



WEST CLIFF AREA 5
LONGWALL 37 END
OF PANEL REPORT
MAY 2015





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ATTACHMENTS

Attachment A: West Cliff Area 5 Longwalls 37 and 38 Extraction Plan Approval;
West Cliff Area 5 Longwalls 37 and 38 Subsidence Management Plan Approval &
Conditions

Attachment B: Subsidence Monitoring Report for West Cliff Longwall 37, Revision A (MSEC740),
April, 2015.

Attachment C: Longwall 37 End of Panel Landscape Monitoring Report, Illawarra Coal
Environmental Field Team, March, 2015.

Attachment C1: Impact Reports, Illawarra Coal Environmental Field Team, June 2014 to January
2015.

Attachment D: End of Panel Assessment of Surface Water Effects, West Cliff Colliery Longwall 37,
Ecoengineers, Revision 1. May, 2015.

Attachment E: West Cliff Longwalls 31 to 38 Aquatic Ecology Monitoring, 2002 to 2014, Cardno
Ecology Lab, April, 2015.

Attachment F: Aboriginal Heritage Assessment for West Cliff Colliery – Longwall 37 End of Panel
Report. Niche Environment and Heritage, April, 2015.

Executive Summary

This End of Panel (EoP) Report details the findings of the monitoring programs and inspections associated with Longwall 37 extraction. It also analyses the monitoring results against relevant impact assessment criteria and predictions made in the Extraction Plan (EP) and associated management plans and reports for Longwall 37.

West Cliff Longwall 37 is located within Consolidated Coal Lease No.767 (CCL767). The extraction of Longwall 37 commenced on the 10th June 2014 and was completed on the 30th January 2015, using conventional longwall techniques and equipment.

Economic Effects

Continuing benefits occur through continuity of employment, expendable income, export earnings and government revenue. BHP Billiton Illawarra Coal was granted consent for the Bulli Seam Operations Project in 2011, which provided continuing operations for its Bulli Seam mines for 30 years.

The Company provides local jobs for approximately 2000 direct employees and contractors throughout its operations with an employment flow-on effect in the Illawarra and Wollondilly regions of 2.6 full time equivalent jobs (IRIS, 2011). More than 400 small to medium local businesses provide goods and services to the company. The company is a major contributor to the economy of the local region and New South Wales. When flow-on effects are taken into account, Illawarra Coal contributes 4.7 per cent of household income and 5.3 per cent of industry value added to the Illawarra and Wollondilly regions (IRIS, 2011).

West Cliff Colliery provided employment for up to 342 full time employees and 181 contractors and fixed term employees throughout the extraction of Longwall 37. These jobs are reliant on maintaining continuity of longwall coal extraction. Illawarra Coal paid over \$9.7 Million in royalties to the NSW Government.

Subsidence

Subsidence movements resulting from the extraction of West Cliff Longwall 37 were monitored at various lines and points within the EP area. Monitoring was conducted to measure subsidence associated with the Georges River, water and gas pipeline easements across Mallaty Creek, Appin Road, TransGrid 330 kV transmission lines, Endeavour Energy low voltage power lines and various infrastructure items of the Sydney Catchment Authority. Measured subsidence movements were generally in line with the predicted subsidence movements (MSEC533 and MSEC705).

The maximum observed incremental and total upsidence movements at the Georges River cross lines L, M and N, after the completion of Longwall 37, were greater than the maxima predicted (MSEC, 2015). The incremental exceedances of upsidence and closure for the L, M and N lines were small, with most of the total upsidence and closure attributed to mining of the previous longwalls (MSEC, 2015).

Only low level subsidence movements developed along the J-Line during the extraction of Longwall 37. There were no identifiable incremental upsidence or closure movements at Mallaty Creek or Leaf's Gully resulting from the extraction of Longwall 37.

The maximum observed incremental and total tensile strains on the B Line (Appin Road) were less than or equal to the maxima predicted systematic strain. The maximum observed incremental tilt was less than the maxima predicted, and the maximum total tilt was greater than predicted systematic tilt. The maximum observed incremental and total compressive strains were greater than the maxima predicted systematic strain, as irregular ground movements developed during the extraction of Longwall 37, which resulted in elevated compressive strains between Marks B222 to B223 and B230 to B231.

The observed total subsidence at the TransGrid 330kV Transmission Line Towers, after the completion of Longwall 37, was smaller than that predicted for Towers 3778, 3779 and 3782, and slightly greater than predicted for Towers 3781. However, the exceedances for Tower 3781 were within survey tolerance.

The observed subsidence at the powerline poles, after the completion of Longwall 37, were less than the maximums predicted anywhere along the powerline. The observed horizontal movements at the tops of the power poles relative to the base were less than predicted for all except Power Pole 55, which was 10 mm greater than predicted.

With respect to Sydney Catchment Authority (SCA) infrastructure:

- Small movements have been observed at the Upper Canal and at Devines Tunnels.
- The observed movements at the wrought iron aqueducts, after the completion of Longwall 37, were all less than those predicted, with the exception of closure at Mallaty Creek, which increased by 5 mm.
- The maximum observed vertical and horizontal movements at Concrete Aqueducts C and D, after the completion of Longwall 37, were generally less than 3 mm, which is in the order of survey accuracy.

Impacts on Man-Made Features

The observed impacts on the surface infrastructure, after the extraction of Longwall 37, are within the predicted impacts. There were no reported impacts to the SCA infrastructure, Sydney Water and Macarthur Water pipelines, gas pipelines, TransGrid's 330 kV transmission line, Integral Energy low voltage power lines, the Telstra Optic Fibre and copper cables, tanks, farm dams, pools or fences. Three properties have reported impacts during Longwall 37 (to date).

Some minor impacts developed along Appin Road above Longwall 37 and partly over the previous Longwall 36. These impacts included small compression bumps in the road pavement, and the opening of minor cracks across the road surface. Remediation was undertaken for one of the more pronounced bumps. This involved milling and patching the pavement. Further rehabilitation of the mining effects along Appin Road is being planned.

Impacts on Natural Features

Impacts observed on natural features from Longwall 37 were within the predictions outlined in the Longwall 37 and 38 EP.

Five new impacts (rock fracturing, rock fall and three pool water level reductions below baseline) were identified by the Illawarra Coal Environmental Field Team (ICEFT) along the Georges River during the Longwall 37 extraction period. These impacts were attributed to Longwall 35 and 36, not Longwall 37, due to: their location;

timing of the observation and distance from the Longwall 37 extraction face. Re-occurring pool water level triggers (from Longwall 35 extraction) were also reported throughout the extraction of Longwall 37. These pool water levels continue to respond to changes in release rate from Brennans Creek Dam and significant rainfall events.

Based on analysis of the long-term water quality records, in the Georges River, for designated upstream and downstream sites of Longwall 37, no significant water quality impacts were observed or measured within the Georges River as a result of the mining of Longwall 37 (Ecoengineers, 2015).

In the first order streams, Mallaty Creek and Nepean Creek, there were no effects on water quality as a result of Longwall 37.

There was no significant water quality or water level effects in boreholes GR27, GR70, WC54 and WC95 during or following completion of Longwall 37.

The indicators of aquatic ecology affected by the extraction of Longwall 35 (identified during the previous survey, November 2013) were shown to be recovering from previous disturbance in the survey campaign undertaken in December 2014. This is attributed to the additional releases of water from Brennans Creek Dam which was implemented as an ameliorative measure following the mining impacts associated with the extraction of Longwall 35 (CEL, 2015). These findings are supported by statistical analysis, which does not indicate that any widespread or persistent impacts have occurred following the commencement of extraction of Longwall 35 (CEL, 2015).

With regards to terrestrial ecology, Subsidence effects are unlikely to have had a significant impact on any threatened flora or fauna species (Niche, 2013). No impacts were observed to the vegetation within the study area during inspections undertaken throughout the Longwall 37 extraction period.

Three Aboriginal archaeological sites were inspected as part of the Longwall 37 End of Panel assessment and included: an Aboriginal shelter with art and deposit, a shelter with art and an Aboriginal shelter with art and axe grinding grooves. There were no impacts or changes to the archaeological sites as a result of the extraction of Longwall 37. No European heritage sites were identified as being potentially affected by Longwall 37.

Trigger Action Response Plans (TARPs)

Impacts associated with Appin Road were minor, and have been reported and monitored in accordance with agreed actions of the EP and Public Road Management Plan. Rehabilitation of the mining affects along Appin Road is being planned and will be assessed by Roads and Maritime Services (RMS) and the Mine Subsidence Board (MSB) to identify mine subsidence related damage and cost responsibilities.

Impacts associated with the extraction of Longwalls 32 to 36 have included gas releases, iron staining, rock fracturing to pools and rock bars and a decline in pool water levels below baseline in some pools along the Georges River. In response to impacts, actions have included increased subsidence surveys and observational monitoring frequencies and increased water releases from Brennans Creek Dam. The Approved Subsidence Management Plan (SMP) and EP requires remediation of the river bed and rock bars to restore flows to the surface of the river and ensure pool water levels respond in a similar way to pre-mining levels.

Conclusion

All impacts to man-made and natural features observed during monitoring associated with the extraction of Longwall 37 have been within prediction. Monitoring of man-made and natural features will continue as part of post-mining monitoring and during mining monitoring (for Longwall 38) in accordance with the Longwall 37 and 38 EP and Longwall 34 to 36 SMP.

1. Introduction

1.1. Background

West Cliff Longwall 37 is located within Consolidated Coal Lease No.767 (CCL767). The extraction of Longwall 37 commenced on the 10th June 2014 and was completed on the 30th January 2015, using conventional longwall techniques and equipment.

This End of Panel (EoP) Report details the findings of the monitoring programs and inspections associated with Longwall 37 extraction. It also analyses the monitoring results against relevant impact assessment criteria and predictions made in the Extraction Plan (EP) and associated management plans and reports for Longwall 37.

Information in this report is based on monitoring and reports undertaken by Illawarra Coal and specialist consultants that have been involved with the monitoring and analysis of data relating to the West Cliff Area 5.

1.2. Approval and Legislative Requirements

The West Cliff Area 5 EP for Longwalls 37 and 38 was approved by Department of Planning and Infrastructure – DoPI (now the Department of Planning and Environment - DoPE) on the 24th March 2014. Subsidence Management Plan approval was granted by the Department Trade and Investment (T&I) on 28th March 2014. The EP and SMP approval are provided as **Attachment A**. Approvals were granted to shorten Longwall 37 from the commencing end by 223m on 6th June 2014 (DoPI and T&I).

In September 2009, Illawarra Coal submitted an Environmental Assessment (EA) for its Bulli Seam Operations Project (BSOP) to the DoPE for the continuation of existing underground mining operations for both Appin and West Cliff Mines. The BSOP was approved 22nd December 2011 by the NSW Planning Assessment Commission (PAC) under delegation of the NSW Minister for Planning under Part 3A of the NSW Environmental Planning and Assessment Act (EP&A Act). *Condition 5, Schedule 3* of the BSOP Approval requires the preparation and implementation of an EP for the first and second workings within each mining domain to the satisfaction of the Director-General. *Condition 1 and 3, Schedule 3* of the BSOP Approval addresses performance measures for the project.

Subsidence impact performance measures relevant to Longwall 37 extraction, stipulated under *Condition 1 and 3, Schedule 3 (Table 1 and Table 2)* of the BSOP Approval, are outlined in Table 1-1. In relation to subsidence impact performance measure the term “*negligible*” is defined within the BSOP Approval as “*small and unimportant, such as not to be worth considering*” and the term “*minor*” is defined as “*not very large, important or serious*”.

Table 1-1: Bulli Seam Operations Project Approval – Environmental Performance Measures.

BSOP Approval Condition	Relevant Section in EoP Report	
<i>Condition 1, Schedule 3</i>		
The Proponent shall ensure that the project does not cause any exceedances of the performance measures in Table 1, to the satisfaction of the Director-General.		
Watercourses		
Georges River	Negligible environmental consequences including: <ul style="list-style-type: none"> - <i>negligible</i> diversion of flows or changes in the natural drainage behaviour of pools; - <i>negligible</i> gas releases and iron staining; and - <i>negligible</i> increase in water cloudiness over at least 80% of the stream length subject to vertical subsidence >20mm. No subsidence impact or environmental consequence greater than minor.	- Section 4.1, 4.2 and 4.3.1 - Attachment C and C1 - Attachment D
Other watercourses	No greater subsidence impact or environmental consequences than predicted in the EA and PPR	- Section 4.1 and 4.3.2 - Attachment C - Attachment D
Land		
Dharawal State Conservation Area	Negligible environmental consequence	N/A
Cliffs of “special significance” (i.e. cliffs longer than 200m and/or higher than 40m; and cliff-like rock faces higher than 5m that constitute waterfalls)	Negligible impact (that is occasional rock falls displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs) within any longwall mining domain.	N/A
Other cliffs	Minor impacts (that is occasional rock falls, displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 3% of the total face area of such cliffs within any longwall mining domain).	- Section 4.1 - Attachment C and C1
Biodiversity		
Threatened species, threatened populations, or endangered ecological communities.	Negligible environmental consequences.	- Section 4.6
Aboriginal Heritage		
Sites determined to hold ‘special significance’ as a result of studies required for Extraction Plans.	Negligible impact or environmental consequences.	- Section 4.7 - Attachment F
Sites determined to hold high or moderate significance as a result of studies required for Extraction Plans.	Less than 10% of such sites across the mining area are affected by subsidence impacts (other than negligible impacts or environmental consequence).	

Other Aboriginal heritage sites.	Less than 10% of such sites within any longwall mining area are affected by subsidence impacts (other than minor impacts or environmental consequence).	
Historic Heritage		
Other buildings or structures of State or National heritage significance.	Negligible loss of heritage value. Negligible impact on structural integrity or external fabric, unless the owner of the feature agrees otherwise in writing.	N/A
Other buildings or structures of identified heritage significance.	No loss of heritage value greater than predicted under a Heritage Management Plan prepared under Condition 6 Schedule 3.	N/A
<i>Condition 3, Schedule 3</i> The Proponent shall ensure that the project does not cause any exceedances of the performance measures in Table 2, to the satisfaction of the Director-General.		
Built Features		
Other public infrastructure (including water supply pipelines; high pressure gas pipelines and the gas distribution network; electricity transmission and distribution lines; telecommunications cables and optical fibre networks; roads, trails and associated structures). Houses, industrial premises, swimming pools, farm dams and other built features or improvements	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repaired or fully compensated, or else the damaged built feature or damaged infrastructure component must be replaced.	- Section 3 - Attachment B

1.3. Management Plans

The impact predictions associated with Longwall 37 are described in the following documents:

- Cardno Forbes Rigby Pty Ltd, March 2014, West Cliff Area 5 Longwalls 37 and 38 Extraction Plan.
 - Annexure A: MSEC, June 2013, *Subsidence Predictions and Impact Assessments for the Natural Features and Surface Infrastructure in Support of the Extraction Plan*, Revision B, MSEC533.
 - Annexure B: BHP Billiton, August 2013, *Subsidence Monitoring Program*, Revision A.
 - Annexure C: Cardno Forbes Rigby Pty Ltd, March 2014, *Water Management Plan*, Revision B.
 - Annexure D: Cardno Forbes Rigby Pty Ltd, August 2013, *Biodiversity Management Plan*, Revision A.
 - Annexure E: Cardno Forbes Rigby Pty Ltd, August 2013, *Land Management Plan*, Revision A.
 - Annexure F: Cardno Forbes Rigby Pty Ltd, August 2013, *Heritage Management Plan*, Revision A.
 - Annexure G: Cardno Forbes Rigby Pty Ltd, August 2013, *Public Safety Management Plan*, Revision A.
 - Annexure H: Cardno Forbes Rigby Pty Ltd, August 2013, *Built Features Management Plan*, Revision A.

1.4. Report Outline

Economic effects associated with the longwall extraction are discussed in Section 1.5. An overview of the consultation involved with West Cliff mining operations is provided in Section 1.6. Subsidence movement predictions and measurements are covered in Section 2. Impacts associated with Longwall 37 on man-made features and natural features are provided in Sections 3 and 4 respectively. Management of impacts, Trigger Action Response Plans (TARPs) and remediation measures are discussed in Section 5. The Longwall 37 monitoring program and proposed future monitoring in the EP Area are outlined in Section 6.

1.5. Economic Effects

The extraction of underground coal reserves from Area 5 provides benefits at international, national, state and local levels due to the coal's unique characteristics. Illawarra Coal provides 70% of BlueScope Steel's coking coal requirements. Mining operations at West Cliff Colliery represents continuing significant capital and operating investments in the Southern Coalfield of New South Wales.

Continuing benefits occur through continuity of employment, expendable income, export earnings and government revenue. Illawarra Coal was granted consent for the Bulli Seam Operations Project in 2011, which approves its Appin and West Cliff mines for 30 years. The Company provides local jobs for approximately 2000 direct employees and contractors throughout its operations with an employment flow-on effect in the Illawarra and Wollondilly regions of 2.6 full time equivalent jobs (IRIS, 2011).

More than 400 small to medium local businesses provide goods and services to the company. The company is a major contributor to the economy of the local region, contributing 4.7 per cent of household income and 5.3 per cent of industry value added. In terms of West Cliff Colliery, the extraction of Longwall 37 provided employment for up to 342 full time employees and 181 contractor and fixed term employees. Illawarra Coal paid over \$9.7 million in royalties to the NSW Government.

1.6. Stakeholder Consultation

Impact monitoring and provision of ongoing information to the community has been undertaken by Illawarra Coal during the extraction of West Cliff Area 5 longwalls.

Information on Illawarra Coal operations is provided to the community through the following mechanisms:

- Community information sheets and letter box drops;
- Media releases and other media activities;
- General community surveys and reports;
- Coal News – an Illawarra Coal publication for employees;
- Coalition News – a quarterly Illawarra Coal publication distributed to the community;
- Illawarra Coal Community e-Newsletter – a monthly newsletter distributed to a managed subscription list of residents and key stakeholders;
- Internet site - as of 25th May 2015 refer to South32
<http://www.south32.net/our-operations/australia/illawarra-coal>
- Illawarra Coal Community Consultative Committee meetings for BSOP (meeting minutes provided on

the BHP Billiton (now South32) website and emailed direct to interested stakeholders);

- Landholder relations program;
- Annual review; and
- Information days.

1.7. Social Impacts Associated with Subsidence

Illawarra Coal aims to mitigate the potential impacts subsidence may cause on individuals through various means outlined in Table 1-2.

