

METROPOLITAN COAL LONGWALLS 311-316

COAL RESOURCE RECOVERY PLAN



METROPOLITAN COAL

LONGWALLS 311-316

COAL RESOURCE RECOVERY PLAN

Revision Status Register

Section/Page/ Annexure	Revision Number	Amendment/Addition	Distribution	DPHI Approval Date
All	CRRP-R01-A	Original	DPHI, MEG	-
All	CRRP-R01-B	Updated to reflect amendments to the Longwalls 311-316 longwall layout and to address agency comments	DPHI	-
All	CRRP-R01-C	Updated to address IEAPM comments	DPHI	

May 2025

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1 INTRODUCTION

The Metropolitan Colliery (Metropolitan Coal Mine) is owned and operated by Metropolitan Collieries Pty Ltd (Metropolitan Coal), which is a wholly owned subsidiary of Peabody Energy Australia Pty Ltd (Peabody). The Metropolitan Coal Mine is located adjacent to the township of Helensburgh, approximately 30 kilometres (km) north of Wollongong in New South Wales (NSW) (Figure 1).

Metropolitan Coal was granted approval for the Metropolitan Coal Project (the Project) under section 75J of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) on 22 June 2009. A copy of the Project Approval is available on the Peabody website (<http://www.peabodyenergy.com>).

The Project comprises the continuation, upgrade and extension of underground coal mining operations (Longwalls 20-27 and Longwalls 301-317) and surface facilities at Metropolitan Coal. Longwalls 311-316 are situated to the west of Longwalls 301-310 and define the next mining sub-domain within the Project underground mining area (Figure 2). Longwall 317 will be subject to a future Extraction Plan.

1.1 PURPOSE AND SCOPE

In accordance with Condition 6(e), Schedule 3 of the Project Approval, this Coal Resource Recovery Plan (CRRP) has been prepared as a component of the Metropolitan Coal Longwalls 311-316 Extraction Plan to demonstrate effective recovery of the available resource.

The relationship of this CRRP to the Metropolitan Coal Environmental Management Structure and to the Metropolitan Coal Longwalls 311-316 Extraction Plan is shown on Figure 4.

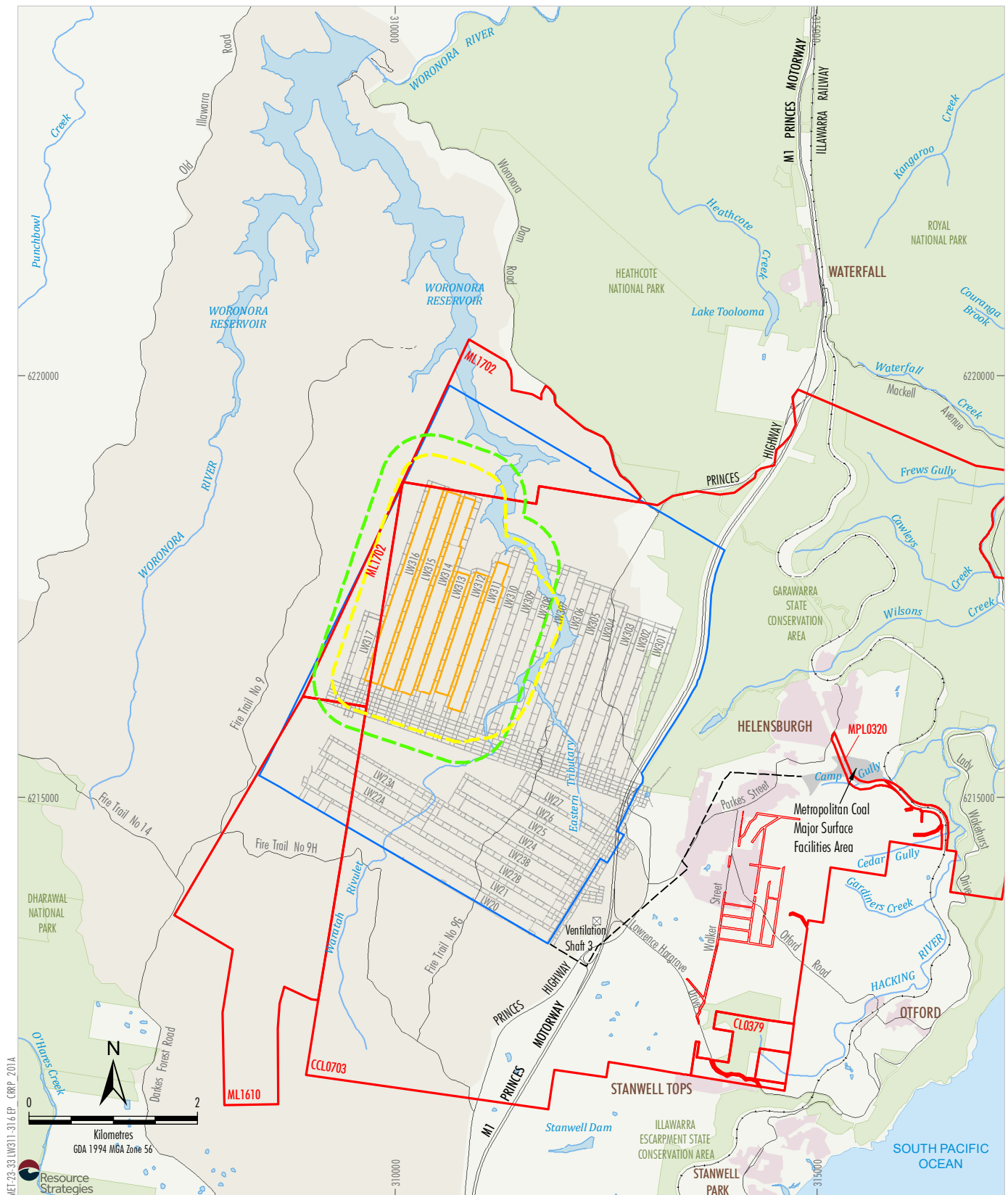
The following graphical plans (Attachment 1) have been prepared in accordance with the then NSW Department of Planning and Environment (DPE) (now known as the Department of Planning, Housing and Infrastructure¹ [DPHI]) (2022) *Extraction Plan Guideline*:

- Plan 1 Existing, Proposed and Future Workings.
- Plan 2 Longwalls 311-316 Surface Features.
- Plan 3 Geological and Seam Data.
- Plan 5 Mining Titles and Land Ownership.
- Plan 6 Geological Section and Geotechnical Logs.

As there are currently no existing and/or planned future workings in seams above and/or below the proposed workings, Plan 4 (All workings: seam and depth of cover) [*sic*] *seams above and below* referred to in the DPE (2022) *Extraction Plan Guideline* has not been included in this CRRP. Plan 7 (Subsidence Monitoring) is included in the Metropolitan Coal Longwall 311-316 Subsidence Monitoring Program (Appendix F of the Longwalls 311-316 Extraction Plan).

¹ The former Department of Planning and Environment (DPE) was renamed to the Department of Planning, Housing and Infrastructure (DPHI) on 1 January 2024. References to DPE have been retained throughout the remainder of this document.

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LEGEND

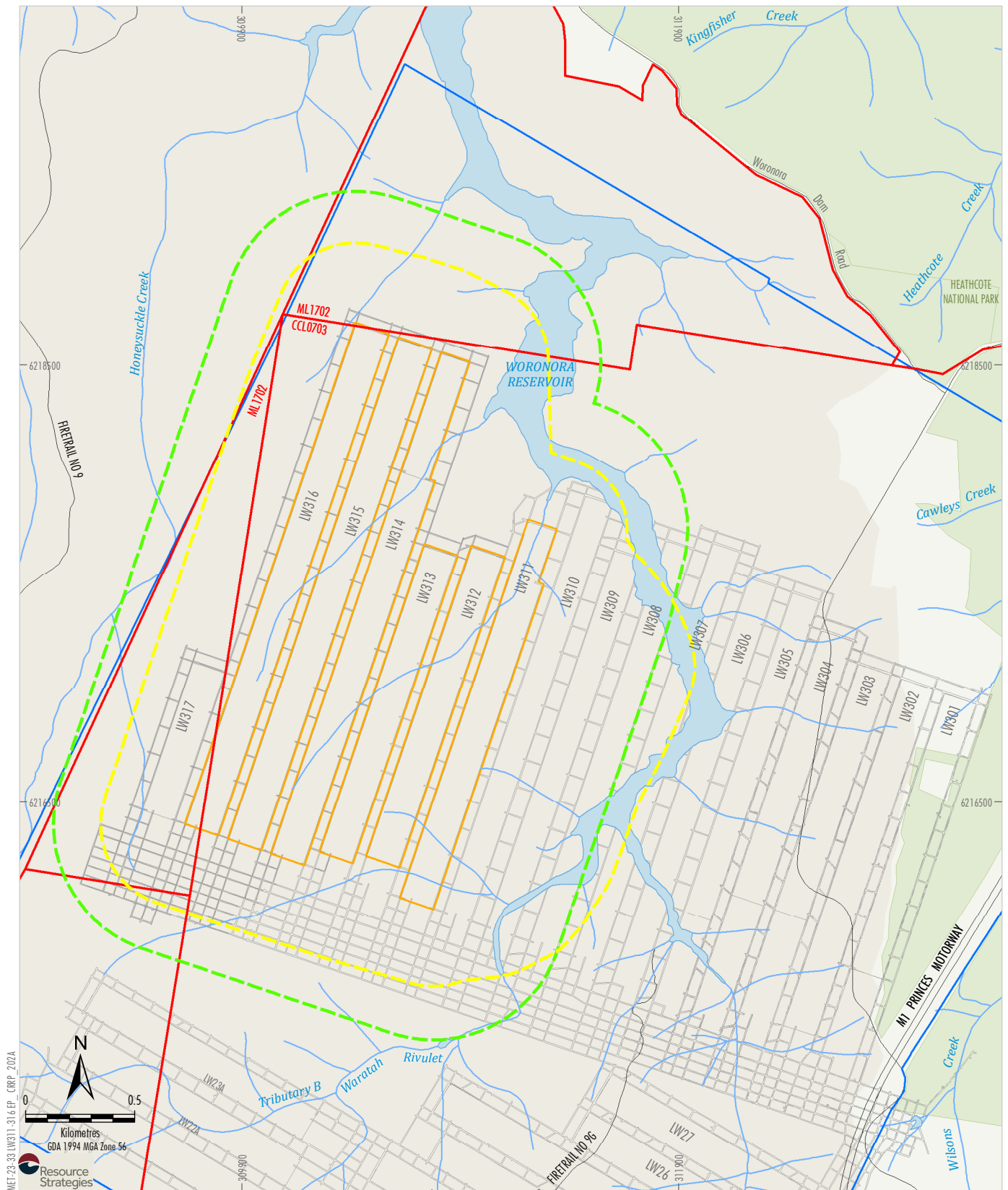
- Mining Lease Boundary
- Woronora Special Area
- Railway
- Project Underground Mining Area
Longwalls 20-27 and 301-317
- Longwalls 311-316 Secondary Extraction
- Longwalls 311-316 35° Angle of Draw and/or
Predicted 20 mm Subsidence Contour
- 600 m from Longwalls 311-316
Secondary Extraction
- Existing Underground Access Drive (Main Drift)

Source: Land and Property Information (2015); Department of Industry (2015);
Metropolitan Coal (2023); MSEC (2024)

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METROPOLITAN COAL
Longwalls 311-316 and
Project Underground Mining Area

Figure 1



LEGEND

- Mining Lease Boundary
- Woronora Special Area
- Project Underground Mining Area
- Longwalls 20-27 and 301-317
- Longwalls 311-316 Secondary Extraction
- Longwalls 311-316 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
- 600 m from Longwalls 311-316 Secondary Extraction

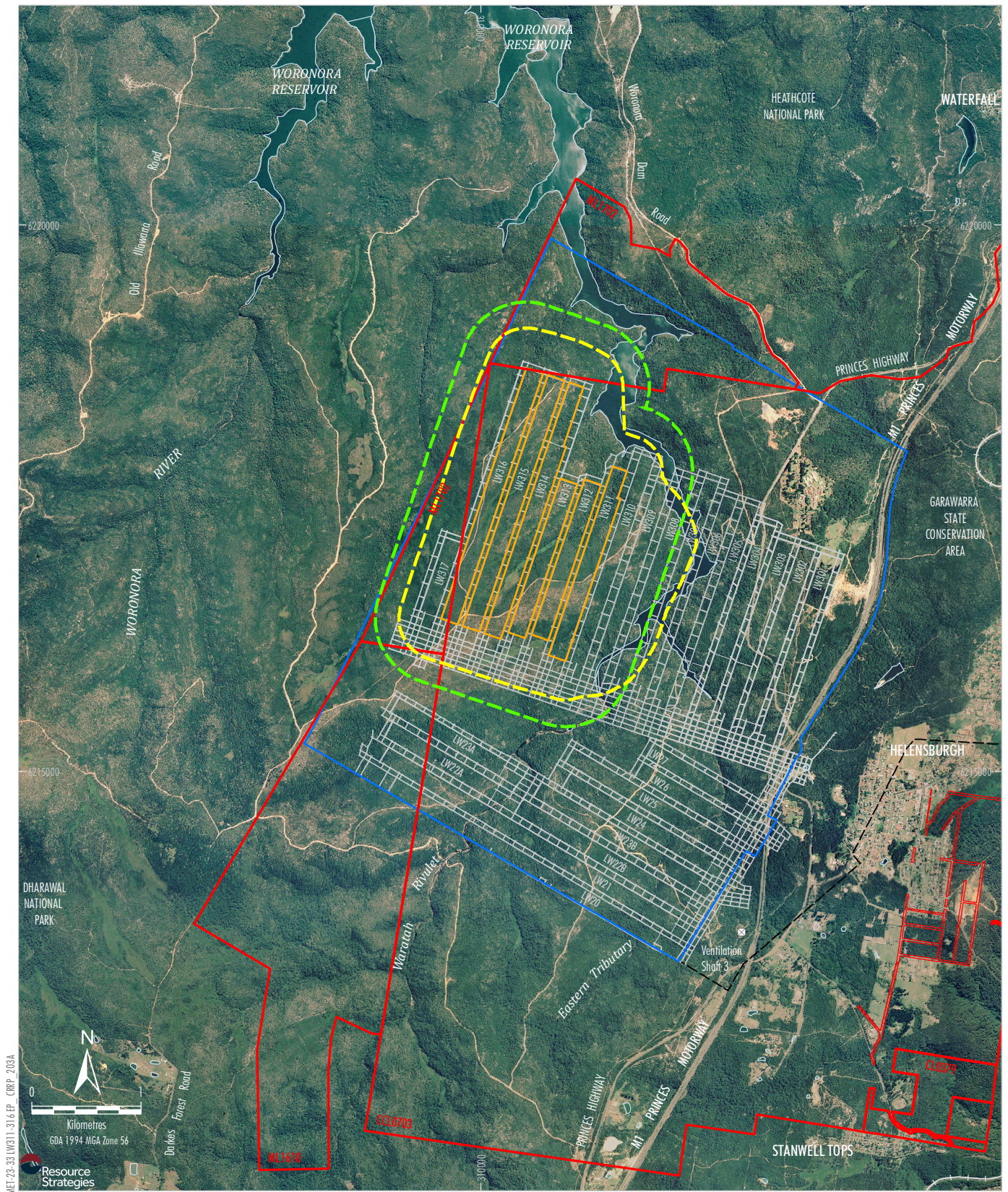
Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2023); MSEC (2024)

