



# UG4 LONGWALLS 401 TO 408 LAND MANAGEMENT PLAN

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## 1.0 INTRODUCTION

The Moolarben Coal Complex is an open cut and underground coal mining operation located approximately 40 kilometres north of Mudgee in the Western Coalfield of New South Wales (NSW) (**Figure 1**).

Moolarben Coal Operations Pty Ltd (MCO) is the operator of the Moolarben Coal Complex on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben [YM] Pty Ltd and a consortium of Korean power companies). MCO, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited.

The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities) (**Figure 2**). Since the commencement of coal mining operations in 2010, mining activities have occurred within OC1, OC2, OC3, OC4, and UG1 (**Figure 2**).

The UG4 Underground Mine (UG4) is a component of the Moolarben Coal Project Stage 1 Approval (05\_0117) (**Figure 2**). First workings for UG4 North Mains commenced in October 2020 (**Figure 3**). Secondary extraction in UG4 of the first Longwall LW401 is scheduled to commence in 2022 (**Table 2**).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 in accordance with Project Approval (05\_0117) (Moolarben Coal Project Stage 1) (as modified) and Project Approval (08\_0135) (Moolarben Coal Project Stage 2) (as modified), granted under the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

### 1.1 PURPOSE AND SCOPE

This UG4 Longwalls 401 to 408 Land Management Plan (LW401- 408 LMP) has been prepared by MCO with input from suitably qualified experts (i.e. Mine Subsidence Engineering Consultants [MSEC]) to satisfy the requirements of Project Approval (05\_0117) as modified and the NSW Department of Planning, Industry and Environment (DPIE) and NSW Division of Resources and Energy (DRE) (2015) *Guidelines for the Preparation of Extraction Plans*. The appointment of the team of suitably qualified and experienced persons was endorsed by the Secretary of the DPIE on the 26 April 2021 (**Attachment 2** of the Extraction Plan).

In summary:

**Purpose:** This LW401-408 LMP outlines the management of potential environmental consequences on cliffs and land in general resulting from the extraction of Longwalls 401- 408.

**Scope:** This LW401-408 LMP covers cliffs and land in general within and in the vicinity of Longwalls 401-408 Study Area<sup>1</sup> (**Figure 4**).

Longwalls 401- 408 form the UG4 Underground Mine at the Moolarben Coal Complex.

Dronvisa Quarry is the only privately-owned built feature within the Study Area. All public utilities and other privately-owned built features are located outside of the Study Area. Owners of public utilities

<sup>1</sup> Longwalls 401-408 and the area of land within the furthest extent of the 26.5 degree (°) angle of draw and 20 millimetre (mm) predicted subsidence contour.

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and privately owned built features on land outside and within the Longwalls 401- 408 Study Area have been consulted with separately as part of the UG4 Longwalls 401 to 408 Built Features Management Plans (LW401-408 BFMPs), including Essential Energy (EE), Mid-Western Regional Council (MWRC), Telstra, Australian Rail Track Corporation (ARTC), Ulan Coal Mines Pty Limited (UCMPL) and Dronvisa Quarry (Dronvisa).

The State of NSW (Crown Land) owns a portion of land (Lot 31, DP755439, a triangle section of adjoining Crown Land and a crown road within Lot 5 DP 1240416) (**Figure 5**). As such, MCO has consulted with NSW Crown Land as potentially affected public authorities. MCO has existing licences, consents and agreements with Crown Land covering the approved activities within the study area. All other land within the Longwalls 401-408 is owned by MCO.

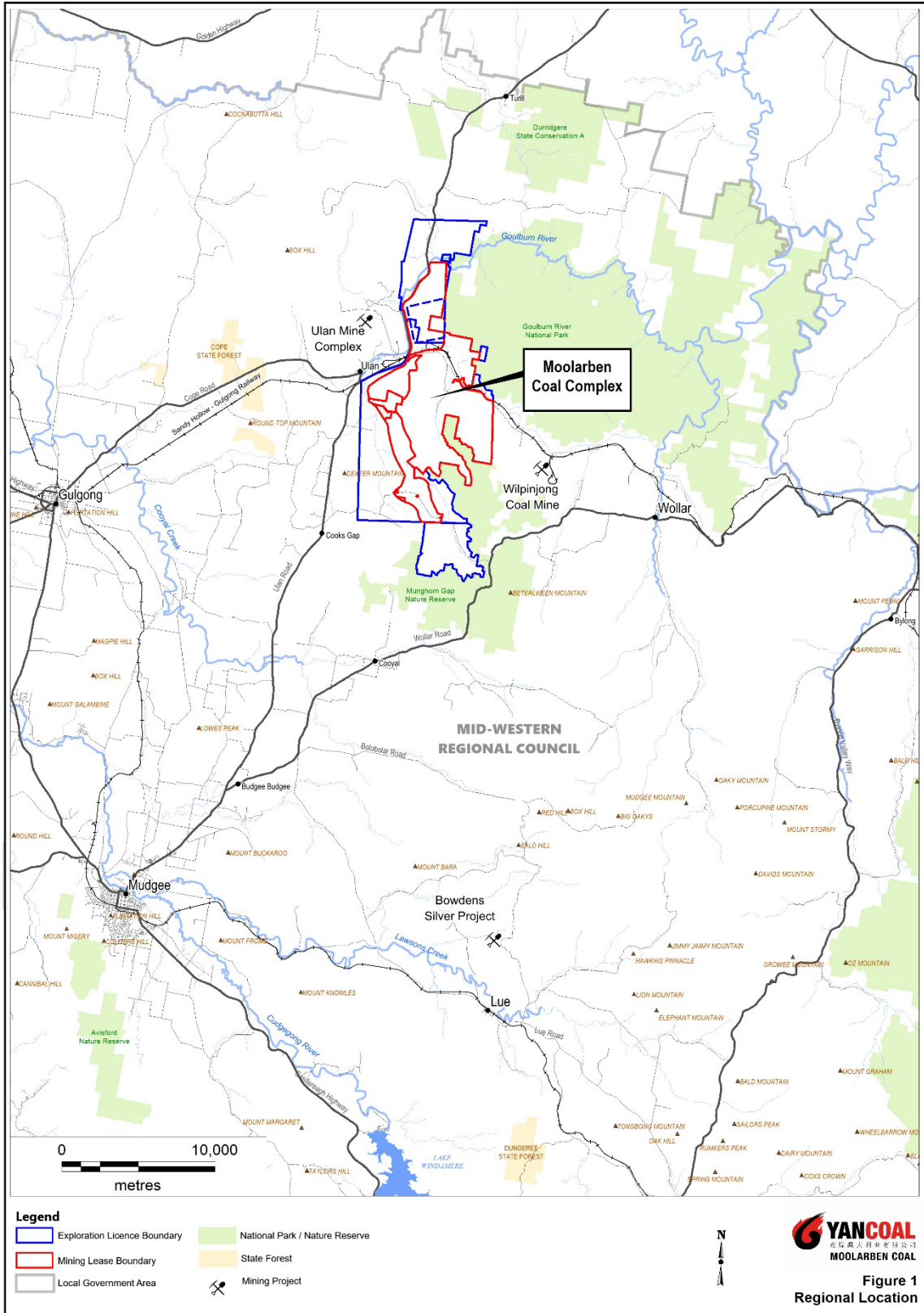
### 1.1.1 Longwalls 401-408 Study Area

The Study Area has been defined (**Figure 3** and **Figure 4**), as a minimum, as the surface area enclosed by a 26.5° angle of draw line from the extents of secondary extraction and by the predicted total 20 mm subsidence contour based on the Extraction Plan Layout and Approved Layout. Other features which could be subjected to far-field or valley related movements and could be sensitive to such movements have also been assessed in this report.

