



UG1 LONGWALLS 101 TO 105 BIODIVERSITY MANAGEMENT PLAN

Version	Issue Date	Section Revised	Description	Review Team
1	September 2017	All	Approved	MCO
2	March 2019	Sections 1, 4, 13 and Figures	Amended 103 layout	MCO
3	June 2020	All	Inclusion of LWs 104-105	MCO

Approved: S.J. Archinal Date: 11/06/2020

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 PURPOSE AND SCOPE	5
1.2 STRUCTURE OF THE LONGWALLS 101-105 BIODIVERSITY MANAGEMENT PLAN	6
2.0 BIODIVERSITY MANAGEMENT PLAN REVIEW AND UPDATE	7
2.1 ACCESS TO INFORMATION.....	7
3.0 STATUTORY REQUIREMENTS	8
3.1 EP&A ACT PROJECT APPROVAL.....	8
3.2 OTHER LEGISLATION	10
4.0 PREDICTED SUBSIDENCE IMPACTS AND ENVIRONMENTAL CONSEQUENCES	11
4.1 LONGWALLS 101-105 EXTRACTION SCHEDULE	11
4.2 SUBSIDENCE IMPACTS SUMMARY	12
4.3 ENVIRONMENTAL RISK ASSESSMENT	12
4.4 FLORA.....	12
4.4.1 Baseline Data.....	12
4.4.2 Predicted Subsidence Impacts and Environmental Consequences.....	19
4.5 TERRESTRIAL FAUNA.....	2
4.5.1 Baseline Data	2
4.5.2 Predicted Subsidence Impacts and Environmental Consequences.....	3
4.6 AQUATIC FAUNA.....	4
4.7 GROUNDWATER DEPENDENT ECOSYSTEMS	4
5.0 PERFORMANCE MEASURES AND PERFORMANCE INDICATORS.....	5
6.0 MONITORING	6
6.1 SUBSIDENCE PARAMETERS.....	6
6.2 SUBSIDENCE IMPACTS	6
6.2.1 Longwall Panel Traverse	8
6.2.2 Floristic Monitoring Sites.....	9
6.2.3 Terrestrial Fauna and Habitat.....	10
6.3 ENVIRONMENTAL CONSEQUENCES.....	11
7.0 MANAGEMENT MEASURES.....	11
7.1 VEGETATION CLEARANCE PROTOCOL	14
7.2 VEGETATION MANAGEMENT ZONES.....	17
8.0 CONTINGENCY PLAN.....	19
8.1 TRIGGER ACTION RESPONSE PLAN	20
9.0 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE	21
9.1 ANNUAL REVIEW.....	21
9.2 AUDITS	22
9.3 FUTURE EXTRACTION PLANS	22

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

10.0 INCIDENTS23
11.0 COMPLAINTS24
12.0 NON-COMPLIANCE WITH STATUTORY REQUIREMENTS25
13.0 REFERENCES26

LIST OF TABLES

Table 1 Biodiversity Management Plan Requirements
 Table 2 Provisional Extraction Schedule
 Table 3 Comparison of Maximum Predicted Total Conventional Subsidence Parameters after the Extraction of Longwalls 101-105
 Table 4 Comparison of Maximum Predicted Total Conventional Subsidence Parameters based on the Approved Layout and Extraction Plan Layout
 Table 5 Maximum Predicted Total Conventional Subsidence Parameters for EEC/CEECs Resulting from the Extraction of LWs 101-103
 Table 6 Maximum Predicted Total Conventional Subsidence Parameters for EEC/CEECs Resulting from the Extraction of LWs 104-105
 Table 7 Predicted Strains for the EEC/CEECs based on Conventional and Non-Conventional Anomalous Movements
 Table 8 Comparison of Maximum Predicted Total Conventional Subsidence Parameters for EEC/CEECs
 Table 9 Threatened and Migratory Fauna Species Recorded in the immediate vicinity of Longwalls 101-105
 Table 10 Biodiversity Subsidence Impact Performance Measure
 Table 11 Biodiversity Monitoring Program Overview
 Table 12 Potential Management Measures

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

LIST OF FIGURES

- Figure 1 Regional Location
- Figure 2 Moolarben Coal Complex Layout
- Figure 3 Underground Mine 1 Longwalls 101 to 105 Layout
- Figure 4a Vegetation Communities, Cliffs and Indicative Locations of Monitoring Transects
- Figure 4b Steep Slopes
- Figure 5 Endangered Ecological Communities in the Vicinity of Longwalls 101 to 105
- Figure 6 Indicative Onsite Vegetation Management Zones
- Figure 7 Vegetation Clearance Protocol

LIST OF ATTACHMENTS

- Attachment 1 UG1 Longwalls 101 to 105 Biodiversity Management Plan Subsidence Impact Register
- Attachment 2 UG1 Longwalls 101 to 105 Biodiversity Management Plan Trigger Action Response Plan
- Attachment 3 Previously Recorded Threatened Species in the Vicinity of the UG1 Longwalls 101 to 105 Study Area (Moolarben Biota, 2006; EcoVision Consulting, 2008; EcoLogical Australia, 2015)

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

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], Sojitz Moolarben Resources Pty Ltd and a consortium of Korean power companies). MCO and MCM are wholly owned subsidiaries of Yancoal Australia Limited.

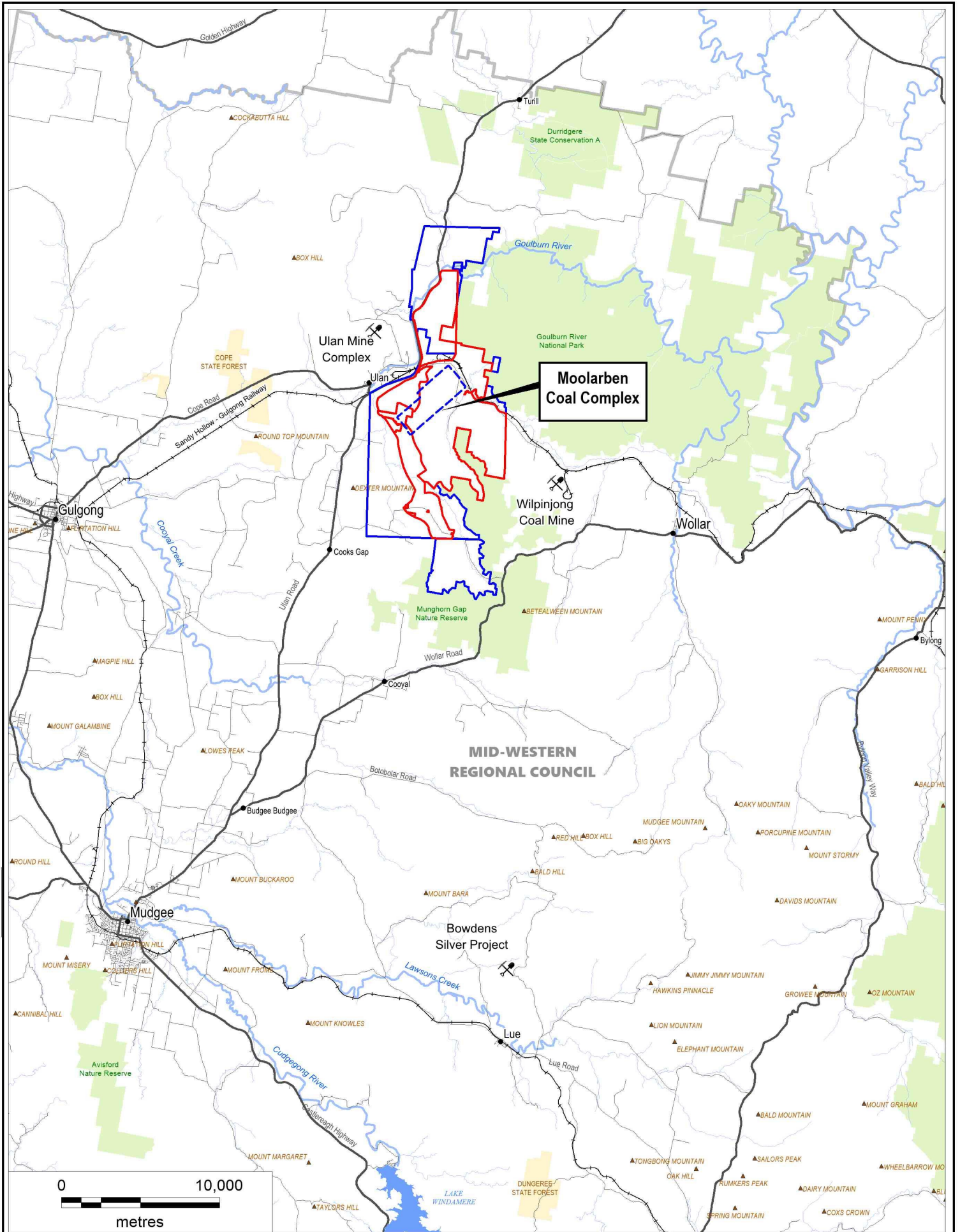
The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities) (Figure 2).

Since the commencement of coal mining operations in 2010, mining activities have occurred within OC1, OC2, OC4 and UG1 (Figure 2).

The UG1 Underground Mine is a component of the approved Moolarben Coal Complex (Figure 2). The UG1 Underground Mine commenced first workings in April 2016 and commenced secondary workings (longwall extraction) in October 2017 by longwall mining methods from the Ulan Seam within Mining Lease (ML) 1605, ML 1606, ML 1628, ML 1691 and ML 1715 (Figure 3).

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).

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

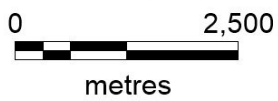
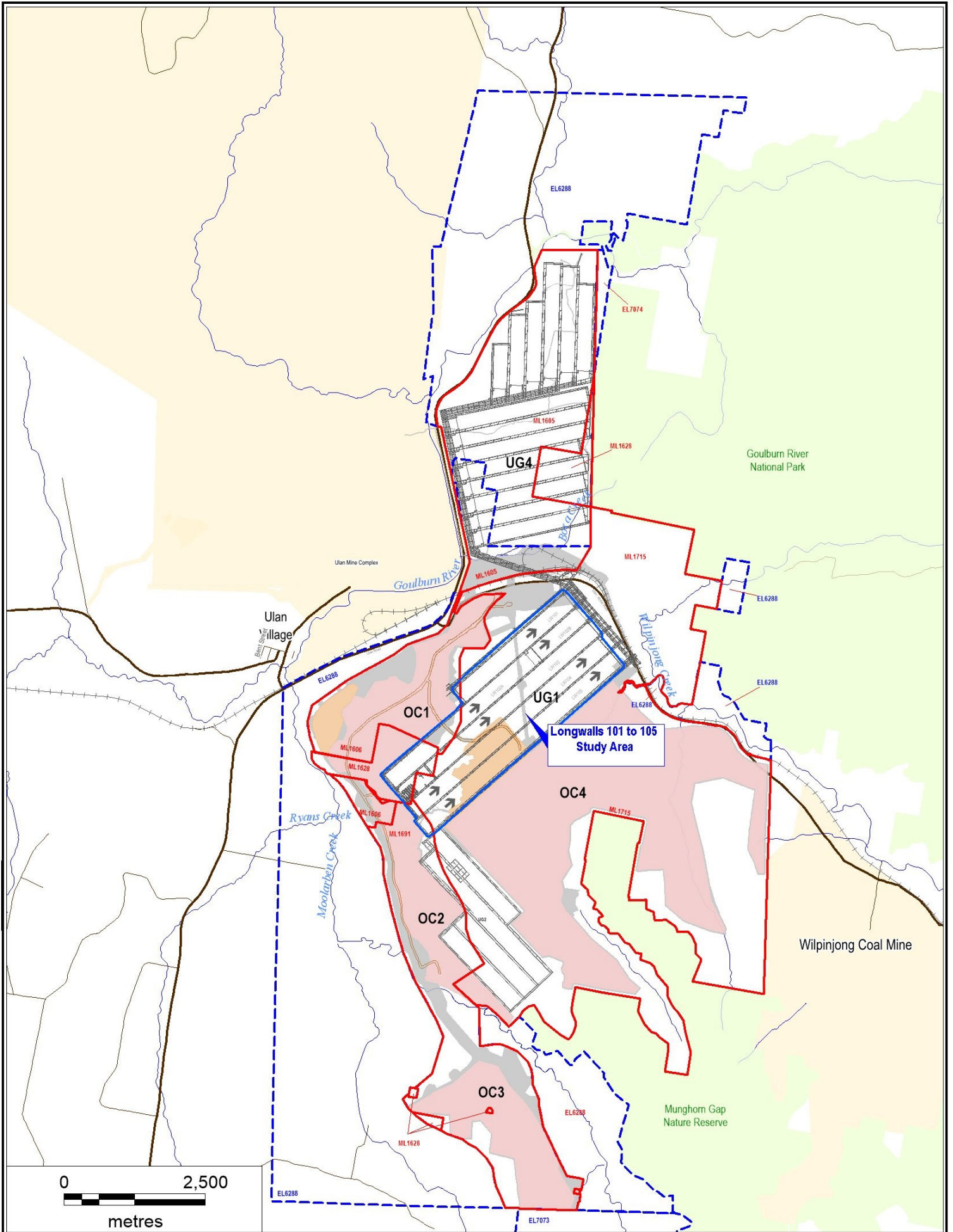


Legend

- Exploration Licence Boundary
- Mining Lease Boundary
- Local Government Area
- National Park / Nature Reserve
- State Forest
- Mining Project



Figure 1
Regional Location



Legend

- Exploration Licence Boundary
- Mining Lease Boundary
- Haul Road
- Rail Line
- Watercourse

