



# Centennial Coal

Angus Place



***Longwalls 900W and 910  
Integrated SMP/Extraction Plan  
2015 Annual Report***

**Angus Place Colliery**

**June 2017**

**Approved 30 June 2017**

**Terry O'Brien**

**Mine Manager Angus Place**

# TABLE OF CONTENTS

<b>1. INTRODUCTION</b>	<b>1</b>
<b>2. PURPOSE AND SCOPE</b>	<b>3</b>
<b>3. REGULATORY REQUIREMENTS</b>	<b>5</b>
3.1. Longwalls 900W and 910 SMP Approval	5
<b>4. FACE POSITION OF THE LONGWALL</b>	<b>6</b>
<b>5. SUBSIDENCE MONITORING PROGRAM</b>	<b>8</b>
5.1. Subsidence Line Monitoring	8
5.2. Built Features	10
5.2.1. Endeavour Energy 66kV Powerline	10
5.2.2. Surface Photographic Monitoring	14
Forest Access Tracks	14
State Survey Marks	15
<b>6. SUBSIDENCE MANAGEMENT</b>	<b>16</b>
6.1. Aboriginal Heritage Sites	16
6.1.1. Heritage Monitoring Results	17
6.2. Natural Features	17
6.2.1. Natural Features Monitoring Results	18
<b>7. ENVIROMENTAL MONITORING PROGRAM</b>	<b>19</b>
7.1. Newnes Plateau Shrub Swamps	19
7.1.1. Newnes Plateau Shrub Swamps Photo Monitoring Results	20
7.2. Flora and Fauna	20
7.2.1. Flora Monitoring Results	20
7.2.2. Fauna Monitoring Results	21
7.3. Aquatic Ecology	23
7.3.1. Aquatic Ecology Monitoring Locations	23
7.3.2. Aquatic Ecology Monitoring Results	24
7.4. Groundwater	25
7.4.1. Groundwater Monitoring Results	25
7.5. Surface Water	26
7.5.1. Surface Water Monitoring Results	26
7.6. West Wolgan Creek	28
7.7. Rainfall	29
<b>8. CONCLUSIONS</b>	<b>30</b>

## Tables

Table 1.	Annual Report Requirements.....	5
Table 2.	Coal Resource Recovery.....	6
Table 3.	Powerline Monitoring Program Results.....	12
Table 4.	Flora and Fauna Monitoring Sites.....	20
Table 5.	Habitat Characteristics within Angus Place Colliery and Area 900/910 (2015).....	22
Table 6.	Aquatic Monitoring Locations.....	23
Table 7.	Summary of River Channel and Environment (REC) Scores – Spring 2015.....	25
Table 8.	Kangaroo Creek Upstream and Downstream Monitoring Results.....	27
Table 9.	Rainfall.....	29

## Figures

Figure 1.	Regional Locality.....	2
Figure 2.	900W and 910 Integrated SMP/Extraction Plan Project Area.....	3
Figure 3.	End Face Position of Longwall 900W .....	7
Figure 4.	Subsidence Monitoring Lines.....	9
Figure 5.	Built Features within 900W and 910 Project Area.....	10
Figure 6.	Power Pole #206 Facing North – 9 June.....	13
Figure 7.	2015 Total Station Survey subsidence monitoring history.....	14
Figure 8.	Aboriginal Heritage Sites within 900W and 910 Project Area.....	17
Figure 9.	Natural Features within 900W and 910 Project Area .....	18
Figure 10.	Environmental Monitoring Program within 900W and 910 Project Area .....	19
Figure 11.	Evenness and Simpsons Index of Biodiversity within the project area.....	21
Figure 12.	Mean Biodiversity Indices within 930 980 SMP Area and Area 900/910.....	23

## Appendices

Appendix 1	Subsidence Line Monitoring Results
Appendix 2	Photographic Monitoring Survey Results
Appendix 3	Total Station Survey Results
Appendix 4	Flora Monitoring Results
Appendix 5	Fauna Monitoring Results
Appendix 6	Aquatic Ecology Monitoring Results
Appendix 7	Notifications to Stakeholders

## 1. INTRODUCTION

Angus Place Colliery (Angus Place) is an underground coal mining operation located approximately five kilometres north of the village of Lidsdale, eight kilometres northeast of the township of Wallerawang and approximately 15 kilometres northwest of the city of Lithgow in the Blue Mountains region of NSW. It is bordered by Springvale Colliery to the south, Ivanhoe Colliery to the northwest and Wolgan Valley and Newnes Plateau to the north and east, respectively. The regional locality of Angus Place is shown on **Figure 1**.

An Integrated Subsidence Management Plan (SMP)/Extraction Plan was developed in accordance with Schedule 3, Condition 3 C of PA 06\_\_0021 (as modified) and the Draft Guidelines for the Preparation of Extraction Plans (DP&I, 2012). It was also prepared to satisfy the relevant conditions of the Angus Place mining tenements; which require an SMP to be prepared in accordance with the requirements of the Guidelines for Applications for Subsidence Management Approvals (2003).

The Extraction Plan was approved by the Department of Planning and Environment (DP&E) on 31 March 2014 and the SMP was approved by NSW Department of Trade and Investment, Regional Infrastructure and Services - Division of Resources and Energy (DTIRIS) on 8 April 2014 subject to conditions.

Regulatory requirements applicable to Integrated SMP Extraction Plan are outlined in Section 3.