Table 1-2: Social Impact Variables Associated with Subsidence

Potential Impact	Monitoring Variables	Mechanism
Subsidence Impacts	<ul style="list-style-type: none"> - Level of community concern relating to subsidence. - Awareness of subsidence and its effects and management. - Level of perceived community risk associated with subsidence effects. - Level of satisfaction with the company's subsidence management practices. - The extent to which the community attributes environmental, social and economic change occurring within the community to mining activities. 	<ul style="list-style-type: none"> - Local notice boards and community e-newsletter where progress of the longwalls is displayed. - The Illawarra Coal Community Consultative Committee meetings for BSOP - A biennial survey of residents and stakeholders in the communities in which Illawarra Coal operates. The survey aims to determine the community's perception of the company's overall performance. - Development of individual Built Feature Management Plans (BFMPs) in consultation with landowners. - Meetings and on-going consultation with landowners during mining and in accordance with individual BFMPs.

The management of subsidence impacts on private properties is addressed in Built Feature Management Plans (BFMPs). The BFMPs have been prepared in consultation with individual property owners. For any impacts to properties in relation to Longwall 37, landholders have been encouraged to make claims with the MSB. Illawarra Coal is available to assist landholders throughout the process of making a claim and is continuing to assist in the management of the social impacts of the mining operations associated with West Cliff Area 5.

2. Predicted and Observed Subsidence

Subsidence movements resulting from the extraction of Longwall 37 were monitored along various lines and points within the EP Area. A comparison of the observed and predicted movements resulting from the extraction of Longwall 37 has been prepared by MSEC (MSEC, 2015). The results are summarised below. For further

details of the observed and predicted movements, including specific measurements, refer to the report by MSEC, provided as **Attachment B** to this report.

Monitoring points and lines associated with Longwall 37 include:

- The Georges River Cross Lines,
- The J-Line and the Mallaty Creek 3D Monitoring Area,
- The B-Line along Appin Road,
- Monitoring points at the towers along the TransGrid 330kV Transmission Line,
- Monitoring points at the poles along Endeavour Energy powerlines, and
- Monitoring lines and points at the Sydney Catchment Authority Infrastructure.

The locations of these monitoring lines and points are shown in **Appendix 8-1**.

2.1. The Georges River Cross Lines

Mine subsidence movements across the Georges River valley were measured by Illawarra Coal along six monitoring lines, being the L-Line to the P-Line and the R-Line (refer to **Appendix 8-1**).

The maximum observed incremental and total upsidence and closure movements at the Georges River cross lines O, P and R, after the completion of Longwall 37, were less than the maxima predicted (MSEC, 2015). The maximum observed incremental and total upsidence movements at the Georges River cross lines L, M and N, after the completion of Longwall 37, were greater than the maxima predicted (MSEC, 2015). The incremental exceedances of upsidence and closure for the L, M and N lines were small, with most of the total upsidence and closure attributed to mining of the previous longwalls (MSEC, 2015).

2.2. The J-Line and Pipeline Easement 3D Monitoring Points

The mine subsidence movements along the J-Line were measured by Illawarra Coal using 2D monitoring techniques. The monitoring line follows the alignment of the pipeline easement, which is located beyond the western end of Longwall 37. There are also a number of 3D monitoring points within the pipeline easement which were monitored by Illawarra Coal.

Only low level subsidence movements developed along the J-Line during the extraction of Longwall 37. The maximum observed incremental subsidence along the J-Line was 8 mm at Mark J139, which is located directly above the previously extracted Longwall 35, and may be associated with long term residual movements. These movements represent around 10% of the maximum total subsidence, similar to the levels of long term residual movements measured elsewhere in the Southern Coalfield (MSEC, 2015).

There were no identifiable incremental upsidence or closure movements at Mallaty Creek or Leafs Gully resulting from the extraction of Longwall 37. That is, the maximum observed incremental upsidence and closure movements were less than 5 mm (i.e. not measureable) (MSEC, 2015).

The 3D horizontal movements measured along the J-Line (3D) in the Mallaty Creek Monitoring Area indicated ground movements up to 54 mm due to the extraction of Longwall 37, moving in an easterly direction over the

length of the monitoring line. These far-field horizontal movements are within the 99% confidence level of observed far-field movements in the Southern Coalfield, at the distance from the active longwall (MSEC, 2015).

2.3. The B-Line

The mine subsidence movements along the B-Line were measured by Illawarra Coal using 2D and 3D monitoring techniques. The monitoring line follows the alignment of Appin Road, crossing the eastern end of Longwall 37.

The maximum observed incremental and total tensile strains were less than or equal to the maxima predicted systematic strain. The maximum observed incremental tilt was less than the maxima predicted, and the maximum total tilt was greater than predicted systematic tilt.

The maximum observed incremental and total compressive strains were greater than the maxima predicted systematic strains, as irregular ground movements developed during the extraction of Longwall 37, which resulted in elevated compressive strains between Marks B222 to B223 and B230 to B231.

2.4. Monitoring of the TransGrid 330 kV Transmission Line Towers

The mine subsidence movements of the TransGrid 330 kV transmission line towers were measured by Illawarra Coal using 3D monitoring techniques. Four towers were monitored during the extraction of Longwall 37, being Tower Nos. 3779 to 3782.

The observed total subsidence at the towers, after the completion of Longwall 37, was smaller than that predicted for Towers 3778, 3779 and 3782, and slightly greater than predicted for Towers 3781. However, the exceedances for Tower 3781 were within survey tolerance. The observed total changes in the inter-tower distance was greater than that predicted for the inter-tower distance between Towers 3781 to 3782, however this movement occurred previously during Longwall 36. Survey accuracy of ± 20 mm was achieved, based on the survey accuracy for absolute position of each tower of ± 10 mm.

The maximum observed total changes in the K-Point distances (i.e. differential horizontal movements between the tower legs), after the extraction of Longwall 37, were of a similar order of magnitude to the maxima predicted, and were all less than predicted. The maximum observed total horizontal movements at the earth wire, after the extraction of Longwall 37, were similar to those predicted, with the exception of tower 3779, which had an observed value about 37 mm greater than predicted at the earth wire. However, this exceedance occurred previously, during the mining of Longwall 36.

2.5. Monitoring of the Endeavour Energy Powerline Poles

The mine subsidence movements of the Endeavour Energy powerline poles were measured by Illawarra Coal using 2D monitoring techniques. Five power poles were monitored during and after the extraction of Longwall 37, being Poles 12, 23, 31, 55, 761599 and 815245.

The observed subsidence at the powerline poles, after the completion of Longwall 37, were less than the maximums predicted anywhere along the powerline. The observed horizontal movements at the tops of the power poles relative to the base were less than predicted for all except Power Pole 55, which was 10 mm greater

than predicted.

2.6. Sydney Catchment Authority Infrastructure

The following sections describe the observed and predicted movements at the Sydney Catchment Authority (SCA) infrastructure, during the extraction of Longwall 37, including the Upper Canal, Devines Tunnels, at the Ousedale Creek, Mallaty Creek and Leafs Gully Aqueducts and at Concrete Aqueducts C and D.

2.7. The Upper Canal and Devines Tunnels

The mine subsidence movements were measured by the SCA along a number of monitoring lines, including the Upper Canal and Devines Tunnel Lines EM-Line, MO-Line, OM-Line, MD-Line and DT-Line.

Small movements have been observed at the Upper Canal and at Devines Tunnels. It is noted that this infrastructure is located between West Cliff Area 5 and Appin Area 7 mining domains. The results represent the period April 2014 to February 2015, which coincide with the extraction of Longwall 37 and approximately 2000 metres of Longwall 706 at Appin Area 7. The Upper Canal and Devines Tunnels are approximately 2.2km from Longwall 37.

2.8. Ousedale Creek, Mallaty Creek, Leafs Gully Aqueducts and Bridges and Nepean Creek

The mine subsidence movements were measured by Illawarra Coal at the Ousedale Creek, Nepean Creek, Mallaty Creek and Leafs Gully aqueducts and bridges during the extraction of Longwall 37.

The observed movements at the wrought iron aqueducts, after the completion of Longwall 37, were all less than those predicted, with the exception of closure at Mallaty Creek, which increased by 5 mm. Horizontal movements were observed to develop during times of shut-down and high water flows, and it is expected that these movements were thermal movements, as the water flow normally moderates the temperature of the aqueduct pipes.

2.9. Concrete Aqueducts C and D

The mine subsidence movements were measured by Illawarra Coal at Concrete Aqueducts C and D during the extraction of Longwall 37. It was considered unlikely that the concrete aqueducts would be subjected to any significant systematic or valley related movements resulting from the extraction of Longwall 37. The maximum observed vertical and horizontal movements at Concrete Aqueducts C and D, after the completion of Longwall 37, were generally less than 3 mm, which is in the order of survey accuracy. The one exception to this was at Mark 1WB for Concrete Aqueduct D, which was observed to have an incremental vertical movement of 5 mm between the last and second last survey epochs. Given that mining of Longwall 37 was in excess of 3,000 m minimum away from Mark 1WB, this vertical movement is not considered to be related to mining at West Cliff.

3. Impacts to Man-Made Features

The buildings and infrastructure located above or immediately adjacent to Longwall 37 are listed below. For their location with respect to Longwall 37, refer to **Appendix 8-2**.

- Appin Road;
- Sydney Water Service Line along Appin Road;
- Macarthur Water 1200 mm diameter Treated Water Gravity Main;
- Alinta EGP and AGN Natural Gas and Gorodock Ethane Pipelines;
- TransGrid 330 kV Transmission Line;
- Endeavour Energy 66 kV, 11 kV and low voltage powerlines;
- Telstra Optical Fibre Cable along Appin Road;
- Telstra Copper Cables;
- Rural Building Structures;
- Tanks and farm dams;
- Houses;
- Pools; and
- Fences.

The buildings and infrastructure located in the vicinity of Longwall 37, which may have been subjected to far-field movements resulting from the extraction of Longwall 37 are:

- The Upper Canal, Devines Tunnels and associated infrastructure; and
- Survey control marks.

Comparisons between the assessed and observed impacts for surface infrastructure resulting from the extraction of Longwall 37 are provided in Table 3-1.

Table 3-1: Summary of the Assessed and Observed Impacts for Surface Infrastructure Resulting from Longwall 37.

Surface Infrastructure	Predicted Impacts	Observed Impacts
Appin Road	Cracking and minor localised buckling which are likely to be infrequent and minor in nature.	Minor cracking and buckling of road surface. Refer to Section 3.1 and MSEC Report.
The Upper Canal, Devines Tunnels and Associated Infrastructure	Impacts unlikely after the implementation of necessary preventive measures at the concrete and wrought iron aqueducts.	No reported impacts.
Sydney Water Service Line along Appin Road	Impacts unlikely.	No reported impacts.
Macarthur Water 1200mm diameter Treated Water Gravity Main	Impacts unlikely after the implementation of preventive measures at Mallaty Creek.	No reported impacts.*
Alinta EGP and AGN Natural Gas and Gorodock Ethane Pipelines	Impacts unlikely after the implementation of preventive measures at Mallaty Creek.	No reported impacts.
TransGrid 330 kV Transmission Line	Impacts unlikely after the implementation of preventive	No reported impacts.

	measures including roller sheaves.	
Endeavour Energy 66 kV, 11 kV and low voltage powerlines	Impacts unlikely.	No reported impacts.
Telstra Optical Fibre Cable along Appin Road	Impacts unlikely.	No reported impacts.
Telstra Copper Cables	Impacts unlikely.	No reported impacts.
Rural Building Structures	Category A or B Tilt Impacts Category 0 to 1 Strain Impacts Negligible to very slight impacts.	No reported impacts.
Tanks	Tilts up to 4.0 mm/m Systematic strains up to 1.1 mm/m Impacts unlikely.	No reported impacts.
Farm Dams	Tilts up to 6.5 mm/m Systematic strains up to 1.8 mm/m Potential for some minor cracking or leakage in farm dams.	No reported impacts.
Houses	Category A or B Tilt Impacts Category 0 to 2 Strain Impacts Negligible to slight impacts.	Three properties have reported impacts during LW37 at the time of preparation of this report. However, one of these properties is being dealt with separately between the home owner and Campbelltown Council rather than the MSB.
Pools	Tilt could be visible along waterline and inground pools could be more susceptible to strain impacts.	No reported impacts.
Fences	Possible that some fences could experience slight impacts.	No reported impacts.
Survey control marks	Small far-field horizontal movements which could require re-establishment.	Small far-field horizontal movements.

* A water leak was observed in late 2014; however this was assessed as not being attributed to mining.

3.1. Observed Impacts on Appin Road

Surface inspections along Appin Road were regularly conducted during the mining of Longwall 37. Some minor impacts developed along the section of road above the extracted Longwall 37 and partly over the previous Longwall 36.

The surface impacts in this area included small compression bumps in the road pavement, and the opening of minor cracks along and across the road surface. A surface bump occurred at the location of the identified irregular movement between marks B222 and B223. Visual inspections of the road noted the following features during the extraction of Longwall 37:

- A small bump 9m north of B223 (B223 plus 9m).
- A bump 15m north of B222 (B222 plus 15m) across the road, which became more pronounced as mining progressed.
- A small bump in the northbound shoulder 19m north of B230, and a slight dip across the carriageway in this location. Minor cracking in the road shoulder was also observed.

Photographs of the impacts are provided below in Photos 1 to 3. The bump (B222 plus 15m) was remediated by

milling and patching the pavement. Further rehabilitation of the mining affects along Appin Road is being planned.



Photo 1: Bump at B222 + 15m, 1/12/2014 (Photo courtesy of Colin Dove).



Photo 2: Pavement repair at B222 + 15m, 8/12/2014 (Photo courtesy of Colin Dove).

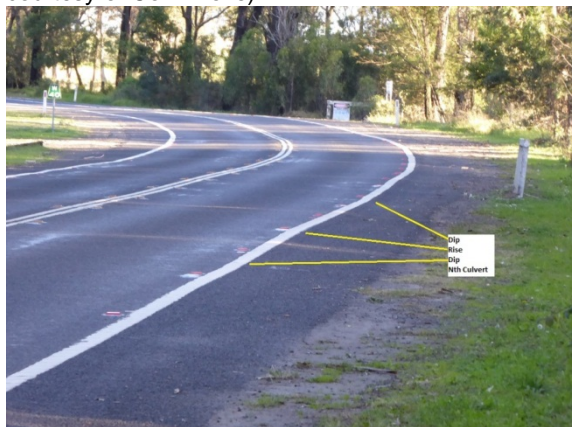


Photo 3: Cracking in road shoulder at B230 + 19m, 4/12/2014 (Photo courtesy of Colin Dove).

4. Impacts to Natural Features

The natural features that are located above or adjacent to Longwall 37 are listed below and shown in **Appendix 8-3**. These features include:

- The Georges River;
- Mallaty Creek and Nepean Creek;
- Rock outcrops; and
- Steep slopes.

Monitoring activities for natural features within the Longwall 37 EP Area relate to the following categories:

- Landscape features (cliffs, steep slopes, vegetation and watercourses);
- Surface water quality, water flow and pool water levels;
- Shallow groundwater level and quality;

- Aquatic ecology monitoring;
- Terrestrial flora and fauna monitoring; and
- Aboriginal and European heritage items.

The ICEFT undertook landscape and detailed watercourse and rock bar monitoring of features potentially impacted by Longwall 37, before, during and after mining. Water quality and flow data has been reviewed by Ecoengineers. Niche Environment and Heritage (Niche) has undertaken a review of cultural heritage sites. Cardno Ecology Lab (CEL) was responsible for the aquatic ecology monitoring and assessment, and their most recent monitoring report was used for the Longwall 37 EoP Report. This section should be read in conjunction with other relevant reports by specialist consultants provided in the Attachments.

The monitoring program for Longwall 37 is undertaken in accordance with EP requirements for West Cliff Longwalls 37 and 38. The monitoring program is outlined in Section 6, Table 6-2. The results of these monitoring programs and assessments are discussed below.

The observed and assessed impacts, TARPs and approved performance measures for each of the aforementioned categories, associated with Longwall 37, are summarised in **Appendix 8-9**.

4.1. Landscape Features

Observations of landscape features such as cliffs, steep slopes, Georges River, first and second order streams were conducted by the ICEFT during extraction of Longwall 37.

Two cliff lines (GR-CL01 and GR-CL02) and steep slopes are located along the Georges River. Cliff GR-CL02 is located approximately 25m south-east of the finishing end of Longwall 37 and GR-CL01 is located approximately 280m west of Longwall 38, on the western side of Georges River (**Appendix 8-6**). These cliff lines are monitored as part of the ICEFT's routine monitoring run. Stream features along the Georges River and its tributaries are monitored for mining impacts such as gas releases, iron staining, rock fracturing and pool water levels as outlined in Table 6-2.

Two surface impacts were observed during the extraction of Longwall 37, including rock fracturing and uplift (impact reference WCA5_LW36_001), and a rock fall from an overhang (impact reference WCA5_LW35_026); refer to Figure 4-6 for locations. Both these impacts were likely a result of Longwall 36 and 35 respectively, due to their location and distance from the Longwall 37 face at the time of observation. Detailed descriptions of the impacts and triggers are provided in **Attachment C** and relevant impact reports are provided as **Attachment C-1**. Photos of these impacts are provided as Photo 4 and 5.

The Georges River is monitored by the ICEFT on a weekly basis (when mining is within 400m of the river) and tributaries of the Nepean River (Mallaty and Nepean Creeks) have been monitored monthly. Photos are taken of monitoring sites and any gas zones and impact sites.

Iron staining was originally identified in Georges River Pool 58 on 21st August 2013 during the extraction of Longwall 36 and this impact was reported as WCA5_LW35_020. Due to the location of Longwall 36 and the timing of when it was first observed the iron staining was likely to be a result of Longwall 35.

During periods of low flow in the river, iron staining was visible and evident from Pool 58 to downstream of Pool 67 (Photo 6). For the duration of these low flow periods pool appearance downstream at GR100 showed no sign of residual iron staining in the water from upstream (Photo 7). When flows returned to higher levels there was no evidence of iron staining in the Georges River.

No other impacts (relating to appearance) were observed at the Georges River, Mallaty Creek or Nepean Creek during the extraction of Longwall 37.

No gas releases were observed during the extraction of Longwall 37. However, the assessment of the Georges River water quality undertaken by Ecoengineers (2015) reported that gas zones previously observed from Longwall 35 extraction may have reactivated from November to December 2014 in Pools 58, 59 and 60. This was indicated in the data by DO and pH 'sags' (Ecoengineers, 2015).



