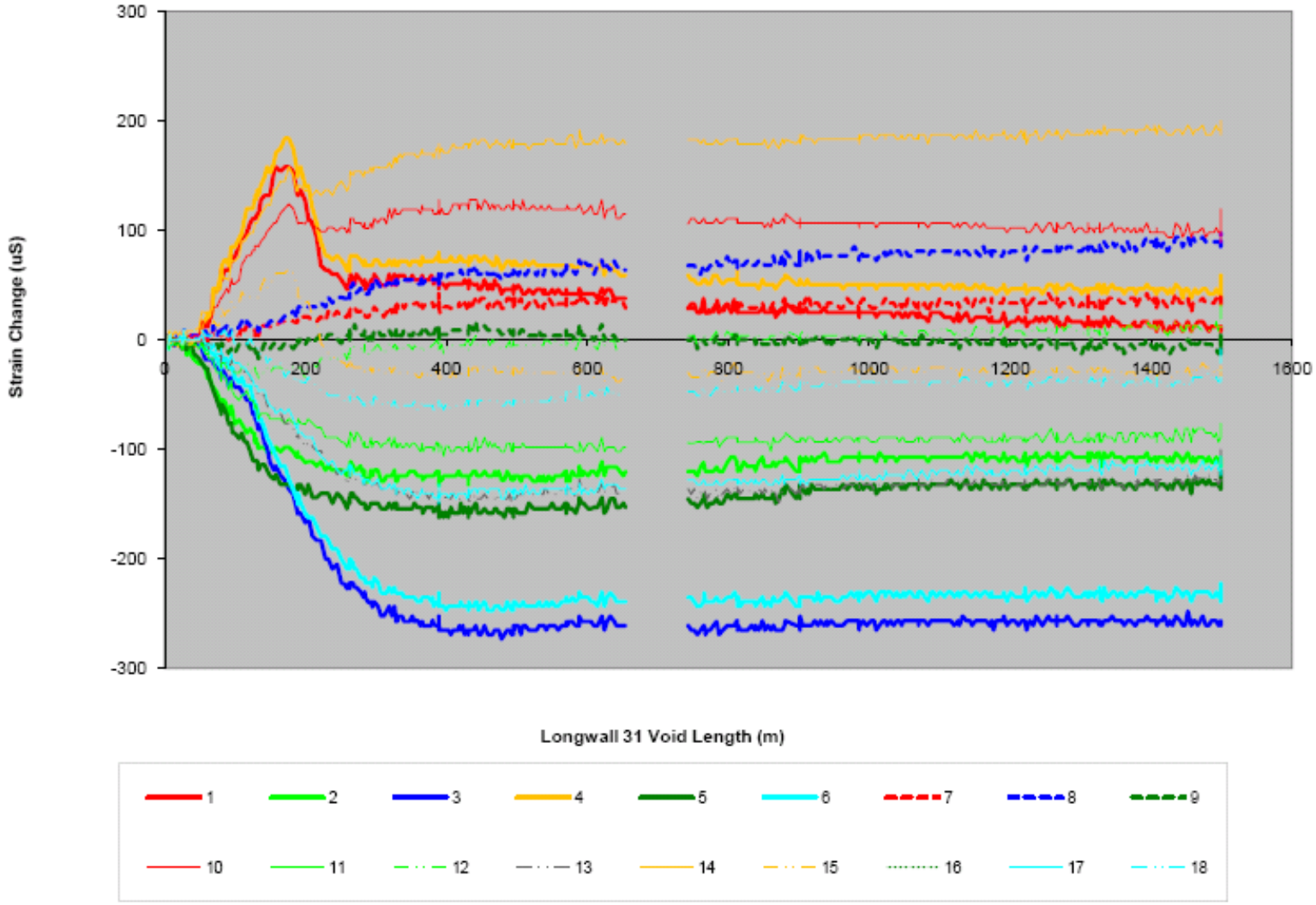
BBO20 Strain Change With LW31 Void Length



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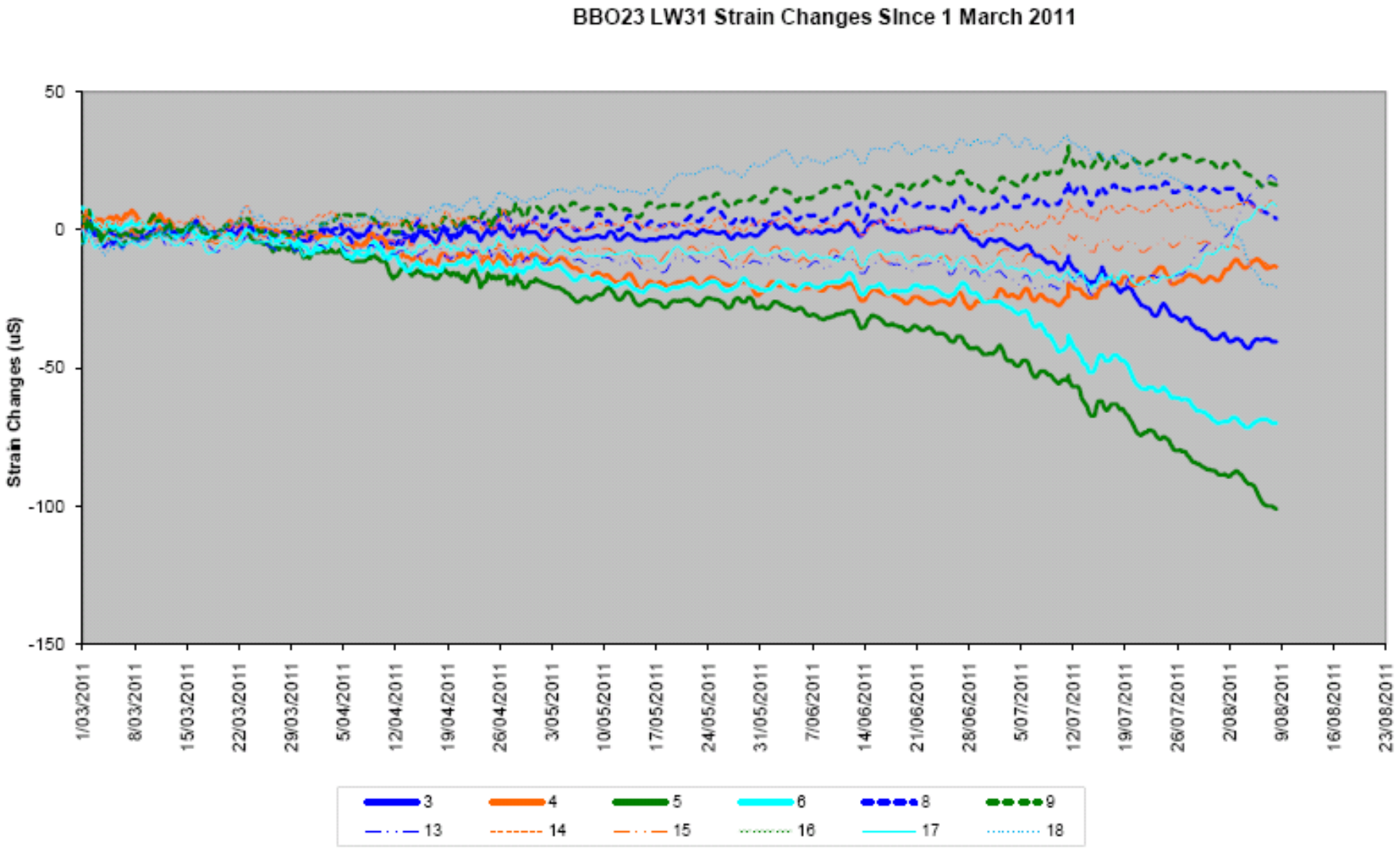