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METROPOLITAN COAL

Longwalls 311-316 Layout

Figure 2



LEGEND

- Mining Lease Boundary
- Railway
- Project Underground Mining Area
- Longwalls 20-27 and 301-317
- Longwalls 311-316 Secondary Extraction
- Longwalls 311-316 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
- 600 m from Longwalls 311-316 Secondary Extraction
- Existing Underground Access Drive (Main Drift)

Source: Land and Property Information (2015); Date of Aerial Photography 1998; Department of Industry (2015); Metropolitan Coal (2023); MSEC (2024)

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METROPOLITAN COAL

Longwalls 311-316 and
Project Underground Mining Area -
Aerial Photograph

Figure 3

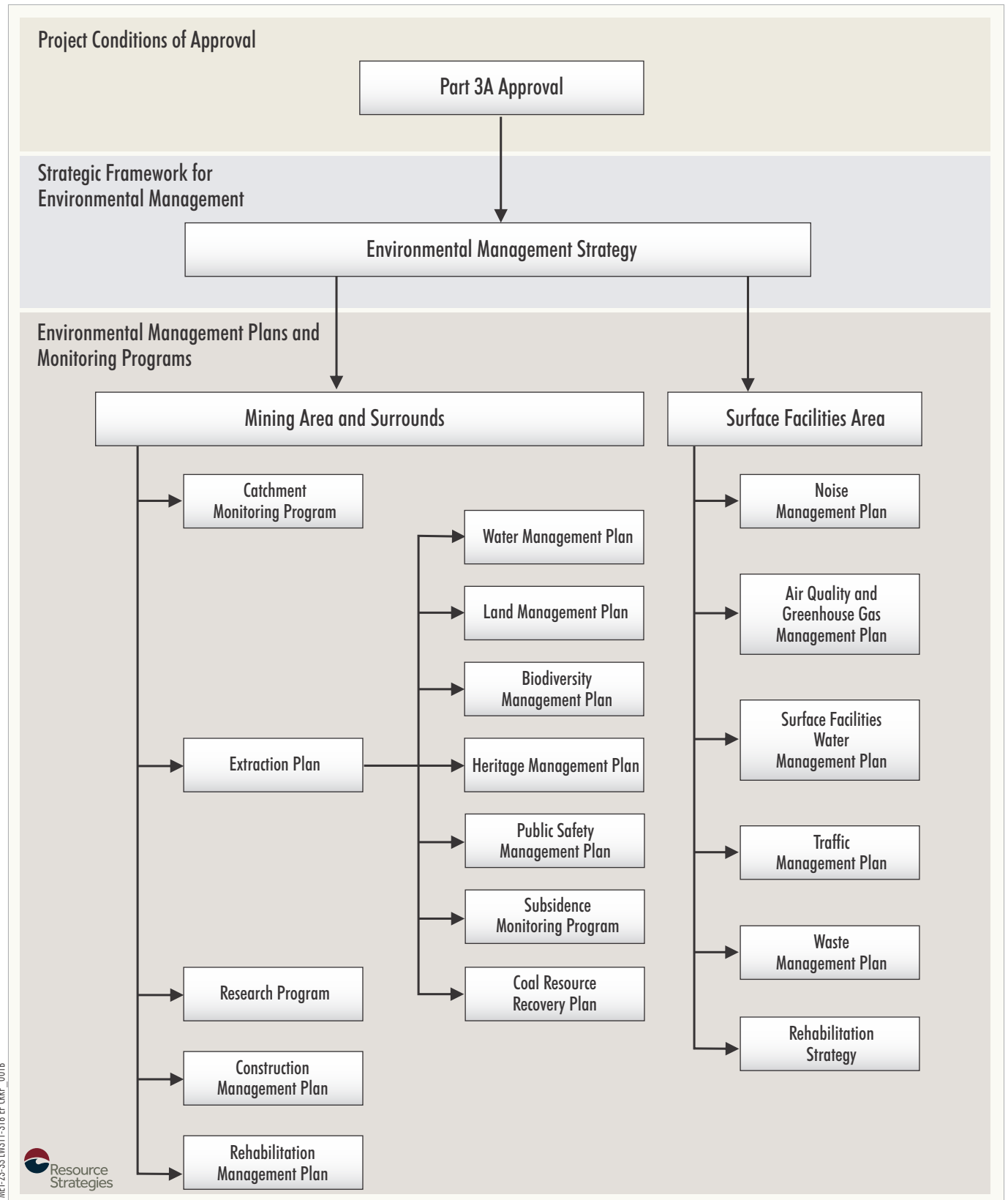


Figure 4

2 COAL RESOURCE RECOVERY PLAN REVIEW AND UPDATE

In accordance with Condition 4, Schedule 7 of the Project Approval, this CRRP will be reviewed within three months of the submission of:

- an audit under Condition 8, Schedule 7;
- an incident report under Condition 6, Schedule 7;
- an annual review under Condition 3, Schedule 7; and

if necessary, revised to the satisfaction of the Director-General (now Secretary) of the DPE.

The CRRP will also be reviewed within three months of approval of any Project modification and if necessary, revised to the satisfaction of the DPE.

The revision status of this CRRP is indicated on the title page of each copy. The distribution register for controlled copies of the CRRP is described in Section 2.1.

Revisions to any documents listed within this CRRP will not necessarily constitute a revision of this document.

2.1 DISTRIBUTION REGISTER

In accordance with Condition 10, Schedule 7 of the Project Approval 'Access to Information', Metropolitan Coal will make this CRRP publicly available on the Peabody website.

Metropolitan Coal recognises that various regulators have different distribution requirements, both in relation to whom documents should be sent and in what format.

An Environmental Management Plan and Monitoring Program Distribution Register has been established in consultation with the relevant agencies and infrastructure owners that indicates:

- to whom the Metropolitan Coal plans and programs, such as this CRRP, will be distributed;
- the format (i.e. electronic or hard copy) of distribution; and
- the format of revision notification.

Metropolitan Coal will make the Distribution Register publicly available on the Peabody website.

Metropolitan Coal will be responsible for maintaining the Distribution Register and for ensuring that the notification of revisions is sent by email or post as appropriate.

In addition, Metropolitan Coal employees with local computer network access will be able to view the controlled electronic version of this CRRP on the Metropolitan Coal local area network. Metropolitan Coal will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on Metropolitan Coal's computer system and the Peabody website.

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3 DESIGN PRINCIPLES

3.1 APPROVAL CONSIDERATIONS

During the NSW Government's assessment phase of the *Metropolitan Coal Project Environmental Assessment* (Project EA) (Helensburgh Coal Pty Ltd [HCPL], 2008), and in recognition of concerns raised by key stakeholders during the formal Planning Assessment Commission (PAC) assessment process, Metropolitan Coal (previously HCPL) considered it appropriate to reduce the proposed extent of the original Project longwall mining area (i.e. Longwalls 20-44).

Metropolitan Coal was granted Project Approval (08_0149) by the Minister for Planning on 22 June 2009. The Project Approval included a layout for Longwalls 301 to 317, referred to as the Preferred Project Layout (as described in the *Metropolitan Coal Preferred Project Report* [HCPL, 2009]). Longwalls 301-317 included in the Preferred Project Layout (PPL) comprised 163 metres (m) panel widths (void) with 45 m pillars (solid) beyond 500 m from the Woronora Reservoir, and 138 m panel widths (void) with 70 m pillars (solid) within 500 m of the Woronora Reservoir.

3.2 LAYOUT OPTIMISATION FOR 300 SERIES LONGWALLS

Following further mine planning investigations, Metropolitan Coal identified that significant operational efficiencies and consequently a significant economic benefit would be achieved by rotating the first workings of Longwalls 301-317 to be square with the 300 Mains (a rotation of approximately six degrees). The Secretary of the Department of Planning and Environment (DP&E) approved the revised first workings in accordance with Condition 5, Schedule 3 of the Project Approval in April 2015.

Subsequently, Metropolitan Coal proposed to consolidate the panel and chain pillar widths of Longwalls 301-304 to 163 m (void) panel widths and 45 m wide pillars (solid). Changes to the first workings of Longwalls 301-303 and Longwall 304 were approved by the DP&E in May 2016 and November 2018, respectively.

Following submission of the Longwalls 305-307 Extraction Plan in October 2019, Metropolitan Coal requested approval from the Secretary of the Department of Planning, Industry and Environment (DPIE) for a revision of the Longwalls 305 and 306 first working layout. The revised layout included a reduction to the panel (void) lengths of Longwall 305 (from 1,596 metres [m] to 1,547 m) and Longwall 306 (from 1,956 m to 1,907 m) and associated changes to the cut-through positions for the Longwalls 305 and 306 maingates. The revised layout of Longwalls 305 and 306 did not change the panel widths, pillar widths or panel orientation.

In January 2021, Metropolitan Coal submitted an application to the DPIE requesting a 50 m extension to the panel (void) length of Longwall 307 at the commencing end (from 1,956 m to 2,006 m). The 50 m extension of Longwall 307 was approved by the DPIE in August 2021.

With the submission of Longwalls 308-310 Extraction Plan in February 2022, Metropolitan Coal requested approval from the Secretary of the DPE for a revision to the first working's of Longwall 310 maingate and a reduction in extraction length of Longwall 308 from 3,110 m to 1,948 m, a reduction of 1,162m. Approximately 1,568 m of the maingate pillar of Longwall 310 from the commencing end was decreased in width from 70 m to 45 m. The commencing positions (i.e. the northern end) of Longwall 309 and Longwall 310 were requested consistent with the PPL. Subsequent to the submission and during the assessment process, Metropolitan Coal requested to vary the first working layout of Longwall 309. The revised layout included a reduction of 1,288 m to the panel (void) length (from 3,118 m to 1948 m). The revised layout of Longwall 309 was approved by the Secretary of the DPE on 15 November 2022. The Longwalls 308-310 Extraction Plan was approved by the Secretary of the DPE on 12 December 2022.

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In November 2023, Metropolitan Coal requested approval from the Secretary of the DPE to vary the first working layout of Longwall 310 to reduce the extraction length from 3,118 m to 2,089 m (a reduction of 1,029 m). The revised layout of Longwall 310 was approved by the Secretary of the DPE on 27 November 2023.

3.3 LONGWALLS 311-316 EXTENT

3.3.1 Commencing Position – Northern Extent

The commencing positions of Longwall 311, Longwall 312 and Longwall 313 are consistent with recent mining experience and are adjacent to the commencing positions of the prior Longwalls 301-310. The commencing positions of Longwalls 311, 312 and 313 are approximately 1,400 m, 1,597 and 1,762 m, respectively, south of the 6 degree modified PPL position (shorter) due to a geological structure located in the coal seam and a deterioration in coal quality and thickness evident in the northern portion of the mining lease.

The commencing position for Longwall 314 is approximately 903 m south of the modified PPL position and Longwalls 315 and 316 are approximately 998 m south of the modified PPL position (shorter). Longwalls 311 to 316 have been withdrawn south and west of the Full Supply Level after a reassessment of coal quality and seam thickness indicated that the northern extents are uneconomic to extract.

3.3.2 Finishing Position – Southern Extent

The finishing positions (i.e. the southern end) of Longwalls 312 and Longwall 313 are approximately 130 m and 80 m, respectively, north of the 6 degree modified PPL position (shorter) due to the application of an environmental standoff to Swamp 92. Longwalls 311, 314, 315 and 316 are generally consistent with the modified PPL.

3.3.3 Longwall Width and Length

Longwall extraction will occur from north to south. A summary of the longwall dimensions for Longwalls 311-316 is provided in Table 1. At the northern end, Longwalls are either 163 m or 138 m panel widths (void) and 45 m and 70 m pillar widths (solid), consistent with the modified PPL. At the southern end, each Longwall has 163 m panel widths (void) and 45 m pillar widths (solid).

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Table 1
Summary of Longwall Dimensions for Longwalls 311-316

Longwall	Longwall Length (m)	Partial Length (m)	Total Void Width (m)	Tailgate Chain Pillar Width (m)
LW311	1,829	260	138	70
		1,569	163	45
LW312	1,502	0	138	70
		1,502	163	45
LW313	1,488	0	138	70
		1,488	163	45
LW314	2,427	569	138	70
		1,858	163	45
LW315	2,427	0	138	70
		2,427	163	45
LW316	2,427	0	138	70
		2,427	163	45

m = metres.

LW = Longwall.

The commencing position changes represent a reduction in longwall extraction meters of 7,868 m, (approximately 3,016 kilotonnes [kt] of coal), from the modified PPL. A summary of changes by longwall is provided in Table 2.

Table 2
Summary of Longwall Dimension Reductions for Longwalls 311-316

Longwall	Reduction in length from PPL (m)	Reduction in Raw Coal from PPL (kt)	Reduction Reason
LW311	1,400	574	Coal quality and in seam geological feature
LW312	1,727	791	Coal quality and in seam geological feature
LW313	1,842	875	Coal quality and in seam geological feature
LW314	903	211	Coal quality and in seam geological feature
LW315	998	242	Coal quality and in seam geological feature
LW316	998	321	Coal quality and in seam geological feature
Total	7,868	3,016	

m = metres.

LW = Longwall.

kt = kilotonnes.

Plan 1 in Attachment 1 shows existing Metropolitan Coal longwalls located within 500 m of Longwalls 311-316, as well as future longwalls (i.e. Longwalls 317).

Longwalls 311-316 and the area of land within 600 m of Longwalls 311-316 secondary extraction is shown on Figures 1 to 3. Plan 2 in Attachment 1 shows the natural and man-made surface features proximal to Longwalls 311-316.

4 GEOLOGICAL DETAILS

4.1 SYDNEY BASIN AT METROPOLITAN COAL

Metropolitan Coal is located within the Southern Coalfield, within the southern part of the Sydney Basin, which is infilled with sedimentary rocks of Permian age (<270 million years ago) and of Triassic age (<225 million years ago) (HCPL, 2008).

Underlying the Sydney Basin sedimentary rocks is the Palaeozoic granite basement rock. A borehole located at the Metropolitan Coal Mine by the Australian Oil and Gas (AOG) Corporation Pty Ltd in 1963, *AOG Woronora PDH and RDH 1* (Figure 5), intersected the Bulli Coal Seam at 1,710 feet (approximately 0.5 km) and the granitic basement rock at 7,470 feet (approximately 2.3 km) (AOG Corporation, 1963). At Metropolitan Coal the inter-burden between the Bulli Coal Seam and the basement rock is 1.8 km, and the total depth of Sydney Basin sedimentation is 2.3 km.

