

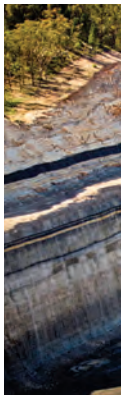



MOOLARBENCOAL

Moolarben Coal Complex
Open Cut Optimisation Modification

Environmental Assessment

APPENDIX C

Biodiversity Assessment Review

YANCOAL
兖煤澳大利亚有限公司

Moolarben Coal Complex
Open Cut Optimisation Modification

Biodiversity Assessment Review and Biodiversity Offset Strategy

Prepared for
Moolarben Coal Operations Pty Ltd

25 October 2017

DOCUMENT TRACKING

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Contents

Executive summary **1**

1 Introduction **4**
1.1 Purpose 4

Stage 1 – Biodiversity Assessment **5**

2 Project Description **5**
2.1 Location 5
2.2 Overview 5
2.3 Modification Disturbance Footprint identification 6
2.4 General description of the development site 6
2.5 Information sources 7

3 Landscape features **11**
3.1 Interim Biogeographic Regionalisation of Australia 11
3.2 Mitchell landscapes 11
3.3 Streams and rivers 12
3.4 Wetlands 12
3.5 Native vegetation extent 12
3.6 Landscape value score 12

4 Native vegetation **17**
4.1 Data review 17
4.2 Surveys 17
4.3 Native vegetation extent 24

5 Threatened species and populations **45**
5.1 Data review 45
5.2 Additional consideration of EPBC Act listed species 48
5.3 Threatened species surveys 48
5.4 Weather data 55
5.5 Targeted threatened species survey results 55
5.6 Fauna surveys 59
5.7 Species credit species 65

Stage 2 – Impact assessment **71**

6 Measures to Avoid and Minimise Impacts **71**
6.1 Avoidance of Impacts 71

6.2 Measures to minimise impacts 75

7 Impacts on biodiversity that require further consideration 79

7.1 Impacts reducing the width of riparian buffer to Moolarben Creek 79

7.2 Impacts on Critically Endangered Ecological Communities 80

8 Summary of impacts under the EPBC Act 84

8.1 Summary of referral pathway 84

8.2 Summary of impacts to MNES 85

9 Impact Summary 86

Stage 3 – Biodiversity Offset Strategy 88

10 Biodiversity Offset Strategy 88

10.1 Objectives of the Biodiversity Offset Strategy 88

10.2 Policy framework of the offset strategy 88

10.3 NSW legislation 88

10.4 Commonwealth legislation 91

10.5 EPBC Act NSW bilateral agreement 93

10.6 Proposed offset measures 93

10.7 Description of proposed offset property 93

10.8 Ecosystem Credit Summary 96

10.9 Ecosystem Credits 96

10.10 Species Credits 96

10.11 Management actions to improve biodiversity values 96

11 Offset Summary 98

12 References 100

Appendix A – Plot and transect data 102

Appendix B – Flora species list 104

Appendix C – Candidate Species Likelihood of Occurrence Table 107

Appendix D – Fauna species recorded during surveys 124

Appendix E – Microbat Analysis Report 126

Appendix F – EP&A Act Assessment of Significance 142

Appendix G – EPBC Act Significant Impact Guidelines 158

Appendix H – Credit Calculator for Major Projects and BioBanking Reports 172

Appendix I – Gilgal Property Biodiversity Assessment Report 173

List of figures

Figure 1: Modification Disturbance Footprint - north 9

Figure 2: Modification Disturbance Footprint - south 10

Figure 3: Site map 15

Figure 4: Location map 16

Figure 5: Vegetation survey effort – north 20

Figure 6: Vegetation survey effort - south 21

Figure 7: Vegetation communities – north 31

Figure 8: Vegetation communities - OC2 – OC3 internal road 32

Figure 9: Vegetation communities – South 33

Figure 10: PCT 281 along Moolarben Creek 35

Figure 11: PCT 618 woodland form along Moolarben Road 37

Figure 12: PCT 618 DNG form at floristic plot OC3-10 38

Figure 13: PCT 1176 at floristic plot OC3-2 39

Figure 14: PCT 1606 at floristic plot OC3-4 40

Figure 15: PCT 1629 at floristic plot OC3-12 41

Figure 16: PCT 1661 at floristic plot OC3-6 42

Figure 17: PCT 1696 at floristic plot OC3-18 43

Figure 18: PCT 1669 at floristic plot OC3-30 44

Figure 19: Fauna survey effort - northern survey area 53

Figure 20: Fauna survey effort - southern survey area 54

Figure 21: Example of large rocky overhang in the survey area (outside the Modification Disturbance Footprint) 56

Figure 22: Habitat features - north 57

Figure 23: Habitat features – south 58

Figure 24: Threatened flora and fauna species locations – north (OEH [2017] and ELA [2017] records) 60

Figure 25: Threatened fauna species locations – south (OEH [2017] and ELA [2017] records) 61

Figure 26: Location of Anabat site 6 64

Figure 27: Brush-tailed Rock-wallaby habitat – southern survey area 68

Figure 28: Koala habitat – southern survey area 69

Figure 29: Regent Honeyeater habitat – southern survey area 70

Figure 30: Gilgal property location relative to the Modification Disturbance Footprint 94

List of tables

Table 1: Relevant SEARs addressed in this report 4

Table 2: Modification Disturbance areas 6

Table 3: IBRA Bioregions occurring within the Modification Disturbance Footprint and 550m buffer 11

Table 4: IBRA Subregions occurring within the Modification Disturbance Footprint and 550m buffer 11

Table 5: Mitchell Landscapes occurring within the Modification Disturbance Footprint and 550m buffer 12

Table 6: Current and future extent of native vegetation within the 550 m buffer 13

Table 7: Connecting links within the Modification Disturbance Footprint 13

Table 8: Change in area to perimeter ratio 13

Table 9: PCTs within the Modification Disturbance Footprint 22

Table 10: Selection criteria for PCTs in the Modification Disturbance Footprint 26

Table 11: Threatened Ecological Communities in the Modification Distubance Footprint 44

Table 12: Ecosystem species constraints within Modification Disturbance Footprint 45

Table 13: Ecosystem species predicted within Modification Disturbance Footprint 46

Table 14: Species credit species within Modification Disturbance Footprint 49

Table 15: Field survey weather conditions 55

Table 16: Bird species and abundance results 62

Table 17: Species credit polygon mapping criteria 65

Table 18: Avoidance of Direct Impacts 71

Table 19: Avoidance and minimisation of direct impacts through site selection 73

Table 20: Avoidance and minimisation of direct impacts through planning 74

Table 21: Minimisation of direct impacts through during the construction phase 75

Table 22: Minimisation of indirect impacts 76

Table 23: Minimisation of Impacts through during the Operational Phase 78

Table 24: Additional information require for impacts to Moolarben Creek 79

Table 25: Threatened Ecological Communities to be impacted by the Modification 80

Table 26: Additional information required for impacts to CEEC 80

Table 27: Modification Offset Requirement 87

Table 28: Updated areas of BVTs present at Gilgal 95

Table 29: Offset Reconciliation Summary 99

Abbreviations

Abbreviation	Description
BAR	Biodiversity Assessment Report
BBAM	BioBanking Assessment Methodology
BBCC	BioBanking Credit Calculator Version 4.0
BC Act	NSW Biodiversity Conservation Act 2016
BMP	Biodiversity Management Plan
BOA	Biodiversity Offset Area
BOS	Biodiversity Offset Strategy
BVT	Biometric Vegetation Type
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environment Management Plan
the development site	all lands within the Modification Disturbance Footprint
DNG	Derived Native Grassland
DotEE	Commonwealth Department of the Environment and Energy
DP&E	NSW Department of Planning and Environment
Ecosystem credit	A measurement of the value of EECs, CEECs, and threatened species habitat for species that can be reliably predicted to occur within a PCT
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environmental Protection and Biodiversity Conservation Act 1999
EPBC Regulations	Commonwealth Environment Protection and Biodiversity Conservation Regulations 2000
EPL	Environmental Protection Licence
FBA	Framework for Biodiversity Assessment
FM Act	Fisheries Management Act 1995
GIS	Geographic Information System
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation of Australia
OC	Open Cut
OEH	NSW Office of Environment and Heritage

LGA	Local Government Area
MCC	Moolarben Coal Complex
MCM	Moolarben Coal Mines Pty Ltd
MCO	Moolarben Coal Operations Pty Ltd
MNES	Matter of National Environmental Significance under EPBC Act
NP	National Park
NSW	New South Wales
PCT	Plant Community Type
ROM	Run of Mine
RMP	Moolarben Coal Complex Rehabilitation Management Plan
SEARs	Secretary's Environmental Assessment Requirements
SEPP 44	State Environmental Planning Policy No. 44 – Koala Habitat Protection
Species credit species	Threatened species and populations that are assessed according to Section 6.4 of the FBA
SSD	State Significant Development
TEC	Threatened Ecological Community
TG value	The ability of a species to respond to improvement in site value or other habitat improvement at an offset site with management actions.
the Project	Installation and operation of the Moolarben Open Cut
TSC Act	NSW Threatened Species Conservation Act 1995
UG	Underground
VEC	Vulnerable Ecological Community
VIS	Vegetation Information System
VCP	Vegetation Clearance Protocol

Executive summary

Moolarben Coal Operations Pty Ltd (MCO) is the operator of the Moolarben Coal Complex (MCC) 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.

Mine operations at the MCC are currently approved until 31 December 2038 and are carried out in accordance with New South Wales (NSW) Project Approval (05_0117) (Moolarben Coal Project Stage 1) as modified, and NSW Project Approval (08_0135) (Moolarben Coal Project Stage 2) as modified.

MCO has identified an opportunity to optimise open cut mining operations and increase run-of-mine coal production. The Open Cut Optimisation Modification (herein referred to as the Modification) would require a modification to both the Stage 1 and Stage 2 Moolarben Coal Project Approvals (05_0117 and 08_0135) under section 75W of the NSW *Environmental Planning and Assessment Act 1979*.

Eco Logical Australia was engaged by MCO to undertake a Biodiversity Assessment Report (BAR) and prepare a Biodiversity Offset Strategy (BOS) for the Modification. The BAR and BOS respond directly to the Secretary's Environmental Assessment Requirements which were issued for the Modification.

The BAR includes an assessment of the biodiversity values which may be impacted by the Modification, identified through a comprehensive data audit, Geographic Information Systems analysis and series of ecological field surveys. The data audit included searches of the relevant threatened species registers, review of ecological assessments associated with previous approvals for the MCC and ongoing biodiversity monitoring in the area. The data audit also included entry of the Modification Disturbance Footprint in the Credit Calculator for Major Projects and BioBanking (Office of Environment and Heritage [OEH] 2016), to generate a Landscape Value Score, which was then used to generate predicted threatened species which may be impacted by the Modification. These were used to guide the field surveys and assessment.

The field surveys included vegetation validation, BioMetric vegetation mapping and targeted flora surveys, targeted fauna surveys and fauna habitat mapping. The Modification Disturbance Footprint covers an area of approximately 81.5 hectares (ha). As part of the modification, MCO proposes to relinquish 34.5 ha of previously approved areas or disturbance under the Stage 1 and Stage 2 approvals, reducing the net overall area to be disturbed by the Modification.

The field survey results provided vegetation validation within the Modification Disturbance Footprint and identified 42.5 ha of cleared land, with the remaining 39 ha of native vegetation comprising both woodland and Derived Native Grassland (DNG). Eight Plant Community Types were identified within the Modification Disturbance Footprint, including DNG. Approximately 15 ha of native vegetation in previously approved areas would be relinquished for the Modification, with approximately 12 ha able to be associated with the vegetation communities within the Modification Disturbance Footprint reducing the net overall impact to native vegetation to 27 ha.

Of the 39 ha of native vegetation to be disturbed by the Modification, approximately 7 ha meets the criteria for Threatened Ecological Communities (TECs) listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and/or the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- *White Box Yellow Box Blakely's Red Gum Woodland* (listed as Endangered under the BC Act) / *White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (listed as Critically Endangered under the EPBC Act); and
- Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion (listed as Vulnerable under the TSC Act) / Central Hunter Valley Eucalypt Forest and Woodland (listed as Critically Endangered under the EPBC Act).

The Relinquishment Areas would contribute approximately 3 ha of TEC, which can be associated with the TEC within the Modification Disturbance Footprint reducing the net disturbance to the above TECs to 4 ha and 0 ha respectively.

Four threatened flora species were identified as having the potential to occur in the Modification Disturbance Footprint as identified from the results of the data audit, based on the presence of suitable habitat and nearby previous records. No threatened flora species were recorded within the Modification Disturbance Footprint during the field survey or previous surveys.

Forty-two threatened fauna species were identified as having potential habitat within the Survey Area from the results of the data audit, including 28 birds, and 14 mammals (including 11 bats), although none of these species have been previously recorded within the Modification Disturbance Footprint.

Two threatened fauna species were recorded in the Modification Disturbance Footprint during the field surveys, being two mammals (bats):

- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat) – vulnerable (BC Act); and
- *Chalinolobus dwyeri* (Large-eared Pied Bat) – vulnerable (both the BC Act and EPBC Act)

The Modification would result in impacts to biodiversity in the Modification Disturbance Footprint through the removal of vegetation and threatened fauna habitat. Approximately 4 ha of TECs listed under both the BC Act and EPBC Act would be removed, although some of this vegetation is in poor to moderate condition owing to the presence of existing roads and evidence of agricultural activities such as historic clearing and cultivation.

Assessment of fauna habitat consisted of mapping cliffline features and other habitat features, and potential koala habitat. Small areas of cliffline features containing caves, rocky outcrops and overhangs was mapped however no bat roosts were identified during the surveys.

Potential koala habitat mapping was prepared in accordance with the *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44), which identified areas of potential koala habitat in the southern survey area associated with *Eucalyptus albens* (White Box). The habitat within the Modification Disturbance Footprint was not determined to be core koala habitat in accordance with SEPP 44 due to the absence of breeding females or records of populations in the survey area.

Assessments of significance have been completed for threatened species and communities likely to be impacted by the Modification. It was concluded that the Modification would not result in a significant impact to any threatened species, population or community listed under the BC and/or EPBC Acts.

Ameliorative management measures have included refining the Modification Disturbance Footprint to minimise the disturbance area and avoid disturbance to some areas of TEC and cliff lines. Ongoing management measures would be implemented to manage unavoidable impacts throughout the pre-construction, construction and operational phases to reduce the severity of impacts. Disturbed areas would be progressively rehabilitated following the completion of mining.

The residual unavoidable impacts in the Modification Disturbance Area were determined for entry into the Credit Calculator for Major Projects and BioBanking (OEH 2014) and the offset requirement was calculated to be 1,437 ecosystem credits.

Based on the habitat clearance within the Modification Disturbance Footprint, the Modification would also require a BOS which accounts for the following species credits:

- *Anthochaera Phrygia* (Regent Honeyeater) (1,568 species credits based on 20.5 ha of potential habitat).
- *Phascolarctos cinereus* (Koala) (77 species credits based on approximately 3.5 ha of potential habitat).
- *Petrogale penicillata* (Brush-tailed Rock-wallaby) (693 species credits based on approximately 26.5 ha of potential habitat).

Offsetting of impacts through the securement of areas of equivalent biodiversity is proposed for a biodiversity offset property, the Gilgal Property. A biodiversity assessment was undertaken at the Gilgal Property which identified approximately 600 ha of native vegetation considered suitable to offset the ecosystem credit requirement of the Modification. The Gilgal property would satisfy all credits required by the Modification with the exception of approximately 400 ecosystem credits and 14 species credits for the Koala. These credit requirements would be offset for the Modification using one, or a combination, of the following:

- mine site rehabilitation;
- acquiring or retiring credits under the BioBanking scheme in the BC Act by:
  - purchasing existing credits on the *Biodiversity Credits Register*; and/or
  - creating new credits by establishing a land-based offset area;
- making payments into an offset fund once established by the NSW Government; and/or
- providing supplementary measures as outlined in the NSW Offset Policy.

1 Introduction

Moolarben Coal Operations Pty Ltd (MCO) is the operator of the Moolarben Coal Complex (MCC) 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.

Mine operations at the MCC are currently approved until 31 December 2038 and are carried out in accordance with New South Wales (NSW) Project Approval (05_0117) (Moolarben Coal Project Stage 1) as modified and NSW Project Approval (08_0135) (Moolarben Coal Project Stage 2) as modified.

Stage 1 at the MCC has been operating since 2008 and, at full development, will comprise three open cut (OC) mines (OC1, OC2 and OC3), a longwall underground (UG) mine (UG4), and mining related infrastructure (including coal processing and transport facilities). Stage 2 at the MCC has commenced and at full development will comprise one open cut mine (OC4), two longwall mines (UG1 and UG2) and mining related infrastructure.

MCO has identified that an opportunity exists to optimise the open cut operations at the MCC, to improve mining efficiencies and increase run-of-mine (ROM) coal production. The Open Cut Optimisation Modification (herein referred to as the Modification) would require a modification to both the Stage 1 and Stage 2 Moolarben Coal Project Approvals (05_0117 and 08_0135) under section 75W of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 Purpose

Eco Logical Australia (ELA) was engaged by MCO to prepare this Biodiversity Assessment Report (BAR) and Biodiversity Offset Strategy (BOS) as part of the Environmental Assessment (EA) to support the Modification. This BAR and BOS have been developed in response to the Secretary's Environmental Assessment Requirements (SEARs) which were issued for the Modification on 12 October 2017, detailed below in Table 1

Table 1: Relevant SEARs addressed in this report

SEARs	Response
Biodiversity – including:	
An assessment of the biodiversity values and the likely biodiversity impacts of the proposed modifications in accordance with the Framework for Biodiversity Assessment (FBA) (OEH 2014), unless otherwise agreed by OEH.	This BAR has been prepared under the FBA and includes a detailed assessment of the vegetation to be impacted by the Modification, as well as any impacts to threatened species, populations or endangered ecological communities.
An assessment of impacts on koalas or their habitat in accordance with the requirements of the *State Environmental Planning Policy No. 44 – Koala Habitat Protection* (SEPP 44).	This BAR includes a detailed assessment of the impacts of the Modification on koalas or their habitat, which included a comprehensive field survey for koalas and potential habitat as described under SEPP 44.
A strategy to offset any residual impacts for the proposed modifications.	The BOS component of this report includes a detailed strategy to offset residual impacts from the Modification, prepared in accordance with the FBA.

Stage 1 – Biodiversity Assessment

2 Project Description

2.1 Location

The MCC is located approximately 40 kilometres (km) north-east of Mudgee, NSW, within the Mid-Western Regional Council Local Government Area (LGA). The Modification Disturbance Footprint comprises an area of 81.5 ha and is located immediately adjacent to areas currently approved under the Stage 1 and Stage 2 approvals of the MCC Open Cut (including some operational areas). All areas within the Modification Disturbance Footprint are considered the development site, as referred to in the FBA.

A location map of the Modification Disturbance Footprint is shown in **Figure 1** and **Figure 2**.

2.2 Overview

The Modification would involve minor extensions to the disturbance limits of the OC2 and OC3 pits. These extensions are required to enable the following:

- minor extension of the OC2 western pit limit;
- straightening of the western pit limits of OC3 to facilitate safe and efficient mining; and
- minor extension of the OC3 eastern pit limit to reflect the latest resource definition results.

There would be no change to OC1 or OC4 disturbance limits as part of the Modification.

Other Optimisations

MCO has also identified the following additional operational optimisations, which form part of the scope of the Modification:

- installation of water treatment facilities to support authorised discharge under Environmental Protection Licence (EPL) release conditions, and associated increase in the rate of controlled releases, when required;
- construction of a bypass conveyor system to facilitate bypass of ROM coal from the open cuts;
- minor changes to the alignment of the haul road from OC2 to OC3, and the location of the OC3 Mine Infrastructure Area;
- additional internal road from OC2 to OC4 via Carrs Gap;
- ancillary infrastructure (e.g. access tracks, power, services, communications, conveyors and pipelines); and
- ongoing exploration activities within mining lease areas.

Section 3 of the Main Text of the EA provides a detailed description of the Modification.

2.3 Modification Disturbance Footprint identification

The Modification Disturbance Footprint has undergone several iterations with the view to reduce, where possible, impacts to biodiversity, whilst maintaining a functional open cut coal mine. The Modification Disturbance Footprint was initially proposed during the preliminary field surveys in November 2016. Following field assessment, the footprint was further reduced via several iterations to provide a final Modification Disturbance Footprint. The progression of the Modification Disturbance Footprint has resulted in a decreased area of direct disturbance, and has minimised impacts to threatened species, populations, and ecological communities that occur within the Modification Disturbance Footprint.

The Modification Disturbance Footprint location has also been selected to align with several areas proposed for relinquishment. As part of the Modification, MCO would relinquish several areas currently approved for disturbance under the Stage 1 and Stage 2 approvals (the Relinquishment Areas), totalling 34.5 ha. The Modification Disturbance Footprint and Relinquishment Areas are summarised below in Table 2**.**

Table 2: Modification Disturbance areas

Modification Disturbance Footprint (ha)	Relinquishment Areas (ha)	Residual Impact Area (ha)
81.5	34.5	48.5^

^ not all native vegetation within the Relinquishment Areas can be associated with the vegetation communities within the Modification Disturbance Footprint.

The Modification Disturbance Footprint and Relinquishment Areas are shown below in Figure 1 and Figure 2**.**

2.4 General description of the development site

2.4.1 Soils

Soil landscapes are mapped across the Moolarben Coal Complex in the *Soil Landscapes of Dubbo 1:250,000 Sheet* (Murphy and Lawrie, 1998). The three soil landscapes within the Modification area are the Ulan, Lees Pinch and Bald Hill Soil Landscapes (Murphy and Lawrie 1998).

Approximately 80% of the Modification area is situated within the Ulan Soil Landscape, which is typically found in association with low undulating rises and creek flats on slopes between 2% and 10% gradient.

The Lees Pinch Soil Landscape, situated on the lower to mid-slopes and occasionally on ridges, covers approximately 15% of the Modification area. This soil landscape is typically found in association with sandstone plateau and hillslopes with boulder debris and rock outcrops, and slopes between 15% and 40%.

The ridgeline around the proposed internal road between OC2 and OC4 is dominated by the Bald Hill Soil Landscape, which is typically characterised by low hillocks with moderately steep slopes between 10% and 35%. The Bald Hill Soil Landscape includes euchrozems on crests, euchrozems-chocolate soils intergrades on mid slopes with brown clays on lower slopes.

2.4.2 Vegetation

The MCC is located in a transitional zone between the western slopes and coastal areas of NSW within the Great Dividing Range. Many plant species and communities representative of these areas intergrade at this locality and are at their range limits. In general, the valley floor vegetation has been cleared and disturbed, with Alluvial Apple Forest occurring as narrow strips along creek line corridors.

Box and Red Gum Woodlands occur as remnant vegetation on the valley floors and adjacent lower slopes. Ironbark Forests occur on ridgelines and upper slopes in the south (south of the Ulan-Wollar Road) and Scribbly Gum Woodlands occur on ridgelines and upper slopes in the north (north of the Ulan-Wollar Road).

2.4.3 **Hydrology**

The Goulburn River is approximately 221 km in length and forms part of the catchment of the Hunter River. It commences on the eastern slopes of the Great Dividing Range at the confluence of Moolarben Creek and Sportsmans Hollow Creek, near the village of Ulan, and discharges into the Hunter River south of Denman, approximately 150 km downstream of the Moolarben Coal Complex. The majority of the river flows through the Goulburn River National Park.

The Goulburn River runs along the north-western boundary of the Moolarben Coal Complex, flowing in a north easterly direction in the vicinity of the Moolarben Coal Complex.

Moolarben Creek is the primary tributary of the upper Goulburn River catchment and flows in a northerly direction along the western boundary of the Moolarben Coal Complex. The Moolarben Creek Dam is located on Moolarben Creek, approximately 1.5 km upstream of the confluence with Sportsmans Hollow Creek. It was constructed between 1955 and 1957 to supply cooling water for the Ulan Power Station.

Bora Creek is an ephemeral stream that discharges into the Goulburn River Diversion approximately 4 km downstream from the town of Ulan. It drains a small catchment that extends to the north-east of the Goulburn River and the Moolarben Coal Complex. EPL Release Point 1 is currently permitted to discharge to Bora Creek.

2.4.4 **Land use**

Land use is primarily agriculture in the form of livestock grazing and breeding (sheep, cattle and goats) and fodder crop production.

2.5 Information sources

2.5.1 **Database review**

The following databases were reviewed as part of this assessment:

- Atlas of NSW Wildlife (BioNet; Office of Environment and Heritage [OEH] 2017);
- Threatened Species Profile Database (OEH, 2017);
- Vegetation Information Systems (VIS) Classification 2.1 (OEH, 2017);
- NSW Planning Portal (www.planningportal.nsw.gov.au);
- NSW Major Projects (majorprojects.planning.nsw.gov.au); and
- VIS map catalogue (maps.six.nsw.gov.au/apps/channels_3.5/?config=vegetation).

2.5.2 **Literature review**

The following relevant ecological literature was reviewed during this assessment:

- MCO Stage 1 Flora, Fauna and Aquatic Ecology Assessment (Moolarben Biota 2006);

- MCO Stage 1 Modification 9 Ecological Impact Assessment (EMGA Mitchell McLennan 2013);
- MCO Stage 2 Ecological Impact Assessment (Ecovision 2008);
- Framework for Biodiversity Assessment (FBA; OEH 2014);
- Credit Calculator for Major Projects and BioBanking (BBCC; OEH 2014);
- BioBanking Assessment Methodology and Credit Calculator Operational Manual (OEH 2016); and
- NSW Biodiversity Offsets Policy for Major Projects (OEH 2014).

2.5.3 **Aerial imagery**

Aerial imagery used in this assessment was taken from SIX Maps.

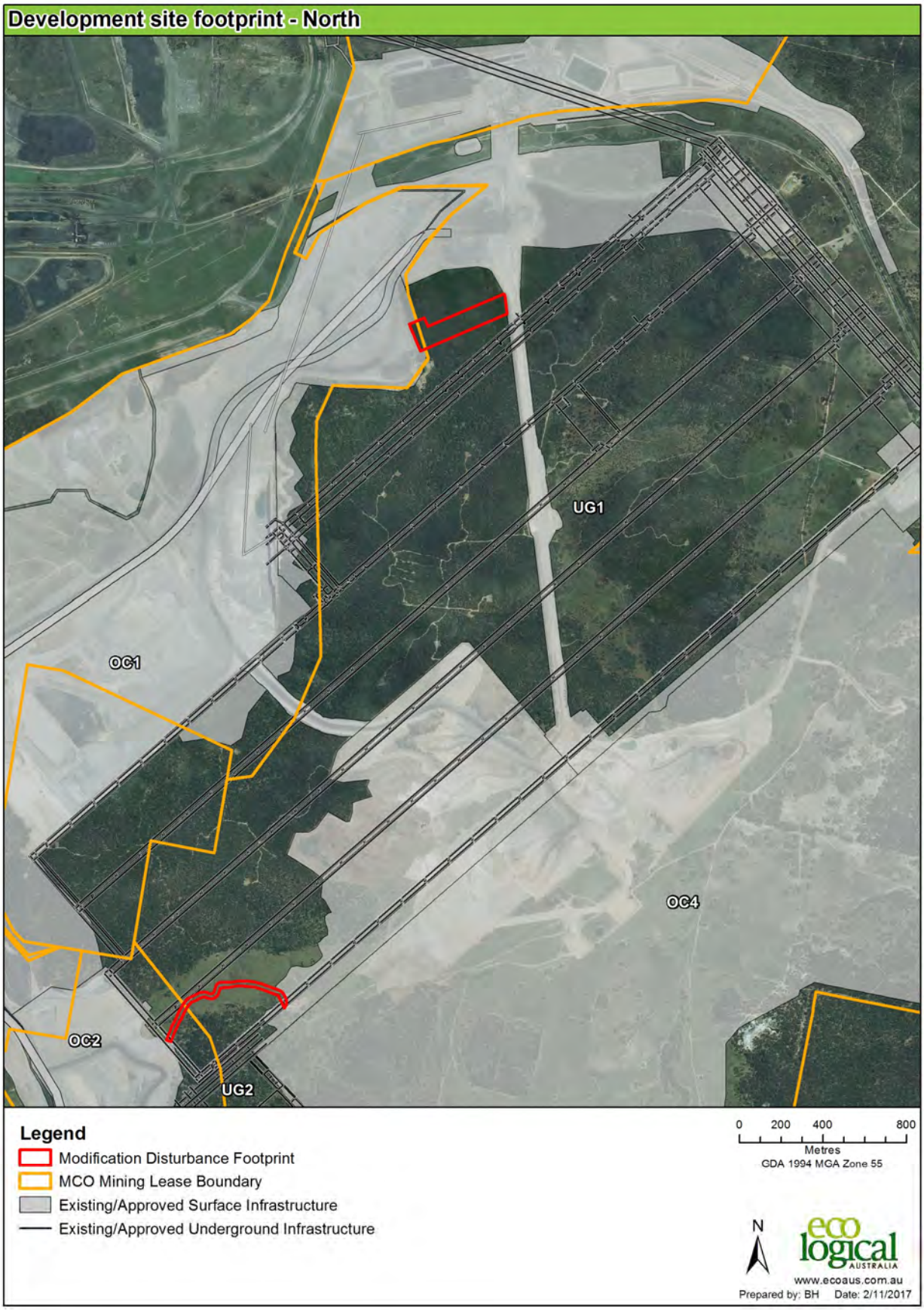

Figure 1: Modification Disturbance Footprint - north

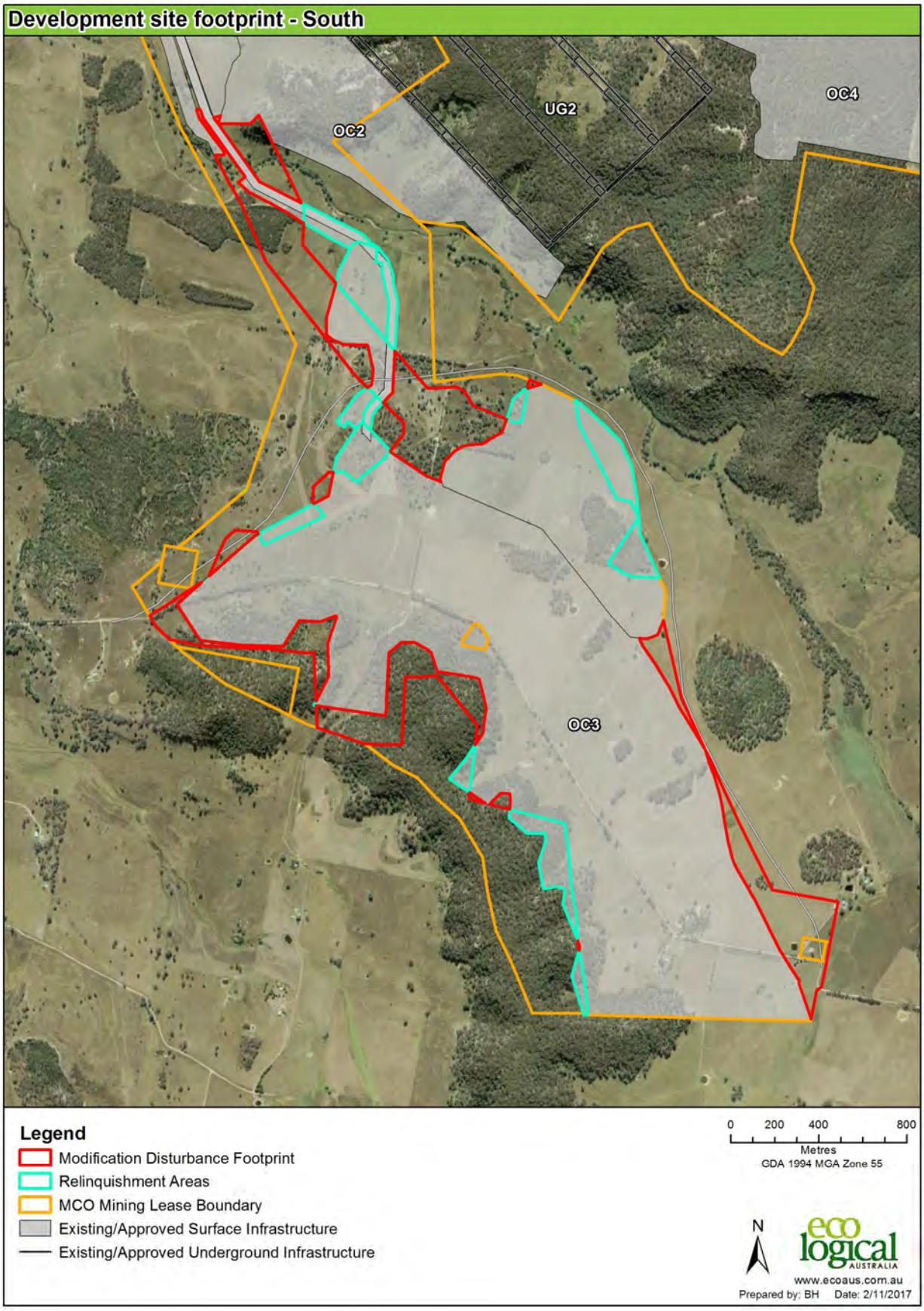

Figure 2: Modification Disturbance Footprint - south

3 Landscape features

The Modification Disturbance Footprint is considered a linear shaped development in accordance with the definition in the FBA:

"development that is generally narrow in width and extends across the landscape for a distance greater than 3.5 kilometres in length."

Analysis of landscape features in this report utilises a 550 m buffer in accordance with Appendix 5 of the FBA. The landscape features of the Modification Disturbance Footprint are described below and shown in a Site Map and Location Map as required by Section 4 of the FBA (Figure 3 and Figure 4).

The descriptions in this section are for the Modification Disturbance Footprint only, although as the proposed Relinquishment Areas occur entirely within the 500 m buffer (Figure 3) the below landscape features also apply to the Relinquishment Areas. Specific assessment and calculations for the landscape featues in the Relinquishment Areas was undertaken for entry into the BBCC , however not presented in this report.

3.1 Interim Biogeographic Regionalisation of Australia

3.1.1 Bioregions

The Modification Disturbance Footprint, including the 550 m buffer, occurs wholly within the Sydney Basin Bioregion (Table 3).

Table 3: IBRA Bioregions occurring within the Modification Disturbance Footprint and 550m buffer

IBRA Bioregion Name	% Modification Disturbance Footprint	550 m buffer
Sydney Basin	100%	100%

Note: IBRA = Interim Biogeographic Regionalisation of Australia

3.1.2 Subregions

The Modification Disturbance Footprint, including the 550 m buffer, occurs wholly within the Kerrabee Subregion (Table 4).

Table 4: IBRA Subregions occurring within the Modification Disturbance Footprint and 550m buffer

IBRA Subregion Name	% Modification Disturbance Footprint	550 m buffer
Kerrabee	100%	100%

3.2 Mitchell landscapes

The Mitchell landscapes within the Modification Disturbance Footprint and 550 m buffer are detailed below in Table 5. The Upper Goulburn Valleys and Escarpment Mitchell Landscape has been used in the Landscape Value Score calculations as it is the landscape with the most area in the Modification Disturbance Footprint.

Table 5: Mitchell Landscapes occurring within the Modification Disturbance Footprint and 550m buffer

Mitchell Landscape	Cleared within CMA	% Modification Disturbance Footprint
Wollemi Ranges	5%	24%
Upper Goulburn Valleys and Escarpment	57%	74%
Liverpool Range Valleys and Footslopes	81%	1%
Lees Pinch Foothills	28%	1%

Note: CMA = Catchment Management Authority

3.3 Streams and rivers

The Modification Disturbance Footprint is intersected by one 4th order stream, Moolarben Creek, as categorised under the Strahler stream ordering system. A riparian buffer of 40 m (20 m either side) is applied as required by Appendix 2 of the FBA.

3.4 Wetlands

There are no wetlands within the Modification Disturbance Footprint or 550 m buffer.

3.5 Native vegetation extent

Within the Modification Disturbance Footprint buffer, native vegetation was mapped using the Google (2014) aerial imagery at a scale of 1:5,000. Native vegetation mapping also considered knowledge of the locality including potential canopy species, history of disturbance and previous site inspections (associated with previous assessments and ongoing monitoring programs).

Native vegetation comprises approximately 685 ha within the buffer (46 %), and is shown in **Figure 3**. It should be noted that some of this vegetation is currently approved to be cleared by MCO.

3.5.1 State or Regionally Significant Biodiversity Links

No state significant or regionally significant biodiversity links have been identified within a plan by the Chief Executive of the OEH.

There is one 4th order stream, Moolarben Creek, within the Modification Disturbance Footprint, which is classed as a regionally significant biodiversity link.

3.6 Landscape value score

3.6.1 Percent native vegetation cover

The current and future native vegetation cover was assessed in Geographic Information Systems (GIS) using aerial imagery sourced from SIXMaps in increments of 5%. The Modification would result in the loss of approximately 39 ha of native vegetation from the 550 m buffer. The current and future extent of native vegetation within the 550 m buffer is shown below in **Table 6**.

Table 6: Current and future extent of native vegetation within the 550 m buffer

	Current Native Vegetation Extent			Future Native Vegetation Extent*		
	Area (ha)	**% Cover**	**Category**	**Area (ha)**	**% Cover**	**Category**
550 m buffer	685	45	46 – 50	645	43	41 – 45

*Does not account for relinquishment areas

3.6.2 **Connectivity value**

The Modification Disturbance Footprint contains a regionally significant biodiversity connecting link in accordance with Appendix 5, Table 17 of the FBA, being the riparian buffer associated with Moolarben Creek, a 4th order stream (**Table 7**).