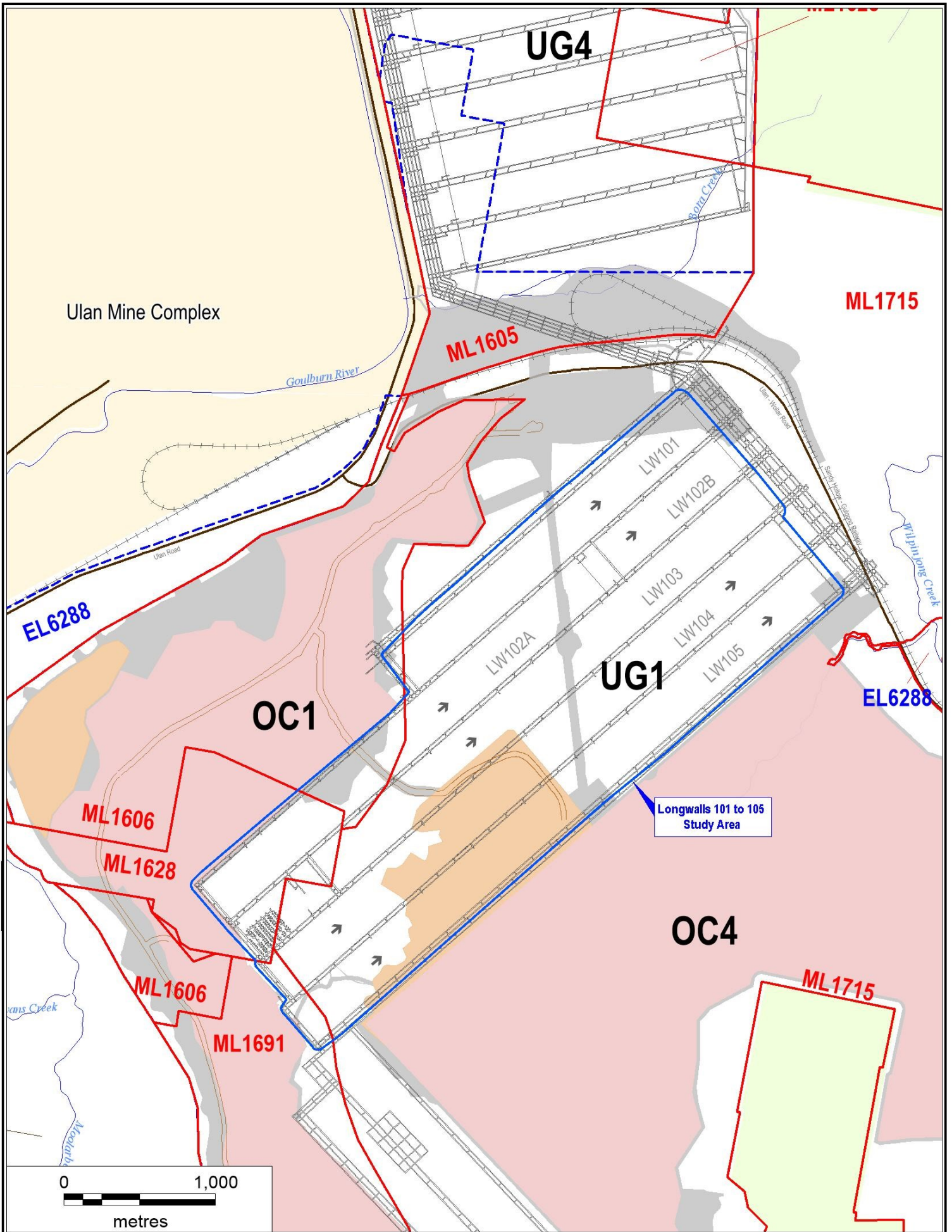
Existing / Approved Development

- Open Cut Mining Area
- Underground Workings
- Out-of-Pit Emplacement
- Surface Infrastructure

- Longwalls 101 to 105 Study Area
- Direction of Longwall Mining



Figure 2
Moolarben Coal Complex Layout



- Legend**
- Exploration Licence Boundary
 - Mining Lease Boundary
 - Haul Road
 - Rail Line
 - Watercourse

- Existing / Approved Development**
- Open Cut Mining Area
 - Underground Workings
 - Out-of-Pit Emplacement
 - Surface Infrastructure

- Longwalls 101 to 105 Study Area
- Direction of Longwall Mining



Figure 3
UG1 Longwalls 101-105 Layout

1.1 PURPOSE AND SCOPE

This UG1 Longwalls 101 to 105 Biodiversity Management Plan (LW101-105 BMP) has been prepared by MCO with input from suitably qualified experts (i.e. Eco Logical Australia Pty Ltd [ELA], Mine Subsidence Engineering Consultants [MSEC] and Mine Advice Pty Ltd [Mine Advice]) to satisfy the requirements of Project Approval (08_0135) as modified and the NSW Department of Planning, Industry and Environment (DPIE) and NSW Division of Resources and Energy (DRE) (2015) Draft *Guidelines for the Preparation of Extraction Plans*. The appointment of the team of suitably qualified and experienced persons (which includes representatives of MCO, ELA and MSEC) was endorsed by the Secretary of the DPIE.

Purpose: This LW101-105 BMP outlines the management of potential environmental consequences on aquatic and terrestrial flora and fauna resulting from the extraction of Longwalls 101-105.

Scope: This LW101-105 BMP covers aquatic and terrestrial flora and fauna within the Longwalls 101-105 Study Area¹.

Longwalls 101-105 form the UG1 Underground Mine at the Moolarben Coal Complex.

This amendment has been prepared to incorporate the final two longwall panels 104 and 105 of the UG1 mining area into the Extraction Plan. The only mine plan alteration from that approved under the Stage 2 Project Approval (08_0135) is the shortening of the commencing end of LW104 by 70m, which was conducted to facilitate the installation of a rear panel ventilation shaft and associated roadway.

A complex-wide Biodiversity Management Plan (complex-wide BMP) has been developed to manage aquatic and terrestrial flora and fauna across the Moolarben Coal Complex (including the Longwalls 101-105 Study Area covered by this LW101-105 BMP). The approved complex-wide BMP is publicly available on MCO's website (www.moolarbencoal.com.au).

To avoid duplication of existing Environmental Management Plans, this LW101-105 BMP references components of the approved complex-wide BMP.

¹ Longwalls 101-105 and the area of land within the furthest extent of the 26.5 degree (°) angle of draw and 20 millimetres (mm) predicted subsidence contour.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

1.2 STRUCTURE OF THE LONGWALLS 101-105 BIODIVERSITY MANAGEMENT PLAN

The remainder of the LW101-105 BMP is structured as follows:

- Section 2** Describes the review and update of the LW101-105 BMP.
- Section 3** Outlines the statutory requirements applicable to the LW101-105 BMP.
- Section 4** Summarises the predicted subsidence impacts and environmental consequences resulting from the secondary extraction of Longwalls 101-105.
- Section 5** Details the performance measures and indicators that will be used to assess environmental performance in relation to aquatic and terrestrial flora and fauna.
- Section 6** Describes the monitoring program.
- Section 7** Describes the potential management measures that could be implemented to remediate any identified impacts to aquatic and terrestrial flora and fauna.
- 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** Outlines the management and reporting of incidents.
- Section 11** Outlines the management and reporting of complaints.
- Section 12** Outlines the management and reporting of any non-compliance with statutory requirements.
- Section 13** Lists the documents referred to in Sections 1 to 12 of this LW101-105 BMP.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

2.0 BIODIVERSITY MANAGEMENT PLAN REVIEW AND UPDATE

In accordance with Condition 5, Schedule 6 of Project Approval (08_0135) (as modified), this LW101-105 BMP will be reviewed as follows:

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 or MP 05_0117 (unless the conditions require otherwise),*

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 6 of Project Approval (08_0135) (as modified), MCO will make the approved LW101-105 BMP publicly available on the MCO website.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

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 2008/444 and EPBC 2017/7974);
- relevant licences and permits, including conditions attached to the Environment Protection Licence (EPL) No. 12932 and MLs (i.e. ML 1605, ML 1606, ML 1628, ML 1691 and ML 1715); and
- other relevant legislation.

Obligations relevant to this LW101-105 BMP are described below.

3.1 EP&A ACT PROJECT APPROVAL

Condition 5(i), Schedule 4 of Project Approval (08_0135) (as modified) requires the preparation of a Biodiversity Management Plan (i.e. this LW101-105 BMP) as a component of the Extraction Plan. In addition, Conditions 5(n), 5(p) and 6, Schedule 4 and Condition 3, Schedule 6 of Project Approval (08_0135) (as modified) outline general management plan requirements that are applicable to the preparation of the LW101-105 BMP.

Table 1 presents these requirements and indicates where they are addressed within this LW101-105 BMP.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Table 1: Biodiversity Management Plan Requirements

Project Approval (08_0135) Condition	LW101-105 BMP Section
<p>Condition 5, Schedule 4</p> <p>5. 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>(i) include a Biodiversity Management Plan, which has been prepared in consultation with OEH, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats; endangered ecological communities; and water dependant ecosystems;</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 Table 18 and 19, or where such exceedances seem likely;</p> <p>...</p> <p>(p) include a program to collect sufficient baseline data for future Extraction Plans.</p>	<p>This document and complex-wide BMP</p> <p>Section 8</p> <p>Section 9.3</p>
<p>Condition 6, Schedule 4</p> <p>6. The Proponent shall ensure that the management plans required under conditions 5(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>Sections 4 and 6.3</p> <p>Section 7 and complex-wide BMP</p>
<p>Condition 3, Schedule 6</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"> • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; • 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; <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"> • impacts and environmental performance of the project; • effectiveness of any management measures (see c above); <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"> • incidents; • complaints; • non-compliances with statutory requirements; and • exceedences of the impact assessment criteria and/or performance criteria; and <p>(h) a protocol for periodic review of the plan.</p>	<p>Sections 4.3.1, 4.4.1, 4.5 and 4.6</p> <p>Section 3</p> <p>Section 5</p> <p>Section 5</p> <p>Sections 7 and 8 and complex-wide BMP</p> <p>Sections 6 and 9 and complex-wide BMP</p> <p>Section 8 and complex-wide BMP</p> <p>Sections 6 and 9</p> <p>Section 10</p> <p>Section 11</p> <p>Section 12</p> <p>Section 8 and complex-wide BMP</p> <p>Section 2</p>

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

3.2 OTHER LEGISLATION

MCO will operate the Moolarben Coal Complex consistent with Project Approval (08_0135) and any other legislation that is applicable to an approved Part 3A Project under the EP&A Act.

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

- *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 (BC Act);*
- *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.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

4.0 PREDICTED SUBSIDENCE IMPACTS AND ENVIRONMENTAL CONSEQUENCES

4.1 LONGWALLS 101-105 EXTRACTION SCHEDULE

Longwalls 101-105, 103 Plunge Panel and the area of land within the furthest extent of the 26.5° angle of draw and 20 mm predicted subsidence contour (i.e. the Longwalls 101-105 Study Area) are shown on Figure 3. Longwall extraction will occur from the west to the east. The longwall layout includes approximately 311 metre (m) panel widths (void) with 20 m pillars (solid).

The provisional extraction schedule for Longwalls 101-105 is provided in Table 2.

Table 2: Provisional Extraction Schedule

Panel	Estimated Start Date	Estimated Duration	Estimated Completion Date
LW101	October 2017		Complete June 2018
LW102 (A+B)	August 2018		Complete August 2019
LW103	September 2019	9 months	June 2020
103 Plunge	April 2019		Complete July 2019
104	July 2020	12 months	June 2021
105	July 2021	11 months	May 2022

Following approval of the UG1 Optimisation Modification in April 2016, MCO has delineated a geological feature in Longwall 102 that prevents economic mining of this section, and has subsequently revised the longwall layout to incorporate a barrier pillar around this feature. The barrier pillar separating Longwalls 102A and 102B is approximately 140 m in length. In addition, following further detailed design, Longwalls 101-103 have been shortened by approximately 70 m to provide safe operational conveyor distance between the end of the longwalls and main headings.

A second geological intrusion has been located at the commencing end of LW103 preventing viable extraction by longwall mining methods in this area. As a consequence, the LW103 commencing position has been moved outbye of the influence of this structure, and a first workings and plunge panel has been established to partially extract the remanent coal that would otherwise become sterilised.

LW104 commencing end has also been shortened by 70m to facilitate the installation of a rear panel ventilation shaft and associated roadway.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

With the exception of these changes, the longwall geometry is the same as that for the approved UG1 Optimisation Modification, and MSEC (2017; 2019 and 2020) conclude that the overall impact assessments for the natural and built features are unchanged or reduced.

4.2 SUBSIDENCE IMPACTS SUMMARY

As reported in the 2018 MCO Annual Review, subsidence impacts during the period [2018] were consistent with predictions by MSEC (2017), which supported the Extraction Plan for LW101 to 103 (MCO 2018). Further detail on subsidence performance can be found in 2017 and 2018 Annual Review. The Annual Review is discussed further in Section 9.1.

4.3 ENVIRONMENTAL RISK ASSESSMENT

Environmental Risk Assessments (ERA) have been conducted for four of the key component plans of the UG1 Longwalls 101-103 Extraction Plan² viz. Water Management Plan, Land Management Plan, Heritage Management Plan and this Biodiversity 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*.

An ERA workshop for LW panels 101-103 was held on 8 December 2016 and reviewed in March 2019 to support the Longwalls 101-103 Extraction Plan Amendment and in consideration of the Revised Extraction Plan Layout. An ERA for LW panels 104-105 was held on 30 January 2020, facilitated by independent specialist, Risk Mentoring.

The suitably qualified and experienced experts endorsed by the Secretary of the DPIE for the preparation of the UG1 Longwalls 101-105 Extraction Plan participated in the ERAs.

The ERA indicated that risks relevant to biodiversity in the Longwalls 101-103 and 104-105 panels were in the “Low” or “Medium” category, and it was expected that the risks could be managed with implementation of the appropriate mitigation, management and/or control measures.

4.4 FLORA

4.4.1 Baseline Data

Previous ecological survey work undertaken at the Moolarben Coal Complex, relevant to the UG1 Longwalls 101-105 Study Area, includes:

² Separate risk assessments have also been conducted for the built features in the vicinity of the UG1 Longwalls 101-105 Study Area and for public safety.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

- Detailed Ecological Impact Assessments prepared by Moolarben Biota (2006) and Ecovision Consulting (2008) for Stages 1 and 2 of the Moolarben Coal Project, respectively.
- An Ecological Impact Assessment undertaken in 2012 for the Moolarben Coal Project Stage 1 Modification 9 EA (EMGA Mitchell McLennan, 2013).
- Flora and Fauna Impact Assessments undertaken in 2015 for the UG1 Optimisation Modification (ELA, 2015a) and the OC4 South-West Modification (ELA, 2015b).
- Flora and Fauna Assessments undertaken in 2016 for the Longwalls 101-103 Extraction Plan BMP (ELA, 2016)
- Flora and Fauna Impacts Assessments undertaken in 2017 for the Open Cut Optimisation Modification (ELA, 2017).

Further detail regarding previous ecological survey work conducted at the Moolarben Coal Complex is available in the approved complex-wide BMP and the Biodiversity Technical Report (ELA, 2020).