Photo 4: WCA5_LW36_001, fracturing and uplift of rock bed.



Photo 5: WCA5_LW35_026, rock fall (17th July, 2014)

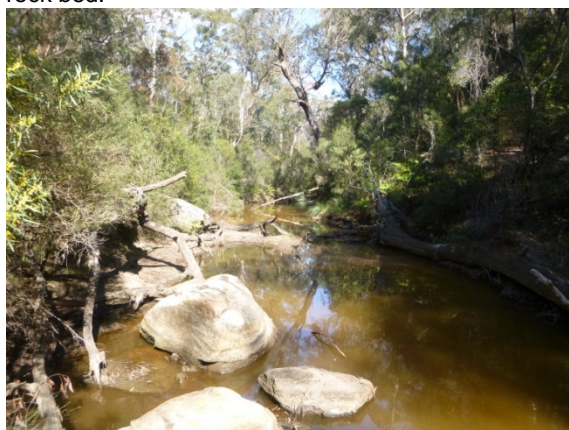


Photo 6: Pool appearance at GR_Pool 61, taken on 14th August 2014.



Photo 7: Pool appearance at GR100, taken on the 14th August 2014.

4.2. Surface Water Level and Flow

Pool water levels in the Georges River are monitored by the ICEFT using observations and measured benchmarks on a weekly basis (when access is safe and available). Pools that were impacted during the extraction of Longwall 35 continued to show low levels during low flow periods within the river. Pool water levels continue to respond to changes in release rate from Brennans Creek Dam and significant rainfall events.

During extraction of Longwall 37, water levels in three additional pools dropped to levels lower than the baseline

period. Due to the location of Longwall 37 (minimum distance of 1200m from pools) at the time of these triggers, they are likely the result of Longwall 35 impacts and have been classified under the West Cliff Area 5 Longwalls 34 to 36 Subsidence Management Plan and Georges River Management Plan (2013). Water levels at *GR_Pool 53* and *GR_Pool 61* were unable to be maintained at levels above baseline and therefore, according to the Georges River Management Plan TARP, were classified as Level 2 Impacts.

Five previously reported low pool water level triggers were reached during Longwall 37 extraction. Pool water levels at *GR_Pool 60*, *GR_Pool 58*, *GR_Pool 57*, *GR_Pool 54* and *GR_Pool 44* continued to show low levels during periods of low flow. These pool water levels were unable to be maintained at levels above baseline measurements and are therefore Level 2 impacts according to the West Cliff Area 5 Longwalls 34 to 36 SMP and Georges River Management Plan (GRMP 2013).

Flow losses in the Georges River resulting from Longwall 37 extraction were not identified. No paired flow measurements for flow monitoring sites upstream (rock bar 40 or 43) or downstream (rock bar 64) of Longwall 37 were available during the active subsidence period (i.e. when Longwall 37 was within 400m of the river) (Ecoengineers, 2015). This was due to flow rates downstream in the Georges River limiting the capacity to undertake manual spot water flow measurements (i.e. no flow, low flow or flow too high to be measured). Flow rates in the Georges River are largely influenced by discharge from Brennans Creek Dam.

4.3. Surface Water Quality

Water quality parameters within the EP Area are measured by the ICEFT on a weekly basis when mining is within 400m of the area and when access to the monitoring sites is safe and available. Parameters measured include temperature, electrical conductivity (EC), Oxidation-Reduction Potential (ORP), pH and dissolved oxygen (DO). Water samples are collected on a monthly basis to test for a range of laboratory parameters. In-situ and sampled water quality results are assessed by Ecoengineers and summarised below. Refer to **Attachment D** for the full report.

4.3.1. Georges River

Three monitoring sites are assessed for mining impacts on water quality based on their proximity to the location of Longwall 37 and the lengths of their monitoring records (Ecoengineers, 2015).

The monitoring sites for the assessments provided by this report were:

- The designated upriver (of Longwall 37) monitoring site: Pool 54
- The designated adjacent impact monitoring site: Pool 60 ("Blackburn Road", GRQ18); and
- The designated downriver monitoring site: Pool 64.

To establish the upstream baseline water quality dataset, only the pre-mining data at Pool 43 (GRQ17a) was used, i.e. all available data prior to the commencement of Longwall 34 on 6 February 2010 (Ecoengineers, 2015).

Based on analysis of the long-term water quality records for designated upstream and downstream sites of Longwall 37, no significant water quality impacts were observed or measured within the Georges River as a result of the mining of Longwall 37 (Ecoengineers, 2015). With respect to the water quality TARP set out in the

Longwalls 37 and 38 EP, pH levels were shown to be consistently within -1.0 pH units of the pre-existing minimum baseline value (at Pool 54), and therefore did not trigger a Level 2 TARP (Ecoengineers, 2015).

Other key water quality parameters such as pH, Dissolved Oxygen, Electrical Conductivity (a measure of salinity) and ORP generally remained within expected levels (i.e. <2 standard deviations from the long term pre-mining means) during and immediately after the extraction of Longwall 37, in particular following approach of the longwall to within 400 m from the River (Ecoengineers, 2015). Figure 4-1 to Figure 4-3 display the water quality data for pH, DO and EC from January 2009 to January 2015.

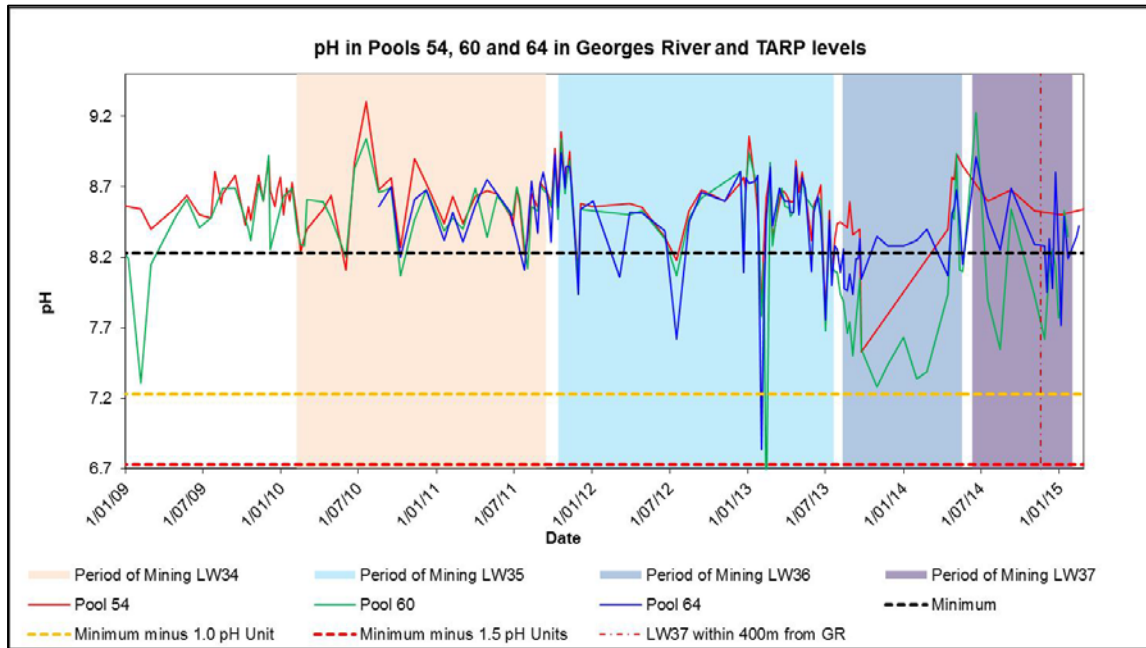


Figure 4-1: Water Quality Data - pH

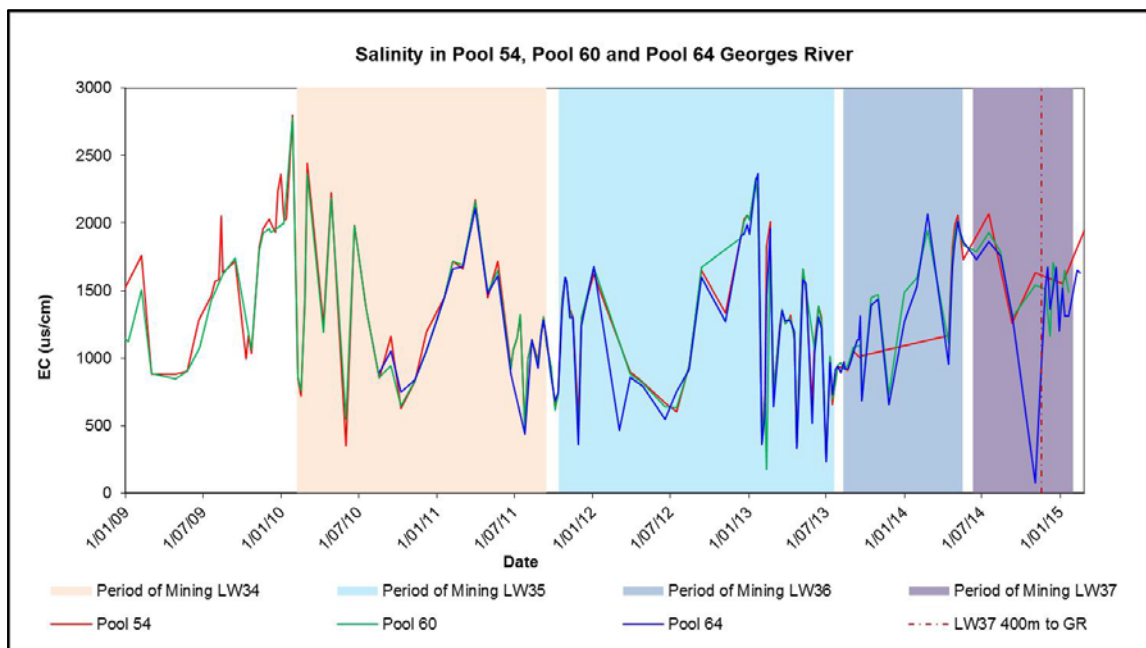


Figure 4-2: Water Quality Data - Salinity

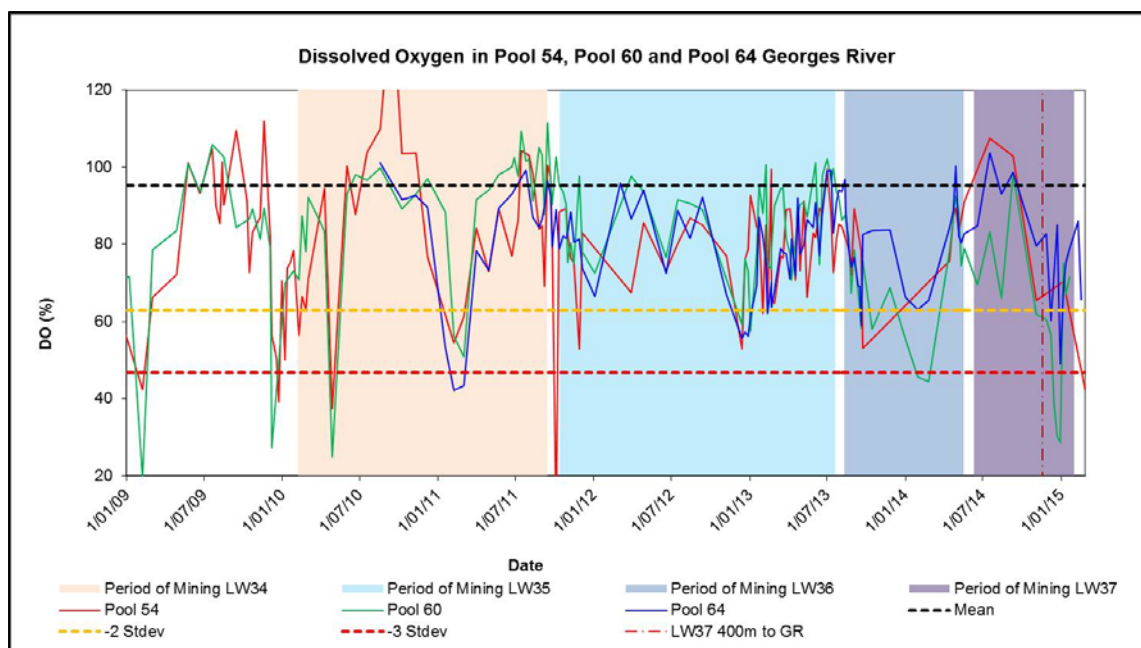


Figure 4-3: Water Quality Data – Dissolved Oxygen

4.3.2. First Order Streams

With respect to the first order streams Mallaty Creek and Nepean Creek; which drain to the Nepean River, it is noted that each of these streams exhibit highly variable, and often low, Dissolved Oxygen concentrations (Ecoengineers, 2015). This is known to be quite common for streams in this area as a result of:

- limited re-aeration in farm dams and isolated stream pools during dry weather; and the
- access of stock to the creek lines leading to biological consumption of Dissolved Oxygen during aerobic decomposition of dung and urine deposited in the creek line.

There were significant elevations in Electrical Conductivity, Sulfate, Total Manganese and Nickel and Zinc concentrations at Mallaty Creek sites MC100 and MC110. However, given the agricultural context, these elevations were considered minor consequences only of the induction of a small saline-non-ferruginous spring in the creek line below Mallaty Creek site MC110 during the prior mining of Longwall 36 (Ecoengineers, 2015).

Electrical Conductivity and laboratory data for dissolved sulfate confirmed that a minor saline spring had been induced in Mallaty Creek during the prior mining of Longwall 36 and that spring had continued to seep during the mining of Longwall 37 (Ecoengineers, 2015). The spring was seen to be manganiferous, but non-ferruginous, and also not acid-producing (Ecoengineers, 2015). Elevations in Nickel and Zinc were considered unrelated to any mining effects and were too low to be of any ecological impact (Ecoengineers, 2015).

There were no detectable impacts within Nepean Creek during the mining of Longwall 37.

4.4. Shallow Groundwater

Shallow groundwater in the Georges River catchment is monitored at five boreholes: GR28, GR27, GR70, WC54 and WC95 (refer **Appendix 8-4**).

As can be seen in Figure 4-4 below, the mining of Longwall 34 beneath borehole GR28 caused a step fall in the standing water level in the borehole. This period also coincided closely with the time when Longwall 34 was approaching to within 400 m of the River. There was no concurrent effect on the groundwater level in borehole GR27 east of the River (Ecoengineers, 2011).

During the mining of Longwall 37, there is no evidence that any significant comparable impact on water levels had occurred in both boreholes GR27 and GR28.

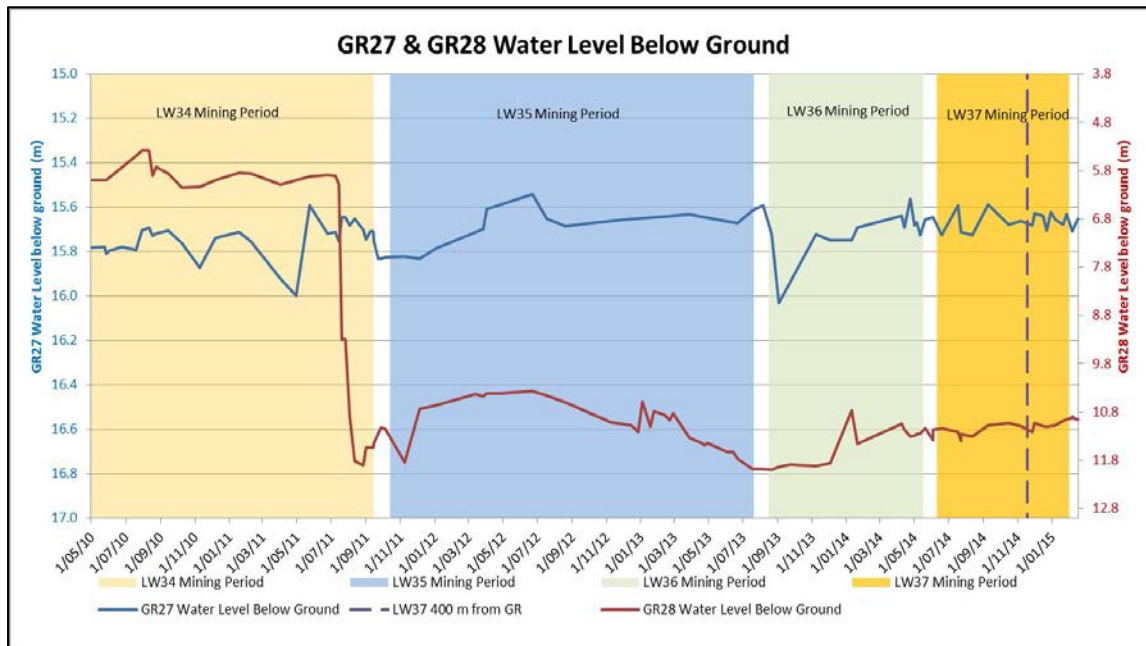


Figure 4-4: GR27 & GR28 water levels

Figure 4-5 below shows the groundwater levels at shallow boreholes GR70, WC54 and WC95 for the entire period that the sites have been monitored (February 2014 through February 2015).