Table 7: Connecting links within the Modification Disturbance Footprint

Category of connecting link	Definition of connecting link	Score
Regionally significant biodiversity link	A riparian buffer 20 m either side of a 4th or 5th order stream	10

3.6.3 **Patch Size**

Patch size was calculated using the vegetation mapping prepared for this assessment (**Section 4**) as well as from the SIX Maps vegetation viewer portal (OEH, 2016). The patch size included all vegetation patches linked to vegetation within the Modification Disturbance Footprint and the buffer zone. Patches within the Modification Disturbance Footprint were considered linked when the adjacent vegetation was:

- in moderate to good condition;
- has a patch size of > 1 ha;
- is separated by a distance of < 100 m; and
- is not separated by a large water body, dual carriageway, wider highway, or similar hostile link.

Based on the above criteria, patch size was considered to be very large (201 ha). The percentage of native vegetation cleared within the Upper Goulburn Valleys and Escarpments Mitchell Landscape is 57%. Based on this information, the patch size score has been calculated to be the maximum 12.5.

3.6.4 **Area to perimeter ratio**

The change in area to perimeter ratio of patch size areas in the Modification Disturbance Footprint was calculated in accordance with Appendix 5 of the FBA. All patches of native vegetation that are impacted by the Modification were considered for the area to perimeter ratio calculations.

All areas of native vegetation were excised from the existing patch calculations, to provide for a post-development area to perimeter ratio. Based on the assessment, the proportional change in area to perimeter was calculated to be a 17% reduction, which resulted in a score of 2 (Table 8).

Table 8: Change in area to perimeter ratio

	Before development	After development	Proportional change	Score
Area/perimeter ratio	109	92	17%	2

3.6.5 **Landscape Value Score**

Based on the assessment of landscape attributes above, the Landscape Value Score has been calculated to be 25.5.

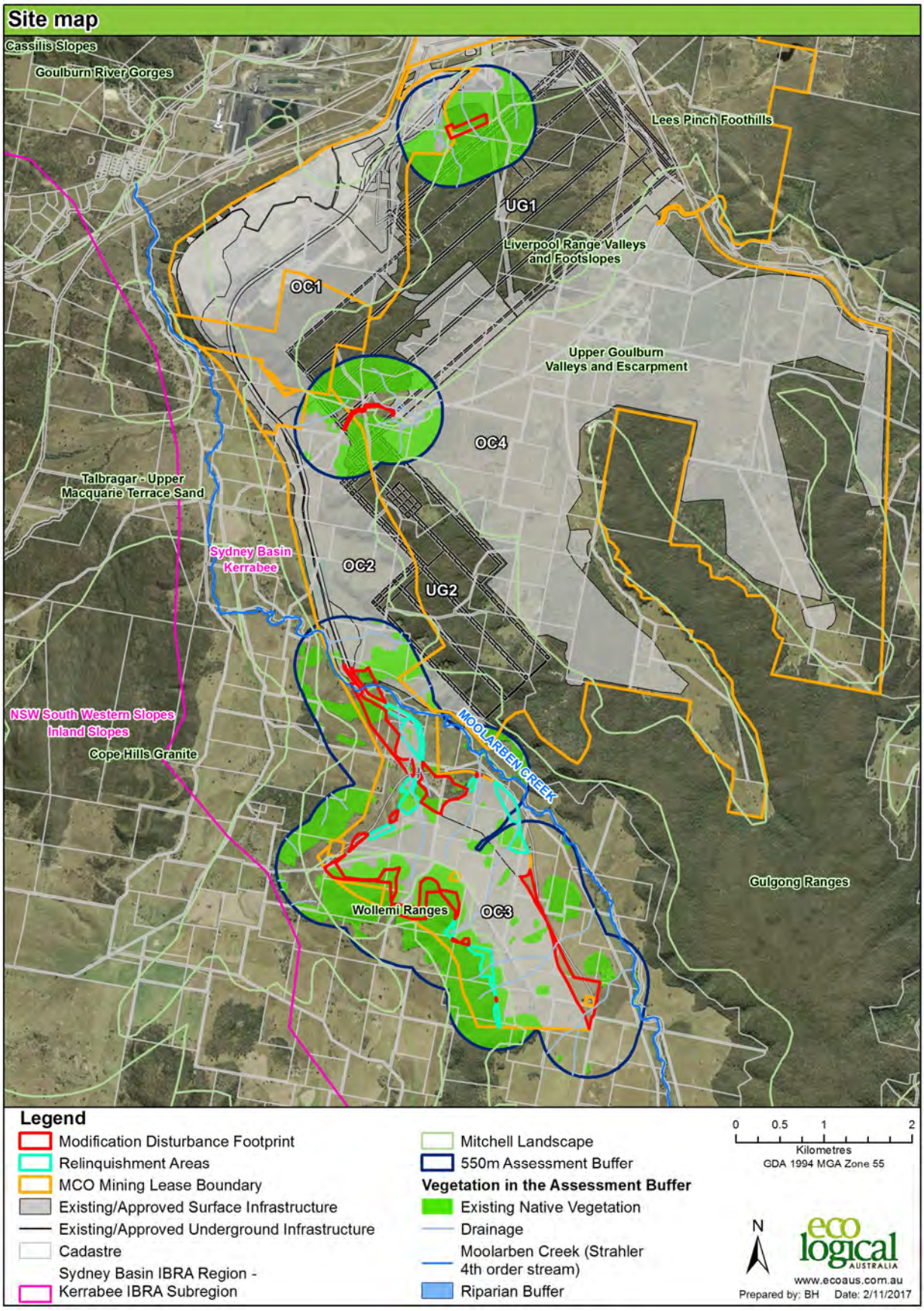

Figure 3: Site map

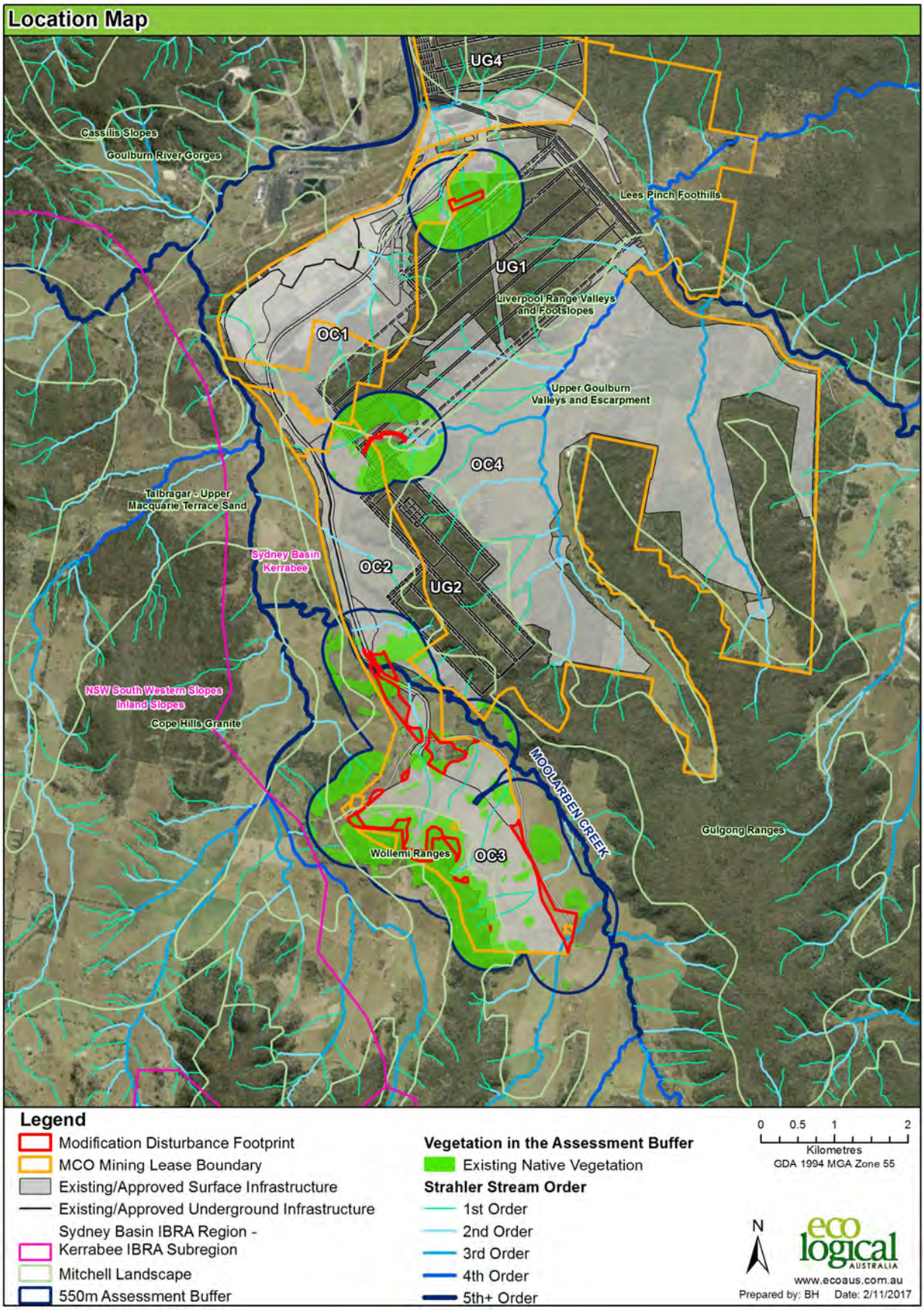

Figure 4: Location map

4 Native vegetation

Native vegetation was assessed within the Modification Disturbance Footprint and the Relinquishment Areas. It is worth noting that the actual area assessed (the survey area) extended outside of these boundaries.

4.1 Data review

A review of existing data sources and information relevant to the survey area was undertaken to identify vegetation zones within the Modification Disturbance Footprint and Relinquishment Areas. The following information sources and databases were reviewed:

- MCO Stage 1 Flora, Fauna and Aquatic Ecology Assessment (Moolarben Biota 2006);
- MCO Stage 1 Modification 9 Ecological Impact Assessment (EMGA Mitchell McLennan 2013);
- MCO Stage 2 Ecological Impact Assessment (Ecovision 2008);
- BioNet Atlas of NSW Wildlife (OEH 2017a) covering an area from latitude -32.26 to -32.40 and longitude 149.75 to 149.85 (Datum GDA94); and
- EPBC Protected Matters Search Tool (Department of the Environment and Energy [DotEE] 2017) covering an area from latitude -32.26 to -32.40 and longitude 149.75 to 149.85 (Datum GDA94), with a 1 km buffer.

4.2 Surveys

4.2.1 Vegetation validation and mapping

The results of the data audit were used to determine and map approximate vegetation zones that were then subject to field validation. These were later used for the development of the plot and transect surveys detailed below in Section 4.2.2.

ELA ecologists David Allworth and Lorraine Parish undertook targeted vegetation validation and mapping of the southern survey area **(**Figure 6) from 2 - 4 November 2016. Additional surveys were undertaken within the northern portion of the survey area and along the OC2 – OC4 Internal Road (Figure 5) by ELA ecologists David Allworth, Tomas Kelly and Cassandra Holt from 20 – 22 March 2017, 18 April 2017 and 19 October 2017. Surveys were undertaken within the Relinquishment Areas by Tomas Kelly and Angelina Siegrist on 26 June 2016.

Existing vegetation mapping from the Stage 1 and Stage 2 Ecological Impact Assessments (Moolarben Biota 2006; Ecovision 2008) was validated and converted to current Plant Community Types (PCTs) where present within the survey area.

Each vegetation community encountered during the field surveys was described and rapid assessments were completed to determine their extent and condition. Rapid assessments were undertaken against the listing criteria for Threatened Ecological Communities (TECs) under both the NSW *Biodiversity Conservation Act 2016* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Rapid assessments also involved describing the vegetation structure, topographic position, soils and any other relevant abiotic factors.

The assessment included obtaining an overview of the biodiversity values of the Modification Disturbance Footprint, as well as mapping of vegetation communities.

4.2.2 **Plot and transect surveys**

The results of the vegetation validation and mapping surveys were used to identify and map the area of each PCT into a vegetation zone within the Modification Disturbance Footprint. The PCT for each zone was then field validated using plot based full floristic survey and plot and transect survey as identified in Table 1 and Table 2 of the FBA.

Plot locations were designed to comply with the minimum number of transects/plots set out in Table 3 of the FBA. At the time of survey, the exact location of the disturbance footprint for the Modification was not known. The survey area extended outside of the final Modification Disturbance Footprint and some plots were carried out in adjacent areas which no longer fall within the Modification Disturbance Footprint location, also resulting in a surplus of plots in some zones above that required by Table 3 of the FBA. All data collected within the Modification Disturbance Footprint and adjacent areas have been used for this assessment. Due to minimal environmental variation within the vegetation patch, this approach is considered suitable for the purposes of the assessment.

Further refinements were made to the mapped extent of each PCT following the plot and transect surveys, as such there is one PCT which does not meet the minimum number of plots required (PCT 1669) as shown below in Table 9. However, the minimal environmental variation observed within the vegetation patch mean that the extent of the field survey, including the vegetation validation survey, is considered sufficient to comprehensively identify the PCT for the purposes of this assessment.

ELA ecologists Liz Norris and Lorraine Parish undertook plot and transect surveys in the survey area from 13 December to 16 December 2016, with additional surveys undertaken by David Allworth and Tomas Kelly from 20 – 22 March 2017 and 19 October 2017. A total of 32 plots (50 m x 20 m) were surveyed in the survey area.

Two plots were surveyed within the Relinquishment Areas on 26 June 2017.

The plot locations are shown in **Figure 5** and **Figure 6**, and further below within each vegetation zone/PCT in **Figure 7**, **Figure 8** and **Figure 9**.

At each plot, the following information was collected:

- site ID;
- name of recorder(s);
- date;
- plot orientation, slope, and aspect;
- easting and northing at either end of the 50 m transect;
- site photographs;
- a plot-based 400 m^2 full floristic survey; and
- a plot and transect survey.

Plot-based Full Floristic Survey

Within a 20 m x 20 m quadrat, the following data was collected at each plot-based full floristic survey site:

- **Species name**: Scientific name and common name
- **Cover**: an estimate of the appropriate cover measure for each recorded species: from 1-5 and then to the nearest 5%
- **Abundance**: A relative measure of the number of individuals or shoots of a species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, or specify a number greater than 1000 if required
- **Form**: (T) Tree; (M) Mallee tree; (S) Shrub; (G) Tussock Grass (Poa/Themeda); (D) Sod grass (Couch/Kikuyu); (L) Vine/climber/scrambler; (V) Sedge (Cyperoid); (R) Rush (Restioid, Juncaceae); (F) Forb; (E) Fern; (P) Palm; (A) Cycad.

Plot and Transect Surveys

Within each plot and transect survey, the following information was collected:

- Within a 20 m x 20 m quadrat:
    - the number of native species present.
- Along a 50 m transect every 5 m:
    - native over-storey cover (%);
    - native mid-storey cover (%);
    - exotic over-storey cover (%); and
    - exotic mid-storey cover (%)
- Along a 50 m transect every 1 m:
    - native ground cover (grasses);
    - native ground cover (shrubs);
    - native ground cover (other); and
    - exotic ground cover.
- Within a 50 m x 20 m quadrat:
    - number of trees with hollows; and
    - total length of fallen logs > 10 cm width (m);
- Within whole vegetation zone:
    - all canopy species; and
    - proportion of regenerating canopy species.

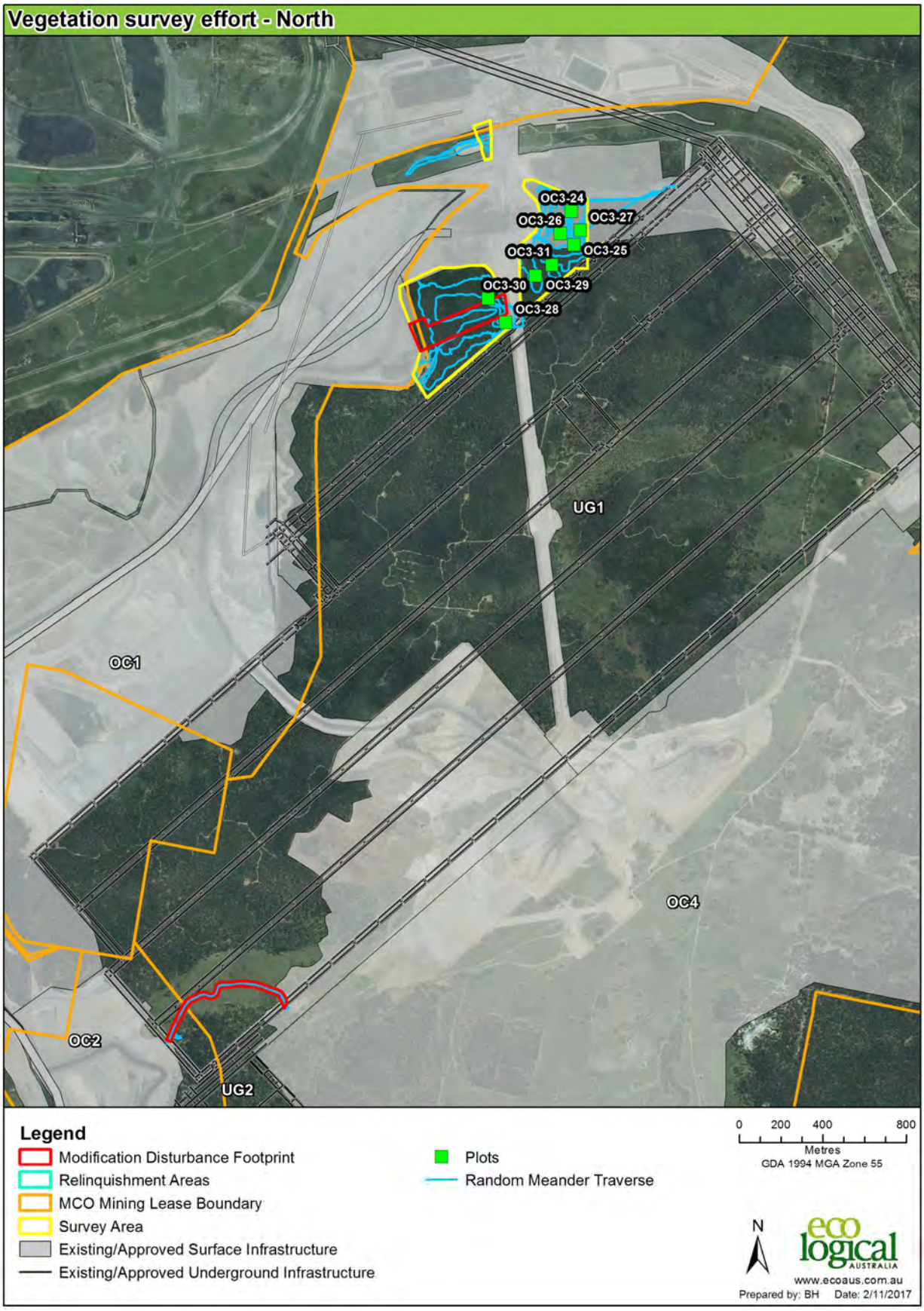

Figure 5: Vegetation survey effort – north

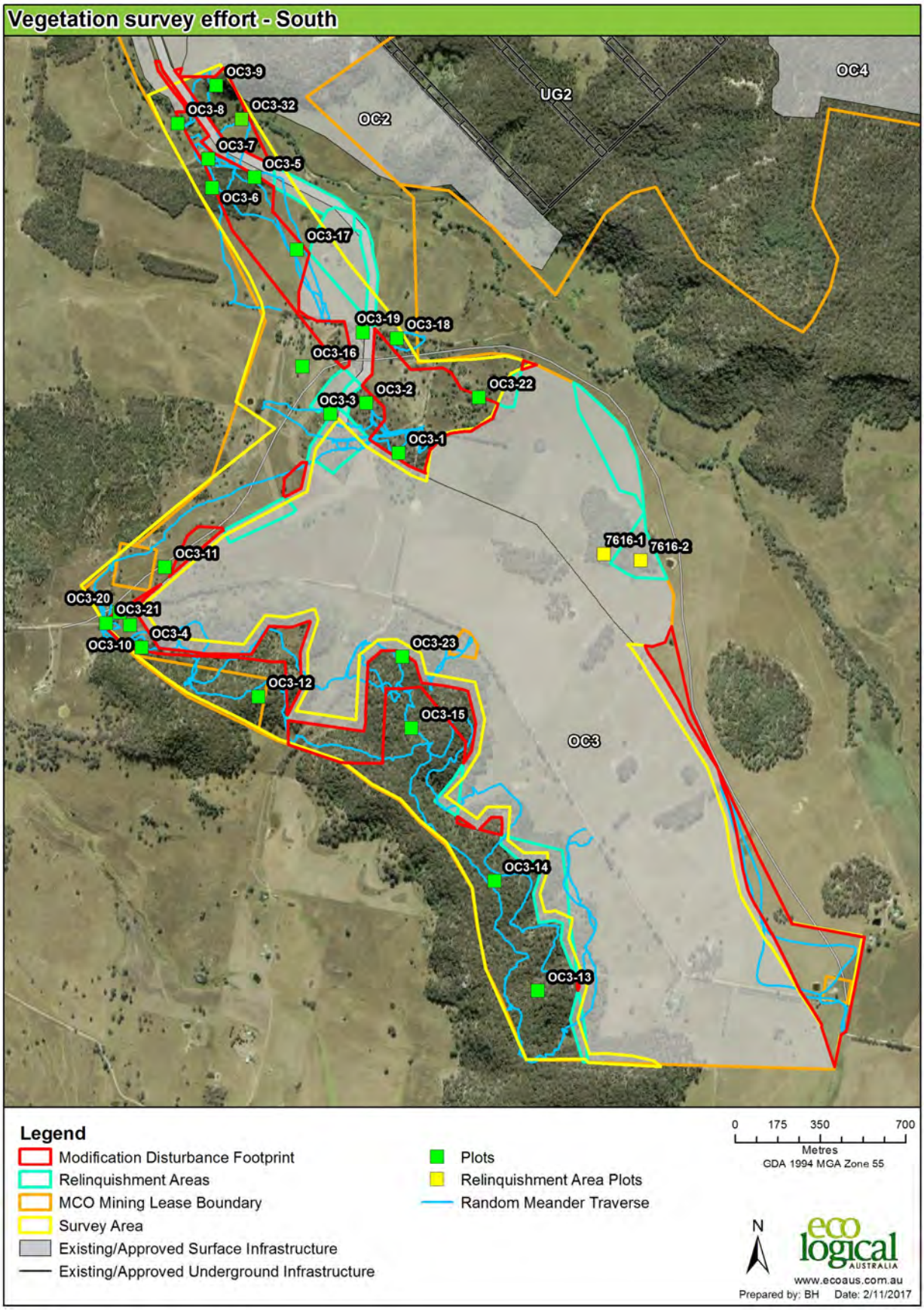

Figure 6: Vegetation survey effort - south

Table 9: PCTs within the Modification Disturbance Footprint

Vegetation Zone	PCT	BVT	Description	Conservation Status		Approximate Area (ha)	Plots required[1]	Plots completed
				BC Act	EPBC Act			
1	**1176**	**HU618**	Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	[2]	**Critically Endangered:** Central Hunter Valley eucalypt forest and woodland	**2**	**2**	**2**
2	**281**	**HU714**	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 Bioregion	**Endangered:** White Box Yellow Box Blakely's Red Gum Woodland	**Critically Endangered:** White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	**1.5**	**2**	**2**
3	**618**	**HU730**	White Box - Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter			**0.5**	**1**	**2**
4	**618 - DNG**	**HU730 - DNG**	White Box - Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter			**3**	**1[3]**	**1**
5	**1606**	**HU820**	White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of	**-**	**-**	**3**	**2**	**2**

[1] Per Table 3 of the FBA

[2] This vegetation type is consistent with the Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion Vulnerable Ecological Community (VEC), however, VEC's do not need to be assessed under the NSW EP&A Act (s.5D).

[3] DNG = Derived Native Grassland. DNG is considered "Low condition" for the provisions of Table 3 of the FBA

Vegetation Zone	PCT	BVT	Description	Conservation Status		Approximate Area (ha)	Plots required[1]	Plots completed
				BC Act	EPBC Act			
			the central and upper Hunter					
6	**1629**	**HU843**	Narrow-leaved Stringybark – Grey Gum shrubby open forest on sandstone ridges of the Sydney Basin	-	-	**13**	**3**	**4**
7	**1661**	**HU875**	Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	-	-	**4**	**2**	**3**
8	**1669**	**HU883**	Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin	-	-	**4.5**	**3**	**2**
9	**1696**	**HU910**	Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter	-	-	**2.5**	**2**	**3**
10	**1696 - DNG**	**HU910 - DNG**	Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter - DNG	-	-	**5**	**2**[3]	**2**
					Total	**39**	**20**	**23**

[3] DNG = Derived Native Grassland. DNG is considered “Low condition” for the provisions of Table 3 of the FBA

4.2.3 **Survey results**

A total of 280 individual flora species were recorded during the vegetation surveys comprising 231 native and 49 exotic species. The results of full floristic plot, and plot and transect surveys is shown in **Appendix A.** A full flora species list is included in **Appendix B**.

4.3 Native vegetation extent

4.3.1 **Identification of Plant Community Types**

The vegetation survey assessment, comprising the data review, vegetation validation surveys and plot and transect surveys, identified a total of eight PCTs in the Modification Disturbance Footprint, including Derived Native Grassland (DNG), along with exotic grassland/pasture and cleared land. The field survey design described above in **Section 4.2** was based on the data review and vegetation validation mapping, to comply with the minimum number of transects/plots set out in Table 3 of the FBA.

Vegetation mapping is shown for the northern area of the Modification Disturbance Footprint in **Figure 7**, the OC2 – OC3 internal road in **Figure 8** and the southern area of the Modification Disturbance Footprint in **Figure 9**. **Table 10** lists the identified PCTs that were validated during the field survey, along with their corresponding BioMetric Vegetation Type (BVT). The corresponding BVT is used for entry into the BBCC.

Identification of PCTs was determined by incorporating field data with the results of the data review and vegetation mapping. PCTs within the Modification Disturbance Footprint were identified by addressing the following hierarchy of factors in conjunction with site data:

- occurrence of the PCT within the Kerrabee IBRA subregion;
- vegetation formation;
- landscape position; and
- dominant native canopy, mid-storey, and groundcover species.

Eight PCTs were identified within the Modification Disturbance Footprint (listed alongside the corresponding BVT number):

- PCT1176 / HU618: Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion
- PCT281 / HU714: 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 Bioregion
- PCT618 / HU730: White Box - Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter
- PCT1606 / HU820: White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter
- PCT1629 / HU843: Narrow-leaved Stringybark – Grey Gum shrubby open forest on sandstone ridges of the Sydney Basin

- PCT1661 / HU875: Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin
- PCT1669 / HU883: Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood; and
- PCT1696 / HU910: Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter

Several of the Dry Sclerophyll Forest and Woodland PCTs present were also observed in a DNG formation. These areas were typically identified immediately adjacent to areas of vegetation in moderate to good condition.

Areas of native vegetation that were identified as being listed as a Threatened Ecological Community (TEC) under either the BC Act or EPBC Act (i.e. White Box Yellow Box Blakely's Red Gum Woodland) have been allocated to their own vegetation zone according to their pre-disturbance PCT. This applies to areas of HU730 – DNG observed within the development footprint.

All non-TEC areas of DNG have been combined in the BBCC for the purposes of streamlining the calculations. This includes combining areas of PCT1176 / HU618, PCT1629 / HU843, PCT1661 / HU875, and PCT1696 / HU910 under a single vegetation zone as PCT1696 / HU910 – DNG.

Following assessment of soil characteristics, landscape position, and vegetation surveys, the criteria included in **Table 10** was used to determine PCTs and vegetation zones within the Modification Disturbance Footprint. The PCTs listed in Table 10 and described below in **Section 4.3.2** are limited to the Modification Disturbance Footprint only.

Relinquishment Areas

Identification of PCTs was also undertaken and mapped for the Relinquishment Areas. These areas are shown alongside the southern area of the Modification Disturbance Footprint in **Figure 9**. In addition to exotic grassland/pasture and cleared land, eight PCTs were identified in the Relinquishment Areas. Six of these correspond directly with PCTs identified in the Modification Disturbance Footprint:

- PCT1176 / HU618
- PCT281 / HU714
- PCT618 / HU730
- PCT1629 / HU843
- PCT1661 / HU875
- PCT1696 / HU910

Two additional PCTs were identified in the Relinquishment Areas which do not correspond directly to PCTs within the Modification Disturbance Footprint:

- PCT1394 / HU603: Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of the upper Hunter Valley
- PCT1691 / HU905: Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter Valley

Table 10: Selection criteria for PCTs in the Modification Disturbance Footprint

Vegetation Zone	PCT / BVT	PCT name	Selection criteria	Species relied upon for assigning PCT	Approximate PCT Area (ha)	Site value score*
1	PCT1176 / HU618	Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Dry Sclerophyll Forests (Shrubby sub-formation) **Vegetation Class (Keith):** Western Slopes Dry Sclerophyll Forests **Landscape Position:** Occurs in gullies and on footslopes	**Upper Stratum Species**: *Eucalyptus dawsonii, Eucalyptus moluccana, Callitris endlicheri* **Mid Stratum Species**: No indicative species present **Ground Stratum Species**: *Aristida ramosa, Lomandra multiflora*	**2**	72.00
2	PCT281 / HU714	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 Bioregion	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Grassy Woodlands **Vegetation Class (Keith):** Western Slopes Grassy Woodlands **Landscape Position:** Valley floors, flats, drainage lines	**Upper Stratum Species**: *Angophora floribunda, Eucalyptus blakelyi, Eucalyptus melliodora* **Mid Stratum Species**: No indicative species present **Ground Stratum Species**: *Aristida ramosa, Cheilanthes sieberi, Desmodium varians, Glyicine clandestine, Hydrocotyle laxiflora, Microlaena stipoides*	**1.5**	44.27

Vegetation Zone	PCT / BVT	PCT name	Selection criteria	Species relied upon for assigning PCT	Approximate PCT Area (ha)	Site value score*
3	PCT618 / HU730	White Box - Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Grassy Woodlands **Vegetation Class (Keith):** Western Slopes Grassy Woodlands **Landscape Position:** Footslopes, hillslopes, and hillcrests	**Upper Stratum Species**: *Eucalyptus albens, Eucalyptus crebra, Brachychiton populneus* **Mid Stratum Species**: *Acacia implexa* **Ground Stratum Species**: *Microlaena stipoides, Geranium solanderi, Cymbopogon refractus, Elymus scaber*	**0.5**	92.36
4	PCT618 / HU730 - DNG	White Box - Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Grassy Woodlands **Vegetation Class (Keith):** Western Slopes Grassy Woodlands **Landscape Position:** Footslopes, hillslopes, and hillcrests	**Upper Stratum Species**: Absent **Mid Stratum Species**: No indicative species present **Ground Stratum Species**: *Microlaena stipoides, Elymus scaber, Chloris truncate, Austrostipa scabra*	**3**	17.71

Vegetation Zone	PCT / BVT	PCT name	Selection criteria	Species relied upon for assigning PCT	Approximate PCT Area (ha)	Site value score*
5	PCT1606 / HU820	White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Dry Sclerophyll Forests (Shrub/grass sub-formation) **Vegetation Class (Keith):** North-west Slopes Dry Sclerophyll Woodlands **Landscape Position:** Flats and hillslopes	**Upper Stratum Species**: *Eucalyptus albens, Eucalyptus crebra* **Mid Stratum Species**: No indicative species present **Ground Stratum Species**: *Austrostipa scabra, Cheilanthes sieberi, Dichondra repens, Microlaena stipoides*	**3**	74.48
6	PCT1629 / HU843	Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Dry Sclerophyll Forests (Shrubby sub-formation) **Vegetation Class (Keith):** Western Slopes Dry Sclerophyll Forests **Landscape Position:** Upper slopes and lower slopes	**Upper Stratum Species**: *Eucalyptus punctate, Eucalyptus sparsifolia* **Mid Stratum Species**: *Persoonia linearis, Podolobium ilicifolium* **Ground Stratum Species**: *Lepidosperma laterale, Lomandra confertifolia, Lomandra filiformis*	**13**	72.89

Vegetation Zone	PCT / BVT	PCT name	Selection criteria	Species relied upon for assigning PCT	Approximate PCT Area (ha)	Site value score*
7	PCT1661 / HU875	Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Dry Sclerophyll Forests (Shrubby sub-formation) **Vegetation Class (Keith):** Western Slopes Dry Sclerophyll Forests **Landscape Position:** Upper slopes and hillslopes	**Upper Stratum Species**: *Eucalyptus crebra, Callitris endlicheri* **Mid Stratum Species**: *Leucopogon muticus* **Ground Stratum Species**: *Cheilanthes sieberi, Joycea pallida, Lomandra multiflora, Microlaena stipoides, Goodenia hederacea*	**4**	78.22
8	PCT1669 / HU883	Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Dry Sclerophyll Forests (Shrubby sub-formation) **Vegetation Class (Keith):** Western Slopes Dry Sclerophyll Forests **Landscape Position:** Hillslopes	**Upper Stratum Species**: *Eucalyptus fibrosa, Eucalyptus punctata, Eucalyptus sparsifolia* **Mid Stratum Species**: Leucopogon muticus, Persoonia linearis, Phyllanthus hirtellus **Ground Stratum Species**: Cleistochloa rigida, Leidosperma gunnii, Lepidosperma laterale, Lomandra confertifolia, Pomax umbellata	**4.5**	60.89

Vegetation Zone	PCT / BVT	PCT name	Selection criteria	Species relied upon for assigning PCT	Approximate PCT Area (ha)	Site value score*
9	PCT1696 / HU910	Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Grassy Woodlands **Vegetation Class (Keith):** Western Slopes Grassy Woodlands **Landscape Position:** Flats and hillslopes	**Upper Stratum Species**: *Angophora floribunda, Eucalyptus blakelyi* **Mid Stratum Species**: *Melaleuca thymifolia* **Ground Stratum Species**: *Aristida vagans, Microlaena stipoides, Cheilanthes sieberi, Glycine clandestina*	**2.5**	70.83
10	PCT1696 / HU910 - DNG	Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter	**IBRA Subregion:** Kerrabee - Hunter/Central Rivers **Vegetation Formation:** Grassy Woodlands **Vegetation Class (Keith):** Western Slopes Grassy Woodlands **Landscape Position:** Flats and hillslopes	**Upper Stratum Species**: Absent **Mid Stratum Species**: Absent **Ground Stratum Species**: *Aristida vagans, Microlaena stipoides, Cheilanthes sieberi, Glycine clandestina*	**5**	45.49

* The site value score is automatically calculated in the BBCC is based on the floristic plot data.