Three formally named coal seams of the Illawarra Coal Measures are present in the Southern Coalfield, namely the Bulli, Balgownie and Wongawilli Seams (HCPL, 2008). Thermal Ionisation Mass Spectrometry (TIMS) dating of a tuff from the lower part of the Bulli Coal in the Metropolitan Coal Mine has yielded an age of 252.60 ± 0.04 million years (Fielding, 2019).

Immediately overlying the Bulli Coal unit of the Illawarra Coal Measures are sandstones and claystones of the Narrabeen Group. The Narrabeen Group contains the Newport Formation (sometimes referred to as the Gosford Formation), the Bald Hill Claystone (also referred to as Chocolate Shale and formed as a result of laterite weathering Gerringong Volcanics), the Bulgo Sandstone, the Stanwell Park Claystone/Shale, the Scarborough Sandstone, the Wombarra Shale and the Coal Cliff Sandstone. At the top of the sequence in the area of interest is the Hawkesbury Sandstone.

4.2 STRATIGRAPHIC SECTION

The sedimentary stratigraphic section at Borehole S225 is shown on Plan 6 in Attachment 1. The location of the borehole is also shown on Plan 6 in Attachment 1. The sandstone and shale units vary in thickness from a few metres to over 160 m. The major sandstone units are interbedded with other rocks and, though shales and claystones are quite extensive in places, the sandstone predominates. A generalised stratigraphic column of the Southern Coalfields is provided in Figure 6 with geological epochs.

4.3 BULLI SEAM

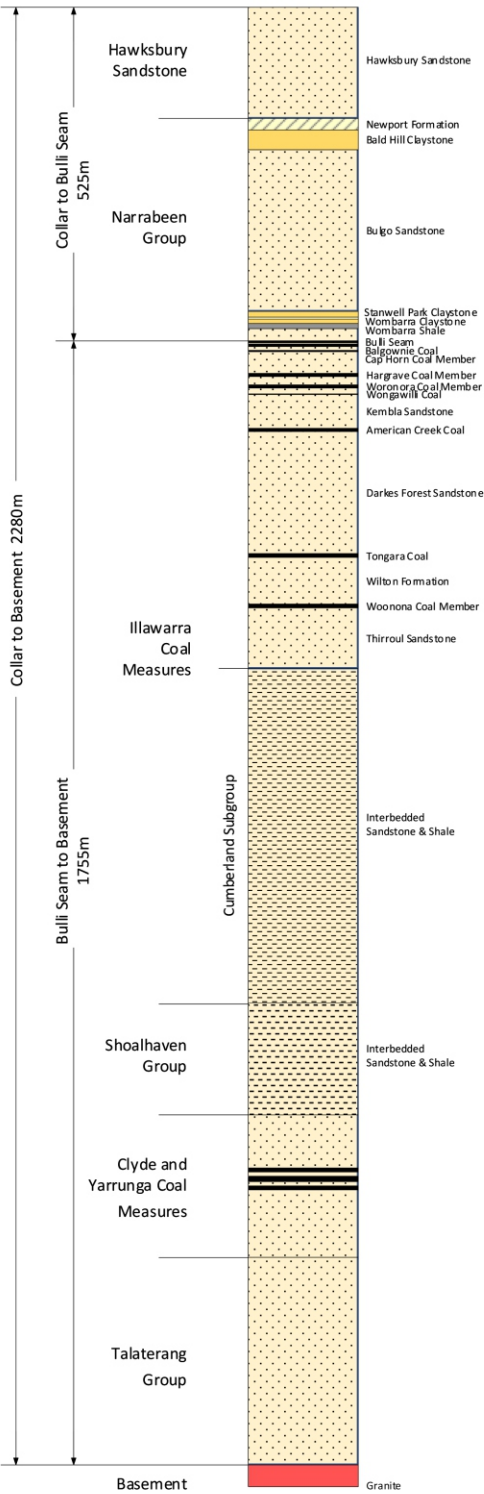
The seam floor within the Longwalls 311-316 35 degree (°) angle of draw and/or 20 millimetres (mm) subsidence contour area generally dips from the south-east to the north-west. The Bulli Seam thickness within the Longwalls 311-316 goaf area varies between approximately 2.5 m at the southern end to 2.65 m at the northern end. Longwalls 311-316 will extract the full height of the seam, with a minimum extraction height of 2.8m. The seam floor contours and seam thickness contours are shown on Plan 3 in Attachment 1.

4.4 TOPOGRAPHY

The topography consists of Hawkesbury Sandstone dip slopes falling to the north-west. The southern slopes tend to be more rugged, consisting of joint controlled escarpments of Hawkesbury Sandstone. These plateau areas are deeply incised by the Woronora River, Waratah Rivulet and other unnamed streams.

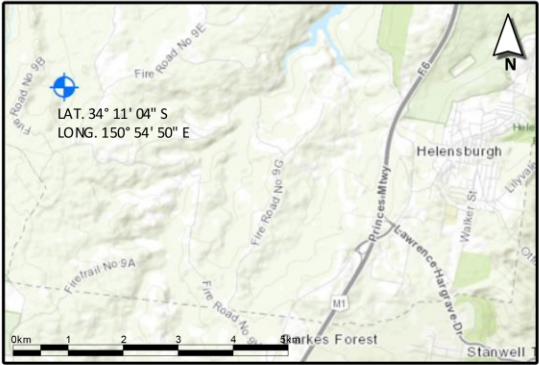
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Metropolitan Colliery – Depth of Basement Rock



County: Cumberland
Parish: Heathcote
District: Wollongong
Hole Name: AOG Woronora PDH & RDH 1
Collar: R.L. 355.092
Total Depth: 2315.52m
Date Commenced: 9-6-1963
Logged By: A.O.G. Geologists

BORE HOLE LOCATION



Source: after Australian Oil and Gas Corporation Ltd (1963)

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METROPOLITAN COAL
Depth to Basement
(2.3 km at Metropolitan Colliery),
AOG Woronora Hole

Figure 5

AGE	GROUP	SUB-GRP	CODE	FORMATION & MEMBERS	
TRIASSIC	WIANAMATTA GROUP		WMSH	BRINGELLY SHALE	
				MINCHINBURY SANDSTONE	
				ASHFIELD SHALE	
				MITTAGONG FORMATION	
			HBSS	HAWKSBURY SANDSTONE	
	NARRABEEN GROUP	GOSFORD	GRFM	NEWPORT FORMATION	
				GARIE FORMATION	
		CLIFTON	BACS	BALD HILL CLAYSTONE	
			BGSS	BULGO SANDSTONE	
			SPCS	STANWELL PARK CLAYSTONE	
			SBSS	SCARBOROUGH SANDSTONE	
			WBCS	WOMBARRA CLAYSTONE	
			CCSS	COAL CLIFF SANDSTONE	
PERMIAN	ILLAWARRA COAL MEASURES	SYDNEY	BUSM	BULLI COAL	
			UNM1	LODDON SANDSTONE	
			BASM	BALGOWNIE COAL	
			LRSS	LAWRENCE SANDSTONE	
				BURRAGORANG CLAYSTONE	
			CHSM		CAPE HORN
			UNM2		UNNAMED MEMBER 2
				ECKERSLEY FORMATION	HARGRAVE COAL
					WORONORA COAL
					NOVICE SANDSTONE
			WW01-11	WONGAWILLI COAL	
		CUMBERLAND	KBSS	KEMBLA SANDSTONE	
			ACSM	ALLANS CREEK FORMATION	AMERICAN CK. COAL
			APFM	DARKES FOREST SANDSTONE (APPIN FORMATION)	
				BARGO CLAYSTONE	HUNTLEY CLAYST.
					AUSTIMER SANDST.
			TGSM	TONGARRA COAL	
			WTFM	WILTON FORMATION	
				WOONONA COAL MEMBER	
				ERINS VALE FORMATION	
					FIGTREE COAL
					UNANDERRA COAL
					BERKELEY LATITE
					MINNAMURRA LATITE
					CALDERWOOD LATITE
					FIVE ISLANDS LATITE
	SHOALHAVEN GROUP			BROUGHTON FORMATION	
				BERRY SILTSTONE	
				NOWRA SANDSTONE	
	TALATERANG			WANDRAWANDIAN SILTSTONE	
				SNAPPER POINT FORMATION	
				PEBBLEY BEACH FORMATION	
				CLYDE COAL MEASURES	
UNDIFFERENTIATED PALAEOZOIC (DEVONIAN, SILURIAN & ORDOVICIAN)					
ROCKS OF THE BASIN BASEMENT					
Information Sourced From - "Geological Survey Report No. GS1998/277 - R.S. Moffitt"					

MEF-23-33 LW311-316 BP CRP 003A

Source: Moffitt, R.S and Geological Survey of New South Wales (1998)

Figure 6

4.5 DEPTH OF COVER

The surface level contours and depth of cover contours to the Bulli Seam are shown on Plan 3 in Attachment 1. The depth of cover within the Longwalls 311-316 35° angle of draw and/or predicted 20 mm subsidence contour varies between a minimum of 405 m and a maximum of 550 m.

4.6 LINEARS

Surface lineaments are linear features in the surface landscape, preferentially eroded, that may be the surface expression of an underlying geological structure, fault or dyke or simply a result of surface joint sets. Lineaments are identified from aerial photography, Light Detection and Ranging (LiDAR) and from digital topographic sets. By far the most common linears are features developed on the prevailing joint sets in the surface rock (Doyle and Newland, 2008). Lineament analysis aims to identify features that may be of greater geological significance, recognised by association with known geology or focussed field investigation.

Lineaments mapped by Metropolitan Coal over Longwalls 311-316 and surrounds are shown on Figure 7. The lineament that runs north-south across Longwalls 20-27 extends over Longwall 304. Over Longwalls 20-27 and through Longwall 304, this lineament is associated with an underground fault (F008). Longwalls 20-27 and Longwall 304 mined through this fault structure and did not intercept water (i.e. the fault did not act as a conduit at depth).

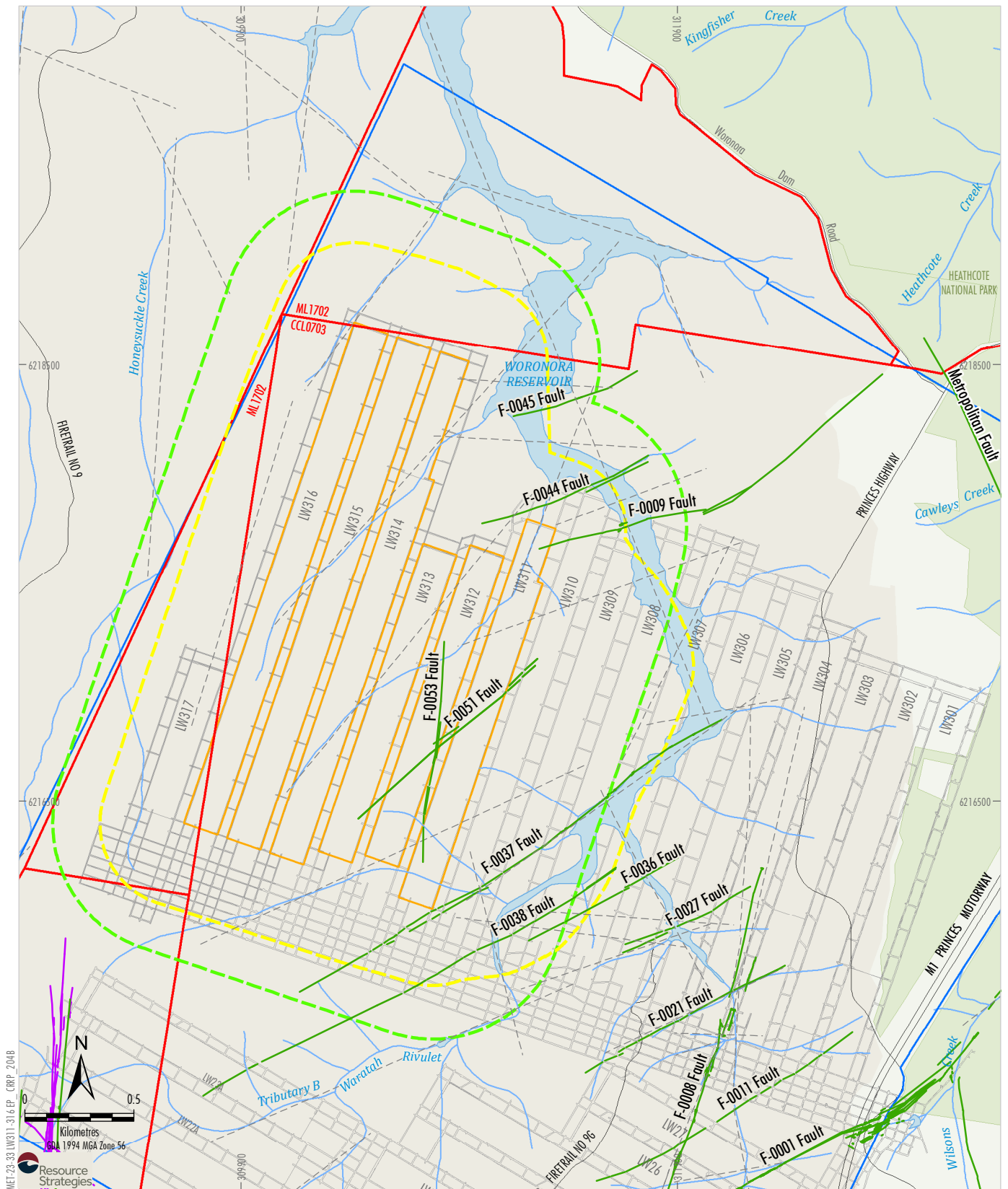
As described in the Longwall 304 CRRP, a key outcome of the Geological Features Risk Assessment (GFRA) that was undertaken for the Longwall 304 Extraction Plan was the further correlation of updated linear mapping with underground geological mapping (Metropolitan Coal, 2019a). Surface field mapping of lineaments occurred prior to Longwall 304, however little value was achieved in reviewing the lineaments on the ground with mapping of joint sets being the only outcome.

As described in the Longwalls 305-307 CRRP, the Longwalls 305-307 GFRA considered lineaments as a possible indicator of underlying geological structures and an action arising from the Longwalls 305-307 GFRA was to reanalyse the Longwalls 305-307 study area (Metropolitan Coal, 2019b). A new LiDAR scan of the landscape was commissioned and in August 2019 the landscape was examined for any new lineaments in the Longwalls 305-307 35° angle of draw and/or predicted 20 mm subsidence contour. The 2019 LiDAR review confirmed the existing lineament mapping analysis with additional lineaments added to the dataset. Lineaments were examined for possible correlation to underground geological mapping in the study area of Longwalls 305-307. Including structure F-0027 coincident with a surface lineament passing through the body of the reservoir. F-0027 was mined through by Maingate 305 and Maingate 306 without evidence of moisture.