A number of natural and built features have been identified within or in the vicinity of the Study Area including: Bora Creek, Goulburn River and ephemeral drainage lines; cliffs; the Goulburn River National Park (GRNP); Sandy Hollow – Gulgong Railway Line; roads; unsealed tracks and trails; electrical and telecommunications infrastructure; dams; a quarry; bores; mine infrastructure; archaeological sites; and survey control marks (MSEC 2021).

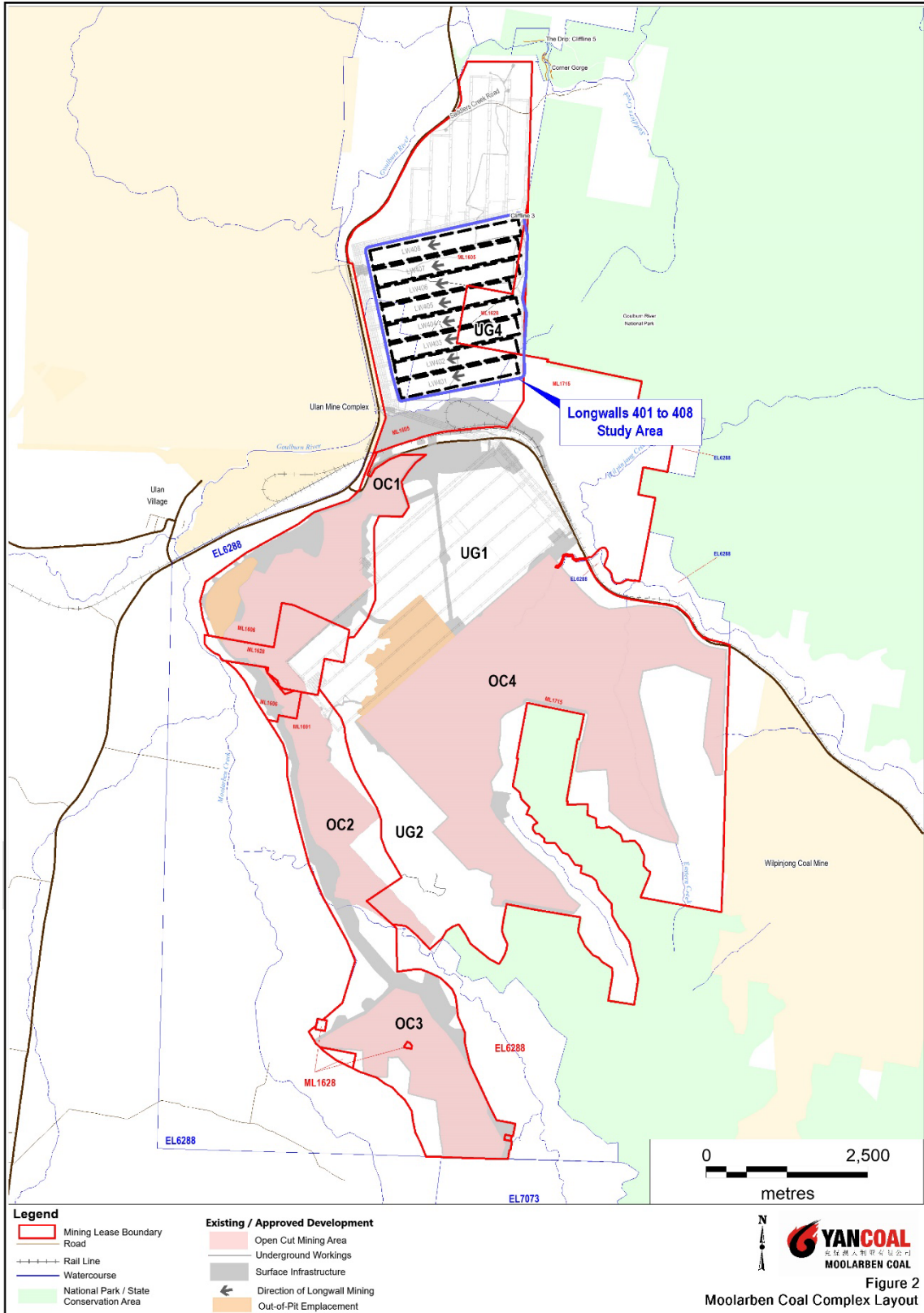
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Figure 1: Regional Location



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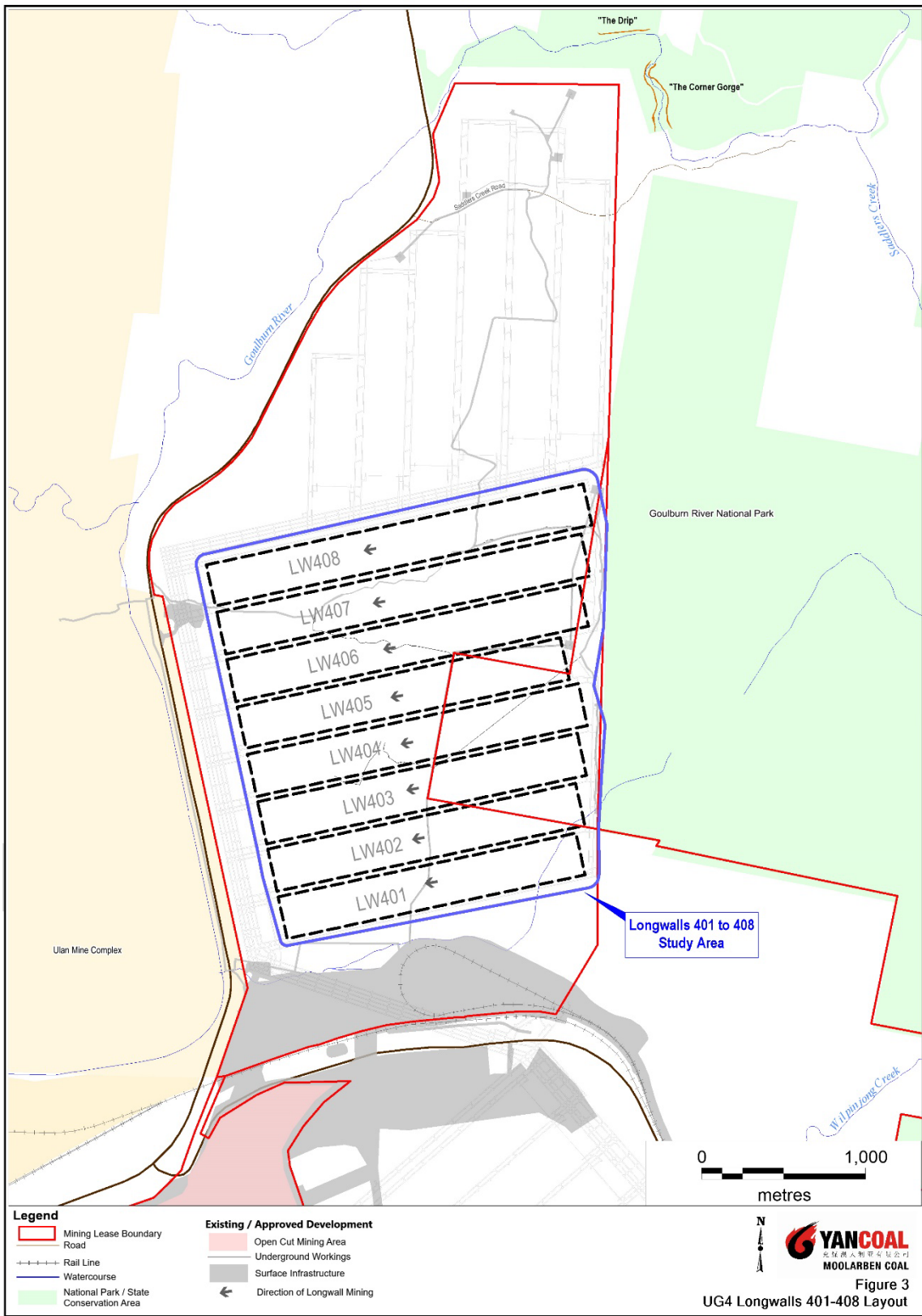
Figure 2: Moolarben Coal Complex Layout