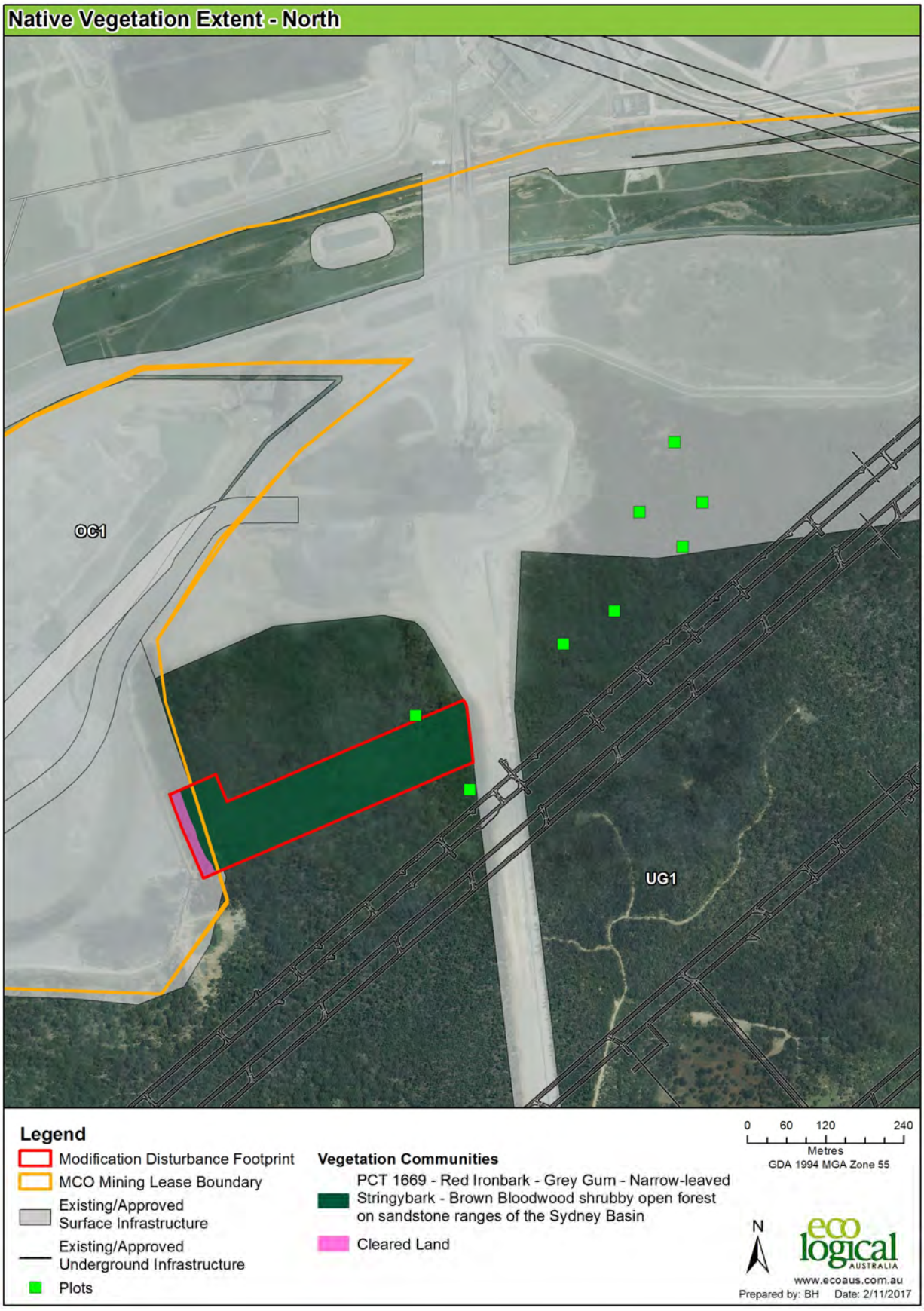

Figure 7: Vegetation communities – north

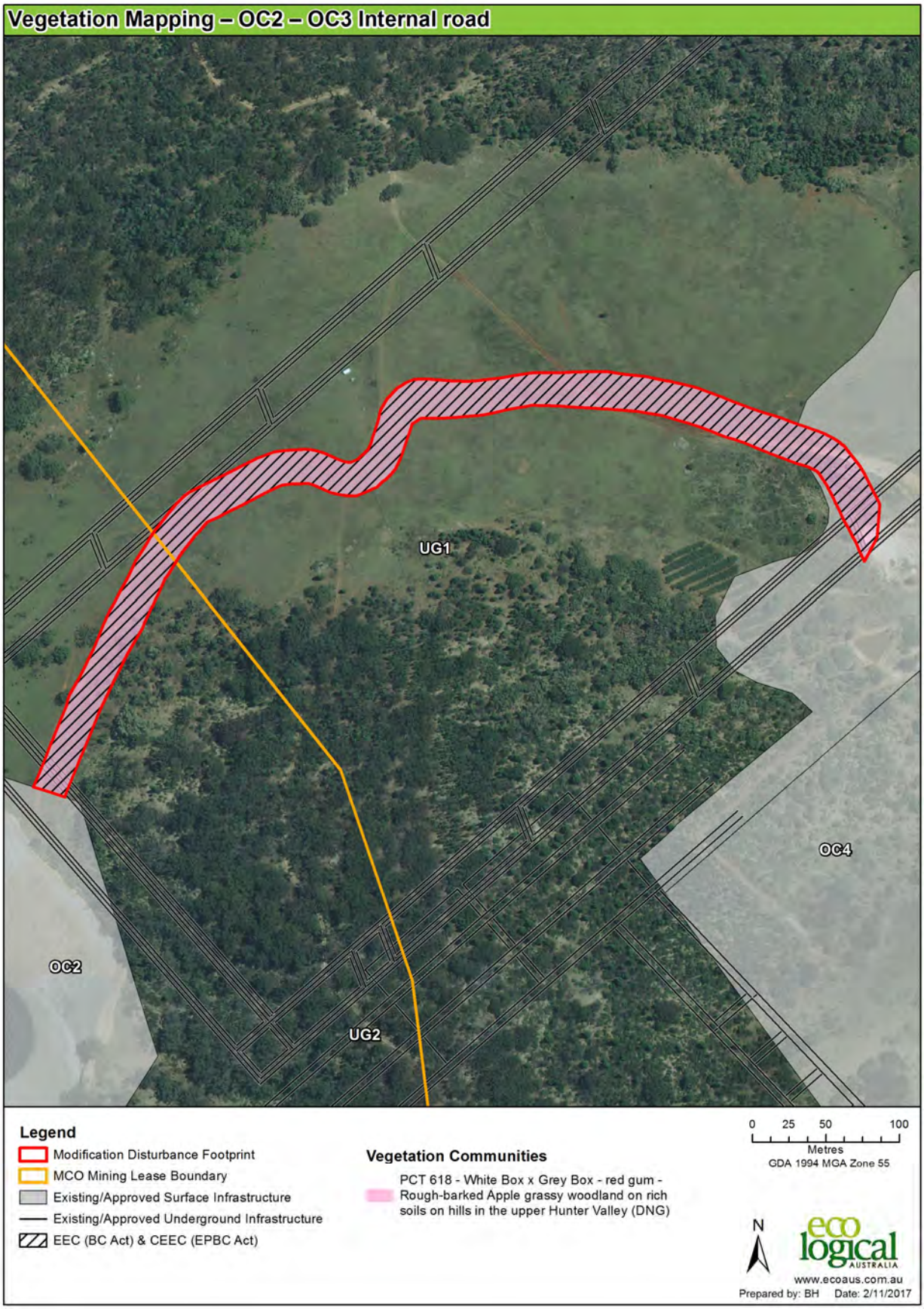

Figure 8: Vegetation communities - OC2 – OC3 internal road

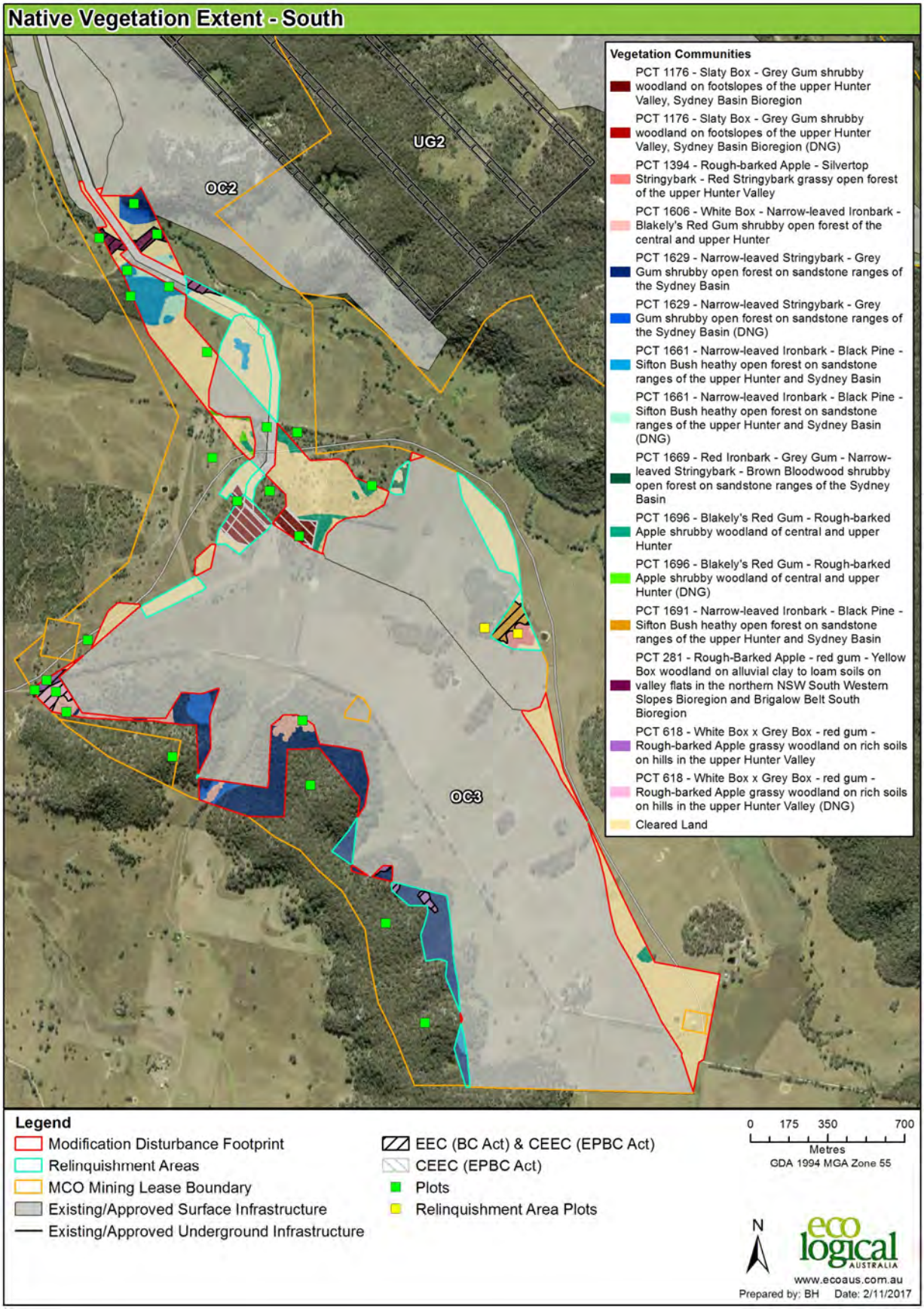

Figure 9: Vegetation communities – South

4.3.2 **Description of Plant Community Types**

Each of the PCTs detailed above in **Table 10** and **Figures 7**, **8** and **9** are described below for the Modification Disturbance Footprint.

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 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 Bioregion (PCT 281) occurs along the riparian fringes of Moolarben Creek within the survey area adjacent to OC2 (**Figure 9**).

This community has a canopy dominated by *Angophora floribunda* (Rough-barked Apple), *E. blakelyi* (Blakely's Red Gum) and *E. melliodora* (Yellow Box). The mid-storey is dominated by *Cassinia arcuata* (Sifton Bush), with the ground layer dominated by both native grasses, including *Aristida ramosa* (Purple Wiregrass) and *Microlaena stipoides* (Weeping Grass), and exotic grasses such as *Aira cupaniana* (Silvery Hairgrass) and *Vulpia bromoides* (Squirrel Tail Fescue).

Rough-Barked Apple - red gum - Yellow Box woodland within the survey area forms part of larger patches of this community. The patches of Rough-Barked Apple - red gum - Yellow Box woodland are deemed to meet the criteria for White Box - Yellow Box - Blakely's Red Gum Woodland and DNG Critically Endangered Ecological Community (CEEC) under the Commonwealth EPBC Act, including:

- having, or previously having, White Box, Yellow Box or Blakely's Red Gum as a common overstorey species;
- having a predominantly native understorey;
- being in a patch of 2 ha or greater in size (although less than 1 ha would be impacted by the Modification, this occurrence forms part of a larger patch of this community along Moolarben Creek); and
- having natural regeneration of the dominant over storey eucalypts (regenerating Yellow Box and Blakely's Red Gum).

The patch of Rough-Barked Apple - red gum - Yellow Box woodland is deemed to meet the criteria for White Box - Yellow Box - Blakely's Red Gum Woodland Endangered Ecological Community (EEC) listing under the NSW BC Act (NSW Scientific Committee, 2002) including:

- the site is in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands or NSW South Western Slopes Bioregions;
- the site has native species in the understorey and is likely to respond to assisted natural regeneration;
- the site contains Yellow Box and Blakely's Red Gum; and
- grass and herbaceous species generally characterise the ground layer.

An indicative photograph of this community is shown in **Figure 10**.

Figure 10: **PCT 281 along Moolarben Creek**

White Box - Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley (PCT 618)

White Box - Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley (PCT 618) is found on Permian sediments within the survey area along the mid-slopes. This community occurs in two forms within the survey area, including grassy woodland in the southern survey area (**Figure 9**) and DNG within the OC2 – OC4 internal road (**Figure 8**).

This community has a scattered canopy dominated by White Box, with scattered *E. moluccana* (Grey Box) also present. The mid-storey is dominated by *Acacia implexa* (Hickory Wattle) and Sifton Bush, with a ground cover of predominantly native grasses including *Austrostipa* spp. and *Rytidosperma* spp.

The derived form of this community is located on either Permian sediments (OC3 area) or on basalt derived soils (as within the OC2 – OC4 internal road area). The ground cover is dominated by native species, including Purple Wiregrass, *Aristida vagans* (Three-awn Speargrass), *Bothriochloa macra* and *Rytidosperma* spp.

White Box grassy woodland present within the survey area forms part of the White Box - Yellow Box - Blakely's Red Gum Woodland EEC listing under the NSW BC Act and White Box - Yellow Box - Blakely's Red Gum Woodland and DNG CEEC under the Commonwealth EPBC Act.

White Box grassy woodland and DNG within the survey area forms part of larger patches of this community. The patches of White Box grassy woodland and DNG are deemed to meet the criteria for the EPBC listed CEEC, including:

- having, or previously having, White Box, Yellow Box or Blakely's Red Gum as a common overstorey species;
- having a predominantly native understorey;
- containing 12 or more native (non-grass) species including at least one important species and being in a patch greater than 0.1 ha in size;
- having natural regeneration of the dominant over storey eucalypts (regenerating White Box).

The patch of White Box grassy woodland and DNG is deemed to meet the criteria for the NSW BC Act listed EEC (NSW Scientific Committee, 2002) including:

- the site is in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands or NSW South Western Slopes Bioregions;
- the site has native species in the understorey and is likely to respond to assisted natural regeneration;
- the site contains White Box (Grassy Woodland Component);
- the site is predominantly treeless but likely to have supported White Box, Yellow Box or Blakely's Red Gum prior to clearing (DNG Component); and
- grass and herbaceous species generally characterise the ground layer.

An indicative photograph of this community in woodland and DNG form is shown in **Figure 11** and **Figure 12** respectively.

Figure 11: PCT 618 woodland form along Moolarben Road

Figure 12: PCT 618 DNG form at floristic plot OC3-10

Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion (PCT 1176)

Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion (PCT 1176) present within the survey area is found on talus slopes of Narrabeen sediments onto Permian sediments, and on a crest between flowlines of the long low slopes on Permian sediments in the southern survey area (**Figure 9**).

This community has a canopy dominated by *E. dawsonii* (Slaty Gum) and *Callitris endlicheri* (Black Cypress Pine), with Grey Box also present. The mid-storey also contains Black Cypress Pine along with *Cassinia uncata* (Sticky Cassinia) and *Casuarina cristata* (Belah). The ground cover is dominated by native grasses including Three-awn Speargrass and *Rytidosperma* spp., along with *Gahnia aspera* (Rough Saw-sedge).

Within the survey area, this community forms part of the Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion which is listed as a vulnerable ecological community (VEC) under the NSW BC Act and the Central Hunter Valley eucalypt forest and woodland listed as a CEEC under the Commonwealth EPBC Act.

Slaty Box - Grey Gum shrubby woodland within the survey area forms part of larger patches of this community. The patches of Slaty Box - Grey Gum shrubby woodland are deemed to meet the criteria for the EPBC listed Central Hunter Valley eucalypt forest and woodland CEEC, including:

- occurs on Permian Sediments within the Hunter Valley Region;

- the woodland or forest must contain one or more of *E. crebra* (Narrow-leaved Ironbark), *Corymbia maculate* (Spotted Gum), Slaty Gum and Grey Box (Slaty Gum is dominant, with Grey Box also present);
- contains other characteristic species in the mid-storey, including *Acacia linearifolia* (Narrow-leaved Wattle);
- having a predominantly native understorey; and
- occurring in patches of 0.5 ha or greater in size.

Slaty Box - Grey Gum shrubby woodland is deemed to meet the criteria for the NSW BC Act listed VEC including:

- the site is in the Hunter Valley Region;
- found on steep talus slopes of Narrabeen sediments onto Permian sediments; and
- the woodland is dominated by Slaty Gum and Black Cypress Pine, with Grey Box also present.

An indicative photograph of this community is shown in **Figure 13**.

Figure 13: PCT 1176 at floristic plot OC3-2

White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter (PCT 1606)

White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter (PCT 1606) is found on steep talus slopes of Narrabeen sediments onto Permian sediments within the southern survey area adjacent to OC3 (**Figure 9**).

This community has a canopy dominated by White Box and Narrow-leaved Ironbark with a mid-storey of Black Cypress Pine. The ground layer has a scattered covering of native grasses and herbs including *Austrostipa densiflora*, *Themeda triandra* (Kangaroo Grass), Rough Saw-sedge, *Cheilanthes sieberi* and *Pomax umbellata*.

PCT 1606 identified within the survey area does not form part of any listed TEC under the NSW BC Act and/or the Commonwealth EPBC Act due to the mainly shrubby substrate species.

An indicative photograph of this community is shown in **Figure 14**.

Figure 14: PCT 1606 at floristic plot OC3-4

Narrow-leaved Stringybark – Grey Gum shrubby open forest on sandstone ridges of the Sydney Basin (PCT 1629)

Narrow-leaved Stringybark – Grey Gum shrubby open forest on sandstone ridges of the Sydney Basin (PCT 1629) is the most common native PCT found within the survey area, occurring along the ridgetops throughout the southern survey area adjacent to OC2 and OC3 (**Figure 9**).

This community is dominated by a canopy of Narrow-leaved Ironbark and Black Cypress Pine, with scattered *E. parramattensis* (Parramatta Red Gum) and *E. punctata* (Grey Gum). The mid-storey is dominated by Narrow-leaved Wattle, *Cassinia quinquefaria*, and *Phebalium squamulosum* (Scaly Phebalium). The ground cover is made up predominantly of scattered grasses including *Austrostipa* sp., *Cleistochloa rigida*, Weeping Grass and *Rytidosperma* sp.

This community is not listed as a TEC under the NSW BC Act and/or the Commonwealth EPBC Act.

An indicative photograph of this community is shown in **Figure 15**.

Figure 15: PCT 1629 at floristic plot OC3-12

Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin (PCT 1661)

Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin (PCT 1661) is found on Narrabeen sediments on low rises within the southern survey area (**Figure 9**).

This community has a canopy dominated by Narrow-leaved Ironbark and Black Cypress Pine, with *E. macrorhyncha* (Red Stringybark) and *E. rossii* (Inland Scribbly Gum) also present. The mid-storey is comprised of *Acacia gladiiformis* (Sword Wattle), *Leucopogon* spp. and *Sannantha cunninghamii*. The ground cover has a scattered covering of native grasses and herbs including *Rytidosperma* spp., Weeping Grass, *Brachyloma daphnoides* (Daphne Heath) and *Gonocarpus tetragynus*.

This community is not listed as a TEC under the NSW BC Act and/or the Commonwealth EPBC Act.

An indicative photograph of this community is shown in **Figure 16**.

Figure 16: PCT 1661 at floristic plot OC3-6

Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter (PCT 1696)

Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter (PCT 1696) is found on deep sandy rise outcrops and rocky outcrops of sandstone rubble within the survey area adjacent to OC2 (**Figure 9**).

This community has a canopy dominated by Rough-barked Apple and Black Cypress Pine, with scattered Blakely's Red Gum. The mid-storey comprises a range of species including *Calytrix tetragona* (Common Fringe-myrtle), Sifton Bush, *Melaleuca thymifolia* (Thyme Honey-myrtle) and *Sannantha cunninghamii*. The ground cover is dominated by native grass species including Purple Wiregrass, Kangaroo Grass, Weeping Grass and *Arundinella nepalensis* (Reedgrass).

This community is not listed as a TEC under the NSW BC Act and/or the Commonwealth EPBC Act.

An indicative photograph of this community is shown in **Figure 17**.

Figure 17: PCT 1696 at floristic plot OC3-18

Red Ironbark – Grey Gum – Narrow-leaved Stringybark – Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin (PCT 1669)

Red Ironbark – Grey Gum – Narrow-leaved Stringybark – Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin occurs on dry-shallow soils on sandstone ridges and upper slopes in the northern survey area north of UG1 and adjacent OC1 (**Figure 7**).

This community has a canopy dominated by *E. sparsifolia* (Narrow-leaved Stringybark), Grey Gum and *E. fibrosa* (Red Ironbark), with a mid-storey featuring *Persoonia linearis* (Narrow-leaved Geebung) and *Leucopogon muticus* (Blunt Beard-heath). The ground cover is sparse and is dominated by native herbs and rushes including *Pomax umbellata* and *Lomandra glauca*.

This community is not listed as a TEC under the NSW BC Act and/or the Commonwealth EPBC Act.

An indicative photograph of this community is shown in **Figure 18**.

Figure 18: PCT 1669 at floristic plot OC3-30

4.3.3 **Threatened Ecological Communities**

A summary of the TECs identified within the Modification Disturbance Footprint is included below in **Table 11**.

Table 11: Threatened Ecological Communities in the Modification Distubance Footprint

Conservation Status		Associated PCT(s) within Modification Disturbance Footprint	Approximate Area (ha)
BC Act	EPBC Act		
Endangered: White Box Yellow Box Blakely's Red Gum Woodland	**Critically Endangered:** White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	281; 618 (including both woodland and DNG)	5
Vulnerable: Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion (note that VEC's are not considered TECs under NSW EP&A Act (s.5D))	**Critically Endangered:** Central Hunter Valley eucalypt forest and woodland	1176	2

5 Threatened species and populations

5.1 Data review

A review of existing data sources and information relevant to the Modification Disturbance Footprint was undertaken to assess the potential for threatened species and populations listed under the BC Act and the EPBC Act to occur within the Modification Disturbance Footprint. The following information sources and databases were reviewed:

- BBCC (OEH 2014);
- BioNet Atlas of NSW Wildlife (Office of Environment and Heritage [OEH] 2017a) covering an area from latitude -32.26 to -32.40 and longitude 149.75 to 149.85 (Datum GDA94);
- EPBC Protected Matters Search Tool (DotEE 2017) covering an area from latitude -32.26 to -32.40 and longitude 149.75 to 149.85 (Datum GDA94), with a 1 km buffer;
- OEH Threatened Species Profile Database (OEH 2017b);
- MCO Stage 1 Flora, Fauna and Aquatic Ecology Assessment (Moolarben Biota 2006);
- MCO Stage 1 Modification 9 Ecological Impact Assessment (EMGA Mitchell McLennan 2013); and
- MCO Stage 2 Ecological Impact Assessment (Ecovision 2008).

5.1.1 Ecosystem credit species

The vegetation communities identified in **Section** 4 were entered into the BBCC to generate a list of predicted ecosystem species, based on habitat constraints associated with the vegetation communities present. Habitat constraints are summarised below in **Table 12**.

Table 12: Ecosystem species constraints within Modification Disturbance Footprint

Habitat Constraint	Modification Disturbance Footprint
IBRA Subregion	Kerrabee
Associated PCTs	281, 618, 1661, 1629, 1176, 1669, 1606, 1696
Percent Native Vegetation within buffer	41 – 45%
Condition of Vegetation	Moderate - Good
Patch Size	Very Large (>200 ha)

For the purposes of the BBCC, the ecosystem credit species with the highest Tg score was assumed present (Barking Owl, Masked Owl and Powerful Owl). A complete list of all predicted ecosystem species is shown in **Table 13** below. No further assessment of these species was undertaken as any potential impacts would be accounted for through the offsetting of ecosystem credits.

Table 13: Ecosystem species predicted within Modification Disturbance Footprint

Common Name	Scientific name	Tg Value
Barking Owl	*Ninox connivens*	3.0
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis* subsp. *gularis*	1.3
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus* subsp. *victoriae*	2.0
Bush Stone-curlew	*Burhinus grallarius*	2.6
Corben's Long-eared Bat	*Nyctophilus corbeni*	2.1
Diamond Firetail	*Stagonopleura guttata*	1.3
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	2.2
Eastern Freetail-bat	*Mormopterus norfolkensis*	2.2
Flame Robin	*Petroica phoenicea*	1.3
Gang-gang Cockatoo	*Callocephalon fimbriatum*	2.0
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	1.8
Greater Broad-nosed Bat	*Scoteanax rueppellii*	2.2
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis* subsp. *temporalis*	1.3
Hooded Robin (south-eastern form)	*Melanodryas cucullata* subsp. *cucullata*	1.7
Little Eagle	*Hieraaetus morphnoides*	1.4
Little Lorikeet	*Glossopsitta pusilla*	1.8
Masked Owl	*Tyto novaehollandiae*	3.0
Painted Honeyeater	*Grantiella picta*	1.3
Powerful Owl	*Ninox strenua*	3.0
Scarlet Robin	*Petroica boodang*	1.3
Speckled Warbler	*Chthonicola sagittata*	2.6
Spotted-tailed Quoll	*Dasyurus maculatus*	2.6
Square-tailed Kite	*Lophoictinia isura*	1.4
Squirrel Glider	*Petaurus norfolcensis*	2.2
Swift Parrot	*Lathamus discolor*	1.3
Turquoise Parrot	*Neophema pulchella*	1.8
Varied Sittella	*Daphoenositta chrysoptera*	1.3
Yellow-bellied Glider	*Petaurus australis*	2.3
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	2.2

5.1.2 **Species credit species**

Species credit species are threatened flora and fauna species that cannot be predicted by vegetation type within the Modification Disturbance Footprint. Species credit species that are likely to occur within the development site based on habitat assessment, must be surveyed to determine presence/absence.

5.1.3 **Habitat present within Modification Disturbance Footprint**

Within the Modification Disturbance Footprint, where native vegetation does occur, the habitat is of moderate to good condition. The retention of this vegetation and higher quality habitat is largely driven by topography and soil type, where sub-standard grazing country has been retained due to inaccessibility and poor soil types.

The following habitat features are present within the Modification Disturbance Footprint:

- land within 250 m of termite mounds or rock outcrops;
- sclerophyll woodland and derived grassland on flats or small rises, on a range of substrates including sandy or loamy soils;
- land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels;
- land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber;
- land within 1 km of rock outcrops or clifflines;
- skeletal sandy soil in shrubland or heath;
- land containing surface rocks (embedded or loose);
- heath or eucalypt forest on sandstone with a build-up of litter or other debris and containing, or within 40 m of, ephemeral or intermittent drainage lines; and
- land within 40 m of heath, woodland or forest with sandy or friable soils.

5.1.4 **Candidate Species**

A list of candidate species was generated by the BBCC and each species assessed for likelihood of occurrence within the Modification Disturbance Footprint. Candidate species are selected for each development site from the Threatened Species Profile Database based on the following criteria:

- the species is identified as a species credit species;
- the geographic distribution of the species is known or predicted to include the IBRA subregion in which the development site is located;
- the development site contains habitat features or components associated with the species; and
- or previous surveys undertaken within the development site have identified the species is present

Candidate species were also sourced from the EPBC Referral advice (DotEE, 2017). A complete assessment of the likelihood of candidate species is provided within **Appendix C**.

The likelihood of occurrence table (**Appendix C**) identifies the candidate species which require further assessment. All species that were determined likely to occur within the Modification Disturbance Footprint were reviewed at the field survey stage. The following species were identified for further assessment:

- Threatened flora:
    - *Acacia ausfeldii* (Ausfeld's Wattle)
    - *Dicanthium setosum* (Bluegrass)
    - *Diuris tricolor* (Pine Donkey Orchid)
    - *Homoranthus darwinioides*
    - *Pomaderris queenslandica* (Scant Pomaderris)
    - *Pomaderris reperta* (Denman Pomaderris)
- Threatened fauna:
    - *Anthochaera Phrygia* (Regent Honeyeater)
    - *Chalinolobus dwyeri* (Large-eared Pied Bat)
    - *Dasyurus maculatus maculatus* (Spotted-tailed Quoll (SE mainland population))
    - *Grantiella picta* (Painted Honeyeater)
    - *Lathamus discolour* (Swift Parrot)
    - *Nyctophilus corbeni* (Corben's Long-eared Bat)
    - *Petrogale penicillata* (Brush-tailed Rock-wallaby)
    - *Phascolarctos cinereus* (Koala)

The species listed above, that are considered species credit species, were assessed via targeted field survey.

5.2 Additional consideration of EPBC Act listed species

In addition to the ecosystem species and species credit species generated by the BBCC, a number of further species or ecological communities listed under the EPBC Act were identified as requiring further assessment under the Controlled Action provisions issues by DotEE. These species were assessed for their likelihood of occurrence (**Appendix C**), with those likely to occur considered further within this report. The EPBC Act listed species that were also identified in the BBCC as species credit species were subject to targeted field surveys as described below in **Section 5.3**.

5.3 Threatened species surveys

Threatened species identified as requiring further assessment were subject to targeted field surveys as described below in **Table 14**. The area surveyed (the survey area) was greater than the Modification Disturbance Footprint due to later refinements to the boundary.

Timing of surveys was broadly planned around the time of year when each species can most easily be identified.

Table 14: Species credit species within Modification Disturbance Footprint

Common name	Scientific Name	Survey period											
		Jan	Feb	**Mar**	**Apr**	May	Jun	Jul	Aug	Sep	Oct	**Nov**	Dec
Threatened flora													
Ausfeld's Wattle	*Acacia ausfeldii*							X	X	X			
Bluegrass	*Dichanthium setosum*	X	X	**X**	**X**	X							X
Pine Donkey Orchid	*Diuris tricolor*									X	X		
Homoranthus darwinioides	*Homoranthus darwinioides*	X	X	**X**	**X**	X	X	X	X	X	X	**X**	X
Scant Pomaderris	*Pomaderris queenslandica*	X	X	**X**	**X**	X	X	X	X	X	X	**X**	X
Denman Pomaderris	*Pomaderris reperta*	X	X	**X**	**X**	X	X	X	X	X	X	**X**	X
Threatened fauna													
Regent Honeyeater	*Anthochaera phrygia*	X	X	**X**	**X**	X	X	X	X	X	X	**X**	X
Large-eared Pied Bat	*Chalinolobus dwyeri*	X	X	**X**	**X**					X	X	**X**	X
Brush-tailed Rock-wallaby	*Petrogale penicillata*	X	X	**X**	**X**	X	X	X	X	X	X	**X**	X
Koala	*Phascolarctos cinereus*	X	X	**X**	**X**	X	X	X	X	X	X	**X**	X

Bold denotes survey time selected

5.3.1 **Targeted threatened flora surveys**

Targeted surveys were undertaken with consideration given to the *NSW Guide to Surveying Threatened Plants* (OEH, 2016). Surveys were undertaken in suitable habitat for each species and included parallel field traverses.

Of the threatened flora identified as potentially occurring within the Modification Disturbance Footprint, *D. tricolor* is only identifiable when flowering, which typically occurs from early September to November (National Herbarium of NSW 2017). Known reference sites for this species in the surrounding area were visited by ELA ecologists to positively confirm that flowering was underway prior to commencement of the targeted flora field survey, which was then undertaken in the southern survey area by ELA ecologists David Allworth and Lorraine Parish from 2 - 4 November 2016.

The remaining flora species are readily identifiable when not in flower so seasonality was not considered to be a limitation to the survey. Targeted flora surveys were also undertaken during the vegetation validation surveys in the northern survey area and internal haul road from 20 – 22 March 2017, and 18 April 2017. *D. tricolor* was not included in these surveys due to the seasonality limitations.

The field surveys were undertaken using a random meander traverse, shown in **Figure 19** and **Figure 20**. Ecological features were mapped using GPS and photographed. Areas that contained potential habitat for threatened flora species, including locations previously identified within the Stage 1 and Stage 2 Ecological Impact Assessment survey areas (Moolarben Biota 2006; Ecovision 2008) as likely to support threatened flora species were also surveyed.

5.3.2 Targeted threatened fauna surveys

Eight threatened fauna species were identified as requiring further assessment from their likelihood to occur in the Survey Area (**Appendix C**). Of these species, four species are classed as 'ecosystem species' which are assumed present within the Modification Disturbance Footprint under the FBA. Field surveys were therefore only targeted at potential species credit species which included:

- habitat mapping, spotlighting, and incidental observations for Koala;
- cliffline features mapping and remote camera survey for Brush-tailed Rock Wallaby;
- ultrasonic detector surveys for Large-eared Pied Bat; and
- diurnal surveys for Regent Honeyeater.

Fauna surveys were conducted over five days between the 20 February and 1 March 2017 in the southern survey area by ELA ecologists Cassandra Holt and Justin Russell, with surveys conducted by David Allworth and Tomas Kelly in the northern survey area on 20 March 2017. Fauna survey sites were established in the southern survey area with their locations based on the potential habitat identified by the vegetation validation and community mapping detailed above in **Section 4.2**.

Fauna survey effort in the northern survey area consisted of opportunistic sightings, and cliff line and habitat feature mapping (**Figure 19**). The southern survey area fauna survey effort is shown in **Figure 20** below, and consisted of diurnal bird surveys, microbat detection surveys, remote camera surveys, nocturnal surveys, reptile surveys, opportunistic sightings, Koala feed tree mapping, and cliff line and habitat feature mapping.

The field survey design was informed by relevant NSW and Commonwealth survey guidelines, including:

- NSW Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (Department of Environment and Conservation 2004);
- Survey Guidelines for Australia's threatened birds (Department of Environment, Water, Heritage and the Arts [DEWHA] 2010a);
- Survey Guidelines for Australia's threatened bats (DEWHA 2010b);
- Survey Guidelines for Australia's threatened mammals (Department of Sustainability, Environment, Water, Populations and Communities [SEWPaC] 2011a); and
- Survey Guidelines for Australia's threatened reptiles (SEWPaC 2011b).

5.3.3 Koala habitat mapping

Koala habitat mapping was undertaken based on the findings of the data audit, where Koala feed tree species as listed under Schedule 2 of SEPP 44 were indicated to occur in accordance with the definition of potential Koala habitat as per Section 4 of the SEPP:

- *Potential Koala habitat* means areas of native vegetation where the trees of the types listed in Schedule 2 constitute at least 15% of the total number of trees in the upper or lower strata of the tree component.

White Box was indicated to occur in sufficient frequency in the southern survey area, therefore survey effort was designed to record individuals of this species. No other feed tree species were indicated to occur in sufficient numbers to warrant potential habitat mapping in the northern survey area or OC2 – OC4 internal road.

5.3.4 Cliff line features habitat mapping

Areas of cliff lines containing rocky outcrops, caves and overhangs providing potential habitat to cave-roosting fauna were mapped to assess the habitat potential of the Modification Disturbance Footprint. Mapping of cliff line habitat was undertaken by walking the length of cliff lines throughout the entire survey area and recording with a handheld GPS the locations of rock outcrops, caves and overhangs.

5.3.5 Diurnal bird surveys

Diurnal bird surveys were conducted by performing six 20 minute surveys at three sites in the southern survey area (**Figure 20**) by two ecologists during the morning and afternoon. Bird species were identified using both visual and acoustic cues. These surveys were targeted at the Regent Honeyeater, but also considered Swift Parrot and Painted Honeyeater.

5.3.6 Microchiropteran bat detection surveys

Microchiropteran bat surveys were conducted using Anabats set to detect ultrasonic bat calls. Surveys took place at two fauna monitoring sites over two nights and four potential roosting caves for one night, providing a combined survey effort of eight nights (labelled as Anabat 1 – 6 in **Figure 20**). These surveys were targeted at the Large-eared Pied Bat.

5.3.7 Remote camera surveys

Remote cameras were positioned at three fauna monitoring sites (**Figure 20**) over four nights for a combined survey effort of 12 nights. The remote cameras were baited with chicken necks placed inside a PVC canister with the aim of targeting Brush-tailed Rock Wallaby, and Spotted-tail Quoll.

5.3.8 Nocturnal surveys

A nocturnal spotlighting survey was conducted for one hour during one evening within the southern woodland section of the survey area. The spotlighting survey specifically targeted nocturnal mammals and reptiles.

5.3.9 General observations and opportunistic sightings

Throughout the survey effort, continual observations were undertaken for opportunistic sightings of threatened fauna. All opportunistic sightings of fauna and fauna habitat features, such as scats, scratchings, nests and burrows, were recorded where observed.

5.3.10 Additional surveys undertaken

Additional surveys were undertaken at three fauna monitoring sites (**Figure 20**), with each site being surveyed by two ecologists for 30 minutes over two days (one hour per site). Surveys involved hand searching of micro-habitat including log and rock turning, as well as searching leaf litter and decorticating bark.