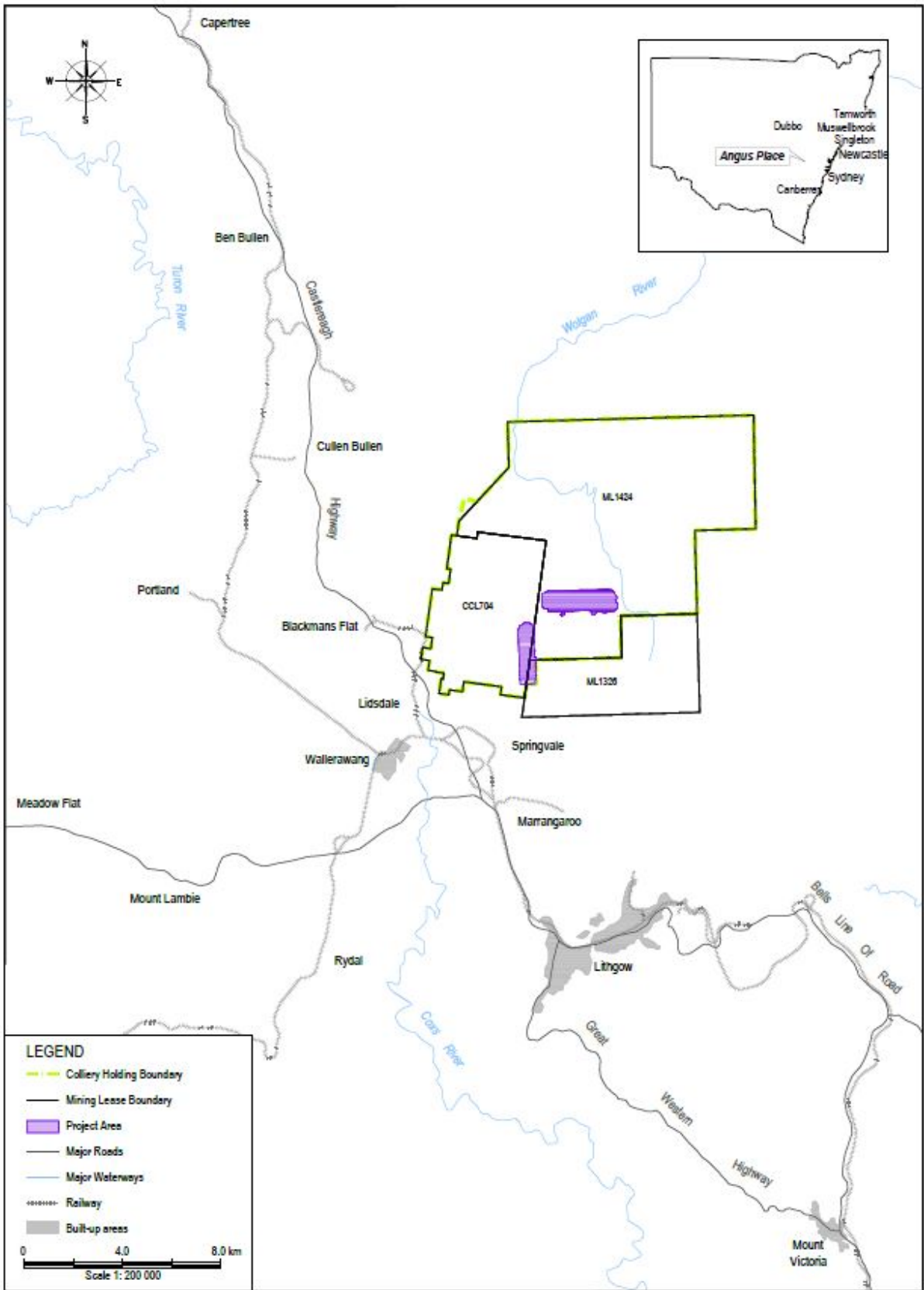


Figure 1. Regional Locality

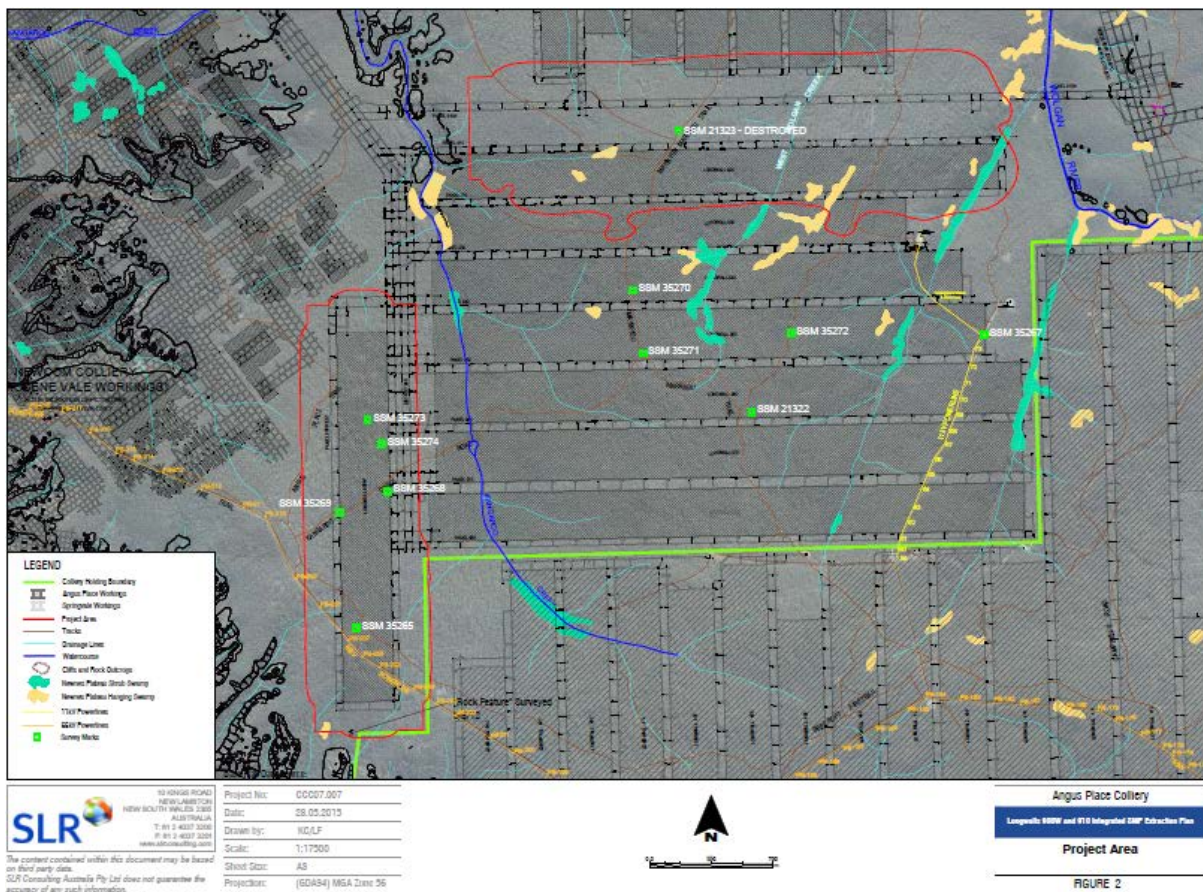
## 2. PURPOSE AND SCOPE

The purpose of this document is to report in accordance with and comply with the requirements of the 900W and 910 SMP Approval.

The reporting program is specific to the Integrated SMP/Extraction Plan for 900W and 910 which is a portion of the Angus Place Colliery Holding. The Project Area was calculated by combining the areas bound by the following limits:

- A 26.5° angle of draw line from the limit of proposed extraction; and
- The predicted limit of vertical subsidence, taken as the 20 mm subsidence contour resulting from the extraction of the Longwalls 900W and 910.

The Project Area is shown in **Figure 2** below.



**Figure 2. 900W and 910 Integrated SMP/Extraction Plan Project Area**

This is the second Annual Report prepared for the Project Area and covers the period from 8 April 2015 to 8 April 2016. Longwall 900W commenced extraction on 30 April 2014 and was completed on 15 February 2015.

This report considers the subsidence and environmental monitoring results for the above mentioned time period including additional data which has been collected since extraction has been completed to consider post mining impacts. Longwall 910 extraction has not commenced as the mine was placed on care and maintenance on 28 March 2015.

As Longwall 900W is the first panel to be extracted under the 900W and 910 SMP Approval, where appropriate, monitoring results have been compared to previous panels 930 – 980 which is the adjacent SMP area to the project area.

Monitoring results are shown for Longwall 900W, as Longwall 910 is outside the angle of draw any data obtained represents baseline condition. Baseline data will be shown comparatively when extraction is planned for the area.

### 3. REGULATORY REQUIREMENTS

#### 3.1. Longwalls 900W and 910 SMP Approval

In accordance with the requirements of relevant mining tenements, Angus Place received SMP Approval from the then NSW Department of Primary Industries (now DTIRIS) on 8 April 2014 for secondary extraction within Longwalls 900W and 910.

Condition 18 of the SMP Approval requires the leaseholder to prepare an Annual Report to be submitted to the Secretary within twelve months of the date of the approval and annually thereafter. It should be noted that the requirement of Condition 18 of the SMP Approval may be satisfied via an Annual Review prepared under conditions of development consent or project approval.

This Report covers the Longwall 900W period from 8 April 2015 until 8 April 2016. The Annual Report includes the following:

**Table 1. Annual Report Requirements**

<b>Condition</b>	<b>Condition Requirement</b>	<b>Section Addressed</b>
18a	A summary of the subsidence and environmental monitoring results for the year;	Section 5 – Section 7
18b	An analysis of these monitoring results against the relevant; <ul style="list-style-type: none"><li>• Impact assessment criteria;</li><li>• Monitoring results from previous panels; and</li><li>• Predictions in the SMP;</li></ul>	Section 5 – Section 7
18c	Any trends in the monitoring results over the life of the activity; and	Section 5 – Section 7
18d	Actions taken to ensure adequate management of any potential or actual subsidence impacts due to mining.	Section 6



## 4. FACE POSITION OF THE LONGWALL

The extraction of Longwall 900W commenced on 30 April 2014. Longwall 900W completed extraction on 15 February 2015, a total distance of 2084.5m.

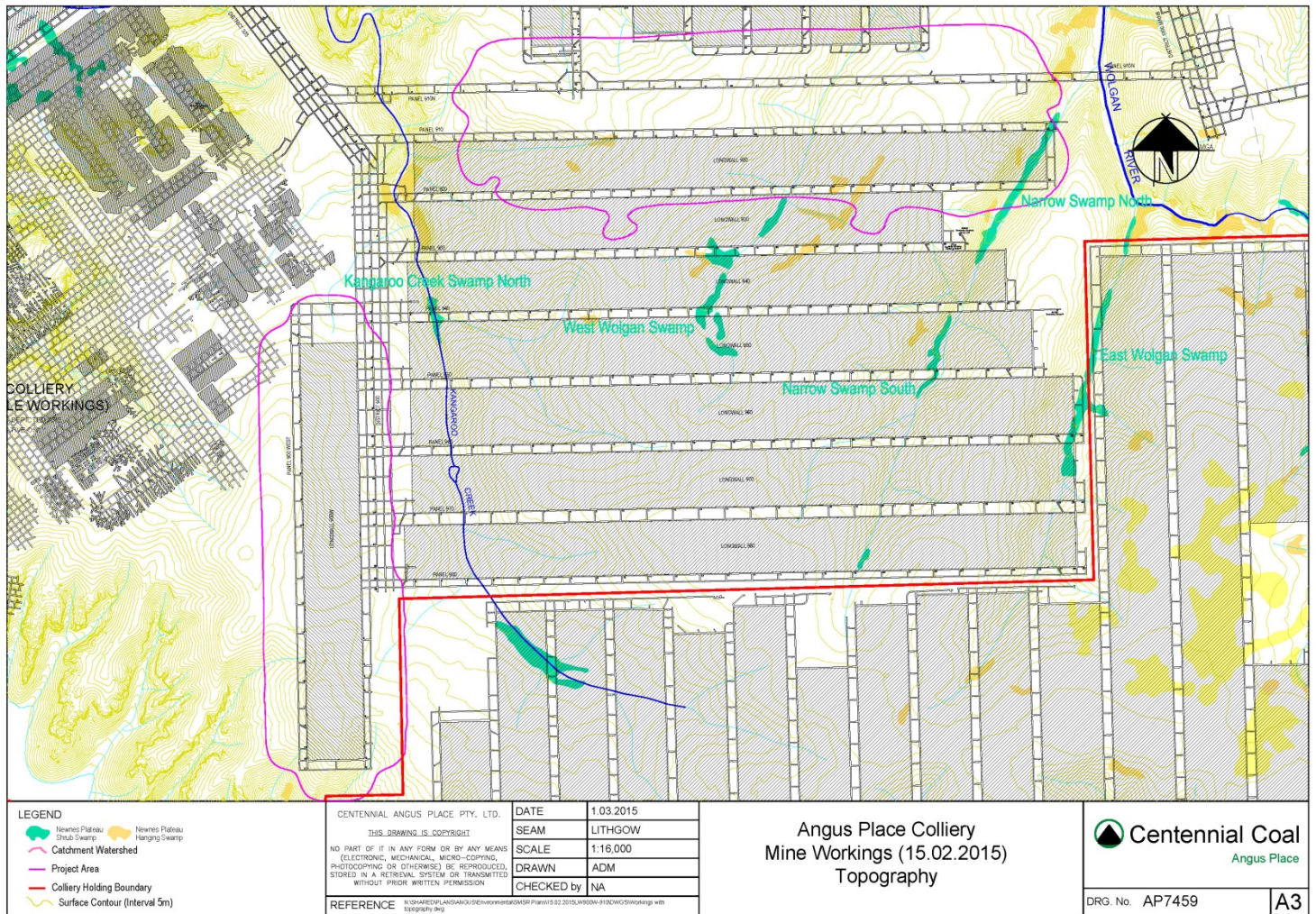
The resource recovery is shown in **Table 2** below.