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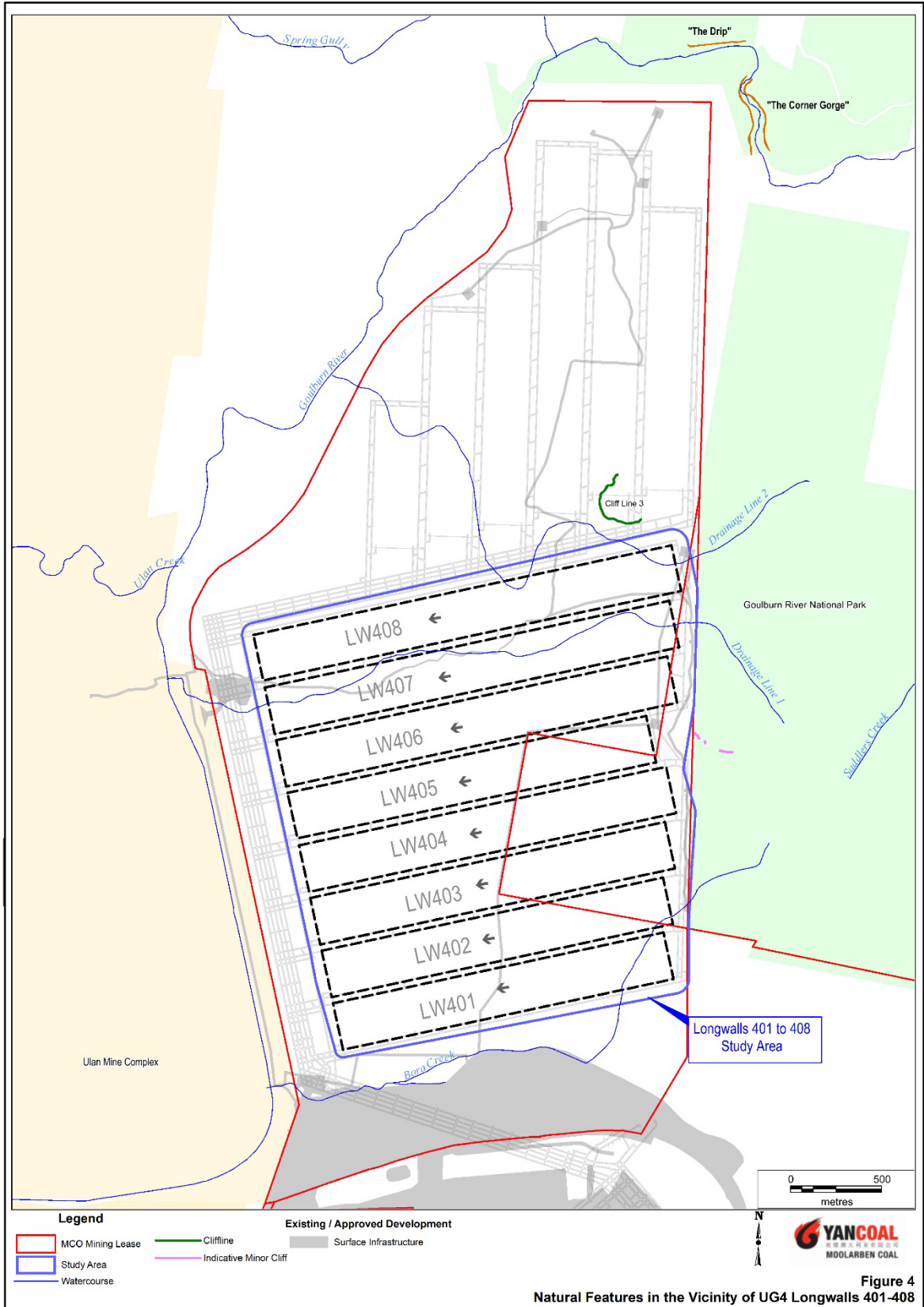


Figure 3: Underground 4 Longwalls 401 to 408 Layout



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Figure 4: Natural Features within and in the vicinity of the Study Area



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Figure 5: Land Ownership within and in the vicinity of the Study Area

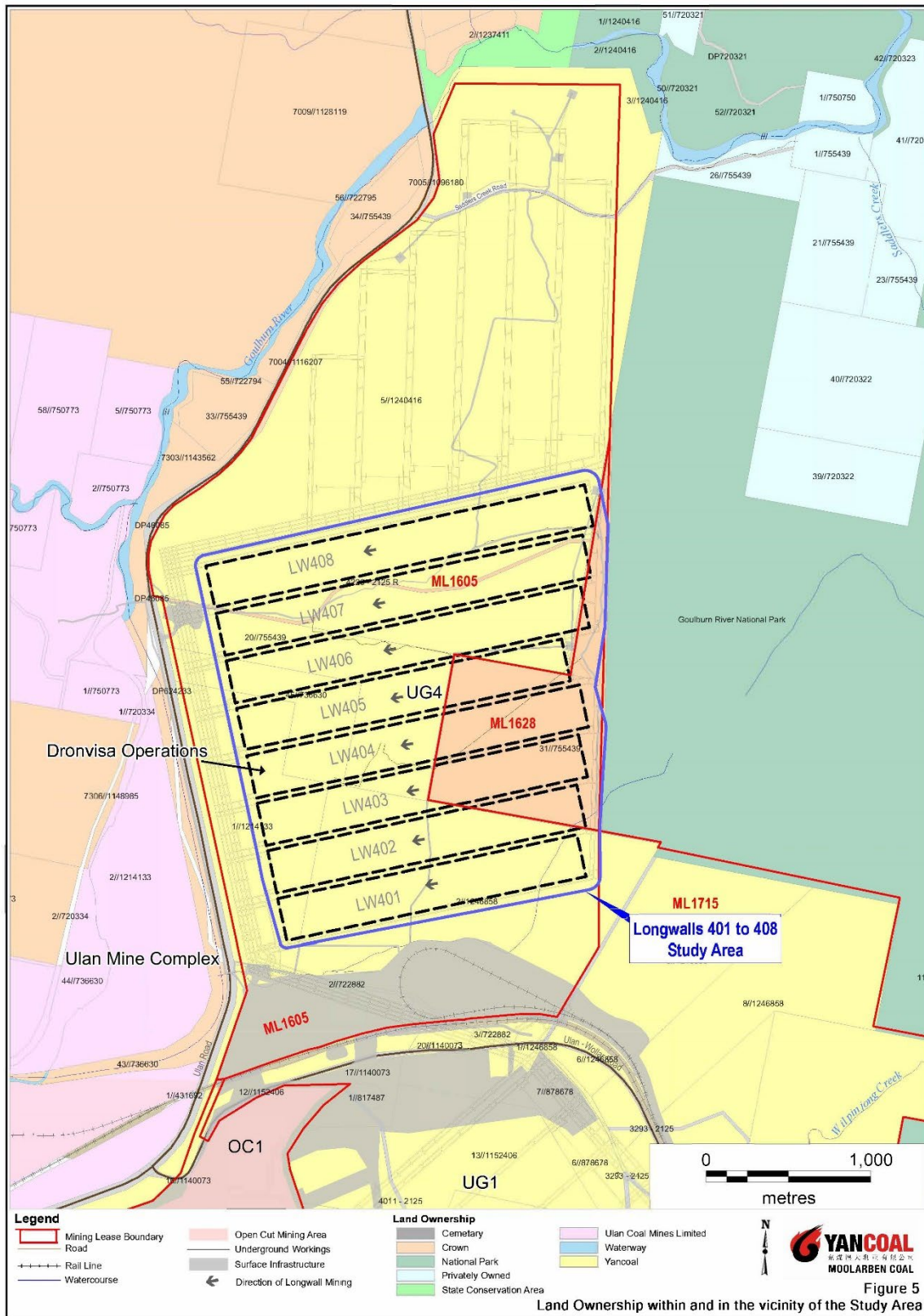


Figure 5  
Land Ownership within and in the vicinity of the Study Area

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## 1.2 STRUCTURE OF THE LONGWALLS 401- 408 LAND MANAGEMENT PLAN

The remainder of the LW401- 408 LMP is structured as follows:

- Section 2** Describes the review and update of the LW401- 408 LMP.
- Section 3** Outlines the statutory requirements applicable to the LW401- 408 LMP.
- Section 4** Summarises the predicted subsidence impacts and environmental consequences resulting from the secondary extraction of Longwalls 401- 408.
- Section 5** Details the performance measures and indicators that will be used to assess environmental performance in relation to land in general over time.
- Section 6** Describes the monitoring program.
- Section 7** Describes the potential management measures that could be implemented to remediate any identified impacts to land features.
- Section 8** Provides a Contingency Plan to manage any unpredicted impacts and their consequences and describes the Trigger Action Response Plan (TARP) management tool.
- Section 9** Describes the Annual Review requirements, audits, improvement of environmental performance and preparation for future Extraction Plans.
- Section 10** Describes how data will be captured for future extraction plans
- Section 11** Outlines the management and reporting of incidents.
- Section 12** Outlines the management and reporting of complaints.
- Section 13** Outlines the management and reporting of any non-compliance with statutory requirements.
- Section 14** Lists the documents referred to in **Sections 1 to 12** of this LW401- 408 LMP.

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## 2.0 LAND MANAGEMENT PLAN REVIEW AND UPDATE

In accordance with Condition 5, Schedule 5 of Project Approval (05\_0117), this LW401-408 LMP will be reviewed as followed:

5. *Within 3 months of the submission of:*

- (a) the submission of annual review under condition 4 above;*
- (b) the submission of an incident report under condition 7 below;*
- (c) the submission of an audit under condition 9 below; or*
- (d) any modification to the conditions of this approval,*

*the Proponent shall review and, if necessary, revise the strategies, plans, and programs required under this approval to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document must be submitted to the Secretary for approval.*

### 2.1 ACCESS TO INFORMATION

In accordance with Condition 11, Schedule 5 of Project Approval (05\_0117), MCO will make the approved LW401- 408 LMP publicly available on the MCO website.

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### 3.0 STATUTORY REQUIREMENTS

MCO's statutory obligations are contained in:

- the conditions of the NSW Project Approval (05\_0117) (as modified) and NSW Project Approval (08\_0135) (as modified);
- the conditions of Commonwealth Approvals (EPBC 2007/3297, EPBC 2013/6926, EPBC 2008/4444, and EPBC 2017/7974);
- relevant licences and permits, including conditions attached to the Environment Protection Licence (EPL No. 12932) and Mining Leases; and
- other relevant legislation.

Obligations relevant to this LW401- 408 LMP are described below.

#### 3.1 EP&A ACT PROJECT APPROVAL

Condition 77(j), Schedule 3 of Project Approval (05\_0117), requires the preparation of a Land Management Plan as a component of the Extraction Plan. In addition, 77(n), 77(p), 78 and Condition 3, Schedule 5 of Project Approval (05\_0117) outline general management plan requirements that are applicable to the preparation of this LW401- 408 LMP.

**Table 1** presents the relevant project approval requirements and indicates where they are addressed within this LW401- 408 LMP.

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**Table 1 : Land Management Plan Requirements**

Project Approval (05_0117) Condition	LW401- 408 LMP Section
<p><b>Condition 77, Schedule 3</b></p> <p>77. The Proponent shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Secretary. Each extraction plan must:</p> <p>...</p> <p>(j) include a Land Management Plan, which has been prepared in consultation with any affected public authorities, to manage the potential impacts and/or environmental consequences of the proposed second workings on land in general;</p> <p>...</p> <p>(n) include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 18 and 19, or where such exceedance appears likely;</p> <p>...</p> <p>(p) include a program to collect sufficient baseline data for future Extraction Plans.</p>	<p><b>This document</b></p> <p><b>Section 8</b></p> <p><b>Section 10</b></p>
<p><b>Condition 78, Schedule 3</b></p> <p>78. The Proponent shall ensure that the management plans required under conditions 77(g)-(l) above include:</p> <p>(a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval; and</p> <p>(b) a detailed description of the measures that would be implemented to remediate predicted impacts.</p>	<p><b>Section 4 &amp; 6.2</b></p> <p><b>Section 7</b></p>
<p><b>Condition 3, Schedule 5</b></p> <p>3. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:</p> <p>(a) detailed baseline data;</p> <p>(b) a description of:</p> <ul style="list-style-type: none"> <li>• the relevant statutory requirements (including any relevant approval, licence or lease conditions);</li> <li>• any relevant limits or performance measures/criteria;</li> <li>• the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;</li> </ul> <p>(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;</p> <p>(d) a program to monitor and report on the:</p> <ul style="list-style-type: none"> <li>• impacts and environmental performance of the project;</li> <li>• effectiveness of any management measures (see c above);</li> </ul> <p>(e) a contingency plan to manage any unpredicted impacts and their consequences;</p> <p>(f) a program to investigate and implement ways to improve the environmental performance of the project over time;</p> <p>(g) a protocol for managing and reporting any:</p> <ul style="list-style-type: none"> <li>• incidents;</li> <li>• complaints;</li> <li>• non-compliances with statutory requirements; and</li> <li>• exceedances of the impact assessment criteria and/or performance criteria; and</li> </ul> <p>(h) a protocol for periodic review of the plan.</p>	<p><b>Sections 4.1</b></p> <p><b>Section 3</b></p> <p><b>Section 5</b></p> <p><b>Section 5</b></p> <p><b>Section 7</b></p> <p><b>Sections 6 &amp; 9</b></p> <p><b>Section 8</b></p> <p><b>Sections 6 &amp; 8</b></p> <p><b>Section 11</b></p> <p><b>Section 12</b></p> <p><b>Section 13</b></p> <p><b>Section 8</b></p> <p><b>Section 2</b></p>

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### 3.2 OTHER LEGISLATION

The following Acts which may be applicable to the conduct of Moolarben Coal Complex includes, but are not limited to:

- *Crown Lands Act, 1989;*
- *Fisheries Management Act, 1994;*
- *Heritage Act, 1977;*
- *Coal Mine Subsidence Compensation Act, 2017;*
- *Mining Act, 1992;*
- *National Parks and Wildlife Act, 1974;*
- *Biodiversity Conservation Act, 2016;*
- *Protection of the Environment Operations Act, 1997;*
- *Roads Act, 1993;*
- *Water Act, 1912;*
- *Water Management Act, 2000;*
- *Work Health and Safety Act, 2011; and*
- *Work Health and Safety (Mines and Petroleum Sites) Act, 2013.*

Relevant licences or approvals required under these Acts will be obtained as required.

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## 4.0 PREDICTED SUBSIDENCE IMPACTS AND ENVIRONMENTAL CONSEQUENCES

### 4.1 LONGWALLS 401- 408 EXTRACTION SCHEDULE

Longwalls 401-408 and the area of land within Study Area are shown on **Figure 4**. Longwall extraction will occur from the east to the west. The longwall layout includes approximately 260 m panel widths (void) with 35 m width pillars (solid). The provisional extraction schedule for Longwalls 401-408 is provided in **Table 2**.