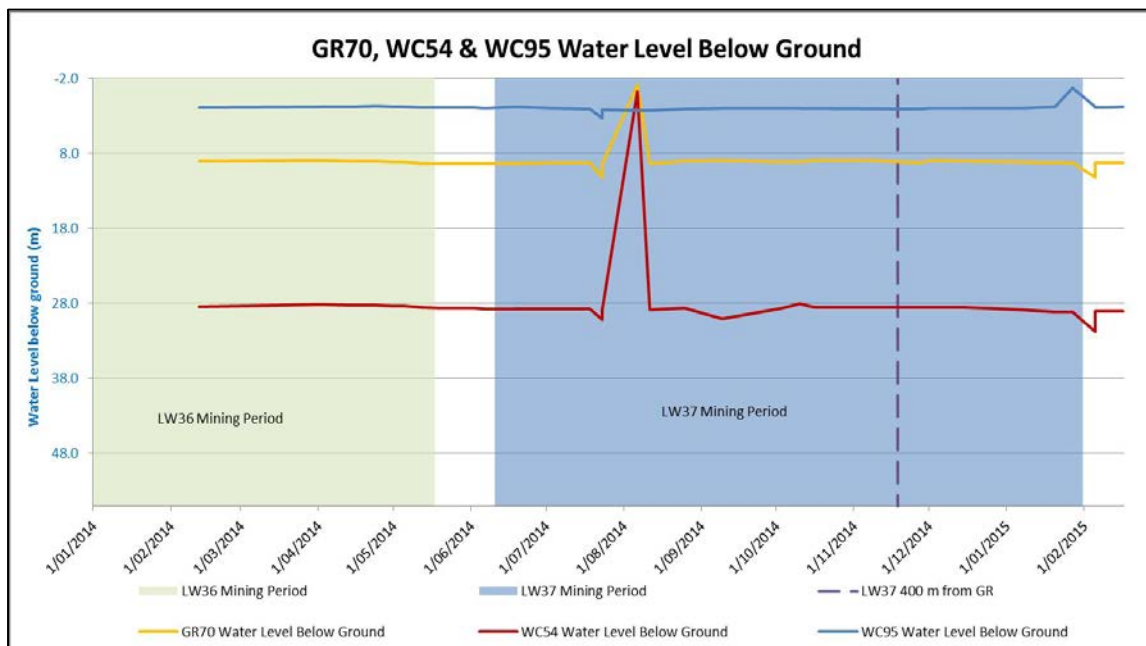


Figure 4-5: GR70, WC54 & WC95 water levels

As can be seen in Figure 4-5 above, there is no evidence showing that the mining of Longwall 37 (directly beneath borehole WC54) caused any significant water level impact in these bores.

For further detail on the assessment of groundwater, refer to **Attachment D**.

4.5. Aquatic Ecology

Cardno Ecology Lab (CEL) was commissioned by Illawarra Coal to assess the potential impact of longwall mining-related subsidence on the aquatic ecology of the Georges River and other nearby watercourses within the West Cliff Area 5 SMP (EP) Area through the implementation of an aquatic ecology monitoring programme. The latest round of aquatic ecology monitoring, undertaken on the 1st and 2nd December 2014, included post-extraction monitoring for Longwalls 35 and 36, monitoring during extraction for Longwall 37 and pre-extraction monitoring for Longwall 38. The assessments focus on aquatic habitats and biota in sections of the Georges River, comparing results from surveys undertaken since 2002 (CEL, 2013). The findings are summarised below and the assessment report is provided as **Attachment E**. The monitoring sites associated with the aquatic ecology programme are shown in **Appendix 8-7**.

Data collected during the current survey suggests that the indicators of aquatic ecology affected by the extraction of Longwall 35 during the previous survey (November 2013) are recovering from previous disturbance (CEL, 2015). This is attributed to the additional releases of water from Brennans Creek Dam which was implemented as an ameliorative measure following the physical mining impacts associated with the extraction of Longwall 35 (CEL, 2015). These findings are supported by statistical analysis, which does not indicate that any widespread or persistent impacts have occurred following extraction of Longwall 35 (CEL, 2015).

Potential pollutants associated with mine water discharge from the West Cliff Colliery via Brennans Creek Dam could influence macroinvertebrates (and other aspects of aquatic ecology) in the section of Georges River currently affected by mining. However, the presence of pollution sensitive Leptophlebiidae (prong-gilled mayflies), which have been shown to be less abundant at sites on the Georges River subject to discharge compared with reference sites, suggests that this section of river is not influenced to any great extent by any potential contaminants in mine water discharge (CEL, 2015).

There is no evidence to suggest the extraction of Longwalls 36 and 37 has had any impact on aquatic ecology (CEL, 2015).

4.5.1. Recommendations

It is recommended that increased discharges from Brennans Creek Dam be maintained for as long as practicable whenever low pool water levels and flow resulting from mining are experienced in the Georges River. This will help minimise impacts to aquatic ecology associated with loss of habitat, flow and connectivity (CEL, 2015). It may also assist in maintaining water flow and connectivity during drought.

Due to the observed impacts associated with Longwall 35 in November 2013, it is also recommended that further monitoring be undertaken during the spring 2015 AUSRIVAS sampling season to provide at least two years of post-extraction data for this longwall following recovery of aquatic ecology. This would provide additional information on the persistence and recovery of previously identified impacts to ecological indicators associated

with this longwall. This monitoring would also provide further post-extraction data for Longwall 36, the first year of post-extraction data for Longwall 37 and (depending on the progress of mining), during extraction data for Longwall 38. The collection of additional during and post mining data will facilitate the assessment of the impact of the longwall extraction on the aquatic habitat and biota in the Georges River. It will also provide information that will help further assess the impacts to aquatic ecology associated with the extraction of Longwall 35, and help inform any future remediation efforts in the Georges River following the completion of mining in West Cliff Area 5.

4.6. Terrestrial Ecology

A baseline Terrestrial Flora and Fauna Assessment (Flora Search, 2009; Biosphere, 2009) was undertaken in support of the Bulli Seam Operations Environmental Assessment, the Study Area for these assessments included the Longwalls 37 and 38 Study Area. Supplementary field surveys for terrestrial biodiversity were undertaken by Niche (2013), for the purposes of the Longwall 37 and 38 EP.

Subsidence effects are unlikely to have a significant impact on any threatened flora or fauna species (Niche, 2013). However, impacts may lead to the alteration of habitat and the alteration of the natural flow regimes of rivers, stream, floodplains and wetlands following longwall mining (Niche, 2013).

Visual inspections of vegetation communities within the Longwalls 37 and 38 Study Area will be undertaken as a part of routine landscape and water monitoring programs. Monitoring focuses on detecting significant changes to vegetation communities and fauna habitat present within the Longwalls 37 and 38 Study Area.

Inspections of vegetation condition will assess the following:

- Vegetation health.
- Visual impacts (e.g. canopy thinning, thinning of shrub layer, loss of ground cover, dead branches present).

No impacts were observed to the vegetation within the study area during inspections undertaken throughout the Longwall 37 extraction period.

4.6.1. Recommendations for Terrestrial Ecology

Visual inspection of vegetation communities, within the Longwall 37 and 38 Study Area, to continue as part of the routine landscape inspections.

4.7. Cultural Heritage

The assessment of cultural heritage and archaeological sites potentially impacted by Longwall 37 was conducted by Niche. Three Aboriginal archaeological sites were inspected as part of this assessment and included: AHMS #52-2-2243 an Aboriginal shelter with art and deposit, a shelter with art AHIMS #52-2-2242 and AHMS #52-2-2244 an Aboriginal shelter with art and axe grinding grooves (**Appendix 8-8**). These sites were inspected because one was located within the possible zone of subsidence movements associated with Longwall 37; the other two were noted to be impacted by subsidence movements associated with Longwalls 35 and 36. There

were no European heritage sites identified as being potentially affected by the extraction of Longwall 37. Hence, no sites were included in the assessment undertaken by Niche (2014).

There were no impacts or changes to the archaeological sites observed as a result of the extraction of Longwall 37 (Niche, 2015). The full report by Niche is provided as **Attachment G**, and a summary of the inspection is provided below and in Table 4-1.

Table 4-1: Summary of the site Visits to the Aboriginal Heritage Sites in Proximity to Longwall 37

AHIMS Site Number	Site Name	Results of Inspection
52-2-2243	Georges River 2	<p>Impacts to this shelter had been noted in Niche (2014).</p> <p>Observations found that impacts had not worsened and remained in the same condition as described by Niche 2014, due to the extraction of Longwall 36.</p> <p>The thin, vertical cracking previously observed in the shelter roof to the right side of the art panel remains the same as previously described.</p> <p>The cracking does not appear to have altered seepage or water movements in the shelter, and there is no evidence of water flow or recent micro-vegetation growth associated with the cracking.</p> <p>The art panel remains in the same condition as described in Biosis Research 2007 and Niche 2013b and 2014 and has not been affected by the observed changes.</p>
52-2-2244	Georges River 3	<p>This shelter was in the same condition as described by Niche 2014. There has been no further movement of the horizontal bedding plane joints of the shelter and the cracking and exfoliation observed in relation to LW35. The site remains the same as previously described.</p> <p>The cracking does not appear to have altered seepage or water movements in the shelter, and there is no evidence of water flow or recent micro-vegetation growth associated with the cracking.</p> <p>The art panel remains in the same condition as described in Biosis Research 2007 and Niche 2013b.</p>
52-2-2242	Georges River 4	<p>Shelter and Art are in the same condition as described by Biosis Research 2007 and Niche Environment and Heritage 2011, 2013 and 2014. The art has started to loose granular substrate and there has been some cracking and flaking to the panel due to case hardening. Artefacts were not observed in the drip-line of the shelter.</p>

The TARP, Performance Measures along with the proposed Corrective Management Actions for Aboriginal heritage sites; as outlined in the Longwalls 37 and 38 Heritage Management Plan (Cardno, 2013), are included in **Appendix 8-9**.

4.7.1. Recommendations for Cultural Heritage

The activities undertaken for the completion of this EoP Report have satisfied several of the response actions required by the TARP. It is not recommended that an additional monitoring program be implemented for the site Georges River No. 2 (52-2-2243). There is also no evidence that the hydrological regime at the site has been

affected by the subsidence impacts. The existing monitoring program will be continued. The following recommendations have been made with consideration of past and present site observations:

- Illawarra Coal should notify the Registered Aboriginal Parties (RAPs) of this End of Panel Report (RAPs are listed in the Bulli Seam Operations Project Heritage Management Plan, unless the RAPs have been otherwise updated in accordance with the Plan); and
- Illawarra Coal should notify all other necessary internal and external parties of the results of this End of Panel Report.

4.8. Summary of Impacts

Five new impacts (rock fracturing, rock fall and three pool water level reductions below baseline) were identified by the ICEFT along the Georges River during the Longwall 37 extraction period. These impacts were attributed to Longwall 35 and 36, not Longwall 37, due to their: their location; and timing of the observation and distance from the Longwall 37 extraction face.

Re-occurring pool water level triggers (from Longwall 35 extraction period) were also reported throughout the extraction of Longwall 37. The new impacts and ongoing pool water level triggers reported during the Longwall 37 extraction period are outlined in Table 4-2 and **Appendix 8-9**.

The locations of the impacts observed during extraction of Longwall 37 are provided in Figure 4-6. A detailed description of these impacts can be found in the relevant impact report provided as **Attachment C-1**.

Table 4-2: Summary of Impacts

Impact	Date	TARP Level Triggered	Description	ICEFT Site	Relevant Report
WCA5_LW35_029	22/12/2014	Level 1	Pool Water Level (attributed to Longwall 35)	GR_Pool 59	West Cliff Area 5 Longwall 36 Impact Update Report 24 December 2014
WCA5_LW35_027	12/08/2014	Level 2	Pool Water Level (attributed to Longwall 35)	GR_Pool 53	West Cliff Area 5 Longwall 35 Impact Report 15 August 2014
WCA5_LW35_028	12/08/2014	Level 2	Pool Water Level (attributed to Longwall 35)	GR_Pool 61	West Cliff Area 5 Longwall 35 Impact Report 15 August 2014
WCA5_LW36_001	19/06/2014	Level 1	Surface Fracture (attributed to Longwall 36)	GR104_Pool 1	West Cliff Area 5 Longwall 36 Impact Report 30 June 2014
WCA5_LW35_026	17/07/2014	Level 1	Rock fall (attributed to Longwall 35)	n/a	West Cliff Area 5 Longwall 35 Impact Report 22 July 2014
WCA5_LW35_023	18/06/2014 (Update)	Level 2	Pool Water Level (reoccurring impact from Longwall 35)	GR_Pool 60	West Cliff Area 5 Longwall 36 Impact Report 30 June 2014
WCA5_LW35_022	18/06/2014 (Update)	Level 2	Pool Water Level (reoccurring impact from Longwall 35)	GR_Pool 58	West Cliff Area 5 Longwall 36 Impact Report 30 June 2014
WCA5_LW35_012	18/06/2014 (Update)	Level 2	Pool Water Level (reoccurring impact from Longwall 35)	GR_Pool 57	West Cliff Area 5 Longwall 36 Impact Report 30 June 2014
WCA5_LW35_007	18/06/2014 (Update)	Level 2	Pool Water Level (reoccurring impact from Longwall 35)	GR_Pool 54	West Cliff Area 5 Longwall 36 Impact Report 30 June 2014

WCA5_LW35_025	18/062014 (Update)	Level 2	Pool Water Level (reoccurring impact from Longwall 35)	GR_Pool 44	West Cliff Area 5 Longwall 36 Impact Report 30 June 2014
WCA5_LW35_020	30/10/2013 (Update)	Level 1	Water Appearance – iron staining (reoccurring impact from Longwall 35)	GR_Pool 58 to GR_Pool 67	n/a (visible throughout LW37 extraction period and reports)

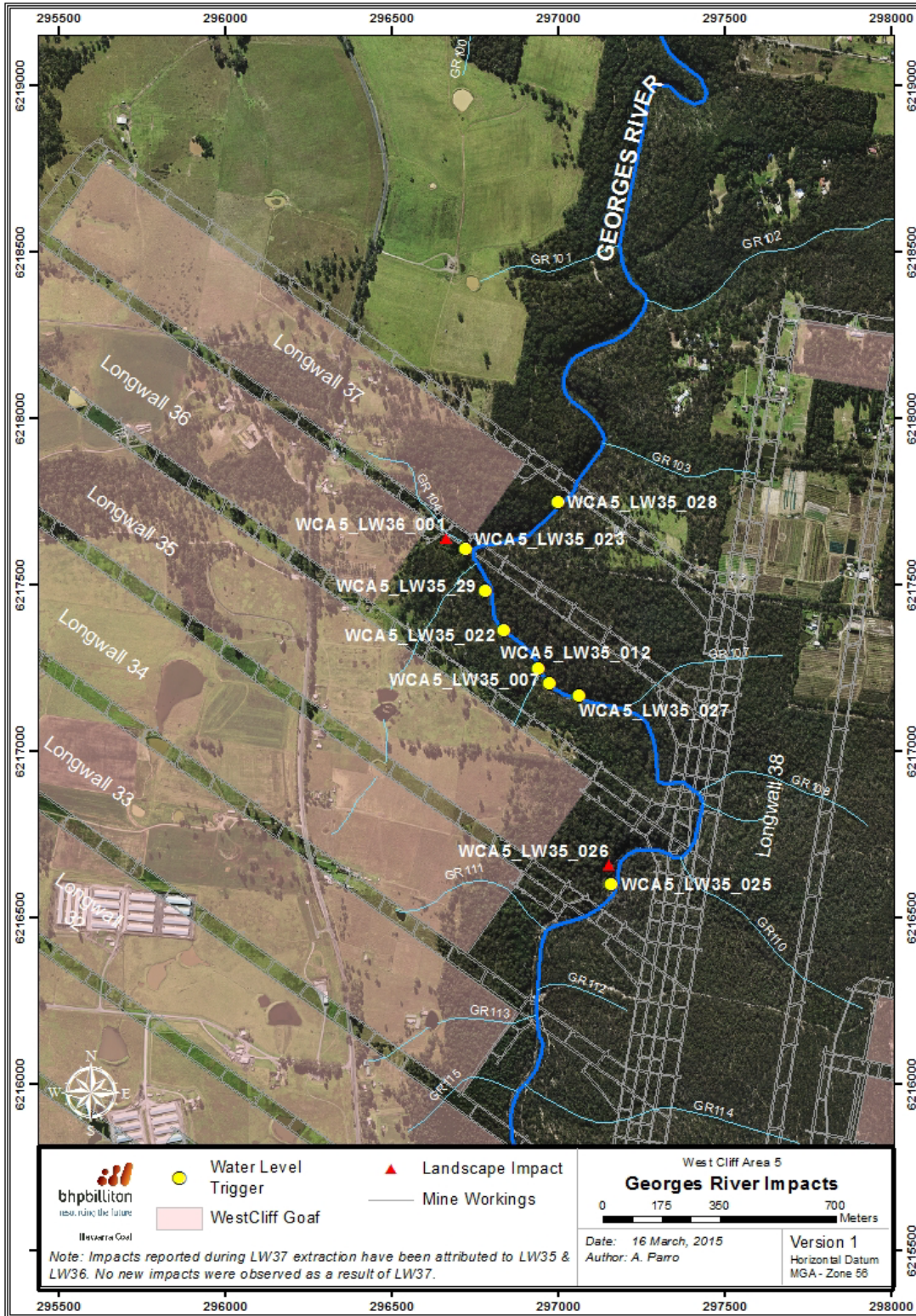


Figure 4-6: Georges River Impacts reported during Longwall 37 Extraction

5. Management of Impacts and Remediation

Reporting of impacts has been carried out as required under the SMPs, EP and GRMP for mining of West Cliff Area 5. Inspections have identified gas releases, iron staining and rock fracturing to pools and rock bars along the Georges River, adjacent to West Cliff Area 5, associated with the extraction of Longwalls 32 to 37. A decline in water level below baseline in some pools has also been recorded. Some of these impacts have remediated naturally while others require management actions to restore the river to its pre-mining condition.

The Approved SMP and EP requires remediation of the river bed and rock bars to restore flows to the surface of the river and ensure pool levels respond in a similar way to pre-mining levels. The rehabilitation is aimed at improving the water flows in the river to enable the natural system to support the ecology of the area following mining.

Impacts associated with Longwalls 32 and 33 have previously been addressed in the *West Cliff Colliery Longwall 33 Georges River Impacts Rehabilitation Options, October 2010*. An update to the 2010 report, including subsequent impacts associated with Longwalls 34 to 36, has been drafted and is currently under preliminary review by Government.

Objectives of the rehabilitation are outlined in the BSOP Approval Condition 31 Schedule 4: Restore pre-mining surface flow and pool holding capacity as soon as reasonably practicable, hydraulically and geomorphologically stable, with riparian vegetation that is the same or better than prior to mining.

In addition the rehabilitation also aims to:

- maintain flows in the Georges River so that pools in the area of impact retain water during low flow conditions;
- carry out remediation works in a manner that protects to the greatest practicable extent the ecological values of the area;
- repair the aesthetic values of the area where necessary;
- reduce the interaction of surface and groundwater flow where it has been enhanced through mining;
- restore hydraulic gradients across impacted rock bars;
- have rivers, creeks and pools functioning in a similar manner to the pre-impact state;
- not obstruct fish passage;
- have surface flows and pool water quality continue to provide suitable aquatic habitat;
- re-establish the ecological values of the area to a similar state to that existing before mining;
- have creeks and catchments yielding similar water quantity and quality following mining; and
- monitor and report effectiveness of the program.