Vegetation Communities

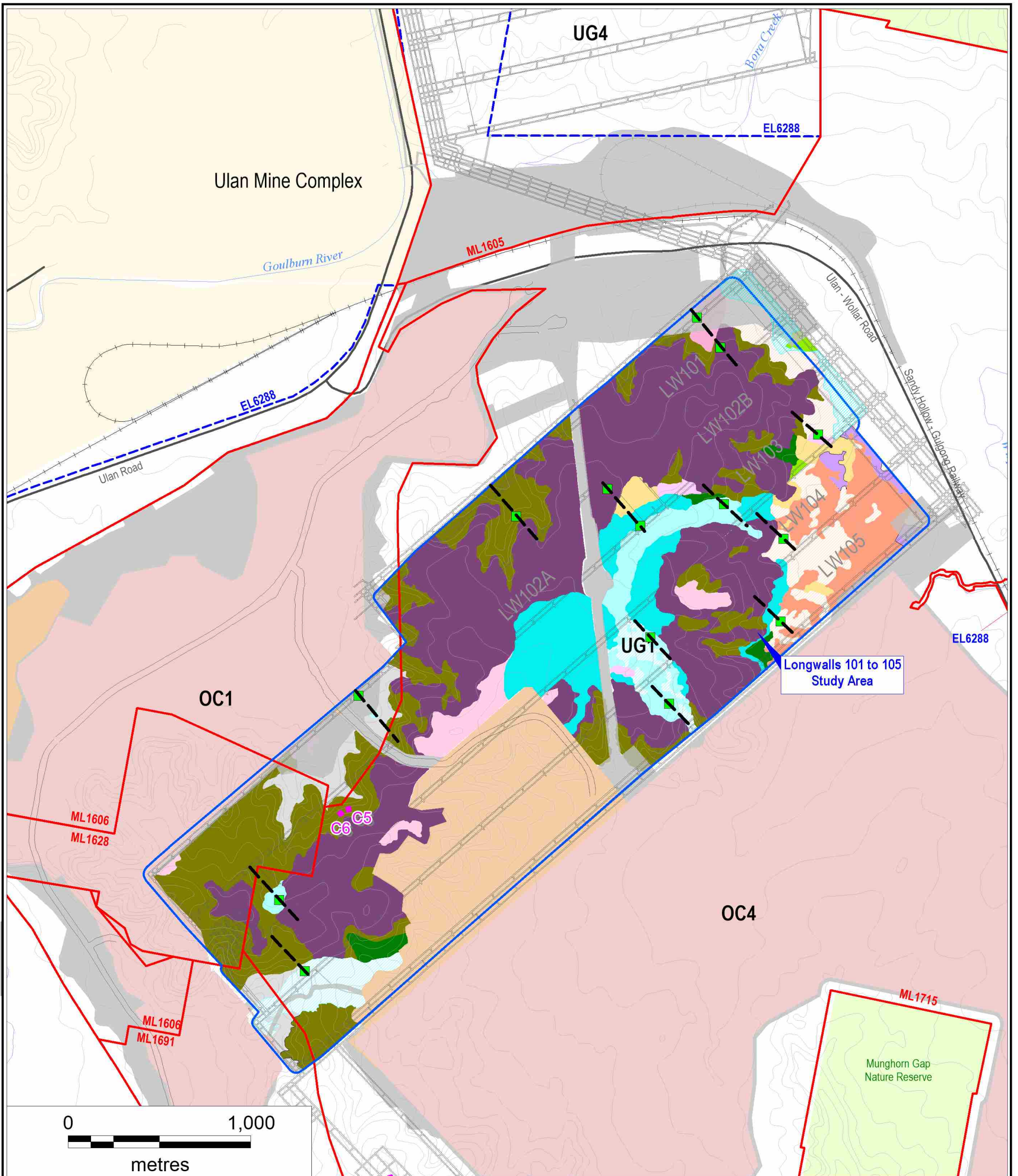
In addition to the ecological survey works described above, vegetation validation surveys have been undertaken by ELA in 2016 and 2019 to revise the existing vegetation mapping to include detailed extents, and to assign each community present to a Plant Community Type (PCT) in accordance with the current NSW Vegetation Classification System (ELA, 2016; 2020). The vegetation validation surveys have identified 13 PCTs in the Longwalls 101-105 Study Area (Figure 4). PCT 1629 was selected as a replacement for PCT 864. PCT 864 has been decommissioned since the vegetation validation assessment for LW101-103 (ELA 2016). The PCTs for Longwalls 101-105 are listed below (ELA, 2020):

- PCT 76 Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions.
- PCT 266 White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion.
- PCT 281 Rough-barked Apple – red gum – yellow box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South
- PCT 277 Blakely’s Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion.
- PCT 401 Rough-barked Apple-Blakely’s Red Gum – Black Cypress Pine woodland on sandy flats, mainly in the Pilliga Scrub region.
- PCT 420 Red Stringybark – Rough-barked Apple +/- Nortons Box open forest on hillslopes in the Warrumbungle NP – Coolah regions.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

- PCT 424 Dwyer’s Red Gum heathy low open woodland on sandstone ridges in the Pilliga Scrub, Brigalow Belt South Bioregion.
- PCT 478 Red Ironbark - Black Cypress Pine - Stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong – Mendooran region, southern Brigalow Belt South Bioregion.
- PCT 479 Narrow-leaved Ironbark – Black Cypress Pine – Stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the Brigalow Belt South Bioregion and Sydney Basin Bioregion.
- PCT 480 Black Cypress Pine – ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone in the Upper Hunter region of the Sydney Basin Bioregion.
- PCT 1606 White Box – Narrow-leaved Ironbark – Blakely’s Red Gum shrubby open forest of the central and upper Hunter.
- PCT 1629 Narrow-leaved Stringybark – Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin
- PCT 1696 Blakely’s Red Gum – Rough-barked Apple shrubby woodland of central and upper Hunter.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal



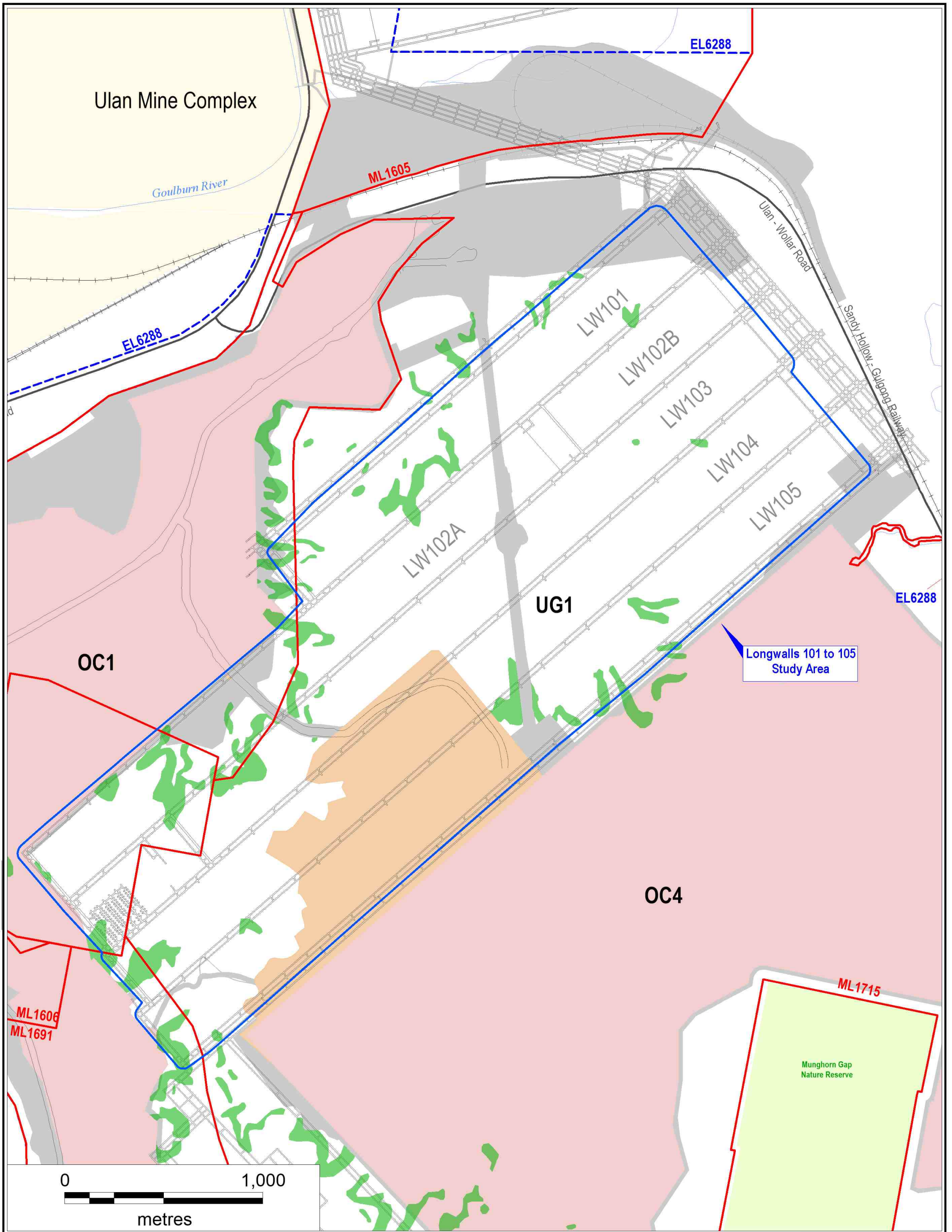
- Legend**
- Exploration Licence Boundary
 - Mining Lease Boundary
 - Longwalls 101-105 Study Area
 - Haul Road
 - Rail Line
 - Watercourse
 - Contour
 - Cliffs
- Existing / Approved Development**
- Open Cut Mining Area
 - Underground Workings
 - Out-of-Pit Emplacement
 - Surface Infrastructure

- Vegetation Communities**
- Cleared
 - PCT 76 (Grey Box grassy woodland)
 - PCT 266 (White Box grassy woodland)
 - PCT 266 (White Box grassy woodland) DNG
 - PCT 277 (Blakely's Red Gum grassy woodland)
 - PCT 281 (Rough-barked Apple - Red Gum - Yellow Box woodland)
 - PCT 281 (Rough-barked Apple - Red Gum - Yellow Box woodland) DNG
 - PCT 401 (Rough-barked Apple - Blakely's Red Gum)
 - PCT 420 (Red Stringybark - Rough-barked Apple Open Forest)
 - PCT 424 (Narrow-leaved Ironbark - Dwyer's Red Gum)
 - PCT 478 (Red Ironbark - Black Cypress Pine - Stringybark Open Forest)

- Biodiversity Monitoring**
- PCT 479 (Narrow-leaved Ironbark - Black Cypress Pine)
 - PCT 480 (Red Ironbark - Black Cypress Pine open forest)
 - PCT 1606 (White Box - Narrow-leaved Ironbark shrubby open forest)
 - PCT 1629 (Narrow-leaved Stringybark - Grey Gum)
 - PCT 1696 (Blakely's Red Gum shrubby woodland)
 - PCT 479 (Narrow-leaved Ironbark-Black Cypress Pine (Cleared))

- Biodiversity Monitoring**
- Floristic Monitoring site
 - Subsidence Monitoring Tra
- N
↑
- YANCOAL**
宽煤澳大利亚有限公司
MOOLARBEN COAL

Figure 4a
Vegetation Communities, Cliffs and
Indicative Monitoring Locations



Longwalls 101 to 105
Study Area

Legend		Existing / Approved Development		Longwalls 101 to 105 Study Area	
	Exploration Licence Boundary		Open Cut Mining Area		Longwalls 101 to 105 Study Area
	Mining Lease Boundary		Underground Workings		Steep Slopes
	Haul Road		Out-of-Pit Emplacement		
	Rail Line		Surface Infrastructure		
	Watercourse				



Figure 4b
Step Slopes

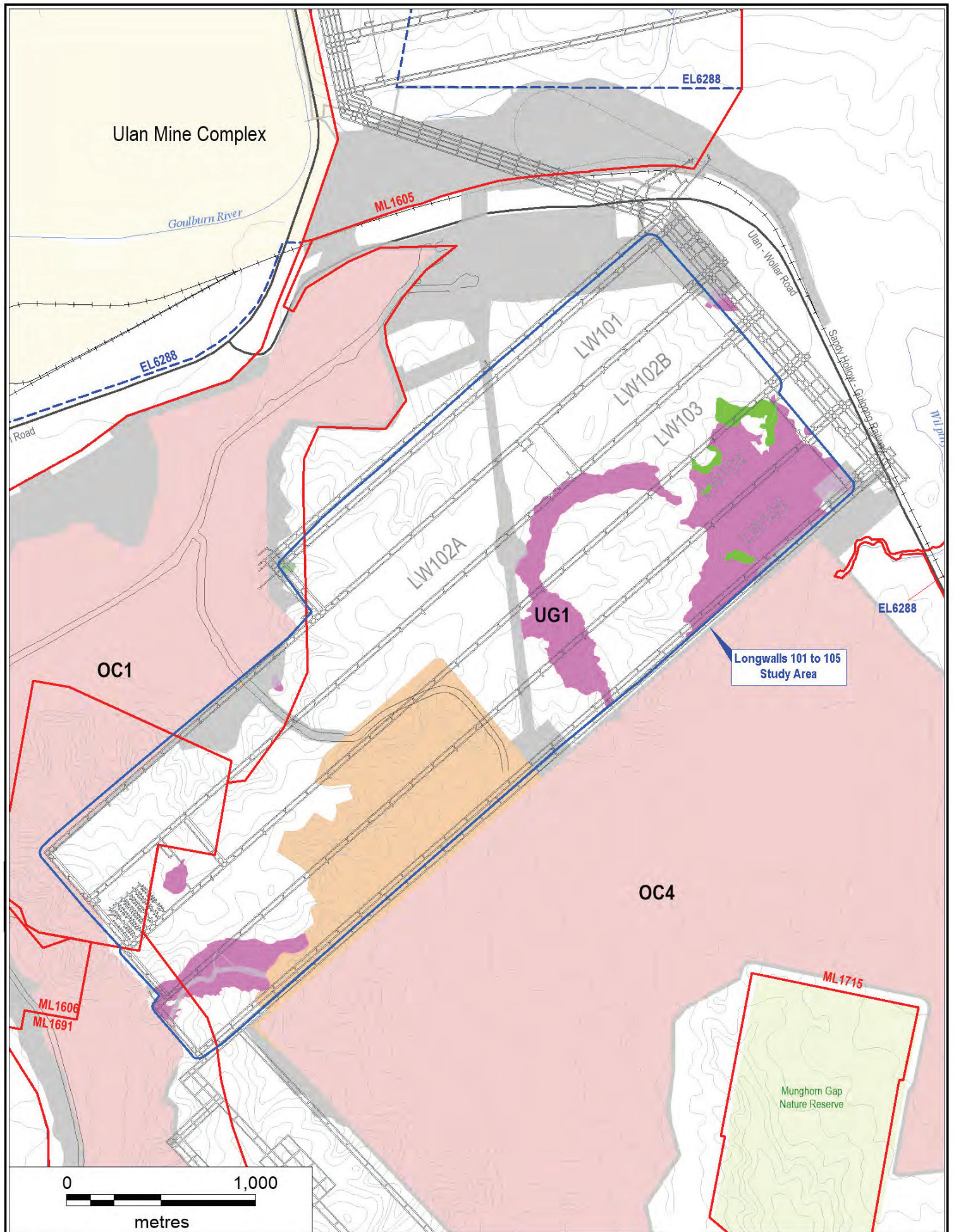
Endangered Ecological Communities

The vegetation validation (ELA, 2016; 2020) identified the following endangered ecological communities (EEC) and critically endangered ecological communities (CEEC), listed under either the BC Act and/or under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act), in the Longwalls 101-105 Study Area (Figure 5) (ELA, 2016; 2020):

- *White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, listed as an EEC under the BC Act and CEEC under the EPBC Act.
- *Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions*, listed as an EEC under the BC Act.

In addition to the above, ELA (2016) also identified *Central Hunter Valley Eucalypt Forest and Woodland*, listed as a CEEC under the EPBC Act. This CEEC was listed in May 2015 and does not apply to the approved Stage 1 and Stage 2 mining operations pursuant to section 158A of the EPBC Act.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal



Legend

- | | | |
|------------------------------|--|--|
| Exploration Licence Boundary | Existing / Approved Development | Longwalls 101 to 105 Study Area |
| Mining Lease Boundary | Open Cut Mining Area | Endangered Ecological Communities |
| Haul Road | Underground Workings | Central Hunter Valley Eucalypt Forest and Woodland |
| Rail Line | Out-of-Pit Emplacement | White Box-Yellow Box-Blakely's Red Gum Grassy Woodland |
| Watercourse | Surface Infrastructure | |
| Contour | | |



Figure 5
Endangered Ecological Communities

Threatened Flora Species

Five threatened flora species have been recorded at the Moolarben Coal Complex, including (Moolarben Biota, 2006; Ecovision, 2008; EMGA Mitchell McLennan, 2013):

- *Diuris tricolor* (Pine Donkey Orchid) – vulnerable under the BC Act.
- *Eucalyptus cannonii* (Capertee Stringybark) – vulnerable under the BC Act.
- *Eucalyptus scoparia* (Wallangarra White Gum) – endangered under the BC Act and vulnerable under the EPBC Act.
- *Leucochrysum albicans* var *tricolor* (Hoary Sunray) – endangered under the EPBC Act.
- *Pomaderris queenslandica* (Scant Pomaderris) – endangered under the BC Act.