Secondary extraction of Longwall 910 has not commenced. The end face position of 900W is shown in **Figure 3**.

**Table 2. Coal Resource Recovery**

<b>Panel</b>	<b>Total Longwall Tonnes Predicted</b>	<b>Actual Longwall Tonnes Extracted</b>
900W	2,988,657	2,948,968

A slight variation (1.3%) exists between the predicted and actual extraction tonnes due to the difference in geological conditions.



**Figure 3. End Face Position of Longwall 900W**

## 5. SUBSIDENCE MONITORING PROGRAM

### 5.1. Subsidence Line Monitoring

The location of subsidence monitoring lines relevant to the Project Area is presented in **Figure 4**.

Subsidence Line H was installed to monitor subsidence, strain, tilt and angle of draw associated with the extraction of Longwalls 970 and 900W.

Subsidence Line I was installed at the southern end of Longwall 900W to monitor subsidence, strain, tilt and angle of draw.

In their report of 25 February 2016, Ditton Geotechnical Services Pty Ltd (DgS) suggested the development of subsidence above LW 900W was practically complete (<92% the predicted maximum had developed after 10 months since panel completion) and the rate of subsidence at the time (2 mm/week) was unlikely to cause further impact at the surface. DgS concluded that subsidence monitoring lines H and I were no longer required and could be removed.

The DgS assessment is provided in **Appendix 1**.

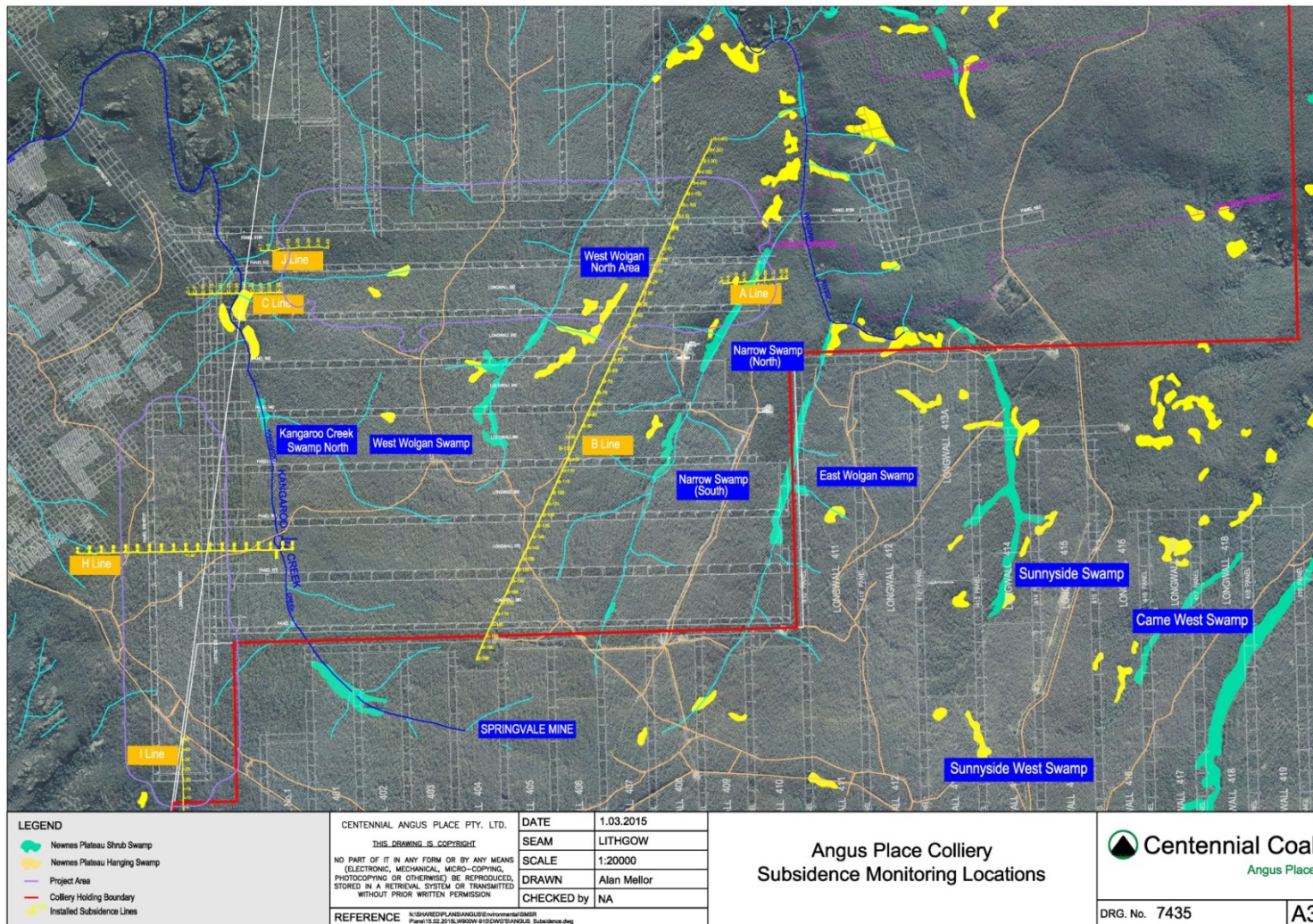
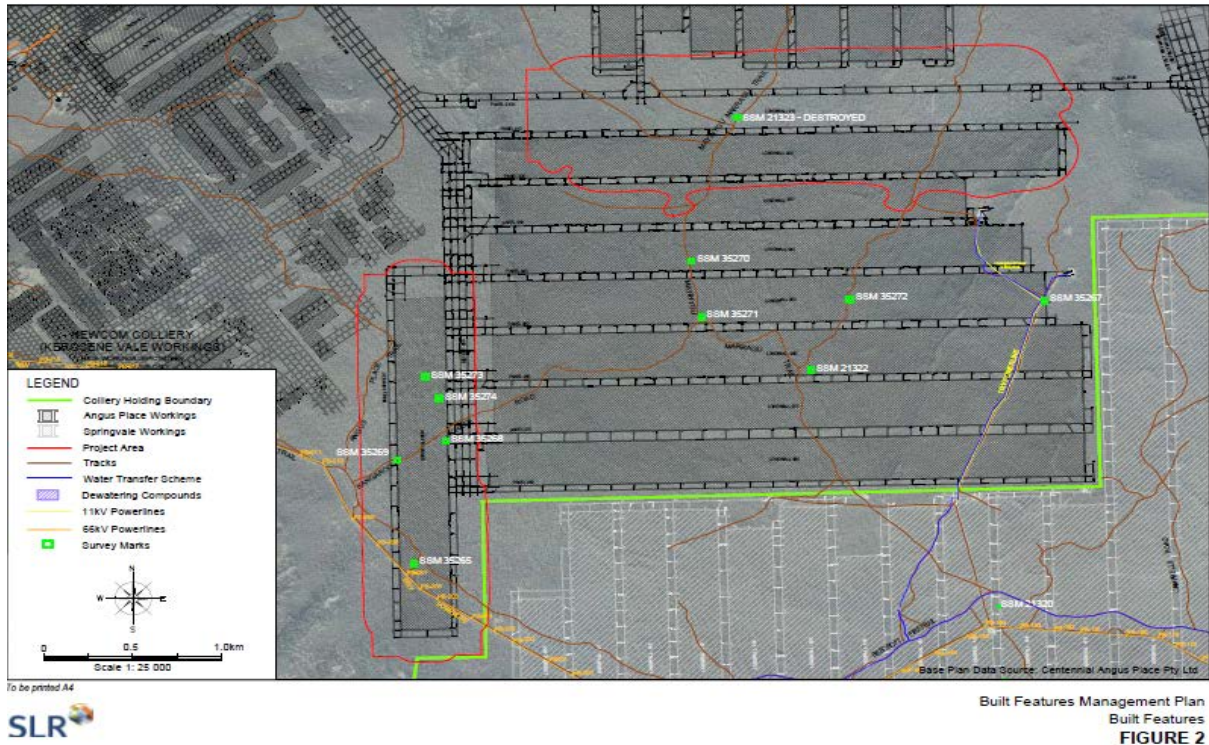


Figure 4. Subsidence Monitoring Lines

## 5.2. Built Features

The built features within the Project Area are shown in **Figure 5**.