**Table 2 Provisional Extraction Schedule**

Longwall	Estimated Start Date	Estimated Duration (months)	Estimated Completion Date
LW401	June 2022	4	October 2022
LW402	November 2022	4	March 2023
LW403	April 2023	4	August 2023
LW404	August 2023	5	January 2024
LW405	February 2024	4	June 2024
LW406	July 2024	5	December 2024
LW407	January 2025	4	May 2025
LW408	June 2025	4	November 2025

### 4.2 REVISED SUBSIDENCE AND IMPACT PREDICTIONS

Revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, have been prepared by MSEC, incorporating any relevant information obtained since approval. Revised predictions have considered the results from the nearby UG1 Longwall extraction.

The LW401-408 LMP for UG4 has incorporated the revised subsidence predictions from the *Subsidence Predictions and Impact Assessment for Longwalls 401 to 408* (MSEC, 2021) and summarised in **Section 4.4** to **Section 4.5**.

### 4.3 ENVIRONMENTAL RISK ASSESSMENT

An Environmental Risk Assessment (ERA) was conducted for four of the key component plans of the UG4 Longwalls 401- 408 Extraction Plan (Water Management Plan, Biodiversity Management Plan, Heritage Management Plan and Land Management Plan) to provide appropriate consideration to risk assessment and risk management in accordance with the Draft DPIE and DRE (2015) *Guidelines for the Preparation of Extraction Plans*.

The ERA workshop for LW panels 401-408 was held on 15 June 2021, facilitated by independent specialist, Risk Mentoring. The suitably qualified and experienced experts endorsed by the Secretary of the DPIE for the preparation of the UG4 Longwalls 401- 408 Extraction Plan relevant MCO personnel participated in the ERA.

The ERA highlighted risks relevant to land impacts were associated with impacts to cliff lines. Cliffs and land in general above Longwalls 401-408 were in the “Low” category, and it was expected that the risks

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could be managed with implementation of the appropriate mitigation, management and/or control measures.

#### 4.4 CLIFFS

MCO are required to minimise subsidence damage to cliff line 3 (CL3) and nil impact or environmental consequence at cliff line 5 (CL5). A detailed assessment to identify all possible cliffs<sup>2</sup> within and in the vicinity of the Study Area was completed by MSEC (2021) using 1m surface level contours generated from a Light Detection and Ranging (LiDAR) survey and from site investigations. A summary of cliffs confirmed within the Study Area is provided in **Table 3**. The locations of the cliffs are shown in **Figure 4**.

**Table 3 Classification of Cliffs Within and in the Vicinity of the Study Area**

Cliff Line Area ID	Maximum Height (m)	Maximum Length (m)	Classification	Location
CL3	15	500	Cliff	Outside of Study Area
CL5*	30	330	Cliff	Outside of Study Area
CL6	10	30	Minor Cliff	Above LW403
CL7	6	30	Minor Cliff	160m from LW406

Notes: \* The Drip & Corner Gorge

CL6 height is predominantly 5 m to 10 and does not meet the conditions of 10m minimum height over at least 20m continuous length for cliffs.

Based on the summary in **Table 3**, only CL3 and CL5 are classified as cliffs. Cliff CL5 is located over 2.7 km from Longwall 408 and is unlikely to experience subsidence related movements due to the extraction of Longwalls 401 to 408. The nearest cliff line to the Study Area is CL3 (**Figure 4**). Photograph of the nearest cliff line CL3 to the Study Area is provided in **Plate 1**.

<sup>2</sup> The definitions of cliffs provided in the NSW DP&E *Standard and Model Conditions for Underground Mining* (DP&E, 2012) are: *Continuous rock face, including overhangs, having a minimum length of 20 metres, a minimum height of 10 metres and a minimum slope of 2 to 1 (>63.4°)*

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Plate 1: Cliff Line CL3

#### 4.4.1 Predicted Subsidence Impacts and Environmental Consequences

Cliff Line CL3 is located outside the Study Area and is 165 m to 440 m from Longwall 408. With a depth of cover of approximately 165 m at the northern end of the longwalls, Cliff Line CL3 is located over 1 depth of cover from the longwalls. At this distance conventional mine subsidence ground movements and valley related movements are expected to be less than limits of survey accuracy. However, the cliff may experience far-field horizontal movements (MSEC, 2021).

The upper limit of previously observed absolute far-field horizontal movements for the sites located greater than 1 depth of cover from longwalls, is less than 145 mm. The predicted maximum far-field horizontal movements of 145 mm at the cliff are expected to be bodily movements towards the extracted goaf area and should be accompanied by very low levels of strain (MSEC, 2021).

The range of potential strains associated with non-conventional movements has been assessed using monitoring data from previously extracted panels in the NSW Coalfields, for single-seam conditions, where the width-to-depth ratios and extraction heights were similar to those of Longwalls 401 to 408. The 95 % confidence levels for the maximum total strains that the individual survey bays above solid coal (between 200 m and 600 m from extracted goaf) experienced at any time during mining are 1.6 mm/m tensile and 1.5 mm/m compressive. The 99 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining are 2.9 mm/m

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tensile and 3.0 mm/m compressive. The 75 % confidence levels for the maximum total strains that the individual survey bays above solid coal experienced at any time during mining are 0.5 mm/m both tensile and compressive, which is the typical limit of accuracy of strain measurement by conventional survey methods. It is noted that these results comprise a component of survey tolerance and have also been affected by disturbed survey marks and survey errors (MSEC, 2021).

Cliff CL5 is located over 2.7 km from Longwall 408 and is unlikely to experience subsidence related movements due to the extraction of Longwalls 401 to 408. The minor cliffs located across the Study Area and will be subjected to the full range of predicted subsidence movements (MSEC, 2021).

MSEC (2021) completed a comparison of the maximum predicted subsidence parameters resulting from the extraction of Longwalls 401 to 408, based on the Extraction Plan Layout, with those based on the Approved Layout with a 3 m cutting height. The values are the maxima anywhere above the longwall layouts. This comparison is provided in **Table 4** with no change from the Approved Layout when compared to the Extraction Plan Layout.

**Table 4: Comparison of Maximum Predicted Conventional Subsidence Parameters based on the Approved Layout and the Extraction Plan Layout**

Layout	Subsidence <sup>1</sup> (mm)	Tilt <sup>2</sup> (mm/m)	Hogging Curvature <sup>3</sup> (km <sup>-1</sup> )	Sagging Curvature <sup>3</sup> (km <sup>-1</sup> )
Approved Layout	1900	60	>3	>3
Extraction Plan Layout	1900	60	>3	>3

Source: MSEC (2021).

mm/m = millimetres per metre, km<sup>-1</sup> = 1/kilometres.

- 1 Subsidence refers to vertical displacements of the ground.
- 2 Tilt is the change in the slope of the ground as a result of differential subsidence and is calculated as the change in subsidence between two points divided by the distance between those two points.
- 3 Curvature is the second derivative of subsidence, the rate of change of tilt, and is calculated as the change in tilt between two adjacent sections of the tilt profile divided by the average length of those sections.

#### 4.5 LAND IN GENERAL

Land in general refers to the general landscape other than cliffs. Land in general includes other land features such as fire trails and vehicular tracks, however excludes surface features such as drains, diversions, and other MCO assets which are addressed elsewhere in the Extraction Plan. Unsealed vehicular tracks and fire trails are located throughout the Study Area and above Longwalls 401-408.