A specific GFRA was completed for the Longwalls 308-310 Extraction Plan (Metropolitan Coal, 2021). Lineaments were also considered in the Longwalls 308-310 GFRA and an action arose to undertake targeted surface mapping above Longwalls 308-310 (Metropolitan Coal, 2021). A feature was identified correlating with F0037 structure underground (similar to F0027) existing as a discernible lineament intercepting the reservoir. F0037 was mined through by Longwall 306, 307 and 308 with no evidence of moisture. A mapped underground feature F0009 located north of Longwall 308 has been targeted for any coincident surface lineament. To date, no corresponding lineament has been identified through surface mapping.

A GFRA was completed for the Longwalls 311-316 Extraction Plan (Metropolitan Coal, 2023). Subsequent to the Longwalls 311-316 GFRA, analysis was undertaken for surface features co-incident with linears, such as swamps. A LiDAR imaging program was completed in July 2023, scanning the Longwalls 311-316 Study Area. New linears were interpreted after the program introduced data integration techniques to highlight changes in the landscape. Whilst no surface linears were detected in association with underground structure F0009, new linears were identified co-incident with the axis of major swamps (i.e. the orientation of the valley), aligned with a possible linear and thus the swamp located in the same valley was similarly aligned.

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LEGEND

- Mining Lease Boundary
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- Longwalls 311-316 Secondary Extraction
- Longwalls 311-316 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
- 600 m from Longwalls 311-316 Secondary Extraction

- Faults (of note or greater than 1 km strike)
- Dykes
- Lineament

Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2023); MSEC (2024);

Peabody

METROPOLITAN COAL

Mapped Faults and Lineament over
Longwalls 311-316 and Surrounds

Figure 7

4.7 IGNEOUS INTRUSIONS

The presence of igneous intrusions at the Metropolitan Coal Mine has not been detected at the surface. Examination of linears and residuals on the topographic surface has failed to identify any such features. Similarly, aeromagnetic surveys made no positive identification of igneous plugs. Aeromagnetic surveys have identified the Maddocks Diatreme to the south of Longwall 1 in 1995 and a possible zone of dykes loosely associated with the Madden Fault zone on the western edge of the Metropolitan Coal lease boundary. A diatreme is an explosive igneous vent that has little or no igneous material associated with the vent. At coal level the diatreme may be represented by an igneous plug, a dyke, sill or induration of the coal by steam and other vapours. No diatremes have been identified in the Metropolitan Coal 300 series longwall area (Doyle and Newland, 2008).

4.8 SYNCLINE/ANTICLINE

The general Bulli Seam structure in the Metropolitan Coal Mine area is a broad syncline trending north to north-west. Geological structures in synclinal areas in the Southern Coalfield are typically more benign than in anticlinal areas (Doyle and Newland, 2008).

4.9 FAULTS

The major geological features at seam level are shown on Plan 3 in Attachment 1. For the Longwalls 311-316 Extraction Plan, in seam faults have been further delineated on the plans by highlighting structures with greater than 1 km strike length. Whilst 1 km is somewhat arbitrary, this delineation is to better highlight what are more persistent structures at seam level and potentially correlate these with surface lineaments. Many faults mapped at seam level are minor in nature and only exist locally about the coal seam.

Longwalls 311-316 are located approximately 11.2 km south-west of the Metropolitan Fault, at its closest point. Extraction has progressively moved further away from the Metropolitan fault with Longwall 301 being the closest at 0.6 km offset. The Metropolitan Fault is a fault trending with other regional faults in a north-northwest to south-southeast strike. Displacement in the historical workings is 70 to 90 m, downthrow to the east. Seismic investigations have identified a series of reverse faults, 600 m north-east of Longwall 309, projecting in line from the known position of the Metropolitan Fault.

A strike slip fault, F0008, with up to 1.2 m vertical displacement occurs over Longwalls 20-27, and this fault extends partially through Longwall 304. This fault is associated with a surface linear that aligns with the Eastern Tributary and then passes east of the Woronora Reservoir full supply level dissipating into the landscape. Longwalls 20-27 and Longwall 304 were extracted through this feature directly under the Eastern Tributary with no moisture evident at seam level and no change in mine water balance during the several years of extraction in the area.

A strike slip fault, F0027, with zero vertical displacement, has been mapped in the gate roads leading into Longwalls 304 and 305. The associated surface linear is located approximately 250 m west of the end of the Eastern Tributary arm of the Woronora Reservoir full supply level. No moisture has been evident where F0027 structures intersects the seam.

A strike slip fault, F0037, with zero vertical displacement, has been mapped in Longwalls 306, 307 and 308. The associated surface linear is aligned with the Waratah Rivulet arm of the Woronora Reservoir. Similar to previous experience of mining through these features no moisture has been evident from F0037 structure in the seam either on development advance or during longwall extraction.

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F0009 is a normal fault with a displacement of 0 m to 18 m located north of Longwall 308 and 309. The displacement of F0009 combined with coal quality north of the structure led to an economic decision to reposition the Longwall 308 and 309 face line from the PPL to the Extraction Plan Layout. Longwall 310 was able to pass through the structure as it had reverted to a strike slip feature with 0 m to 2 m displacement.

A detailed seismic assessment of F0009 was commissioned to determine the vertical extent of the structure with multiple dedicated seismic lines installed to provide a suitable resolution throughout the stratigraphy. The Velseis (2018) report concluded:

The large normal fault F0009 can be seen to impact the Bulli Seam only, and there is no evidence from available seismic data that this normal fault extends to the shallower Bald Hill Claystone level in the stratigraphy

From the detailed seismic report, the fault is not vertically extensive, residing at depth about the Illawarra Coal Measures. Whilst not vertically extensive, horizontally the structure extends north-west away from the extraction area towards the Metropolitan Fault. From the point where F0009 bisects Longwall 310 to the Metropolitan fault, the horizontal distance is approximately 1.7 km.

To demonstrate the structure poses negligible effects to the groundwater systems, a surface to seam borehole (2020EX02) was approved and installed in 2020. This borehole is located along strike, approximately 700 m north-west of the intercept with Longwall 310, was designed to measure the horizontal permeability characteristics of F0009 by coring through the structure at depth. An assessment of the permeability characteristics found (Golder Associates Pty Ltd, 2020):

Hydraulic conductivities measured across the fault were comparable to those recorded for the unfractured host rock... there is negligible variance in horizontal flow characteristics associated with the fault measured at this location.

Detailed surface mapping has not identified any associated surface linear with this feature. Given the available data, it is highly unlikely that this feature would provide hydraulic connectivity either vertically or horizontally as a result of the extraction of Longwalls 311-316, similar to previous experiences of mining through other structures such as F0008, F0021, F0027 and F0037. The risk posed by F0009 was carefully considered and reviewed during the Longwalls 311-316 GFRA, with an additional control being specified to undertake water make monitoring specifically for F0009 with further delineation to occur on roadway advancement (similar to controls previously used for structures passed through by mining).

Upon roadway development of Maingate 309, F0009 was intersected in B Heading with a displacement of 6.0 m and intersected in A Heading with a displacement of 2.8 m. Both A and B Heading of Maingate 310 intersected F0009 with no discernible displacement observed. All four roadway intersections with F0009 were dry upon roadway development and remain dry.

In seam gas drainage drilling activities have identified two probable normal faults, F0044 and F0045. These being located further north at 200 m and 600 m respectively. Both of these faults appear to run parallel to F0009, en échelon, with a south-west strike direction. A seam displacement of 0 to 5 m has been confirmed and reflects the decision on the starting position of Longwall 311 to be south of this structure. Further delineation may necessitate further shortening of both Longwalls 311 and 312 to avoid these features.

The Longwalls 311-316 GFRA participants were shown images of F0008, F0032, F0033, F0037 and F0009 during longwall extraction with all structures displaying dry and dusty conditions.

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4.10 RISK ASSESSMENT ON GEOLOGICAL FEATURES WITH THE POTENTIAL TO EFFECT WATER QUANTITY AVAILABLE TO WORONORA RESERVOIR, OR ABORIGINAL CULTURAL HERITAGE

The Independent Expert Panel for Mining in the Catchment (IEPMC)² Initial Report recommended that the potential implications for water quantity of faulting, basal shear planes and lineaments be carefully considered, and risk assessed at all mining operations in the Catchment Special Areas (IEPMC, 2018).

In relation to the Metropolitan Coal Mine, the IEPMC Initial Report concluded (pg. 127):

In the case of Metropolitan Mine:

-
- *the potential for water be diverted out of Woronora Reservoir and into other catchments through valley closure shear planes and geological structures including lineaments will require careful assessment in the future because it is planned that most of the remaining longwall panels in the approved mining area will pass beneath the reservoir.*

A GFRA workshop for Longwalls 311-316 was held on 25 July 2023. The workshop participants³ identified and assessed the potential for mining effects on lineaments, joints, faulting, shear planes and dykes to impact on the quantity of water to the Woronora Reservoir, including the potential for water to be diverted out of the Woronora Reservoir and into other catchments. Participants also assessed the impacts to Aboriginal heritage sites and swamps as a result of mining effects on geological features.

Controls arising from the risk assessment workshop included targeted surface mapping above Longwalls 311-316 for further correlation of updated linear mapping with underground geological mapping, a specific underground water monitoring program for F0009 and F0037, consideration of a post-mining, groundwater monitoring site above Longwall 310 should site 9EGW2 not survive extraction beneath it, specific mapping of drainage lines of Large Swamps 76, 77 and 92, specific subsidence predictions for large swamps, conduct a detailed pre-mining geological mapping of sites with high cultural significance and/or high archaeological significance for Longwalls 311-316, and develop a plan which overlays geological features and Aboriginal heritage sites to identify those at a higher risk of impact (Metropolitan Coal, 2023).

The participants considered the risk control measures and procedures to be reasonable to manage the identified risks.

The outcomes of the risk assessment are provided in Attachment 2.

² The IEPMC was established in November 2017 by the NSW Government to provide expert advice to the DP&E on the impact of mining activities in the Greater Sydney Water Catchment Special Areas, with a particular focus on risks to the quantity of water in the catchment.

³ Participants included, Ines Epari (SLR Consulting Australia Pty Ltd, Principal Hydrology & Hydrogeology) Peter DeBono (Mine Subsidence Engineering Consultants Pty Ltd, Subsidence), Shane Kornek (Metropolitan Coal, Senior Geotechnical Engineer), Jon Degotardi (Metropolitan Coal, Approvals Manager), Roger Byrnes (Byrnes Geotechnical, Principal Geotechnical Engineer), Nicolas Tucker (Metropolitan Technical Services Manager), Jamie Warwick (Resource Strategies Pty Ltd [Resource Strategies], Senior Environmental Project Manager), Harper Mulloy (Resource Strategies, Environmental Project Manager), and Stephen Love (Metropolitan Coal, Environment & Community Superintendent). The risk assessment was facilitated by Mr Nate Bain (Peabody Senior Mining Engineer).

5 RESOURCE RECOVERY

5.1 MINING METHOD

Longwalls 311-316 will be extracted using retreating longwall mining methods for secondary extraction of a panel with an initial 138 m void width, expanding to 163 void width as they retreat to the south outside the 35° angle of draw of the reservoir. The longwall panel will be formed by driving two sets of gate roads (the tailgate and maingate roads). Each gate road requires two roadways (headings) to be driven parallel to each other. The two roadways will be used for ventilation purposes, with one of the roadways utilised as a transport road and the other roadway used to convey the coal that will be mined back to the main conveyors. Construction of development main headings and gate roads are mined using continuous miners.

The dimensions of the headings will be approximately 5.2 m wide and 3.2 m in height. The headings are connected approximately every 130 m by driving a cut-through from one heading to another which forms pillars of coal along the length of the gate road. The tailgate and maingate roads are separated by the longwall panel. The maingate roads and tailgate roads are then linked together by driving an installation road and bleeder road at the top end of the longwall panels. Run-of-mine (ROM) coal will be conveyed by the maingate conveyor to the main conveyor which will carry coal to the surface of the mine.

5.2 MINE PLAN

5.2.1 Justification

As described in Section 3.2, the seam thickness within the Longwalls 311-316 goaf area varies from approximately 2.5 m to 2.65 m. Longwalls 311-316 will extract the full height of the seam at a minimum cut height of 2.8 m. Using the proposed mining method, the resource recovery of ROM coal from the Bulli Seam in Longwalls 311-316 is estimated to be 67 percent (%). The total amount of ROM coal anticipated to be extracted is estimated to be approximately 9.5 million tonnes (Mt).

Metropolitan Coal considers the layout of Longwalls 311-316 to provide the most efficient resource recovery given the constraints.

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5.2.2 Mining Schedule

The Metropolitan Coal Mine operates seven days a week, 24 hours a day on a rotating shift basis. The extraction of Longwalls 1 to 310 is complete, with extraction of Longwall 311 underway.

The provisional extraction schedule for Longwalls 311-316 is provided in Table 3.

Table 3
Provisional Extraction Schedule

Longwall	Estimated Start Date	Estimated Duration	Estimated Completion Date
Longwall 311	October 2024	8 Months	June 2025
Longwall 312	July 2025	7 Months	January 2026
Longwall 313	February 2026	7 Months	September 2026
Longwall 314	November 2026	10 Months	September 2027
Longwall 315	October 2027	11 Months	September 2028
Longwall 316	October 2028	11 Months	September 2029

5.2.3 Future Mine Plans

The current layout of Longwall 317 is shown on Figures 1 and 3, on Plan 1 in Attachment 1.

The layout of Longwall 317 will however be subject to further review for a future Extraction Plan in consideration of potential subsidence impacts and environmental consequences.

5.2.4 Effects on Future Resource Recovery

The Bulli Seam is the upper seam of the Illawarra Coal Measures of the Southern Coalfields. The interburden thickness between the base of the Bulli Seam and the top of the seam below (Balgownie Seam) varies between 7.9 m and 13.9 m. The planned mining of Longwalls 311-316 is not expected to impede on any future mining of the lower seams. Currently there are no plans for mining of these seams within the Longwalls 311-316 mining area.