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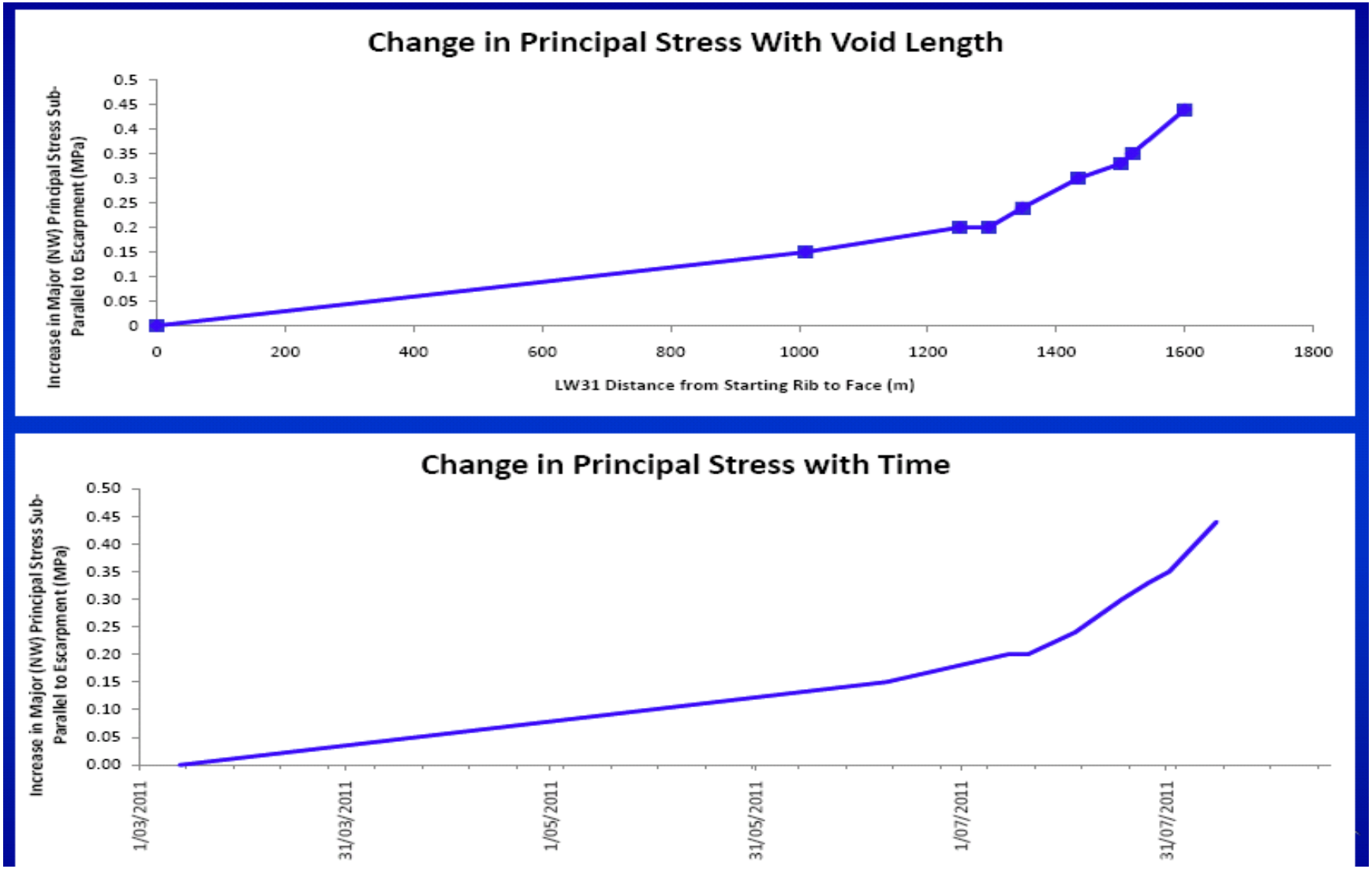
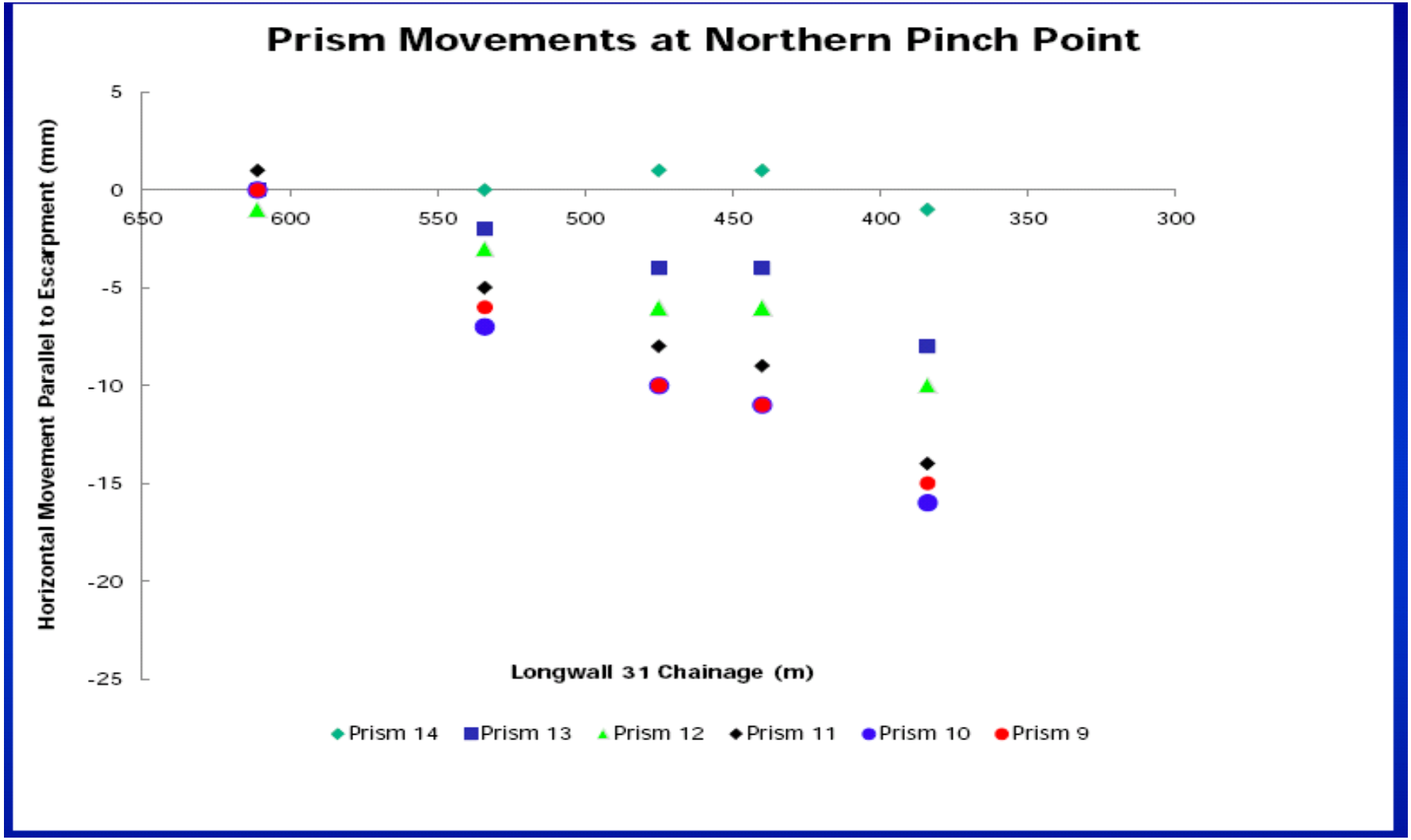
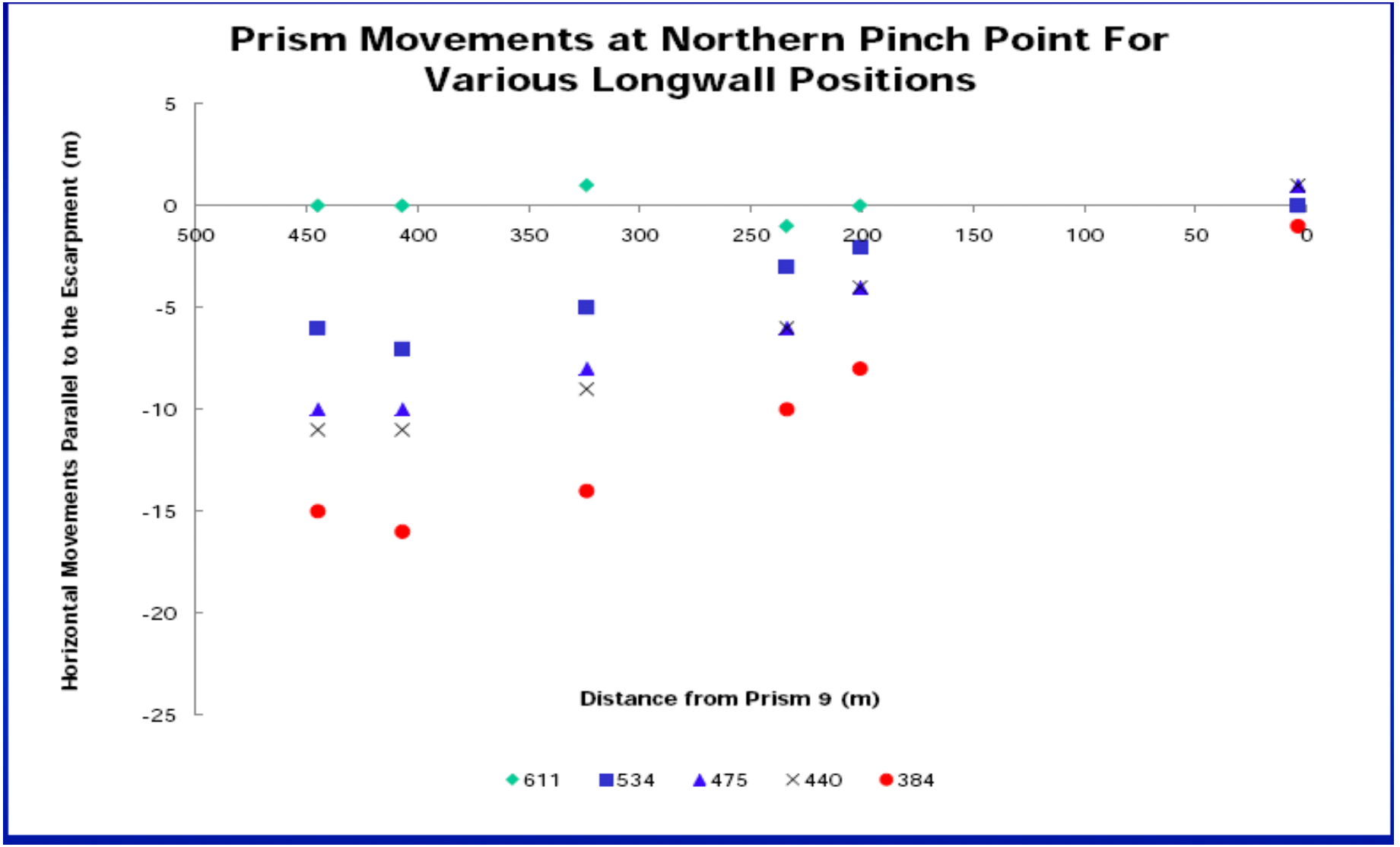