**Figure 5. Built Features within 900W and 910 Project Area**

### 5.2.1. Endeavour Energy 66kV Powerline

There is a 66kV suspended powerline located above the commencing (southern) end of Longwall 900W at Angus Place. This powerline runs in a general northwest - southeast direction over the longwall panel and is owned by Endeavour Energy. The powerline is suspended using timber power poles that are approximately 15m high. There are five poles (204 – 208) located within the Project Area which are separated by distances ranging from 77m - 266m. The Endeavour Energy 66kV powerline was monitored pre and post-mining for evidence of any subsidence related impacts.

### 2014 Total Station Survey and Photographic Monitoring

During the 2014 reporting period, soon after the commencement of secondary extraction within Longwall 900W, Angus Place extracted coal from beneath the 66 kV powerline. Subsidence monitoring of the powerline was undertaken in accordance with the approved *Longwall 900W Powerlines Management Plan* which included surveys of individual power poles that were predicted to

be affected by subsidence. A Total Station Survey undertaken on 17 July 2014 identified that the predicted subsidence at two poles (#205 and #206) were exceeded by 49 mm and 43 mm, respectively. The predicted subsidence at three poles (#209 – #211) were also exceeded by 9 mm – 25 mm, however these results are within the range of possible survey accuracy limits.

In accordance with the requirements of the SMP Approval, Angus Place notified relevant stakeholders (Section 6) of the higher than predicted subsidence at poles #205 and #206 and an investigation of the exceedance was undertaken by DgS. The investigation considered that the exceedances of subsidence predictions were likely to be due to one of the following causes:

- The predictions were based on smooth profile contours and may vary within +/- 10 % due to natural discontinuous rock mass behaviour during subsidence development;
- The subsidence profile that has developed above the panel has been skewed slightly to the east due to Kangaroo Creek valley; or
- The presence of Type 2 faulting across the south west corner of the panel may have influenced subsidence behaviour at the pole locations.

Subsequently the investigation by DgS (2014) recommended that the predicted value for all poles should be increased by 15 % to allow for the residual subsidence that is likely to occur over the following year. The subsidence model was revised and the amended predictions were presented to Endeavour Energy.

### **2015 Total Station Survey and Photographic Monitoring**

During the 2015 reporting period subsidence monitoring of the powerline was undertaken in accordance with the approved *Longwall 900W Powerlines Management Plan* which included surveys of individual power poles and photographic monitoring. Details are provided in **Table 3**.

Photographic monitoring in the reporting period indicated there was no impact from mining observed.

Total Station Surveys were conducted on 28 July 2015 and 8 December 2015. The Total Station Survey of 28 July 2015 identified a maximum difference in subsidence over the previous survey of 30 January 2015 of 20mm at Stays 3 and 6 on Power Pole #206, shown in **Figure 6**. The December survey identified a maximum difference in subsidence over the previous survey of 28 July 2015 of 32mm at the top of Power Pole #208.

The Strain and Tilt values calculated for each survey were consistent with previous surveys where power poles had been undermined.

**Table 3. Powerline Monitoring Program Results**

Monitoring Method	Longwall Chainage	Date	Comment/Results
Photographic Monitoring Survey	189.2m	06/01/2015	<p>At the time of the survey Longwall 900W had retreated 1995.3 meters with the longwall face having undermined all the power poles on the 66kv powerline above this longwall.</p> <p>No impact from mining observed when compared to pre-mining condition.</p>
	Longwall 900W Completed 15 February 2015 + 1 month	18/03/2015	<p>At the time of the survey Longwall 900W was completed having retreated a total of 2084.5 meters.</p> <p>No impact from mining observed when compared to pre-mining condition.</p>
		09/06/2015	Visual Inspections of the site identified no evidence of damage
		28/07/2015	Visual Inspections of the site identified no evidence of damage
		09/09/2015	Visual Inspections of the site identified no evidence of damage
		08/12/2015	Visual Inspections of the site identified no evidence of damage
		09/12/2015	Visual Inspections of the site identified no evidence of damage
Total Station Survey	Longwall 900W Completed 15 February 2015 + 6 months	28/07/2015	<p>The maximum difference in subsidence measured between this and the previous survey of 30 January 2015 is 20mm at Stay 3 and 6 on Power Pole #206.</p> <p>Calculated Strain and Tilt values were consistent with previous surveys where power poles had been undermined.</p>
	Longwall 900W Completed 15 February 2015 + 10 months	08/12/2015	<p>The maximum difference in subsidence measured between this and the previous survey of 28 July 2015 is 32mm at the top of Power Pole #208.</p> <p>Calculated Strain and Tilt values were consistent with previous surveys where power poles had been undermined.</p>

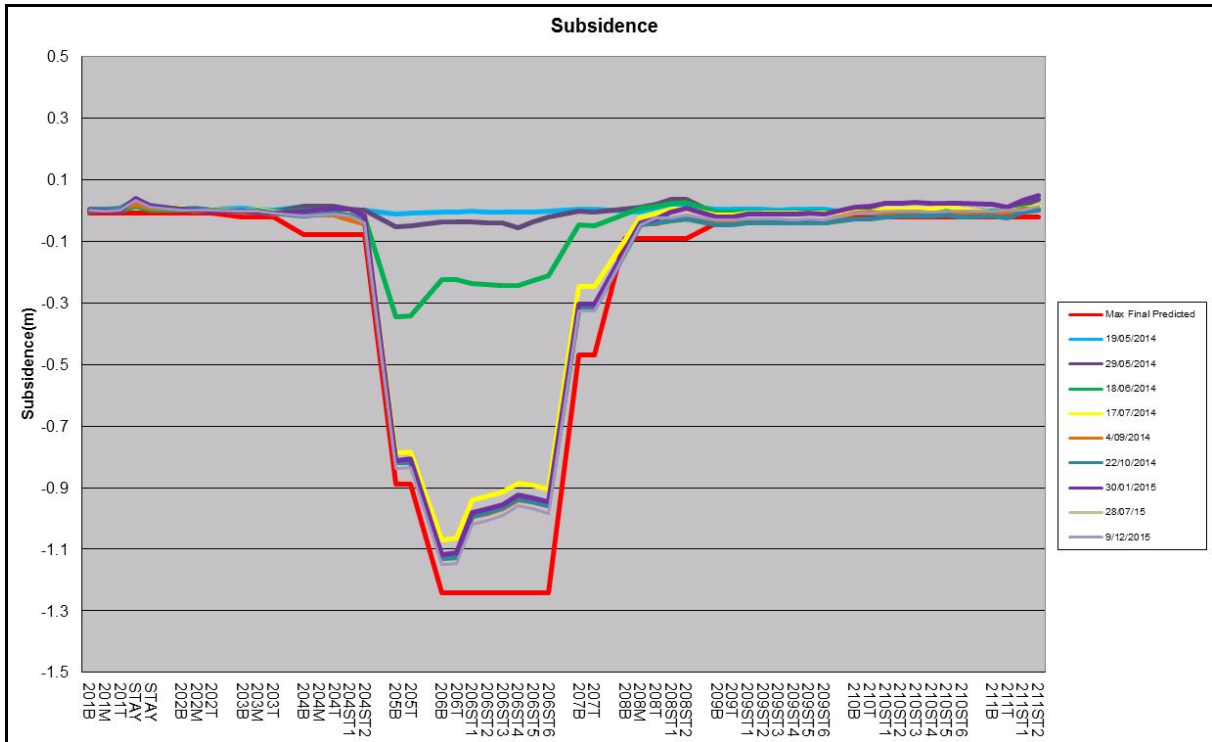


**Figure 6. Power Pole #206 Facing North – 9 June 2015**

A summary of the Total Station Survey data is shown in **Figure 7**.

Results from the Photographic Monitoring Surveys (**Appendix 2**) and the Total Station Surveys (**Appendix 3**) were provided to the relevant stakeholders in accordance with the *Longwall 900W Powerline Management Plan*.