5.1. Previous Mitigation/Rehabilitation of the Georges River

Remediation work has been carried out on the Georges River upstream of Longwall 36, associated with West Cliff Longwalls 5A1-4, which were mined from 1999 till 2003. This work is detailed in the report 'Georges River Report Assessment of Georges River Remediation Longwalls 5A1-4', dated November 2006.

It should be noted that during this period, mining occurred directly beneath the Georges River, resulting in greater impacts than have been observed for subsequent longwalls that have not mined directly under the Georges River.

Impacts observed from Longwalls 5A1-4 included an increased level of interaction between surface and ground waters, as well as reduced pool levels during low and no flow conditions. Localised water quality changes were also observed due to surface and groundwater interactions.

Several techniques were applied during the remediation of the Georges River. These included:

- The short term release of a supplementary flow to the river when low and no flow conditions were experienced;
- Grouting of fractures within the riverbed to increase surface flows and water holding capacity in impacted areas. Three main types of grouting were applied. These were:
 - Shallow pattern grouting
 - Grouting of deep angled drilled holes targeting specific fractures
 - Grout curtains
- A slot installed near Marhnyes Hole prior to mining to reduce impacts to the large rock bar located immediately upstream of the pool.

The mitigation and rehabilitation work completed on the Georges River has allowed for a significant reduction in the impacts resulting from subsidence. It demonstrates that rehabilitation would be successful.

5.2. Trigger Action Response Plans (TARPs)

The TARPs relate to identifying, assessing and responding to the potential impacts to landscape features (including impacts greater than predicted) from subsidence. These TARPs have been prepared using knowledge gained from previous mining in West Cliff Area 5. The TARPs for the natural features associated with Longwalls 37 and 38 extraction are included in **Appendix 8-9**.

It should be noted that the TARPs represent actions to be taken upon reaching each defined trigger level. A Corrective Management Action (CMA) is developed in consultation with stakeholders in order to manage an observed impact in accordance with relevant approvals.

Monitoring of environmental aspects provides key data when determining any requirement for mitigation or rehabilitation. The triggers are based on comparison of baseline and impact monitoring results. Where required the triggers will be reviewed and changes proposed in impact assessment reports provided to government agencies or in End of Panel Reports

5.3. Remediation Associated with Longwall 37

5.3.1. Georges River

No impacts were recorded during the Longwall 37 extraction period which were attributed to Longwall 37.

Impacts associated with the extraction of Longwalls 32 to 36 have included gas releases, iron staining, rock fracturing to pools and rock bars and a decline in pool water levels below baseline in some pools along the Georges River. The Approved SMP and EP requires remediation of the river bed and rock bars to restore flows to the surface of the river and ensure pool levels respond in a similar way to pre-mining levels.

5.3.2. Infrastructure

Rehabilitation of the mining affects along Appin Road is being planned. The section of Appin Road from Brian's Road to the LGA boundary has been assessed by (RMS and the MSB, with cost sharing agreed for this section. It is planned that the section of Appin Road, to the north of the LGA boundary covering the area influenced by Longwalls 35 to 37, will be assessed by the RMS and the MSB in coming months to identify mine subsidence related damage and cost responsibilities.

Three properties have reported impacts during Longwall 37 at the time of preparation of this report. One of these properties is being dealt with separately between the home owner and Campbelltown Council rather than the MSB. The remaining two are being managed by the MSB.

Survey control marks will require re-establishment following the completion of all movement in the area in consultation with the Department of Lands.

6. Longwall 37 Monitoring Program

A comprehensive monitoring program for Longwall 37 is undertaken as required by the Longwall 37 and 38 EP Approval and in accordance with the Longwall 37 and 38 EP and associated management plans (listed in Section 1.3).

The monitoring commitments undertaken for Longwall 37 are outlined in Table 6-1(man-made features) and Table 6-2(natural features).

Table 6-1: Longwall 37 Monitoring Program for Man-Made Features.

Aspect	Frequency	Monitoring Undertaken By
Gas Pipelines		
J Line – 2D	<ul style="list-style-type: none"> Prior to Longwall 37 starting. after 500m extraction only if Technical Committee agree on a cessation End of Longwall 37 	Illawarra Coal
J Line – 3D	<ul style="list-style-type: none"> Prior to Longwall 37 starting. End of Longwall 37 	Illawarra Coal
Mallaty Creek – 3D	<ul style="list-style-type: none"> Prior to Longwall 37 starting. End of Longwall 37 	Illawarra Coal
Sydney Water Supply Pipeline		
J Line (as above)	as above	Illawarra Coal
TransGrid 330kV Transmission Line Towers		
Towers 37-79 to 37-82	<ul style="list-style-type: none"> Prior to Longwall 37 starting. 	Illawarra Coal

	<ul style="list-style-type: none"> • After 500m extraction • End of Longwall 37 	
Endeavour Energy Powerline Poles		
	<ul style="list-style-type: none"> • Prior to Longwall 37 starting. • Monthly from 100m before until 500m past • End of Longwall 37 	Illawarra Coal
Appin Road, Telstra OFC, Sydney Water Sewerage		
B Line – 2D	<ul style="list-style-type: none"> • Prior to Longwall 37 starting. • 100m from Appin Road • Weekly (or nominally every 50m extraction) • End of Longwall 37 	Illawarra Coal
B Line – 3D	<ul style="list-style-type: none"> • Prior to Longwall 37 starting. • 100m from Appin Road • Monthly until 500m past Appin Road • End of Longwall 37 	Illawarra Coal
SCA Infrastructure		
Aqueducts and Bridge Surveys	<ul style="list-style-type: none"> • Prior to Longwall 37 starting • 350m and 700m extraction • End of Longwall 37 	Illawarra Coal
The Upper Canal and Devines Tunnels		SCA
Private Properties – Built Features		
Houses, sheds, farm dams, pools, fences, boreholes etc.	<ul style="list-style-type: none"> • as outlined in <i>Built Feature Management Plans</i> (where applicable) 	As outlined in <i>Built Feature Management Plans</i> (where applicable)

Table 6-2: Longwall 37 Monitoring Program for Natural Features

MONITORING SITE	MONITORING TYPE	MONITORING FREQUENCY	MONITORING TO DATE AND RECOMMENDATIONS
SURFACE WATER QUALITY			
Longwall 37			As stated in the Extraction Plan.
<p>Georges River Upstream monitoring site:</p> <ul style="list-style-type: none"> • Pool 54 <p>Downstream monitoring site:</p> <ul style="list-style-type: none"> • Pool 64 	<ul style="list-style-type: none"> • Field testing of water quality parameters • Grab sample for testing of specific analytes at an accredited laboratory • Water level measurements (using benchmarks where they can be installed and/or photos) • Observational and photographic monitoring 	<ul style="list-style-type: none"> • Monthly before and after mining • Weekly during mining (when the longwall is within 400 m) 	<p>Post-mining monitoring for Mallaty Creek has been undertaken since April 2014, it is recommended that this monitoring cease. Refer to Attachment C for additional information.</p>
<p>Mallaty Creek Downstream monitoring sites:</p> <ul style="list-style-type: none"> • MC100, MC106 and MC110 			
<p>Nepean Creek Downstream monitoring site:</p> <ul style="list-style-type: none"> • NC10 			
<p>Tributary of Georges River Downstream monitoring site:</p> <ul style="list-style-type: none"> • GR104 and 105 			
Longwall 38			
<p>Georges River Upstream monitoring site:</p> <ul style="list-style-type: none"> • Pool 34 <p>Adjacent monitoring site:</p> <ul style="list-style-type: none"> • Pool 54 <p>Downstream monitoring site:</p> <ul style="list-style-type: none"> • GR100 	<ul style="list-style-type: none"> • Field testing of water quality parameters • Grab sample for testing of specific analytes at an accredited laboratory • Water level measurements (using benchmarks where they can be installed and/or photos) • Observational and photographic monitoring 	<ul style="list-style-type: none"> • Monthly before and after mining • Weekly during mining (when the longwall is within 400 m) 	
<p>Tributaries of Georges River Upstream monitoring site:</p> <ul style="list-style-type: none"> • GR119 <p>Adjacent monitoring sites:</p> <ul style="list-style-type: none"> • GR107, GR108, GR110 <p>Downstream monitoring sites:</p> <ul style="list-style-type: none"> • GR102, GR103, GR114 and GR117 			

GROUNDWATER			
BHPBIC piezometers: <ul style="list-style-type: none"> GR27 GR28 GR29 GR70 WC54 WC95 	<ul style="list-style-type: none"> Field testing of water quality parameters and grab sample for testing of specific analytes at an accredited laboratory (where access is available to the water) Water level (measured and logged at least twice daily) 	<ul style="list-style-type: none"> At least one pre-mining sample One sample following the completion of Longwall 37 One sample following the completion of Longwall 38 	As stated in the Extraction Plan, except GR29 which is inaccessible due to equipment malfunction and unable to be monitored.
Private bores: <ul style="list-style-type: none"> GW32310 GW72454 GW105921 GW108322 	<ul style="list-style-type: none"> Monitoring as agreed in Property Subsidence Management Plans or as requested by landholder 	<ul style="list-style-type: none"> One pre-mining level measurement and water sample One post mining level measurement and water sample 	Private boreholes were inspected where access to the properties was available. Monitoring conducted as agreed with the landholders.
BHPBIC piezometer: <ul style="list-style-type: none"> S2087 	<ul style="list-style-type: none"> Vibrating wire piezometers within a cemented hole (note that some are damaged due to ground shear) 	<ul style="list-style-type: none"> Monitoring of functional piezometers 	S2087 is non-functional and was rehabilitated in 2011.
Groundwater inflows to the mine	<ul style="list-style-type: none"> Mine water budget Statutory inspections 	<ul style="list-style-type: none"> Flow meters 	As stated in the Extraction Plan.
LANDSCAPE FEATURES, VEGETATION AND WATERCOURSES			
All mapped cliffs, steep slopes and pools within the mining areas, including: <ul style="list-style-type: none"> Cliffs GR-CL01 and GR-CL02 Georges River – all mapped pools and rock bars (GR-RB42, GR-RB43, GR-RB44, GR-RB45, GR-RB47, GR-RB48, GR-RB49, GR-RB51, GR-RB52, GR-RB53, GR-RB54, GR-RB55, GR-RB56a, GR-RB56b, GR-RB57, GR-RB59, GR-RB60, GR-RB61, GR-RB62, GR-RB63, GR-RB64, GR-RB65, GR-RB66, GR-RB67) Tributaries (GR103, GR104, GR105, GR107, GR108, GR110, GR114) 	Site inspections include: <ul style="list-style-type: none"> General inspection of active subsidence areas Re-visits to identified impact sites Measurement of pool water level 	<ul style="list-style-type: none"> Monthly before and after mining Weekly during mining (when the longwall is within 400 m) 	As stated in the Extraction Plan.

AQUATIC ECOLOGY

<p>Georges River</p> <ul style="list-style-type: none"> • Site 6 (upstream control site); • Site 8 (impact site for Longwalls 35 and 38); • Site 9 (impact site Longwalls 35 and 36); • Site 10 (impact site Longwalls 36 and 37); and, • Site 11 (downstream controls site). 	<p>Habitat assessment, water quality, aquatic macroinvertebrates, fish.</p>	<ul style="list-style-type: none"> • Two baseline monitoring campaigns during spring • Monitoring during mining in spring each year • Two monitoring campaigns post mining
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CULTURAL HERITAGE

<p>Aboriginal Archaeology Area 5:</p> <ul style="list-style-type: none"> • 52-2-2064 • 52-2-2234 • 52-2-2236 • 52-2-2241 • 52-2-2242 • 52-2-2243 • 52-2-2062 • 52-2-2063 • 52-2-2264 • 52-2-3691 	<ul style="list-style-type: none"> • Macro and micro recording using digital photography; • Detailed elevation plans of shelter walls recording structural and surface features including but not limited to the art itself, graffiti, joints, bedding planes, exfoliation scars, cracks, mineral and micro-organism growth, drip line and water seepage locations. 	<ul style="list-style-type: none"> • <i>Baseline archival recording:</i> Prior to commencement of mining • <i>Impact assessment recording:</i> Following the identification of impacts • <i>Final assessment recording:</i> Following the completion of subsidence 	<p>Sites monitored for Longwall 37:</p> <ul style="list-style-type: none"> • 52-2-2243 • 52-2-2242 • 52-2-2244
<p>European Heritage</p> <p>Longwall 38:</p> <ul style="list-style-type: none"> • Site WH1 (bridge and road remains) 	<ul style="list-style-type: none"> • A subsidence monitoring program for the bridge and road remains site (WH1) will be developed on the basis of the pre-mining inspection and assessment. • The subsidence monitoring program will include: <ul style="list-style-type: none"> – Pre-mining inspection and assessment prior to mining. – Observational monitoring to identify potential subsidence impacts. – Assessment of heritage impacts by a suitably qualified heritage expert (if required). 	<ul style="list-style-type: none"> • <i>Baseline archival recording:</i> Prior to commencement of mining • <i>Impact assessment recording:</i> Following the identification of impacts • <i>Final assessment recording:</i> Following the completion of subsidence 	<p>Monitoring not required for Longwall 37.</p>

7. References

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- Annexure A: MSEC, June 2013, *Subsidence Predictions and Impact Assessments for the Natural Features and Surface Infrastructure in Support of the Extraction Plan*, Revision B, MSEC533.
- Annexure B: BHP Billiton, August 2013, *Subsidence Monitoring Program*, Revision A.
- Annexure C: Cardno Forbes Rigby Pty Ltd, March 2014, *Water Management Plan*, Revision B.
- Annexure D: Cardno Forbes Rigby Pty Ltd, August 2013, *Biodiversity Management Plan*, Revision A.
- Annexure E: Cardno Forbes Rigby Pty Ltd, August 2013, *Land Management Plan*, Revision A.
- Annexure F: Cardno Forbes Rigby Pty Ltd, August 2013, *Heritage Management Plan*, Revision A.
- Annexure G: Cardno Forbes Rigby Pty Ltd, August 2013, *Public Safety Management Plan*, Revision A.
- Annexure H: Cardno Forbes Rigby Pty Ltd, August 2013, *Built Features Management Plan*, Revision A.

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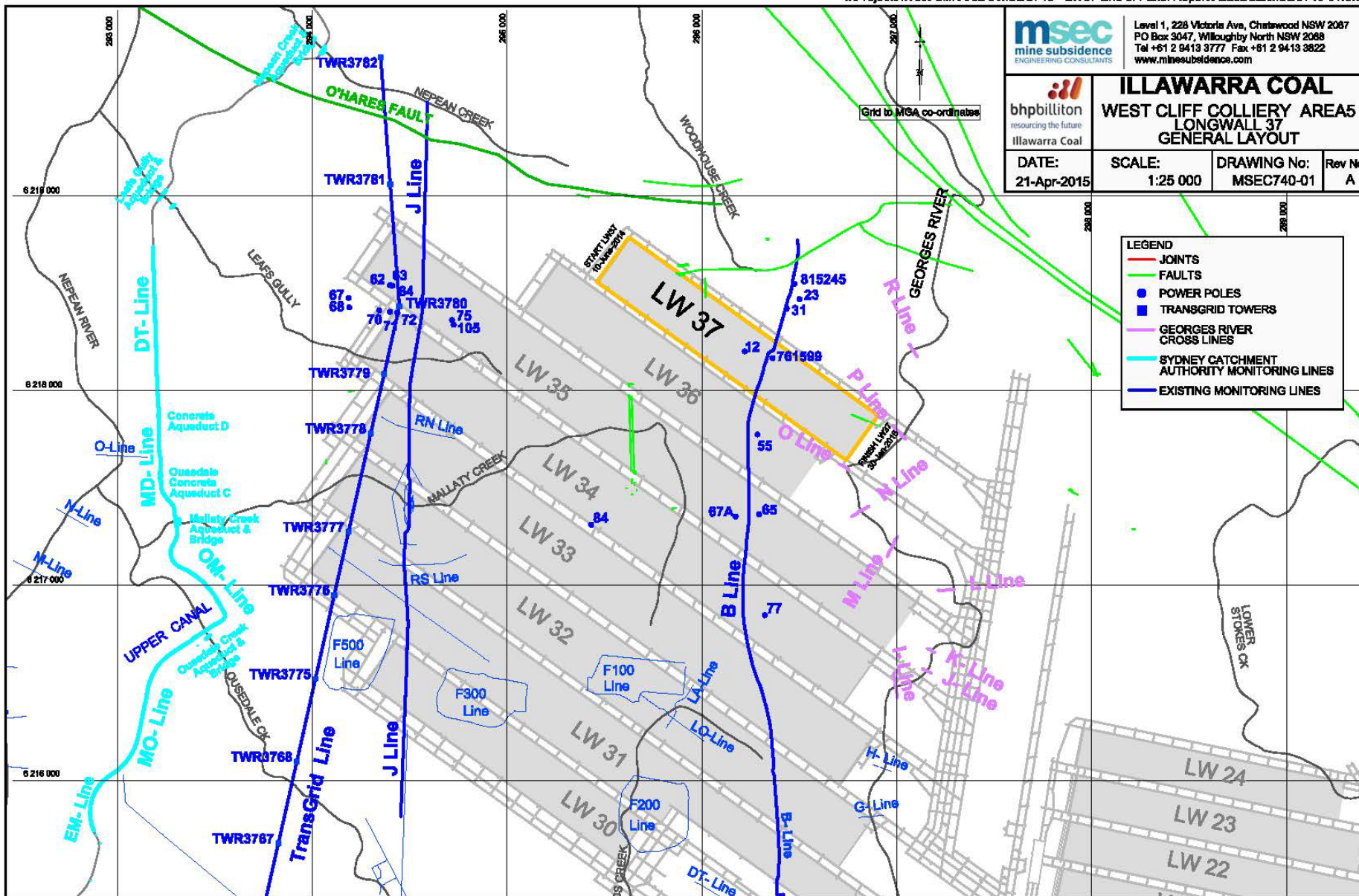
MSEC, 2015. *End of Panel Subsidence Monitoring Report for West Cliff Longwall 37*, Revision A (MSEC740), April 2015.

Niche, 2015. *Aboriginal Heritage Assessment for West Cliff Colliery – Longwall 37 End of Panel Report*, April 2015.