Change in Principal Stress With Void Length
Increase in Major (NW) Principal Stress Sub-Parallel to Escarpment (MPa)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
200
400
600
800
1000
1200
1400
1600
1800
LW31 Distance from Starting Rib to Face (m)
Change in Principal Stress with Time
Increase in Major (NW) Principal Stress Sub-Parallel to Escarpment (MPa)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1/03/2011
31/03/2011
1/05/2011
31/05/2011
1/07/2011
31/07/2011


Prism Movements at Northern Pinch Point
Horizontal Movement Parallel to Escarpment (mm)
5
0
-5
-10
-15
-20
-25
650
600
550
500
450
400
350
300
Longwall 31 Chainage (m)
Prism 14
Prism 13
Prism 12
Prism 11
Prism 10
Prism 9


Prism Movements at Northern Pinch Point For Various Longwall Positions
Horizontal Movements Parallel to the Escarpment (m)
5
0
-5
-10
-15
-20
-25
500
450
400
350
300
250
200
150
100
50
0
Distance from Prism 9 (m)
611
534
475
440
384

6.1.2 Rock Features

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

6.1.3 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 the previous Status Report 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) have 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, with additional photo points near the Longwall 30 crack area and upstream and downstream of the longwall 29-31 area, until LW 31 is complete and any subsidence/ upsidence impacts and/or required remediation on the stream will be reassessed at that stage."

6.1.4 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.

6.1.5 Swamp

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

6.1.6 Fauna

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

Nine native mammal (plus three introduced), 34 bird and two amphibian species were located from within or near the SMP area. Calculations of diversity indices were undertaken and are provided in **Table 1.**

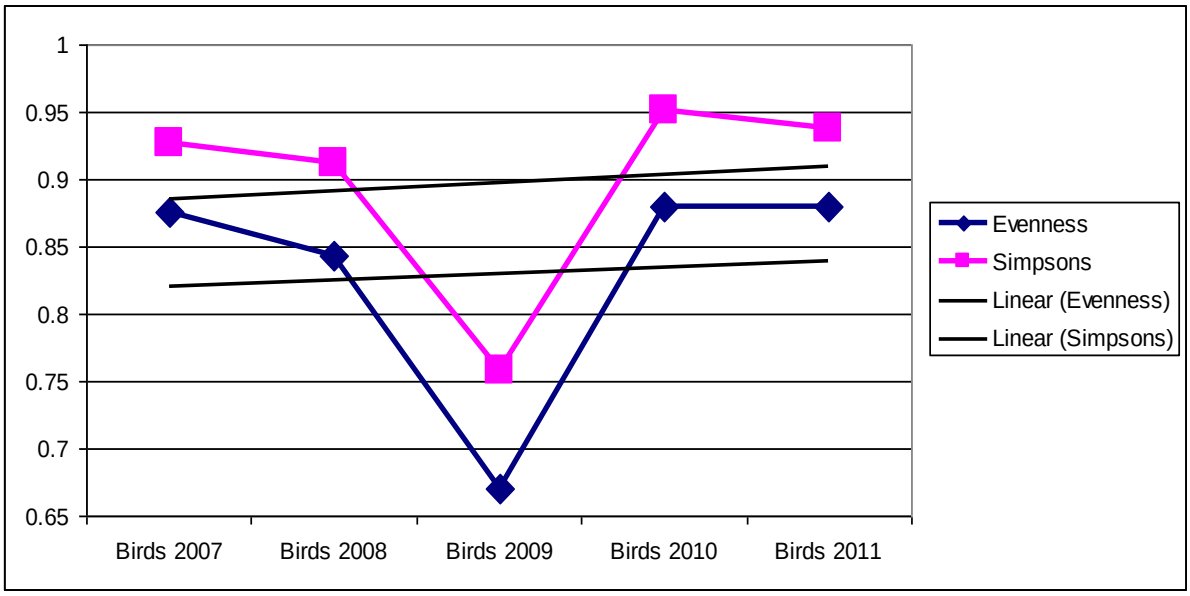
Table 1 - Biodiversity Indices for Fauna in Baal Bone SMP Area During Autumn