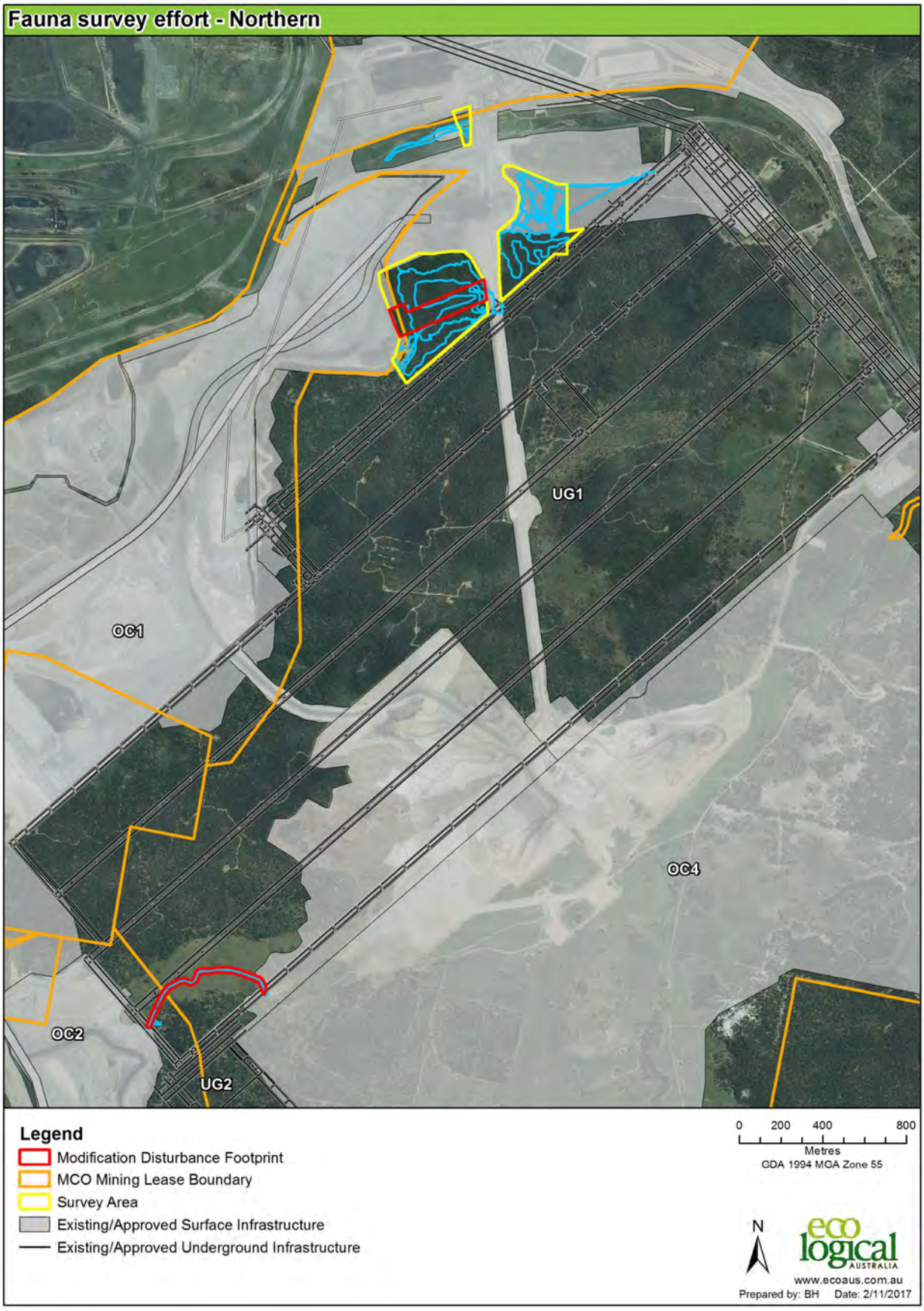

Figure 19: Fauna survey effort - northern survey area

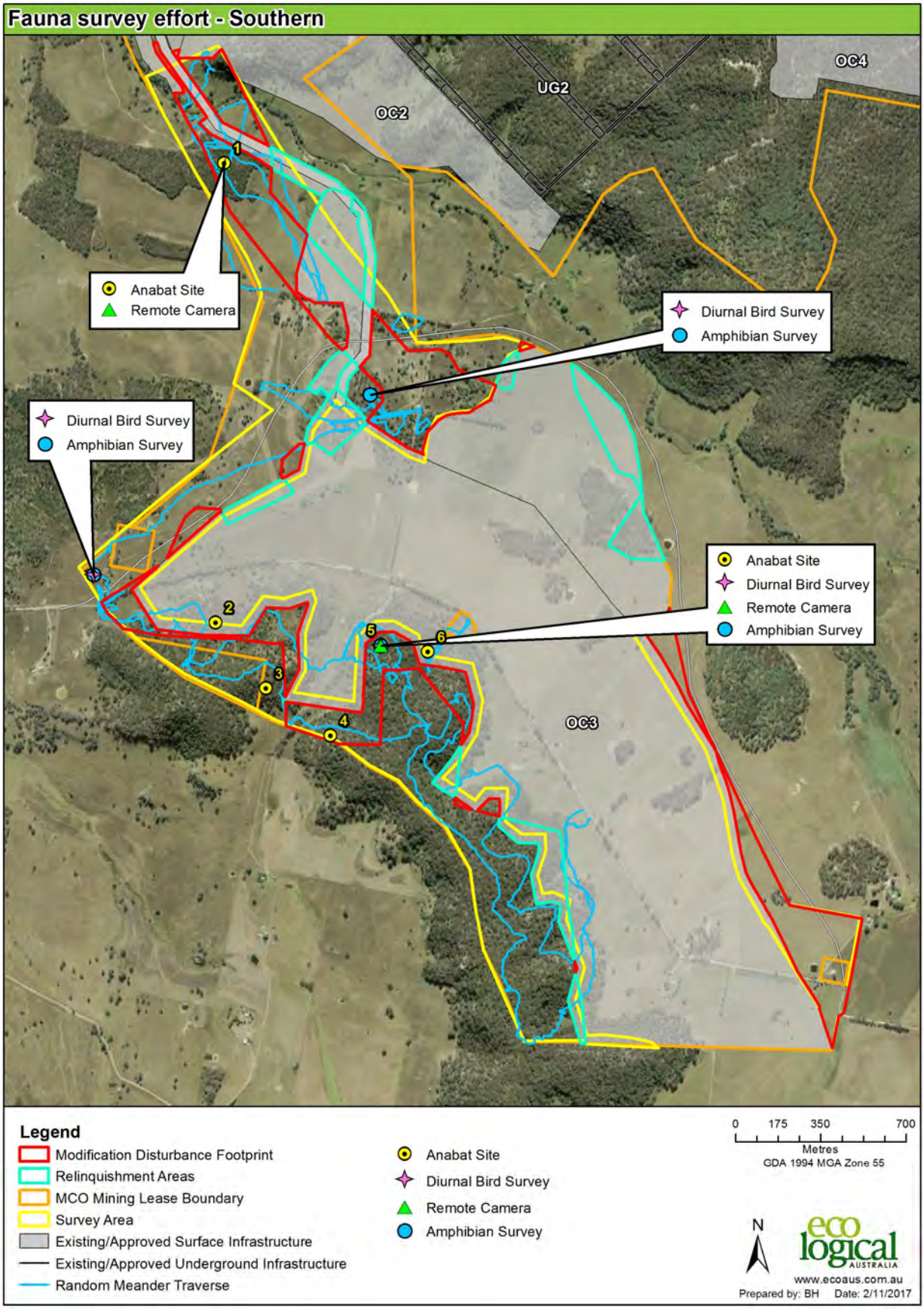

Figure 20: Fauna survey effort - southern survey area

5.4 Weather data

Weather data for all the survey dates is shown below in **Table 15**. During the first three days of the field survey (2 – 6 November 2016) temperatures were seasonally mild, with no rainfall recorded. Weather conditions over the remaining field survey dates were variable, with warm and dry conditions on the 13 – 14 December 2016, followed by cool and wet conditions on the 15 – 16 December 2016, hot and dry conditions during February 2017 and warm, damp conditions in March. Weather data was captured at the MCC weather station.

Table 15: Field survey weather conditions

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	Average Wind Speed (km/h)
2 November 2016	3.2	20.6	0	6.5
3 November 2016	5.0	23.9	0	5.3
4 November 2016	5.0	25.0	0	6.2
13 December 2016	14.5	34.9	0	1.9
14 December 2016	14.8	35.4	0	2.3
15 December 2016	14.9	23.3	7.8	3.1
16 December 2016	14.9	21.7	9.4	2.5
20 February 2017	8.2	24.6	0	2.2
21 February 2017	5.8	30.4	0	1.3
22 February 2017	13.8	33.2	0	1.6
23 February 2017	14.2	35.5	0	1.2
24 February 2017	16.0	35.7	0	1.9
1 March 2017	14.2	26.7	0	2.2
20 March 2017	19.3	27.3	0.8	1.7
21 March 2017	19.9	29.3	1.8	1.6
22 March 2017	19.7	28.7	7.0	1.4
18 April 2017	8.7	23.0	0	1.5

5.5 Targeted threatened species survey results

5.5.1 Threatened flora

No threatened flora species were identified during the targeted threatened flora surveys. The survey effort, including the survey timing, was considered appropriate to identify the presence of the targeted flora species. As such, it is assumed that none of the threatened flora species occur within the Modification Disturbance Footprint.

5.5.2 **Cliffline features habitat mapping**

The cliffline features surveyed throughout the Modification Disturbance Footprint included numerous caves, rocky outcrops and overhangs, providing potential sheltering/roosting opportunities for microbats, as well as other mammals, birds and reptiles. An example is shown below in **Figure 21**, although this is representative of the survey area and not the Modification Disturbance Footprint. Cliff lines were surveyed for microbat habitat features within the Modification Disturbance Footprint and relinquishment areas (**Figure 22** and **Figure 23**) however no specific microbat maternity or nursing roosts were identified during the surveys.

Figure 21: Example of large rocky overhang in the survey area (outside the Modification Disturbance Footprint)

Figure 22: Habitat features - north

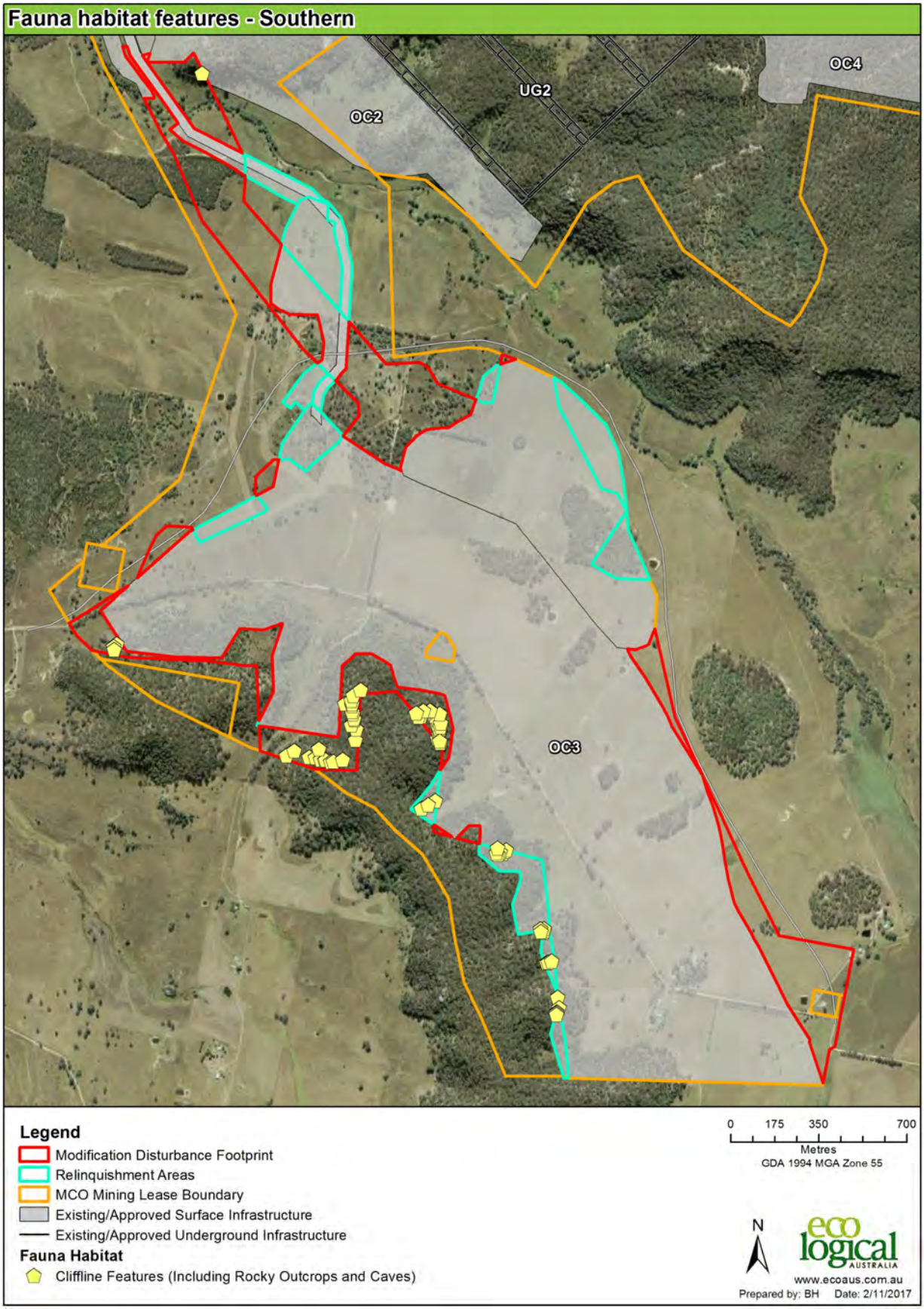

Figure 23: Habitat features – south

5.6 Fauna surveys

A total of 53 native fauna species were recorded across the survey area, comprising 37 bird species, 13 mammals (including eight microchiropteran bat species) and three reptile species. Native fauna species recorded are listed in **Appendix D**. A further two introduced mammal species were recorded, including *Felis catus* (Feral cat) and *Vulpes vulpes* (Red Fox) – these are not included in the list at **Appendix D**.

A total of five threatened fauna species were positively recorded during the field surveys, including three bird species and two microchiropteran bats. Threatened fauna species' locations are shown below in **Figure 24** and **Figure 25**. Additional threatened fauna records (e.g. from the Moolarben Stage 1 and Stage 2 approvals) are not shown on **Figure 24** and **Figure 25** as impacts to these species associated with the approved works have been previously offset but these species have been considered with respect to likelihood of occurrence within the Modification Disturbance Footprint.

The three threatened bird species recorded during the field survey, listed as vulnerable under the BC Act, were:

- *Climacteris picumnus victoriae* (Brown Treecreeper (eastern subspecies));
- *Artamus cyanopterus cyanopterus* (Dusky Woodswallow); and
- *Pomatostomus temporalis temporalis* (Grey-crowned Babbler (eastern subspecies)).

Two threatened microbat species listed under the NSW BC Act and/or Commonwealth EPBC Act were positively identified within the survey area:

- *Chalinolobus dwyeri* (Large-eared Pied Bat) – vulnerable under the NSW BC Act and Commonwealth EPBC Act; and
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat) – vulnerable under the NSW BC Act.

A further 37 threatened species listed under the NSW BC Act and/or Commonwealth EPBC Act are considered to have potential habitat within the Modification Disturbance Footprint, based on the results of the data audit and database searches (**Appendix C**). Therefore, a total of 42 threatened fauna species are considered to have potential habitat within the Modification Disturbance Footprint including:

- 28 threatened bird species;
- three mammals (excluding bats); and
- 11 bats.

All of these species are ecosystem species with the exception of the Regent Honeyeater, Koala and Brush-tailed Rock Wallaby.

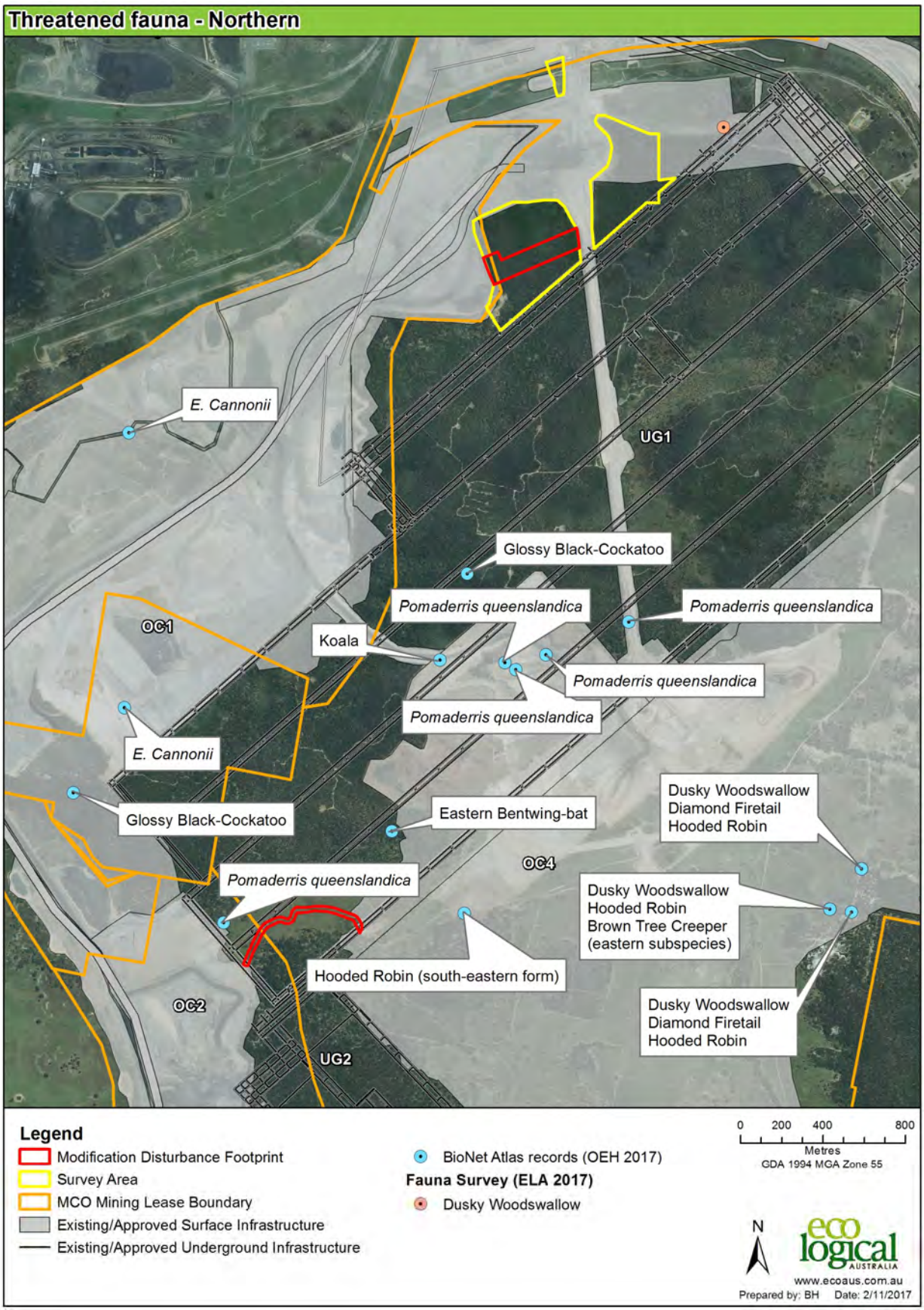

Figure 24: Threatened flora and fauna species locations – north (OEH [2017] and ELA [2017] records)

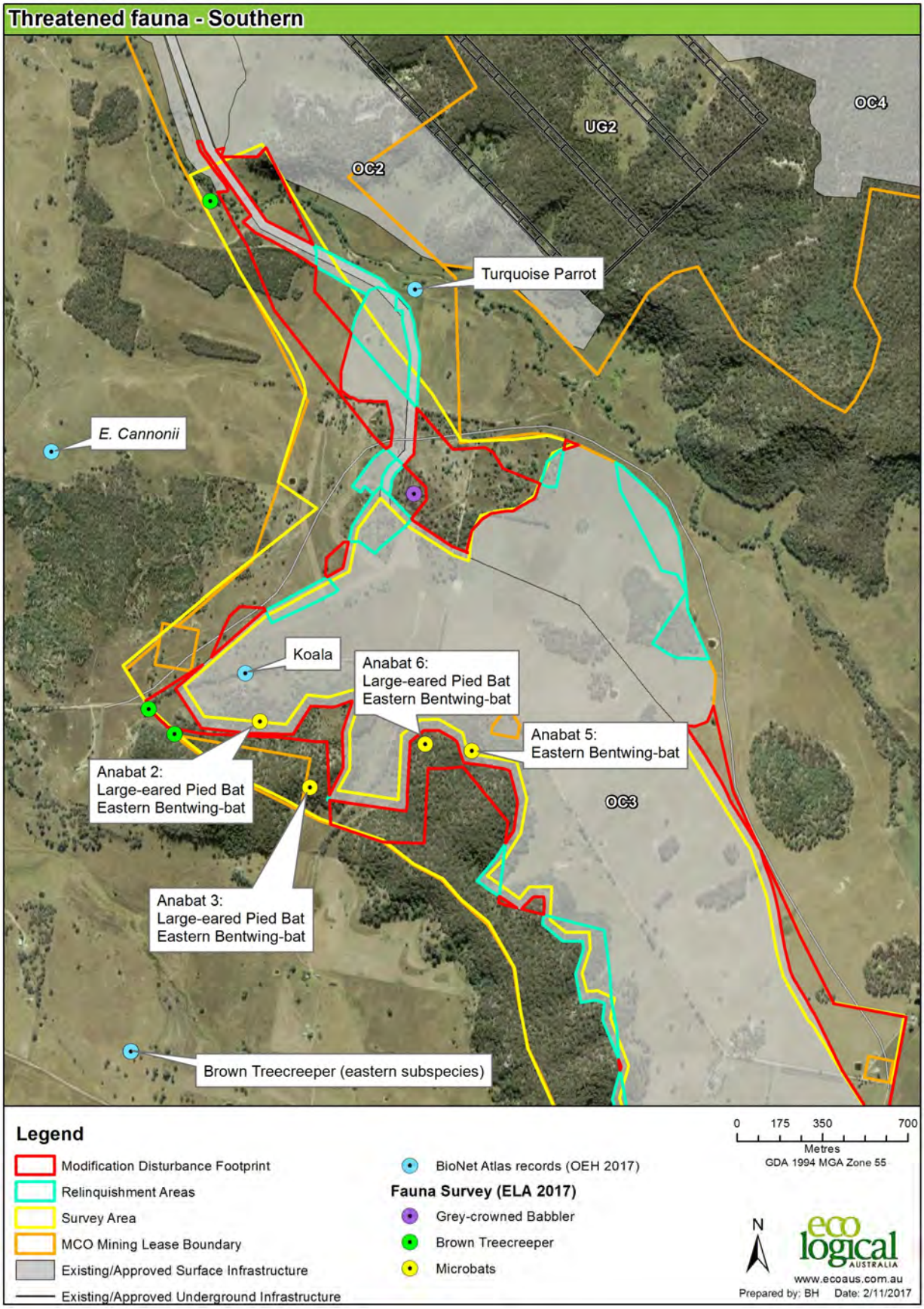

Figure 25: Threatened fauna species locations – south (OEH [2017] and ELA [2017] records)

5.6.1 **Diurnal bird surveys**

A total of 37 bird species were recorded during the diurnal bird surveys. Two sites recorded the highest species diversity with 18 species recorded at both sites, with 14 species recorded at the remaining site. The highest bird abundance score was a total of 95 individuals recorded at one site across both survey periods (**Table 16**).

One species listed as vulnerable under the NSW BC Act was recorded during the surveys; Grey-crowned Babbler (eastern subspecies). Ten individuals of this species were recorded at one site. Threatened species recorded during the field survey are shown above in **Figure 24** and **Figure 25**.

Other bird species were recorded opportunistically during the field survey, including one threatened species Brown Treecreeper (eastern subspecies) which was recorded at three locations in the survey area (although just outside of the later refined Modification Disturbance Footprint). Dusky Woodswallow was recorded opportunistically to the east of the northern survey area. No targeted threatened species (Regent Honeyeater, Swift Parrot or Painted Honeyeater) were recorded during the diurnal field survey.

Table 16: Bird species and abundance results

Survey	AM			PM		
Site	F2	F3	F4	F2	F3	F4
Species diversity	15	3	11	10	12	9
Bird abundance	52	5	41	43	27	20

5.6.2 **Microbat detection surveys**

Microbat surveys undertaken across the survey area recorded a total of 1,623 call sequences, of which 730 call sequences were of sufficient quality and length to be analysed. At least 18 microbat species were recorded from the data which includes eight species positively identified as being present and 10 species possibly present.

The Large-eared Pied Bat and Eastern Bentwing-bat, listed under the NSW BC Act and/or Commonwealth EPBC Act, were positively identified within the survey area. Additionally, the calls of five further threatened bat species were determined to be possibly recorded, but unable to be positively confirmed due to a medium to high probability of confusion with calls of similar species:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) - vulnerable under NSW BC Act;
- *Miniopterus australis* (Little Bentwing-bat) – vulnerable under the NSW BC Act;
- *Myotis macropus* (Southern Myotis) – vulnerable under the NSW BC Act;
- *Nyctophilus spp.* (Long-eared bats) – vulnerable under the NSW BC Act; and
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) - vulnerable under NSW BC Act.

The site with the highest microbat diversity recorded at least 16 species (labelled as Anabat site number 6 above in **Figure 20**). This site was located at the top of the ridge with the Anabat recorder placed at the entrance to a cave as shown in **Figure 26**.

The activity levels (based on the time when the calls were recorded) were generally low and evenly spread across the night. The detailed microbat analysis report is included at **Appendix E**.

Figure 26: Location of Anabat site 6

5.6.3 Remote camera surveys

A total of seven species were recorded during remote camera surveys, comprising one bird, one reptile and five mammal species. No threatened species were recorded. Native mammals included:

- *Wallabia bicolor* (Swamp Wallaby);
- *Macropus robustus* (Common Wallaroo);
- *Macropus giganteus* (Eastern Grey Kangaroo);
- *Tachyglossus arcuate* (Echidna); and
- *Macropus rufus* (Red-necked Wallaby).

Two introduced mammal species were recorded, feral cat and Red Fox.

5.6.4 Nocturnal surveys

No species were recorded during the nocturnal surveys undertaken within the survey area.

5.6.5 General observations and opportunistic sightings

The following reptile species were recorded at fauna sites on an opportunistic basis:

- *Amphibolurus muricatus* (Jacky Dragon);

- *Varanus varius* (Lace Monitor); and
- *Ctenotus taeniolatus* (Copper-tailed Skink).

No reptile species listed as threatened under the NSW BC Act and/or Commonwealth EPBC Act were recorded during the field survey within the survey area. Habitat for reptiles in the survey area includes rocky outcrops, large-woody debris, hollow-bearing trees and creekline/riparian areas.

5.7 Species credit species

Based on the findings of the field surveys, species credit polygons were drafted for candidate species either known or assumed to be present within the Modification Disturbance Footprint. Species credit polygons were drafted based on the habitat requirement of each species as described within BioNet. Descriptions for each species habitat criteria are provided below.

A summary of the species polygon criteria and area of habitat mapped within the Modification Disturbance Footprint is shown in **Table 17**.

Table 17: Species credit polygon mapping criteria

Common name	Species name	Method of identification	Habitat constraint	Approximate Area of species polygon
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Assumed	Land within 500 m of cliffline features	37 ha
Koala	*Phascolarctos cinereus*	Assumed	All vegetation mapped as Koala habitat as described in **Section 5.3.3**.	4 ha
Large-eared Pied Bat	*Chalinolobus dwyeri*	Anabat	Species polygon only applies to breeding habitat (cliffs and caves)	No breeding caves identified. Species assessed as an ecosystem credit species.
Regent Honeyeater	*Anthochaera Phrygia*	Assumed	All areas of vegetation containing suitable feed species (i.e. E. punctata	31 ha

Species credits species were assumed in the Relinquishment Areas in the same manner as for the Modification Disturbance Footprint (**Table 17**). Targeted fauna surveys were not undertaken in the Relinquishment Areas with the exception of suvery and mapping of cliffline features.

5.7.1 **Threatened species that cannot withstand further loss**

Identification of any species that "cannot withstand further loss" in the major catchment area is required under Section 6.5.1.12 of the FBA, as detailed in the OEH Threatened Species Profile Database. At the time of writing, this information was not available online as OEH had removed it when the BC Act commenced. ELA attempted to contact OEH and request this data with no response received.

5.7.2 **Brush-tailed Rock-wallaby species polygon**

Brush-tailed Rock-wallaby was not identified within the Modification Disturbance Footprint. This species is known from the surrounding region associated with the Modification Disturbance Footprint, and as a precautionary measure, the species was assumed to be present.

The species occupies clifflines and ridges along the sandstone escarpment, as well as areas of adjacent vegetation. As such a species polygon was calculated for the species, and included all areas within 500 m of cliffline features identified during field surveys. This resulted in a total of 37 ha of habitat within the development footprint. Species polygons for this species are shown in **Figure 27**.

5.7.3 **Koala**

Koala was not identified within the Modification Disturbance Footprint during the survey. No direct evidence of Koalas was observed. The survey area is not considered core Koala habitat as per the definition in Section 4 of the SEPP due to the absence of attributes such as breeding females. Previous records do not indicate a population in the survey area, although there have been isolated recordings of individuals in proximity to the survey area during previous assessments (Moolarben Biota 2006; Ecovision 2008).

'Koala feed tree species' listed under Schedule 2 of SEPP 44 consisted of White Box and Grey Gum trees within the southern survey area, a single mature White Box along the OC2 – OC3 internal road, and Grey Gum in the northern survey area. White Box were present in sufficient numbers in the southern survey area to warrant assessment as potential Koala habitat, in accordance with Section 4 of SEPP 44.

266 individual White Box trees were recorded in the southern survey area and were used to create the Koala species polygons shown below in **Figure 28**. The total area of potential Koala habitat in the Modification Disturbance Footprint is 4 ha.

Whilst Grey Gum was noted along the ridge lines in the southern survey area within PCT 1629 (**Figure 9**), as well as PCT 1669 in the northern survey area (**Figure 7**), these tree species were not in sufficient numbers to be determined potential Koala habitat as per the SEPP.

5.7.4 **Large-eared Pied Bat**

This species was recorded on ANABAT devices at three locations within the Modification Disturbance Footprint. At each location, only a few calls were recorded for this species. Large–eared Pied Bat roosts in caves, disused Fairy Martin nests, and occasionally hollows. The species forages in well timbered areas and gullies. This species breeds in maternity roosts which are located within domed caves. There are very few known breeding sites for the species (OEH 2017b).

Large-eared Pied Bat is listed as both an ecosystem and species credit species, and species credits are only calculated if based on breeding habitat for this species. The Modification Disturbance Footprint may contain suitable breeding habitat for the species, however the surveys did not detect any maternity/nursery roosts within the Modification Disturbance Footprint.

No species credits have been calculated for Large-eared Pied Bat as part of this assessment.

5.7.5 **Regent Honeyeater**

This species was not recorded within the Modification Disturbance Footprint. Regent Honeyeater is known locally to frequent similar patches of vegetation for foraging habitat. The species feeds on Eucalypt species such as Grey Gum, Yellow Box and White Box. As a precautionary approach, the species has been assumed present within the Modification Disturbance Footprint and species credits calculated.

Habitat was mapped as any woodland or forest vegetation containing suitable forage species which included 31 ha of habitat. This included all areas of the following PCTs:

- HU618: Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion
- HU714: 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 Bioregion
- HU730: White Box - grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley
- HU820: White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter
- HU843: Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin
- HU883: Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin

The species polygons for Regent Honeyeater are shown in **Figure 29**.

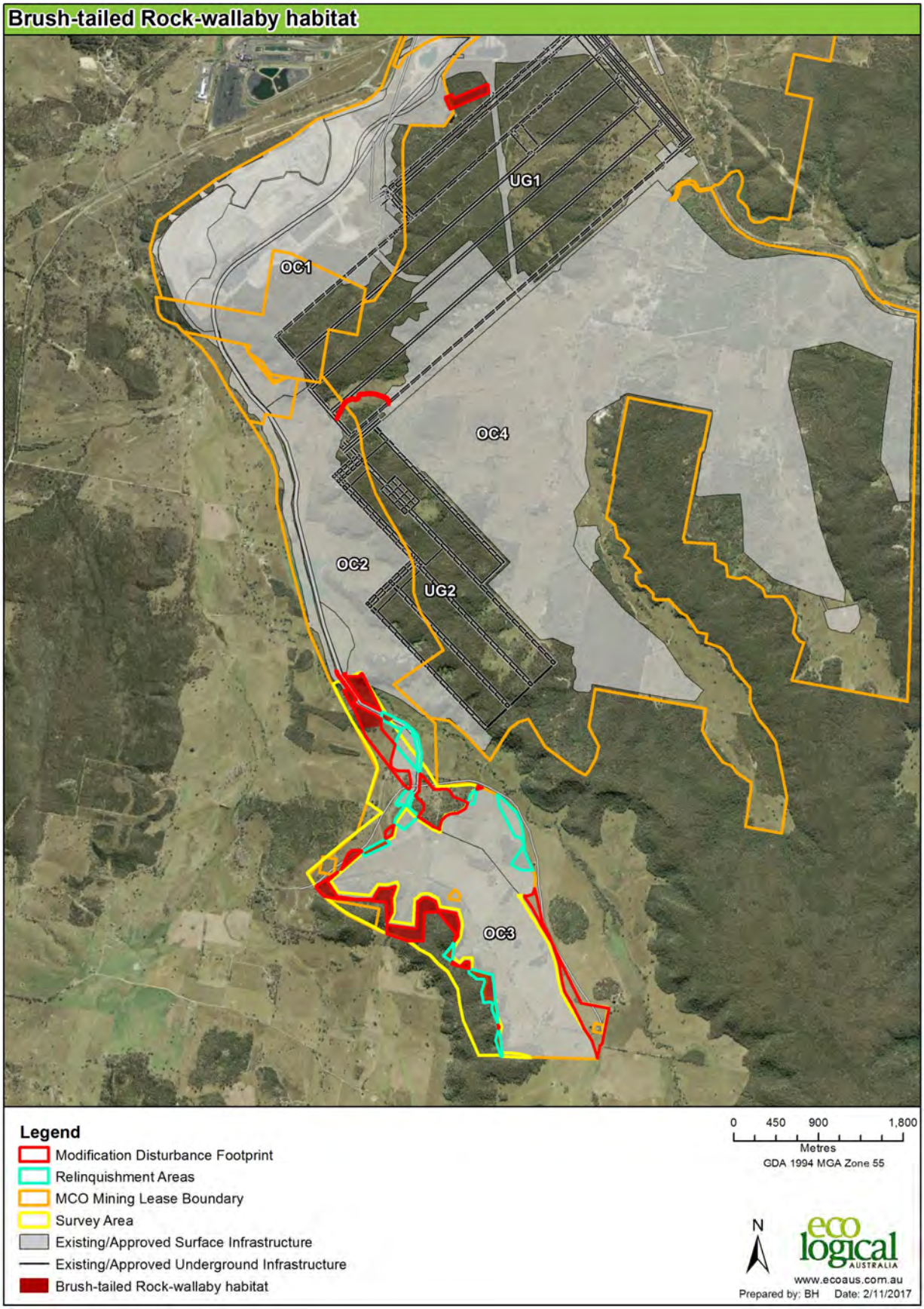

Figure 27: Brush-tailed Rock-wallaby habitat – southern survey area

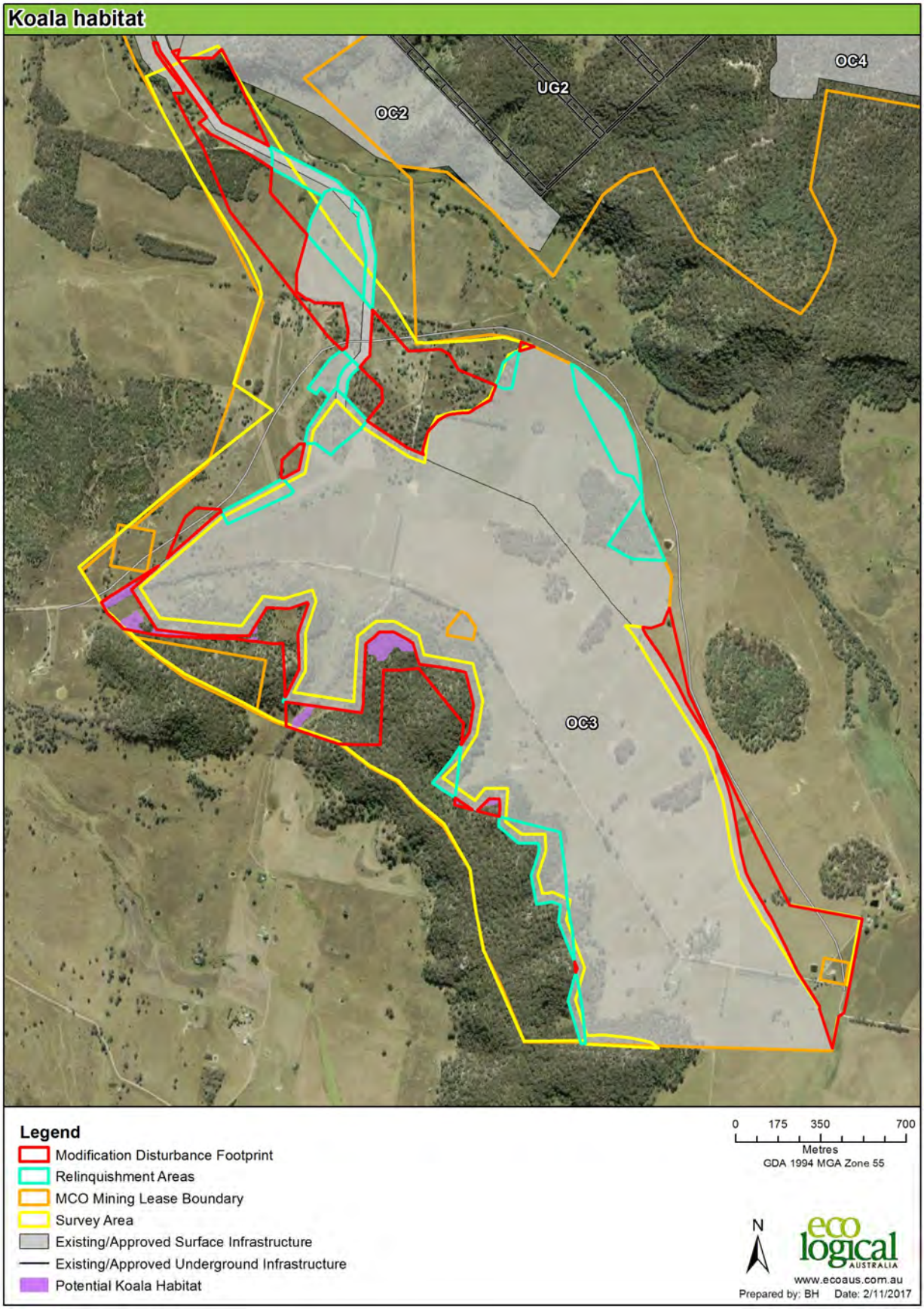

Figure 28: Koala habitat – southern survey area

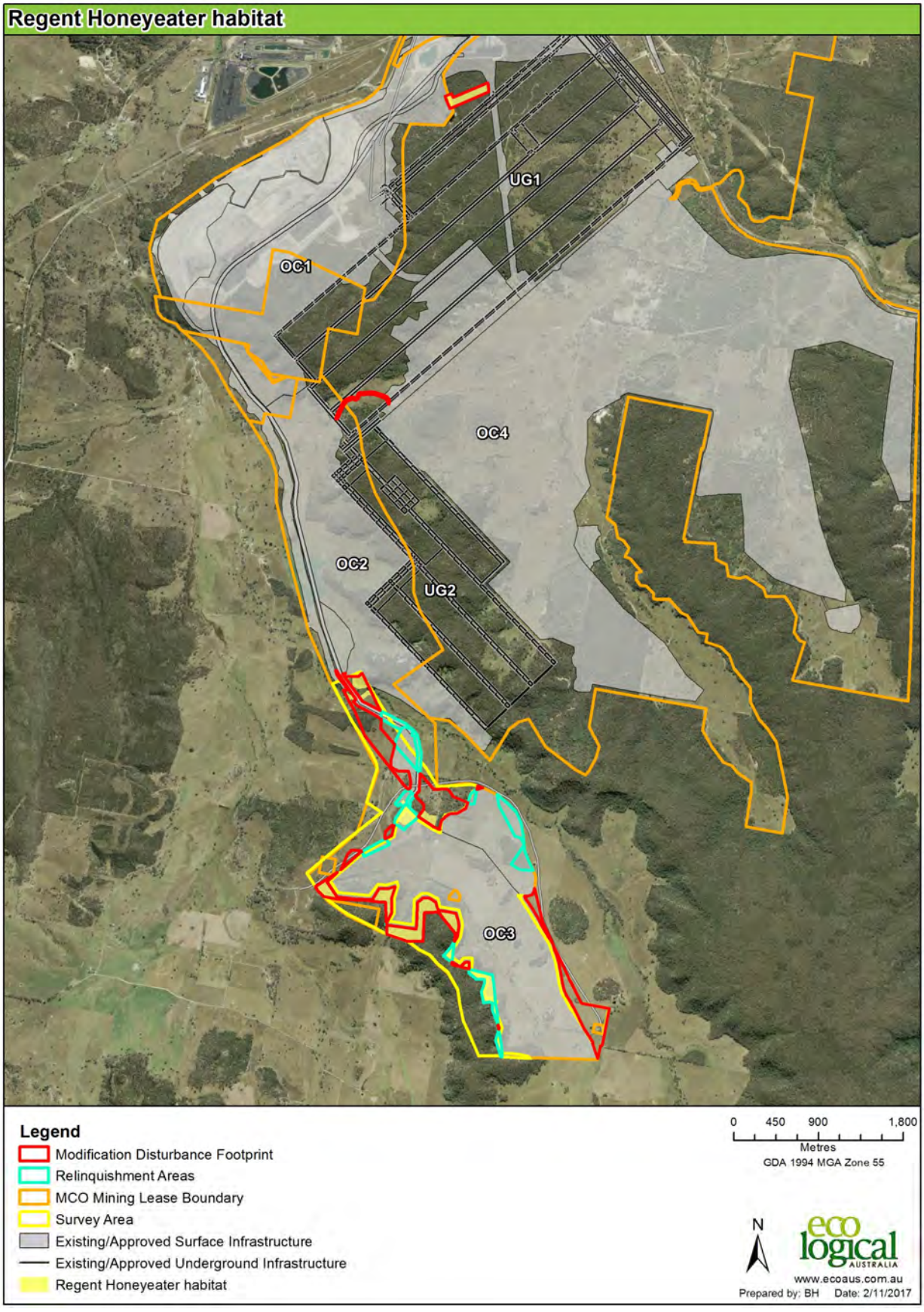

Figure 29: Regent Honeyeater habitat – southern survey area

Stage 2 – Impact assessment

6 Measures to Avoid and Minimise Impacts

6.1 Avoidance of Impacts

6.1.1 Relinquishment Areas

As part of the Modification, MCO would relinquish its approval to disturb some areas of native vegetation associated with the approved Stage 1 (Relinquishment Areas), including areas for surface infrastructure, emplacement areas and/or open cut mining.