6 REFERENCES

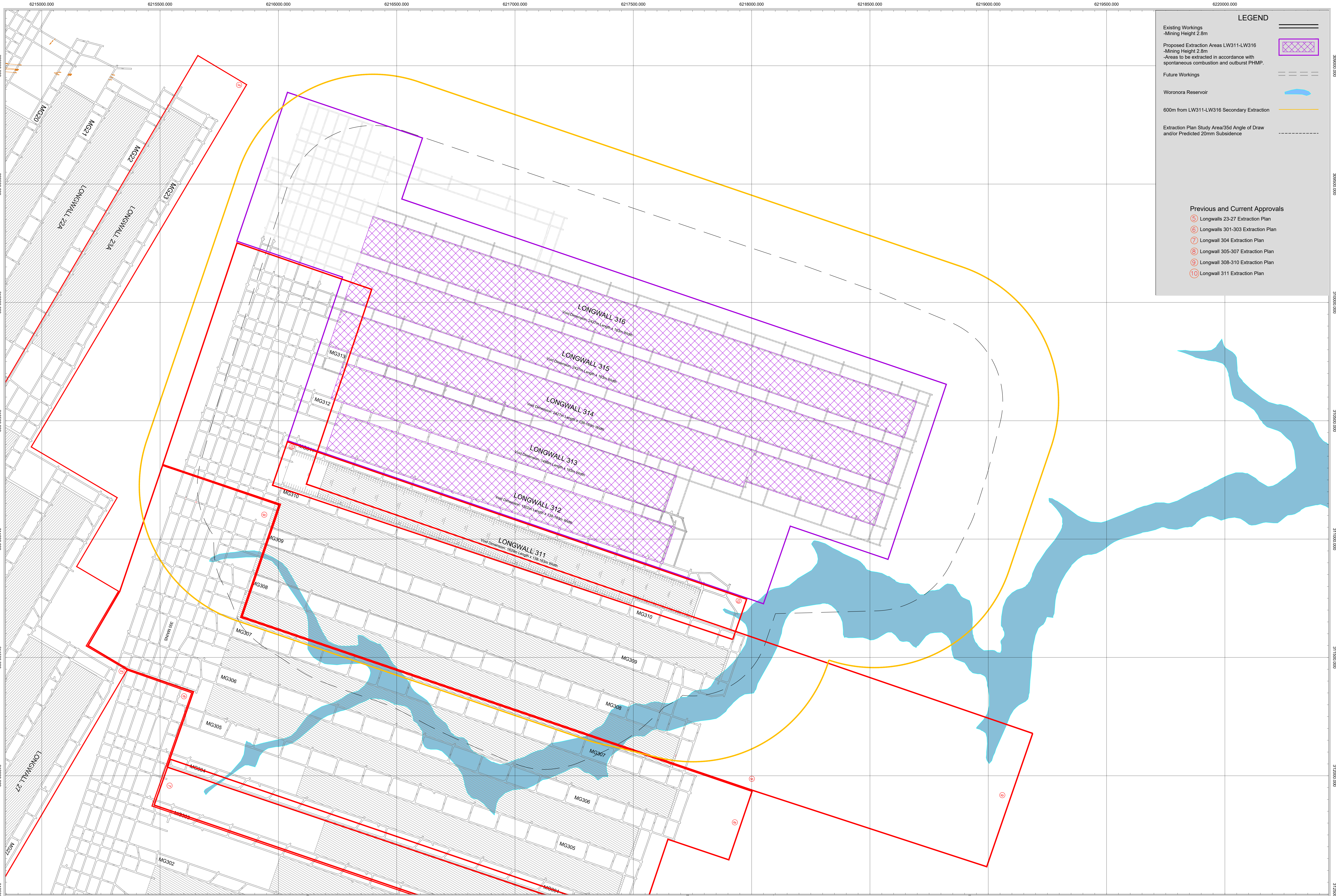
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ATTACHMENT 1

PLANS 1, 2, 3, 5 AND 6 IN ACCORDANCE WITH THE
DEPARTMENT OF PLANNING AND ENVIRONMENT (2022)
EXTRACTION PLAN GUIDELINE

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LEGEND

Existing Workings
-Mining Height 2.8m

Proposed Extraction Areas LW311-LW316
-Mining Height 2.8m
-Areas to be extracted in accordance with spontaneous combustion and outburst PHMP.

Future Workings

Woronora Reservoir

600m from LW311-LW316 Secondary Extraction

Extraction Plan Study Area/35d Angle of Draw and/or Predicted 20mm Subsidence

Previous and Current Approvals

- ⑤ Longwalls 23-27 Extraction Plan
- ⑥ Longwalls 301-303 Extraction Plan
- ⑦ Longwall 304 Extraction Plan
- ⑧ Longwall 305-307 Extraction Plan
- ⑨ Longwall 308-310 Extraction Plan
- ⑩ Longwall 311 Extraction Plan

Mining Engineering Manager Date

Registered Mine Surveyor Date

CLIENT/PROJECT

METROPOLITAN COLLIERIES PTY LTD
Metropolitan Coal Mine
PO BOX 402
HELENSBURGH 2508

SURV/D/DES'G'D

CHECKED

AUTHORISED

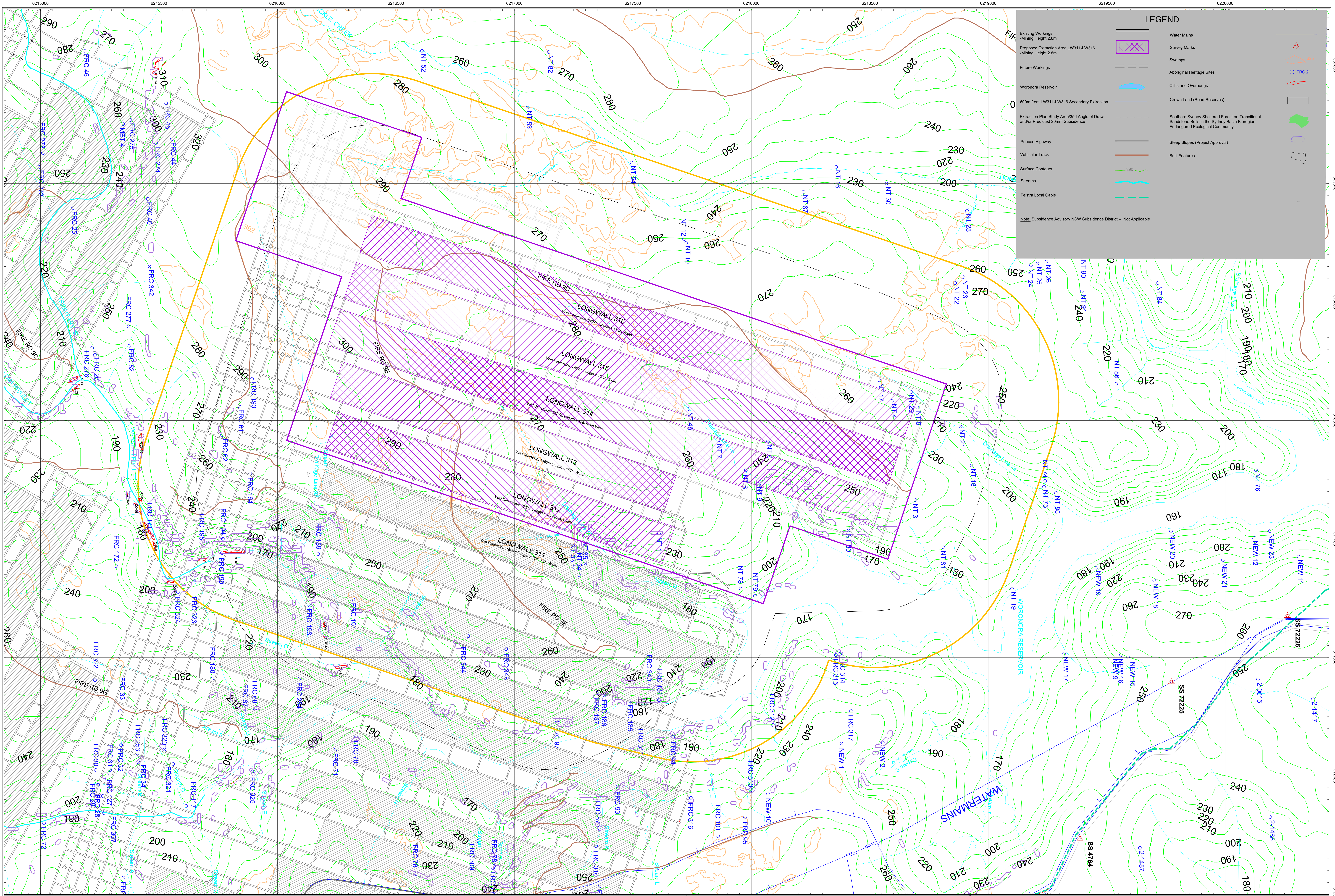
DRAWING No MET- 11 - 30 - Rev 3 - Plan 1

© MCA2020 Drawing File11 Approvals, Layouts & Extraction Plans\MET-11-30-1 to 48 LW01-1316 Extraction Plans\Rev3\MET-11-30-Rev3-Plan 1 - Final Workings Plan LW311-14-0016.dwg

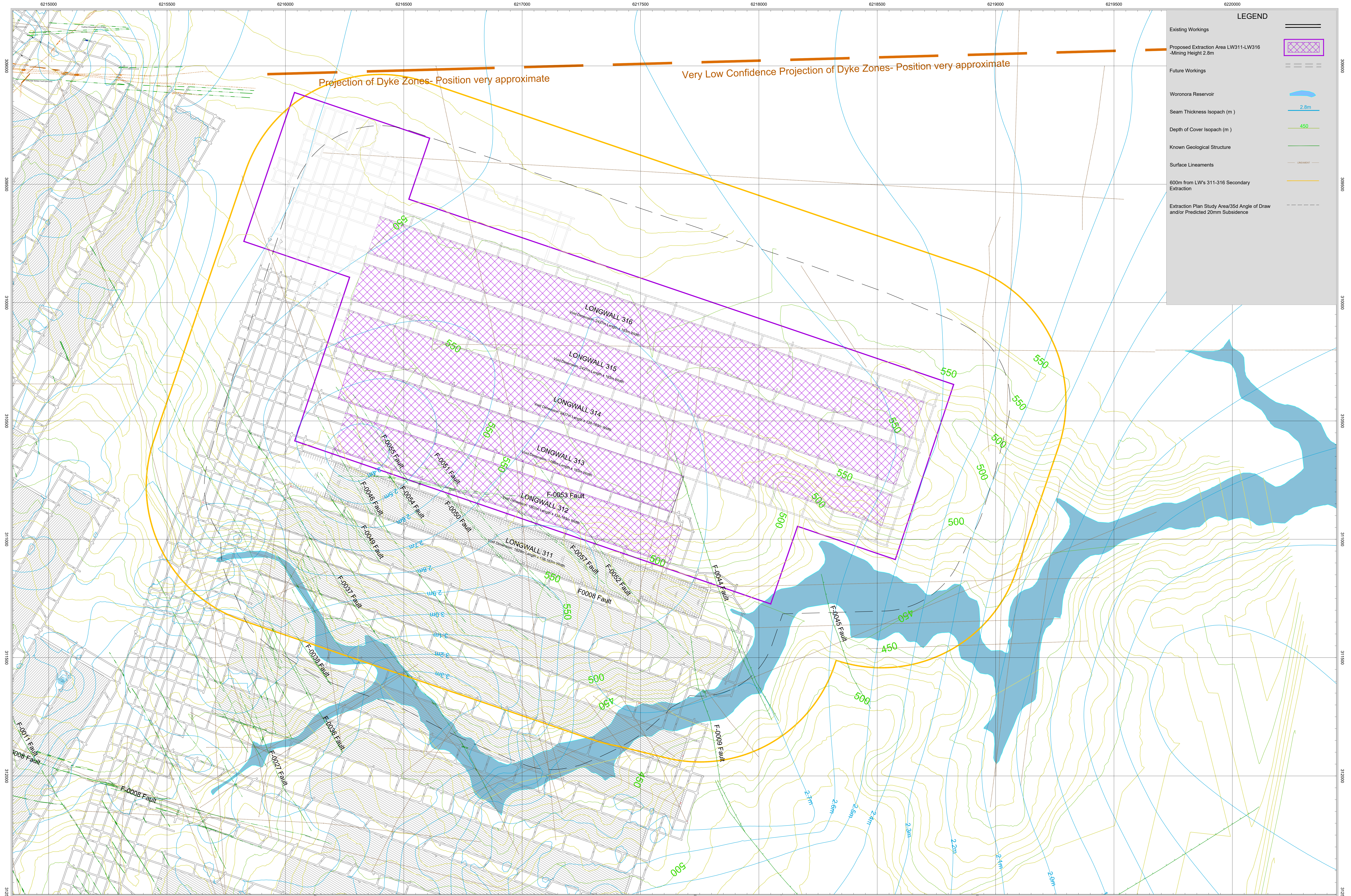
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08/05/2025	Survey Dept.	1	1	1:5000

Longwalls 311-316 Extraction Plan

Existing and Proposed Workings



				DRAWING No MET-11-31-Rev 3		Longwalls 311-316 Extraction Plan: Plan 2 - Surface Features			
CLIENT/PROJECT METROPOLITAN COLLIERIES PTY LTD Metropolitan Coal Mine PO BOX 402 HEILSBURG 2508		SURV'D/DES'G'D		CHECKED				AUTHORISED	
DATE 08/05/2025		DRAWN Survey Dept.		SHEET 1		OF 1		SCALE 1:5,000	



LEGEND

Existing Workings

Proposed Extraction Area LW311-LW316
-Mining Height 2.8m

Future Workings

Woronora Reservoir

Seam Thickness Isopach (m)
2.8m

Depth of Cover Isopach (m)
450

Known Geological Structure

Surface Lineaments

600m from LW's 311-316 Secondary Extraction

Extraction Plan Study Area/35d Angle of Draw and/or Predicted 20mm Subsidence

MCA

Mining Engineering Manager

Date

Registered Mine Surveyor

Date

CLIENT/PROJECT

Peabody

METROPOLITAN COLLIERIES PTY LTD
Metropolitan Coal Mine
PO BOX 402
HELENSBURGH 2508

SURV'D/DES'G'D

CHECKED

AUTHORISED

DRAWING No

MET-11-32- Rev3

DATE

08/05/2025

DRAWN

Survey Dept.