Diversity Index	Birds 2007	Birds 2008	Birds 2009	Birds 2010	Birds 2011
Evenness	0.8726	0.843	0.670	0.880	0.880
Simpson (1-D)	0.927	0.912	0.758	0.951	0.938
Total Numbers	145	175	209	282	341
Species Richness	35	27	30	41	34

Diversity Index	Native Mammals 2007	Native Mammals 2008	Native Mammals 2009	Native Mammals 2010	Native Mammals 2011
Evenness	0.753	0.951	0.841	0.822	0.893
Simpson (1-D)	0.683	0.781	0.770	0.785	0.839
Total Numbers	41	8	28	41	52
Species Richness	7	6	9	8	9

Table 2: Changes in Biodiversity Indices Between 2007 and 2011

a. Birds



b. Mammals

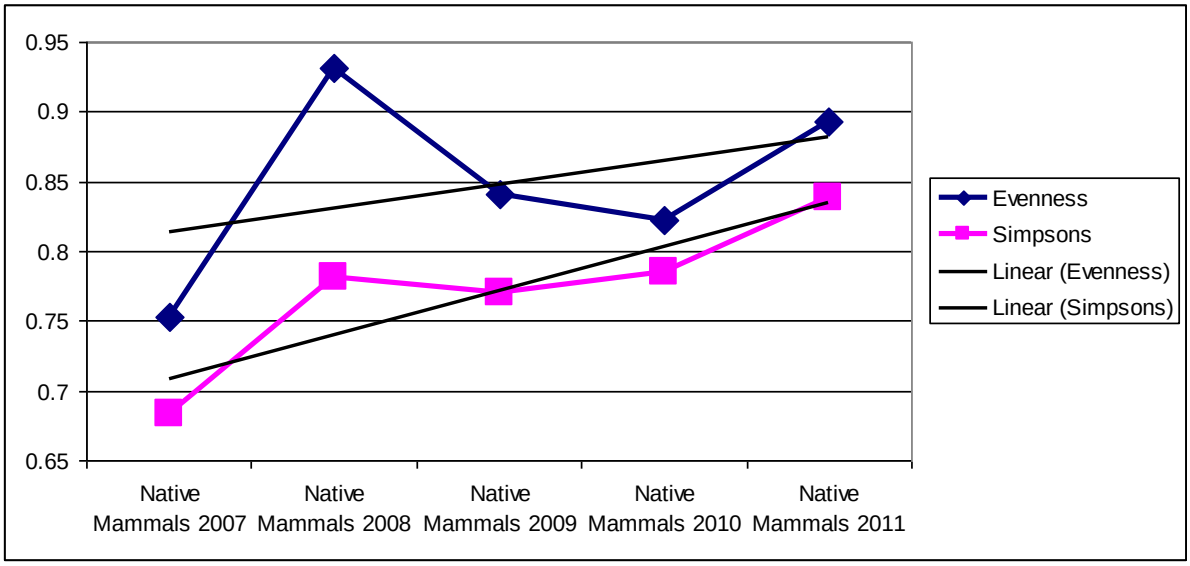
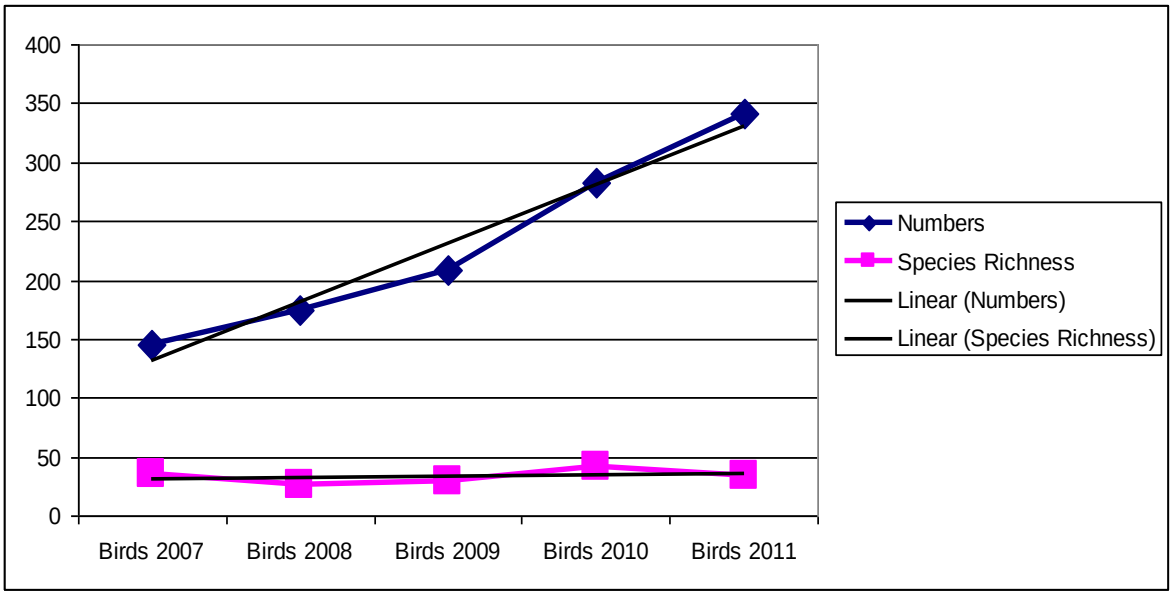
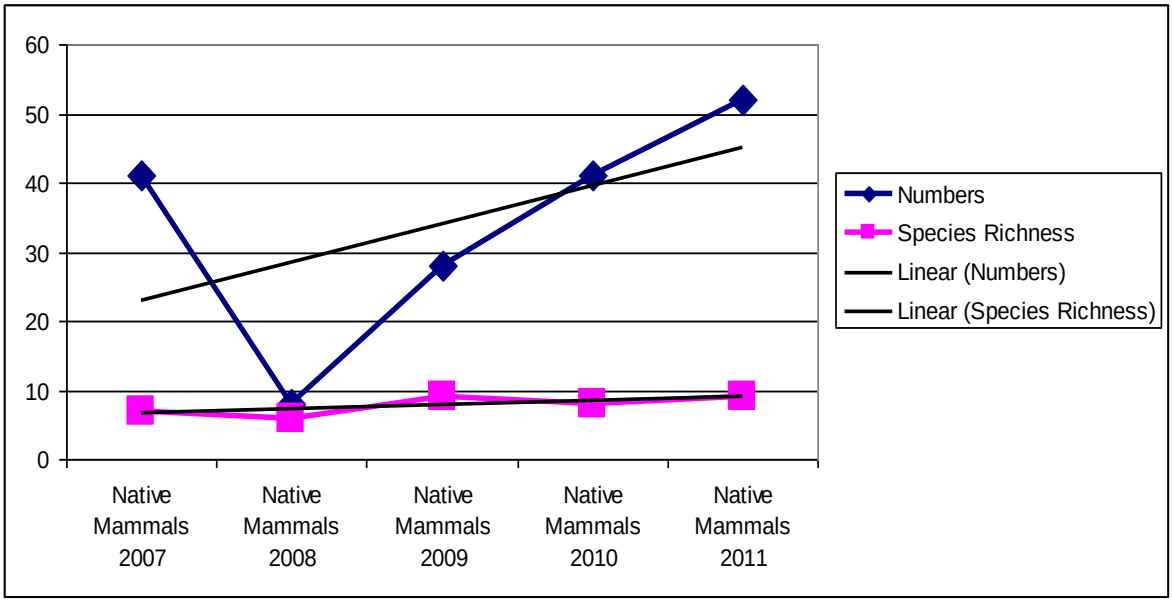