Section 4 presents the relative areas of native vegetation present within the Modification Disturbance Footprint and Relinquishment areas, including the residual areas that require consideration for offsetting.

6.1.2 Avoidance of Direct Impacts

Under the FBA the proponent must design the project to minimise impacts to biodiversity. Specifically, the FBA requires proponents to identify and avoid direct impacts to:

- TECs;
- PCTs that contain threatened species habitat;
- threatened species that cannot be predicted by vegetation type;
- declared critical habitat; and
- regional and state significant biodiversity links.

A summary of the impact avoidance methods of the Modification are provided below in **Table 18.**

Table 18: Avoidance of Direct Impacts

Direct Impact to be Avoided[1]	Method to Avoid Impact
Impacts to EECs and CEECs	The Modification Disturbance Footprint has been revised and reduced significantly from the original design, taking into consideration the field-verified mapped areas of EEC/CEEC. An area to the north east of the proposed Modification, containing Central Hunter Valley Eucalypt Forest and Woodland CEEC, has been excluded altogether. Other areas of EEC/CEEC have been avoided and reduced as far as practicable to support the Modification.
Impacts to PCTs that contain threatened species habitat	All PCTs within the Modification Disturbance Footprint are identified as potential habitat for threatened species likely to occur in as identified in earlier sections of this report. The Modification Disturbance Footprint is directly

	adjacent to areas already approved for disturbance and would involve an extension to these areas, including some operational mining areas to the north. The siting of the Modification site has been reduced to avoid cliffline features and impacts to threatened species habitat, where possible.
Impacts to areas that contain habitat for Vulnerable, Endangered, or Critically Endangered threatened species or populations in accordance with Step 5 in Section 6.5 of the FBA	Three candidate species were assumed to be present in the Modification Disturbance Footprint: • Regent Honeyeater • Koala • Brush-tailed Rock-wallaby Habitat for these species to be removed by the Modification in the form of native vegetation providing potential foraging habitat, shown in the species polygon mapping in **Figures 27**, **28** and **29**. The revision and reduction in size of the Modification Disturbance Footprint considered avoiding areas of habitat, particularly to exclude PCTs relevant to Regent Honeyeater. In addition, the large areas of intact remnant vegetation adjacent to the MCC, being the Munghorn Gap Nature Reserve and Goulburn River National Park, provide abundant contiguous habitat for these species.
Impacts to areas of land that the Minister for Environment has declared as critical habitat in accordance with s47 of the TSC Act	Critical habitat has not been identified within the Modification Disturbance Footprint.
Impacts to riparian areas of 4th order or higher streams and rivers, important wetlands and estuaries	The Modification Disturbance Footprint would not impact on riparian areas of rivers, wetlands, or estuaries. The 4th order stream, Moolarben Creek, would be impacted by the Modification, with an area of approximately 1.11 ha (including a 20 m buffer either side) to be disturbed. This area is immediately adjacent to an area of existing approved disturbance to facilitate the construction of a haul road crossing. The location, width and extent of this disturbance has been revised and reduced to minimise disturbance as far as practicable to support the Modification.
Impacts to state significant biodiversity links	No state significant biodiversity links have been identified within the Modification Disturbance Footprint.

[1] Framework for Biodiversity Assessment (OEH, 2017)

6.1.3 **Site Selection**

Site selection was undertaken considering the extent of known biodiversity values, as well as the extent of current disturbance within the Modification Disturbance Footprint. A summary of considerations during the selection of the Modification Disturbance Footprint is shown in **Table 19**.

Table 19: Avoidance and minimisation of direct impacts through site selection

Site Selection Criteria[1]	Method to Avoid Impact
Selecting a suitable development site for a Major Project or a route for linear projects, should be informed by knowledge of biodiversity values. An initial desktop assessment of biodiversity values would assist in identifying areas of native vegetation cover, EECs or CEECs, and potential habitat for threatened species	The Modification Disturbance Footprint has been subject to comprehensive biodiversity assessment to inform the final Modification Disturbance Footprint. These assessments are detailed in earlier sections of this report and included a desktop review of databases and existing information, vegetation validation, full floristic surveys, habitat mapping and threatened fauna surveys. Following assessment, the Modification Disturbance Footprint was revised and reduced to avoid and minimise impacts to EECs or CEECs, and potential habitat (cliffline features) for threatened species.
Stage 1 of the FBA will provide the preliminary information necessary to inform project planning. Early consideration of biodiversity values is recommended in site selection, or route selection for linear projects, and the planning phase.	Biodiversity values were identified within the Modification Disturbance Footprint through the assessment process described above. This document was reviewed when planning the final Modification Development Footprint, and refined through several iterations considering impacts to biodiversity values within the Modification Disturbance Footprint.
The site/route selection process should include consideration and analysis of the biodiversity constraints of the proposed development site and consider the suitability of the Major Project based on the types of biodiversity values present on the development site	As identified above, the biodiversity assessment stage of the Modification was conducted to determine areas of biodiversity constraints. The final Modification Disturbance Footprint reflects the retention, where possible, of existing biodiversity within the Modification Disturbance Footprint.

Site Selection Criteria[1]	Method to Avoid Impact
When considering and analysing the biodiversity constraints for the purpose of selecting a development site, the following matters should be addressed: *(a) whether there are alternative sites within the property on which the proposed development is located where siting the proposed Major Project would avoid and minimise impacts on biodiversity values* *(b) how the development site can be selected to avoid and minimise impacts on biodiversity values as far as practicable* *(c) whether an alternative development site to the proposed development site, which would avoid adversely impacting on biodiversity values, might be feasible.*	The Modification Disturbance Footprint is directly adjacent to areas already approved for disturbance and would involve an extension to these areas, including some operational mining areas to the north. There are no potential alternative locations, rather, the footprint has been revised and reduced as far as practicable to avoid biodiversity constraints whilst still supporting the Modification.
For linear projects, the route selection process must include consideration and an analysis of the biodiversity constraints of the various route options. In selecting a preferred option, loss of biodiversity values must be weighed up and justified against social and economic costs and benefits.	The Modification is considered a linear project as per the definition in the FBA; however, it doesn't involve a route in the context of this assessment.

[1] Framework for Biodiversity Assessment (OEH, 2017)

6.1.4 **Planning**

Planning was considered during the selection of the Modification Disturbance Footprint. A summary of criteria utilised is shown in **Table 20**.

Table 20: Avoidance and minimisation of direct impacts through planning

Planning Criteria[1]	Method to Avoid Impact
Siting of the project – the Major Project should be located in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower site value score) or which avoid an EEC or CEEC	The Modification Disturbance Footprint has been subject to comprehensive biodiversity assessment to inform the final Modification Disturbance Footprint. These assessments are detailed in earlier sections of this report and included a desktop review of databases and existing information, vegetation validation, full floristic surveys, habitat mapping and threatened fauna surveys. Following assessment, the Modification Disturbance Footprint was revised and reduced to avoid and minimise impacts to EECs or CEECs, and potential habitat (cliffline features) for threatened species.
Minimise the amount of clearing or habitat loss – the Major Project (and associated construction infrastructure) should be located in areas that do not have native vegetation, or in areas that require the least	The Modification Disturbance Footprint is directly adjacent to areas already approved for disturbance and would involve an extension to these areas, including some operational mining areas to the north. There are

amount of vegetation to be cleared (i.e. the development footprint is minimised), and/or in areas where other impacts to biodiversity will be the lowest	no potential alternative locations, rather, the footprint has been revised and reduced as far as practicable to avoid biodiversity constraints whilst still supporting the Modification.
Loss of connectivity – some developments can impact on the connectivity and movement of species through areas of adjacent habitat. Minimisation measures may include providing structures that allow movement of species across barriers or hostile gaps	The Modification Disturbance Footprint is directly adjacent to areas already approved for disturbance and would involve an extension to these areas, including some operational mining areas to the north. Large areas of intact god condition remnant vegetation are present in the surrounding areas including Munghorn Gap Nature Reserve and the Goulburn river National Park.

[1] Framework for Biodiversity Assessment (OEH, 2017)

6.2 Measures to minimise impacts

MCO would implement measures to minimise the impacts of the Modification during both the construction and operational phase. MCO's existing Biodiversity Management Plan (BMP) would be revised, which would describe mechanisms for reduction of impacts in the Modification Disturbance Footprint as well as existing approved and operational areas. The BMP would address impacts to flora and fauna such as clearing and other environmental impacts such as sediment control, and protection of waterways. The BMP would include operational measures to reduce impacts of the Modification such as:

- vegetation clearance protocols;
- re-vegetation strategies; and
- weed and pest animal control measures.

Details of measures to minimise impacts during the construction and operational phase are described below.

6.2.1 Measures to minimise direct impacts during construction phase

Several considerations were given to minimising impacts to biodiversity during the construction phase of the Modification. These are detailed below in **Table 21**.

Table 21: Minimisation of direct impacts through during the construction phase

Matter considered to minimise impacts[1]	Adopted matters within Modification Disturbance Footprint
Method of clearing – using a method of clearing during the construction phase that avoids damage to retained native vegetation and reduces soil disturbance. For example, removal of native vegetation by chain-saw, rather than heavy machinery, is preferable in situations where partial clearing is proposed	The Modification Disturbance Footprint would be progressively cleared according to MCO's existing Vegetation Clearance Protocols, as described in the approved BMP, which includes the delineation of areas to be cleared, pre-clearance surveys, management of impacts to fauna including specific measures for threatened fauna, and vegetation clearance procedures. The BMP would be updated to incorporate the Modification. The BMP currently:
Clearing operations – minimising direct harm to native fauna during actual construction operations through onsite measures such as undertaking pre-clearing	

surveys, daily fauna surveys and the presence of a trained ecologist during clearing events	• outlines the vegetation clearance protocol for the MCC; • describes the collection and use of locally sourced native seeds and supplementary tube stock planting; • outlines the revegetation strategy to improve vegetation connectivity; • describes additional biodiversity management measures for the MCC (e.g. weed and pest animal control, management of grazing and agriculture, bushfire management); • outlines the biodiversity monitoring program at the MCC; • describes the biodiversity offset strategy; • describes the performance measures; and • provides a contingency plan to manage any unprecedented impacts and their consequences.
Timing of construction – identifying reasonable measures that minimise the impacts on biodiversity. For example, timing construction activities for when migratory species are absent from the site, or when particular species known to or likely to use the habitat on the site are not breeding or nesting, can minimise the impacts of construction activities on biodiversity	
Other measures that minimise inadvertent impacts of the Major Project on the biodiversity values – measures such as installing temporary fencing to protect significant environmental features such as riparian zones, promoting the hygiene of construction vehicles to minimise spread of weeds or pathogens, appropriately training and inducting project staff and contractors so that they can implement all measures that minimise inadvertent adverse impacts of the Major Project on biodiversity values.	

[1] Framework for Biodiversity Assessment (OEH, 2017)

6.2.2 **Measures to minimise indirect impacts during construction phase**

During the construction phase the following management actions would be undertaken to minimise indirect impacts during construction as shown in **Table 22**.

Table 22: Minimisation of indirect impacts

Indirect impact[1]	Method to avoid indirect impact
Sedimentation and run-off – sediment barriers or sedimentation ponds to minimise impacts of the Major Project on biodiversity values on land that is adjoining the development site, and waterways downstream of the development site	Water management at the MCC is conducted in accordance with the Water Management Plan. The Modification would not require any changes to the objectives or implementation of the existing water management system, which is designed to capture sediment-laden runoff from disturbed mining areas in sediment dams to prevent sediment reporting to the receiving environment. Erosion and sediment control strategies and techniques would be designed in accordance with the requirements of 'Managing Urban Stormwater: Soils and Construction' including Volume 1, 2A, 2C and 2E. The Modification Disturbance Footprint would be located within the area covered by the water management system. On this basis, there would be no additional impacts associated with sedimentation or erosion associated with the Modification.

Indirect impact[1]	Method to avoid indirect impact
Noise, dust or light spill – adopting onsite measures that can minimise the impacts on biodiversity values from noise, dust or light spill during the construction phase. For example, only undertake construction during daylight hours to avoid impacts from light spill where this may be detrimental to species habitat on adjoining lands	Dust minimisation and suppression measures would continue to be implemented for the Modification, as detailed in the MCO Air Quality Management Plan (2015) or its future revision. Vibration impacts would continue to be managed in accordance with the MCO Blast Management Plan (2015) or future revisions. Noise associated with the MCC would continue to be managed in accordance with the MCO Noise Management Plan (2015) or future revisions.
Inadvertent impacts on adjacent habitat or vegetation – considering measures such as retaining vegetation on the development site as a buffer to protect significant environmental features (e.g. riparian zones, likely or known threatened species habitat)	The Modification Disturbance Footprint would be progressively cleared according to MCO's existing Vegetation Clearance Protocols, as described in the approved BMP, which includes the delineation of areas to be cleared, pre-clearance surveys, management of impacts to fauna including specific measures for threatened fauna, and vegetation clearance procedures. The BMP would be updated to incorporate the Modification.
Feral pest, weed and/or pathogen encroachment into vegetation on land adjoining the development site – one example is using protocols for hygiene that minimise the likelihood of construction vehicles spreading weeds or pathogens from the development site into native vegetation on land adjoining the development site	Weeds and pest animals would be managed in accordance with the BMP.
Impacts that are infrequent, cumulative or difficult to measure – where there are likely to be indirect impacts on biodiversity that are infrequent, cumulative or difficult to measure over time, consideration should be given to how an operational monitoring program can be used to assess the timing and/or extent of these impacts. A proposal for an operational monitoring program should be set out in the BAR. Development of a monitoring program may involve determining the base-line information that will be necessary to measure the impact over time. It should also consider how the results of the monitoring program could be used to inform ongoing operations in order to reduce the extent of indirect impacts	A monitoring program would be drafted within the BMP to measure infrequent and cumulative impacts of the Modification. The monitoring program would include baseline data capture to measure any effects of the Modification over time. The BMP would be updated to incorporate the Modification.

Indirect impact[1]	Method to avoid indirect impact
Impacts during the operational phase – measures to avoid or minimise the indirect impacts on threatened species and threatened species habitat on land adjoining the development site, migratory species or flight pathways as a result of the operation of the development. Such measures may include those adopted to avoid and minimise: *(i) trampling of threatened flora species* *(ii) rubbish dumping* *(iii) noise* *(iv) light spill* *(v) weed encroachment* *(vi) nutrient run-off* *(vii) increased risk of fire, and* (viii) *pest animals.*	Fences and security measures would be placed around key biodiversity areas to prevent unauthorised access and activities. Noise impacts would not be increased from the current levels experienced by the Modification Disturbance Footprint and adjacent land. The Modification is not expected to increase light spill during the construction phase above that already approved and operational in adjacent mining areas. Weed encroachment would be managed by a weed management plan within the BMP. Nutrient, and stormwater runoff would be managed by a water management plan. The BMP would be updated to incorporate the Modification.

[1] Framework for Biodiversity Assessment (OEH, 2017)

6.2.3 **Measures to minimise impacts during operational phase**

Impacts to biodiversity values would be minimised during the operational phase using the methods described in **Table 23**.

Table 23: Minimisation of Impacts through during the Operational Phase

Operational Phase Impact[1]	Method to Avoid Impact
Seasonal impacts – whether there are likely to be any impacts that occur during specific seasons. Minimisation measures may include amending operational times to minimise impacts on biodiversity during periods when seasonal events such as breeding or species migration occur	Seasonal biodiversity monitoring would be undertaken, the results of which would be used to inform management measures
Artificial habitats – using 'artificial habitats' for fauna where they may be effective in minimising impacts on such fauna. These include nest boxes, glider-crossings or habitat bridges.	Nest boxes may be considered where removal of hollow-bearing trees occurs. The salvage and introduction of habitat features such as hollow logs into rehabilitation and enhancement areas may be considered more effective.

[1] Framework for Biodiversity Assessment (OEH, 2017)

7 Impacts on biodiversity that require further consideration

Section 9.2 of the FBA details impacts on biodiversity values which will require further consideration by the consent authority. Relevant to the Modification are:

- impacts reducing the riparian buffer of Moolarben Creek, as a 4th order stream; and
- impacts to CEEC.

7.1 Impacts reducing the width of riparian buffer to Moolarben Creek

The Modification would involve removal of approximately 1.11 ha of native vegetation in the 20 m buffer either side of Moolarben Creek. Additional information required by Section 9.2.3.3 of the FBA is provided below in **Table 24**.

Table 24: Additional information require for impacts to Moolarben Creek

Information requirement[1]	Response
The name and stream order of the riparian buffer being impacts	Moolarben Creek is a Strahler 4th order stream which intersects the Modification Disturbance Footprint, adjacent to areas already approved for disturbance under MCC's Stage 1 and Stage 2 approvals.
The total area of the riparian buffer that is impacted, the extent to which the width of the link will be reduced and over what length, and the size of gaps being created or expanded	Approximately 1.11 ha of the riparian buffer would be impacted by the Modification. This would add to 0.24 ha section of immediately adjacent riparian buffer already approved for disturbance under the Stage 1 and Stage 2 approvals
The PCT and condition of the vegetation in the riparian buffer being impacted	The 1.11 ha of riparian buffer to be removed is PCT281 – 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 Bioregion. This PCT also meets the criteria for EEC: White Box Yellow Box Blakely's Red Gum Woodland/CEEC: White Box Yellow Box Blakely's Red Gum grassy woodlands and derived native grasslands under the BC Act and EPBC Act respectively.
Any indirect impacts on wetland or watercourses downstream of the development site	There are no wetlands downstream which would be impacted by the Modification. Clearing of vegetation in the riparian buffer has the potential to impact downstream watercourses through the increased risk of erosion and resulting sediment laden run-off entering the watercourse.
Mitigation measures proposed to minimise the impact on the biodiversity values of the riparian or downstream	Management of the riparian buffer zone would adhere to the objectives or implementation of the existing water

Information requirement[1]	Response
area	management system and MCC Water Management Plan, which is designed to capture sediment-laden runoff from disturbed areas to prevent sediment reporting to the receiving environment. The Modification Disturbance Footprint would be located within the area covered by the water management system. On this basis, there would be no additional impacts associated with sedimentation or erosion associated with the Modification.

[1] Framework for Biodiversity Assessment (OEH, 2017)

7.2 Impacts on Critically Endangered Ecological Communities

Impacts on native vegetation that require further consideration include impacts on any CEEC, unless specifically excluded by the SEARs. The Modification would result in the removal of approximately 7 ha of CEEC as detailed below in **Table 25.**

Table 25: Threatened Ecological Communities to be impacted by the Modification

Conservation Status		Associated PCT(s)	Area to be removed (ha)
BC Act	EPBC Act		
EEC: White Box Yellow Box Blakely's Red Gum Woodland	**CEEC:** White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	281; 618	5 (comprising 2 ha woodland and 3 ha DNG)
VEC: Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion (note that VEC's are not considered TECs under NSW EP&A Act (s.5D))	**CEEC:** Central Hunter Valley eucalypt forest and woodland	1176	2
		Total	7

Section 9.2.4.2 of the FBA details the additional information required to allow the consent authority to determine the significance of impacts to CEEC. This information is detailed below in **Table 26**.

Table 26: Additional information required for impacts to CEEC

Information requirement[1]	Response
The area and condition of the CEEC to be directly impacted	**White Box-Yellow Box-Blakely's Red Gum Grassy woodland and Derived Native Grassland (EPBC Act)** This CEEC is found in several patches in the southern Modification Disturbance Footprint (**Figures 8 and 9**) associated with drainage lines and along ridges. Areas of the DNG form of this community were identified along disturbed areas associated with existing surface infrastructure (roads) in both the southern area (**Figure 9**) and along the OC2 – OC3 internal road (**Figure 8**). The condition of this community varies within the Modification

Information requirement[1]	Response
	Disturbance Footprint, with better quality, largely undisturbed and intact remnant vegetation associated with the ridge areas (PCT 618), while along drainage lines and areas of DNG it was generally of poor to moderate condition and showed obvious signs of previous disturbance such as clearing and cultivation as well as existing roads. The regional priority weed St John's Wort was recorded in high abundance (approximately 500 indivduals) within the DNG portion of this community in the southern portion of the Modification Disturbance Footprint **(Figure 9)**. An assessment of significance under the EPBC Act have been completed for this CEEC and is provided at **Appendix G**. Whilst 5 ha of this CEEC would be removed in the Modification Disturbance Footprint, due to the minimal occurence of this community within the Modification Disturbance Footprint (when compared with large undisturbed tracts in the region), the generally modified and fragmented condition, and the fact that this occurence is not likely to be critical to the survival of this community, this is not considered a significant impact to this CEEC. In addition, 1 ha of this CEEC would remain undisturbed in the Relinquishment Areas, bringing the residual net disturbance area of this TEC down to 4 ha. **Central Hunter Valley eucalypt forest and woodland (EPBC Act)** This CEEC is associated with PCT 1176 in the southern Modification Disturbance Footprint (**Figure 9**). The condition of this community was generally poor to moderate, associated with signs of previous disturbance due to agricultural use of the area, such as grazing and possibly previous clearing and cultivation. The woodland component (excluding areas of DNG) is, however, listed as a CEEC under the EPBC Act and has been assessed in **Appendix G**. Whilst 2 ha of this CEEC would be removed in the Modification Disturbance Footprint, an additional 4.5 ha is located within the Relinquishment areas (compensating for this proposed clearance). Further to this, due to the minimal occurence of this community within the Modification Disturbance Footprint (when compared with large undisturbed tracts in the region), the generally modified and fragmented condition of the community, and the fact that this occurence is not likely to be critical to the survival of this community, this is not considered to be a significant impact to this CEEC. An area of this CEEC in the northern survey area, associated with PCT 479, was excluded from the Modification Disturbance Footprint.
The extent and overall condition of the CEEC within an area of 1000 ha and then 10, 000 ha surrounding the proposed development footprint	Greater Hunter vegetation mapping (OEH 2017c) was reviewed to determine the extent and overall condition of the CEECs to be impact by the Modification, in the area surrounding the Modification Development Footprint. The extent of the closest match communities are listed below.

<table>
<tr><th>Information requirement[1]</th><th>Response</th></tr>
<tr><td></td><td>
<table>
<tr><th>EEC</th><th>1, 000 ha</th><th>10, 000 ha</th></tr>
<tr><td>White Box/ Black Cypress Pine shrubby woodland of the Western Slopes</td><td>25.69</td><td>209.34</td></tr>
<tr><td>Yellow Box/ Rough-barked Apple grassy woodland of the upper Hunter and Liverpool Plains</td><td>1.48</td><td>70.73</td></tr>
<tr><td>Total</td><td>27.17</td><td>280.06</td></tr>
</table>
Review of the available mapping did not provide an account of the condition of vegetation communities in the surrounding areas. However, the MCC's location directly adjacent to both Munghorn Gap Nature Reserve and the Goulburn River National Park, comprising areas of 5, 934 ha and 72, 300 ha respectively, would indicate that native vegetation in the surrounding area is good condition.
</td></tr>
<tr><td>The development proposal's impact on:
(i) abiotic factors critical to the long-term survival of the CEEC. For example, will the impact lead to a reduction of groundwater levels or substantial alteration of surface water patterns?
(ii) characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants
(iii) the quality and integrity of an occurrence of the through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the CEEC.</td><td>The Modification would not result in impacts to abiotic factors critical to the long-term survival of the CEEC. Detailed groundwater and surface water impact assessments have been undertaken for the Modification EA which concluded that impacts to ecosystems (including Groundwater Dependent Ecosystems) would not occur due to the Modification (HydroSimulations, 2017).
Clearing of area of CEEC would be undertaken in accordance with the BMP and would be clearly delineated to prevent disturbance to adjacent areas. There would be no disturbance to areas of CEEC outside of the Modification Disturbance Footprint.
Invasive plant species could establish on the peripheries and in the Modification Disturbance Footprint following vegetation clearance. The condition thresholds for CEEC centre on levels of perennial native vegetation, and weed establishment in areas of CEEC has the potential to cause quality of the patch to decline. Weeds would be managed in accordance with the BMP, including noxious species, in order to avoid and mitigate impacts to surrounding vegetation. Previous activities at the MCC have not resulted in perceptible weed invasion. It is therefore unlikely that there would be a substantial reduction in quality or integrity of the CEEC surrounding the Modification Disturbance Footprint.</td></tr>
<tr><td>Direct or indirect fragmentation and isolation of an important area of the CEEC.</td><td>This CEEC is present in an already fragmented form in the Modification Disturbance Footprint due to indication of disturbance from historic agricultural processes, such as clearing and potentially cultivating. Areas of</td></tr>
</table>

Information requirement[1]	Response
	the CEEC would remain in large areas of intact vegetation associated with the Goulburn River NP and Munghorn Gap Nature Reserve. The Modification Disturbance Footprint is directly adjacent to areas already approved for disturbance and would involve an extension to these areas, including some operational mining areas to the north. The siting of the Modification site has been reduced to avoid areas of CEEC and would not result in direct or indirect fragmentation an isolation of an important area of either CEEC listed above.
The measures proposed to contribute to the recovery of the CEEC in the IBRA subregion.	A National Recovery Plan is in place for White Box-Yellow Box-Blakely's Red Gum Grassy woodland and Derived Native Grassland (NSW Department Environment, Climate Change and Water 2011). The overall aim of the recovery plan is to promote the recovery and prevent the extinction of the CEEC. The specific objective to be achieved within the life-span of this recovery plan is to minimise the risk of extinction of the ecological community through: • achieving no net loss in extent and condition of the ecological community throughout its geographic distribution; • increasing protection of sites in good condition; • increasing landscape function of the community through management and restoration of degraded sites; • increasing transitional areas around remnants and linkages between remnants; and • bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland. These principles have and would continue to be incorporated into the BMP to manage areas of this CEEC within MCO's exisiting and future offset areas. A targeted strategy for managing White Box-Yellow Box-Blakely's Red Gum Grassy woodland and Derived Native Grassland has been developed under the Saving Our Species program (OEH 2017d), however there are no specific actions relating to the Kerrabee IBRA subregion. There are no recovery plans in place for Central Hunter Valley eucalypt forest and woodland.

[1] Framework for Biodiversity Assessment (OEH, 2017)

8 Summary of impacts under the EPBC Act

8.1 Summary of referral pathway

The Modification was referred to the DotEE on 26 June 2017 due to likely impact to threatened species or threatened ecological communities listed under the EPBC Act (referral 2017/7974). The DotEE determined on 24 August 2017 that the Modification was likely to impact on Matters of National Environmental Significance (MNES) under the EPBC Act, including:

- Listed threatened species and communities (sections 18 & 18A); and/or
- A water source, in relation to coal seam gas development and large coal mining development (section 24D & 24E).

The decision on the referral identified that the following MNES were likely to be significantly impacted by the Modification:

- Central Hunter Valley Eucalypt Forest and Woodland;
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands;
- Regent Honeyeater;
- Swift Parrot;
- Large-eared Pied Bat;
- Corben's Long-eared Bat; and
- Koala.

DotEE also indicated that further information would be required to determine the likely level of impact on:

- Spot-tailed Quoll; and
- Painted Honeyeater.

The referral advice also identified Upper Goulburn River water source, however the impacts to this are beyond the scope of an assessment under the FBA. The referral advice also identified a range of other species that may be significantly impacted by the Modification which have been considered within this document.

The assessment pathway determined for the Modification was via the *Bilateral agreement made under section 45 of the EPBC act relating to environmental assessment* (the bilateral agreement; DotEE 2015). Under the bilateral agreement, a proposed action does not require assessment under Part 8 of the EPBC Act, if the action is to be assessed under Part 4 Division 4.1 or Part 5.1 of the EP&A Act, provided the assessment:

- Contains an assessment of all impacts the action has on each matter protected under the EPBC Act;

- Contains enough information about the controlled action and its relevant impacts to allow the Commonwealth Minister to make an informed decision whether or not to approve the action; and
- Addresses all matters outlined in Schedule 4 of the Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regs; DotEE 2000).

8.2 Summary of impacts to MNES

The Modification has been redesigned through several iterations to reduce the final impact on MNES. The final development footprint presented within this report has considered the impacts to biodiversity and minimised where possible. The unavoidable impact of the Modification would remove:

- 5 ha of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (which includes 2.07 ha of woodland and 2.86 ha of derived native grassland); and
- 2 ha of Central Hunter Valley Eucalypt Forest and Woodland.

Field surveys identified several records of Large-eared Pied Bat within the Modification Disturbance Footprint. No breeding habitat for this species has been identified within the Modification Disturbance Footprint. Cliff lines have been identified within the Modification Disturbance Footprint, which may provide breeding habitat for this species. Foraging habitat for this species has been incorporated into the BBCC as an ecosystem species.

Although not identified within the Modification Disturbance Footprint, the following species have been assumed to be present, and the Modification would impact on:

- 37 ha of habitat for Brush-tailed Rock-wallaby;
- 4 ha of habitat for Koala; and
- 31 ha of habitat for Regent Honeyeater.

For all MNES identified to likely occur within the Modification Disturbance Footprint, an assessment of the impacts following the EPBC Significant Impact Criteria has been undertaken as described in **Appendix G**. The assessments reviewed each species likely to occur and determined that the Modification is unlikely to significantly impact any MNES.

The impacts to MNES known or assumed present within the Modification Disturbance Footprint have been quantified using the BBCC, and an offset has been proposed to compensate for the loss of habitat. These species have not been identified on the offset, however habitat has been identified that is suitable to support the species. The suitability of the proposed offset has been discussed in the Biodiversity Offset Strategy in **Section 10**.

9 Impact Summary

The results of the BAR, including the vegetation and threatened species assessment results, were entered into the BBCC.

All non-TEC areas of DNG have been combined in the BBCC for the purposes of streamlining the calculations. This includes combining areas of PCT1176 / HU618, PCT1629 / HU843, PCT1661 / HU875, and PCT1696 / HU910 under a single vegetation zone as PCT1696 / HU910 – DNG. This was due to the small size of some areas (<1 ha) and/or a lack of corresponding BVT available for selection in the BBCC.

As part of the Modification, MCO is relinquishing its approval to disturb some areas of native vegetation associated with the approved Stage 1 (Relinquishment Areas), including areas for surface infrastructure, emplacement areas and/or open cut mining. The Relinquishment Areas were also entered into the BBCC to determine the reduction in credit requirement for the Modification.

Table 27 presents the relative areas of native vegetation present within the Modification Disturbance Footprint and Relinquishment areas, including the residual areas that require consideration for offsetting. The full BBCC reports are included in **Appendix H**.

As outlined above there would be no significant impact as a result of indirect impacts from the Modification.

Table 27: Modification Offset Requirement

Credit Type	Disturbance Area		Relinquishment Area		Residual Impact Area	
	Area (ha)	Credits	Area (ha)	Credits	Area (ha)	Credits
Ecosystem Credits						
HU618[1]	2	108	3.5	188	0	0
HU714[2]	1.5	53	0.5	18	1	35
HU730[2]	3.5	112	0.5	39	3	73
HU820	3	190	1[3]	40	2	150
HU843	13	827	6.5	416	7	411
HU875	4	237	1	33	3	204
HU883	4.5	233	0	0	4.5	233
HU910	7.5	354	0.4	23	7.1	331
HU905	0	0	1.5	57	0	0
Total*	**39**	**2,114**	**15^**	**814^**	**27^**	**1,437^**
Species Credits						
Regent Honeyeater	31	2,371	10.5	803	20.5	**1,568**
Koala	4	94	0.5	17	3.5	**77**
Brush-tailed Rock Wallaby	37	960	10.5	267	26.5	**693**

* May contain slight errors due to rounding.

^ Only 12 ha of native vegetation (equating to 677 credits) within the Relinquishment Areas can be associated with the vegetation communities within the Modification Disturbance Footprint.

[1] Central Hunter Eucalypt Critically Endangered Ecological Community.

[2] Box Gum Woodland Critically Endangered Ecological Community.

[3] HU603 (located in the Relinquishment areas) is identified as an 'Offset Option' within the BBCC report.

Stage 3 – Biodiversity Offset Strategy

10 Biodiversity Offset Strategy

10.1 Objectives of the Biodiversity Offset Strategy

The objective of this BOS is to provide a pathway for delivery of a suitable offset to ameliorate the impacts of the Modification.

The purpose of determining offsets for the Modification is to achieve a long term biodiversity gain for threatened species, populations and ecological communities impacted by the Modification.

This BOS has been drafted to provide options for complying with the objectives of the NSW *Biodiversity Offsets Policy for Major Projects* (the NSW offsets policy), as well as the EPBC Act *Environmental Offsets Policy* (the Commonwealth offsets policy).

10.2 Policy framework of the offset strategy

This BOS is guided by policy frameworks under both NSW and Commonwealth legislation. The *NSW Biodiversity Offsets Policy for Major Projects* provides guidance for offsets to impacted threatened species, populations, and ecological communities under the BC Act; and the *Environmental Offsets Policy* provides guidance for offsets to impacted MNES under the EPBC Act.

Both NSW and Commonwealth offsets policies are guided by principals to ensure the security, effectiveness, and transparency of offsets. These are discussed for both NSW and Commonwealth policies in **Section 10.3** and **Section 10.4** of this BOS.

10.3 NSW legislation

10.3.1 NSW Biodiversity Offsets Policy for Major Projects

For projects declared as SSD or State Significant Infrastructure (SSI), unavoidable impacts must be assessed under the FBA, and a BOS drafted under the NSW offsets policy. The NSW offsets policy identifies that the suitability of offsets is guided by six principles. Details of how this BOS complies with the six principles of the NSW offsets policy are provided below.

Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.

The Modification has been located within areas that are currently developed as agricultural land, along with areas of remnant vegetation. The location of the development has been positioned as much as possible within previously cleared land to minimise impacts to biodiversity.

Within Chapter 5 of the BARBOS, measures to avoid and minimise direct and indirect impacts during both the construction and operation phase of the Modification have been detailed. Offsets have only been considered following consideration of avoidance measures. Details of avoidance measures proposed are detailed within the BARBOS.

Principle 2: Offset requirements should be based on a reliable and transparent assessment of losses and gains.

Offsets requirements have been assessed under the endorsed FBA. All losses of the Modification have been calculated using the BBCC. The BBCC is also the tool for measuring gains at any offset site providing for a transparent and reliable methodology for assessing the offsetting requirement of the Modification.

Principle 3: Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.