The depths of cover over the underground mining areas vary from 83 m to 205 m. Where the depths of cover above Longwalls 401 to 408 are less than 100 m, surface cracking is expected to be typically in the order of 150 to 200 mm wide, but could be as large as 500 mm wide where the depths of cover are the shallowest. The surface crack widths are likely to be smaller where the depths of cover are greater, or where the surface cracks result from the travelling wave. Where the depths of cover above Longwalls 401 to 408 are 100 to 150 m, the surface crack widths are expected to be typically in the order of 100 to 150 mm wide. The surface cracking and deformation could result in safety issues (i.e. trip hazards), affect vehicle access (i.e. large deformations in access tracks), or result in increased erosion (especially along the drainage lines and the steeper slopes) (MSEC, 2021).

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## 5.0 PERFORMANCE MEASURES AND PERFORMANCE INDICATORS

This LW401- 408 LMP has been developed to manage the potential environmental consequences of the secondary extraction of Longwalls 401- 408 on cliffs and land in accordance with Condition 77(j), Schedule 3 of Project Approval (05\_0117).

In accordance with Condition 73, Schedule 3 of Project Approval (05\_0117), MCO must ensure that there is no exceedance of the subsidence impact performance measures listed in Table 14 relevant to land in the UG4 Study Area as listed in **Table 5**.

**Table 5 Land Subsidence Impact Performance Measures**

Feature	Subsidence Impact Performance Measure
The Drip and Goulburn River Gorge	Nil impact or environmental consequences
Cliff Line 3	Minimise subsidence damage

Source: Table 14 of Condition 73, Schedule 3 of Project Approval (05\_0117).

The Drip and Corner Gorge are located at distances of 2.2 km or more from Longwalls 401 – 408. At these distances, MSEC (2021) determined that the Drip and Corner Gorge will not experience measurable conventional tilts, curvatures or strains and that impacts due to the extraction of Longwalls 401 to 408 are unlikely to occur. The subsidence impact performance measure relevant to the Drip and Goulburn River Gorge of *nil impact or environmental consequences* is therefore expected to be maintained. Performance indicators for the Drip and Corner Gorge will be included in future Extraction Plans for Longwalls within the vicinity of these features.

Cliff Line CL3 is located outside the Study Area and is 165 m to 440 m from Longwall 408. With a depth of cover of approximately 165 m at the northern end of the longwalls. At this distance conventional mine subsidence ground movements and valley related movements are expected to be less than limits of survey accuracy. The subsidence impact performance measure relevant to CL3 of *minimise subsidence damage* is therefore expected to be maintained. The performance indicator for Cliff Line 3 is:

- Cliff Line 3 impacts due to LW401-408 are less than 1.9m vertical conventional subsidence and 60mm/m conventional tilt.

Performance indicators for Cliff Line 3 will be revised in future Extraction Plans for Longwalls beneath this feature.

Project Approval (05\_0117) does not include any specific performance measures for the Goulburn River National Park. However, a performance indicator has been included for the Minor Cliffs in the Goulburn River National Park.

- Negligible impact due to longwall mining for Minor Cliffs in Goulburn River National Park.

**Section 6.0** describes the monitoring that will be conducted to assess the UG4 Underground mine against the relevant subsidence impact performance measures.

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## 6.0 MONITORING

A monitoring program will be implemented to monitor the impacts of the secondary extraction of Longwalls 401- 408 on land features including cliffs and land in general. Key components of the monitoring program are summarised in **Table 6**.

**Table 6 Land Monitoring Program Overview**

Monitoring Component	Parameter	Timing/Frequency	Responsibility
<b>Pre-mining</b>			
Visual inspection of cliff CL3	Observations and description (e.g. baseline photography, existing rockfalls, cliff instabilities, surface cracking).	Prior to commencement of Longwall 401 extraction.	Underground Technical Manager
UG4 subsidence monitoring lines, as described in the UG4 Longwalls Subsidence Monitoring Program (LW401-408 SMP), including CL3 and GNSS stations at Drip and Corner Gorge.	Ground survey – baseline, as described in the LW401-408 SMP	Prior to commencement of Longwall 401 extraction (Prior to Longwall 405 for GNSS stations and Longwall 406 for CL3 survey).	Underground Technical Manager / Registered Mine Surveyor
Visual inspection of minor cliffs in GRNP within 400m of LW401-408	Observations and description (e.g. baseline photography, existing rockfalls, cliff instabilities, surface cracking).	Prior to commencement of Longwall 403 extraction.	Underground Technical Manager
<b>During &amp; After Mining</b>			
UG4 subsidence monitoring lines and GNSS array, as described in the UG4 Longwalls Subsidence Monitoring Program (LW401-408 SMP).	Survey as described in the LW401-408 SMP	Following the completion of each Longwall (completion of Longwall 408 for CL3 survey).	Underground Technical Manager / Registered Mine Surveyor
Visual inspection of minor cliffs in GRNP within 400m of Longwall	Observations and description (e.g. comparison to baseline photography).	Following completion of Longwall within 400m of Minor Cliff.	Underground Technical Manager
Visual inspection of cliff CL3	Observations and description (e.g. comparison to baseline photography).	Following the completion of Longwall 408	Underground Technical Manager

### 6.1 SUBSIDENCE PARAMETERS

Subsidence parameters (i.e. vertical subsidence, tilt, tensile strain, compressive strain) will be measured in accordance with the LW401-408 SMP. In summary, ground surveys will be conducted to measure subsidence movements in three dimensions using a total station survey instrument. Subsidence movements will be measured along subsidence lines that have been positioned across the general landscape or feature. Global Navigation Satellite System (GNSS) monitoring stations will be progressively established at locations above and adjacent to the UG4 mining domain over the life the UG4 in accordance with the LW401-408 SMP.

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## 6.2 SUBSIDENCE IMPACTS

Visual inspections of cliff line CL3 will be conducted prior to commencement of secondary extraction of Longwall 401 to photographically record the baseline condition of these cliff lines. The post mining inspection will be carried out using comparisons made against the pre-mining condition to evaluate against the relevant subsidence impact performance measures for these features.

Visual inspections of land in general including MCO's vehicular tracks and surrounds will be conducted opportunistically during mining. Where relevant, if subsidence impacts are observed during an inspection on other land features within the Study Area, any observed rockfalls, displacement of or dislodgement of boulders or slabs, or fracturing will be recorded.

MCO will compare the results of the subsidence impact monitoring against the land performance measures and indicators (**Section 5.0**). In the event the observed subsidence impacts exceed the performance measure or indicators, MCO will assess the consequences of the exceedance in accordance with the Contingency Plan described in **Section 8.0**.

If subsidence impact(s) which have the potential to impact on the land performance measures and indicators (**Section 5.0**) are observed during an inspection, the following details will be recorded in the Subsidence Impact Register Template (**Attachment 1**) and photographed:

- the date of the inspection;
- the location of longwall extraction (i.e. the longwall chainage);
- the location of the impact
- the nature and extent of the impact;
- other relevant aspects such as water seepage (which can indicate weaknesses in the rock);
- whether any actions are required (e.g. implementation of management measures, initiation of the Contingency Plan, incident notification, implementation of appropriate safety controls, review of public safety etc.); and
- any other relevant information.

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## 7.0 MANAGEMENT MEASURES

A number of potential management measures are available to mitigate/remediate subsidence impacts to land features (i.e. cliffs and land in general) resulting from the extraction of Longwalls 401- 408. The requirement and methodology for any subsidence remediation techniques will be determined in consideration of:

- Potential impacts of the unmitigated impact, including potential risks to public safety and the potential for self-healing or long-term degradation.
- Potential impacts of the remediation technique, including site accessibility.