Of the above, only Scant Pomaderris was recorded within the Longwalls 101-105 Study Area (Attachment 3)³.

4.4.2 Predicted Subsidence Impacts and Environmental Consequences

Vegetation Communities

Natural vegetation, which covers the majority of the Study Area, would be subjected to the full range of subsidence movements predicted by MSEC (2017; 2020) across the Longwalls 101-105 Study Area, except in those areas above the 103 first workings plunge panel. Subsidence related impacts to the natural vegetation above the 103 first working plunge panel (including PCT 266 White Box Grassy Woodland) are not anticipated to be subject to the full range of subsidence movement as the surface is predicted to remain long-term stable and non-subsiding (Mine Advice, 2019).

The maximum predicted total conventional subsidence, tilt and curvature resulting from the extraction of each of Longwalls 101 to 105, based on the Extraction Plan Layout are provided in Table 3.

³ Note, Narrow Goodenia (*Goodenia macbarronii*) was recorded in the Longwalls 101-105 Study Area by Moolarben Biota (2006), but was subsequently delisted from the EPBC Act Threatened Species list in December 2006 (Threatened Species Scientific Committee, 2006).

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Table 3: Comparison of Maximum Predicted Total Conventional Subsidence Parameters after the Extraction of Each of the Longwalls 101 to 105

Longwalls	Subsidence ¹ (mm)	Tilt ² (mm/m)	Hogging Curvature ³ (km ⁻¹)	Sagging Curvature ³ (km ⁻¹)
After Longwall 101	2250	65	>3	>3
After Longwall 102	2400	>100	>3	>3
After Longwall 103	2400	>100	>3	>3
After Longwall 104	2400	>100	>3	>3
After Longwall 105	2400	>100	>3	>3

Source: after MSEC (2020).

mm/m = millimetres per metre, km⁻¹ = 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.

MSEC (2017; 2020) compared the maximum predicted subsidence parameters due to the Longwalls 101-105 based on the Extraction Plan Layout with the maximum predictions due to the extraction of Longwalls 101-105 based on the Approved Layout (Table 4).

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

Layout	Subsidence (mm)	Tilt (mm/m)	Hogging Curvature (km ⁻¹)	Sagging Curvature (km ⁻¹)
Approved Layout (LW101-103)	2400	>100	>3	>3
Extraction Plan Layout	2400	>100	>3	>3

Source: after MSEC (2017; 2020).

The comparison shows the maximum predicted total conventional subsidence, tilt and curvature across the Study Area, based on the Extraction Plan Layout, are the same as the predicted maxima for the Approved Layout. MSEC (2017; 2020) concluded that the potential impacts on natural vegetation would be the same as those assessed based on the Approved Layout.

Endangered Ecological Communities

Subsidence impact predictions for EECs and CEECs in the Longwalls 101-105 Study Area were conducted in 2015 for the UG1 Optimisation Modification (the Approved Layout) and have been revised to reflect the latest longwall layout (the Extraction Plan Layout) and the results of the ELA (2016; 2020) vegetation validation surveys (MSEC, 2017; 2019; 2020).

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

The maximum predicted total conventional subsidence, tilt and curvature for EECs and CEECs, based on the Extraction Plan Layout are provided in Table 5 and Table 6, with the maximum predicted strains provided in Table 7.

Table 5: Maximum Predicted Total Conventional Subsidence Parameters for EEC/CEECs Resulting from the Extraction of LWs 101-103

EEC/CEEC	Subsidence (mm)	Tilt (mm/m)	Hogging Curvature (km ⁻¹)	Sagging Curvature (km ⁻¹)
EEC01 ¹	2250	50	>3	>3
EEC05 ²	2050	55	>3	>3
EEC09 ^{1,3}	2200	55	>3	>3
EEC11 ¹	2250	40	>3	>3
EEC12 ¹	1000	55	2.7	1.6
EEC13 ¹	65	3	0.25	0.1

Source: after MSEC (2017, 2019).

¹ EEC01, EEC09, EEC11, EEC12 and EEC13 are *White Box, Yellow Box, Blakely's Red Gum Grassy Woodland and Derived Native Grassland*.

² EEC05 is *Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions*.

³ EEC09 is not predicted to experience a full range of subsidence due to shortening of LW103 panel.

Table 6: Maximum Predicted Total Conventional Subsidence Parameters for EEC/CEECs Resulting from the Extraction of LWs 104-105

EEC/CEEC	Subsidence (mm)	Tilt (mm/m)	Hogging Curvature (km ⁻¹)	Sagging Curvature (km ⁻¹)
EEC01 ¹	2350	60	>3	>3
CEEC03 ²	2250	>100	>3	>3
EEC05 ²	2200	>100	>3	>3
EEC09 ^{1,4}	50	<0.5	0.06	0.06
EEC11 ¹	2250	>100	>3	>3
EEC12 ¹	1100	55	2.7	2.0
EEC13 ¹	65	3	0.26	0.11
EEC14 ³	1300	100	>3	>3

Source: after MSEC (2020).

¹ EEC01, EEC09, EEC11, EEC12 and EEC13 are *White Box, Yellow Box, Blakely's Red Gum Grassy Woodland*.

² CEEC03 and EEC05 are *White Box, Yellow Box, Blakely's Red Gum Grassy Woodland Derived Native Grassland*.

³ EEC14 is *Central Hunter Valley Eucalypt Forest and Woodland*.

⁴ EEC09 is not predicted to experience a full range of subsidence due to shortening of LW103 panel.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Table 7: Predicted Strains for the EEC/CEECs based on Conventional and Non-Conventional Anomalous Movements

Type	Conventional Strain Based on 10 times Curvature	Non-Conventional based on the 95% Confidence Level	Non-Conventional based on the 99% Confidence Level
Tension	>30	10	22
Compression	>30	13	31

Source: after MSEC (2017; 2020).

% = percent.

MSEC (2020) compared the maximum predicted subsidence impacts on EECs and CEECs due to the extraction of Longwalls 101-105 based on the Extraction Plan Layout with the maximum predictions due to the extraction of Longwalls 101-105 based on the Approved Layout (Table 8).

Table 8: Comparison of Maximum Predicted Total Conventional Subsidence Parameters for EEC/CEECs

Layout	Subsidence (mm)	Tilt (mm/m)	Hogging Curvature (km ⁻¹)	Sagging Curvature (km ⁻¹)
Approved Layout (LW101-105)	2350	> 100	>3	>3
Extraction Plan Layout	2350	>100	>3	>3

Source: after MSEC (2020).

The comparison shows the maximum predicted total conventional subsidence, tilt and curvature for the EECs and CEECs, based on the Extraction Plan Layout, are the same as the predicted maxima for the Approved Layout. MSEC (2017; 2019; 2020) concluded that the potential impacts on the EECs and CEECs would be the same as or less than those assessed based on the Approved Layout.

Potential impacts to the EECs and CEECs include:

- The likely changes in gradients will result in reduced grades and increased grades depending on the position of the EECs and CEECs in the subsidence bowl. These changes in grade may result in ponding of surface water runoff where existing natural grades are relatively shallow.
- It is expected that fracturing and dilation of the bedrock would occur as a result of the extraction of Longwalls 101 to 105. It is possible that below some of the EECs and CEECs, massive basalt layers could be present that could resist the deformation and cracking that occurs in the sandstone layers. Fracturing and dilation of the bedrock could result in surface cracking.
- It is expected, that the surface cracking could be easily and quickly remediated, if it is required, by infilling with soil or other suitable materials, or by locally regrading and compacting the surface.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

- Remediation works, which may impact on biodiversity within the immediate vicinity. Remediation works will only be undertaken where the works do not create a greater impact than the subsidence impact itself.

Threatened Flora Species

ELA (2017; 2020) considers that the potential subsidence impacts to threatened flora species in the LWs 101-105 Study Area would be consistent with those described in ELA (2015a):

Subsidence of vegetation within the underground mining area is not expected to result in the loss of vegetation cover or community structure. Fauna habitat (including that identified as Koala habitat) will not be directly impacted by the occurrence of subsidence. Direct mortality of plants and animals (including cave roosting bats) may occur as a result of subsidence-induced rock fall or collapse; however the impacts of such events are expected to be short-term and insignificant.

In summary, the potential subsidence of vegetation is not expected to result in a loss of vegetation cover or community structure. This conclusion is supported by previous local studies that have been unable to detect an impact of subsidence on local vegetation communities.

Direct mortality of a small number of individual plants may occur as a result of subsidence induced rock fall or collapse, however the impacts of such events are expected to be short-term, localised and not significant. The effect of subsidence is unlikely to cause any significant impact on vegetation communities or critical habitats.

4.5 TERRESTRIAL FAUNA

4.5.1 Baseline Data

Previous ecological survey work undertaken at the Moolarben Coal Complex, is outlined in Section 4.3.1, and described in detail in the approved complex-wide BMP and the Biodiversity Technical Reports (ELA, 2017; 2020).

Across the Moolarben Coal Complex, a total of 32 threatened and/or migratory fauna species, consisting of seven mammal species (including six microbat species) and 25 bird species have been recorded by Moolarben Biota (2006), Ecovision (2008) and EMGA Mitchell McLennan (2013) at the Moolarben Coal Complex.

Only a subset of the threatened and migratory species recorded at the Moolarben Coal Complex has been recorded within the Longwalls 101-105 Study Area (Table 9 and Attachment 3).

Other threatened species were assessed (i.e. the likelihood of occurrence was assessed) and offset as part of the various impact assessments conducted for Stage 1 and Stage 2 of the Moolarben Coal

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Complex however, the LW101-105 BMP focuses on those species recorded as they are more likely to be encountered during the life of the mine.

Potential cave-dwelling bat roosting sites have been identified across the UG1 Longwalls 101-105 Study Area, including cliffs C5 and C6 (Figure 4a) and minor cliffs. Minor cliffs are located within the mapped steep slopes areas as shown in Figure 4b.

4.5.2 Predicted Subsidence Impacts and Environmental Consequences

As described in Section 4.3.2, ELA (2017 and 2020) considers that the potential effects of subsidence are unlikely to cause any significant impact on vegetation communities or critical habitats.

Direct mortality of a small number of individual animals may occur as a result of subsidence induced rock fall or collapse, however the impacts of such events are expected to be short-term, localised and not significant (ELA, 2017; 2020). It is also predicted that the nature and extent of habitat for cave roosting bats is not likely to be significantly altered as a result of the proposed extraction in a way that would jeopardise these species in the locality (ELA 2020).

Table 9: Threatened and Migratory Fauna Species Recorded in the immediate vicinity of Longwalls 101-105

Common Name ¹	Scientific Name	Conservation Status ¹	
		BC Status	EPBC Status
Square-tailed Kite	<i>Lophoictinia isura</i>	V	-
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	V	-
Gang-Gang Cockatoo	<i>Callocephalon fimbriatum</i>	V	-
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V	-
Speckled Warbler	<i>Chthonicola sagittata</i>	V	-
Black-chinned Honeyeater (eastern subspecies)	<i>Meliphreptus gularis gularis</i>	V	-
Painted Honeyeater	<i>Grantiella picta</i>	V	V ²
Diamond Firetail	<i>Stagonopleura guttata</i>	V	-
Varied Sittella	<i>Daphoenositta chrysoptera</i>	V	-
Hooded Robin (south-eastern form)	<i>Melanodryas cucullata cucullata</i>	V	-
Little Pied Bat	<i>Chalinolobus picatus</i>	V	-
Large Bent-winged Bat	<i>Miniopterus schreibersii oceanensis</i>	V	-

Source: Moolarben Biota (2006); Ecovision (2008), EMGA Mitchell McLennan (2013 and ELA (2020).

V = vulnerable; M = migratory.

¹ Conservation status under the BC Act and the EPBC Act (current as at March 2020).

² Species listed as Vulnerable under the EPBC Act in June 2015.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

4.6 AQUATIC FAUNA

Most of the creeks and drainages in the Moolarben Coal Complex area are ephemeral or intermittent. Literature reviews and aquatic ecology studies undertaken at the Moolarben Coal Complex indicate that there are no threatened aquatic plants, fish or macroinvertebrate species or populations (as listed under EPBC Act or under the NSW *Fisheries Management Act, 1994*) listed or found in the upper Goulburn River (Ecovision, 2008).

4.7 GROUNDWATER DEPENDENT ECOSYSTEMS

There are two types of Groundwater Dependent Ecosystem (GDEs): ecosystems that are dependent in whole or in part on water reserves held in the ground; and those dependent on the surface expression of groundwater (Eamus *et al.*, 2006).

'The Drip', on the Goulburn River north of UG4, represents the only significant seep/spring GDE within the locality, with native vegetation reliant on this surface expression of water evident within the cliff line of 'The Drip'. No impacts from the Moolarben Coal Complex are expected on this GDE (Wells Environmental Services, 2006).

Other GDEs throughout the Moolarben Coal Complex include springs and groundwater seeps in creek valleys that support a variety of non-threatened plant species. A subset of other vegetation is also thought to be linked to local aquifers, and as such could be classified as a GDE. Similarly, evidence of shallow water tables (pools and soaks) along the Murragamba, Eastern and Wilpinjong creeks likely support riparian tree cover (Wells Environmental Services & Coffey Natural Systems, 2009).

No GDEs have been identified in the Longwalls 101-105 Study Area.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

5.0 PERFORMANCE MEASURES AND PERFORMANCE INDICATORS

This LW101-105 BMP has been developed to manage the potential environmental consequences of the secondary extraction of Longwalls 101-105 on biodiversity in accordance with Condition 5(i), Schedule 4 of Project Approval (08_0135) (as modified). In accordance with Condition 1, Schedule 4 of Project Approval (08_0135) (as modified), MCO must ensure that there is no exceedance of the subsidence impact performance measures listed in Table 18 of Condition 1, Schedule 4 and Table 19 of Condition 3, Schedule 4 of Project Approval (08_0135) (as modified). Subsidence impact performance measures relevant to biodiversity in the Longwalls 101-105 Study Area are listed in Table 10.

Table 10: Biodiversity Subsidence Impact Performance Measure

Feature	Subsidence Impact Performance Measure
Threatened species, threatened populations, or endangered ecological communities	Negligible subsidence impacts or environmental consequences

Source: Table 18 of Condition 1, Schedule 4 of Project Approval (08_0135).

Notes:

- MCO is required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this approval.
- Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.
- Negligible is defined by Project Approval (08_0135) as “*small and unimportant, such as to be not worth considering*”.

The subsidence impact performance measure ‘*negligible subsidence impacts or environmental consequences*’ for threatened species, threatened populations or EECs was considered by ELA (2017; 2020) to be achievable when considering that the effect of subsidence is unlikely to cause any significant impact on vegetation communities or critical habitats, consistent with the predicted impacts for the Approved Layout.