Assessment of impacts of the Modification and the proposed offsets are provided under a 'like for like' methodology, whereby biodiversity credits of the same PCT are assessed for the impacts and proposed for the offsets. Under the FBA there are variation rules proposed whereby the consent authority may approve the variation to the offset rules for matching ecosystem credits where like-for-like offsets are not available. The proponent may vary the biodiversity credits used to offset an impact with a BOS, provided the proponent can demonstrate to the consent authority that:

All reasonable steps to secure a matching ecosystem credit have been taken by the proponent, and

- The required ecosystem credit is not for a PCT associated with a CEEC under the BC Act or an ecological community listed under the EPBC Act, and
- The PCT from the same vegetation formation has a percent cleared value of the PCT in the major catchment area equal to or greater than the percent cleared of the PCT to which the required ecosystem credit relates, or
- Where the required ecosystem credit is for a PCT that is associated with a CEEC/EEC, the PCT from the same formation is also associated with a CEEC/EEC.

Principle 4: Offsets must be additional to other legal requirements.

Offsets proposed under the FBA must be sourced from Biobank sites established under a BioBanking Agreement.

A BioBanking Agreement is a voluntary scheme entered into by land holders for the purpose of managing the land for biodiversity. Since the repealing of the TSC Act, managed and funded conservation areas are now known as Stewardship Sites. A Stewardship Agreement stipulates management actions that must be undertaken at the Stewardship Site in perpetuity as guided by a Management Action Plan (MAP). The MAP guides management actions that are additional to all other legal requirements.

Standard management actions that are required at a Stewardship Site include:

- Management of grazing for conservation
- Weed control
- Management of fire for conservation
- Management of human disturbance
- Retention of regrowth and remnant native vegetation
- Replanting or supplementary planting where natural regeneration will not be sufficient
- Retention of dead timber

- Erosion control
- Retention of rocks

Additional management actions that may apply at a Stewardship Site includes:

- Control of feral and overabundant native herbivores
- Vertebrate pest management
- Nutrient control
- Control of exotic fish species
- Maintenance or reintroduction of natural flow regimes

Principle 5: Offsets must be enduring, enforceable and auditable.

A Stewardship Agreement entered into at the Stewardship Site is a legally binding agreement that operates in perpetuity. Stewardship Agreements are guided by the MAP, which contains a reporting and review schedule. Management of the Stewardship site is funded through annual stipends to the landholder as determined within the Total Fund Deposit spreadsheet (TFD). The condition and compliance with the MAP at all Stewardship Sites must be provided to the Biodiversity Conservation Trust (BCT) annually to ensure continued funding of the Stewardship Site. If the landholder is found to be non-compliant with the MAP, the BCT has the capacity to recommend to withhold funding to the landholder.

In addition to annual audits, the MAP is also reviewed every 5 years by both a qualified consultant as well as the BCT to ensure the MAP remains applicable to the quantum of management required to improve biodiversity at the Stewardship Site.

Principle 6: Supplementary measures can be used in lieu of offsets.

If the proponent can suitably demonstrate that offsets have cannot be provided for the impacts, in accordance with Section 10.5 of the FBA, then the proponent may propose the use of supplementary measures to compensate for impacts.

The consent authority may approve supplementary measures for ecosystem credits proposed within a BOS provided:

- all reasonable steps have been taken by the proponent to secure a matching ecosystem credit, and
- the PCT to which a required ecosystem credit relates is associated with a CEEC/EEC or for which the impact of development does not require further consideration according to Subsection 9.2.4, and
- the supplementary measure applies to that CEEC/EEC; and
- the supplementary measure is carried out in accordance with the rules governing supplementary measures, including calculating the financial contribution of the supplementary measures in accordance with Appendix B of the NSW Biodiversity Offsets Policy for Major Projects.

The consent authority may approve supplementary measures for species credits proposed within a BOS provided:

- The proponent can demonstrate that all reasonable steps have been taken to secure the number and types of species credits impacted on at the Modification Disturbance Footprint; and
- The species to which the species credit relates is not listed on the EPBC Act or listed as critically endangered on the BC Act.

No supplementary measures are proposed within this BOS.

10.4 Commonwealth legislation

Under the *Bilateral agreement made under section 45 of the EPBC act relating to environmental assessment* (the bilateral agreement; DotEE 2015), a proposed action does not require assessment under Part 8 of the EPBC Act, if the action is to be assessed under Part 4 Division 4.1 (SSD) or Part 5.1 (SSI) of the EP&A Act, provided the assessment:

- Contains an assessment of all impacts the action has on each matter protected under the EPBC Act
- Contains enough information about the controlled action and its relevant impacts to allow the Commonwealth Minister to make an informed decision whether or not to approve the action; and
- Addresses all matters outlines in Schedule 4 of the Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations 2000; DotEE 2000)

The proposed action will be assessed via an EA, which will involve several public consultation periods.

10.4.1 **EPBC Act Environmental Offsets Policy 2012**

For projects declared controlled actions under the EPBC Act, under the bilateral agreement impacts of the project are not required to be assessed by the Commonwealth. Whilst assessment may be undertaken via the exhibition of an EIS/EA, the project must demonstrate the suitability of offsets under the Commonwealth offsets policy. The Commonwealth offsets policy is guided by eight principles. Details of how this BOS complies with the eight principles of the Commonwealth offsets policy are provided below.

1. Offsets must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action

The Modification would impact areas of vegetation communities which comply with the listing as Critically Endangered under the EPBC Act. Under the FBA an offset must be calculated using the BBCC for all direct impacts to vegetation communities that are listed as EEC or CEEC under the BC Act.

The BBCC calculates the offsets to provide for a net gain in biodiversity as a result of the Modification. The FBA also requires all impacts for species, populations, and ecological communities listed under the EPBC Act to be offset with 'like for like' biodiversity credits.

2. Offsets must be built around direct offsets but may include other compensatory measures

As described under Principle 6 in **Section 10.3.1** above, supplementary measures may be included as part of the BOS under Section 10.5 of the FBA.

3. Offsets must be in proportion to the level of statutory protection that applies to the protected matter

Offsets have been calculated using the BBAM which includes a threatened species multiplier within the calculation of the quantum of impacts. The threatened species multiplier increases the quantum of credits required for a Modification due to impacts to species, populations, and ecological communities.

4. Offsets must be of a size and scale proportionate to the residual impacts on the protected matter

The quantum of offsets required under the FBA is calculated using the BBCC which incorporates the size and scale of the impacts at the Modification Disturbance Footprint. Impacts to threatened species, populations, and ecological communities at the Modification Disturbance Footprint are adjusted by incorporating the impacts to connectivity, patch size, threatened species predicted, and vegetation type. The BBCC also incorporates the overall loss of vegetation within the locality as a result of the Modification.

5. Offsets must effectively account for and manage the risks of the offset not succeeding

Offsets proposed under the FBA must be secured through BioBanking credits which are generated at a Biobank site, under a BioBanking Agreement. A BioBanking Agreement is legally binding, enforceable, audited, and enduring in perpetuity.

A BioBanking Agreement is the strongest voluntary covenant in NSW that can be placed on a parcel of land. The BioBanking Agreement can only be removed by the Minister, by certain mining and gas projects, or by offsetting the BioBanking Agreement via a highly inflated volume of BioBanking credits.

Under a BioBanking Agreement the risk of loss is considered to be the lowest of available on title covenants.

6. Offsets must be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.6)

All BioBanking Agreements are additional to existing management requirements. Should any existing requirements be stipulated under NSW planning regulations or schemes, the BBCC reduces the quantum of BioBanking credits generated at a site commensurate to the existing requirements of a site.

7. Offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable

BioBanking Agreements are a scientifically robust offsetting mechanism that is calculated using the BBCC, protects the land in perpetuity from development, funds management actions, and is annually enforced by OEH.

8. Offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

As discussed above, all Biobank sites are annually inspected by OEH to ensure biodiversity outcomes are managed appropriately. The quantum of BioBanking credits generated at a Biobank site is calculated using the BBCC which is a transparent, standardised, repeatable method for measuring biodiversity values at a site.

10.5 EPBC Act NSW bilateral agreement

This BOS has been drafted to comply with both the NSW offsets policy, Commonwealth offsets policy, as well as the criteria for offsets within section 7.2 of the *Bilateral agreement made under section 45 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) relating to environmental assessment* (DotEE, 2015).

This BOS complies with Section 7.2 of the bilateral agreement by under the following criteria:

- If the action is, or is part of, a major project as referred to in the NSW Biodiversity Offsets Policy, and the BAR for this action has been drafted under the FBA; and
- The BAR addresses how section 127b of the TSC Act (the BBAM) has been applied.

As such, the Commonwealth Minister may choose to approve the project without assessment by the DotEE.

10.6 Proposed offset measures

The proposed offset measures of the Modification are to acquire and retire the full quantum of ecosystem credits required by the impacts of the Modification as calculated within the BBCC. This would be achieved by the securement of a Stewardship site (referred to herein as the offset property, Gilgal).

10.7 Description of proposed offset property

ELA was engaged by MCO to undertake a baseline biodiversity survey of the Gilgal property, owned by MCO. The baseline survey was designed to collect data required for the completion of a BioBanking Credit Report to support the Modification BAR and form the basis of this BOS. A detailed description of the biodiversity assessment undertaken at Gilgal is provided in **Appendix I**.

10.7.1 **Location**

The Gilgal property is a 653 ha landholding within the Mid-Western Regional Council LGA, located approximately 28 km northeast of Mudgee and 10 km south of the current MCO operational area. It is located within the Sydney Basin Bioregion, to the west of the Munghorn Gap Nature Reserve and directly adjacent to the existing 'Moolarmoo' MCO Biodiversity Offset Area (BOA). The Gilgal property occupies Lot 156 and Lot 263 on DP755442.

The Gilgal property is shown below in **Figure 30**.

Figure 30: Gilgal property location relative to the Modification Disturbance Footprint

The Gilgal property is comprised mostly of remnant woodland vegetation on slopes and ridgetops, which form the dominant landscape features of the property. Several narrow valleys extend into the northern section of the property and contain both remnant and partly cleared woodland vegetation, which appear to have been subject to historical agricultural and/or pastoral activities.

The Gilgal property contains eleven BVTs, including three which meet the criteria for listing as TECs under the BC Act and EPBC Act (**Appendix I**). **Table 28** details the BVTs present within the Gilgal property.

Table 28: Updated areas of BVTs present at Gilgal

BVT No.	BVT Name	Area (ha)
CW242	Blue-leaved Stringybark open forest of the Mudgee region NSW central western slopes	130.87
HU618	Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	33.41
HU693	Grey Myrtle - Rusty Fig dry rainforest in sandstone gorges of the upper Hunter Valley, mainly Sydney Basin Bioregion	0.66
HU702	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	185.33
HU707	Red Ironbark - Black Cypress Pine - Stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	18.62
HU713	Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	19.22
HU713/HU714	Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region / 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 Bioregion - White Box-Yellow Box-Blakely's Red Gum Woodland EEC	32.45
HU820	White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	16.15
HU889	Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	48.22
HU889/HU702	Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin / Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	111.92
HU893	Dwyer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin	3.51
Cleared land		6.54
	Total	**606.9**

10.8 Ecosystem Credit Summary

The results of the biodiversity assessment for the Gilgal property were used to populate the BBCC and generate the Ecosystem Credits created.

10.9 Ecosystem Credits

Ecosystem credits generated from the Gilgal property would meet (and exceed) the ecosystem credit requirements for all BVTs with the exception of HU730 and HU910. **Section 11** provides a reconciliation of the ecosystem credits required and ecosystem credits available in proposed offset area.

Under the Biobanking Offset Scheme, the additional credits generated at the Gilgal property could be sold and used to offset a different development.

10.10 Species Credits

The survey work undertaken on the Gilgal property also identified habitat for species credit species relevant to the Modification, including:

- Regent Honeyeater (4,182 species credits based on 589 ha of potential habitat);
- Koala (64 species credits based on approximately 9 ha of potential habitat); and
- Brush-tailed Rock Wallaby (3,781 species credits based on approximately 532.5 ha of potential habitat).

Species credits generated from the Gilgal property would meet (and exceed) the credit requirements for the Regent Honeyeater and the Brush-tailed Rock Wallaby however, a small credit deficit would still exist for the Koala (13 credits). **Section 11** provides a reconciliation of the species credits required and species credits available in the Gilgal property.

Under the Biobanking Offset Scheme, the additional credits generated at the Gilgal property could be sold and used to offset a different development.

10.11 Management actions to improve biodiversity values

Management actions would be implemented to manage remnant native vegetation in the Gilgal Property following approval of the Modification, and would be incorporated into the MCO BMP. These include:

- Determining benchmark criteria for native vegetation and habitat condition at the site;
- Enhancing the quality of native vegetation and habitat;
- Restoring native vegetation and habitat through support of natural regeneration, targeted vegetation establishment, and potentially through the introduction of habitat features (fallen logs, tree hollows etc);
- Land management of issues including salinity, erosion, weeds and feral pests through targeted management programs;
- Controlling access to the site through installation and maintenance of fencing and gates;
- Bushfire management, including access trails and fire breaks; and

- A comprehensive monitoring program to determine the success of management actions to improve biodiversity values and progress the condition of the native vegetation and habitat towards the benchmark state.

11 Offset Summary

Table 29 provides a reconciliation of the ecosystem/species credits required and ecosystem/species credits available in proposed the offset area.

The result of running the BBCC is that the Gilgal property would create 4,880 ecosystem credits, of which 1,033 could be used for the Modification (**Table 29**). Based on the habitat characteristics identified during the surveys the Gilgal property would also generate the following species credits:

- Regent Honeyeater (4,182 species credits based on 589 ha of potential habitat);
- Koala (64 species credits based on approximately 9 ha of potential habitat); and
- Brush-tailed Rock Wallaby (3,781 species credits based on approximately 532.5 ha of potential habitat).

The full BBCC reports are included in **Appendix H**.

As demonstrated in **Table 29**, the Gilgal property would satisfy all credits required by the Modification with the exception of approximately 400 ecosystem credits and 13 species credits for the Koala. These credit requirements would be offset for the Modification using one, or a combination, of the following:

- mine site rehabilitation;
- acquiring or retiring credits under the BioBanking scheme in the BC Act by:
  - purchasing existing credits on the *Biodiversity Credits Register*; and/or
  - creating new credits by establishing a land-based offset area.
- making payments into an offset fund once established by the NSW Government; and/or
- providing supplementary measures as outlined in the NSW Offset Policy.

Table 29: Offset Reconciliation Summary

Credit Requirement					Credits Generated			
Credit Type	Disturbance Area		Relinquishment Area		Residual Impact Area		Gilgal Credits[1]	Offset Liability Met (%)
	Area (ha)	Credits	Area (ha)	Credits	Area (ha)	Credits		
Ecosystem Credits								
HU618[2]	2	108	3.5	188	**0**	**0**	N/A	N/A
HU714[3]	1.5	53	0.5	18	**1**	**35**	35	100%
HU730[3]	3.5	112	0.5	39	**3**	**73**	0	0%
HU820	3	190	1[4]	40	**2**	**150**	150	100%
HU843	13	827	6.5	416	**7**	**411**	411[5]	100%
HU875	4	237	1	33	**3**	**204**	204[6]	100%
HU883	4.5	233	0	0	**4.5**	**233**	233[7]	100%
HU910	7.5	354	0.4	23	**7.1**	**331**	0	0%
HU905	0	0	1.5	57	**0**	**0**	N/A	N/A
Total*	**39**	**2,114**	**15^**	**814^**	**27^**	**1,437^**	**1,033**	72%
Species Credits								
Regent Honeyeater	31	2,371	10.5	803	**20.5**	**1,568**	1,568	100%
Koala	4	94	0.5	17	**3.5**	**77**	64	84%
Brush-tailed Rock Wallaby	37	960	10.5	267	**26.5**	**693**	693	100%

* May contain slight errors due to rounding.

^ Only 12 ha of native vegetation (equating to 677 credits) within the Relinquishment Areas can be associated with the vegetation communities within the Modification Disturbance Footprint.

1 The credits shown in this column have been capped at those required by the Modification. Additional credits would be generated at Gilgal and could be used for subsequent Projects should a BioBanking Agreement be put in place.

2 Central Hunter Eucalypt Critically Endangered Ecological Community.

3 Box Gum Woodland Critically Endangered Ecological Community.

4 HU603 (located in the Relinquishment areas) is identified as an 'Offset Option' within the BBCC report.

5 HU874 (located on Gilgal) is identified as an 'Offset Option' within the BBCC report.

6 HU702 (located on Gilgal) is identified as an 'Offset Option' within the BBCC report.

7 HU618 (located on Gilgal) is identified as an 'Offset Option' within the BBCC report.

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Appendix A – Plot and transect data

PCT	Plot Name	NSR	NOS	NMS	NGCG	NGCS	NGCO	EC	NTH	OR	FL
281	OC3-8	27	7.5	0	72	2	14	56	0	100	10
	OC3-32	19	27	1	50	0	4	16	2	100	22
473	OC3-24	27	10	18.2	16	12	8	2	0	100	17
	OC3-25	28	16.7	10.3	2	6	6	2	6	66.6	92
479	OC3-26	25	7.4	10.3	4	6	10	0	1	100	44
	OC3-27	27	9.1	10.8	0	12	4	0	3	100	62
618	OC3-10	24	0	0	72	0	0	32	0	0	0
	OC3-20	44	24	3.4	32	0	32	0	7	100	25
	OC3-21	43	21.5	3.5	66	2	8	2	4	100	14
1176	OC3-1	33	18.5	0	16	0	16	6	0	66.6	631
	OC3-2	33	21.5	0	16	6	16	0	1	100	139
	OC3-3	32	13	0.5	4	6	20	0	0	66.6	102
1606	OC3-4	36	14.2	3.9	6	0	6	0	0	15	30
	OC3-23	26	15.6	1	58	0	8	0	1	100	20
1629	OC3-9	62	17	3	72	22	14	24	0	33.3	199
	OC3-12	31	19.2	0	0	2	8	0	3	0	284
	OC3-13	16	13	8.2	4	2	2	0	3	50	36
	OC3-14	20	19	7.8	2	0	2	0	3	20	100
	OC3-15	21	20.5	1	14	4	0	0	0	15	221
1661	OC3-5	45	19.2	5	0	6	2	0	0	66.6	40
	OC3-6	48	22.6	0	2	0	4	0	1	25	105
	OC3-7	50	30.5	0	32	2	24	2	0	50	126

PCT	Plot Name	NSR	NOS	NMS	NGCG	NGCS	NGCO	EC	NTH	OR	FL
1696	OC3-18	30	7.5	1.1	22	2	6	0	0	100	0
	OC3-19	25	2	0.6	42	28	18	0	0	100	15
	OC3-22	31	15.5	0.8	2	0	8	0	7	100	75
1871	OC3-28	30	4	14.7	0	4	8	0	2	0	25
	OC3-29	31	5.5	5.8	0	6	4	0	0	100	80
1669	OC3-30	24	24.5	7	0	2	6	0	5	0	75
	OC3-31	29	21	3	0	2	4	0	2	0	20
1691	7616_1	39	14	10.5	40	4	2	0	0	0.4	60
1394	7616_2	22	18.5	0	60	0	2	0	0	0.5	70
Exotic Grassland / Pasture	OC3-11	10	0	0	0	0	10	174	0	0	0
	OC3-16	5	0	0	0	0	14	150	0	0	0
	OC3-17	2	0	0	0	0	2	130	0	0	0

Appendix B – Flora species list

Species	Native/Exotic	Species	Native/Exotic
Abutilon spp.	Exotic	*Calytrix tetragona*	Native
Acacia brownii	Native	*Carex inversa*	Native
Acacia buxifolia	Native	*Carthamus lanatus*	Exotic
Acacia decora	Native	*Cassinia arcuata*	Native
Acacia doratoxylon	Native	*Cassinia cunninghamii*	Native
Acacia gladiiformis	Native	*Cassinia quinquefaria*	Native
Acacia implexa	Native	*Cassinia sp.*	Native
Acacia leucolobia	Native	*Cassinia uncata*	Native
Acacia linearifolia	Native	*Cassytha pubescens*	Native
Acacia sp.	Native	*Cassytha sp.*	Native
Acacia spectabilis	Native	*Centaurium sp.*	Exotic
Acaena novae-zelandiae	Native	*Cerastium sp.*	Exotic
Acetosella vulgaris	Exotic	*Chamaesyce drummondii*	Native
Acrotriche rigida	Native	*Chamaesyce sp.*	Native
Aira cupaniana	Exotic	*Cheilanthes seiberi*	Native
Allocasuarina gymnanthera	Native	*Cheilanthes sp.*	Native
Allocasuarina verticillata	Native	*Chloris sp.*	Native
Alternanthera denticulata	Native	*Chloris truncata*	Native
Amyema miquelii	Native	*Chloris ventricosa*	Native
Anagallis arvensis	Exotic	*Chondrilla juncea*	Exotic
Angophora floribunda	Native	*Chrysocephalum apiculatum*	Native
Aristida ramosa	Native	*Chrysocephalum sp.*	Native
Aristida sp.	Native	*Cirsium vulgare*	Exotic
Aristida vagans	Native	*Cleistochloa rigida*	Native
Aristida warburgii	Native	*Cleistochloa sp.*	Native
Arundinella nepalensis	Native	*Clematis aristada*	Native
Asplenium sp.	Native	*Clematis glycinoides*	Native
Aster subulatus	Exotic	*Convolvulus erubescens*	Native
Astroloma humifusum	Native	*Convolvulus sp.*	Exotic
Austrostipa densiflora	Native	*Conyza sp.*	Exotic
Austrostipa scabra	Native	*Coronidium scorpiodes*	Native
Austrostipa setacea	Native	*Cotula australis*	Native
Austrostipa sp.	Native	*Crassula sieberiana*	Native
Austrostipa verticillata	Native	*Cryptandra sp.*	Native
Avena sp.	Exotic	*Cymbopogon refractus*	Native
Bidens subalternans	Exotic	*Cynoglossum australe*	Native
Bossiaea sp.	Native	*Daucus glochidiatus*	Native
Brachychiton populneus	Native	*Daviesia genistifolia*	Native
Brachyloma daphnoides	Native	*Daviesia sp.*	Native
Brachyscome sp.	Native	*Daviesia ulicifolia*	Native
Briza minor	Exotic	*Desmodium varians*	Native
Bromus sp.	Exotic	*Dianella caerulea*	Native
Bursaria spinosa	Native	*Dianella longifolia*	Native
Callitris endlicheri	Native	*Dianella revoluta*	Native
Calotis cuneifolia	Native	*Dianella sp.*	Native
Calotis lappulacea	Native	*Dichelachne hirtella*	Native
Dichelachne micrantha	Native	*Goodenia sp.*	Native
Dichelachne sp.	Native	*Grevillea ramosissima subsp. ramosissima*	Native
Dichondra repens	Native	*Grevillea sericea*	Native
Dichondra sp. A	Native	*Haloragis heterophylla*	Native

Digitaria breviglumis	Native	*Hardenbergia violacea*	Native
Digitaria parviflora	Native	*Hibbertia circumdans*	Native
Digitaria sp.	Native	*Hibbertia obtusifolia*	Native
Dillwynia phylicoides	Native	*Hibbertia sp.*	Native
Dillwynia sieberi	Native	*Hordeum sp.*	Exotic
Dillwynia sp.	Native	*Hovea lanceolata*	Native
Dodonaea triagularis	Native	*Hovea linearis*	Native
Dodonaea viscosa	Native	*Hydrocotyle laxiflora*	Native
Drosera peltata	Native	*Hypericum gramineum*	Native
Echinopogon caespitosus	Native	*Hypericum perforatum*	Exotic
Echinopogon sp.	Native	*Hypochaeris radicata*	Exotic
Einadia hastata	Native	*Indigofera adesmiifolia*	Native
Einadia nutans	Native	*Joycea pallida*	Native
Einadia trigonos	Native	*Juncus bufonius*	Exotic
Elymus scaber	Native	*Juncus sp.*	Native
Entolasia stricta	Native	*Juncus subsecundus*	Native
Eragrostis brownii	Native	*Kunzea ambigua*	Native
Eragrostis leptostachya	Native	*Kunzea parvifolia*	Native
Eragrostis sp.	Native	*Lachnagrostis filiformis*	Native
Ericaceae sp.	Native	*Lactuca serriola*	Exotic
Eucalyptus albens	Native	*Laxmannia gracilis*	Native
Eucalyptus blakelyi	Native	*Lepidium bonariense*	Exotic
Eucalyptus crebra	Native	*Lepidium sp.*	Native
Eucalyptus dawsonii	Native	*Lepidosperma gunnii*	Native
Eucalyptus dwyeri	Native	*Lepidosperma laterale*	Native
Eucalyptus fibrosa	Native	*Lepidosperma sp.*	Native
Eucalyptus macrorhyncha	Native	*Lepidosperma viscidum*	Native
Eucalyptus moluccana	Native	*Leptospermum parvifolium*	Native
Eucalyptus punctata	Native	*Leptospermum polygalifolium*	Native
Eucalyptus rossii	Native	*Leucopogon juniperinus*	Native
Eucalyptus sp.	Native	*Leucopogon muticus*	Native
Eucalyptus sparsifolia	Native	*Leucopogon sp.*	Native
Eucalyptus tenella	Native	*Leucopogon virgatus*	Native
Euchiton sp.	Native	*Lilaceae sp.*	Exotic
Euchiton sphaericus	Native	*Lissanthe strigosa*	Native
Eulalia aurea	Native	*Lolium sp.*	Exotic
Exocarpos strictus	Native	*Lomandra confertifolia*	Native
Ficus rubiginosa	Native	*Lomandra confertifolia subsp. rubiginosa*	Native
Fimbristylis dichotoma	Native	*Lomandra filiformis subsp. coriacea*	Native
Gahnia aspera	Native	*Lomandra filiformis subsp. filiformis*	Native
Galium binifoliium	Native	*Lomandra glauca*	Native
Galium sp.	Native	*Lomandra gracilis*	Native
Gamochaeta sp.	Exotic	*Lomandra multiflora*	Native
Geranium solanderi	Native	*Lomandra sp.*	Native
Geranium sp.	Native	*Macrozamia secunda*	Native
Glycine clandestina	Native	*Macrozamia sp.*	Native
Glycine tabacina	Native	*Maireana enchylaenoicles*	Native
Gonocarpus tetragynus	Native	*Marrubium vulgare*	Exotic
Melaleuca thymifolia	Native	*Sisyrinchium sp. A*	Native
Microlaena stipoides	Native	*Solanum campanulatum*	Native
Microtis sp.	Native	*Solanum nigrum*	Exotic
Microtis unifolia	Native	*Solanum sp.*	Native
Mirbelia pungens	Native	*Solenogyne sp.*	Native

Monotoca scoparia	Native	*Sporobolus creber*	Native
Onopordum sp.	Exotic	*Stackhousia viminea*	Native
Opercularia diphylla	Native	*Styphelia triflora*	Native
Opercularia hispida	Native	*Taraxacum spp.*	Native
Oxalis perennans	Native	*Templetonia stenophylla*	Native
Oxalis sp.	Native	*Themeda australis*	Native
Panicum effusum	Native	*Tolpis barbata*	Exotic
Paronychia brasiliana	Exotic	*Trifolium arvense*	Exotic
Patersonia sericea	Native	*Trifolium campestre*	Exotic
Persoonia linearis	Native	*Trifolium glomeratum*	Exotic
Petrorhagia nanteuilii	Exotic	*Trifolium repens*	Exotic
Phalaris sp.	Exotic	*Triplodiscus pygmaeus*	Native
Phebalium squamulosum	Native	*Triticum aestivum*	Exotic
Phebalium squamulosum subsp. gracile	Native	*Typha orientailis*	Native
Phyllanthus hirtellus	Native	*Verbena bonariensis*	Exotic
Phyllanthus occidentalis	Native	*Veronica plebeia*	Native
Pimelea sp.	Native	*Veronica sp.*	Native
Plantago lanceolata	Exotic	*Vittadinia cuneata*	Native
Plantago sp.	Native	*Vittadinia muelleri*	Native
Poa sp.	Native	*Vittadinia sp.*	Native
Podolobium ilicifolium	Native	*Vulpia bromoides*	Exotic
Polycarpon tetaphyllum	Exotic	*Vulpia muralis*	Exotic
Polypogon monspeliensis	Exotic	*Vulpia sp.*	Exotic
Polypogon sp.	Exotic	*Wahlenbergia gracilis*	Native
Pomax umbellata	Native	*Wahlenbergia sp.*	Native
Poranthera corymbosa	Native	*Xanthorrhoea johnsonii*	Native
Poranthera microphylla	Native	*Xanthorrhoea sp.*	Native
Poranthera sp.	Native		
Pultenaea microphylla	Native		
Pultenaea sp.	Native		
Rumex brownii	Native		
Rumex conglomeratus	Exotic		
Rytidosperma caespitosum	Native		
Rytidosperma erianthum	Native		
Rytidosperma monticola	Native		
Rytidosperma pallidum	Native		
Rytidosperma racemosum var. racemosum	Native		
Rytidosperma sp.	Native		
Rytidosperma tenuius	Native		
Salvia verbenaca	Exotic		
Sannantha cunninghamii	Native		
Schoenus apogon	Native		
Senecio quadridentatus	Native		
Senecio sp.	Native		
Setaria sp.	Exotic		
Sida corrugata	Native		
Silene gallica	Exotic		

Appendix C – Candidate Species Likelihood of Occurrence Table

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Threatened flora						
Acacia ausfeldii	Ausfeld's Wattle	Habitat within BioNet is described as 'as per vegetation type'. Acacia ausfeldii occurs in the Mudgee - Ulan - Gulgong area north of Mudgee on the Central Western Slopes. These areas have been heavily cleared for agriculture and this species is largely limited to remnant roadside woodland patches. Occurs in woodland containing E. Albens, Blakely's Red Gum and Cypress Pine and grasses. The largest population of this species concentrated around Tuckland State Forest, Yarrobil NP and Goodiman State Park NW of Gulgong, and 6 km west of Ulan. Smaller populations are located around Mudgee and Lue (OEH 2017b). This species was not recorded during the field survey, although it is known to occur within proximity, less 5 km from the Modification Disturbance Footprint.	X		Yes	Yes
Acacia dangarensis		Habitat within BioNet is described as 'as per vegetation type'. This species is limited to a very restricted geographical range around the basalt peak Mt Dangar. Acacia dangarensis occurs in pure stands or as a co-dominant tree in sclerophyll woodland on the edge of dry rainforest on basalt and basalt colluvium 65km to the east of the study area (OEH 2017b). The lack of dry rainforest in the study area indicates the low likelihood of its occurrence. This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Commersonia procumbens		Habitat within BioNet is described as 'as per vegetation type'. This species is found in red ironbark – red gum dry sclerophyll forest on sedimentary substrate, where understorey plants such as Calytrix tetragona, Leptospermum parvifolium, and Kunzea parviflora can be found (OEH, 2017b). The species responds to disturbance and availability of full light. This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No
Commersonia rosea		Habitat within BioNet is described as 'as per vegetation type'. This species grows on skeletal soils with scrub or heath. After extensive surveys has still only been located at Sandy Hollow some 75kms from the study area (OEH 2017b). This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No
Cynanchum elegans	White-flowered Wax Plant	Habitat within BioNet is described as 'as per vegetation type'. Recorded from rainforest gullies scrub and scree slopes; from the Gloucester district to the Wollongong area and inland to Mt Dangar which is 65km from the study site (OEH 2017b). This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Dicanthium setosum	Bluegrass	Habitat within BioNet is described as 'as per vegetation type'. The species is associated with heavy basaltic black soils and red-brown loams with clay subsoil. Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture. Associated species include E. albens, E. melanophloia, E. melliodora, E. viminalis, Myoporum debile, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Medicago minima, Leptorhynchos squamatus, Lomandra aff. longifolia, Ajuga australis, Calotis hispidula and Austrodanthonia, Dichopogon, Brachyscome, Vittadinia, Wahlenbergia and Psoralea species (OEH 2017b). The species is a plant of the summer rainfall belt which extends from the Liverpool Ranges north. Records south of that area are very old. The last record in the Mudgee district is over 100 years old, as is the record from Dubbo (OEH 2017b). The closest record of the species is 6 km to the north from MCC, which was recorded in 2010 (OEH 2017a).		X	Yes	Yes
Diuris pendunculata	Small Snake Orchid	Habitat within BioNet is described as 'as per vegetation type'. This species is found from Port Jackson to Tenterfield on peat soils and grassy areas. Closest location is 65km to the east. It has a wide range of habits but has not been recorded within western Sydney Basin (OEH 2017b). This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Diuris tricolor	Pine Donkey Orchid	Habitat within BioNet is described as 'as per vegetation type'. Diuris tricolor occurs in sclerophyll forest among grass, often with native Cypress Pine (Callitris spp.). It is found in sandy soils, either on flats or small rises (OEH 2017b). This species was not recorded during the field survey, however isolated individuals have previously been recorded during the Stage 1 and Stage 2 assessments (Moolarben Biota 2006; Ecovision 2008). Several known populations exist in the region surrounding the survey area (ELA 2017). Individuals are known to occur on granite geology immediately to south of Open Cut 1.	X		Yes	Yes
Pine Donkey Orchid population in the Muswellbrook LGA	Pine Donkey Orchid population in the Muswellbrook LGA		X		No	No
Eucalyptus cannonii	Capertee Stringybark	Habitat within BioNet is described as 'as per vegetation type'. Eucalyptus cannonii occurs between Rylstone and the upper Wolgan Valley on the Central Tablelands and the Central Western Slopes. It is locally frequent, but restricted, in sclerophyll woodland on shallow soil on rises (PlantNet 2017). This species was not recorded during the field survey. Isolated individuals were previously recorded during the Stage 1 and Stage 2 assessments (Moolarben Biota 2006; Ecovision 2008); however, the records have since been proved to be the similar (non-threatened) E. macrorhyncha (although the records remain on BioNet (OEH 2017a). This is evidenced by the lack of vouchered records in the Moolarben area on the Australasian Virtual Herbarium map (2017).	X		No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Goodenia macrobarronii	Narrow Goodenia	This species was returned as a potential species credit species from the BBCC; however, it is not listed in NSW or the Commonwealth and therefore has not been considered for further assessment.	X			
Homoranthus darwinioides		Habitat within BioNet is described as 'as per vegetation type'. Although historically recorded from numerous areas on the NSW Central West Slopes, Homoranthus darwinioides now appears to be restricted to disjunct populations – Goulburn River NP and surrounding areas to the south-west of Merriwa, and in the Goonoo Forest to the north of Dubbo. Plants grow in shrubby woodland on sandy soils over sandstone, and has been known to occur in the region on Triassic sandstone to the north of the survey area at Lees Pinch, and to the south east at Oz Mountain (OEH 2017b). The nearest record is at Ulan, approximately 5km north of the MCC (AVH 2017), which was recorded in 1959.	X	X	Yes	Yes
Kennedia retrorsa		Habitat within BioNet is described as 'as per vegetation type'. This species is believed to be restricted to the Mount Dangar area and the adjacent Goulburn River catchment, within the Muswellbrook and adjacent Merriwa local government areas. Sites occur within Goulburn River and Wollemi National Parks and nearby private land. This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No
Lasiopetalum longistamineum		Habitat within BioNet is described as 'as per vegetation type'. This species occurs in the Mt Dangar - Gungal area within Merriwa and Muswellbrook Local Government Areas. A very small number of plants have been recorded within the Goulburn River National Park. This species tends to grow on rich alluvial deposits. This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Leucochrysum albicans var. *tricolor*	Hoary Sunray	Habitat within BioNet is described as 'as per vegetation type'. Leucochrysum albicans var. tricolor occurs in a wide range of habitats from peaty uplands to stony plains, and has been associated with the Western (Basalt) Plains Natural Temperate Grasslands (OEH 2017b). In the Mudgee area, this species has been observed on metasediments and granites (OEH 2017b). This species was not identified in the field survey; however, an isolated individual was identified during the Stage 1 assessment (Moolarben Biota, 2006), most likely on an area of granite. It has been observed on granite areas near the township of Ulan.		X	No	No
Monotaxis macrophylla	Large-leafed Monotaxis	Habitat within BioNet is described as 'as per vegetation type'. This species has been recorded from several highly disjunct populations in NSW: eastern edge of Deua NP (west of Moruya), Bemboka portion of South East Forests National Park, Cobar area (Hermitage Plains), the Tenterfield area, and Woodenbong (near the Queensland border) (OEH 2017b). This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No
Ozothamnus tesselatus		Habitat within BioNet is described as 'as per vegetation type'. This species is restricted to a few locations in an east-west zone south of Bunnan and between west Bylong and east Ravensworth (OEH 2017b). The closest record of this species is less than 5 km south of the MCC (OEH 2017a). This species on the edge of the known western limits of occurrence derived from 45 year old records.	X		No	No
Persoonia marginata	Clandulla Geebung	Habitat within BioNet is described as 'as per vegetation type'. This species is found in dry sclerophyll forest in vicinity of Clandulla and nearby parts of the Central Tablelands (OEH 2017b). The closest record of this species is approximately 50 km south of the MCC (OEH 2017a).	X		No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Philotheca ericifolia		Habitat within BioNet is described as 'as per vegetation type'. This species is known from the upper Hunter Valley and Pilliga to Peak Hill districts of NSW. Grows chiefly in dry sclerophyll forest and heath on damp sandy flats and gullies. It has been collected from a variety of habitats including heath, open woodland, dry sandy creek beds, and rocky ridge and cliff tops. Noted as being a "moisture-loving plant" (OEH 2017b). The closest record of this species is approximately 10 km south of the MCC (OEH 2017a).		X	No	No
Pomaderris queenslandica	Scant Pomaderris	Habitat within BioNet is described as 'as per vegetation type'. Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey. Widely scattered but not common in north-east NSW, it is known from several locations on the NSW north coast, New England Tablelands and North West Slopes (OEH 2017b). This species has been recorded during the Stage 1 and Stage 2 assessments (Moolarben Biota 2006; Ecovision 2008). It has been identified in a number of areas within the MCO estate since then.	X		Yes	Yes
Pomaderris reperta	Denman Pomaderris	Habitat within BioNet is described as 'as per vegetation type'. Recorded in a range of environments. Recently it has had a significant range extension from the sandstone geology of the Hunter Valley to the metasediments of the Central Tablelands of NSW. Occurs in a wide range of sclerophyll vegetation communities (OEH 2017a).	X		Yes	Yes
Pomaderris sericea	Silky Pomaderris	Habitat within BioNet is described as 'as per vegetation type'. In NSW, this species is known only from Morton National Park near Bundanoon and from Wollemi National Park. Silky Pomaderris has also been recorded in north-eastern Victoria (OEH 2017b). The closest record of this species is approximately 35 km south-east of the MCC (OEH 2017a).	X		No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Prasophyllum petilum	Tarengo Leek Orchid	Habitat within BioNet is described as 'as per vegetation type'. Natural populations of this species are known from a total of five sites in NSW. These area at Boorowa, Captains Flat, Ilford, Delegate and a newly recognised population c.10 k SE of Muswellbrook. It also occurs at Hall in the Australian Capital Territory. This species has also been recorded at Bowning Cemetery where it was experimentally introduced, though it is not known whether this population has persisted. (OEH 2017b). The closest record of this species is approximately 50 km south of the MCC (OEH 2017a).		X	No	No
Prasophyllum sp. *Wybong*	Leek-orchid	Habitat within BioNet is described as 'as per vegetation type'. Prasophyllum sp. Wybong is now included with P. petilum (The Royal Botanic Gardens and Domain Trust 2015). P. sp. Wybong was considered to occur in the Upper Hunter Valley, the Central Tablelands and the New England Tablelands (TSSC 2009cj). The Atlas of Living Australia (2015) includes P. aff. petilum (Murchison) and P. aff. petilum (Wangaratta) with P. petilum, however, this treatment is not used by the Royal Botanic Gardens Melbourne (Jeanes 2015) (DotEE 2017). This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).		X	No	No
Prostanthera cryptandroides subsp. cryptandroides	Wollemi Mint-bush	Habitat within BioNet is described as 'as per vegetation type'. This species is distributed between Lithgow and Sandy Hollow on the NSW central west slopes, central tablelands and western parts of the central coast botanical regions. Populations occur in Wollemi National Park and Gardens of Stone National Park. A voucher specimen exists for the far northern tablelands near Tenterfield; however, this may represent subsp. Euphrasioides (OEH 2017b). This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Prostanthera discolor		Habitat within BioNet is described as 'as per vegetation type'. This species grows in dry sclerophyll forest in rocky gullies; in the Sandy Hollow-Merriwa district (OEH 2017b). The closest record of this species is approximately 25 km east of the MCC (OEH 2017a).	X		No	No
Prostanthera stricta	Mount Vincent Mint-bush	Habitat within BioNet is described as 'as per vegetation type'. This species occurs from Mt Vincent to Genowlan Mountain in the Capertee Valley. Prostanthera aff. stricta is found at Dingo Creek and the Widden and Baerami Valleys in the Upper Hunter (OEH 2017b). The closest record of this species is approximately 50 km south of the MCC (OEH 2017a).	X		No	No
Thesium australe	Austral Toadflax	Habitat within BioNet is described as 'as per vegetation type'. This species is widespread throughout the eastern third of NSW but most common on the North Western Slopes, Northern Tablelands and North Coast. Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (Themeda australis) (OEH 2017b). The preferred soil type is a fertile loam derived from basalt although it occasionally occurs on metasediments and granite. This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).		X	No	No
Tylophora linearis		Habitat within BioNet is described as 'as per vegetation type'. This species is widespread on the North and Central Western Slopes of NSW. Grows in a variety of drier vegetation types but mostly in shrubby woodland and dry scrubland that may have Eucalyptus spp., Callitris glaucophylla and/or Allocasuarina leuhmannii as a canopy overtopping the scrub. This species has been observed on Permian/Triassic sediments in the Bylong Valley and in areas west of the survey area. (OEH 2017b). The closest record of this species is 32 km west of the MCC (AVH 2017).		X	No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Weeping Myall population in the Hunter catchment	Weeping Myall population in the Hunter catchment	A disjunct population of fewer than 1000 individuals that occurs in the Hunter Valley at the eastern distributional limit of the species' range (OEH 2017b).	X		No	No
Threatened fauna						
Anthochaera phrygia	Regent Honeyeater	Foraging habitat: as per vegetation type. This species occupies open woodlands and forests, particularly Eucalyptus sideroxylon (Mugga Ironbark), E. Albens, E. melliodora and E. blakelyi as well as mistletoes which provide sufficient nectar on which it feeds. This species makes nomadic movements following winter flowering eucalypt species (OEH 2017b). Breeding habitat: Two of three known key breeding areas are in NSW are in the Capertee Valley and Bundarra-Barraba region. The species breeds between July and January and usually nests in horizontal branches or forks in tall mature eucalypts and Sheoaks. Shelter / roosting refuge: The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (OEH 2017b). The closest record for this species is approximately 4 km to the east of the MCC (OEH 2017a) and date from 1977 and 1981.	X	X	Yes	Yes
Aprasia parapulchella	Pink-tailed Worm-lizard / Pink-tailed Legless Lizard	Foraging habitat: As per vegetation type. This species inhabits sloping, open woodland areas with predominantly native grassy groundcover, particularly those dominated by Kangaroo Grass (OEH 2017b). Shelter / roosting refuge: This species is commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites (OEH 2017b). The closest record for this species is approximately 15 km to the east of the MCC.	X	X	No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Cercartetus nanus	Eastern Pygmy-possum	Foraging habitat: As per vegetation type. Found in broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest (OEH 2017b). Breeding habitat: Trees with hollows, loose bark of eucalypts or accumulations of shredded bark in tree forks for nesting. Shelter / roosting refuge: Habitat is hollow-bearing trees, decorticating bark or forks in trees. The closest record of the species is 35 km to the south east of MCC (OEH 2017a).	X		No	No
Chalinolobus dwyeri	Large-eared Pied Bat	Foraging habitat: As per vegetation type. This species has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (OEH 2017b). Roosting habitat: This species roosts in caves, rock overhangs and disused mine shafts (OEH 2017b). This species was recorded during the field survey within the Modification Disturbance Footprint.	X	X	Yes	Yes
Dasyurus maculatus maculatus	Spotted-tailed Quoll (SE mainland population)	Foraging habitat: As per vegetation type. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline (OEH 2017b). Breeding habitat: Uses hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Shelter / roosting refuge: Mostly nocturnal, and spends most of the time on the ground, although also an excellent climber and will hunt in tree hollows and prey on roosting birds. The closest record for this species is 5 km south of the MCC in the Munghorn Gap Nature Reserve.		X	Yes	Yes