The implementation of management measures will be considered with regard to the specific circumstances of the subsidence impact (e.g. the location, nature and extent of the impact) and the assessment of environmental consequences. The implementation of management measures will be related to the scale of impact and the ability to, and value in, undertaking mitigation measures on a case by case basis. Potential management measures that will be considered to mitigate/remediate environmental consequences, if safe to do so, are provided in **Table 7**.

Where new impacts (rockfalls, cliff instabilities, surface cracking) on Minor Cliffs in the Goulburn River National Park are observed within 400m of longwalls (whether due to longwall extraction or not), notification will be provided to the National Parks and Wildlife Service Area Manager and BCS as soon as practicable after becoming aware. MCO will complete a visual assessment, review subsidence data associated with UG4 Extraction and provided a copy to the National Parks and Wildlife Service Area Manager and BCS within 14 days unless otherwise agreed with the NPWS

**Table 7 Potential Management Measures**

Potential Management Measures	
Measure	Description
<b>Stabilisation techniques</b>	<ul style="list-style-type: none"> <li>• Scaling/dislodgement/removal of remaining loose rock.</li> </ul>
<b>Erosion and sediment control techniques</b>	<ul style="list-style-type: none"> <li>• Implementation of erosion and sediment control measures, such as:                             <ul style="list-style-type: none"> <li>– Installation of sediment fences downslope of erosion areas.</li> <li>– Stabilisation of erosion areas using rock or other appropriate materials.</li> </ul> </li> </ul>
<b>Site access control, signage, stabilisation techniques</b>	<ul style="list-style-type: none"> <li>• Measures to address safety hazards will be implemented in accordance with the UG4 Longwalls 401 to 408 Public Safety Management Plan, such as:                             <ul style="list-style-type: none"> <li>– Signage to warn persons accessing the area of safety hazards.</li> <li>– Construction or placement of barriers to restrict access to unsafe areas.</li> <li>– Road works to maintain road safety.</li> </ul> </li> </ul>
<b>Remediation of surface tension crack</b>	<ul style="list-style-type: none"> <li>• Permanent filling of the surface tension cracks. Methods of in-filling may include manual application or use of small machinery (e.g. bob cat) where practicable (e.g. where use of this equipment would not result in greater impact than the cracking itself).</li> </ul>

In the event the subsidence impacts are deemed to present a safety hazard (i.e. regardless of the nature or extent of the subsidence impact) actions will be implemented in accordance with the UG4 Longwalls 401 to 408 Public Safety Management Plan (**Appendix F**).

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The implementation of any stabilisation techniques or measures to improve the aesthetic value of the feature, other than those listed in **Table 7**, will be conducted in consultation with Crown Lands where required. Any management measures required in GRNP will be implemented in consultation with the NPWS. Appropriate erosion and sediment control techniques will be implemented as required. Follow-up inspections will be conducted to assess the effectiveness of implemented management measures and the requirement for any additional management measures. Management measures will be reported in the Annual Review (**Section 9.1**).

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## 8.0 CONTINGENCY PLAN

In the event a subsidence impact performance measure relevant to land (**Table 5**) is considered to have been exceeded or is likely to be exceeded, MCO will implement the following Contingency Plan:

- The observation will be reported to the Underground Technical Manager and/or the Environmental and Community Manager within 24 hours.
- The observation will be recorded in the Subsidence Impact Register template (**Attachment 1**) consistent with the monitoring program described in **Section 6.0**.
- Any exceedance of a subsidence impact performance measure relevant to land will be reported to the DPIE as soon as practicable after MCO becomes aware of the exceedance.
- MCO will assess public safety and where appropriate implement safety measures in accordance with the UG4 Longwalls 401- 408 Public Safety Management Plan.
- MCO will assess the impacts on the aesthetic values of the land feature.
- MCO will conduct an investigation to evaluate the potential contributing factors. The investigation will:
  - include the re-survey of relevant subsidence monitoring lines;
  - compare and critically analyse measured versus predicted subsidence parameters;
  - review measured subsidence parameters against the observed impact; and
  - review the LW401-408 SMP and update the program where appropriate.
- MCO will identify an appropriate course of action with respect to the identified impact(s), in consultation with specialists and relevant agencies, as necessary. For example:
  - proposed contingency measures;
  - a program to review the effectiveness of the contingency measures; and
  - consideration of adaptive management.

Contingency measures will be developed in consideration of the specific circumstances of the impact (e.g. location, nature and extent) and the assessment of environmental consequences. Potential contingency measures would include management measures similar to those described in **Table 7**.

The proposed course of action will consider the nature and extent/scale of all recorded impacts. It may, for example, be more appropriate to remediate previously impacted areas as opposed to the specific impact that initiated the implementation of the Contingency Plan.

- MCO will submit the proposed course of action to the DPIE for approval.
- MCO will implement the approved course of action to the satisfaction of the DPIE.
- In accordance with Condition 74, Schedule 3 of Project Approval (05\_0117), MCO will provide a suitable offset to compensate for the impact or environmental consequence to the satisfaction of the Secretary of the DPIE if either the remediation measures implemented by MCO have failed to remediate the impact or environmental consequence or the Secretary of the DPIE determines that it is not reasonable or feasible to remediate the impact or environmental consequence.

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Contingency measures will be developed in consideration of the specific circumstances of the feature (e.g. the location, nature and extent of the impact, and the assessment of environmental consequences).

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## 9.0 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

### 9.1 ANNUAL REVIEW

In accordance with Condition 4, Schedule 5 of Project Approval (05\_0117) (as modified), MCO will conduct an annual review of operations conducted at the Moolarben Coal Complex (including the performance of the LW401-408 LMP) prior to 31 March for the preceding calendar year, or as otherwise agreed by the Secretary of the DPIE.

The Annual Review will:

- describe the works carried out in the previous calendar year, and the development proposed to be carried out over the current calendar year;
- include a comprehensive review of the monitoring results and complaints records of the Project over the previous calendar year, including a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - monitoring results of previous years; and
  - relevant predictions in the EA;
- identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
- identify any trends in the monitoring data over the life of the Project;
- identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies; and
- describe what measures will be implemented over the next year to improve the environmental performance of the Project.

In accordance with Condition 11, Schedule 5 of Project Approval (05\_0117), the Annual Review will be made available on the MCO website. As described in **Section 2.0**, this LW401-408 LMP will be reviewed within three months of the submission of an Annual Review, and, if necessary, revised to ensure the plan is updated on a regular basis and to incorporate any recommended measures to improve environmental performance.

### 9.2 AUDITS

In accordance with Condition 9, Schedule 5 of Project Approval (05\_0117), an independent environmental audit was conducted by the end of December 2015 and every three years thereafter. Notwithstanding the three-yearly timing, an audit must also be carried out prior to the completion of longwall panels 404 and 408, the precise timing of these audits will be determined in consultation with the DPIE. A copy of the independent environmental audit will be provided to the Secretary of the DPIE and made available on the MCO website.

The independent environmental audit will be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary of the DPIE. The independent environmental audit will assess the environmental performance of the Project and assess whether it is complying with the requirements of Project Approval (05\_0117), and any other relevant approvals, and recommend measures or actions to improve the environmental performance of the Project.

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As described in **Section 2.0**, this LW401-408 LMP will be reviewed within three months of the submission of an independent environmental audit, and, if necessary, revised to ensure the plan is updated on a regular basis and to incorporate any recommended measures to improve environmental performance.

## 10.0 FUTURE EXTRACTION PLANS

In accordance with Condition 77(p), Schedule 3 of Project Approval (05\_0117), MCO will collect baseline data for future Extraction Plans. Consideration of the environmental performance and management measures, in accordance with the review(s) conducted as part of this LW401-408 LMP, will inform the appropriate type and frequency of monitoring of the assets relevant to the next Extraction Plan.