Section 6 describes the monitoring that will be conducted to assess the UG1 Underground Mine against the relevant subsidence impact performance measures.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

6.0 MONITORING

The objective of biodiversity monitoring is to evaluate the vegetation and fauna habitat condition at the Moolarben Coal Complex (including recovery and or enhancement of native vegetation) and to identify appropriate management actions to be applied, where required. Sections 8.1, 8.2, 8.3 and 8.4 of the approved complex-wide BMP describe monitoring of noxious and environmental weeds, vertebrate pests, access and rehabilitation, respectively.

6.1 SUBSIDENCE PARAMETERS

Subsidence parameters will be measured in accordance with the UG1 Longwalls 101-105 Subsidence Monitoring Program (LW101-105 SMP).

In summary, 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.

6.2 SUBSIDENCE IMPACTS

A monitoring program has been developed based on recommendations from ELA (2017; 2020) to monitor the impacts of the secondary extraction of Longwalls 101-105 on aquatic and terrestrial flora and fauna (and, in particular, threatened species, threatened populations and EECs). The monitoring is based on baseline monitoring prior to mining and for two years following longwall mining beneath the monitoring location. Key components of the monitoring program are summarised in Table 11.

Table 11: Biodiversity Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Pre-mining			
UG1 subsidence monitoring lines as described in the LW101-105 SMP.	Ground survey – baseline, as described in the LW101-105 SMP.	Prior to commencement of Longwall extraction.	Underground Technical Manager / Registered Mine Surveyor
Longwall panel traverses.	Baseline condition (e.g. surface cracking, ponding, tree health, weed incursion and/or infestation, flora and fauna habitats) and any observations of terrestrial fauna. Where a threatened flora species or EEC is identified, its baseline extent and condition within the traverse will be recorded.	During spring, prior to longwall extraction beneath the transect.	Environmental and Community Manager / Specialist

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Table 11 (Continued): Biodiversity Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
Pre-mining (continued)			
Floristic monitoring sites.	Baseline data collection at each site, including: <ul style="list-style-type: none"> • Canopy health and defoliation. • Vegetation structure. • Nature and extent of any impacts on flora and fauna habitats. • Evidence of any impacts on terrestrial fauna. • Condition and extent of threatened flora species or EECs within the monitoring site (if present). 	During spring, prior to longwall extraction beneath the monitoring site.	Environmental and Community Manager / Specialist
Targeted cliff line monitoring.	Baseline survey of habitat features that provide potential bat roosting sites in the Longwalls 101-105 Study Area (i.e. cliffs and minor cliffs).	Prior to commencement of longwall extraction beneath the potential roosting site.	Environmental and Community Manager / Specialist
During and After Mining			
UG1 subsidence monitoring lines as described in the LW101-105 SMP.	Ground survey, as described in the LW101-105 SMP.	Within three months of completion of extraction of each of Longwall panel.	Underground Technical Manager / Registered Mine Surveyor
Longwall panel traverses.	Any evidence of subsidence impacts compared to baseline condition (e.g. surface cracking, ponding, deterioration in tree health outside natural variation, weed incursion and/or infestation). Nature and extent of any impacts on flora and fauna habitats and evidence of any impacts on terrestrial fauna. The extent and condition of identified threatened flora species or EECs will be recorded and compared to the baseline condition.	During spring, for two years following longwall extraction beneath the transect.	Environmental and Community Manager / Specialist
Floristic monitoring sites.	Data collected at each site, including: <ul style="list-style-type: none"> • Canopy health and defoliation. • Vegetation structure. • Nature and extent of any impacts on flora and fauna habitats. • Evidence of any impacts on terrestrial fauna. • Condition and extent of threatened species or EECs (if present). 	During spring, for two years following longwall extraction beneath the monitoring site.	Environmental and Community Manager / Specialist

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Table 11 (Continued): Biodiversity Monitoring Program Overview

Monitoring Component	Parameter	Timing/Frequency	Responsibility
<i>During and After Mining</i>			
Targeted cliff line monitoring.	Any evidence of subsidence impacts to features that provide potential bat roosting sites compared to baseline condition (e.g. rockfalls, displacement of or dislodgement of boulders or slabs, or fracturing).	Between October and February after completion of longwall extraction.	Environmental and Community Manager / Specialist

The monitoring results will be:

- Used to assess the potential environmental consequences of an observed subsidence impact (Section 6.3).
- Used to identify appropriate management measures, where relevant (Section 7).
- Used to assess compliance with the subsidence impact performance measure (Section 5).

In the event monitoring identifies any subsidence related impacts on aquatic or terrestrial flora and fauna, the relevant details will be recorded in the Subsidence Impact Register (Attachment 1) and reported in accordance with Project Approval (08_0135) (Section 9).

More detailed information regarding monitoring methods is provided in Sections 6.2.1 to 6.2.3 below.

6.2.1 Longwall Panel Traverse

A series of transects will be established across the width of each longwall and have been indicatively positioned to intersect with the identified EECs (as illustrated in Figure 4). Each transect will be traversed to identify any subsidence related impacts. Key triggers to undertake more detailed monitoring include:

- areas of cracking or ponding that exceed predictions in the subsidence predictions and assessments of the impacts relating to the predicted subsidence above Longwalls 101-105;
 - declining trend in canopy health or vegetation structure inconsistent with seasonal trends at analogue sites;
 - deterioration in tree health outside natural variations (analogue sites to be used as a guide);
 - areas of weed incursion and/or infestation; and
- mortality of more than a small number of threatened flora or fauna species attributed to subsidence impacts.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Opportunistic observations of subsidence impacts (e.g. surface cracking and ponding, deterioration of tree health and weed incursion and/or infestation) will be recorded during routine works conducted by MCO and its contractors. Where relevant, observations of subsidence impacts will include detailed measurement and photographic record of the impact for comparison with baseline records.

6.2.2 Floristic Monitoring Sites

Fourteen floristic monitoring sites (total, not per transect) will be established at random locations along the longwall transects, with a minimum distance of 50 m between each site, and, where relevant, will be positioned proximal to any observed threatened species (e.g. Scant Pomaderris) and/or within the EECs (i.e. *White Box*, *Yellow Box*, *Blakely's Red Gum Grassy Woodland* and *Derived Native Grassland* and *Central Hunter Grey Box – Ironbark Woodland in the NSW North Coast and Sydney Basin Bioregions*). Notwithstanding, in the event Scant Pomaderris is not identified along the longwall transects, visual monitoring of representative Scant Pomaderris individuals would be undertaken following completion of each longwall. Each site will be marked with a metal star picket.

Data collected at each floristic monitoring site will include (ELA, 2017; 2020):

- Canopy health and defoliation (all in 5% increments):
 - percentage of epicormic foliage in relation to total tree foliage;
 - proportion of primary branches within canopy that have died back;
 - percentage of current canopy foliage as a proportion of the estimated canopy foliage volume/potential canopy; and
 - percentage of canopy foliage discoloured.
- Plot vegetation:
 - projected foliage cover (PFC) (PFC – 1 to 5%, then 5% increments) of native grass/ground cover; native shrubs less than 1 m height, native shrubs/small trees greater than 1 m height;
 - PFC (5% increments) of upper canopy (assessed at each quadrat corner and averaged);
 - Dominant species at the upper, mid and ground strata, and PFC of each species.
- Vegetation structure:
 - exotic species;
 - number of stags, estimated time since cause of death;
 - lower, estimated median and upper height of canopy (m);
 - lower, estimated median and upper diameter at breast height over bark of canopy stems (centimetres);

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

- abundance of each canopy species (identified to species level); calculated, total stems per in the transect.
- Photograph of the canopy (camera placed on top of the star picket, facing up); photograph facing due north, south, east and west from the star picket and a general photograph taken from the plot along each transect.

In the event monitoring identifies subsidence related impacts greater than predicted to threatened flora, fauna or EECs, MCO will investigate the implementation of additional monitoring or appropriate management measures (Section 7). Potential subsidence related impacts include:

- areas of cracking or ponding that exceed predictions in the subsidence predictions and assessments of the impacts relating to the predicted subsidence above Longwalls 101-105;
- declining trend in canopy health or vegetation structure inconsistent with seasonal trends at analogue sites;
- deterioration in tree health outside natural variations (analogue sites to be used as a guide);
- areas of weed incursion and/or infestation; or
- mortality of more than a small number of threatened flora or fauna species attributed to subsidence impacts.

6.2.3 Terrestrial Fauna and Habitat

Terrestrial fauna and habitat monitoring will be conducted following review of the results of the flora/vegetation monitoring, if subsidence-related impacts greater than predicted are observed. Opportunistic recording of fauna species will also be undertaken during the traverses of the longwall transects.

If required, terrestrial fauna and habitat monitoring will be used to assess the environmental consequences of subsidence-related impacts, including the nature and extent of impacts on flora and fauna habitats and evidence of impacts on terrestrial fauna.

Review of the cliff line monitoring data will be undertaken in accordance with Table 10 and the Subsidence Monitoring Program, particularly in relation to any potential roosting sites for cave-dwelling bats (including the Large-eared Pied Bat). In the event that impacts are considered likely to occur, or are identified as having occurred, inspection of any potential roosting sites for the Large-eared Pied Bat will be undertaken to document any potential impacts.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

6.3 ENVIRONMENTAL CONSEQUENCES

MCO will compare the results of the subsidence impact monitoring against the biodiversity performance measure and indicators (Section 5). In the event that any observed subsidence impacts exceed a performance indicator, additional monitoring and assessment will be undertaken (Section 7). In the event that any observed subsidence impacts exceed the performance measure, MCO will assess the consequences of the exceedance in accordance with the Contingency Plan described in Section 8 and Trigger Action Response Plan (TARP) developed for threatened flora (including EECs) and fauna species in Attachment 2.

7.0 MANAGEMENT MEASURES

Biodiversity management at the Moolarben Coal Complex is currently undertaken in accordance with the approved complex-wide BMP. Section 6.0 of the approved complex-wide BMP details strategies to manage vegetation onsite and improve vegetation connectivity, and Section 7.0 of the approved complex-wide BMP describes specific biodiversity management measures.

In addition to the management measures detailed in Sections 6.0 and 7.0 of the approved complex-wide BMP, ELA (2017; 2020) has recommended a number of management measures that will be implemented, where appropriate in the Longwalls 101-105 Study Area. Management measures have been recommended for vegetation, terrestrial fauna and habitat, weed management and additional monitoring, and are summarised in Table 12.

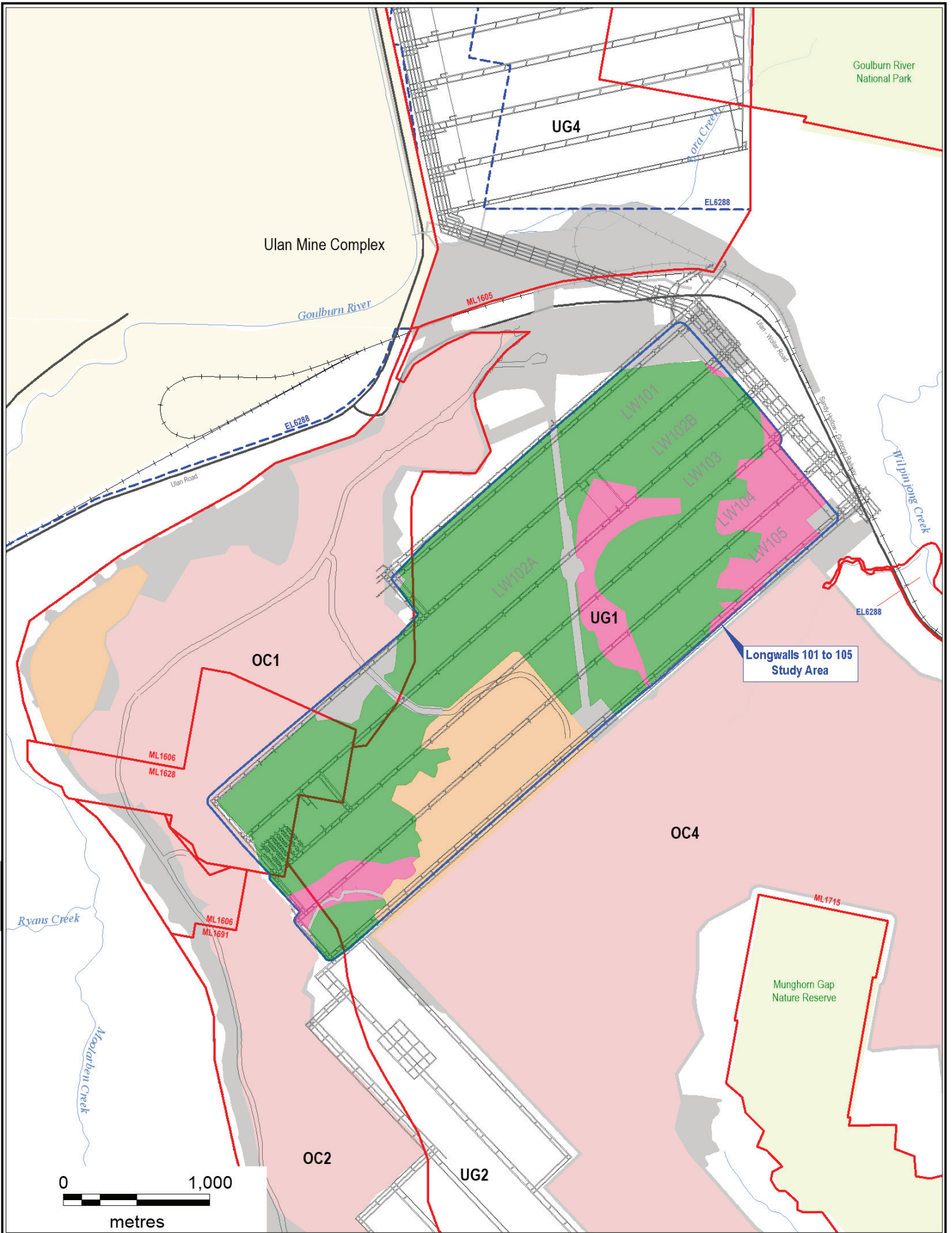
Table 12: Potential Management Measures

Potential Management Measures	
Measure	Description
Vegetation management	<ul style="list-style-type: none"> Planting of endemic plant species if remediation works are required. Vegetation planting should use flora species characteristic of the particular vegetation community in that area. Any vegetation clearance required during the extraction of Longwalls 101-105 (e.g. for subsidence monitoring and remediation activities) must be conducted in accordance with the Vegetation Clearance Protocol (as described in section 4.0 of the approved complex-wide BMP and summarised in Section 7.1). Rehabilitation of disturbed areas would be undertaken in accordance with the requirements of the approved complex-wide Rehabilitation Management Plan. As described in section 6.0 of the approved complex-wide BMP, vegetation management zones have been developed for areas within the Stage 1 and Stage 2 Project Boundaries. Onsite vegetation management zones in the vicinity of UG1 are shown on Figure 6 and are based on existing vegetation and habitat condition, and final land use objectives. A detailed description of the management strategy to be applied to each zone is provided in the approved complex-wide BMP, and a summary is provided in Section 7.2.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Terrestrial fauna and habitat management	<ul style="list-style-type: none">• Implementation of management measures will be considered with regard to the specific circumstances of the subsidence impact and environmental consequence occurring as a result.
Weed management	<ul style="list-style-type: none">• Implementation of weed control measures to limit the spread of noxious and environmental weeds (if identified within the Longwalls 101-105 Study Area) in accordance with section 7.3 of the approved complex-wide BMP. Weed management measures will prioritise noxious weeds initially.
Additional monitoring	<ul style="list-style-type: none">• Where a predicted subsidence impact has been exceeded, it may be appropriate to conduct additional monitoring (e.g. increase the frequency of monitoring or the parameters monitored) or conduct additional test work.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal



Legend Exploration Licence Boundary Mining Lease Boundary Longwalls 101 to 105 Study Area Haul Road Rail Line Watercourse		Existing / Approved Development Open Cut Mining Area Underground Workings Out-of-Pit Emplacement Surface Infrastructure		Vegetation Management Zones Zone 1 Zone 2 <small>Note: Vegetation Management Zones are generalised mapping areas and include approved disturbance works, e.g. ancillary infrastructure. Infrastructure easements not shown.</small>		 N	 YANCOAL 安煤澳洲有限公司 MOOLARBEN COAL
--	--	--	--	---	--	-------	---

Figure 6
Vegetation Management Zones

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.