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Delma impar	Striped Legless Lizard	Foraging habitat: As per vegetation type. This species occurs throughout temperate lowland grasslands in the Australian Capital Territory (ACT), the south-western slopes and southern tablelands of New South Wales (NSW), central and southern Victoria, and the south-eastern corner of South Australia (SA) (OEH, 2017b). Shelter / roosting refuge: This species is found in habitat where grassland is dominated by perennial, tussock-forming grasses such as Kangaroo Grass Themeda australis, spear-grasses Austrostipa spp. and Poa tussocks Poa spp., and occasionally wallaby grasses Austrodanthonia spp (OEH 2017b). This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).		X	No	No
Grantiella picta	Painted Honeyeater	Foraging habitat: as per vegetation type. This species is a nomadic species that typically inhabits woodlands with abundant mistletoe (OEH 2017b). Breeding habitat: This species nests from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches (OEH 2017b). Shelter / roosting refuge: This species is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, preferring Amyema sp. mistletoe (OEH 2017b). This species was recorded previously in proximity to the survey area during assessments undertaken for Stage 1 and Stage 2 (Ecovision 2008; Moolarben Biota 2006).		X	Yes	Yes

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Heleioporus australiacus	Giant Burrowing Frog	Foraging habitat: As per vegetation type. Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based (OEH 2017b). Breeding habitat: When breeding, this species will call from open spaces, under vegetation or rocks or from within burrows in the creek bank (OEH 2017b). Shelter / roosting refuge: Whilst in non-breeding habitat, this species burrows below the soil surface or in the leaf litter (OEH 2017b). This species has not been recorded within the Mid-Western Regional LGA (OEH 2017a).	X		No	No
Hoplocephalus bungaroides	Broad-headed Snake	Foraging habitat: as per vegetation type. Shelter / roosting refuge: Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring (OEH, 2017b). The closest record for this species is approximately 50 km to the south of the MCC.	X	X	No	No
Lathamus discolor	Swift Parrot	Foraging habitat: as per vegetation type. This species occurs in areas where eucalypts are flowering profusely, or where there are abundant lerp (OEH 2017b). Breeding habitat: This species breeds in Tasmania during spring and summer, migrating to south-eastern Australia in the autumn and winter months (OEH 2017b). Shelter / roosting refuge: This species favoured feed trees include winter flowering species such as Eucalyptus robusta (Swamp Mahogany), Corymbia maculata (Spotted Gum), C. gummifera (Red Bloodwood), E. sideroxylon (Mugga Ironbark), and E. albens (White Box) (OEH 2017b). The closest record for this species is approximately 20 km to the south of the MCC.		X	Yes	Yes

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Nyctophilus corbeni	Corben's Long-eared Bat	Foraging habitat: as per vegetation type. This species is thought to prefer structurally complex forest as foraging habitat (OEH 2017b). Roosting habitat: This species roosts and shelters within tree hollows (OEH 2017b). Possible calls for this species were recorded during the field survey, although no previous records occur in the Modification Disturbance Footprint. The closest record for this species is less than 5 km to the east of the MCC.		X	Yes	Yes
Petauroides volans	Greater Glider	Foraging habitat: As per vegetation type. This species is associated with Eucalyptus forests and woodlands (OEH 2017b). Breeding habitat: Trees with hollows. Shelter / roosting refuge: Shelters in tree hollows, with a particular selection for large hollows in large, old trees. The closest record of this species occurs within 10km of the MCC (OEH 2017a).		X	No	No
Petrogale penicillata	Brush-tailed Rock-wallaby	Foraging habitat: As per vegetation type. This species is found in rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices and usually near fresh water (OEH 2017b). Breeding habitat: As per vegetation type. Shelter / roosting refuge: Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. The closest record for this species is approximately 15 km to the north of the MCC (OEH 2017a).	X	X	Yes	Yes
Phascolarctos cinereus	Koala	Foraging habitat: As per Koala Food Tree Species listed in Appendix 2 of the NSW State Koala Recovery Plan (DECC 2008). The Koala is associated with both wet and dry eucalypt forest and woodland with acceptable eucalypt food trees (OEH 2017b). Koala feed tree species are listed under the SEPP 44. Breeding habitat: As per vegetation type. Shelter / roosting refuge: As per vegetation type. This species was not recorded during the field survey; however, it was recorded in close proximity to the survey area during the Stage 2 assessment (Ecovision 2008).	X	X	Yes	Yes

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Polytelis swainsonii	Superb Parrot	Foraging habitat: as per vegetation type. This species is found in Box-gum woodland, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest (OEH 2017b). Breeding habitat: This species nests in small colonies, often with more than one nest in a single tree. They breed between September and January (OEH 2017b). Shelter / roosting refuge: This species may forage up to 10 km from nesting sites, primarily in grassy box woodland. Feed in trees and understorey shrubs and on the ground and their diet consists mainly of grass seeds and herbaceous plants. Also eaten are fruits, berries, nectar, buds, flowers, insects and grain (OEH 2017b). The closest record is over 40km from the survey area.		X	No	No
Pseudomys novaehollandiae	New Holland Mouse	Foraging habitat: as per vegetation type. This species inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes (DotEE 2017). Breeding habitat: As per vegetation type. Shelter / roosting refuge: This species is a social animal, which lives predominantly in burrows shared with other individuals. This species has been recorded within the MCC Biodiversity Offset Areas (approximately 3 km outside of the Modification Disturbance Footprint) during ongoing monitoring (ELA 2015).		X	No	No
Pseudophryne australis	Red-Crowned Toadlet	Foraging habitat: As per vegetation type. This species inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings in open forests, mostly on Hawkesbury and Narrabeen Sandstones (OEH 2017b). Breeding habitat: Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters (OEH 2017b). Shelter / roosting refuge: This species shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter (OEH 2017b). The closest record for this species is approximately 55 km to the south of the MCC.	X		No	No

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
Varanus resenbergi	Rosenberg's Goanna	Foraging habitat: as per vegetation type. This species is found in heath, open forest and woodland (OEH, 2017b). Shelter / roosting refuge: Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens (OEH 2017b). The closest record for this species is approximately 45 km to the east of the MCC.	X		No	No
Threatened Ecological Communities						
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion (BC Act) Central Hunter Valley eucalypt forest and woodland (EPBC Act)		Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion, (referred to as Slaty Gum Woodland) is a low to mod-high open woodland community that generally occurs at the interface of Narrabeen Sandstone and Permian sediments in the Hunter Valley. The tree canopy is typically dominated by *E. dawsonii* and/or Grey Box. *Angophora floribunda* may also be sub-dominant or locally dominant. *Acacia salicina* (Cooba) and *Allocasuarina luehmannii* (Buloke) may form a low tree stratum, or may be part of the upper-most canopy. Other trees which may be present include *Brachychiton populneus* subsp. *populneus* (Kurrajong), *Callitris endlicheri* (Black Cypress Pine), *Eucalyptus crebra* (Narrow-Leaved Ironbark) and *Eucalyptus punctata* (Grey Gum) (OEH 2017b and DotEE 2017). Communities of both Slaty Gum woodland and Rough-barked Apple woodland occur in the Modification Disturbance Footprint which meet the definition of this VEC and CEEC.	X	X	Yes	Yes

Scientific name	Common name	Habitat associations	Data Source		Habitat present?	Assessment required?
			BBCC	EPBC Advice		
White Box-Yellow Box-Blakely's Red Gum Woodland (BC Act) White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act)		Characterised by the presence or prior occurrence of *E. Albens*, *E. melliodora* and/or Blakely's Red Gum. The trees may occur as pure stands, mixtures of the three species or in mixtures with other trees, including wattles. The understorey in intact sites is characterised by native grasses and a high diversity of herbs; the most commonly encountered include *Themeda triandra, Poa sieberiana, Rytidosperma* spp., *Austrostipa* spp., *Chrysocephalum apiculatum, Goodenia pinnatifida, Hypericum gramineum, Vittadinia muelleri* and *Wahlenbergia* spp. Shrubs are generally sparse or absent, though they may be locally common. Remnants generally occur on fertile lower parts of the landscape where resources such as water and nutrients are abundant (DotEE 2017). Both the EEC and CEEC occur within the Modification Disturbance Footprint as both derived native grassland and grassy woodland form.	X	X	Yes	Yes

Appendix D – Fauna species recorded during surveys

Common name	Scientific name	BC Act	EPBC Act
Birds			
Australian Magpie	*Cracticus tibicen*		
Australian Raven	*Corvus coronoides*		
Crested Pigeon	*Ocyphaps lophotes*		
Galah	*Eolophus roseicapillus*		
Laughing Kookaburra	*Dacelo novaeguineae*		
Noisy Friarbird	*Philemon corniculatus*		
Noisy Miner	*Manorina melanocephala*		
Pied Butcherbird	*Cracticus nigrogularis*		
Striated Thornbill	*Acanthiza lineata*		
Sulphur-crested Cockatoo	*Cacatua galerita*		
Superb Fairy-wren	*Malurus cyaneus*		
Welcome Swallow	*Hirundo neoxena*		
White-winged Chough	*Corcorax melanorhamphos*		
Yellow Thornbill	*Acanthiza nana*		
Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*		
Buff-rumped Thornbill	*Acanthiza reguloides*		
Pied Currawong	*Strepera graculina*		
Eastern Rosella	*Platycercus eximius*		
Emu	*Dromaius novaehollandiae*		
Grey-crowned Babbler (eastern subsp.)	***Pomatostomus temporalis temporalis***	**V**	
Musk Lorikeet	*Glossopsitta concinna*		
Common Bronzewing	*Phaps chalcoptera*		
Magpie-lark	*Grallina cyanoleuca*		
White-necked Heron	*Ardea pacifica*		
Nankeen Kestral	*Falco cenchroides*		
White-throated Treecreeper	*Cormobates leucophaea*		
Yellow-faced Honeyeater	*Lichenostomus chrysops*		
Eastern Yellow Robin	*Eopsaltria australis*		
Grey Fantail	*Rhipidura albiscapa*		
Grey Shrike-thrush	*Colluricincla harmonica*		
Double-barred Finch	*Taeniopygia bichenovii*		
Olive-backed Oriole	*Oriolus sagittatus*		
Grebe sp.			
Tawny Frogmouth	*Podargus strigoides*		
Brown Treecreeper (eastern subsp.)	***Climacteris picumnus victoriae***	**V**	
Rockwarbler	*Origma solitaria*		
Pardalote sp.	*Pardalotus sp.*		
Mammals			
Swamp Wallaby	*Wallabia bicolor*		

Common Wallaroo	*Macropus robustus*		
Eastern Grey Kangaroo	*Macropus giganteus*		
Echidna	*Tachyglossus arcuata*		
Red-necked Wallaby	*Macropus rufus*		
White-striped freetail Bat	*Austronomus australis*		
Large-eared Pied Bat	***Chalinolobus dwyeri***	**V**	**V**
Gould's Wattled Bat	*Chalinolobus gouldii*		
Chocolate Wattled Bat	*Chalinolobus morio*		
Eastern Bentwing-bat	***Miniopterus schreibersii oceanensis***	**V**	
Inland Freetail Bat	*Mormopterus (Ozimops) petersi*		
South-eastern Freetail Bat	*Mormopterus (Ozimops) planiceps*		
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*		
Reptiles			
Jacky Dragon	*Amphibolurus muricatus*		
Lace Monitor	*Varanus varius*		
Copper-tailed Skink	*Ctenotus taeniolatus*		

V = Vulnerable

Appendix E – Microbat Analysis Report

Targeted microbat survey results – Moolarben MOD cliff and cave Anabat Assessment

Six Anabat ultrasonic call recorders (Anabat) were set to record between 20 and 24 of February 2017 in the survey area.

Bat calls were analysed using the program AnalookW (Version 3.8, 25 October 2012, written by Chris Corben, www.hoarybat.com). Call identifications were made using regional based guides to the echolocation calls of microbats in New South Wales (Pennay et al. 2004); and south-east Queensland and north-east New South Wales (Reinhold et al. 2001) and the accompanying reference library of over 200 calls from north-eastern NSW. Available at: (http://www.forest.nsw.gov.au/research/bats/default.asp).

Bat calls are analysed using species-specific parameters of the call profile such as call shape, characteristic frequency, initial slope and time between calls (Rinehold et al. 2001). To ensure reliable and accurate results the following protocols (adapted from Lloyd et. al. 2006) were followed:

- Search phase calls were used in the analysis, rather than cruise phase calls or feeding buzzes (McKenzie et al. 2002)
- Recordings containing less than three pulses were not analysed and these sequences were labelled as short (Law et al. 1999)
- Four categories of confidence in species identification were used (Mills et al. 1996):
    - definite – identity not in doubt
    - probable – low probability of confusion with species of similar calls
    - possible – medium to high probability of confusion with species with similar calls
    - unidentifiable – calls made by bats which cannot be identified to even a species group.
- *Nyctophilus* spp. are difficult to identify confidently from their calls and no attempt was made to identify this genus to species level (Pennay et al. 2004)
- Sequences not attributed to microbat echolocation calls were labelled as junk or non-bat calls and don't represent microbat activity at the site
- Sequences labelled as low were of poor quality and therefore not able to be identified to any microbat species, they can however be used as an indicator of microbat activity at the site

This call data was analysed on the 05 April 2016 by Rodney Armistead.

Results

There were 1,623 sequences recorded on the six Anabat detectors. Of these, 730 (44.98%) were of sufficient quality or length to enable positive identified to genus or species. The remaining sequence were either to short or of low quality, thus preventing positive identification.

There were at least 18 microbat species identified in this survey (**Table E-1**). This includes eight species that were positively identified as being present within the study area and ten species that were not, and therefore were determined as being possibly present (**Table E-1**).

There were at least seven threatened microbat species identified in this survey (**Table E-1**). Of these threatened species, the following were positive identification as being present within the study area:

- *Chalinolobus dwyeri* (Large-eared Pied Bat) (vulnerable under TSC Act and EPBC Act)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat) (vulnerable under TSC Act)

Only possible calls were recorded for the five remaining species of the six threatened species recorded, including *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) and *Scoteanax rueppellii* (Greater Broad-nosed Bat).

The species diversity differed marginally across the survey sites, with at least six to 16 species being recorded at each site (**Table E-1**). The most diverse survey site was SM3 -5, where at least 16 microbat species (seven positively identified and nine as possibly present) were recorded. The most widespread species included *Austronomus* (*Nyctimonus* / *Tadarida*) *australis* (White Striped Free-tail Bat), *Large-eared Pied Bat, C. goudlii* (Gould's Wattled Bat), *C. morio* (Chocolate Wattled Bat), *Miniopterus australis* (Little Bentwing-bat) and *M. schreibersii oceanensis* (Eastern Bentwing-bat) (**Table E-1**).

Cave dwelling microbat species were recorded at each survey site. The cave dwelling species included Large-eared Pied Bats (with definite calls being recorded on Anabat 6, Anabat 2 and Anabat 3), Little Bentwing-bats (possible calls being recorded on Anabat 4 and Anabat 2), Eastern Bentwing-bats (possible calls being recorded on Anabat 4 and definite calls being recorded at all other locations and *Rhinolophus megaphyllus* (Eastern Horseshoe Bat) (Anabat 4, 1, 2 and 3). As stated previously, the Little Bentwing-bat and Eastern Bentwing-bat are listed as Vulnerable under the TSC Act, whilst the large-eared Pied Bat is listed as Vulnerable under both the TSC Act and the EPBC Acts.

The activity levels (based on the time when the calls were recorded) were generally low and evenly spread across the night. The greatest levels of activity occurred in the evening and early mornings.

Generally, the calls were short in length or of low quality, thus making them difficult to identify these bats to species of genus level. This may reflect the targeted nature of the surveys and the Anabats being set close to cliffs, rocky areas that contain (possibly) relatively dense vegetation. The short and low quality calls suggest that the bats that are present are moving quickly through each study site possibly to forage elsewhere. This is supported by the longer calls that are of low quality. These calls are possibly from bats foraging above the vegetation and making calls that are only just being recorded by the Anabats and Songmeters (**Table E-1)**. Microbat species diversity recorded during the Moolarben MOD cliff and cave Anabat ultra-sonic m call survey undertaken between 20 and 23 February 2017.

Table E-1: Microbat species diversity recorded during the Moolarben MOD cliff and cave Anabat ultra-sonic m call survey undertaken between 20 and 23 February 2017

Species name	Common name	Anabat 4		Anabat 6		Anabat 1		Anabat 5		Anabat 2		Anabat 3	
		20 – 24 February		22, 23 - 24 February		20 - 22 February		20 – 22 February		20 – 23 February		23 – 24 February	
		Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present
Austronomus australis	White-striped freetail Bat	X				X		X			X	X	
*Chalinolobus dwyeri**[1,2]	Large-eared Pied Bat		X	X			X		X	X		X	
Chalinolobus gouldii	Gould's Wattled Bat	X				X				X		X	
Chalinolobus morio	Chocolate Wattled Bat	X				X				X		X	
*Falsistrellus tasmaniensis**[2]	Eastern False Pipistrelle												X
*Miniopterus australis**[2]	Little Bentwing-bat		X								X		
*Miniopterus schreibersii oceanensis**[2]	Eastern Bentwing-bat		X	X		X		X		X		X	
Mormopterus (*Ozimops*) *petersi*	Inland Freetail Bat	X								X			
Mormopterus (*Ozimops*) *planiceps*	South-eastern Freetail Bat	X			X				X	X		X	
*Myotis macropus**[2]	Large-footed Myotis										X		X
Nyctophilus spp.*[2]	Long-eared Bats										X		X
Rhinolophus megaphyllus	Eastern Horseshoe Bat	X				X				X		X	
*Scoteanax rueppellii**[2]	Greater Broad-nosed Bat												X

Species name	Common name	Anabat 4		Anabat 6		Anabat 1		Anabat 5		Anabat 2		Anabat 3	
		20 – 24 February		22, 23 - 24 February		20 - 22 February		20 – 22 February		20 – 23 February		23 – 24 February	
		Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present	Positively identified	Possibly present
Scotorepens balstoni	Inland Broad-nosed Bat						X						X
Scotorepens orion	Eastern broad-nosed Bat												X
Vespadelus darlingtoni	Large Forest Bat		X		X		X		X		X		X
Vespadelus regulus	Southern Forest Bat		X		X		X		X		X		X
Vespadelus vulturnus	Little Forest Bat		X		X		X		X		X		X
Species Diversity (Positive identification)		**7**		**2**		**5**		**2**		**7**		**7**	
Species Diversity (Possible)			**5**		**4**		**5**		**5**		**6**		**9**
Total (at least) number of species		**13**		**6**		**10**		**7**		**13**		**16**	

* Threatened species listed under TSC Act / [1] Threatened species listed under the EPBC Act / [2] Vulnerable species listed under the TSC Act

Feeding buzzes were observed in the data set indicating that bats were foraging actively at the study site. Feeding buzzes were recorded as being of low quality, as it is generally regarded that it is more difficult to identify the species making these calls.

Survey Limitations

Calls were only positively identified when defining characteristics were present, such as call shape and when the characteristic frequency allowed discrimination of a species. In this survey, there were a number of species call profiles, that due to similarities among species could not be positively identify to species level. Where this was apparent, these species with similar call profiles were lumped together into groups of two or three potential species depending on the recorded and defining call characteristics. When this occurred, these calls were assigned to the lowest certainty level of 'possible'.

The calls of Chocolate Wattled Bat and *Vespadelus spp.* (Forest Bats) can be difficult to separate in the range 50.5 – 53 kHz. Calls were identified as *C. morio* when a down-sweeping tail was present within the call profiles. Alternatively, calls with up-sweeping tails that an end frequency below 51 kHz were generally identified as a Forest Bat species. When no distinguishing characteristics were present within the calls, they were assigned as Chocolate Wattled Bat / Forest Bat.

The calls from *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Scotorepens orion* (Eastern Broad-nosed Bat and Greater Broad-nosed Bat can be difficult to separate in a frequency range between 35 and 37 kHz. Calls were identified as the following species if the call profiles matched the descriptions given below:

- Eastern False Pipistrelle – characteristic frequency between 35 and 39 kHz, with a curved, usually steep pulse that generally do not have up sweeping tails. This species generally has a pre-characteristic section that drops by more than 3 kHz.
- Eastern Broad-nosed Bat – characteristic frequency between 33 and 36 kHz that have no or short tails. This frequency of the knee (see below for description) in this species is generally greater than 37 kHz and the pre-characteristic section that drops by less than 3 kHz.
- Greater Broad-nosed Bat characteristic frequency between 33 and 36 kHz, with a curved pulse that lack tails. This frequency of the knee in this species is generally greater than 37 kHz and the pre-characteristic section that drops by less than 3 kHz.

Calls of Eastern Bentwing-bat overlap in frequency with those of the three Forest Bat species that are known to occur in the region. Calls were identified as Eastern Bentwing-bat when there was a down-sweeping tail, drop of more than 2 kHz in the pre-characteristic section, and the pulse shape and time between calls was variable. Calls were identified as Forest Bat species, when the characteristic frequency fell between 40 – 44 kHz and the characteristic section was long. When no distinguishing characteristics (e.g. some pulses with downward while others have upward sweeping tails) were present within the calls, they were assigned as Eastern Bentwing-bat / Forest Bat combination.

The calls of Large-footed Myotis are very similar to all *Nyctophilus* species and it is often difficult to separate these species. Calls were identified as *Nyctophilus* spp. when the time between calls (TBC) was higher than 95 minutes and the initial slope (OPS) was lower than 300. Calls were identified as Large-footed Myotis when the TBC was lower than 75 minutes and the OPS was greater than 400.

Calls of Southern Forest Bat overlap in frequency in the southern regions of NSW with those of Large Forest Bat and Little Forest Bat. Calls were identified as Southern Forest Bat when the duration of characteristic section appeared short in duration (<1.8ms). Calls were identified as Large Forest Bat when the characteristic section appeared to be longer than (>1.8ms). When no distinguishing characteristics were present, these call profiles were assigned as Southern Forest Bat / Large Forest Bat / Little Forest Bat.

The call profiles that were difficult to separate are not shown in this document as all of the species discussed were positively identified.

Table E-2: Microchiropteran bat call results Cliff 20 – 24 (Anabat 1) recorded between 20 and 22 of February 2017

Species Name	Common name	Positively identified	Potential	Possible	Total
Austronomus australis	White-Striped Freetail Bat	1	0	0	1
Chalinolobus dwyeri[1]	Large-eared Pied Bat	0	2	0	2
Chalinolobus gouldii	Gould's Wattled Bat	4	2	0	6
Chalinolobus morio	Chocolate Wattled Bat	17	20	3	40
Chalinolobus morio / *Vespadelus vulturnus*	Chocolate Wattled Bat / Little Forest Bat	0	0	13	13
*Miniopterus australis**	Little Bentwing-bat	0	1	0	1
*Miniopterus schreibersii oceanensis**	Eastern Bentwing-bat	2	0	2	4
*Miniopterus schreibersii oceanensis** / *Vespadelus darlingtoni* / *Vespadelus regulus* / *Vespadelus vulturnus*	Eastern Bentwing-bat/ Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	0	5	5
Mormopterus (*Ozimops*) *petersi*	Inland Freetail Bat	1	3	0	4
Mormopterus (*Ozimops*) *planiceps*	South-eastern Freetail Bat	7	3	1	11
Rhinolophus megaphyllus	Eastern Horseshoe Bat	3	0	0	3
Vespadelus darlingtoni / *Vespadelus regulus* / *Vespadelus vulturnus*	Large Forest Bat / Southern Forest Bat / Little Forest Bat	3	5	0	8
Low					46
Short					15
Useable calls					**98**
Total Calls					**159**
Percentage usable calls					**61.63**

* Threatened species listed under TSC Act / [1] Threatened species listed under the EPBC Act

Table E-3: Microchiropteran bat call results for Cliff 22, 23 and 24 (Anabat 2) recorded between 20 and 23 of February 2017 (three survey nights)

Species Name	Common name	Positively identified	Potential	Possible	Total
Chalinolobus dwyeri[1]	Large-eared Pied Bat	1	0	0	1
*Miniopterus schreibersii oceanensis**	Eastern Bentwing-bat	1	2	4	7
*Miniopterus schreibersii oceanensis** / *Vespadelus darlingtoni* / *Vespadelus regulus* / *Vespadelus vulturnus*	Eastern Bentwing-bat/ Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	0	6	6
Mormopterus (*Ozimops*) *planiceps*	South-eastern Freetail Bat	0	1	0	1
Low					82
Short					1
Useable calls					**15**
Total Calls					**98**
Percentage usable calls					**15.31**

* Threatened species listed under TSC Act / [1] Threatened species listed under the EPBC Act

Table E-4: Microchiropteran bat call results F1 – Cliff 20 and 22 (SM3 – 5) recorded between 20 and 21 of February 2017 (two survey nights)

Species Name	Common name	Positively identified	Potential	Possible	Total
Austronomus australis	White-Striped Freetail Bat	5	3	1	9
Chalinolobus dwyeri[1]	Large-eared Pied Bat	0	0	1	1
Chalinolobus gouldii	Gould's Wattled Bat	4	9	0	13
Chalinolobus morio	Chocolate Wattled Bat	2	5	1	8
*Miniopterus schreibersii oceanensis**	Eastern Bentwing-bat	104	53	36	193
*Miniopterus schreibersii oceanensis** / *Vespadelus darlingtoni* / *Vespadelus regulus* / *Vespadelus vulturnus*	Eastern Bentwing-bat / Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	0	30	30
Rhinolophus megaphyllus	Eastern Horseshoe Bat	5	0	0	5
Scotorepens balstoni	Inland Broad-nosed Bat	0	1	0	1
Vespadelus darlingtoni / *Vespadelus regulus* / *Vespadelus vulturnus*	Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	0	8	8
Low					89
Short					336
Useable calls					**268**
Total Calls					**693**
Percentage usable calls					**38.67**

* Threatened species listed under TSC Act / [1] Threatened species listed under the EPBC Act

Table E-5: Microchiropteran bat call results for F3 – Cliff 20 and 22 (SM3 -1) recorded between 20 and 21 of February 2017 (two survey nights)

Species Name	Common name	Positively identified	Potential	Possible	Total
Austronomus australis	White-Striped Freetail Bat	4	2	0	6
Chalinolobus dwyeri[1]	Large-eared Pied Bat	0	0	1	1
Chalinolobus gouldii	Gould's Wattled Bat	1	3	1	5
*Miniopterus schreibersii oceanensis**	Eastern Bentwing-bat	0	0	2	2
*Miniopterus schreibersii oceanensis** / *Vespadelus darlingtoni* / *Vespadelus regulus* / *Vespadelus vulturnus*	Eastern Bentwing-bat / Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	0	2	2
Low					31
Short					20
Useable calls					**16**
Total Calls					**67**
Percentage usable calls					**23.88**

* Threatened species listed under TSC Act / [1] Threatened species listed under the EPBC Act

Table E-6: Microchiropteran bat call results Cliff 20 – 23 (SM3 - 3) recorded between 20 and 22 of February 2017 (three survey nights)

Species Name	Common name	Positively identified	Potential	Possible	Total
Austronomus australis	White-Striped Freetail Bat	0	1	0	1
Chalinolobus dwyeri[1]	Large-eared Pied Bat	2	0	3	5
Chalinolobus gouldii	Gould's Wattled Bat	16	18	2	36
Chalinolobus morio	Chocolate Wattled Bat	18	14	6	38
Chalinolobus morio / *Vespadelus vulturnus*	Chocolate Wattled Bat / Little Forest Bat	0	0	4	4
Miniopterus australis	Little Bentwing-bat	0	0	1	1
*Miniopterus schreibersii oceanensis**	Eastern Bentwing-bat	12	6	8	26
*Miniopterus schreibersii oceanensis** / *Vespadelus darlingtoni* / *Vespadelus regulus* / *Vespadelus vulturnus*	Eastern Bentwing-bat/ Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	0	61	61
Mormopterus (*Ozimop*s) *petersi*	Inland Freetail Bat	1	0	0	1
Mormopterus (*Ozimops*) *planiceps*	South-eastern Freetail Bat	1	2	0	3
*Myotis macropus** / *Nyctophyllus* spp.	Large-footed Myotis / Large-eared Bats	0	0	1	1
Rhinolophus megaphyllus	Eastern Horseshoe Bat	2	0	0	2
Vespadelus darlingtoni / *Vespadelus regulus* / *Vespadelus vulturnus*	Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	0	18	18
Low					115
Short					70
Useable calls					**197**
Total Calls					**382**
Percentage usable calls					**51.57**

* Threatened species listed under TSC Act / [1] Threatened species listed under the EPBC Act

Table E-7: Microchiropteran bat call results Cliff 23 and 24 (SM3 - 5) recorded at between 23 of February 2017 (one survey nights)

Species Name	Common name	Positively identified	Potential	Possible	Total
Austronomus australis	White-Striped Freetail Bat	1	0	0	1
Chalinolobus dwyeri[1]	Large-eared Pied Bat	1	0	1	2
Chalinolobus gouldii	Gould's Wattled Bat	6	12	0	18
Chalinolobus morio	Chocolate Wattled Bat	54	32	2	88
*Falsistrellus tasmaniensis** / *Scoteanax rueppellii** / *Scotrepens balstoni* / *Scotorepens orion*	Eastern False Pipistrelle / Greater Broad-nosed Bat / Inland Broad-nosed Bat / Eastern broad-nosed Bat	0	0	1	1
*Miniopterus schreibersii oceanensis**	Eastern Bentwing-bat	4	0	0	4
*Miniopterus schreibersii oceanensis** / *Vespadelus darlingtoni* / *Vespadelus regulus* / *Vespadelus vulturnus*	Eastern Bentwing-bat/ Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	0	9	9
Mormopterus (*Ozimops*) *planiceps*	South-eastern Freetail Bat	3	2	0	5
*Myotis macropus** / *Nyctophyllus* spp.	Large-footed Myotis / Large-eared Bats	0	0	3	3
Rhinolophus megaphyllus	Eastern Horseshoe Bat	2	0	0	2
Scotorepens balstoni	Inland Broad-nosed Bat	0	2	0	2
Vespadelus darlingtoni / *Vespadelus regulus* / *Vespadelus vulturnus*	Large Forest Bat / Southern Forest Bat / Little Forest Bat	0	0	1	1
Low					68
Short					20
Useable calls					**136**
Total Calls					**224**
Percentage usable calls					**60.71**

* Threatened species listed under TSC Act / [1] Threatened species listed under the EPBC Act

Call profiles

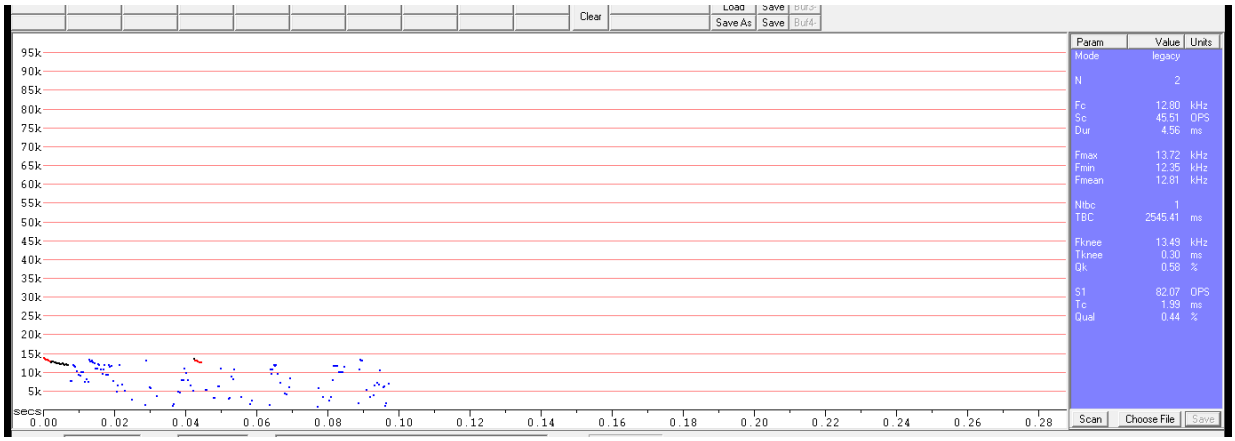

Figure E-1: Call profile for *Austronomus australis* recorded on Anabat 1 at 0306 (3.06 am), 22 February 2017