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## 11.0 INCIDENTS

An incident is defined in Project Approval (05\_0117) as a set of circumstances that:

- causes or threatens to cause material harm to the environment; and/or
- breaches or exceeds the limits or performance measures/criteria in Project Approval (05\_0117) (as modified).

In the event that an incident which causes, or threatens to cause, material harm to the environment occurs, the incident will be managed in accordance with the Pollution Incident Response Management Plan.

The reporting of incidents will be conducted in accordance with Condition 7, Schedule 5 of Project Approval (05\_0117).

MCO will notify the Secretary of DPIE and any other relevant agencies of any incident associated with the UG4 which causes or threatens to cause material harm to the environment immediately after MCO confirms that an incident has occurred. For any other incident associated with the UG4, MCO will notify the Secretary and any other relevant agencies as soon as practicable after becoming aware of the incident. Incidents relating to the Goulburn River National Park or Goulburn River State Conservation Area will include notification of the National Parks and Wildlife Service Area Manager and BCS. Within seven days of the date of the incident, MCO will provide the Secretary of DPIE and any relevant agencies with a detailed report on the incident. The report will:

- describe the date, time and nature of the exceedance/incident;
- identify the cause (or likely cause) of the exceedance/incident;
- describe what action has been taken to date; and
- describe the proposed measures to address the exceedance/incident.

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## 12.0 COMPLAINTS

MCO maintains a Community Complaints Line (Phone Number: 1800 556 484) that is dedicated to the receipt of community complaints. The Community Complaints Line is publicly advertised and operates 24 hours per day, seven days a week, to receive any complaints from neighbouring residents or other stakeholders.

MCO has developed a Community Complaints Procedure which details the process to be followed when receiving, responding to and recording community complaints. The Community Complaints Procedure is supported by a Complaints Database.

The Community Complaints Procedure is a component of the MCO Environmental Management Strategy which requires the recording of relevant information including:

- the nature of complaint;
- method of the complaint;
- relevant monitoring results and meteorological data at the time of the complaint;
- site investigation outcomes;
- any necessary site activity and activity changes;
- any necessary actions assigned; and
- communication of the investigation outcome(s) to the complainant.

In accordance with Condition 11, Schedule 5 of Project Approval (05\_0117), the complaints register will be updated monthly and made available on the MCO website.

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### 13.0 NON-COMPLIANCE WITH STATUTORY REQUIREMENTS

A protocol for the managing and reporting of non-compliances with statutory requirements has been developed as a component of MCO's Environmental Management Strategy and is described below.

Compliance with all approvals, plans and procedures will be the responsibility of all personnel (staff and contractors) employed on or in association with the Moolarben Coal Complex.

The Environmental and Community Manager (or delegate) will undertake regular inspections, internal audits and initiate directions identifying any remediation/rectification work required, and areas of actual or potential non-compliance.

As described in **Section 11.0**, MCO will notify the Secretary of the DPIE, and any other relevant agencies, of any incident associated with MCO immediately after MCO becomes aware of the incident. Within seven days of the date of the incident, MCO will provide the Secretary of the DPIE, and any relevant agencies, with a detailed report on the incident.

A review of MCO's compliance with all conditions of Project Approval (05\_0117) will be undertaken prior to (and included within) each Annual Review. The Annual Review will be made publicly available on the MCO website.

As described in **Section 9.2**, an independent environmental audit was conducted by the end of December 2015 and undertaken every three years thereafter. A copy of the audit report will be submitted to the Secretary of the DPIE and made publicly available on the MCO website.

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## 14.0 REFERENCES

Department of Planning and Environment and NSW Trade & Investment – Division of Resources and Energy (2015) *Guidelines for the Preparation of Extraction Plans Required under Conditions of Development Consents, Project Approvals and Mining Lease Conditions for Underground Coal Mining*. Version 5. Draft.

Mine Subsidence Engineering Consultants (2021) *Subsidence Predictions and Impact Assessment for Longwalls 401 to 408* (MSEC, 2021)

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**ATTACHMENT 1**

**UG4 LONGWALLS 401 TO 408 LAND MANAGEMENT PLAN  
SUBSIDENCE IMPACT REGISTER TEMPLATE**

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**ATTACHMENT 2**

**UG4 LONGWALLS 401 TO 408 LAND MANAGEMENT PLAN  
TRIGGER ACTION RESPONSE PLAN**

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*LONGWALLS 401-408 LAND MANAGEMENT PLAN  
MOOLARBEN COAL OPERATIONS*

Condition	Normal		Level 1	Level 2
	Baseline Conditions	Predicted Impacts	Implement Management Measures	Restoration/Contingency Phase
<b>Trigger</b>	Subsidence damaged minimised to CL3 consistent with EA.	Subsidence parameters and environmental consequences as predicted for cliffs ( <b>Section 4.4</b> ) and land in general ( <b>Section 4.5</b> ) within and in the vicinity of the Study Area.	Subsidence monitoring results identifies impacts that are greater than predicted, and Performance Measures ( <b>Section 5.0</b> ) have not been exceeded or likely to be exceeded, and Performance Indicators ( <b>Section 5.0</b> ) have not been triggered.  New impacts (rockfalls, cliff instabilities, surface cracking) on Minor Cliffs in the GRNP (whether due to longwall extraction or not).	Subsidence monitoring results identifies impacts that are greater than predicted, and either Performance Measure ( <b>Section 5.0</b> ) relevant to CL3 or The Drip and Goulburn River Gorge have been exceeded, or are likely to be exceeded; or Performance Indicators ( <b>Section 5.0</b> ) for Cliff 3 or Minor Cliffs in GRNP have been triggered,
<b>Action</b>	Establish baseline data consistent with <b>Section 6.0</b> , including: <ul style="list-style-type: none"> <li>Visual inspections of CL3 and minor cliffs in GRNP (baseline photography), including observations of existing rockfalls / instabilities / surface cracking.</li> <li>Pre-extraction subsidence survey as per the UG4 Longwalls 401 to 408 Subsidence Monitoring Program.</li> </ul>	Conduct monitoring, consistent with <b>Section 6.0</b> and the UG4 Longwalls 401 to 408 Subsidence Monitoring Program.  Implement management measures, as required, in accordance with <b>Section 7.0</b> .	Management measures implemented as described in <b>Section 7.0</b> (with regard to the specific circumstances of the subsidence impact [e.g. the nature and extent of the impact]).  Management measures implemented in consultation with relevant land holders (Crown or NPWS) as described in <b>Section 7.0</b> .  Where new impacts (rockfalls, cliff instabilities, surface cracking) on minor cliffs in the GRNP are identified, NPWS Area Manager notified and visual assessment undertaken as described in <b>Section 7.0</b> .  Follow-up inspections will be conducted to assess the effectiveness of the management measures implemented and the requirement for any additional management measures.	Implement Contingency Plan including notifications as described in <b>Section 8.0</b> including management measures implemented as described in <b>Section 7.0</b> .  Incidents will be reported and investigated in accordance with <b>Section 11.0</b> .
<b>Frequency</b>	Prior to commencement of extraction of Longwall 401 (or other Longwall as relevant) In accordance with <b>Section 6.0</b> .	Subsidence monitoring frequency consistent with <b>Section 6</b> including Subsidence monitoring lines and visual inspections of CL3 and Minor Cliffs in GRNP.	As required, in accordance with <b>Section 7.0</b> .	As required, in accordance with <b>Section 8.0</b> and/or <b>Section 11.0</b> .
<b>Position of Decision Making</b>	Underground Technical Manager.	Underground Technical Manager.	Environment and Community Manager and Underground Technical Manager.	Environment and Community Manager and Underground Technical Manager.

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*LONGWALLS 401-408 LAND MANAGEMENT PLAN*  
*MOOLARBEN COAL OPERATIONS*

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