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 and consideration of vegetation that would potentially be disturbed (e.g. avoidance of unnecessary disturbance of mapped EECs or previously recorded threatened flora species).
- Potential impacts of remediation work, including determining whether remediation work will create no greater impact than the subsidence impact itself as part of the Vegetation Clearance Protocol.

7.1 VEGETATION CLEARANCE PROTOCOL

A VCP has been developed and implemented by MCO to minimise impacts on threatened species during native vegetation clearing at the Moolarben Coal Complex. The VCP was developed in consideration of the Roads and Traffic Authority (2011) guideline titled *Biodiversity Guidelines – Protecting and Managing Biodiversity on RTA Projects*. Key components of the VCP include:

- Delineation of areas to be cleared.
- Pre-clearing procedure, including:
 - Ground Disturbance Permit;
 - pre-clearance surveys;
 - management of key habitat features; and
 - identification of suitable release locations.
- Clearing procedure and management strategies, including:
 - timing considerations;
 - general vegetation clearance/management strategies;
 - detailed fauna management strategies; and

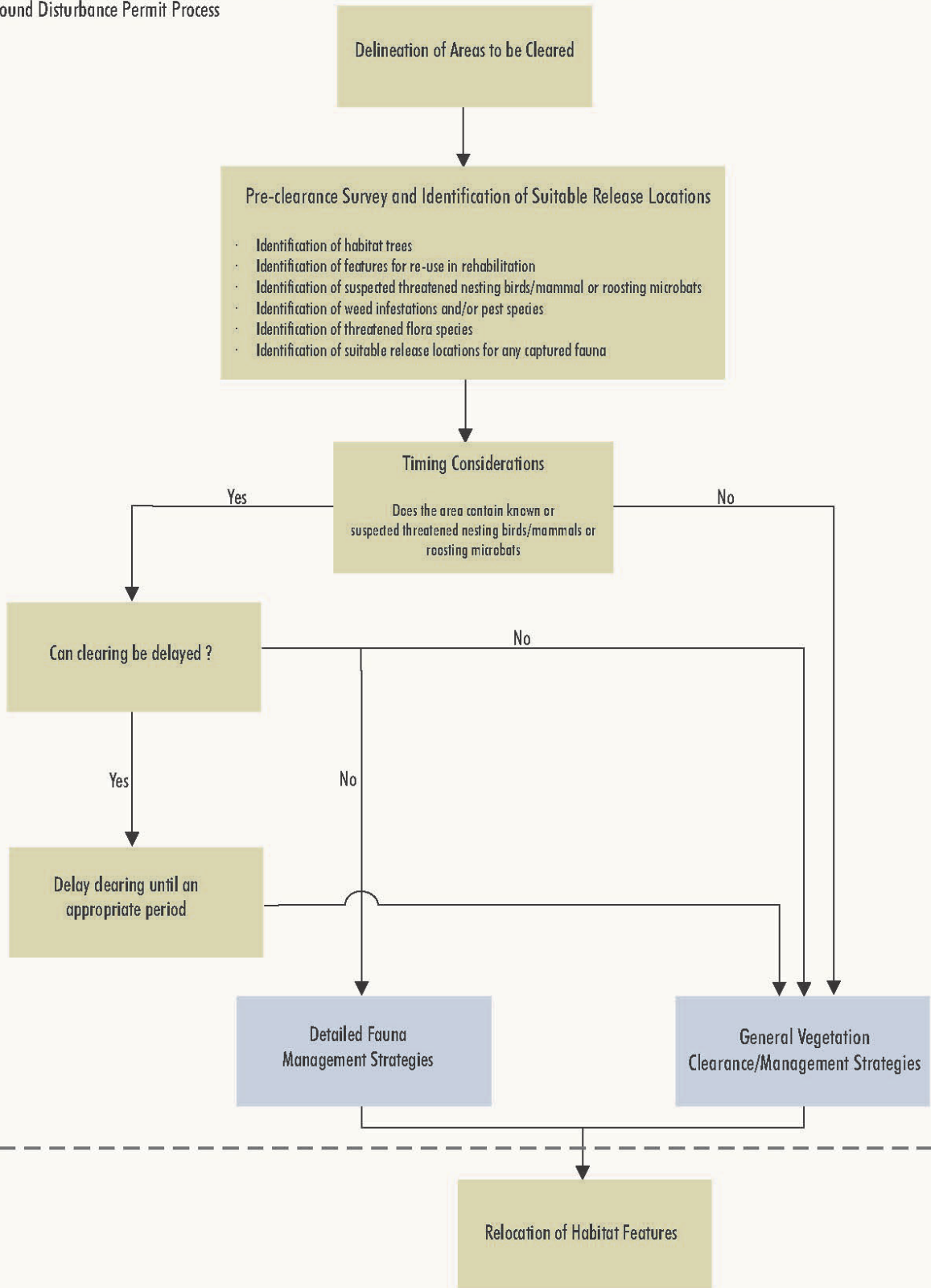
Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

- relocation of habitat features.

A flow diagram showing a graphical representation of the VCP is provided on Figure 7 and a detailed summary of the above components is provided in the approved complex-wide BMP.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Ground Disturbance Permit Process



7.2 VEGETATION MANAGEMENT ZONES

Vegetation management zones have been developed for areas within the Stage 1 and Stage 2 Project Boundaries that are outside of approved major surface disturbance areas, biodiversity offset areas, Aboriginal heritage management areas and areas outside the control of MCO (e.g. Dronvisa Quarry, Ulan Coal Mines Limited land or tenements, linear infrastructure and other easements, Crown land and land leased for agricultural purposes). These onsite vegetation management zones are shown on Figure 6 and are based on existing vegetation and habitat condition, and final land use objectives.

Various activities associated with the Moolarben Coal Complex are approved to occur within these zones (e.g. ancillary infrastructure, monitoring and underground mining) however the precise location of these works is not known. Therefore, the management zone mapping is to be used as a guide to assist management planning/implementation and not as a boundary of disturbance versus no disturbance.

Vegetation Management Zone 1 – Forest/Woodland

The primary management objective of this zone is to maintain vegetation structure and species diversity. Management actions to be implemented in this zone include:

- Control of stock and grazing to promote understorey recovery and reduce competition for food with native fauna species. (Note controlled/crash grazing may be required for weed control or hazard reduction purposes).
- Management of human access and disturbance including installation of fencing, gates and signage (where required) to prevent unauthorised entry/use.
- Stabilising and remediating eroding areas (where required).
- Retaining dead timber (i.e. prevent fire wood collection).
- Targeted control of noxious and environmental weeds (where required).
- Targeted control of feral animals including foxes, rabbits, goats, wild dogs and pigs.

Further detail is provided in sections 7.0, 8.0 and 10.0 of the approved complex-wide BMP.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Vegetation Management Zone 2 – Grassland/Regenerating Woodland

Management Zone 2 requires implementation of management actions to enable natural or assisted regeneration of previously cleared woodland in areas to improve native species richness and structural diversity (albeit excluding areas to be retained for future agricultural production). Management actions to be implemented in this zone include:

- Control of stock and grazing to promote understorey recovery and reduce competition for food with native fauna species. (Note use of controlled/crash grazing may be required for weed control or hazard reduction purposes).
- Weed control.
- Vertebrate Pest control (i.e. targeted control of foxes, rabbits, goats, feral cats, wild dogs and pigs).
- Access control (to prevent unauthorised entry/use).
- Direct seeding and revegetation with tube stock planting to assist regeneration where required.

Seeding and revegetation of these areas will be undertaken generally according to the measures described in section 5.0 of the approved complex-wide BMP and the Moolarben Coal Complex Rehabilitation Management Plan.

Further detail is provided in sections 7.0, 8.0 and 10.0 of the approved complex-wide BMP.

Vegetation Management Zone 3 – Land Subject to Agricultural License

No areas mapped as Vegetation Management Zone 3 are within the vicinity of Longwalls 101 to 105 (Figure 6).

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

8.0 CONTINGENCY PLAN

In the event a subsidence impact performance measure relevant to aquatic and terrestrial flora and fauna (Table 10) is considered to have been exceeded or is likely to be exceeded, MCO will implement the Contingency Plan detailed in section 11.0 of the approved complex-wide BMP. Section 11.0 of the approved complex-wide BMP states:

In the event a performance measure detailed in Section 10 has not been met or is considered to have been exceeded, MCO will implement the following Contingency Plan:

- *The Environment and Community Manager will report the exceedance to the General Manager within 24 hours of assessment completion.*
- *MCO will report the exceedance of the performance measure to the DPIE and DPIE Biodiversity Conservation Division as soon as practicable after MCO becomes aware of the exceedance.*
- *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, identification of proposed contingency measure(s) and a program to review the effectiveness of the contingency measures. Contingency measures will be developed in consideration of the specific circumstances of the exceedance and the assessment of environmental consequences.*
- *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.*
- *MCO will report the exceedance of the performance measure and the success of the approved course of action as a component of the Annual Review (Section 13).*

Examples of contingency measures/controls that relate to the subsidence performance measure listed in Section 10 include:

- *Subsidence monitoring provides timely provision of data relating to impact of subsidence.*
- *Contingency budgetary allocation for remedial works associated with subsidence.*
- *Filling of minor cracks with appropriate material (e.g. soil or mulch) to avoid the creation of drainage channels.*
- *Re-grading of isolated depressions or highpoints and revegetation.*
- *Revegetation and monitoring.*
- *Additional monitoring.*

As described in Section 10, relevant Extraction Plans for underground mining operations or subsequent revisions of this plan will describe in further detail how the subsidence related performance measure listed in Table 3 will be met.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

8.1 TRIGGER ACTION RESPONSE PLAN

The framework for the various components of this LW101-105 BMP are summarised in the TARPs shown in Attachment 2. The TARPs illustrate how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements, and the framework for management and contingency actions.

The TARP system provides a simple and transparent snapshot of the monitoring of environmental performance and the implementation of management and/or contingency measures.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

9.0 REVIEW AND IMPROVEMENT OF ENVIRONMENTAL PERFORMANCE

9.1 ANNUAL REVIEW

In accordance with Condition 4, Schedule 6 of Project Approval (08_0135), MCO will conduct an annual review of operations conducted at the Moolarben Coal Complex (including the performance of this LW101-105 BMP) prior to 31 March for the preceding calendar year.

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 6 of Project Approval (08_0135), the Annual Review will be made available on the MCO website.

As described in Section 2, this LW101-105 BMP 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.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

9.2 AUDITS

In accordance with Condition 9, Schedule 6 of Project Approval (08_0135), an independent environmental audit was conducted in 2018, and will be undertaken every three years thereafter. A copy of the independent environmental audit report will be submitted to the Secretary of the DPIE and made publicly 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 (08_0135), and any other relevant approvals, and recommend measures or actions to improve the environmental performance of the Project.

As described in Section 2, this LW101-105 BMP 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.

9.3 FUTURE EXTRACTION PLANS

In accordance with Condition 5(p), Schedule 4 of Project Approval (08_0135), MCO will collect baseline data for future Extraction Plans (e.g. for the next Underground Mine).

Consideration of environmental performance and management measures, in accordance with the review(s) conducted as part of this LW101-105 BMP, will inform the appropriate type and frequency of monitoring and management/mitigation for future Extraction Plans.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

10.0 INCIDENTS

An incident is defined in Project Approval (08_0135) 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 (08_0135).

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 6 of Project Approval (08_0135).

MCO will notify the Secretary of DPIE and any other relevant agencies of any incident associated with the UG1 Underground Mine 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 UG1, MCO will notify the Secretary and any other relevant agencies as soon as practicable after becoming 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. 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.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

11.0 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 6 of Project Approval (08_0135), the complaints register will be updated monthly and made available on the MCO website.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

12.0 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 10, 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 (08_0135), mining leases and all other approvals and licenses 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 in 2018, and will be undertaken every three years thereafter. A copy of the independent environmental audit report will be submitted to the Secretary of the DPIE and made publicly available on the MCO website.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

13.0 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.

Eamus, D., Froend, R., Loomes, R., Hosea, G., and Murray, B. (2006) A functional methodology for determining the groundwater regime needed to maintain the health of groundwater-dependent vegetation. *Australian Journal of Botany*, 54, 97–114.

Eco Logical Australia Pty Ltd (2015a) *Moolarben Coal Complex – UG1 Optimisation Modification Flora and Fauna Impact Assessment*, Appendix E in Moolarben Coal Operations Pty Ltd (2015) *Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment*.

Eco Logical Australia Pty Ltd (2015b) *MCO OC4 South-West Modification Flora and Fauna Impact Assessment*, Appendix C in Moolarben Coal Operations Pty Ltd (2015) *Moolarben Coal Complex OC4 South-West Modification Environmental Assessment*.

Eco Logical Australia Pty Ltd (2016) *Moolarben Coal UG1 Vegetation Validation*.

Eco Logical Australia Pty Ltd (2017) *Biodiversity Technical Report – UG1 Extraction Plan*. Prepared for Moolarben Coal Operations.

Eco Logical Australia Pty Ltd (2020) *MCO UG1 Longwalls 104-105 Vegetation Validation*. Prepared for Moolarben Coal Operations.

Ecovision Consulting (2008) *Ecological Impact Assessment*, Appendix 7 in Moolarben Coal Mines Pty Limited (2009) *Moolarben Coal Project Stage 2 Environmental Assessment Report*.

EMGA Mitchell McLennan (2013) *Ecology Assessment*, Appendix E in EMGA Mitchell McLennan (2013) *Moolarben Coal Project – Stage 1 Optimisation Modification*.

Mine Advice (2019), *SUBJECT: Geotechnical Evaluation of Proposed Taking of Unsupported Plunges in LW103A Block*

Mine Subsidence Engineering Consultants (2015) *Subsidence Assessment (MSEC Report MSEC731 Revision A, June 2015)*, Appendix A in Moolarben Coal Operations Pty Ltd (2015) *Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment*.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Mine Subsidence Engineering Consultants (2017) *Moolarben Coal Complex: Moolarben Project Stage 2 – Longwalls 101 to 103 – Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Extraction Plan*. Report number MSEC867.