Table 3 : Changes in Numbers and Species Richness Between 2007 and 2011





Statistical analysis (non-parametric Kruskal-Wallis One Way Analysis of Variance on Ranks) of these results shows no significant differences for the biodiversity indices over the years. However, it appears that there has been a general increase in biodiversity values for birds and mammals over the years.

This has also seen an increase in numbers located and species richness measured.

The survey in autumn was successful, in terms of the number of individuals and diversity of species within the two main fauna groups surveyed. Also, there were sufficient numbers and

diversities of these fauna groups to be able to calculate a set of diversity indices that form part of the baseline monitoring database. There is now sufficient data accumulated to provide annual population estimates for all groups of fauna.

It was possible to assess any differences in the biodiversity and habitat condition of those sites sampling an area that will be subject to underground mining in the future. This comparison showed that there are no significant differences in the biodiversity and habitat complexity over the years. The changes in the physical environment do not appear to be reflected in the fauna assemblages.

Four threatened bird species were located during this year's autumn survey (Gang-gang Cockatoo, Scarlet Robin, Varied Sittella and Eastern Pygmy-possum). The Eastern Pygmy-possum was captured in a pit trap at a stand of Banksias near Long Swamp.

It is concluded that, at present, there are no discernable impacts from underground mining of LW29-31 at Baal Bone Colliery upon the fauna on the surface.

6.1.7 Flora

Gingra Ecological Surveys submitted their Spring 2010 survey on 8 December 2010.

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.

The autumn 2011 survey took place on 25th March 2011.

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 (see below) 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.

Modified Braun-Blanquet scale used in monitoring

1 = cover less than 5% of site and rare
2 = cover less than 5% of site and uncommon
3 = cover of less than 5% and common
4 = cover of 5-20% of site
5 = cover of 20-50% of site
6 = cover of 50-75% of site
7 = cover of greater than 75%

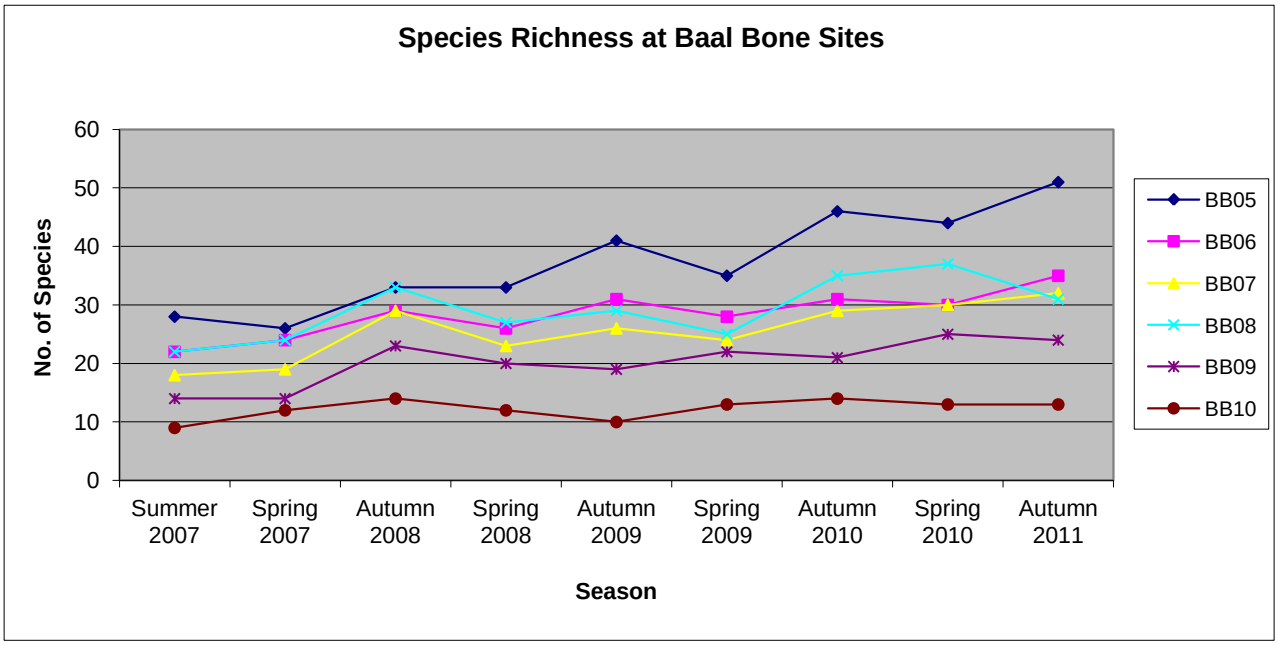
Results

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. Figure 7 shows species richness recorded across all sites during spring and autumn since the baseline data was obtained.

At the woodlands sites BB05, BB06 and BB07, species diversity in autumn 2011 was higher than at any other sampling over the monitoring period.

Figure 7. Species Richness at Baal Bone Vegetation Monitoring Sites



Weed Species

Exotic weeds were recorded at four sites in autumn 2011, with a total of three species, Dirty Dora (*Cyperus eragrostis*), Yorkshire Fog (*Holcus lanatus*) and Catsear (*Hypochaeris radicata*). The only weed at woodland sites was Catsear (*Hypochaeris radicata*).

Yorkshire Fog declined in abundance at the tow Long Swamp sites (BB09 & BB10). The decline from 2010 levels may be attributable to extended inundation within the Swamp favouring species adapted to wetter conditions.

Changes in Plant Species Distribution and Abundance

The following list shows new records of species at each site for autumn 2011:

BB05 Amyema pendulum
Boronia microphylla
Dichelachne parva
Eriochilus cucullatus
Todea barbara
BB06 Leucopogon lanceolatus
BB07 Eriochilus cucullatus
Wahlenbergia luteola
Xanthosia tridentata
BB08 Stylidium graminifolium
Styphelia tubiflora

BB09 Deyeuxia brachyathera
BB10 Arthropodium minus
Cyperus sp.
Deyeuxia brachyathera

The majority of these were orchids, lilies and grasses which are difficult to detect when not flowering.

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.

Species richness at the all sites had higher levels recorded during autumn 2011 in comparison to those recorded in 2007 and 2008.

Abundance of Yorkshire Fog declined in autumn 2011. This was most probably due to prolonged inundation of Long Swamp.

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.

6.1.8 Underground Water Make

Data continues to be collected from the mines dewatering bores, flow meters and data loggers regarding mines water discharges and underground water storage levels. Review of this data is continuing and the mine water model is currently being reviewed along with the post-closure mine water make model, which is scheduled for completion by the end of October, for inclusion in Baal Bone's Detailed Mine Closure Plan.