**Figure 7. Total Station Survey subsidence monitoring history**

### 5.2.2. Surface Photographic Monitoring

Surface photographic monitoring was undertaken by an external consultant and results were reviewed by the Angus Place Environment and Community Officer. This photographic record is maintained at the Colliery.

### Forest Access Tracks

A number of publicly-accessible forest tracks are located within the Project Area including Kangaroos Creek Road, Beecroft Fire Trail, Mayinygu Marragu Trail and Angus Place Trail. These are unsealed roads managed by the Forestry Corporation of NSW (FCNSW). Mayinygu Marragu Trail is located above Longwall 910, all other tracks are associated with Longwall 900W.

Visual inspections, including photo monitoring, of access tracks were to be conducted monthly during secondary extraction within 500m of Longwalls 900W and 910. Inspections were to continue for four consecutive months following the completion of secondary extraction within Longwalls 900W and 910, with a final inspection conducted 12 months after completion of secondary extraction of Longwalls 900W and 910.

Hairline cracking identified on 16 July 2014 on the Beecroft Track was no longer visible after an inspection of 7 August 2014. Cracking identified on an access track on the northern end of Longwall 900W on 14 January 2015 had almost completely closed over when inspected on 23 February 2015.

No additional cracking has been identified from following photo monitoring surveys conducted during the 2015 reporting period.

### State Survey Marks

There are six permanent state survey control marks associated with the Project Area. Five state survey marks are associated with Longwall 900W, these being SSM35265, SSM35268, SSM35269, SSM35273 and SSM35274. The sixth mark, being SSM21323, is located above Longwall 910, however this mark has been destroyed. The locations of these survey marks are shown in **Figure 5**.

On the 30<sup>th</sup> of April 2014 the Survey Control Information Management System (SCIMS) search was completed and the Survey Control Branch was notified that the 5 marks were in the 900W subsidence area and that extraction of Longwall 900W could commence on the 30<sup>th</sup> of April 2014. In correspondence with the senior surveyor (Survey Infrastructure and Geodesy, Land Property and Information), Angus Place did not need to resurvey the marks within the subsidence footprint as they were all of very low accuracy.

## 6. SUBSIDENCE MANAGEMENT

Potential subsidence induced impacts resulting from the secondary extraction of Longwall 900W during the reporting period were undertaken in accordance with the approved Longwalls 900W and 910 Integrated SMP/Extraction Plan. The Integrated SMP/Extraction Plan includes the following Management Plans:

- Site Water Management Plan;
- Flora and Fauna Management Plan;
- Longwalls 900W and 910 Heritage Management Plan;
- Longwall 900W Powerlines Management Plan;
- Longwalls 900W and 910 Built Features Management Plan;
- Longwalls 900W and 910 Land Management Plan;
- Longwalls 900W and 910 Rehabilitation Management Plan;
- Longwalls 900W and 910 Subsidence Monitoring and Reporting Program;
- Longwalls 900W and 910 Public Safety Management Plan;
- Longwalls 900W and 910 Kangaroo Creek Management Plan;
- Longwalls 900W and 910 Subsidence Community Consultation Process;
- Longwalls 900W and 910 Environmental Monitoring Program; and
- Longwalls 900W and 910 Coal Resource Recovery Plan.

Each management plan contains a Trigger Action Response Plan (TARP). Monitoring results are reviewed against the appropriate TARP and response measures are undertaken accordingly.

No subsidence impact notifications were made to stakeholders in the 2015 reporting period.

### 6.1. Aboriginal Heritage Sites

A Rock Shelter with PAD has been identified to the west of Longwall 910, noting this is situated outside the Project Area. The Rock Shelter with PAD (45-12692) is located approximately 465m to the west of Longwall 910 and 280 m from the Project Area. All other sites that have been previously registered on the Aboriginal Heritage Information Management System (AHIMS) database are also located outside the Project Area. No items of European historical significance or potential for archaeological deposit were identified within the Project Area. Aboriginal Heritage sites are shown in **Figure 8**.