Mine Subsidence Engineering Consultants (2019) *Modified Commencing End of LW103 and Proposed 103A Workings* Report number MSEC103.

Mine Subsidence Engineering Consultants (2020) *Moolarben Project Stage 2 – Longwalls 101 to 105. Subsidence Predictions and Impact Assessments for the Natural and Built Features in Support of the Extraction Plan*.

Moolarben Biota (2006) *Flora, Fauna and Aquatic Ecology Assessment*, Appendix 11 in Wells Environmental Services (2006) *Moolarben Coal Project Environmental Assessment Report*. Prepared for Moolarben Coal Mines Pty Limited.

Moolarben Coal Operations Pty Ltd (2009) *Moolarben Coal Project – Stage 2 Environmental Assessment*.

Moolarben Coal Operations Pty Ltd (2017) *Moolarben Coal Complex Annual Review – 2017*

Moolarben Coal Operations Pty Ltd (2018) *Moolarben Coal Complex Annual Review – 2018*

Threatened Species Scientific Committee (2006) *Commonwealth Listing Advice on Goodenia macbarronii*. In effect under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* from 15 December 2006.

Wells Environmental Services (2006) *Moolarben Coal Project Environmental Assessment Report*.

Wells Environmental Services & Coffey Natural Systems (2009) *Moolarben Coal Project Stage 2 Environmental Assessment Report*. Moolarben Coal Mines Pty Ltd.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

ATTACHMENT 1

**UG1 LONGWALLS 101 TO 105 BIODIVERSITY MANAGEMENT PLAN
SUBSIDENCE IMPACT REGISTER**

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

UG1 Longwalls 101 to 105 Biodiversity Management Plan – Subsidence Impact Register

Impact Register Number	Impacted Species or Vegetation Community	Impact Description	Does Impact Exceed the Land Performance Measure/Indicators? (Yes/No)	Were Management Measures Implemented? (Yes/No)	Were Management Measures Effective? (Yes/No)

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

ATTACHMENT 2

**UG1 LONGWALLS 101 TO 105 BIODIVERSITY MANAGEMENT PLAN
TRIGGER ACTION RESPONSE PLANS**

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

UG1 Longwalls 101 to 105 Threatened Flora, Fauna and Endangered Ecological Communities TARP

Condition	Normal		Level 1	Level 2
	Baseline Conditions	Predicted Impacts	Implement Management Measures	Restoration/Contingency Phase
Trigger	Record of threatened flora (including Scant Pomaderris [<i>Pomaderris queenslandica</i>]) and endangered ecological communities (EECs) in the Longwalls 101 to 105 Study Area.	Negligible loss of vegetation cover or community structure due to subsidence. No unapproved direct impacts (i.e. clearance). Negligible impact on vegetation communities or critical habitats. Negligible impact to threatened fauna. Direct mortality of a small number of individual flora or fauna may occur as a result of subsidence (e.g. rock fall or collapse).	Monitoring identifies subsidence related impacts to threatened flora, fauna or an EEC, including: <ul style="list-style-type: none"> • areas of cracking or ponding that exceed predictions in the subsidence predictions and assessments of the impacts relating to the predicted subsidence above Longwalls 101-105; • greater than 10% decline, outside of seasonal variations, in estimated canopy foliage (determined after all longwall extraction monitoring is completed) when compared to pre-mining transect baseline results for that longwall panel. • deterioration in tree health, outside of seasonal variation, determined after all longwall extraction monitoring is completed for that longwall panel. • areas of weed incursion and/or infestation; or • mortality of more than a small number of threatened flora or fauna species attributed to subsidence impacts. 	If the subsidence impact performance measure for threatened species, threatened populations or endangered ecological communities (i.e. <i>negligible subsidence impacts or environmental consequences</i>) has been exceeded, or is likely to be exceeded (e.g. greater than negligible impacts or environmental consequences).
Action	Establish floristic monitoring sites and longwall panel traverses and undertake baseline survey to determine condition, as described in Section 6 .	Conduct monitoring of floristic monitoring sites and longwall panel traverses, as described in Section 6 .	Investigate to determine whether the cause of the decline is from MCO mining activity and to recommend an appropriate response action level. Management measures implemented with regard to the specific circumstances of the subsidence impact (e.g. the nature and extent of the impact) and in accordance with Section 7 .	Implement Contingency Plan including notifications as described in Section 8 .

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

Condition	Normal		Level 1	Level 2
	Baseline Conditions	Predicted Impacts	Implement Management Measures	Restoration/Contingency Phase
Frequency	During spring, prior to longwall extraction beneath the monitoring site or transect.	Monitoring frequency consistent with Section 6 .	As required, in accordance with Section 7 .	As required, in accordance with Section 8 .
Position of Decision Making	Environmental and Community Manager.	Environmental and Community Manager.	Environmental and Community Manager and Underground Technical Manager.	Environmental and Community Manager and Underground Technical Manager.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

UG1 Longwalls 101 to 105 Cave-Dwelling Bats TARP

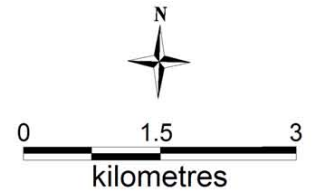
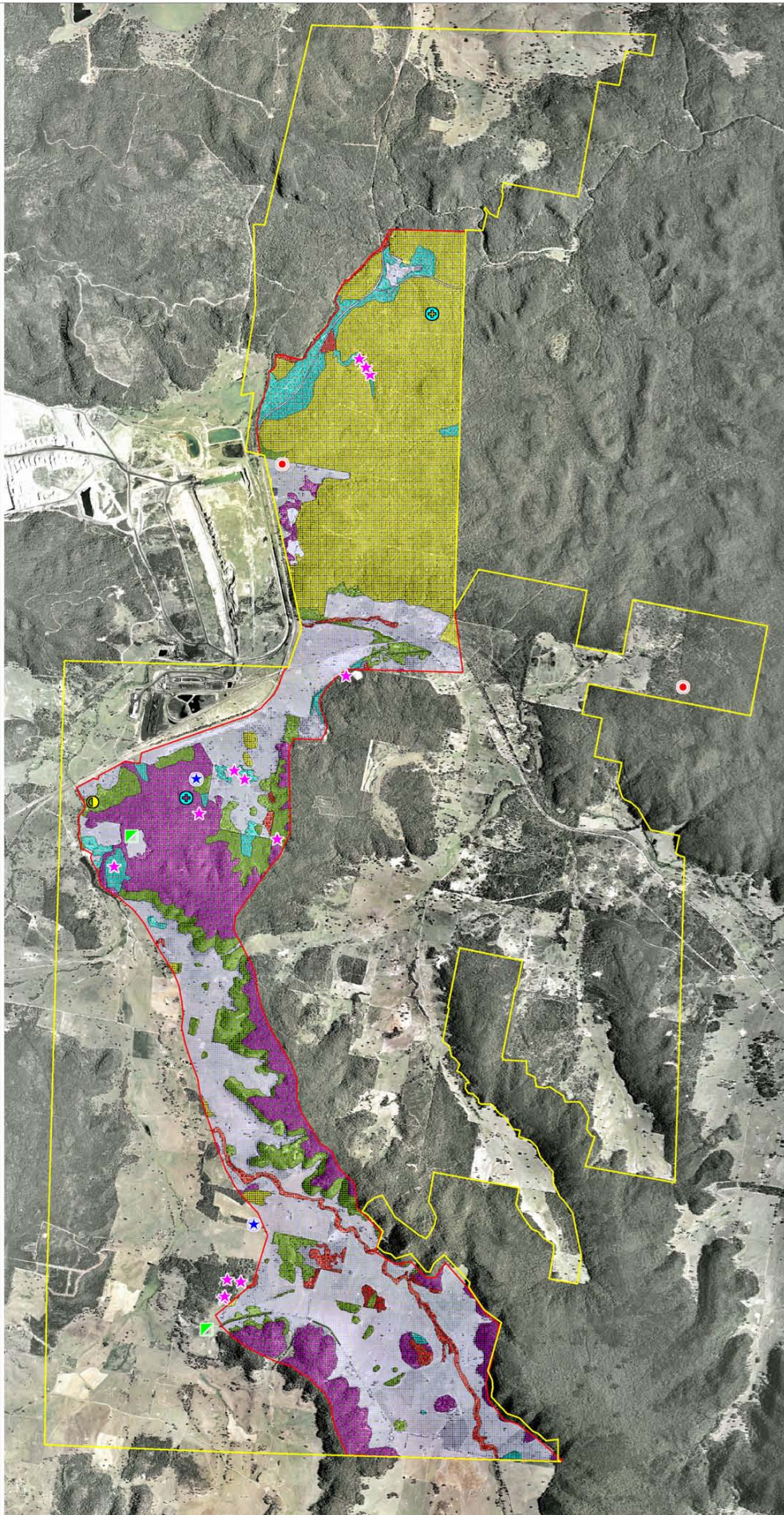
Condition	Normal		Level 1	Level 2
	Baseline Conditions	Predicted Impacts	Implement Management Measures	Restoration/Contingency Phase
Trigger	Potential bat roosting sites in the Longwalls 101 to 105 Study Area associated with cliffs and minor cliffs.	No unapproved direct impacts (i.e. clearance) to habitat. Negligible impact to threatened bat species. Subsidence predicted to impact less than 5% of potential habitat (i.e. cliffs and minor cliffs) across the mining domain. Direct mortality of a small number of individual animals may occur as a result of subsidence induced rock fall or collapse.	Monitoring identifies evidence of impacts (attributable to subsidence) to more than 5% of features across the mining domain that provide potential bat roosting sites in the Longwalls 101 to 105 Study Area (i.e. cliffs and minor cliffs).	If the subsidence impact performance measure for threatened species, threatened populations or endangered ecological communities (i.e. <i>negligible subsidence impacts or environmental consequences</i>) has been exceeded, or is likely to be exceeded (e.g. greater than negligible impacts or environmental consequences).
Action	Baseline survey of features that provide potential bat roosting sites in the Longwalls 101 to 105 Study Area (i.e. cliffs and minor cliffs).	Conduct monitoring, consistent with Section 6 and the UG1 Longwalls 101 to 105 Subsidence Monitoring Program.	Management measures implemented with regard to the specific circumstances of the subsidence impact (e.g. the nature and extent of the impact) and in accordance with Section 7 .	Implement Contingency Plan including notifications as described in Section 8 .
Frequency	Prior to commencement of longwall extraction beneath the area.	Monitoring frequency consistent with Section 6 .	As required, in accordance with Section 7 .	As required, in accordance with Section 8 .
Position of Decision Making	Environmental and Community Manager and Underground Technical Manager.	Environmental and Community Manager and Underground Technical Manager.	Environmental and Community Manager and Underground Technical Manager.	Environmental and Community Manager and Underground Technical Manager.

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal

ATTACHMENT 3

**PREVIOUSLY RECORDED THREATENED SPECIES IN THE VICINITY OF THE
UG1 LONGWALLS 101 TO 105 STUDY AREA
(MOOLARBEN BIOTA, 2006; ECOVISION CONSULTING, 2008;
ECOLOGICAL AUSTRALIA PTY LTD, 2015)**

Document	Version	Issue	Effective	Review	Author	Approved
MCO_UG1_LW101-105_BMP	3	Jun 20	Jun 20	Jun 21	MCO	S. Archinal



Legend

- *Boronia rubiginosa* (ROTAP) (2)
- ⊕ *Pseudanthus divaricatissimus* (ROTAP) (2)
- *Diuris tricolor* (V) (2)
- ★ *Eucalyptus cannonii* (V) (2)
- ★ *Goodenia macbarronii* (V) (13)
- ⊕ *Leucochrysum albicans tricolor* (E) (1)

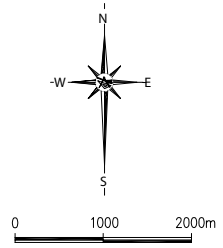
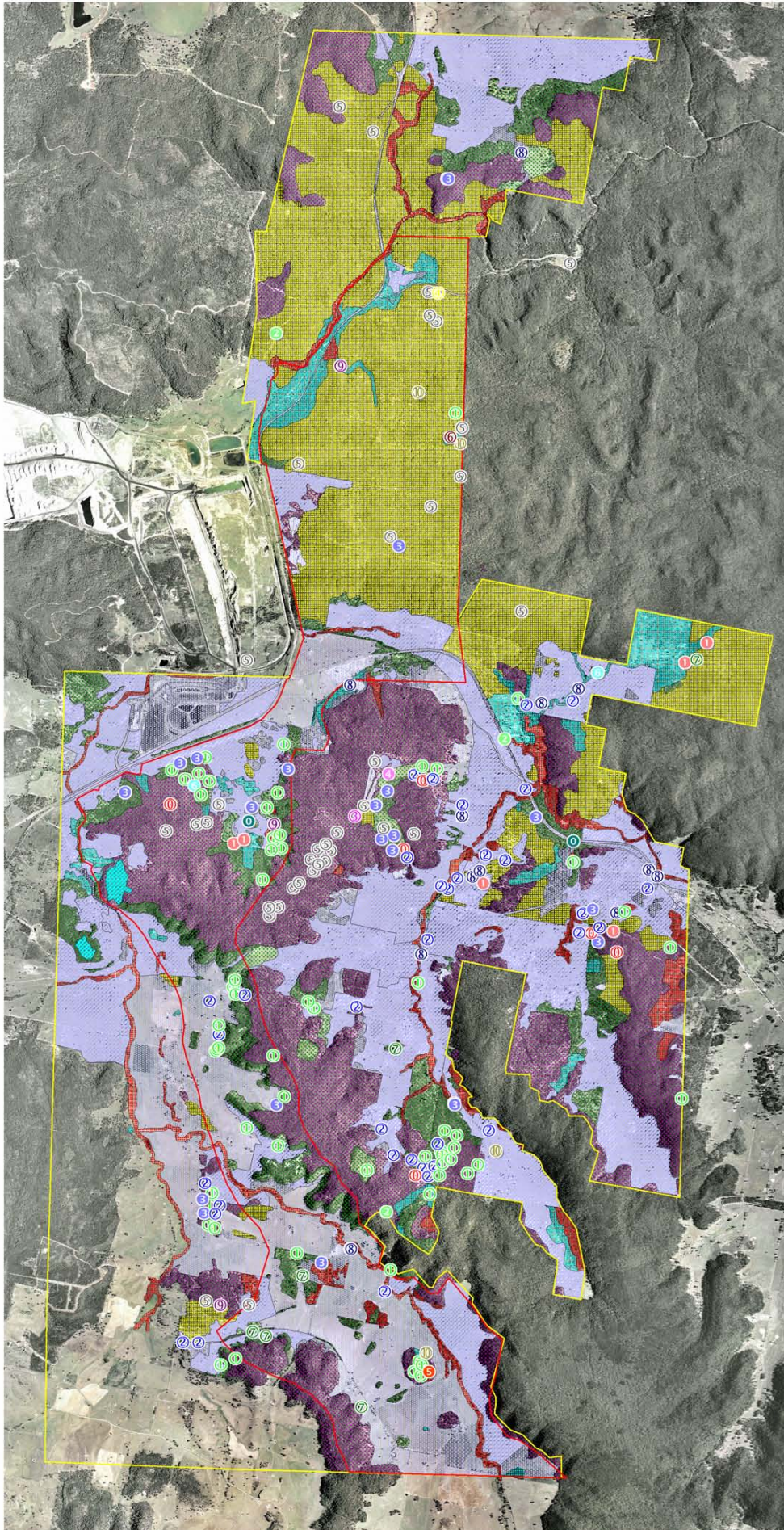
Terrestrial Stratification Units (TSUs)