6.1.9 Ground Water, Aurecon

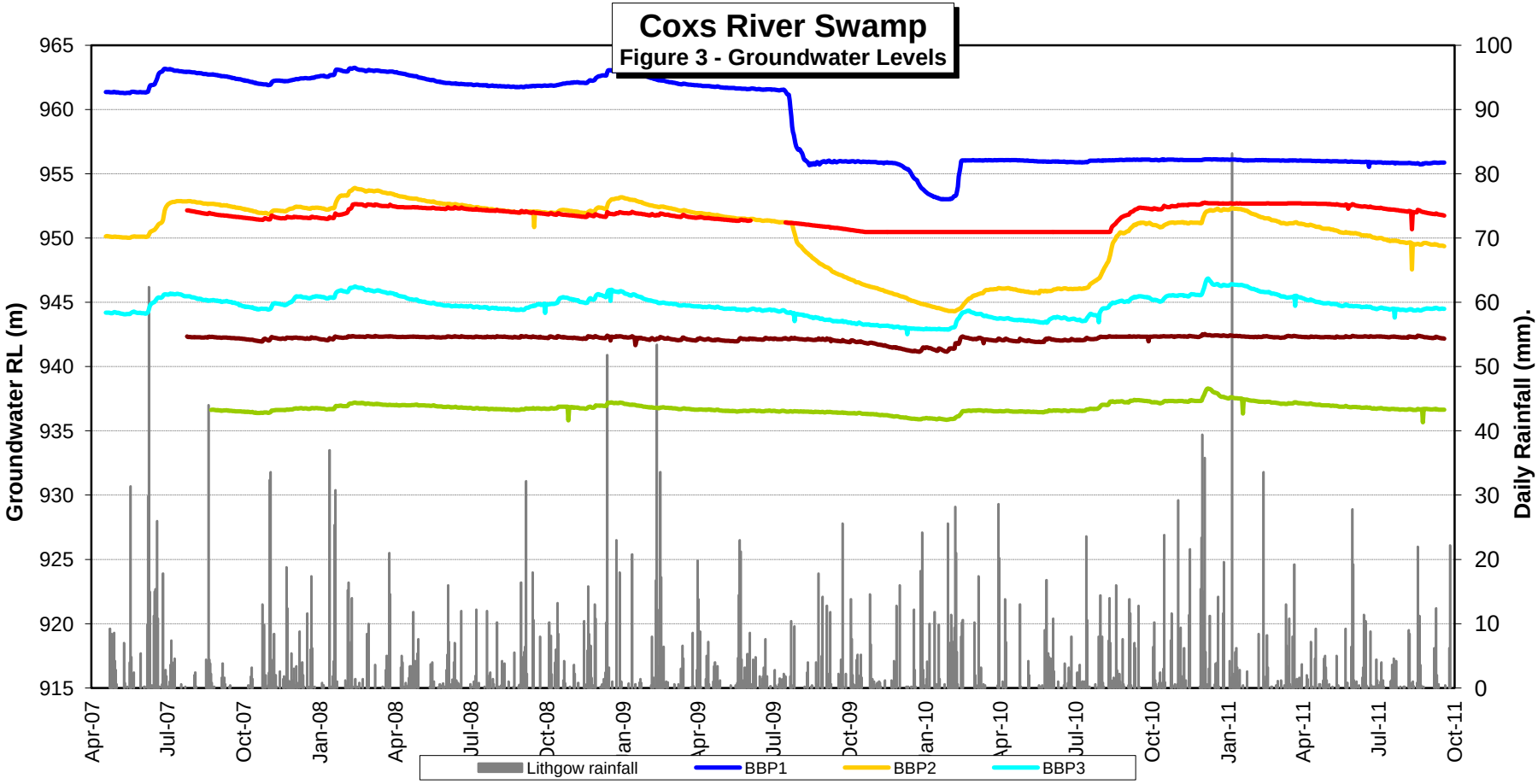
Aurecon monitors data loggers in the six piezometers on a regular basis to gather baseline data regarding groundwater level fluctuations in the vicinity of the Coxs River Swamp. Baseline data obtained prior to commencement of mining confirms a strong correlation between groundwater levels and prevailing climatic conditions, most particularly the relationship to rainfall.

Rainfall over this reporting period has been at or less than the long term average with June falls approximately average (72 mm) and July being less than half the average (25 mm). The long term rainfall excess / deficit is approaching 100 mm following the lower rainfall in this period.

Majority of the trends noted within the last period have continued for this current period. The flat piezometric levels observed in bores 1, 5 and 6 have all remained flat, while the slow declining trend in bores 2, 3 and 4 appear to be levelling out. A downstream gradient continues to be observed in the results, indicating flow from the upper to lower section of the swamp. The top end of the swamp has also dried out slightly, with less boggy ground to negotiate, which may well be due to the lower rainfall over the period

There are no unusual trends indicated within the dataset.

Figure 8- Coxs River Swamp Groundwater Levels



6.2 Subsidence Development (Summary of Survey Results)

Additional monitoring prisms have been installed and surveyed adjacent to the both the southern and northern "pinch points" of the Wolgan escarpment to provide further information.

Additional surveys of various subsidence monitoring lines have been undertaken during this reporting period. Results of these surveys relating to surveys conducted during this reporting period listed below. The results are all within predicted ranges. One minor exceedance of 38mm on E Line has previously been reported. A summary of the results are presented in **Table 4** below.

Table 4 – 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	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
F Line	21-01-2011	1400 – 1600	1418	9 – 21	12.0	32 – 52	26.1	400	333

G Line	09-03-2011	1400 – 1600	50	9 - 21	2.3	32 – 52	0.9	400	61
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)**
H Line	21-01-2011	1400 – 1600	5	9 - 21	1.1	32 - 52	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

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	1400 - 1600	5	9 - 21	0.7	32 - 52	0.2	400	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

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	1400 - 1600	7	9 - 21	0.8		0.5	400	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

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)
Northern Pinch Point Reflectors	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

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)
Northern Pinch Point Prisms	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

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)
Southern Pinch Point 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

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)
Southern Pinch Point 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

7 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 a remediation program with regard to the surface cracking are also considered to be appropriate and effective.

8 PROPOSED ADDITIONAL / OUTSTANDING MANAGEMENT ACTIONS

There are no current proposed or outstanding management actions to report.

9 CONCLUSIONS

During the reporting period mining of LW31 continued. As of 7 August 2011, the faceline of LW31 had retreated a total of 1593m.

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.

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

All other monitoring results are within expected / predicted parameters. Routine and scheduled seasonal monitoring will continue.