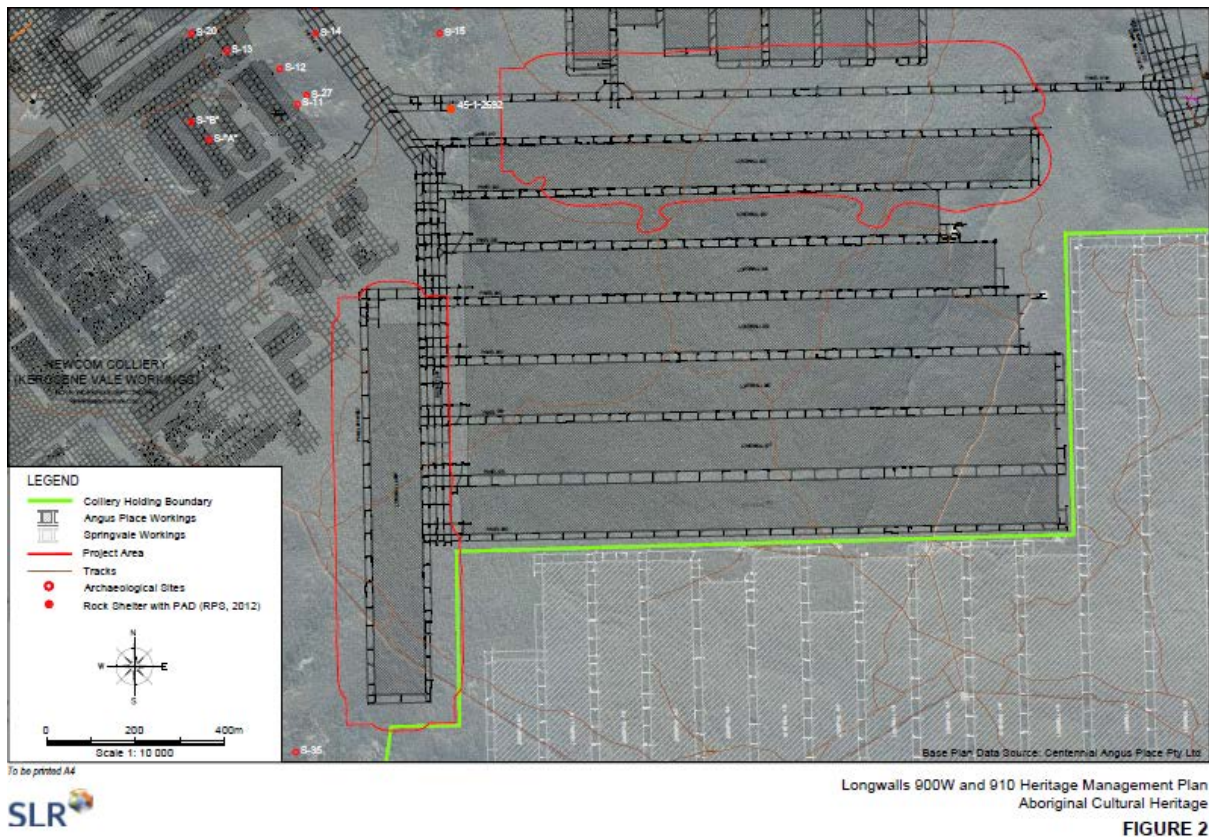


Figure 8. Aboriginal Heritage Sites within 900W and 910 Project Area

### 6.1.1. Heritage Monitoring Results

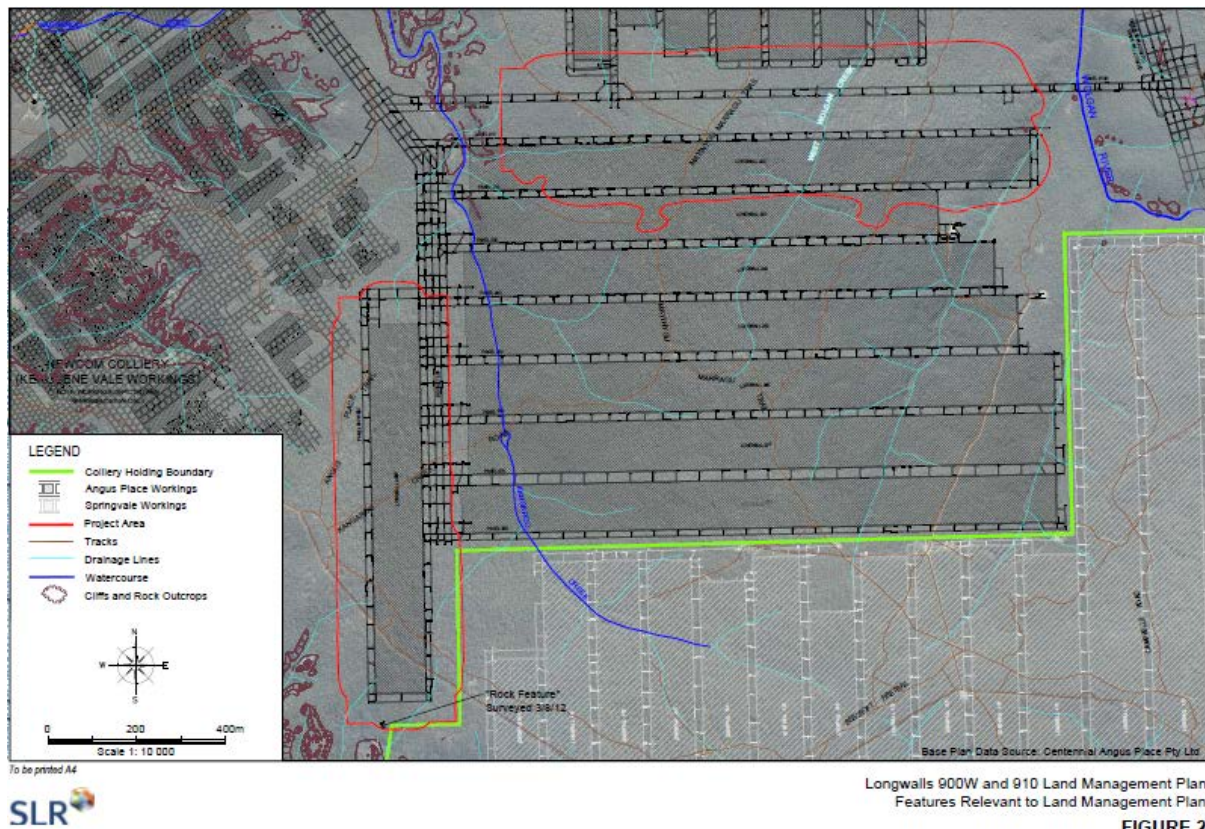
There was no subsidence from the extraction of Longwalls 900W and 910 predicted in the area of the Rock Shelter with PAD.

As the heritage monitoring program is specific to the extraction of Longwall 910 there has been no monitoring required during the reporting period. Longwall 910 is not planned to be extracted until the recommencement of mining.

### 6.2. Natural Features

There are no significant clifflines (i.e. greater than 20m in height) or rock features (between 5m and 20m in height) located within the 26.5° angle of draw line from the limit of extraction within Longwalls 900W and 910. The nearest rock feature is located approximately 175m south of the commencing end of Longwall 900W. This feature is located approximately 17m within the 20mm subsidence contour and is subsequently located within the Project Area. The nearest cliffline is located approximately 275m west of the finishing end of Longwall 910. The location of all clifflines and rock features in proximity to the Project Area are shown on **Figure 9**.

There is one ephemeral drainage line located above Longwall 910 known as West Wolgan Creek, and there are two first order tributaries of Kangaroo Creek located above Longwall 900W. The locations of drainage lines associated with the Project Area are shown on **Figure 9**.



**Figure 9. Natural Features within 900W and 910 Project Area**

### 6.2.1. Natural Features Monitoring Results

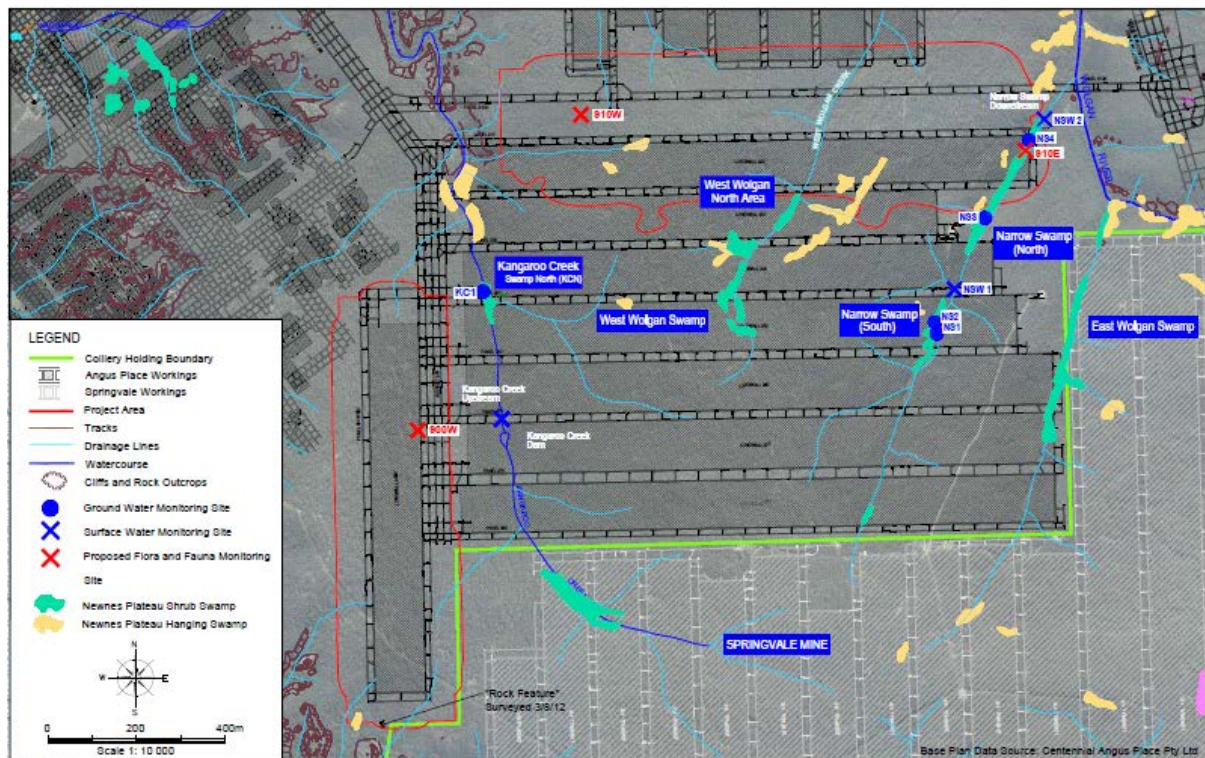
Rock features, cliff lines, West Wolgan Creek, tributaries of Kangaroo Creek and drainage lines within and in close proximity to the Project Area were monitored pre and post mining for evidence of any subsidence related impacts such as cracking, ponding or erosion and sedimentation.

A comprehensive photographic program was developed to include Natural and Built Features. The program reviews features relevant to the extraction of the Longwall on a monthly basis. Photographs record the current condition and can be compared to pre-mining conditions. Results from the photo monitoring showed no adverse impacts requiring a response measure to be undertaken. Land performance measures were met in accordance with PA 06\_0021, Schedule 3 - Condition 3.

This photographic record is maintained at the Colliery and Photo monitoring reports from the period are include in **Appendix 2**.

## 7. ENVIRONMENTAL MONITORING PROGRAM

The Environmental Monitoring Program for 900W and 910 focuses on the Project Area. Monitoring requirements have been defined by the secondary extraction of these longwalls which have continued since mining.



Longwalls 900W and 910 Environmental Monitoring Program  
Environmental Monitoring Locations

FIGURE 2

Figure 10. Environmental Monitoring Program within 900W and 910 Project Area

### 7.1. Newnes Plateau Shrub Swamps

Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps are listed as being an Endangered Ecological Community (EEC) under the NSW *Threatened Species Conservation Act 1995* (TSC Act). Both of these vegetation communities also correspond with the Temperate Highland Peat Swamps on Sandstone EEC listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Longwalls 900W and 910 do not mine directly under any Temperate Highland Peat Swamps on Sandstone but Longwall 910 will mine adjacent to Narrow Swamp which has been previously undermined.

### 7.1.1. Newnes Plateau Shrub Swamps Photo Monitoring Results

Photographic monitoring sites have been established for each swamp that is associated with or in close proximity to the Project Area, including Kangaroo Creek Swamp, Narrow Swamp and West Wolgan Swamp.

The final photographic monitoring survey of Kangaroo Creek area was completed in December 2015. This photographic report is included in **Appendix 2**. No anomalies were detected by comparing the pre-mining and post-mining results for 900W.

## 7.2. Flora and Fauna

Monitoring of flora and fauna is undertaken in accordance with the *Longwalls 900W and 910 Environmental Monitoring Program* and *Flora and Fauna Management Plan*. Baseline monitoring at one monitoring site for flora and fauna associated with Longwall 900W was undertaken by RPS in Spring 2013, and Summer and Autumn 2014.

The following table outlines the impact sites for flora and fauna.

**Table 4. Flora and Fauna Monitoring Sites**

Longwall	Monitoring Site	Approximate Coordinates MGA Zone 56	Establishment Date
900W	Forest Impact Site Two	6305594 233622	Spring 2013
910	Forest Impact Site One	6303872 232790	
	Swamp Impact Site One	6305413 236193	
900W	Forest Control One	6303899 233433	
910	Swamp Control One	6305042 235981	

### 7.2.1. Flora Monitoring Results

Surveys have been conducted in Spring, Autumn and Summer since base line monitoring was established in 2013. The baseline report presents the condition prior to the monitoring sites being undermined and is presented in **Appendix 4**. As specified in the Longwall 900W and 910

Environmental Monitoring Program, flora monitoring was to be undertaken in Summer, Autumn and Spring for 12 months after secondary extraction of the 900W longwall.