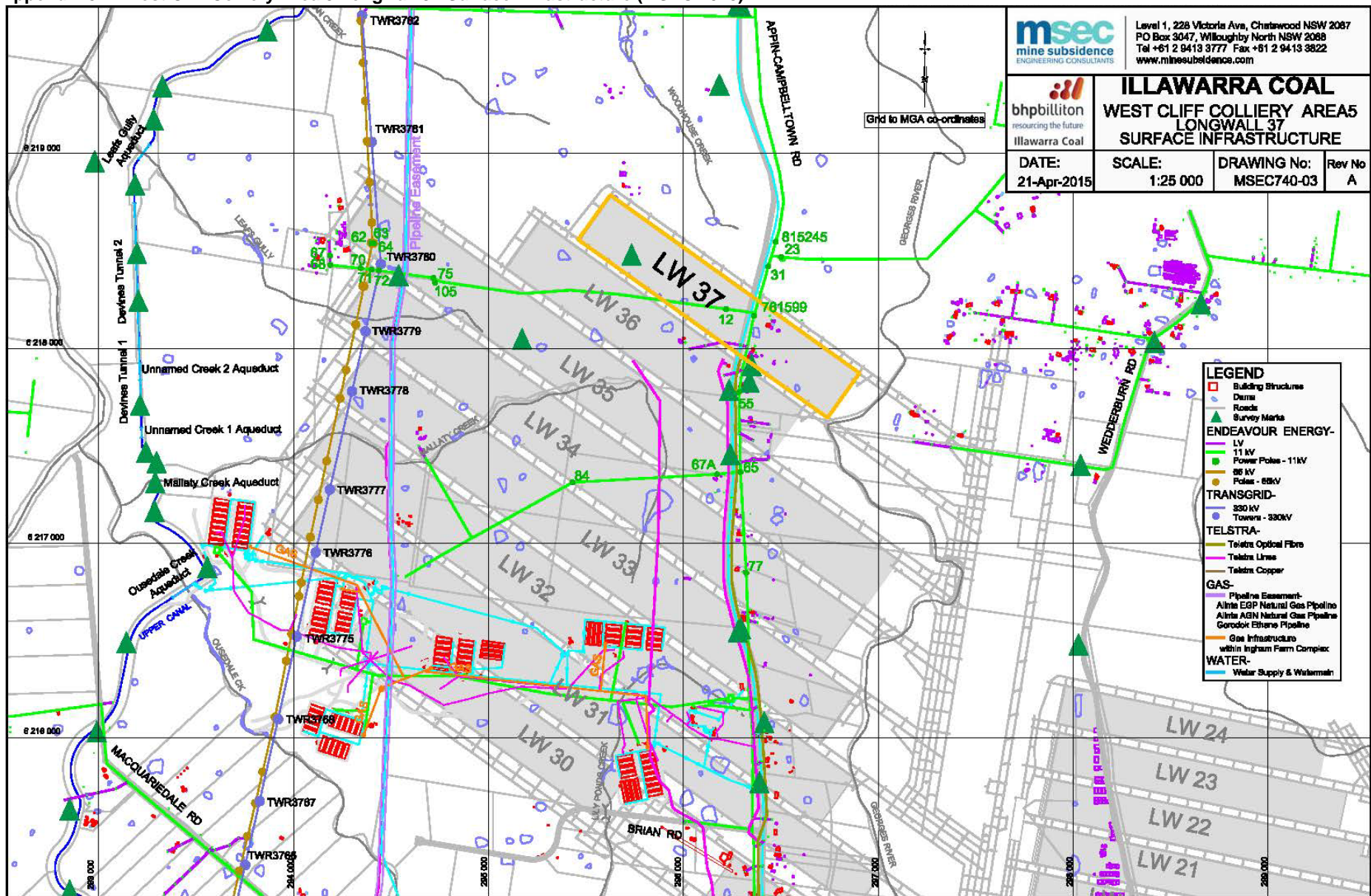
Niche, 2013. *West Cliff Longwalls 37 and 38 Terrestrial Flora and Fauna Assessment*.

8. Appendices

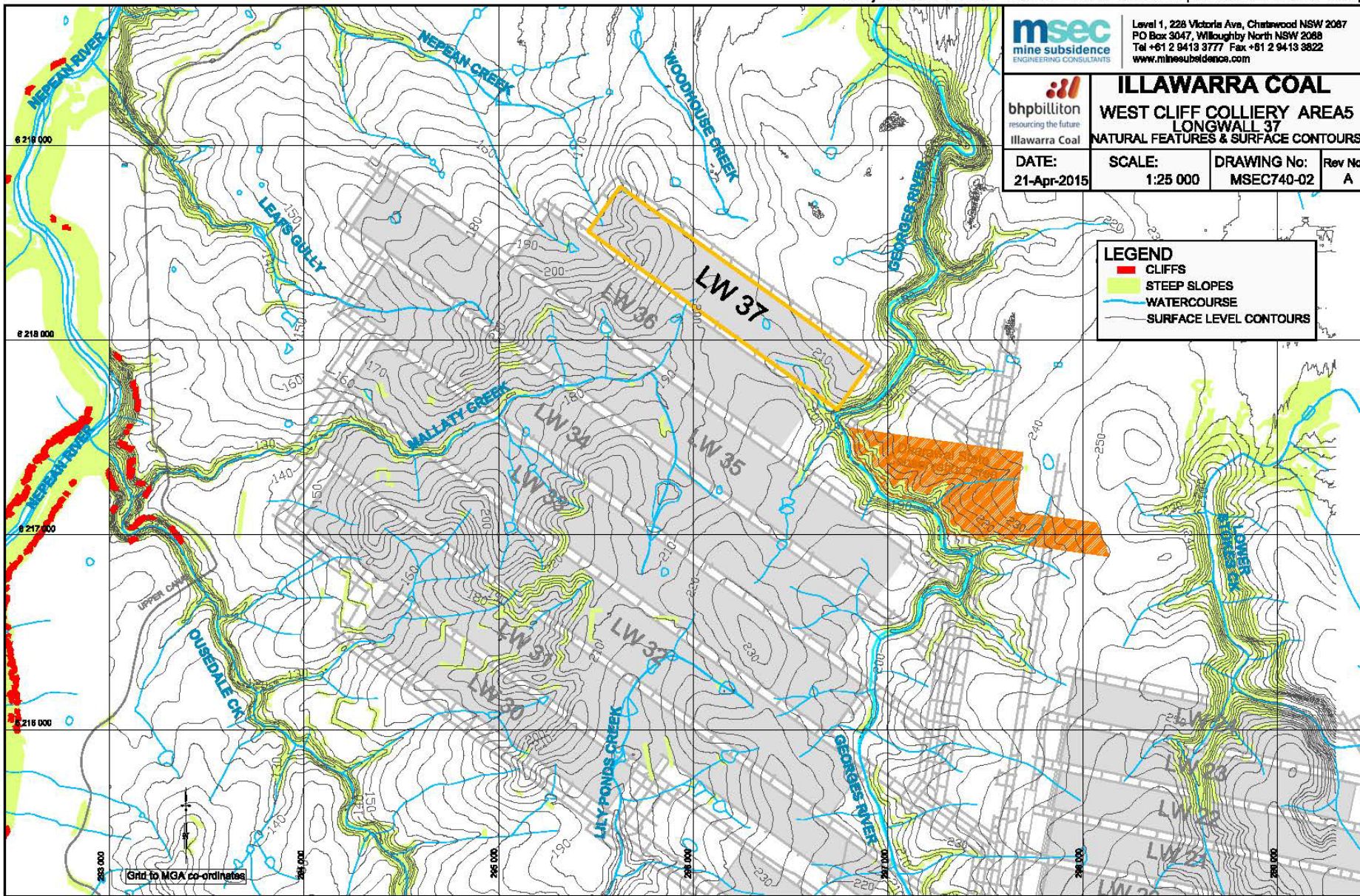
Appendix 8-1: West Cliff Colliery Area 5 Longwall 37 General Layout (MSEC 2015).



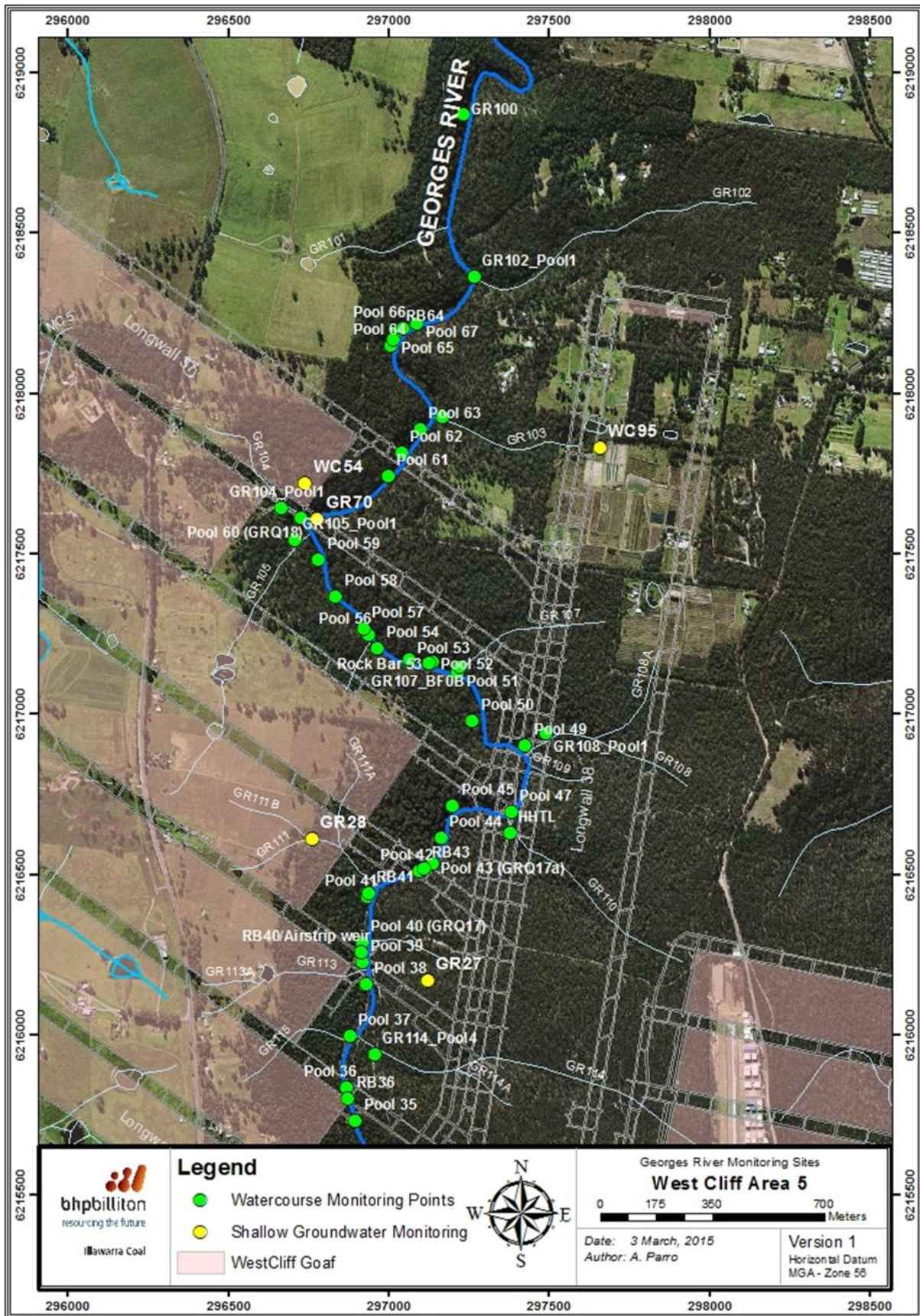
Appendix 8-2: West Cliff Colliery Area 5 Longwall 37 Surface Infrastructure (MSEC 2015).



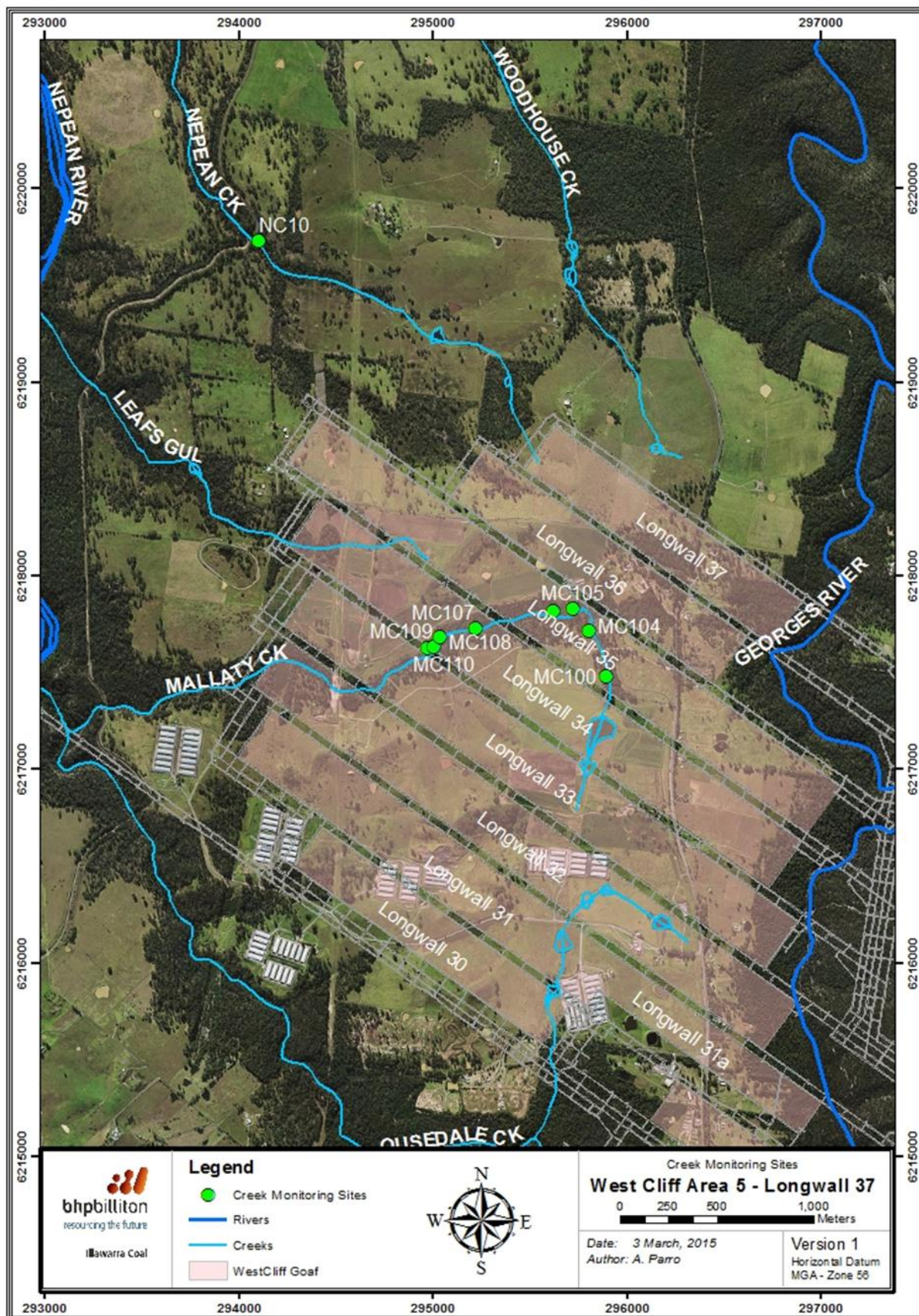
Appendix 8-3: West Cliff Colliery Area 5 Longwall 37 Natural Features and Surface Contours (MSEC 2015)



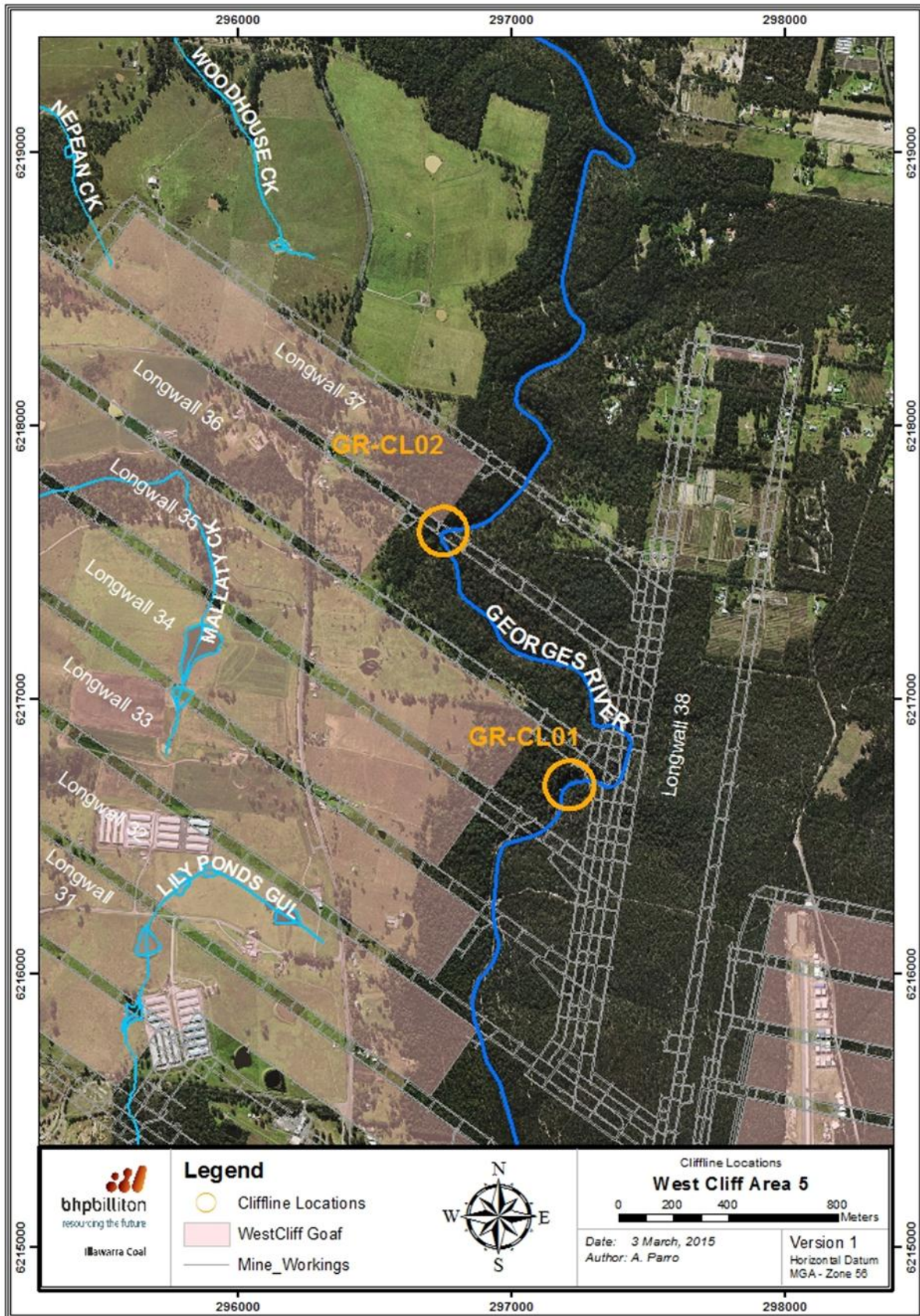
Appendix 8-4: Monitoring Sites along the Georges River (ICEFT sites)