FIGURE 9: Subsidence Survey and Data Monitoring Locations (Source: *Baal Bone Colliery LW29-31 SMP Subsidence Monitoring Program*)

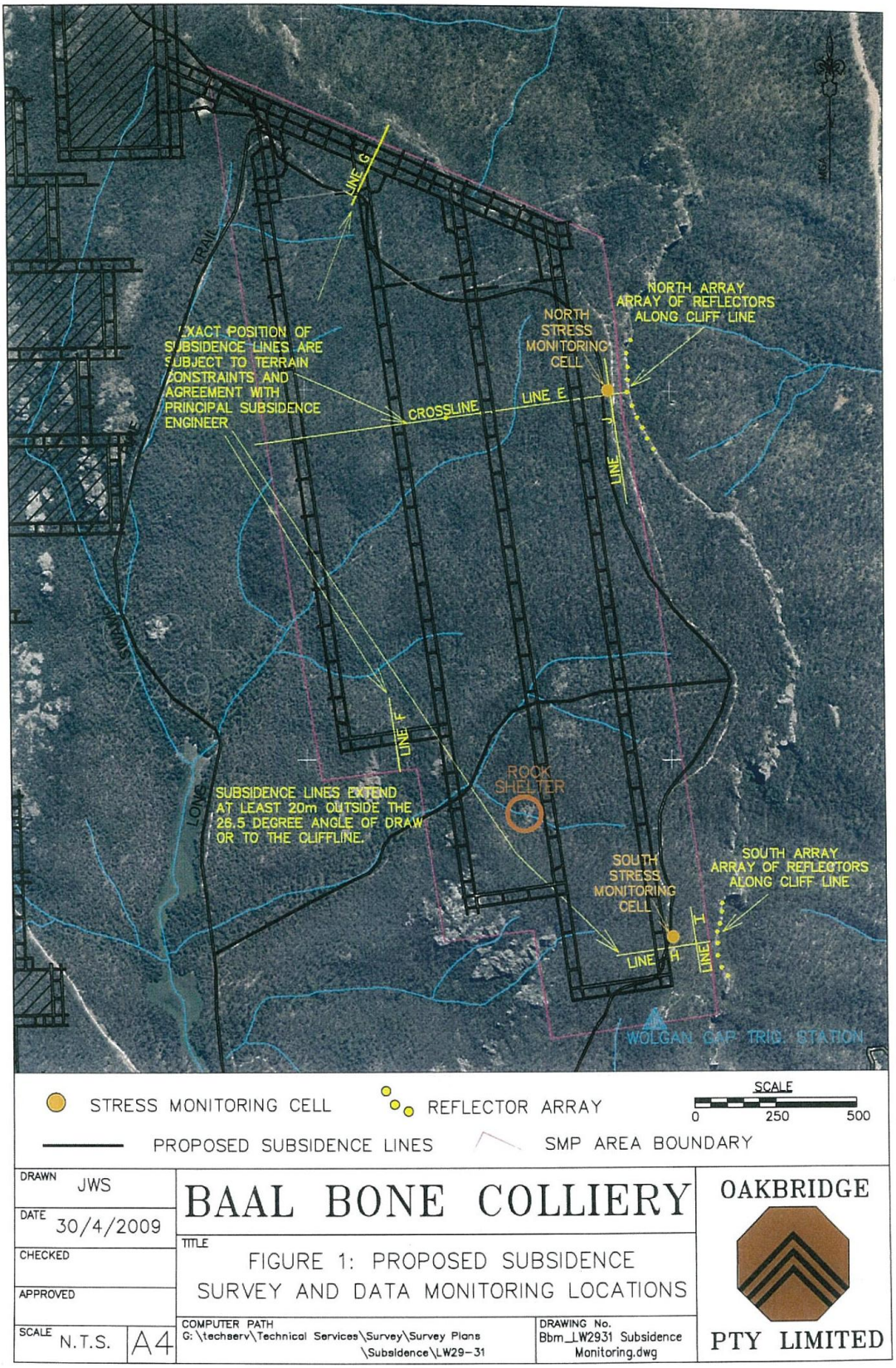


FIGURE 10: Location of Groundwater Observation Bores and Geological Structures

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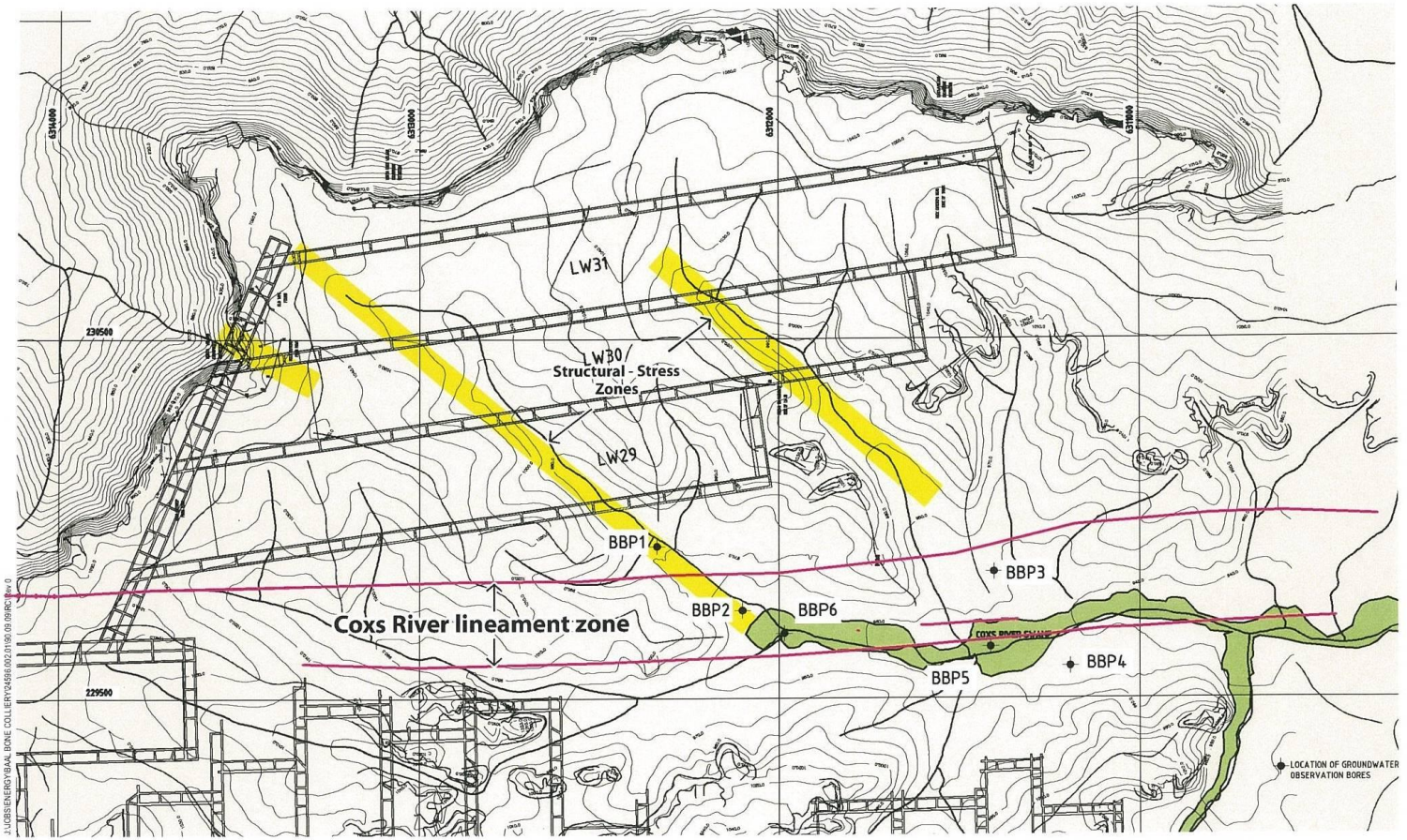