The monitoring results indicate minimal change in species composition across summer, spring and autumn in 2015. Seasonal fluctuations in observable species richness are likely to have accounted for the changes that did occur between summer 2015 and spring 2015. With exception to 'Forest Impact Site 1', spring monitoring revealed the highest level of species richness in each monitoring location. With the exception of 'Swamp Impact Site 1', autumn monitoring revealed the lowest level of species richness in each monitoring location. This indicates a trend in seasonal fluctuations of species richness. These changes have occurred in impact sites as well as in control sites, indicating mining is unlikely to be responsible for the compositional changes in flora species.

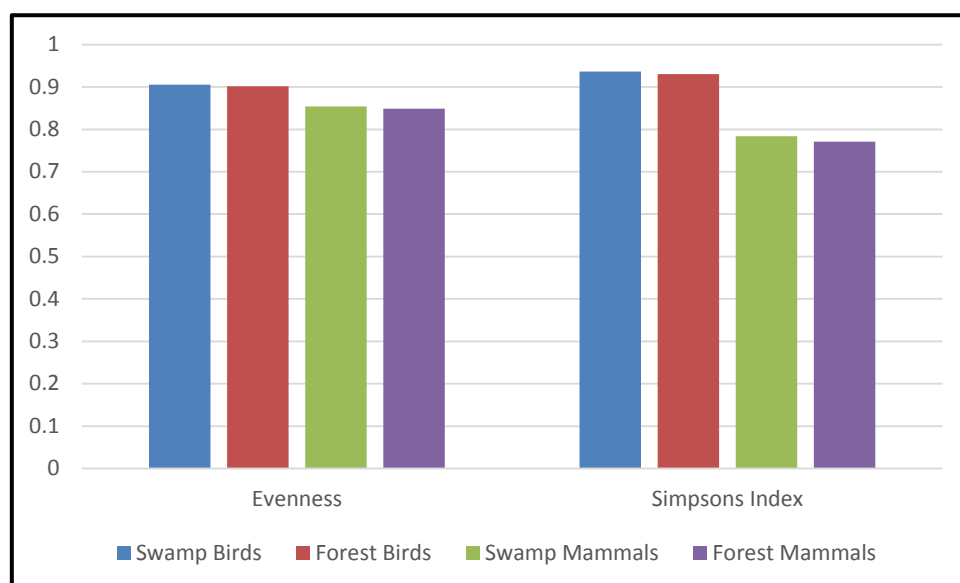
Monitoring results from Summer, Spring and Autumn 2015 are included in **Appendix 4**.

### 7.2.2. Fauna Monitoring Results

The Autumn 2015 report is presented in **Appendix 5** and the following summarises and presents key findings from the specialist report. Measurements of habitat characteristics derived from trap site descriptions have been used to provide an index of habitat complexity that can be helpful in determining changes over time of the habitats surveyed in the Study Area.

It is possible to compare the results from the Spring 2015 fauna monitoring surveys undertaken at Angus Place Colliery SMP Area with those obtained from area 900/910. A summary of the results is presented in **Table 5**. There are no significant differences between the habitat characteristics measured at area 900/910 and Angus Place Colliery SMP Area (Students t-test).

**Figure 11** shows the mean biodiversity values for the swamp and forest sites with the Project Area.



**Figure 11. Evenness and Simpsons Index of Biodiversity within the project area**



**Table 5. Habitat Characteristics within Angus Place Colliery and Area 900/910 (2015)**

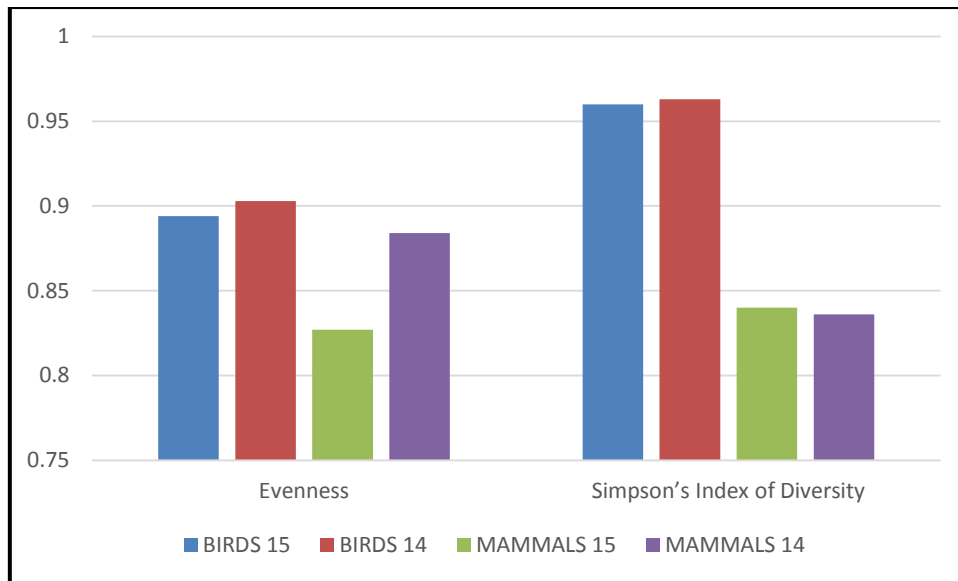
<b>% Cover</b>	<b>Angus Place Colliery</b>	<b>Area 900/910</b>
Tree Cover	18	25
Tall Shrub Cover	84	67
Tall Sapling Cover	19	14
Low Shrub Cover	37	32
Low Sapling Cover	43	22
Fern Cover	52	47
Cutting Grass	49	52
Grass Cover	34	47
Forb Cover	100	100
Reed Cover	27	39
Litter Cover	1	6
Log Cover	18	25
Rock Cover	84	67
% Tree Hollows	19	14

There are no significant differences between the biodiversity values for the swamp and forest sites for birds, native mammals or reptiles (Students t-test and non-parametric Mann-Whitney Rank Sum Test). However, there are some differences between the Diversity Indices for reptiles within the swamp and forest sites.

The biodiversity indices calculated from the results of the spring surveys in 2014 and 2015 are shown in **Figure 12**. There are no significant differences between the values from the two years (Student's t-test).

The surveys have been undertaken for more than a year and can now be used to track changes over time. As the area is undermined it will be possible to determine any impacts upon terrestrial fauna.

Seven threatened species were recorded in the 900/910 area during the present surveys (Gang-gang Cockatoo, Powerful Owl, Flame Robin, Scarlet Robin, Varied Sittella, Eastern False Pipistrelle and Eastern bent-wing Bat).



**Figure 12. Mean Biodiversity Indices within 930 980 Previous SMP Area and Area 900/910**

The results from the survey of the Angus Place Colliery 900/910 area in Spring 2015 show that the assemblages found are typical of that found throughout Newnes Plateau and are similar to that obtained in the remainder of Angus Place Colliery.

### 7.3. Aquatic Ecology

#### 7.3.1. Aquatic Ecology Monitoring Locations

Aquatic ecology monitoring was carried out at two locations on Kangaroo Creek, known as Kangaroo Creek Upstream (KCup) and Kangaroo Creek Downstream (KCdn). The sites are surveyed twice annually. The autumn monitoring was undertaken in May 2015 and the spring monitoring in November 2015. The Autumn and Spring 2015 reports are presented in **Appendix 6**.

**Table 6. Aquatic Monitoring Locations**

Monitoring Site	Approximate Easting MGA Zone 56	Approximate Northing MGA Zone 56	Description
Kangaroo Creek Upstream (KCup)	232588	6306501	Kangaroo Creek upstream site located upstream of Angus Place pit top facilities and LDP1, and downstream of the underground workings (longwalls 920-980).
Kangaroo Creek Downstream (KCdn)	230368	6306102	Kangaroo Creek downstream site located downstream of LDP1 confluence with Kangaroo Creek (adjacent pit top).

### 7.3.2. Aquatic Ecology Monitoring Results

The Angus Place monitoring study area was subjected to below average rainfall conditions during the Autumn 2015 survey. Rainfall conditions over the winter months were well below average and the month of September was very dry, however the latter spring months leading into the Spring 2015 survey were closer to average with some consistent precipitation falling just prior to and during the sample period.

The study design provides for up and downstream monitoring sites of Licensed Discharge Point 1 within receiving creek and river systems, and additional monitoring of reference sites within the Coxs River receiving environment. The water flow at KCdn was consistent with previous recent surveys. KCup flow was slightly higher in Spring than flow measured during former surveys.