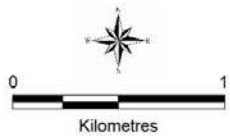
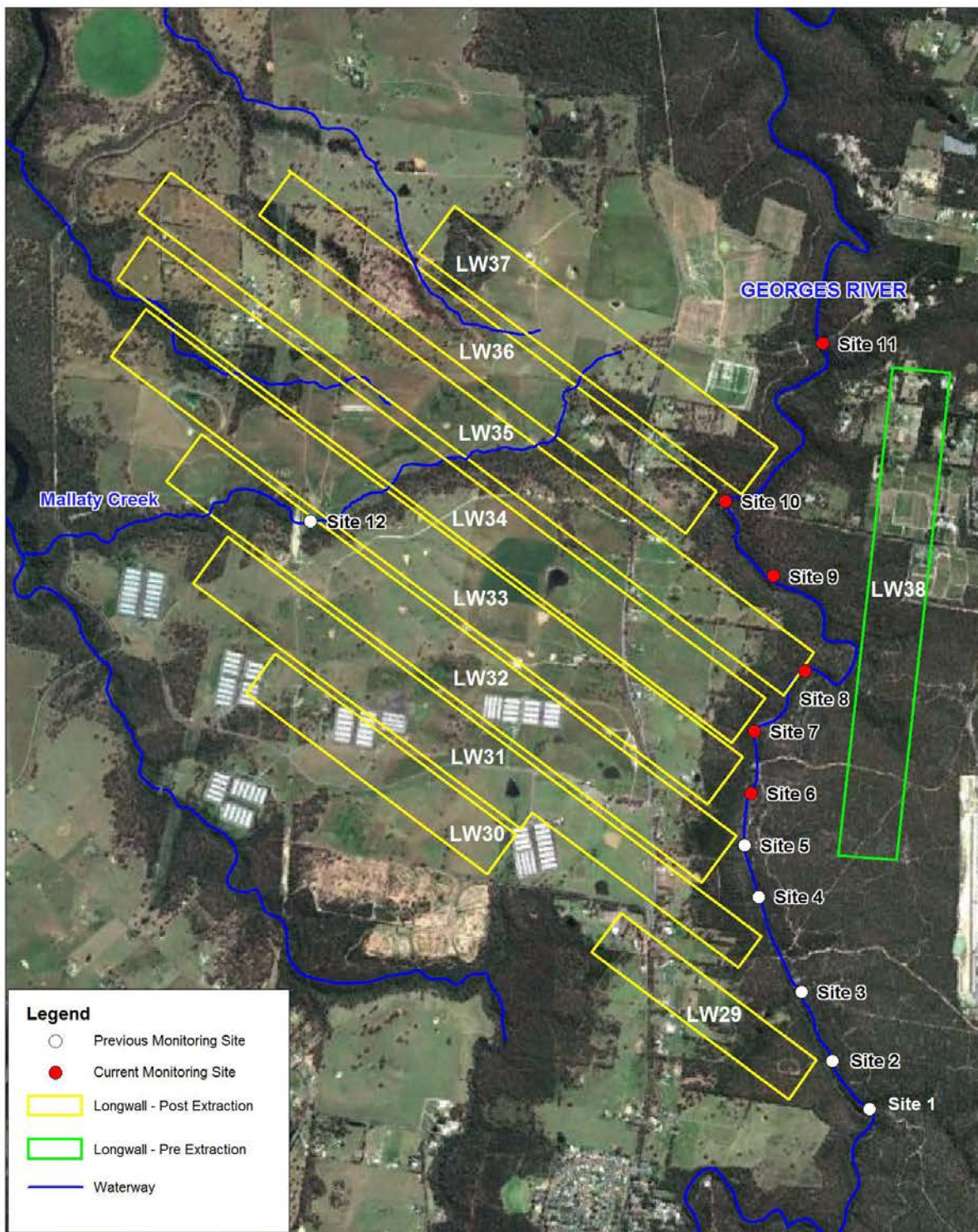


Appendix 8-5: Monitoring Sites along First and Second Order Streams (ICEFT sites)



Appendix 8-6: Cliff and Steep Slope Monitoring Sites

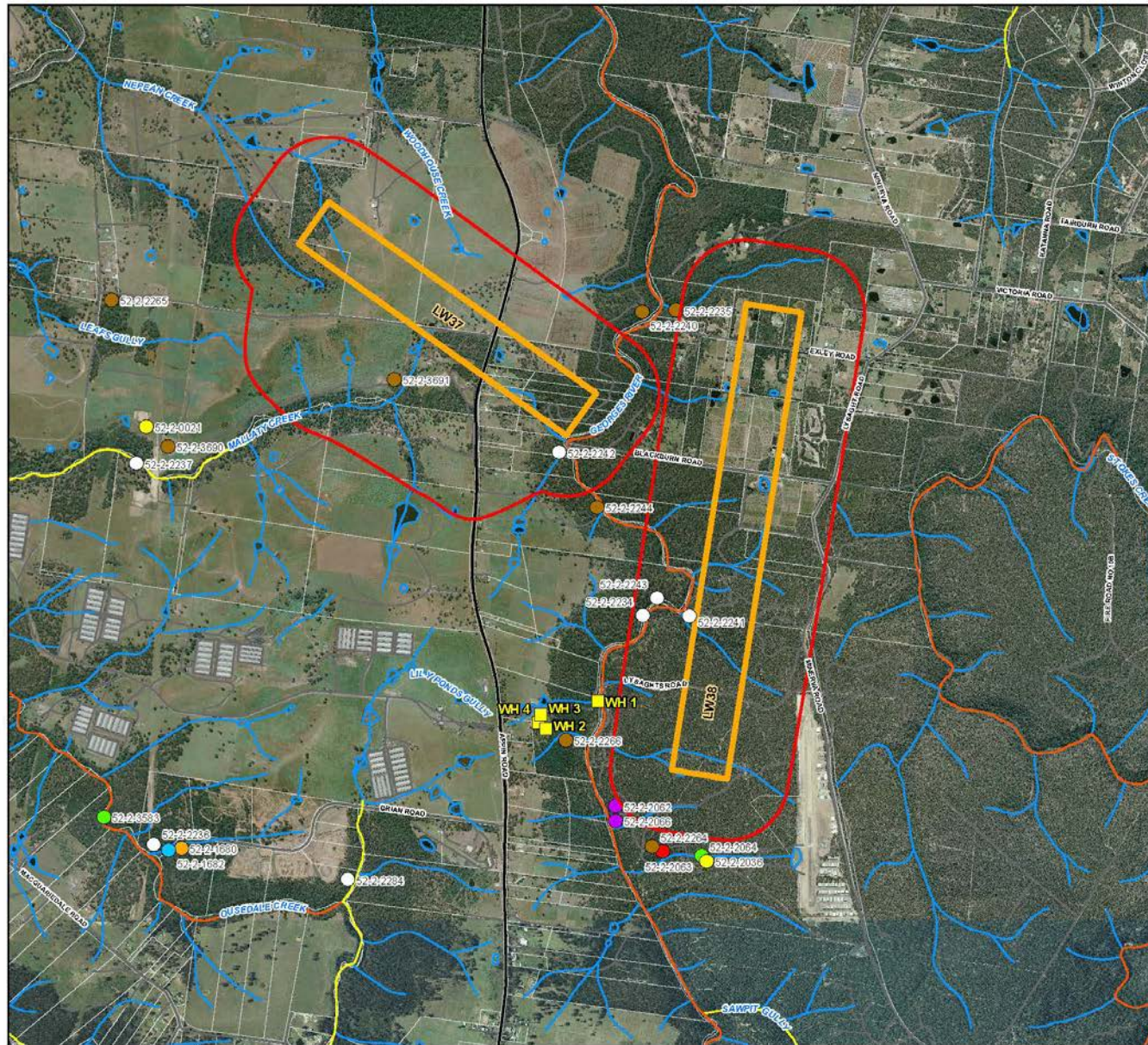





West Cliff Longwalls 33 to 38
 Aquatic Ecology Monitoring 2002 to 2014
 Figure 3.1: Aquatic Ecology Monitoring Sites

Cardno Ecology Lab
 Map Produced by Cardno Ecology Lab
 Date: 4 March 2014
 Coordinate System: Zone 56 MGA/GDA 94
 GIS MAP REF: Google Earth
 59915064

Appendix 8-8: Cultural Heritage Monitoring Sites





ILLAWARRA COAL

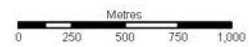
Recorded Heritage Items


WESTCLIFF AREA 5
LW 37 and 38

Legend

- Study Area
- European Heritage (Niche, 2013)
- Aboriginal Sites (Niche, 2013)**
- Art (Pigment or Engraved)
- Artefact
- Axe Grinding Groove
- Open Camp Site
- Scarred Tree
- Shelter with Art
- Shelter with Deposit
- Shelter with PAD
- Major Roads (LPI)
- Watercourse (MSEC, 2013)
- 3rd Order Watercourse (MSEC, 2013)
- 4th Order Watercourse (MSEC, 2013)
- West Cliff LW 37 and 38 (BHPBIC 2013)


FIGURE 2
 Scale 1:20,000 (at A3)


 Metres


 Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
 Date: 11/06/2013
 Coordinate System: ODA 1994 MGA Zone 56
 Project: 112054-01
 Map: 01010_Plan-0004-4rtagattemis.mxd 02
 Aerial imagery supplied by BHP BIC (2007 and 2008)

Appendix 8-9: TARPs and Impact Summary

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
NATURAL FEATURES						
<p>Georges River – Appearance and Pool Water Level</p> <p>All mapped pools in the mining area</p>	<p>Negligible environmental consequences including:</p> <ul style="list-style-type: none"> - negligible diversion of flows or changes in the natural drainage behaviour of pools; - negligible gas releases and iron staining; and - negligible increase in water cloudiness. <p>over at least 80% of the stream length subject to vertical subsidence >20mm.</p> <p>No subsidence impact or environmental consequence greater than minor.</p>	<p>Level 1</p> <ul style="list-style-type: none"> • Fracturing with no observable surface water diversion • Pool water level lower than baseline in any mapped pool located in the mining area (within 400m of the longwall) • Increase in turbidity, iron staining, algal growth, or other visible water quality parameters determined by comparing baseline photos with photos during the mining period 	<p><i>No impacts attributed to Longwall 37 extraction.</i></p> <p><i>Impacts from previous longwall:</i></p> <ul style="list-style-type: none"> - WCA5_LW35_029 - WCA5_LW35_020 	<p><i>GRMP:</i></p> <ul style="list-style-type: none"> • No Remedial Action necessary • Monthly Review Meeting • Continue Monitoring Program • Increase Survey Monitoring Programme to weekly for all Georges River Cross Lines <p><i>LW37 & 38 EP:</i></p> <ul style="list-style-type: none"> • Continue monitoring program • Report trigger to key stakeholders • Summarise impacts and report in the End of Panel Report and AEMR 	<ul style="list-style-type: none"> • West Cliff Area 5 Longwall 35 Impact Report 24 December 2014 	<ul style="list-style-type: none"> - Remediation of the river bed and rock bars
		<p>Level 2</p> <ul style="list-style-type: none"> • Pool water level lower than baseline in the majority of mapped pools located in the mining area (within 400m of the longwall) • Fracturing with observable surface water diversion 	<p><i>No impacts attributed to Longwall 37 extraction.</i></p> <p><i>Impacts from previous Longwalls:</i></p> <ul style="list-style-type: none"> - WCA5_LW35_027 - WCA5_LW35_028 - WCA5_LW35_023 - WCA5_LW35_022 - WCA5_LW35_012 - WCA5_LW35_007 - WCA5_LW35_025 	<p><i>GRMP:</i></p> <ul style="list-style-type: none"> • Increase monitoring/inspection frequency of key sites to twice weekly • Increase discharge from BCD to maintain pool water levels for ecosystem protection • Develop and following appropriate approvals implement remedial action such as manual crack filling with local materials • Review management options, including implementation of; measures to reduce the level of observed impacts and mine plan changes to ensure Level 3 impacts are not induced by Longwall(s) • Within 3 months of the completion of the Longwall, assess the magnitude of pool level reduction. If ongoing mining induced pool water level reduction is occurring, develop remedial works to restore pool water level. Implement remedial works as soon as subsidence movements within Area 5 that may affect the rehabilitation works are complete and appropriate approvals are in place. • Develop and implement monitoring program to endure effectiveness of remedial works if 	<ul style="list-style-type: none"> • West Cliff Area 5 Longwall 35 Impact Report 15 August 2014 	<ul style="list-style-type: none"> - Remediation of the river bed and rock bars

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
				<p>they are required.</p> <p><i>LW37 & 38 EP:</i></p> <ul style="list-style-type: none"> • Actions as stated for Level 1 • Review monitoring program • Review impacts against the Performance Measures • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved 		
		<p>Level 3</p> <ul style="list-style-type: none"> • Pool water level lower than baseline in all mapped pools in the mining area (within 400m of the longwall) • Fracturing with observable water diversion results in any mapped pool becoming dry during a mitigation flow in the River 	No impacts observed.	<p><i>LW37 & 38 EP:</i></p> <ul style="list-style-type: none"> • Actions as stated for Level 2 • Notify DP&I, DPI, relevant resource managers and technical specialists and seek advice on any CMA required • Invite stakeholders for site visit • Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> • Grouting of fractures which result in flow diversion • Completion of works following approvals • Issue CMA report within 1 month of works completion • Review the TARP and Management Plan in consultation with key stakeholders 	N/A	N/A
		<p>Exceeding Performance Measures</p> <ul style="list-style-type: none"> • More than negligible diversion of flows or changes in the natural drainage behaviour of pools over more than 20% of the stream length subject to vertical subsidence >20mm • More than negligible increase in water cloudiness over more than 20% of the stream length subject to vertical subsidence >20mm • More than negligible increase in iron staining over more than 20% of the stream length subject to vertical subsidence >20mm • Subsidence impacts or environmental consequences greater than minor 	No impacts observed.	<p><i>GRMP:</i></p> <ul style="list-style-type: none"> • Increase monitoring/inspection frequency of key sites to twice weekly • Increase discharge from BCD or Appin East Main Dam to provide a minimum refuge water level in pools for minimum ecosystem protection • Implement remedial action such as manual crack filling with sand or hand mortaring to reduce rock bar bypass flow • Review management options, including implementation of additional mitigation and contingencies measures to reduce the level of observed impacts (e.g. maintenance watering of aquatic plants and 	N/A	N/A

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
				<p>relocation of aquatic fauna) and mine plan changes to ensure further Level 3 impacts in other parts of the Georges River are not induced by future longwall (s)</p> <ul style="list-style-type: none"> • Within three months of the completion of the longwall, assess the magnitude of pool water level reduction. If ongoing mining induced pool water level reduction is occurring, develop remedial works to restore pool water level. Implement remedial works as soon as subsidence movements within Area 5 that may affect the rehabilitation works are complete and appropriate approvals are in place • Develop and implement monitoring program to ensure effectiveness of remedial works <p><i>LW37 & 38 EP:</i></p> <ul style="list-style-type: none"> • Actions as stated for Level 3 • Investigate reasons for the exceedance • Update future predictions based on outcomes of the investigation • Provide environmental offset if CMAs are unsuccessful 		
<p>Georges River – Surface Water Quality</p> <p>Adjacent and downstream sites for Longwalls 37 and 38:</p> <ul style="list-style-type: none"> - Pool 54 - Pool 64 - GR100 	<p>Negligible environmental consequences including:</p> <ul style="list-style-type: none"> - negligible diversion of flows or changes in the natural drainage behaviour of pools; - negligible gas releases and iron staining; and - negligible increase in water cloudiness. <p>over at least 80% of the stream length subject to vertical subsidence >20mm.</p> <p>No subsidence impact or environmental consequence greater</p>	<p>Level 1</p> <ul style="list-style-type: none"> • Temporary reduction in water quality (observed for 2 consecutive months) at any site when comparing the baseline period to mining period for that site i.e. : <ul style="list-style-type: none"> - pH drop between 0.5 and 1.0 units from the minimum baseline value <p>Level 2</p> <ul style="list-style-type: none"> • Temporary reduction in water quality (observed for 2 consecutive months) at any site when comparing the baseline period to mining period for that site i.e.: <ul style="list-style-type: none"> - pH drop between 1.0 and 1.5 units from the minimum baseline value <p>Level 3</p> <ul style="list-style-type: none"> • Reduction in water quality (observed 	<p>pH values were shown to be within -1.0 pH units of the pre-existing minimum baseline value.</p> <p>No observed reductions in pH.</p> <p>No observed reductions in pH.</p>	<ul style="list-style-type: none"> • Continue monitoring program • Report trigger to key stakeholders • Summarise impacts and report in the End of Panel Report and AEMR <p><i>Actions as stated for Level 1</i></p> <ul style="list-style-type: none"> • Review monitoring program • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as approved <p><i>Actions as stated for Level 2</i></p> <ul style="list-style-type: none"> • Notify DP&I, DPI, relevant 	Attachment D	<p>Removal of laboratory tested parameters:</p> <ul style="list-style-type: none"> - Total Dissolved Solids <p>Implementation of laboratory tested parameters:</p> <ul style="list-style-type: none"> - Dissolved Methane