- 10 Disturbed Vegetation
- 20 Sedimentary Ironbark Forests
- 30 Box Woodlands
- 40 Tablelands Redgum Woodlands
- 50 Sedimentary Scribbly Gum Woodlands
- 60 Alluvial Apple Forests

Other Mapping Features

- EL 6288 (Study Area)
- Development Application Area

(V = Vulnerable, E = Endangered
ROTAP = Rare or Threatened Australian Plants)



Legend

- ① Black-chinned Honeyeater (8)
- ② Brown Treecreeper (76)
- ③ Diamond firetail (52)
- ④ Gang Gang Cockatoo (1)
- ⑤ Gilbert's Whistler (2)
- ⑥ Glossy Black Cockatoo (39)
- ⑦ Greater Longeared Bat (1)
- ⑧ Grey-crowned Babbler (6)
- ⑨ Hooded Robin (26)
- ⑩ Large Bentwing Bat (5)
- ⑪ Large-eared Pied Bat (9)
- ⑫ Little Pied Bat (3)
- ⑬ Painted Honeyeater (6)
- ⑭ Powerful Owl (3)
- ⑮ Speckled Warbler (21)
- ⑯ Square-tailed Kite (1)
- ⑰ Squirrel Glider (1)
- ⑱ Yellow-bellied Sheath-tail Bat (2)

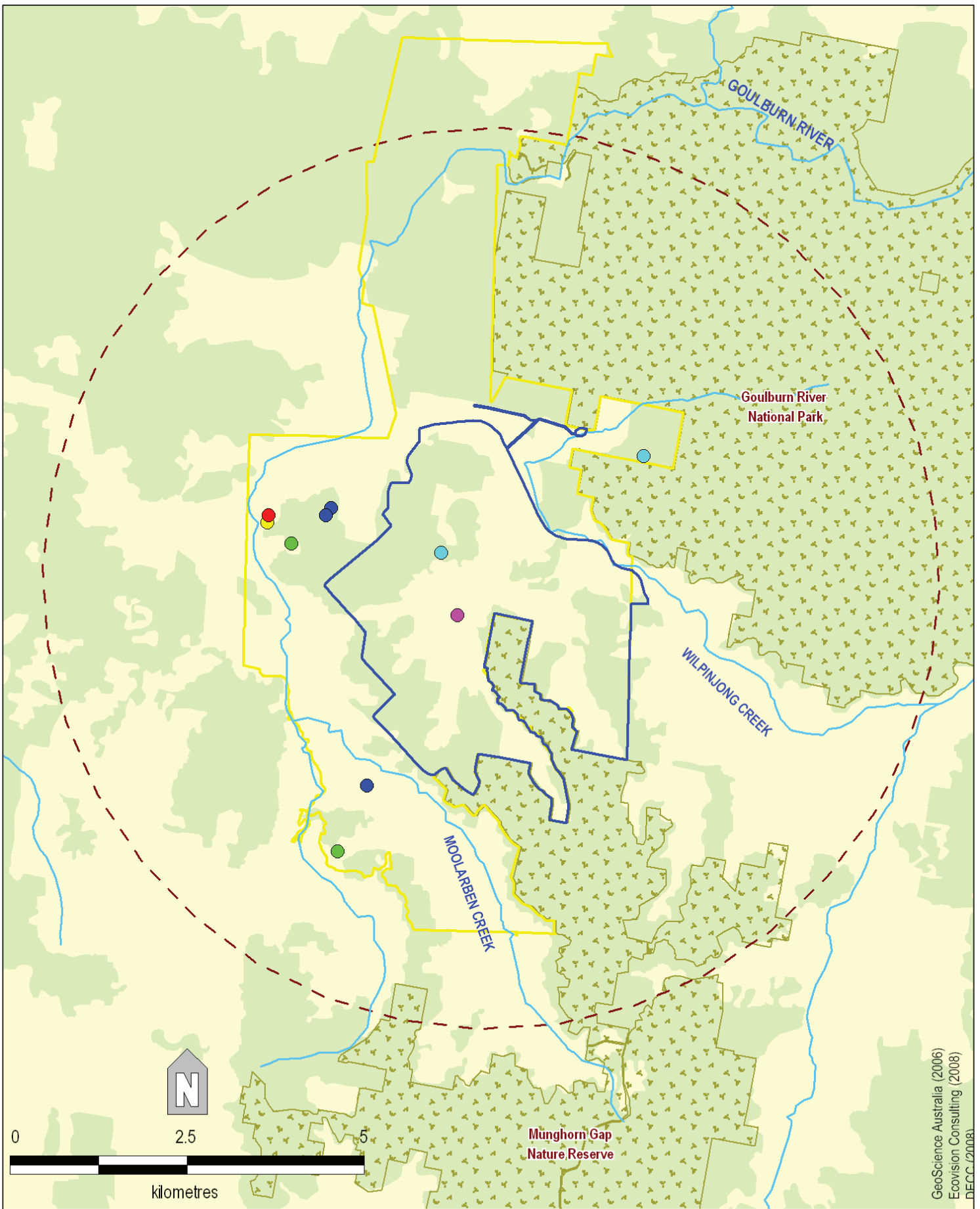
Terrestrial Stratification Units (TSUs)

- 10b Disturbed Vegetation
- 20 Sedimentary Ironbark Forests
- 30 Box Woodlands
- 40b Tablelands Redgum Woodlands
- 50 Sedimentary Scribbly Gum Woodlands
- 60 Alluvial Apple Forests

- 10a Unimproved Ungrazed
- 10a Unimproved Grazed
- 40a Tumbledown Redgum

Other Map Features

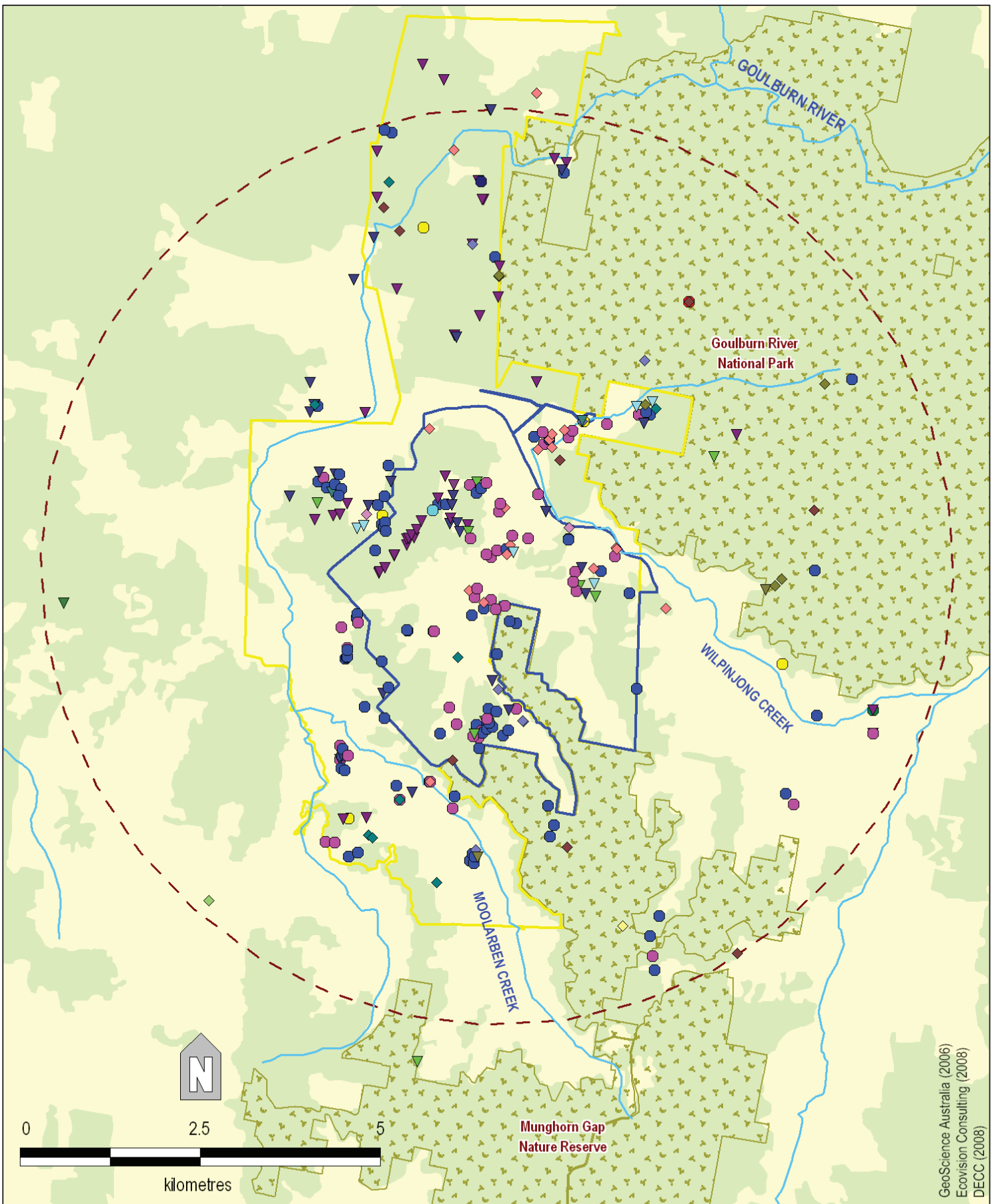
- Development Application Area
- EL 6288 (Study Area)



GeoScience Australia (2006)
 Ecovision Consulting (2008)
 DECC (2008)

Legend

- | | | | |
|-----------------------|----------------------|----------------------------|---|
| Waterways | Native Vegetation | <i>Acacia ausfeldii</i> | <i>Eucalyptus scoparia</i> |
| Study Area | "Treeless" Landcover | <i>Diuris tricolor</i> | <i>Leucochrysum albicans</i> var. <i>tricolor</i> |
| Boundary of EL6288 | 5 km radius | <i>Eucalyptus cannonii</i> | <i>Pomaderris queenslandica</i> |
| Conservation Reserves | | | |



GeoScience Australia (2006)
 Ecovision Consulting (2008)
 DECC (2008)

Legend

- Waterways
- Study Area
- Boundary of EL6288
- Conservation Reserves
- Native Vegetation
- "Treeless" Landcover
- 5km radius

- | | | |
|--|---|--|
| ● Barking Owl | ◆ Greater Longeared Bat | ▼ Glossy Black Cockatoo |
| ● Brown Treecreeper | ◆ Grey-crowned Babbler | ▼ Black-chinned Honeyeater |
| ● Diamond Firetail | ◆ Hooded Robin | ▼ Painted Honeyeater |
| ● Eastern Bentwing Bat | ◆ Koala | ▼ Regent Honeyeater |
| ● Gang Gang Cockatoo | ◆ Large-eared Pied Bat | ▼ Speckled Warbler |
| ● Gang-gang Cockatoo | ◆ Little Pied Bat | ▼ Square-tailed Kite |
| ● Giant Barred Frog | ◆ Masked Owl | ▼ Squirrel Glider |
| ● Gilbert's Whistler | ◆ Powerful Owl | ▼ Yellow-bellied Sheathtail Bat |

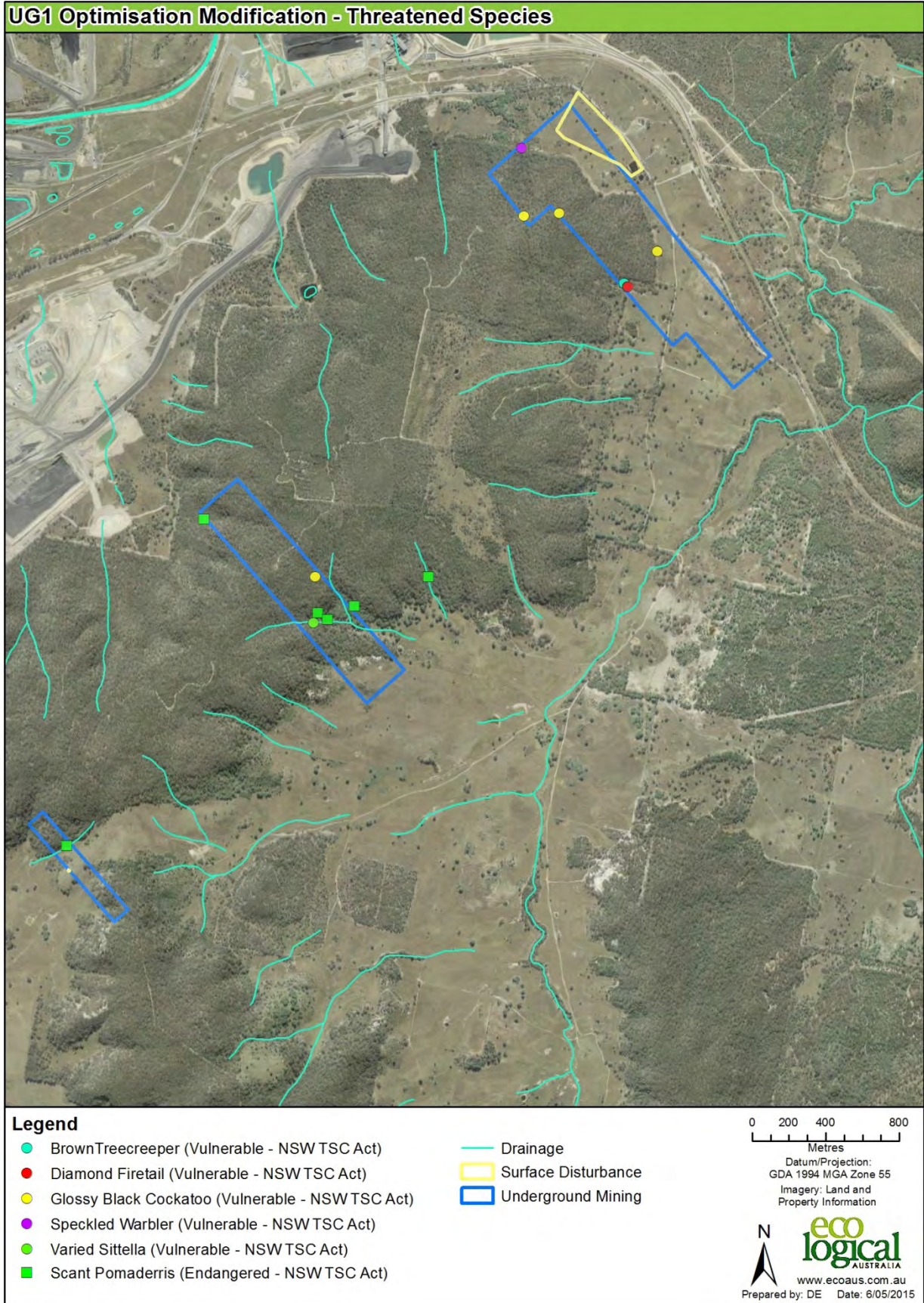


Figure 10: Threatened Species Found within the Study Area