There were no significant changes to the site riparian channel conditions or indications of flood impacts at any of the sites that warranted changes to the relevant category scores. There were no changes to the site RCE scores, reflecting stability in conditions over the period between the Autumn and Spring 2015 surveys. KCup recorded an RCE score of 83% and KCdn recorded an RCE score of 62% for both the Autumn and Spring periods (**Table 7**).

In the Spring 2015 survey, 3 macrophytes taxa was recorded from KCdn and no noted macrophytes for KCup. The individual site macroinvertebrate diversity sampling recorded 14 taxa at KCup and 18 taxa recorded at KCdn. Both scores are within the long term mean for each monitoring site.

There were no threatened or other protected invertebrate or vertebrate aquatic species (as listed under the TSC, FMA or EPBC) caught or observed during the Spring 2015 sampling at KCup and KCdn and there were no Australian water rats, platypus or platypus burrows observed. Biodiversity performance measures were met in accordance with PA 06\_0021, Schedule 3 - Condition 3.

**Table7. Summary of River Channel and Environment (RCE) Scores - Spring 2015**

<b>Category</b>	<b>KCup</b>	<b>KCdn</b>
Land-use pattern beyond immediate riparian zone	4	3
Width of riparian strip-of woody vegetation	4	4
Completeness of riparian strip of woody vegetation	4	4
Vegetation of riparian zone within 10 m of channel	4	3
Stream bank structure	4	1
Bank undercutting	3	2
Channel form	4	4
Riffle/pool sequence	2	2
Retention devices in stream	3	1
Channel sediment accumulations	2.5	2
Stream bottom	2	1
Stream detritus	3	1.5
Aquatic vegetation	3.5	3.5
RCE Score	43	32
Spring 2015 RCE %	83	62
Autumn 2015 REC %	83	62

## **7.4. Groundwater**

Groundwater monitoring is carried out within the Newnes Plateau Shrub Swamps to monitor shallow aquifers.

### **7.4.1. Groundwater Monitoring Results**

Groundwater level monitoring will be carried out using shallow piezometers within Narrow Swamp. Water quality will be undertaken opportunistically, when adequate water is available to obtain a sample. Determination of adequate water levels is undertaken following a review of the groundwater depth data received every two months.

Narrow Swamp is associated with the extraction of Longwall 910 and therefore no monitoring results are applicable to this report.

## 7.5. Surface Water

Flow monitoring sites and surface water quality monitoring sites relevant to the Project Area are shown in **Figure 10**.

Kangaroo Creek surface water monitoring sites are applicable to the extraction of Longwall 900W and results are summarised below. Kangaroo creek is not undermined by Longwall 900W nor is it within the project area.

### 7.5.1. Surface Water Monitoring Results

Stream flows are currently monitored fortnightly for flow, pH, total suspended solids, electrical conductivity, manganese, iron and temperature. If there is no flow, no water quality parameters are monitored. Results are shown in **Table 8**.

The average electronic conductivity at Kangaroo Creek DS was higher than the ANZECC guideline of 350 micro siemens per centimetre. This is the result of discharge from LDP001, a groundwater discharge point upstream of the Kangaroo Creek DS monitoring location. All other monitoring results were below the applicable ANZECC guideline level.

A high TSS result of 33mg/L (ANZECC Trigger Value 25mg/L) was returned from a Kangaroo Creek US sample collected during low flow and likely impacted by a recreational motorcycle track crossing the creek approximately 100m above the monitoring point.

The sample returning a low pH result of 6.1 (ANZECC Trigger Value range of 6.5-9.0) from Kangaroo Creek US was collected during a high flow event and the water appeared to be clear.

Variation in flow and temperature can be attributable to climatic conditions.

**Table 8. Kangaroo Creek Upstream and Downstream Monitoring Results**

<b>Upstream</b>	<b>Unit</b>	<b>Minimum</b>	<b>Average</b>	<b>Maximum</b>	<b>ANZECC/ARCMCANZ (2000) Trigger Value</b>
Flow	k/Day	0	633.5	3923	NA
pH	pH Units	6.1	6.6	7.3	6.5-9.0
Total Suspended Solids	mg/L	1	16.8	33	25
Electrical Conductivity	µS/cm	0.05	49.4	120	350
Filterable Manganese	Mg/l	0.0	0.2	0.7	1.9
Filterable Iron	Mg/L	0.3	1.6	9.0	NA
Temperature	°C	3.9	11.7	19.2	NA
<b>Downstream</b>	<b>Unit</b>	<b>Minimum</b>	<b>Average</b>	<b>Maximum</b>	<b>ANZECC/ARCMCANZ (2000) Trigger Value</b>
Flow	k/Day	401	1123	3133	NA
pH	pH Units	6.6	7.9	8.6	6.5-9.0
Total Suspended Solids	mg/L	<10	<10	<10	25
Electrical Conductivity	µS/cm	0.3	534.8	1016	350
Filterable Manganese	Mg/l	0.0	0.1	0.4	1.9
Filterable Iron	Mg/L	0.1	0.5	2.9	NA
Temperature	°C	7.2	13.2	19.1	NA

## 7.6. West Wolgan Creek

West Wolgan Creek monitoring was an additional monitoring commitment made in the *Site Water Management Plan* following feedback from DRE. A commitment was made by Angus Place to determine a suitable control site for west Wolgan Creek which would be monitoring during extraction of LW910 within 500m of West Wolgan Creek following >20mm of rain in 24 hours.

The Pagoda City Site has been chosen as a suitable control for West Wolgan Creek due to its similarity in catchment size, drainage line characteristics (rock, sandy, pebble) and low lying areas which contain water following rainfall. The sites are also of similar altitude and topography.

West Wolgan Creek is associated with the extraction of Longwall 910 which has not commenced therefore no monitoring results are presented in this Report.

## 7.7. Rainfall

**Table 9** documents the observed rainfall on the Newnes Plateau and Lithgow and compares to the long term monthly averages at respective locations.

**Table 9. Rainfall**

	Observed Rainfall		Average Rainfall	
	Newnes Plateau (mm)	Lithgow (mm)	Newnes Plateau (mm)	Lithgow (mm)
Apr-15	206.4	184.2	108.8	58
May-15	36.8	31	57.9	51.6
Jun-15	39.6	26.2	44.4	73.8
Jul-15	51.2	44.6	85.4	61.4
Aug-15	42.6	31.6	51.1	57.7
Sep-15	23	12.6	52.26	56.3
Oct-15	68.2	37.2	57.8	62.2
Nov-15	87	67.2	81.6	63.3
Dec-15	87.8	57.2	100.7	78.5
Jan-16	194.2	166.6	86.4	84.1
Feb-16	15.2	46.6	92.6	80.8
Mar-16	52.2	36.8	126.6	74.9
<b>TOTAL</b>	<b>904.2</b>	<b>741.8</b>	<b>945.5</b>	<b>802.6</b>

Generally, both Newnes Plateau and Lithgow received lower rainfall than the long term averages with exception to April and August 2015, and January 2016 in which both locations received above average rainfall.



## 8. CONCLUSIONS

The extraction of Longwall 900W commenced on the 30<sup>th</sup> of April 2014 following the approval of the 900W/910 Integrated SMP Extraction Plan. The longwall was completed on the 15<sup>th</sup> of February 2015. Longwall 910 extraction has not commenced as the mine was placed on care and maintenance on the 28<sup>th</sup> of March 2015.

Observed impacts from the extraction of Longwall 900W has been within the predictions.

Subsidence monitoring results and the Power Line Total Survey results during 2015 show subsidence results within predictions. The, Ditton Geotechnical Services report (February 2016) suggested the development of subsidence above LW 900W was practically complete and concluded that subsidence monitoring lines H and I were no longer required and could be removed.

No Aboriginal heritage sites were undermined during the extraction of Longwall 900W.

The flora and fauna monitoring sites were established prior to undermining. The flora monitoring baseline reports from 2014 presents the condition prior to the monitoring sites being undermined. The Summer 2015, Autumn 2015 and Spring 2015 flora monitoring reports enabled comparisons to baseline reports in 2014. The fauna monitoring methodology considers the habitat characteristics and demonstrates no significant variation in results.

The RPS fauna monitoring surveys were undertaken during three seasons. The results from these surveys give species listings that are similar to that obtained during the 2014 survey. The combination of the results from the two sets of surveys enabled comparisons to be made between 2014 and 2015 and demonstrate no impact from undermining.

There were no significant changes to the site riparian channel conditions at any of the aquatic ecology monitoring sites that warranted changes to the relevant category scores. Aquatic ecology monitoring results generally concur with previous reports.

The surface water monitoring program at Kangaroo Creek demonstrates fluctuations in water quality and flow with changing climatic conditions. The average water quality scores at Kangaroo Creek down stream and upstream were within the associated ANZECC guidelines with the exception of Electronic Conductivity at the down stream monitoring location, and pH and TSS results at the upstream location.

All monitoring and management protocols were carried out in accordance with the approved component management plans and programs of the 900W/910 Integrated SMP Extraction Plan.



# Centennial Coal

Angus Place