SHEET

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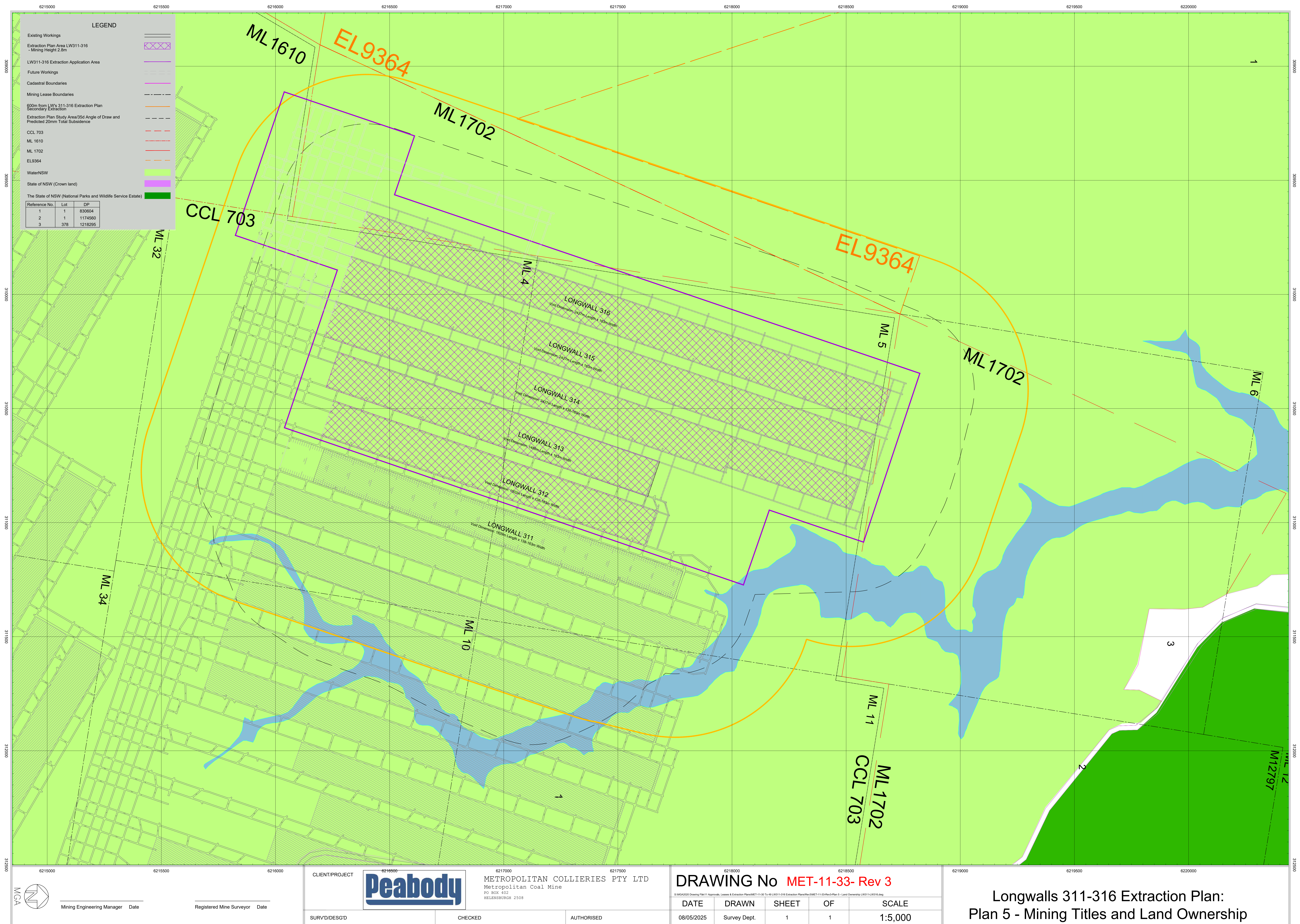
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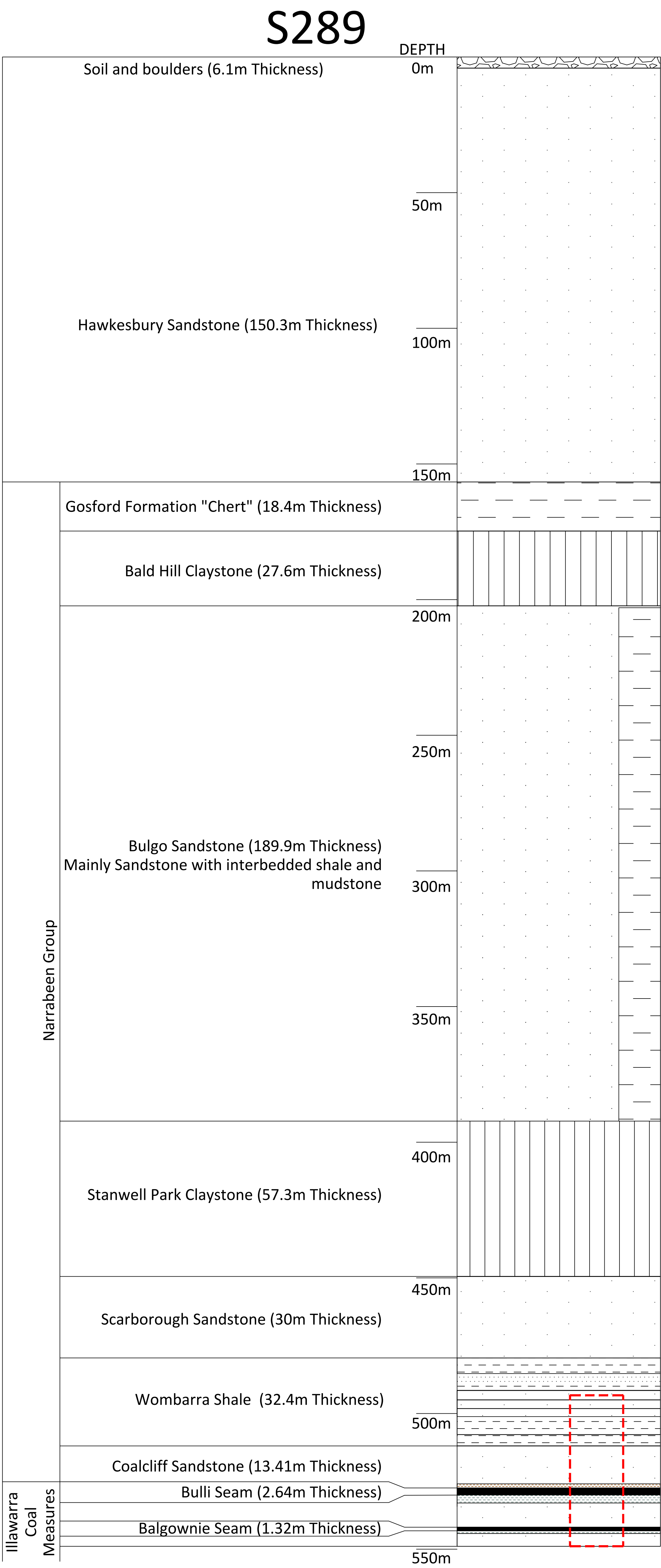
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Longwalls 311-316 Extraction Plan

Plan 3 - Proposed Working: Seam & Depth of Cover

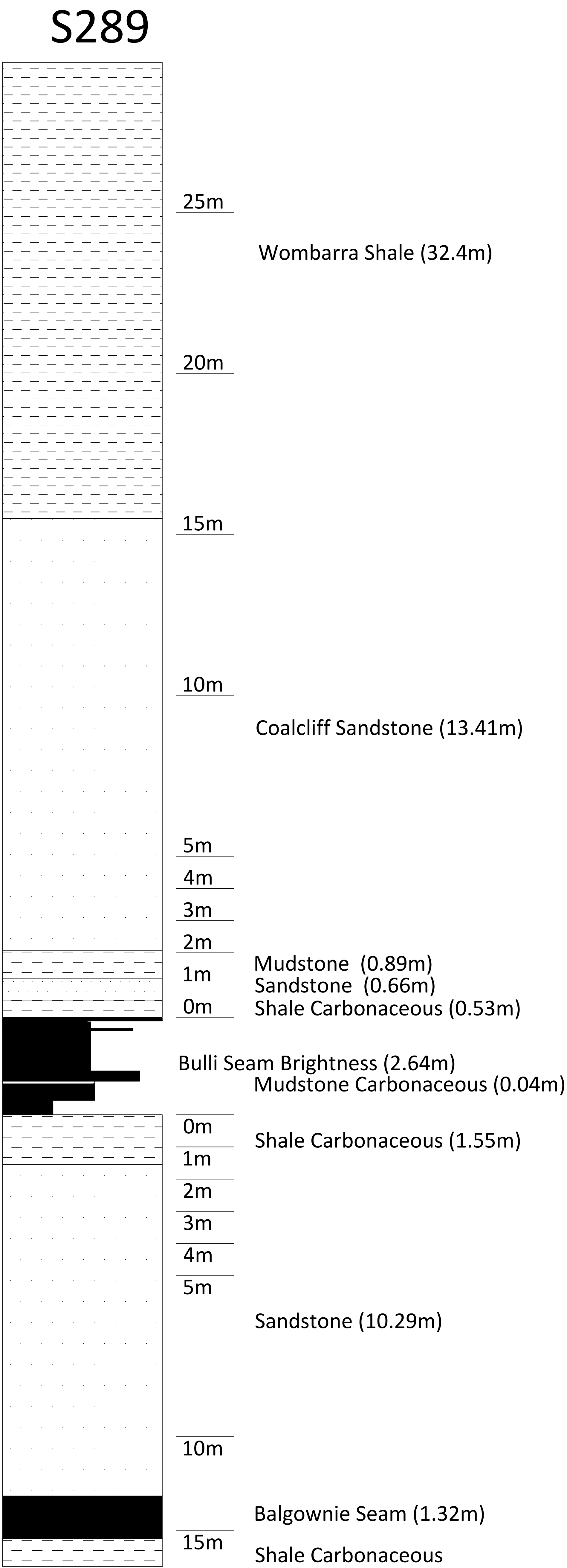


Vertical Log of Bore S289



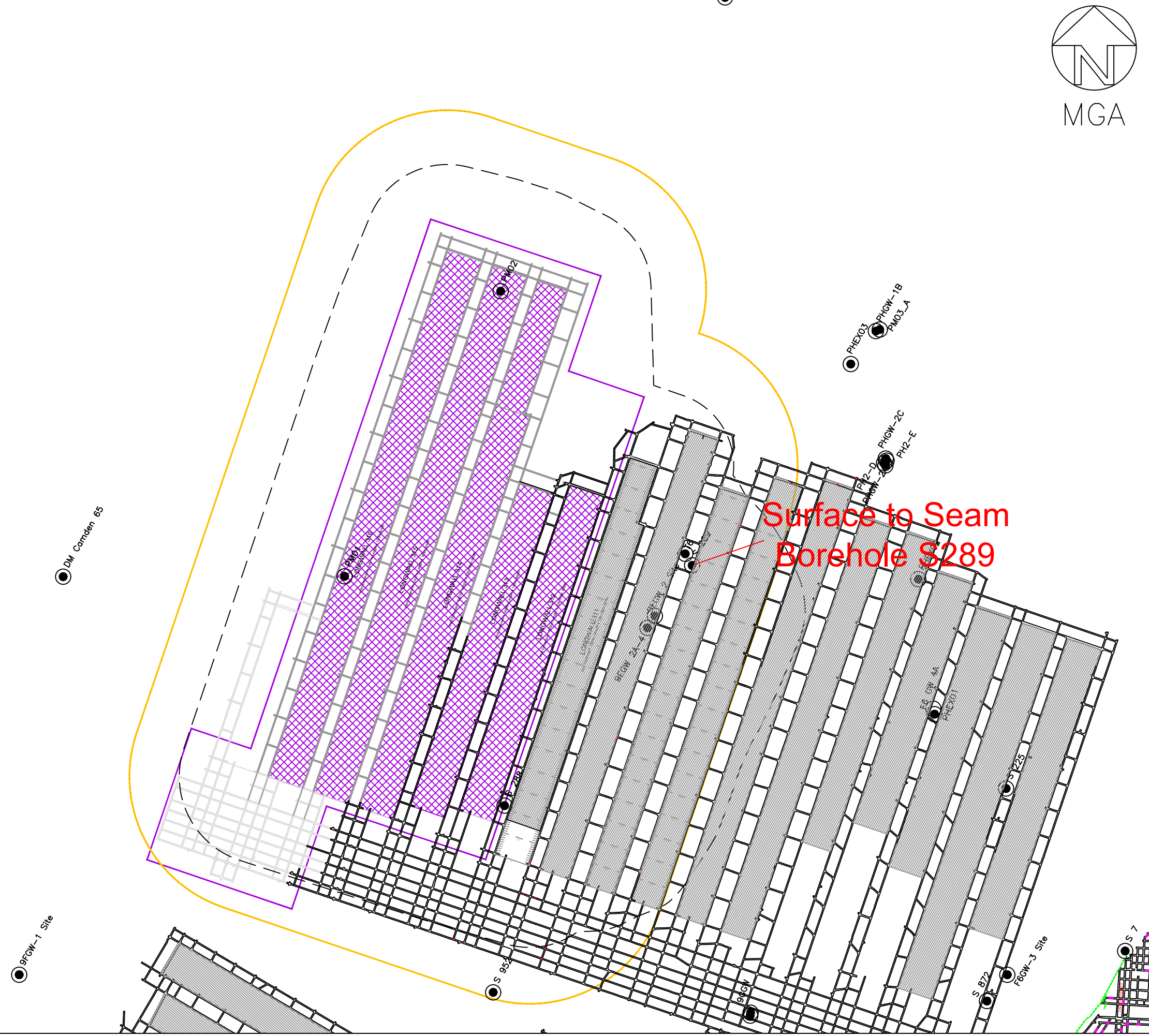
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Inset of Vertical Log Bore S289