FIGURE 11: Survey Monitoring and Stress Cell Location North Pinch Point Area

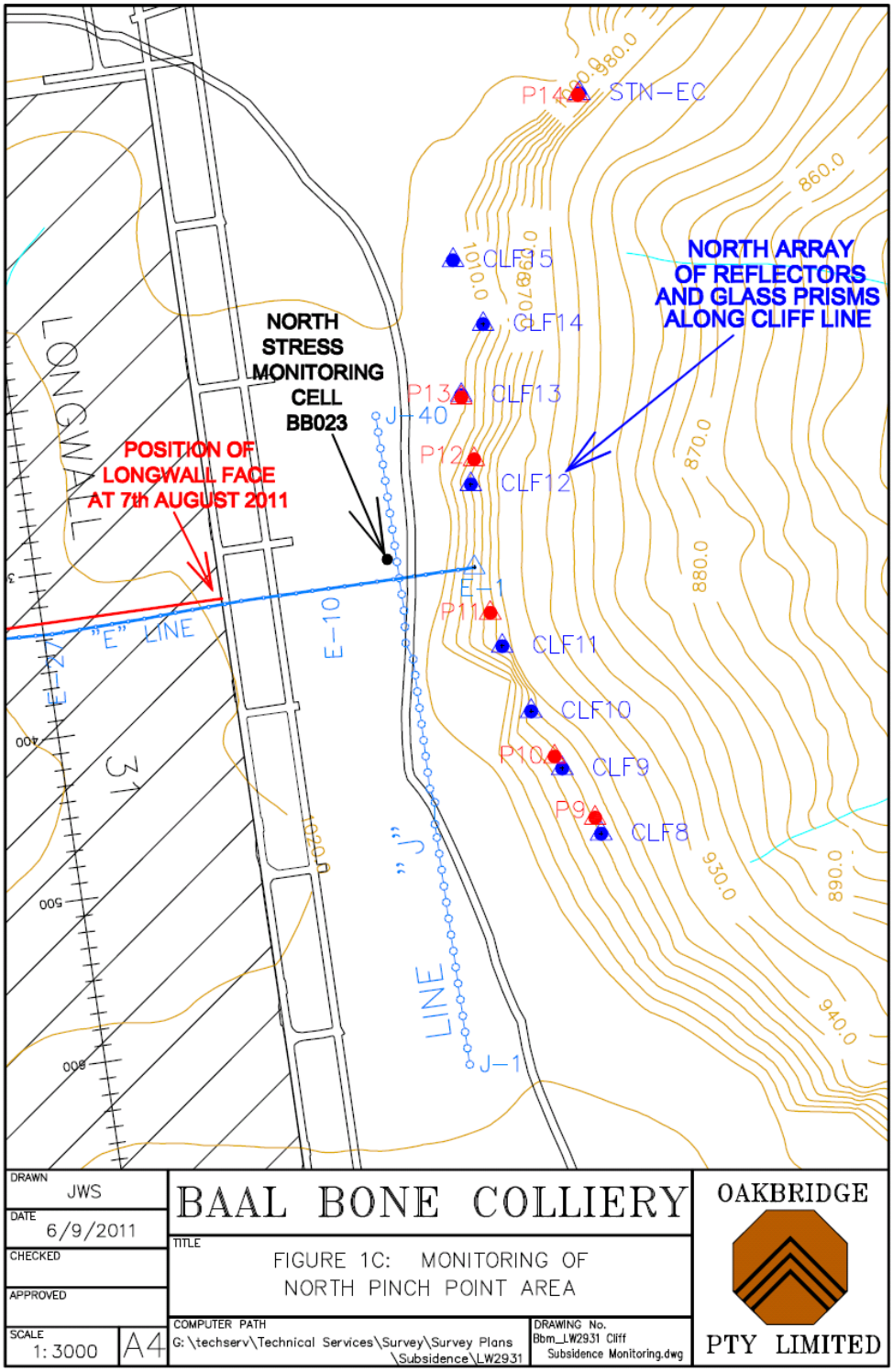

FIGURE 12: Survey Monitoring and Stress Cell Location South Pinch Point Area

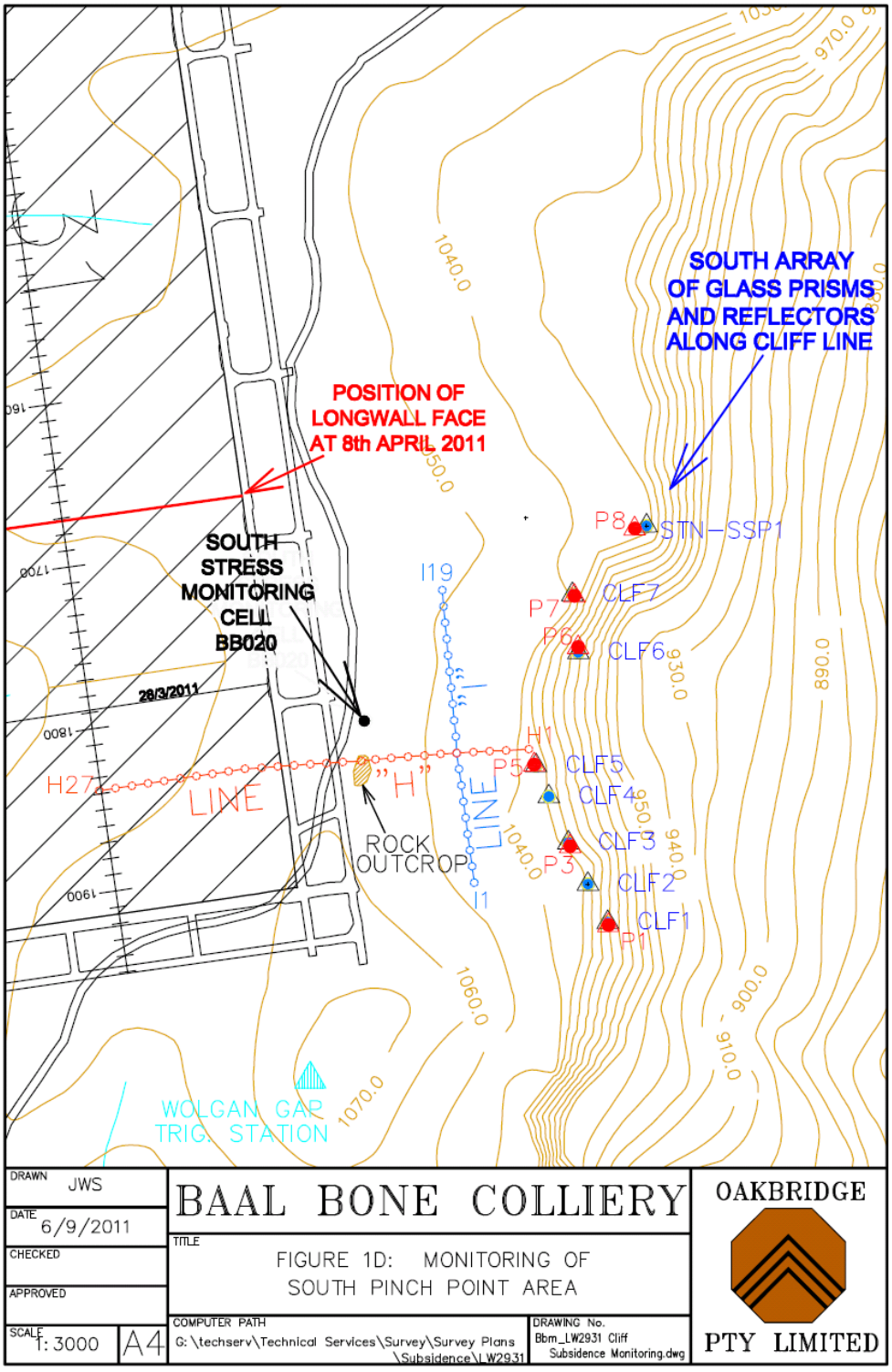

FIGURE 13 – Longwall Extraction Timing