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
	than minor.	<p>for more than 2 consecutive months) when comparing the baseline period to mining period for that site i.e.:</p> <ul style="list-style-type: none"> - pH drop of 1.5 units from the minimum baseline value 		<p>resource managers and technical specialists and seek advice on any CMA required</p> <ul style="list-style-type: none"> • Invite stakeholders for site visit • Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> - Emplacement of sandstone rocks in constricted stream flow areas to increase the aeration capacity where it is appropriate to do so - Grouting of fractures which result in flow diversion • Completion of works following approvals • Issue CMA report within 1 month of works completion • Review the TARP and Management Plan in consultation with key stakeholders 		
		<p>Exceeding Performance Measures</p> <ul style="list-style-type: none"> • Subsidence impacts or environmental consequences greater than minor 	No impacts or consequences greater than minor.	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • Investigate reasons for the exceedance • Update future predictions based on outcomes of the investigation • Provide environmental offset if CMAs are unsuccessful 		
<p>Groundwater Quality and Quantity</p> <p>BHPBIC Piezometers:</p> <ul style="list-style-type: none"> - GR27 - GR28 - GR29 - GR70 - WC54 - WC95 <p>Private Bores:</p> <ul style="list-style-type: none"> - GW32310 - GW72454 - GW105921 - GW108322 	<p>Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated, or else the damaged built feature or damaged infrastructure component must be replaced.</p>	<p>Level 1</p> <ul style="list-style-type: none"> • Increase in water flow from the goaf between 2.7 – 3.0 ML/day (20 day average) • 5.0 – 7.5 m reduction in the Hawkesbury Sandstone greater than predicted standing water level or pressure (outside of pumping influences in private bores) over a minimum 2 month period 	No inflow events or TARP levels triggered for Longwall 37 extraction period.	<ul style="list-style-type: none"> • Continue monitoring program • Report trigger to key stakeholders • Summarise impacts and report in the End of Panel Report and AEMR 		No additional actions or recommendations.
		<p>Level 2</p> <ul style="list-style-type: none"> • Rise in water flow from the goaf between 3.0 – 3.4 ML (20 day average) • 7.5 - 10 m reduction in the Hawkesbury Sandstone greater than predicted standing water level or pressure (outside of pumping influences in private bores) over a 	No inflow events or TARP levels triggered for Longwall 37 extraction period.	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Review monitoring program • Review impacts against the Performance Measures • Notify relevant technical specialists and seek advice on any CMA required • Implement agreed CMAs as 		

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
Mine Water Budget		minimum 2 month period		approved		
		Level 3 * <ul style="list-style-type: none"> Abnormal rise in water flow from the goaf >3.4 ML (20 day average) >10m reduction in the Hawkesbury Sandstone standing water level or pressure (outside of pumping influences in private bores) over a minimum 2 month period Total loss of groundwater level within the bore 	No inflow events or TARP levels triggered for Longwall 37 extraction period.	<ul style="list-style-type: none"> Actions as stated for Level 2 Notify DP&I, DPI, relevant resource managers and technical specialists and seek advice on any CMA required Invite stakeholders for site visit Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> - Any actions agreed to in the Property Subsidence Management Plan - Provision of alternate water supply where this has been impacted by mining Completion of works following approvals Issue CMA report within 1 month of works completion Review the TARP and Management Plan in consultation with key stakeholders 		No additional actions or recommendations.
		Exceeding Performance Measures Subsidence impacts or environmental consequences greater than minor	No inflow events or TARP levels triggered for Longwall 37 extraction period.	<ul style="list-style-type: none"> Actions as stated for Level 3 Investigate reasons for the exceedance Update future predictions based on outcomes of the investigation Provide environmental offset if CMAs are unsuccessful 		
Landscape Features Cliffs: - GR-CL01 & GR-CL02 Georges River - including pools and rock bars - GR-RB42 - GR-RB43 - GR-RB44 - GR-RB45 - GR-RB47 - GR-RB48 - GR-RB49 - GR-RB51	Cliffs of "special significance": Negligible impact (that is occasional rock falls displacement or dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 0.5% of the total face area of such cliffs) within any longwall mining domain. Other cliffs: Minor impacts (that is occasional rock falls, displacement or	Level 1 <ul style="list-style-type: none"> Rock fall from a cliff where the cliff is left mostly intact (<10% length of the cliff) Surface movement or rock displacement where any exposed soil surface is stable Crack at the surface which does not result in ongoing erosion or ground movement Erosion which stabilises within the period of monitoring without CMA Crack or fracture up to 100 mm width Crack or fracture up to 10 m length 	No impacts attributed to Longwall 37 extraction. Impacts from previous Longwalls: - WCA5_LW35_026 - WCA5_LW36_001	<ul style="list-style-type: none"> Continue monitoring program Report trigger to key stakeholders Summarise impacts and report in the End of Panel Report and AEMR 	<ul style="list-style-type: none"> West Cliff Area 5 Longwall 35 Impact Report 22 July 2014 West Cliff Area 5 Longwall 35 Impact Report 30 June 2014 	No additional actions or recommendations.
		Level 2 <ul style="list-style-type: none"> Rock fall from cliff where the characteristics of the cliff change (>10% length of the cliff) 	No impacts observed.	<ul style="list-style-type: none"> Actions as stated for Level 1 Review monitoring program Review impacts against the Performance Measures 		N/A

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
<ul style="list-style-type: none"> - GR-RB52 - GR-RB53 - GR-RB54 - GR-RB55 - GR-RB56a - GR-RB56b - GR-RB57 - GR-RB59 - GR-RB60 - GR-RB61 - GR-RB62 - GR-RB63 - GR-RB64 - GR-RB65 - GR-RB66 - GR-RB67 	dislodgement of boulders or slabs, or fracturing, that in total do not impact more than 3% of the total face area of such cliffs within any longwall mining domain)	<ul style="list-style-type: none"> • Ground disturbance that is unlikely to stabilise within the period of monitoring without CMA • Mass movement of a slope causing areas of exposed soil • Crack or fracture between 100 and 300 mm width • Crack or fracture between 10 and 50 m length 		<ul style="list-style-type: none"> • Notify relevant technical specialists and seek advice on any CMA required • Provide safety signage and barricades as appropriate • Implement agreed CMAs as approved 		
		<p>Level 3</p> <ul style="list-style-type: none"> • Cliff collapse (100% length of cliff) • Ground disturbance that does not stabilise within the period of monitoring • Mass movement of a slope causing areas of exposed soil that does not stabilise within the period of monitoring • Crack or fracture over 300 mm width • Crack or fracture over 50 m length 	No impacts observed.	<ul style="list-style-type: none"> • Notify DP&I, DPI, relevant resource managers and technical specialists and seek advice on any CMA required • Invite stakeholders for site visit • Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> - Erosion prevention works - Establishment of vegetation • Completion of works following approvals • Issue CMA report within 1 month of works completion • Review the TARP and Management Plan in consultation with key stakeholders 		N/A
		<p>Exceeding Performance Measures</p> <ul style="list-style-type: none"> • For cliffs of 'special significance' - more than negligible environmental consequences (i.e. more than occasional rock falls, displacement or dislodgement of boulders or slabs, or fracturing, that in total impact more than 0.5% of the total face area of such cliffs within any longwall mining domain) • Other cliffs - more than minor environmental consequences (that is occasional rock falls, displacement or dislodgement of boulders or slabs or fracturing, that in total impact more than 3% of the total face area of such cliffs within any longwall mining domain) 	No impacts observed.	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • Investigate reasons for the exceedance • Update future predictions based on outcomes of the investigation 		N/A
<p>Aquatic Biodiversity</p> <p>Longwall 37:</p>	Threatened species, threatened populations, or endangered	<p>Level 1</p> <ul style="list-style-type: none"> • Reduction of aquatic habitat for 1 season 	Reduction in aquatic habitat was observed during the survey undertaken in November 2013, in sites 8 and 9, and related to impacts	<ul style="list-style-type: none"> • Continue monitoring program • Report trigger to key stakeholders • Summarise impacts and report in the End of Panel Report and 	Attachment E	<ul style="list-style-type: none"> - Increased discharges from BCD be maintained - further monitoring during the spring 2015 AUSRIVAS sampling season

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
- Site 9 - Site 10 - Site 11 Longwall 38: - Site 3 - Site 8 General observations of the mining area.	ecological communities: - Negligible environmental consequences		associated with Longwall 35. A recovery of aquatic habitat at sites 8 and 9 was observed during the survey campaign undertaken in December 2014.	AEMR		
		Level 2 <ul style="list-style-type: none"> Reduction of aquatic habitat for 2 seasons 	Not observed.	<ul style="list-style-type: none"> Actions as stated for Level 1 Review monitoring program Review impacts against the Performance Measures Notify relevant technical specialists and seek advice on any CMA required Implement agreed CMAs as approved 		
		Level 3 <ul style="list-style-type: none"> Reduction of aquatic habitat for > 2 seasons or complete loss of habitat 	Not observed.	<ul style="list-style-type: none"> Actions as stated for Level 2 Notify DoPI, DPI, relevant resource managers and technical specialists and seek advice on any CMA required Invite stakeholders for site visit Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> - Grouting of fractures which result in flow diversion Completion of works following approvals Issue CMA report within 1 month of works completion Review the TARP and Management Plan in consultation with key stakeholders 		
		Exceeding Performance Measures <ul style="list-style-type: none"> Subsidence impacts or environmental consequences greater than minor. More than negligible environmental consequences in respect of threatened species, threatened populations, or endangered ecological communities. 	Not observed.	<ul style="list-style-type: none"> Actions as stated for Level 3 Investigate reasons for the exceedance Update future predictions based on outcomes of the investigation Provide environmental offset if CMAs are unsuccessful 		

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
Terrestrial Biodiversity General observation of active mining areas including: Cliffs - GR-CL01 and GR-CL02 Steep slopes Georges River – including pools and rock bars - GR-RB42 - GR-RB43 - GR-RB44 - GR-RB45 - GR-RB47 - GR-RB48 - GR-RB49 - GR-RB51 - GR-RB52 - GR-RB53 - GR-RB54 - GR-RB55 - GR-RB56a - GR-RB56b - GR-RB57 - GR-RB59 - GR-RB60 - GR-RB61 - GR-RB62 - GR-RB63 - GR-RB64 - GR-RB65 - GR-RB66 - GR-RB67	Threatened species, threatened populations, or endangered ecological communities: - Negligible environmental consequences	Level 1 <ul style="list-style-type: none"> Vegetation impacted by mining (by rock falls, soil slippage, gas emissions) that naturally regenerates within the monitoring period. 	No impacts observed.	<ul style="list-style-type: none"> Continue monitoring program Report trigger to key stakeholders Summarise impacts and report in the End of Panel Report and AEMR 	N/A	N/A
		Level 2 <ul style="list-style-type: none"> Vegetation impacted by mining (by rock falls, soil slippage, gas emissions) that does not regenerate within the monitoring period. 	No impacts observed.	<ul style="list-style-type: none"> Actions as stated for Level 1 Review monitoring program Review impacts against the Performance Measures Notify relevant technical specialists and seek advice on any CMA required Implement agreed CMAs as approved 	N/A	N/A
		Level 3 <ul style="list-style-type: none"> Vegetation impacted by mining that is not responding to CMAs 	No impacts observed.	<ul style="list-style-type: none"> Actions as stated for Level 2 Notify DoPI, DPI, relevant resource managers and technical specialists and seek advice on any CMA required Invite stakeholders for site visit Develop site CMA (subject to stakeholder feedback). This may include: <ul style="list-style-type: none"> Erosion prevention works Establishment of vegetation Completion of works following approvals Issue CMA report within 1 month of works completion Review the TARP and Management Plan in consultation with key stakeholders 	N/A	N/A
		Exceeding Performance Measures <ul style="list-style-type: none"> Subsidence impacts or environmental consequences greater than minor. More than negligible environmental consequences in respect of threatened species, threatened populations, or endangered ecological communities. 	No impacts observed.	<ul style="list-style-type: none"> Actions as stated for Level 3 Investigate reasons for the exceedance Update future predictions based on outcomes of the investigation Provide environmental offset if CMAs are unsuccessful 	N/A	N/A
Aboriginal Archaeology - 52-2-2064 - 52-2-2234	Sites determined to hold 'special significance' as a result of studies required for EPs:	Level 1 <ul style="list-style-type: none"> Change in shelter conditions not attributable to natural weathering or preservation – mineral growth or microorganism growth (as observed 	No impacts associated with Longwall 37.	<ul style="list-style-type: none"> Continue monitoring program Condition assessment and photographic record Notify relevant specialists and key 	Attachment F	<ul style="list-style-type: none"> Illawarra Coal to notify the RAPs of this End of Panel Report (RAPs are listed in the Bulli Seam Operations Project

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
<ul style="list-style-type: none"> - 52-2-2236 - 52-2-2241 - 52-2-2242 - 52-2-2243 - 52-2-2062 - 52-2-2063 - 52-2-2264 - 52-2-3691 	<ul style="list-style-type: none"> - Negligible impact or environmental consequences <p>Sites determined to hold high or moderate significance as a result of studies required for EPs:</p> <ul style="list-style-type: none"> - Less than 10% of such sites across the mining area are affected by subsidence impacts (other than negligible impacts or environmental consequence) <p>Other Aboriginal heritage sites:</p> <ul style="list-style-type: none"> - Less than 10% of such sites within any longwall mining area are affected by subsidence impacts (other than minor impacts or environmental consequence). 	<p>by comparing pre-mining photographs with post-subsidence/mining photographs)</p> <ul style="list-style-type: none"> • Changes external to the shelter that affect the site context (e.g. ground cracking, boulder slumping, rock and/or tree falls) 		<p>stakeholders (e.g. Registered Aboriginal Parties)</p> <ul style="list-style-type: none"> • Summarise impacts and report in the End of Panel Report and AEMR 		<p>Heritage Management Plan, unless the RAPs have been otherwise updated in accordance with the Plan); and</p> <ul style="list-style-type: none"> • Illawarra Coal to notify all other necessary internal and external parties of the results of this End of Panel Report.
		<p>Level 2</p> <ul style="list-style-type: none"> • Change in shelter conditions not attributable to natural weathering or preservation – change in drip line or seepage, cracking or exfoliation of overhang or shelter, movement or opening of existing planes and joints at panel, block fall within shelter or overhang, shelter or overhang collapse 	No impacts associated with Longwall 37.	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Review monitoring program • Review impacts against the Performance Measures • Develop site management plan to mitigate effects in consultation with Registered Aboriginal Parties and the landowner 		
		<p>Level 3</p> <ul style="list-style-type: none"> • Level 2 impacts at greater frequency than predicted • Level 2 impacts attributable to mining remote from the mining area 	No impacts associated with Longwall 37.	<ul style="list-style-type: none"> • <i>Actions as stated for Level 2</i> • Investigate reasons for the impacts • Update future predictions based on outcomes of the investigation 		
		<p>Exceeding Performance Measures</p> <ul style="list-style-type: none"> • More than negligible environmental consequences for sites determined to hold “special significance” as a result of the studies required for Extraction Plans • More than 10% of sites determined to hold high or moderate significance as a result of studies for Extraction Plans (or 1 such site, whichever is the greater) within any longwall mining domain are/is affected by subsidence impacts (other than minor impacts or environmental consequences) • More than 10% of other Aboriginal heritage sites (or 1 such site, whichever is the greater) within any longwall mining domain are/is affected by subsidence impacts (other than minor impacts or environmental consequences) 	No impacts associated with Longwall 37.	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • Investigate reasons for the exceedance • Update future predictions based on outcomes of the investigation 		
MAN MADE FEATURES						
European Heritage	Other buildings or structures of State or	<p>Level 1</p> <ul style="list-style-type: none"> • Changes external to the site that affect the site context (e.g. ground 	N/A	<ul style="list-style-type: none"> • Continue monitoring program • Condition assessment and photographic record 		

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
- Site WH1 (bridge and road remains)	<p>National heritage significance:</p> <ul style="list-style-type: none"> - Negligible loss of heritage value - Negligible impact on structural integrity or external fabric, unless the owner of the feature agrees otherwise in writing. <p>Other buildings or structures of identified heritage significance:</p> <ul style="list-style-type: none"> - No loss of heritage value greater than predicted under a HMP prepared under <i>Condition 6 Schedule 3</i>. 	cracking)		<ul style="list-style-type: none"> • Notify relevant specialists and key stakeholders • Summarise impacts and report in the End of Panel Report and AEMR 		
		<p>Level 2</p> <ul style="list-style-type: none"> • Change in site conditions not attributable to natural weathering or preservation – movement or opening of existing fractures, bedding planes and joints. 	N/A	<ul style="list-style-type: none"> • <i>Actions as stated for Level 1</i> • Review monitoring program • Review impacts against the Performance Measures • Develop site management plan to mitigate effects in consultation with stakeholders, where appropriate 		
		<p>Level 3</p> <ul style="list-style-type: none"> • Fracturing of the bridge footings 	N/A	<ul style="list-style-type: none"> • <i>Actions Stated for Level 2</i> • Investigate reasons for the impacts • Update future predictions based on outcomes of the investigation 		
		<p>Exceeding Performance Measures</p> <ul style="list-style-type: none"> • Loss of heritage value greater than predicted under the HMP 	N/A	<ul style="list-style-type: none"> • <i>Actions as stated for Level 3</i> • Investigate reasons for the exceedance • Update future predictions based on outcomes of the investigation 		
<p>Built Features</p> <p>Other public infrastructure (including water supply pipelines, high pressure gas pipelines; high pressure gas pipelines and the gas distribution network; electricity transmission and distribution lines; telecommunications cables and optical fibre networks; roads, trails and associated structures). Other built</p>	<p>Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated, or else the damaged built feature or damaged infrastructure component must be replaced.</p>	<p><i>Appropriate TARPs developed in consultation with the infrastructure owners and provided in the relevant Infrastructure Management Plans.</i></p>	<p>No impacts exceeded the performance measures.</p>	<p><i>Appropriate actions developed in consultation with the infrastructure owners and provided in the relevant Infrastructure Management Plans.</i></p>		

Feature	Performance Measure	TARP Trigger Level	Impacts Observed	Actions Required	Refer to report(s):	Further Actions or Recommendations
features (including houses, industrial premises, swimming pools, farm dams and other improvements)						

Note: CMAs are to be proposed based on appropriate management of environmental and other consequences of mining impacts i.e. cracking at the surface with insignificant consequences may not require specific CMAs other than ongoing monitoring to confirm there are no ongoing impacts

Sources:

- Longwall 37 and 38 Extraction Plan (March 2014)
 - o Annex C – Water Management Plan, version B, Table 5.1 and Attachment A – Table 2
 - o Annex D – Biodiversity Management Plan, ver A, Table 5.2 and Table 7.1
 - o Annex E - Land Management Plan Ver A, Table 7.1
 - o Annex F – Heritage Management Plan Ver A, Table 5.1 and Table 7.1
 - o Annex H – Built Features Management Plan, Ver A, Table 5.1
- Longwalls 34 to 36: Georges River Management Plan (February 2013)