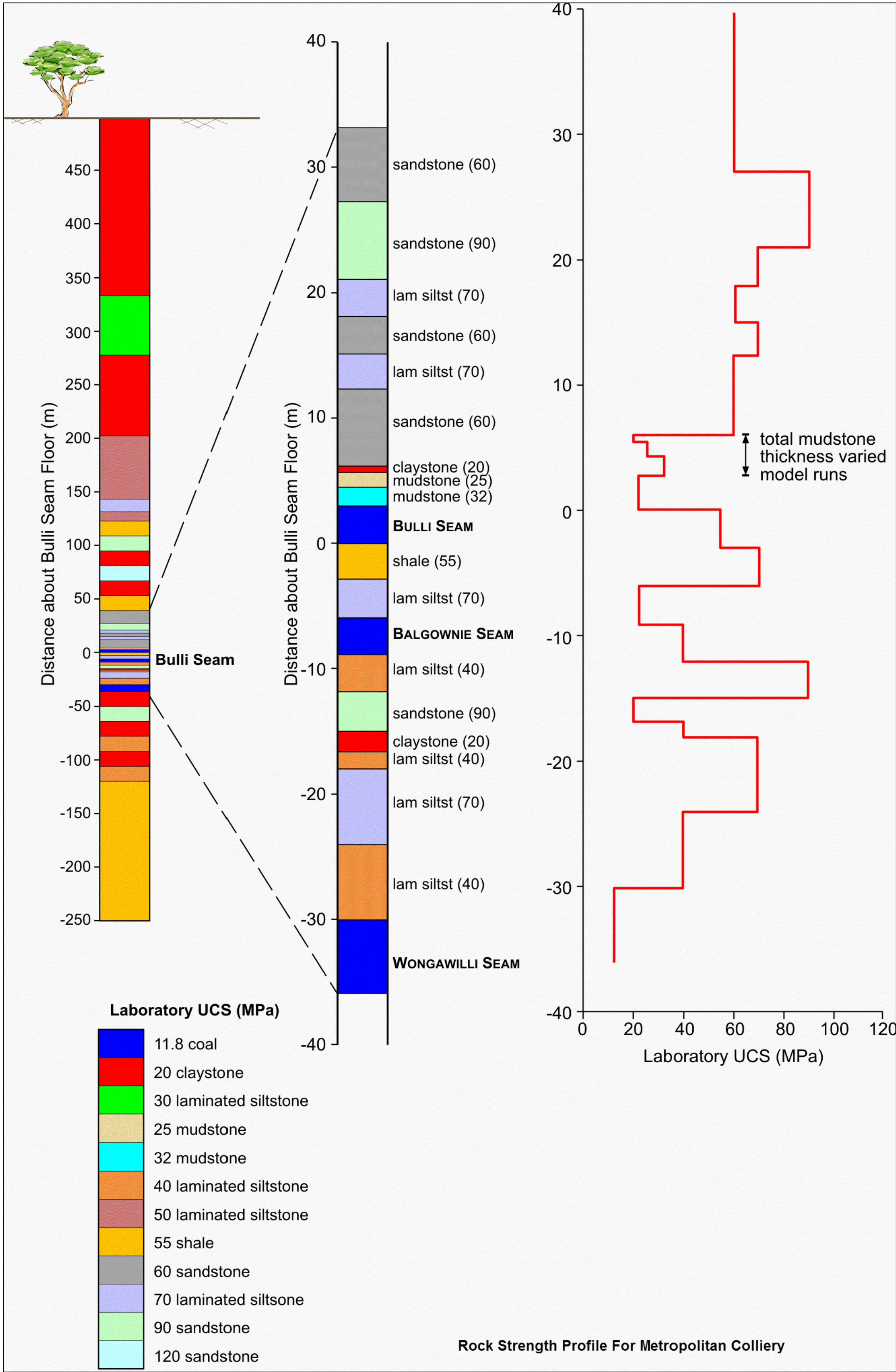


Inset

Location Plan



Geotechnical Log



CLIENT/PROJECT



METROPOLITAN COLLIERIES PTY LTD
Metropolitan Coal Mine
PO BOX 402
HELDENSBURGH 2508

DRAWING No MET-11-34- Rev 3

DATE

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S.Kornek

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Mining Engineering Manager Date

Geologist Date

SURV'D/DES'G'D

CHECKED

AUTHORISED

Longwalls 311-316 Extraction Plan:
Plan 6 - Geological Section and Geotechnical Logs

ATTACHMENT 2

RISK ASSESSMENT ON GEOLOGICAL FEATURES WITH THE POTENTIAL TO EFFECT WATER
QUANTITY AVAILABLE TO WORONORA RESERVOIR OR POTENTIAL TO EFFECT ABORIGINAL
CULTURAL HERITAGE SITES

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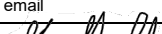
WORKPLACE RISK ASSESSMENT AND CONTROL (WRAC)



Title / ID number	ME-ENV-RSK-0492 Potential geological features that may be affected by LW 311 - LW 316 mining and affect water quantity available to Woronora Reservoir and subsidence impacts to aboriginal heritage. 1-424189		
Site	Metropolitan Coal	Date	25-Jul-23
Purpose and objectives	Assess the risks and hazards of potential geological features that may be affected by extracting LW311 - LW316. Consider hazards that may affect water quantity available to Woronora Reservoir or loss of groundwater from the catchment. To assess the risks and hazards from geological features to Aboriginal Heritage from subsidence impacts.		
Scope / context	This risk assessment is a recommendation arising from the Independent Expert Panel into Mining in Catchments, IEPMC*, that all future Extraction Plan applications are to be accompanied by a Risk Assessment considering potential outcomes on water quantity to the catchment from geological features. <i>*Note the IEPMC (as of July 2023) is the Independent Expert Advisory Panel for Mining (IEAPM)</i>		
Activity	This Risk Assessment was carried out in the offices at Metropolitan Colliery and via web based meeting		
Assumptions	The following assumptions and limitations were applied to this risk assessment: - Current mine plan for LW311 - LW316 - Existing natural groundwater system pathways in place. - SharePoint Document Kiosk is available and provides access to site documentation and procedures - Supervision Arrangements are in place for all activities carried out at the operation - Inspection Program Principal Control Plan is in place and followed - All existing Management Plans, Systems and Procedures are available and understood - Pre-shift and toolbox talks are completed at the start of every shift - Job Hazard Analysis is performed for all tasks where procedures are not available or when changes to the task occur - SLAM process is utilised for tasks - Incident and Hazard Reporting Procedure exist - Defect Management System is used for all defect reporting - Cardinal Rules have been developed and are communicated to the workforce and contractors - All personnel performing tasks have completed all relevant inductions - All personnel performing tasks are trained and competent in their field of expertise - All monitoring equipment is maintained to acceptable levels as determined by the mine site and the OEM - Mine water make monitoring is in place and monthly reporting conducted - Geological mapping underground occurs monthly (at a minimum) as per the Outburst Prevention Management plan - Geological mapping on surface has been completed for current mining area and will be updated as required - Overall exploration program is in place. This includes the following items: stratigraphic units - variations in nature and thickness, and lateral continuity, presence of structures and defects in overburden, permeability of overburden, stress regime		

Reference / related documents <i>(including Change Management number reference if applicable)</i>	IEPMC panel report - 2018 and 2019 Metropolitan Geological Plan as of 21/07/23 [ME-ENV-RSK-0333] Geological features affected by mining LW304 regarding Woronora reservoir [ME-ENV-RSK-0364] Geological features affected by mining LW305-307 regarding Woronora reservoir [ME-ENV-RSK-0445] Geological features affected by mining LW308-310 regarding Woronora reservoir [ME-TSE-HMP-0011] Subsidence [ME-MIN-HMP-0006] Inundation or inrush of a substance PHMP [ME-TSE-HMP-0031] Ground or Strata Failure [ME-TSE-MNP-0002] Survey and drafting arrangements [ME-MIN-HMP-0013] Outburst Prevention [ME-MIN-HMP-0063] Contingency Mine Water Sealing [ME-MIN-MNP-0010] - Inspection Program Principal Control Plan [ME-TSE-MNP-0078] - Longwalls 308 - 310 Water Management Plan [ME-TSE-HMP-0031] - Heritage Management Plan SLR - LW305 Goaf Hole Hydrogeological Report - A00.07197.00000-P01-v0.2-20220121 Niche - Monitoring of Aboriginal Cultural Heritage Sites (LW306 - Round 2 report) MSEC - Metropolitan Mine Geotechnical Risk Assessment of Aboriginal Heritage Sites LW308-310) AAM end of Panel LW307 Lidar results Metropolitan June 2023 monthly NSW Dams Safety report MDG1010 - Minerals industry safety and health risk management guideline, Jan 2011 MDG1014 - Guide to Reviewing a Risk Assessment of Mine Equipment and Operations Dated. July 1997 AS NZS ISO 31000-2009 - Risk management - Principles and guidelines Work Health and Safety Act 2011 Work Health and Safety Regulation 2017 New South Wales - Work Health and Safety (Mines and Petroleum Sites) Act 2013 New South Wales - Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 New South Wales - Dams Safety Act 2015 New South Wales - Dams Safety Regulation 2019
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Approved by:	Name	Jon Degotardi	Signature		Date	20/03/2024
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Participants - ME-ENV-RSK-0492 Potential geological features that may be affected by LW 311 - LW 316 mining and affect water quantity available to Woronora Reservoir and subsidence impacts to aboriginal heritage. 1-424189					
Name	Title	Company	Experience (years / detail)	Consensus (Qld)	Signature and date
Peter DeBono	Mine Subsidence Engineer	MSEC	18		14/08/2023 - by email
Ines Epari	Principal Hydrology & Hydrogeology	SLR	20		01/08/2023 
Jon Degotardi	Approvals Manager	Peabody	20+		21/08/2023 
Nate Bain	Facilitator / Senior Mining Engineer	Peabody	12		21/08/2023 
Stephen Love	Environmental & Community Superintendent	Peabody	13		21/08/2023 
Roger Byrnes	Principal Geotechnical Engineer	Byrnes Geotechnical	30+		4/08/2023 - by email
Shane Kornek	Senior Geotechnical Engineer	Peabody	20+		21/08/2023 
Jamie Warwick	Senior Environmental Project Manager	Resource Strategies	12		26/07/2023 - by email
Nicolas Tucker	Technical Services Manager	Peabody	13		21/08/2023 
Harper Mulloy	Environmental Project Manager	Resource Strategies	2		26/07/2023 - by email

Ref ID	Risk / threat	Work area or exposure group	Consequence category (use a separate row if multiple reasonable consequences of the same threat as shown in example)	Impact	Act, Object or System Current controls in place	Exposure Factors - Monitoring and Support to Address (Relevant specification documents, inspection and monitoring, training, systems or procedures, etc.)	Risk evaluation (with current control measures)			Act, Object or System Proposed additional controls (if required)	Ownership (Position / role of person(s) accountable for the risk)	Peabody Notification level	Action to address (30+2004 Act or 2007 Act)
							Maximum reasonable consequence	Likelihood	Risk score				
1. LINEAMENTS													
1.1	Mining effects geological feature - known and unknown LINEAMENTS and affects water quantity available to the Woronora reservoir and / or ground water. LINEAMENTS - Definition Linear feature in the surface landscape that may be the surface expression of an underlying geological structure - (faults, joints, dyke)	Water NSW and NSW Dam Safety for all	Compliance / regulatory Considered other consequence categories - Financial, Reputation, Strategic, Environmental	Breach of approval	System - Water management plan includes ground water monitoring and assessment Act - Lineament analysis prior to mine design System - Regular underground mapping of geological features in development panel Act - Correlation of surface lineaments with potential underground structures (inseam drilling , mapping) Act - Seismic surveying to assess continuity and extent of structure System - Mine water balance - monitoring and monthly reporting System - Regular review and update of MP's System - [ME-TSE-HMP-0031] Ground or Strata Failure System - [ME-TSE-MNP-0002] Survey and drafting arrangements System - [ME-TSE-HMP-0011] Subsidence System - [ME-MIN-HMP-0006] Inundation or intrust of a substance PHMP System - Mining approvals System - Geometry, Narrow Extraction / depth of cover ratios System - Wide chain pillars System - End of panel subsidence monitoring programme - LIDAR plus aerial photography Object - Previous experience at Metropolitan, and other operations within the southern coalfields, mining near Lineaments Act - Review in seam drilling Act - Correlation of underground structures (inseam drilling , mapping) with surface lineaments	Limited coverage of all survey and monitoring techniques, due to vegetation and topography impacting accessibility. Inadequate application of Management Plans. Inaccuracies in water balance monitoring. Limited deep groundwater monitoring holes as progressing further to the west, which do become damaged during mining.	4 Significant	1 Rare	10	Act - Potential for LW step around Act - Potential for LW standoff - environmental pillar Object - Potential for additional or replacement ground water monitoring sites Act - Targeted surface mapping above LW311 - LW316 Act - Consider additional post mining monitoring groundwater holes once mining impacts have progressed beyond LW310/311 area, on fire trail 9E Act - Consider geological mapping of Streams 'S' and 'R' looking for similar sandstone features as seen at Eastern Tributary.	SK JD JD	Crew/Team	Engage consultant to prepare a new lineament drawing file for the purposes of LW311-316 extraction Plan. Engage consultant to inspect and provide report on any evidence of lineaments, faulting, jointing, dykes or highly laminated fine bedding layers along lower reaches of Stream R or Stream S where permanent pools of water may reside. During preparation of groundwater report for Longwall 311-316 specify scope of work for specialist consultant to make recommendation on requirement for additional post groundwater monitoring holes in the extraction plan footprint
2. JOINTS													
2.1	Mining effects geological feature - JOINTS and affects water quantity available to the Woronora reservoir and / or ground water. <i>The Assessment Team deemed the risk from joints to be the same or less than the risk for lineaments above. Joints may contribute to the formation of a lineament but are not likely to be vertically connective with underground workings.</i>												
3. FAULTING													
3.1	Mining effects geological feature - FAULTING re-activates a structure resulting in effect to water quantity available to the Woronora reservoir and / or ground water.	Water NSW	Compliance / regulatory Considered other consequence categories - Financial, Reputation, Strategic, Environmental	Breach of approval	System - Water management plan includes ground water monitoring and assessment Act - Lineament analysis prior to mine design System - Regular underground mapping of geological features in development panel Act - Correlation of surface lineaments with potential underground structures (inseam drilling , mapping) Act - Seismic surveying to assess continuity and extent of structure System - Mine water balance - monitoring and monthly reporting System - Regular review and update of MP's System - [ME-TSE-HMP-0031] Ground or Strata Failure System - [ME-TSE-MNP-0002] Survey and drafting arrangements System - [ME-TSE-HMP-0011] Subsidence System - [ME-MIN-HMP-0006] Inundation or intrust of a substance PHMP System - Mining approvals Act - Ground water modelling to predict ground water flow behaviour System - Conceptual model - ground water and geotechnical, faults not necessarily contiguous System - Narrow Extraction / depth of cover ratios + geometry System - End of panel subsidence monitoring programme - LIDAR plus aerial photography	Limited coverage of all survey and monitoring techniques, due to vegetation and topography impacting accessibility. Inadequate application of MP Inaccuracies in water balance model Limited deep groundwater monitoring holes as progressing further to the west, which do become damaged during mining. Limitations/uncertainties in investigating and characterising the fault planes - permeability, infills, continuity - and how they may vary within the overburden.	4 Significant	2 Unlikely	20	Act - Potential for LW step around Act - Potential for LW standoff - environmental pillar Object - Potential for additional ground water monitoring sites Act - Targeted surface mapping above LW311 - LW316 Act - Consider additional post mining monitoring groundwater holes once mining impacts have progressed beyond LW310/311 area, on fire trail 9E Act - Continue visual UG inspection of Fault F0004 for any signs of moisture	SK JD SK	Supervisor	Engage consultant to inspect and provide report on any evidence of lineaments, faulting, jointing, dykes or highly laminated fine bedding layers along lower reaches of Stream R or Stream S where permanent pools of water may reside. For swamps 76, 77 and 92 and after high resolution aerial mapping completed engage a consultant to inspect and provide a photographic report on any evidence of lineament, faulting, jointing, dykes or other geological features that may increase the risk of the swamp control point becoming susceptible to the effects of subsidence. Inspection of Fault F0004 for any signs of moisture in MG310

Peabody													
Ref ID	Risk / threat	Work area or exposure group	Consequence category (use a separate row if multiple reasonable consequences of the same threat as shown in example)	Impact	Risk threat or exposure Current controls in place	Schemes Factor - Monitoring and Support to Address (Relevant specification documents, inspection and monitoring, training, systems or procedures, etc.)	Risk evaluation (with current control measures)			Proposed additional controls (if required)	Ownership (Position / role of person(s) accountable for the risk)	Peabody Notification level	Action to address (RAMP BSEW action number)
							Maximum reasonable consequence	Likelihood	Risk score				
3.2	Mining effects geological feature - FAULTING that is a connective structure surface to seam resulting in loss of water from Woronora reservoir. (The interaction of Basal Shear Planes with faulting has also been assessed within this risk category)	Water NSW	Compliance / regulatory	Breach of approval	System - Water management plan includes ground water monitoring and assessment Act - Lineament analysis prior to mine design Act - Correlation of surface lineaments with potential underground structures (inseam drilling, mapping) Act - Seismic surveying to assess continuity and extent of structure System - Mine water balance - monitoring System - Regular review and update of MP's System - [ME-TSE-HMP-0031] Ground or Strata Failure System - [ME-TSE-MNP-0002] Survey and drafting arrangements System - [ME-TSE-HMP-0011] Subsidence System - [ME-MIN-HMP-0006] Inundation or intrush of a substance PHMP System - Mining approvals System - Narrow Extraction / depth of cover ratios System - End of panel subsidence monitoring programme - LIDAR plus aerial photography System - Visual monitoring of any geological features intersected underground Object - Experience at other mines in Southern Coalfield indicate that connection through a surface to seam structure is a rare event Object - Experience of Mining through faults of little to minor displacement (less than seam height) with Longwall Extraction has shown no evidence of moisture	Limited coverage of all survey and monitoring techniques, due to vegetation and topography impacting accessibility. Inadequate application of MP Inaccuracies in water balance model Limited deep groundwater monitoring holes as progressing further to the west, which do become damaged during mining. Limitations/uncertainties in investigating and characterising the fault planes - permeability, infills, continuity - and how they may vary within the overburden.	5 Major	1 Rare	25	Act - Potential for LW step around Act - Potential for LW standoff - environmental pillar Object - Potential for additional ground water monitoring sites Act - Targeted surface mapping above LW311 - LW316 Act - Potential for additional surface drilling to characterise a faulting feature Act - Consider additional post mining monitoring groundwater holes once mining impacts have progressed beyond LW310/311 area, on fire trail 9E Act - Continue visual UG inspection of Fault F0004 for any signs of moisture Act - Continue further delineation of F0004 with roadway advancement and inseam drilling.	Supervisor 		

Ref ID	Risk / threat	Work area or exposure group	Consequence category (use a separate row if multiple reasonably consequences of the same threat as shown in example)	Impact	Act, Object or System Current controls in place	Expected Future Monitoring and Support to Address (Relevant specification documents, inspection and monitoring, training, systems or procedures, etc.)	Risk evaluation (with current control measures)			Proposed additional controls (if required)	Ownership (Position / role of person(s) accountable for the risk)	Peabody Notification level	Action to address (30+ 2004 Action Number)
							Maximum reasonable consequence	Likelihood	Risk score				
6.1	Mining affects known and unknown aboriginal heritage sites of significance (Either cultural or archaeological significance)	Aboriginal stakeholder group Biodiversity Conservation & Science Directorate	Impact on Reputation <i>The team also considered compliance and breach of approval consequence, however this was less than the impact on</i>	Public Criticism, adverse media coverage and impact to social licence	System - Regular review and update of MP's System - [ME-TSE-HMP-0031] Heritage Management Plan System - [ME-TSE-HMP-0011] Subsidence System - Subsidence prediction model, low tilts and strains System - Mining approvals System - Narrow Extraction / depth of cover ratios + geometry Object - Topography and orientation of the assessed sites within the LW311-LW316 assessment area Act - pre mining geotechnical mapping and report process of high culturally significant sites and high archaeology significant sites Act - post mining review of all sites within mining footprint after completion of each longwall panel. This includes registered aboriginal parties	Inadequate application of Management Plan	4 Significant	2 Unlikely	20	Act - Potential for specific management and remediation measures for high risk Aboriginal Heritage sites	JD	Supervisor	Include in scope for Aboriginal Heritage geotechnical mapping report (LW311-316) for the consultant to provide specific management and remediation measures for any identified geotechnically high risk Aboriginal Heritage sites.
7. Swamps													
7.1	Mining affects known and unknown geological features in a swamp, resulting in hydrology impacts greater than predicted.	Water NSW Biodiversity Conservation & Science Directorate	Impact on Reputation <i>The team also considered compliance and breach of approval consequence, however this was less than the impact on</i>	Public Criticism, adverse media coverage and impact to social licence	System - Water management plan includes ground water monitoring and assessment Act - Lineament analysis prior to mine design Act - Correlation of surface lineaments with potential underground structures (inseam drilling , mapping) Act - Aero magnetic survey over mine lease to detect presence of dykes and sills - none detected during latest survey System - Regular underground mapping of geological features in development panel System - Baseline swamp monitoring (groundwater and soil moisture in swamps overlaying LW311-316). Flow gauging station at base of Swamp 92 and Swamp 76 System - Regular review and update of MP's System - [ME-TSE-HMP-0011] Subsidence System - Mining approvals System - Narrow Extraction / depth of cover ratios + geometry System - Visual monitoring of any geological features intersected underground System - End of panel subsidence monitoring programme - LIDAR plus aerial photography System - Subsidence prediction model, low tilts and strains	Not identifying geological features under vegetation and swamps	3 Moderate	2 Unlikely	10	Act - review of any lineaments identified passing through swamps Act - specific mapping of large swamp drainage lines (Pre-mining high resolution LIDAR) Act - specific subsidence predictions for large swamps Act - Targeted surface mapping above LW311 - LW316	JD JD JD SK	Crew/Team	Produce a premining high resolution drainage line drawing file from aerial LIDAR mapping for Swamps 76, 77 and 92, including the presence of any clearly evident rock bar control points or lineaments intersecting the noted swamps. Include in the LW311-316 Extraction Plan subsidence report specific sections to detail expected subsidence for swamps 76, 77 and 92. For swamps 76, 77 and 92 and after high resolution aerial mapping completed engage a consultant to inspect and provide a photographic report on any evidence of lineament, faulting, jointing, dykes or other geological features that may increase the risk of the swamp control point becoming susceptible to the effects of subsidence.

WORKPLACE RISK ASSESSMENT AND CONTROL (WRAC)



Site	Metropolitan Coal
Date	25-Jul-23
Title	ME-ENV-RSK-0492 Potential geological features that may be affected by LW 311 - LW 316 mining and affect water quantity available to Woronora Reservoir and subsidence impacts to aboriginal heritage. 1-424189

Treatment plan					
Ref ID	Additional controls	Action to address	SAP action no:	Responsible person	Due date
1	Targeted surface mapping above LW311 - LW316	Engage consultant to prepare a new lineament drawing file for the purposes of LW311-316 extraction Plan	NA	Jon Degotardi 	31/09/2023 Completed 28/09/2023
3	Targeted surface mapping above LW311 - LW316	Engage consultant to inspect and provide report on any evidence of lineaments, faulting, jointing, dykes or highly laminated fine bedding layers along lower reaches of Stream R or Stream S where permanent pools of water may reside.	2000000081035	Shane Kornek	30-Jun-24
4	Continue visual UG inspection of Fault F0004 for any signs of moisture	Inspection of Fault F0004 for any signs of moisture in MG310	NA	Shane Kornek 	29/02/2024 Completed 15/01/2024
5	Continue further delineation of F0004 with roadway advancement and in-seam drilling.	Provide the latest available mapping of F0004 for the LW311-316 extraction plan application	NA	Shane Kornek 	31/12/2023 Completed 15/11/2023
6	Consider additional post mining monitoring groundwater holes once mining impacts have progressed beyond LW310/311 area, on fire trail 9E	During preparation of groundwater report for Longwall 311-316 specify scope of work for specialist consultant to make recommendation on requirement for additional post groundwater monitoring holes in the extraction plan footprint	NA	Jon Degotardi 	30/06/2024 Completed 28/11/2023
7	Specific mapping of large swamp drainage lines (Pre-mining high resolution LiDAR)	Produce a premining high resolution drainage line drawing file from aerial LiDAR mapping for Swamps 76, 77 and 92. Including the presence of any clearly evident rock bar control points or lineaments intersecting the noted swamps.	NA	Jon Degotardi 	30/06/2024 Completed 8/02/2024
8	Targeted surface mapping above LW311 - LW316	For swamps 76, 77 and 92 and after high resolution aerial mapping completed engage a consultant to inspect and provide a photographic report on any evidence of lineament, faulting, jointing, dykes or other geological features that may increase the risk of the swamp control point becoming susceptible to the effects of subsidence.	2000000081036	Shane Kornek	30-Jun-24
9	Specific subsidence predictions for large swamps	Include in the LW311-316 Extraction Plan subsidence report specific sections to detail expected subsidence for swamps 76, 77 and 92.	NA	Jon Degotardi 	31/01/2024 Completed 16/01/2024
10	Potential for specific management and remediation measures for high risk Aboriginal Heritage sites	Include in scope for Aboriginal Heritage geotechnical mapping report for the consultant to provide specific management and remediation measures for any identified geotechnically high risk Aboriginal Heritage sites	NA	Jon Degotardi 	31/01/2024 Completed 31/01/2024

Likelihood	Likelihood description	Consequence					
		Low (1)	Minor (2)	Moderate (5)	Significant (10)	Major (25)	Catastrophic (50)
		Near miss, near hit, no medical treatment, report only (RO)	Slightly injured, first aid treatment (FAI)	Medical treatment (MTI), disabling reversible impairment, restricted work (RWI) or lost time (LTI)	Serious bodily injury or disabling irreversible impairment, permanent partial disability (PPD)	Single fatality incident. Total and permanent disability (TPD). Major irreversible health effects	Multiple fatality incident. Major injury / disease among multiple employees
Very Likely (5)	Likely to occur repeatedly – Expected in the work team	5	10	25	50	125	250
Likely (4)	Probably will occur several times – Expected at this location	4	8	20	40	100	200
Possible (3)	Could occur intermittently – Expected within Peabody	3	6	15	30	75	150
Unlikely (2)	Could occur but hardly ever	2	4	10	20	50	100
Rare (1)	Improbable or unrealistic	1	2	5	10	25	50

Figure 5: Peabody risk matrix

Consequence Category			Consequence descriptions					
Harm to People	P		Low	Minor	Moderate	Significant	Major	Catastrophic
			Near miss, near hit, no medical treatment, report only (RO)	Slightly injured, first aid treatment (FAI)	Medical treatment (MTI), disabling reversible impairment, restricted work (RWI) or lost time (LTI)	Serious bodily injury or disabling irreversible impairment, permanent partial disability (PPD)	Single fatality incident. Total and permanent disability (TPD). Major irreversible health effects	Multiple fatality incident. Major injury / disease among multiple employees
Environmental	E		Negligible or reversible environmental impact Nil to minor remediation (typically a shift) No breach of regulations or requirement to report to regulators	Minor reversible environmental impact, minor remediation (typically < 5 days) Non-compliances and breaches of regulation that may result in a citation (NOV) May require reporting to the regulators	Incident resulting in moderate reversible onsite and/or off-site impact causing short term effect. Moderate remediation required (typically a month) Non-compliances and breaches of regulation that may result in prosecution or citation or punitive fine. Requirement or obligation to report to the regulators	Incident resulting in significant onsite or off-site environmental impact causing medium to long term environmental harm Significant remediation required (typically less than 12 months) Significant legal issues, non-compliances and breaches of regulation that results in a prosecution or citation or fine Moderate litigation issues involving many weeks of senior management time	A major incident resulting in regional environmental impact causing long term environmental harm Major long term remediation required (greater than 12 months) Major litigation or prosecution resulting in long term interruption to operations or loss of licence at a site	Incident resulting in catastrophic widespread regional environmental harm causing disastrous effect Major long term remediation required (over multiple years) Major litigation or prosecution, Loss of License to operate at Multiple sites
Finance (higher of cost or NPV)	F		<\$10,000	\$10,000 - \$100,000	\$100,000 - \$1 mil	\$1 mil - \$20 mil	\$20 mil-\$100 mil	>\$100 mil
Impact on reputation	R		Minor impact, no public concern; Market cap impact < \$20 M (< \$0.07 per share)	Local media or public concern; Market cap impact \$20 M - \$30 M (\$0.07 - \$0.12 per share)	Regional media or public concern. Local criticism; Market cap impact \$30 M - \$100 M (\$0.12 - \$0.40 per share)	National adverse media or public criticism; Market cap impact \$100 M - \$250 M (\$0.40 - \$1.00 per share)	International adverse media or public criticism; International public concern; Market cap impact \$250 M - \$500 M (\$1.00 - \$1.85 per share)	Significant international public or media criticism or condemnation; Market cap impact > \$500 M (> \$1.85 per share)
Law / Compliance / regulatory	C		Minor, one-off violations of law, regulation, permit or policy; minimal fines, penalties or costs	Recurring or systemic minor violations of law, regulation, permit or policy	Violations of law, regulation, permit or policy with moderate fines or penalties, Moderate Litigation, MSHA imminent danger order or similar	Significant violation of law or permit with material fines, penalties or costs. Serious dispute with strategic customer. Major Litigation	Material Litigation. Serious investigation by SEC, DOJ or foreign equivalent. Code of Conduct violations	Criminal investigation or proceedings involving officers or directors. Litigation with allegations of executive fraud or misappropriation
Strategic risk	SR		Event does not have a meaningful impact to Strategic Outlook	Event does not have a meaningful impact to Strategic Outlook, but may require further monitoring	Event may have a material impact on near-term outlook for a region or mine	Event has a material impact on strategic outlook for a region or basin that may require a change to operations to mitigate risk	Event causes mines in a region or basin to cease current operations	Event or threat such that BTU would cease to exist as an ongoing concern in coal operations

Risk Score	Notification	Action for safety and health risks
<11	Crew / team	Develop a plan (formal or informal) with crew or continue with an established plan (safe work procedure etc.) that ensures the task can be completed safely. Team should remain aware for changing conditions.
11 to 30	Supervisor	Develop a formal safe action plan (safe work procedure) with supervisor and others within the crew that identifies all known hazards and details what controls need to be in place and how the task should be performed to ensure it can be completed safely.
31 to 50	Area manager or site GM	Conduct a formalized risk review of existing work process and controls. Explore additional control options that eliminate, substitute or reduce the risk. Monitor controls for effectiveness during the task.
51 - 100	Business Unit Management	Controls should be reviewed to ensure risk is as low as reasonably practicable (ALARP), critical controls must be identified and monitored for effectiveness. If risk is not at ALARP, additional controls must be identified and a plan developed for implementation.
101 to 199	ELT	Controls should be added / improved and an additional risk assessment completed for activity to proceed.
200 or greater	CEO	Controls should be added / improved and an additional risk assessment completed for activity to proceed.

Figure 6: Risk notification and action thresholds