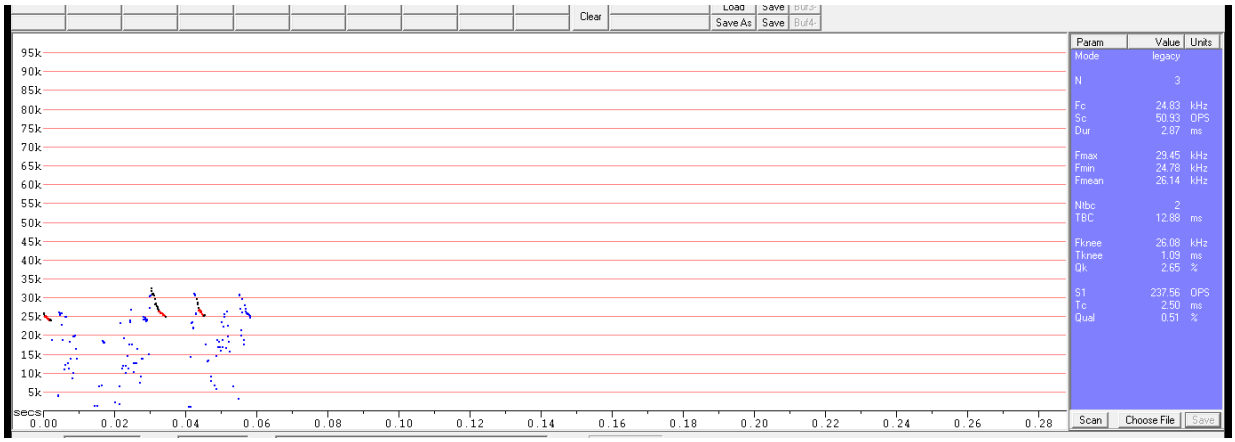

Figure E-2: Possible call profile for *Chalinolobus dwyeri* (Large-eared Pied Bat) recorded on Anabat 1 at 2159 (9.59 am) 21 February 2017

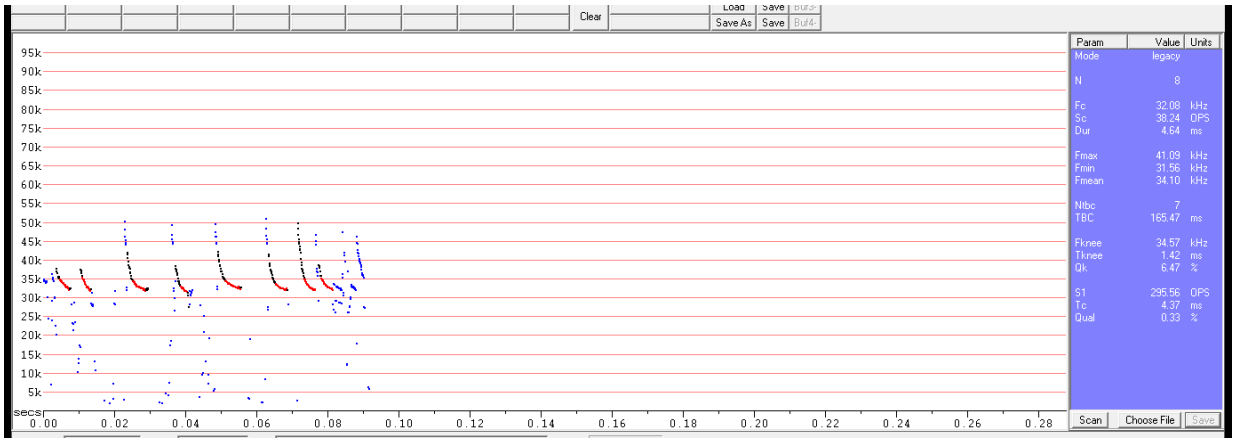

Figure E-3: Call profile for *Chalinolobus gouldi* (Gould's Pied Bat) recorded on Anabat 1 at 2159 (9.59 am) 21 February 2017

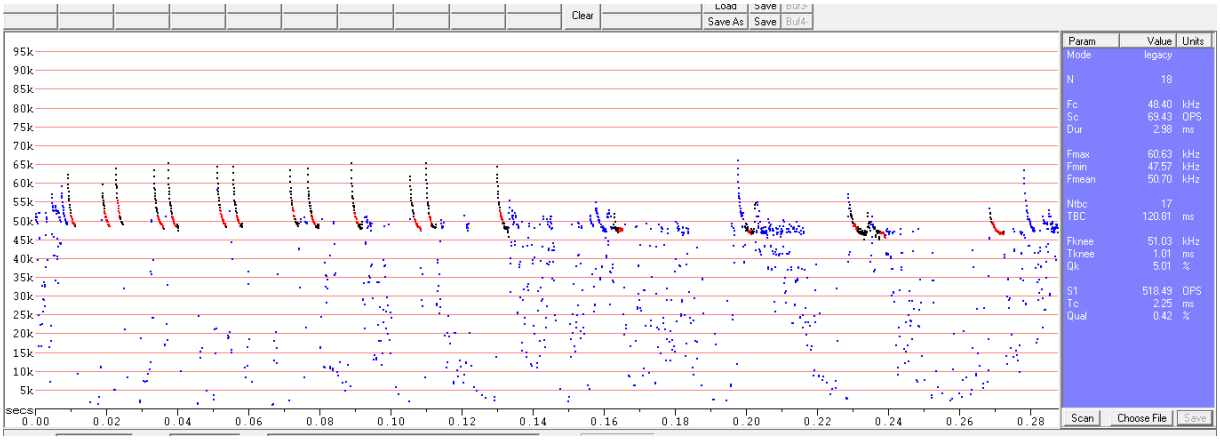

Figure E-4: Call profile for *Chalinolobus morio* (Chocolate Wattled Bat) recorded on Anabat 1 at 2015 (8.15 pm), 20 February 2017

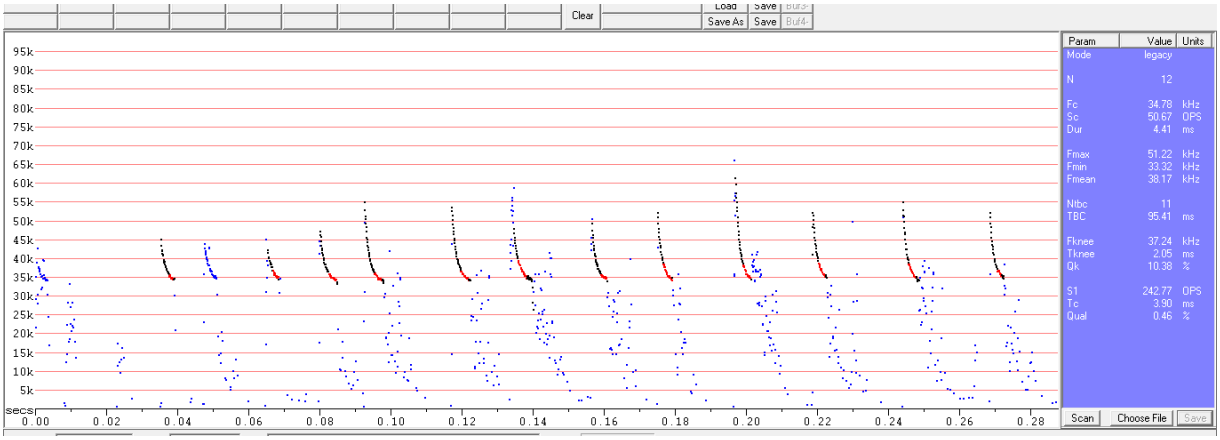

Figure E-5: Definite call profile for *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Scoteanax rueppellii (Greater Broad-nosed Bat), *Scotorepens balstoni* (Inland Broad-nosed Bat) and *Scotorepens orion* (Eastern broad-nosed Bat) recorded on SM3-3 at 0233 (2.33 am), 21 February 2017**

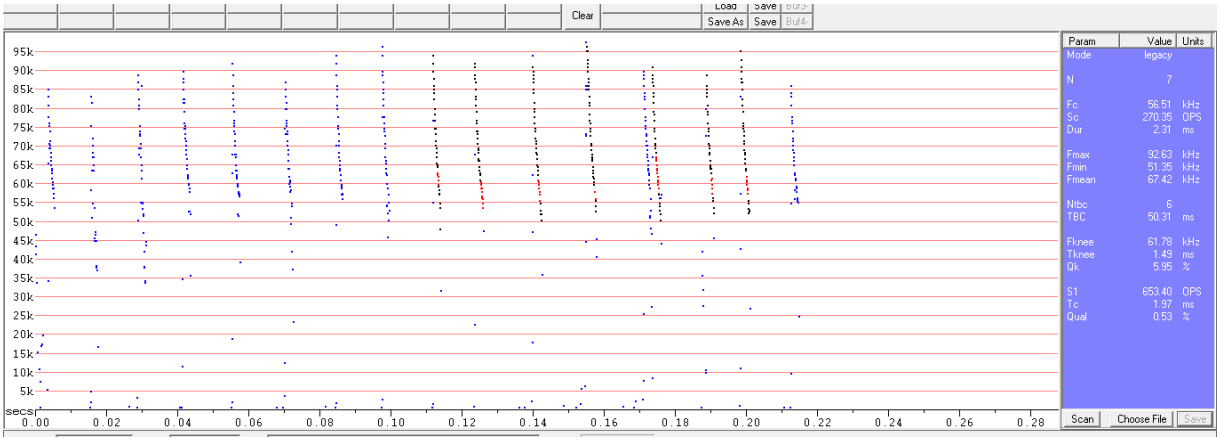

Figure E-6: Possible call profile for *Miniopterus australis* (Little Bentwing-bat) recorded on SM3-3 at 0233 (2.33 am), 21 February 2017

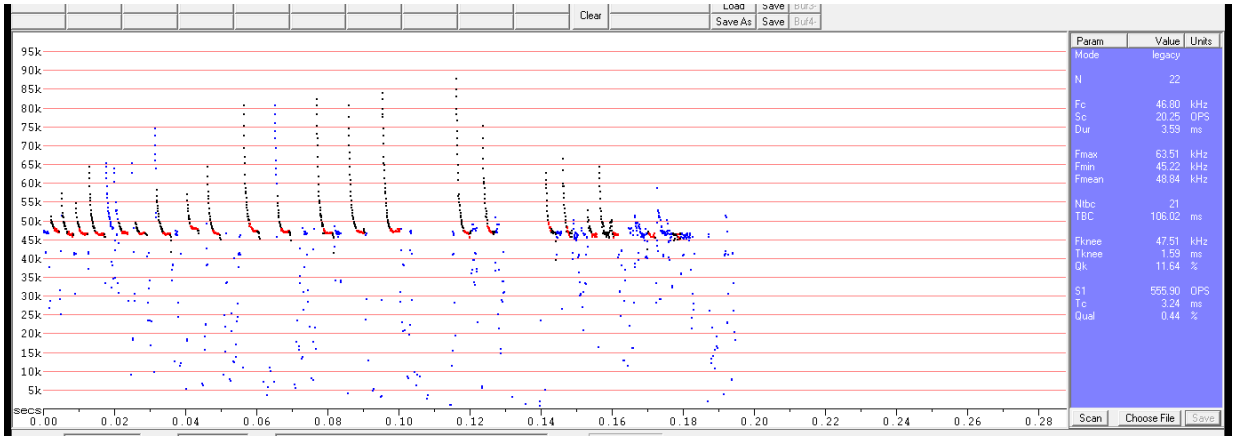

Figure E-7: Definite call profile for *Miniopterus scherisberi oceanensis* (Eastern Bentwing-bat) recorded on Anabat 1 at 2022 (8.22 pm), 22 February 2017

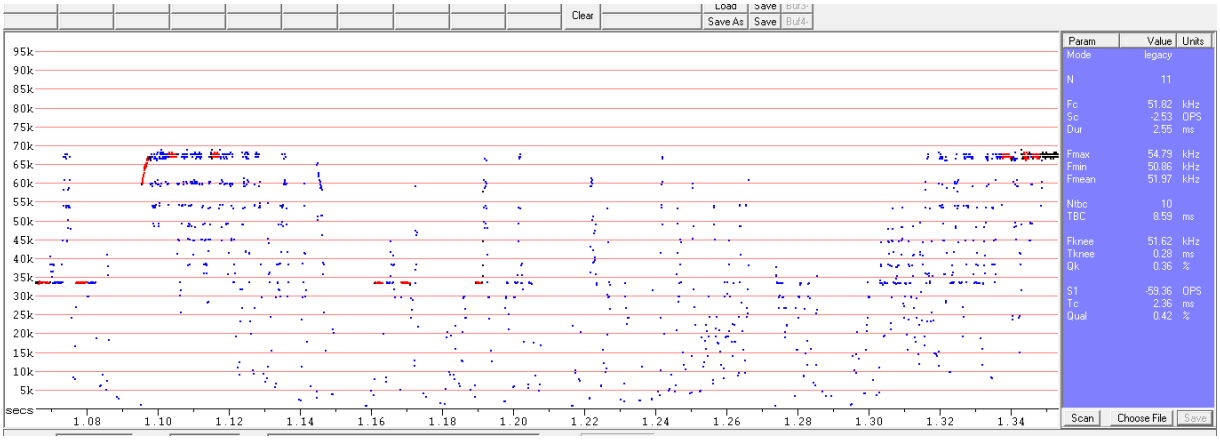

Figure E-8: Call profile for *Mormopterus* (Ozimops) petersi (Inland Freetail Bat) with *Rhinolophus megaphyllus* (Eastern Horseshoe Bat) recorded on Anabat 1 at 0311 (3.11 am) 21 February 2017

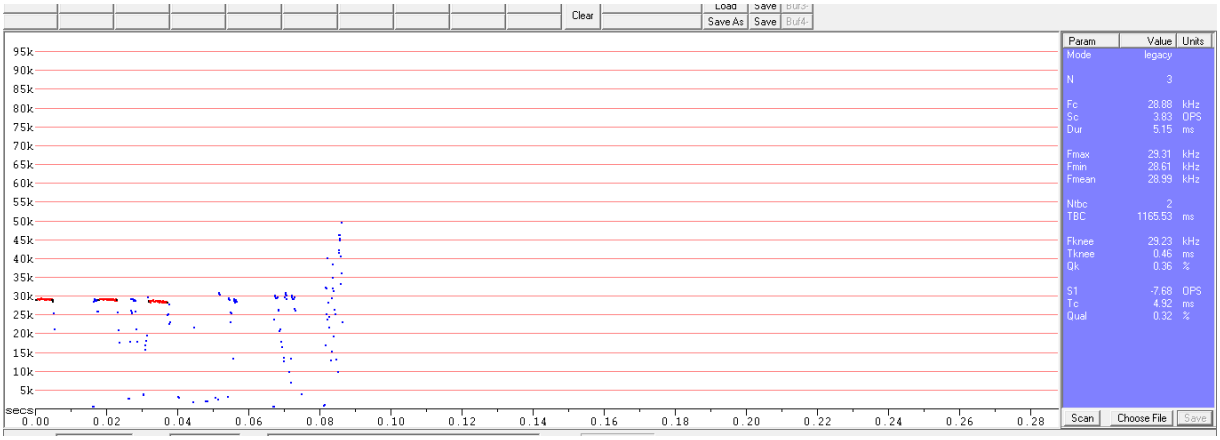

Figure E-9: Call profile for *Mormopterus* (Ozimops) *planicepsi* (Eastern Freetail Bat) recorded on Anabat 1 at 2246 (10.46 am) 20 February 2017

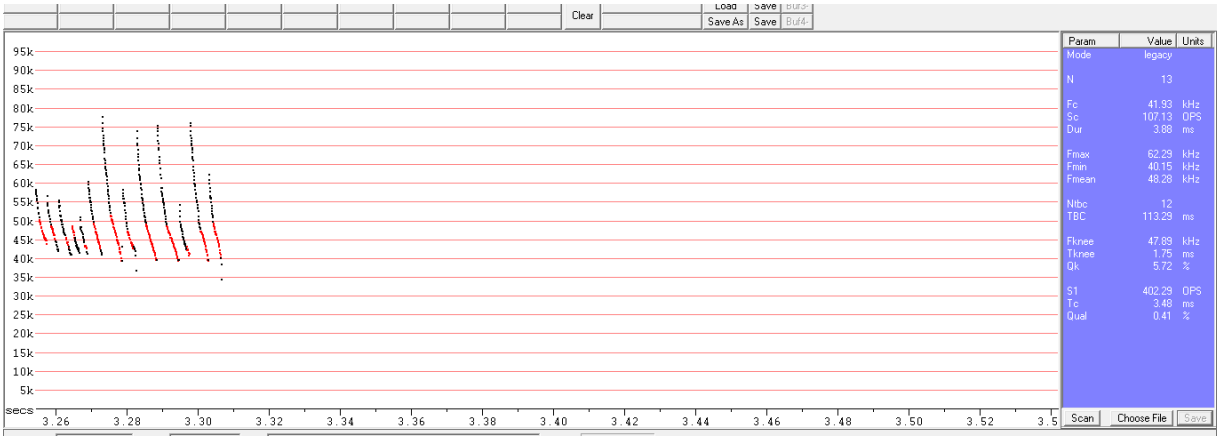

Figure E-10: Possible call profile for *Myotis macropus* (Large-footed Myotis) and *Nyctophyllus* spp. recorded on SM3-3 at 2120 (9.20 pm) 21 February 2017

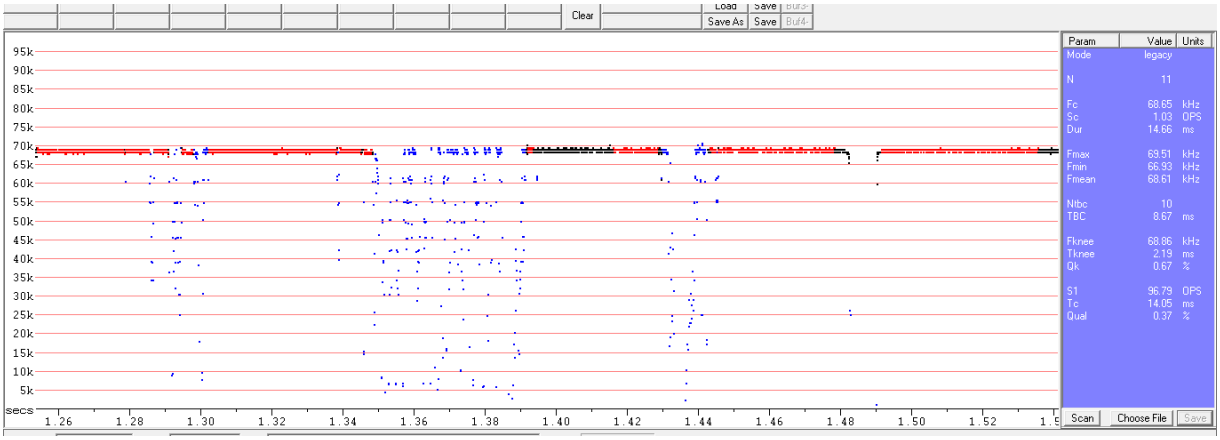

Figure E-11: Call profile for *Rhinolophus megaphyllus* (Eastern Horseshoe Bat) recorded on Anabat 1 at 1007 (1.07 am) 21 February 2017

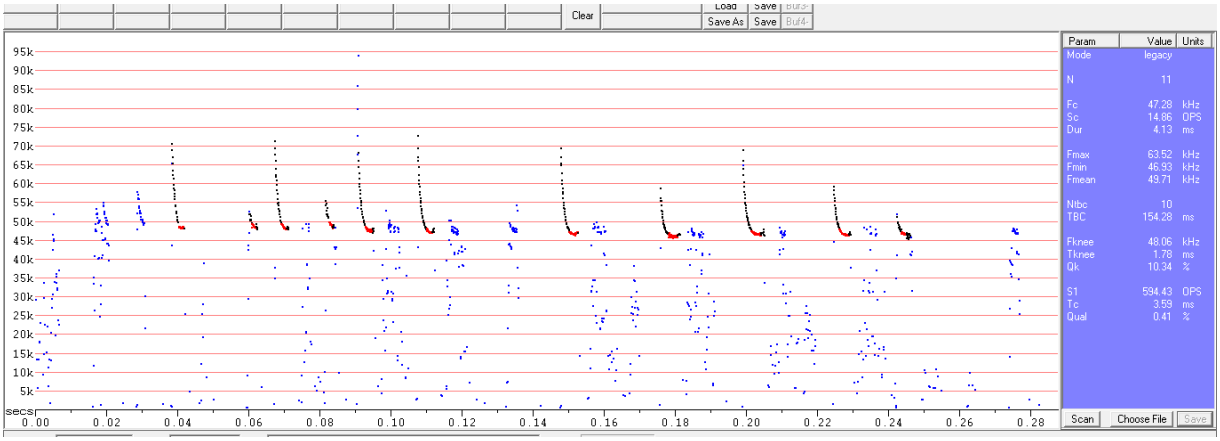

Figure E-12: Possible call profile for *Vespadelus darlingtoni* (Large Forest Bat), *Vespadelus regulus* (Southern Forest Bat) and *Vespadelus vulturnus* (Little Forest Bat) recorded on Anabat 1 at 1007 (1.07 am) 21 February 2017

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Appendix F – EP&A Act Assessment of Significance

Under Section 5A of the EP&A Act, an assessment of the possibility of 'significant effect on threatened species, populations or ecological communities, or their habitats' is required for modification activities prescribed under section 75W of the EP&A Act, for threatened species listed under the NSW TSC Act (now repealed under the BC Act).

Species already accounted for as “ecosystem credit species” in the BBCC are excluded from this assessment.

The threatened species that have potential to occur are the subject of the '*Assessment of Significant Effect'* for the Modification, namely:

Birds

- *Anthochaera phrygia* (Regent Honeyeater)

Mammals

- *Dasyurus maculata* (Spotted-tailed Quoll)
- *Petrogale penicillate* (Brush-tailed Rock-wallaby)
- *Phascolarctos cinereus* (Koala)

Bats

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Nyctophilus corbeni* (Corben’s Long-eared Bat)

Flora

- *Acacia ausfeldii* (Ausfeld's Wattle)
- *Dichanthium setosum* (Bluegrass)
- *Diuris tricolor* (Pine Donkey Orchid)
- *Homoranthus darwinioides*
- *Pomaderris queenslandica* (Scant Pomaderris)
- *Pomaderris reperta* (Denman Pomaderris)

Vegetation Communities[1]

- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland EEC

[1] Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion (VEC) is not considered TEC under NSW EP&A Act (s.5D)

Birds

Anthochaera Phrygia (Regent Honeyeater)

This species is a nomadic, migratory nectivorous bird that occurs in open woodlands and forests, particularly *Eucalyptus sideroxylon* (Mugga Ironbark), *E. melliodora*, E. blakelyi and *E. Albens* associations on fertile flats and alluvial areas (DotEE 2017; OEH 2017b). Foraging can occur anywhere there is sufficient flowering of potential feed trees and elsewhere (DotEE 2017; OEH 2017b). Breeding is only known from select areas within its distribution. The closest location to the project site is the Capertee Valley (~60km SE). The bulk of the population forages and breeds in box-gum and ironbark woodlands west of the great divide (DotEE 2017; OEH 2017b) and makes sporadic migratory movements to the east to forage on coastal flowering eucalypt species during times of low eucalypt flowering inland (DoE 2014b; OEH 2017b).

Potential habitat for the Regent Honeyeater to forage or pass through exists within the Modification Disturbance Footprint.

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	The Modification Disturbance Footprint contains feed trees that provide potential habitat for the Regent Honeyeater. It is therefore likely that the Modification Disturbance Footprint may provide potential foraging habitat for the Regent Honeyeater. Evidence of foraging or breeding has not been recorded in the Modification Disturbance Footprint, but foraging habitat has been recorded near Moolarben Creek and at Munghorn Gap Nature Reserve, south of the Modification Disturbance Footprint. Similar, more suitable foraging habitat for these highly mobile species are available across the locality and the region. These surrounding areas are expected to contain a higher density of suitable foraging habitat for this species. Therefore, habitat loss from the Modification is unlikely to affect the life cycles of viable local populations of this species such that they would be placed at risk of extinction.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	Potential foraging habitat for this species containing feed trees would be removed by the Modification. It is noted, however, that larger areas of potential habitat would continue to exist to the east and west of the Modification Disturbance Footprint, particularly Goulburn River NP and Munghorn Gap Nature Reserve.
Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known extent of this species' distribution.
How is the proposal likely to affect current disturbance regimes?	The Modification would disturb a maximum additional area of approximately 20.5 ha of woodland (outside what is already approved), adding to the current disturbance regimes. Large undisturbed areas of potential habitat would continue to exist to the east and west of the Modification Disturbance Footprint, particularly Goulburn River

	NP and Munghorn Gap Nature Reserve. These surrounding areas are expected to contain a higher density of suitable foraging habitat for this highly mobile species. Consequently, the Modification would not place a viable local population of the species at risk of extinction. Potential increases in noise from the Modification are considered negligible given the existing noise impacts associated with the three existing/approved mining operations in the locality.
How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

Mammals

***Dasyurus maculatus* (Spotted-tailed Quoll)**

The Spotted-tailed Quoll is a medium-sized marsupial carnivore with reddish-brown fur and white spots. It occupies a range of environments within a disjunct distribution along the east coast of Australia, extending from south-eastern Queensland through NSW and Victoria to Tasmania (OEH 2017b).

This species is found in a variety of habitats, including sclerophyll forest and woodlands, coastal heathlands and rainforests. Occasional sightings are made in open country, grazing lands, rocky outcrops and other treeless areas. This species feeds on a wide variety of birds, reptiles, mammals and invertebrates and uses several 'latrines' within its territory for defecation. It is mostly terrestrial, but is also an agile climber (OEH 2017b).

Nesting occurs in rock shelters, hollow logs, caves or tree hollows and they use numerous dens within the home range. Estimates of home ranges vary from 800 ha to 20 km^2 and individuals may move several kilometers in a night (OEH 2017b).

The Spotted-tailed Quoll is threatened by a number of processes including fragmentation and degradation of habitat through clearing of native vegetation, logging and frequent fire. The loss of large hollow logs and other potential den sites is a major problem, as well as competition for food and predation by foxes and cats (OEH 2017b).

The Spotted-tailed Quoll was not detected during field surveys, but a record exists 5km south of the MCC (OEH 2017a).

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	Potential foraging and nesting habitat in the form of woodland, including hollow logs and trees would be removed for the Modification. The Spotted-tailed Quoll's large home range size and high dispersal capability across suitable habitat which would remain in the locality would limit any potential impacts from the Modification. Pre-clearing surveys and clearing supervision (with spotter/catcher present) would reduce potential impacts further, as such the lifecycles of this species is unlikely to be affected.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	The Modification would remove up to an additional 19.5 ha of potential foraging habitat (native woodland) for the Spotted-tailed Quoll from the Modification Disturbance Footprint. Areas of suitable or better-quality habitat would remain in the surrounding areas.
Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known extent of this species distribution.
How is the proposal likely to affect current disturbance regimes?	The Modification would clear a maximum additional area of approximately 19.5 ha of woodland and would add to the current disturbance regimes. However, impacts would be managed including measures to retain salvaged habitat features and revegetate previously cleared areas to compensate for the loss of habitat features. Large undisturbed areas of potential habitat would remain present in areas surrounding the Modification Disturbance Footprint. Potential increases in noise from the Modification are considered negligible given the existing noise impacts associated with the three existing/approved mining operations in the locality.
How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

***Petrogale penicillata* (Brush-tailed Rock-Wallaby)**

Habitat for this species include rocky outcrops, boulder piles, cliffs, gorges and steep rocky slopes in sclerophyll forest and woodland. This species was not recorded during the field surveys and no records exist within the Modification Disturbance Footprint (the nearest record is 15 km to the north of the MCC).

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	Potential habitat for Brush-tailed Rock-Wallaby would be removed for the Modification. However, the removal of this potential habitat is unlikely to impact this species due to its large home range size and high dispersal capability across suitable habitat which would remain in the locality. Increased noise may deter Brush-tailed Rock-Wallaby from foraging in areas immediately adjacent to the Modification Disturbance Footprint which would be retained. However, potential increases in noise from the Modification are considered negligible given the existing noise impacts associated with the three existing/approved mining operations in the locality. Potential impacts to this species would be minimised though the implementation of the MCO VCP. Therefore, the removal of this potential Brush-tailed Rock-Wallaby habitat is not expected to impact the lifecycle of this species such that it would decline.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	The Modification would remove an additional approximately 26.5 ha of potential habitat for the Brush-tailed Rock-Wallaby from the Modification Disturbance Footprint.
Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known extent of this species distribution.
How is the proposal likely to affect current disturbance regimes?	The Modification would clear a maximum area of approximately 26.5 ha of potential Brush-tailed Rock-Wallaby habitat, adding to the current disturbance regimes. However, impacts would be managed through the MCO BMP. Large undisturbed areas of potential habitat would remain present in areas surrounding the Modification Disturbance Footprint. These surrounding areas are expected to contain a higher density of suitable habitat. Potential increases in noise from the Modification are considered negligible given the existing noise impacts associated with the three existing/approved mining operations in the locality.

How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

Phascolarctos cinereus (Koala)

The Koala occurs in eucalypt woodlands and forests. It was not recorded during the field survey however isolated records of individuals have previously been recorded (Ecovision 2008). Two feed tree species listed under Schedule 2 of the SEPP 44 were present within the survey area, Grey Gum and White Box. White Box were present in sufficient numbers to warrant mapping portions of the survey area as potential Koala habitat.

Koalas spend most of their time in trees (resting and foraging), but will descend and traverse open ground to move between trees. Home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in size. The species is generally solitary, but have complex social hierarchies based on a dominant male with a territory overlapping several females and sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year (OEH 2014).

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	Potential Koala foraging habitat in the form of White Box and Grey Gum trees would be removed for the Modification. However, the removal of this potential habitat is unlikely to impact the Koala due to its large home range size and high dispersal capability across suitable habitat which would remain in the locality. Increased noise may deter Koala from foraging in areas immediately adjacent to the Modification Disturbance Footprint which would be retained. However, potential increases in noise from the Modification are considered negligible given the existing noise impacts associated with the three existing/approved mining operations in the locality. Potential impacts to this species would be minimised though the implementation of the MCO VCP. Therefore, the removal of this potential Koala foraging habitat is not expected to impact the lifecycle of this species such that it would decline.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	The Modification would remove an additional approximately 3.5 ha of potential habitat for the Koala from the Modification Disturbance Footprint.

Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known extent of this species distribution.
How is the proposal likely to affect current disturbance regimes?	The Modification would clear a maximum additional area of approximately 3.5 ha of potential Koala habitat, adding to the current disturbance regimes. However, impacts would be managed through the MCO BMP. Large undisturbed areas of potential habitat would remain present in areas surrounding the Modification Disturbance Footprint. These surrounding areas are expected to contain a higher density of suitable habitat. Potential increases in noise from the Modification are considered negligible given the existing noise impacts associated with the three existing/approved mining operations in the locality.
How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

Bats

***Chalinolobus dwyeri* (Large-eared Pied Bat)**

The Large-eared Pied Bat is listed as Vulnerable under the BC Act. This species is found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. There are scattered records from the New England Tablelands and North-West Slopes (OEH 2017b). The Large-eared Pied Bat was positively identified in the field survey as being present in the Modification Disturbance Footprint.

The Large-eared Pied Bat roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the *Hirundo ariel* (Fairy Martin). Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves. They remain loyal to the same cave over many years (OEH 2017b).

The Large-eared Pied Bat forages in well-timbered areas containing gullies. It frequents low to mid-elevation dry open forest and woodland close to caves, crevices in cliffs, old mine workings and disused mud nests of Fairy Martin. This species probably forages for small, flying insects below the forest canopy (OEH 2017b).

The threats to this species include clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture or development; loss of foraging habitat close to cliffs, caves and old mine workings from forestry activities; too-frequent burning, usually associated with grazing; damage to roosting and maternity sites from mining operations, and recreational caving activities; and use of pesticides (OEH 2017b).

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	Potential roosting and breeding habitat for Large-eared Pied Bat would be potentially impacted by the Modification through removal of approximately 0.93 km of cliff lines containing caves, overhangs and rocky outcrops. Potential habitat may also be disturbed in surrounding areas from rock cracks and fissures resulting from blasting during mining operations. There is a limited chance of direct mortality of roosting individuals from cave collapse during construction. A further 2.3 km of cliffline features habitat was identified in the survey area that would not be removed by the Modification. As such, it is unlikely that the Modification would result in a significant impact to the Large-eared Pied Bat.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	The Modification would remove a maximum additional area of approximately 27 ha of potential breeding, roosting and foraging habitat (cliff lines and rocky outcrops, derived grassland and woodland) for the Large-eared Pied Bat. Foraging habitat is widely distributed in the Modification Disturbance Footprint, with sheltering habitat and potential breeding habitat occurring in more restricted areas, only on ridgelines in open forest with caves considered a limiting factor in the locality.
Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known extent of this species' distribution.
How is the proposal likely to affect current disturbance regimes?	The Modification would remove an additional approximately 27 ha of potential habitat and would add to the current disturbance regimes. Potential increases in noise from the Modification are considered negligible given the existing noise impacts associated with the three existing/approved mining operations in the locality. Vibration from blasting would add to current disturbance in the surrounding area. However, potential increases in vibrations from the Modification are considered negligible given the existing blasting impacts associated with the existing/approved mining operations in the locality.

How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

Nyctophilus corbeni (Corben's Long-eared Bat)

The Corben's Long-eared Bat is a large microbat which occurs in a range of inland woodland vegetation types, including box, ironbark and cypress pine woodlands. It is most abundant in vegetation with a distinct canopy with a dense cluttered shrub layer. It roosts in tree hollows (OEH 2017b).

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	The Modification Disturbance Footprint contains potential foraging and breeding habitat for this microbat species. Hollow-bearing trees are present within the Modification Disturbance Footprint. The removal of this resource could potentially impact these species given the likely competition for such resources in the landscape. Potential breeding habitat would be removed for all species which may cause movement out of the Modification Disturbance Footprint into nearby conservation reserves and other connected patches of forest and woodland. Potential impacts to these species would be minimised though implementation of measures outlined in the BMP. Therefore, the removal of this potential breeding habitat is not expected to impact the lifecycle of this species such that they would decline.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	The Modification would remove an additional area of up to 19.5 ha of potential foraging and breeding habitat for the Corben's Long-eared Bat from the Modification Disturbance Footprint. Given the abundance of habitat in the wider surrounds, it is unlikely that the Modification would result in a significant impact to this species.
Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known extent of this species distribution.
How is the proposal likely to affect current disturbance regimes?	The Modification would clear an additional area of up to 19.5 ha and would add to the current disturbance regimes. However, impacts would be managed through the continued implementation of the BMP. Potential increases in noise and light from the Modification are considered negligible given the existing noise impacts associated with the three existing/approved mining operations in the locality.

How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

Flora

Acacia ausfeldii (Ausfeld's Wattle)

Acacia ausfeldii occurs in NSW and Victoria. In NSW, it is found restricted to the Mudgee-Wollar region, often in large aggregations. It is found in dry sclerophyll woodlands on sandy soils and is not often found in rocky areas but rather on flats or foot slopes (OEH 2017b). In the Ulan area, it is often found in *Angophora floribunda* grassy or shrubby woodland, or *E. crebra* / *Allocasuarina luehmannii* shrubby woodland on flats. It also occurs along roadsides where it is often promoted by shallow surface disturbance (OEH 2017b).

Dichanthium setosum (Bluegrass)

Bluegrass is an upright grass less than 1 m tall. It has mostly hairless leaves about 2-3 mm wide. The flowers are densely hairy and are clustered together along a stalk in a cylinder-shape. The flower-clusters grow in pairs at the end of an 8 cm-long stem and appear mostly during summer (OEH 2017b). Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants and highly disturbed pasture (OEH 2017b).

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	These species were not identified during the field surveys and there are no records within the Modification Disturbance Footprint. It is unlikely that viable local populations for either species exist within the Modification Disturbance Footprint and as such, the Modification is unlikely to result in impacts to the lifecycle of a population of this species.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	Areas of potential habitat for these species would be removed for the Modification, however, large areas of suitable habitat would remain in the surrounding areas, including areas supporting known populations of these species.
Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known limit of the distribution of *Acacia ausfeldii* or *Dicanthium setosum*.
How is the proposal likely to affect current disturbance regimes?	Dust produced from mining activity in the region would be further exacerbated by the Modification. Potential increases in dust from the Modification are considered negligible given the existing dust impacts associated with the existing/approved mining operations in the locality. Nonetheless, the extent of this impact is expected to be small and restricted to the vegetation immediately adjacent the Modification Disturbance Footprint. This species (if it were to be present) would be likely to continue to survive in these areas, as well as the unmodified habitat present in surrounding areas.

How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

***Diuris tricolor* (Pine Donkey Orchid)**

D. tricolor is a tuberous, deciduous terrestrial orchid. It is sporadically distributed on the western slopes of NSW, extending from south of Narrandera all the way to the Queensland border. Localities in the south include Red Hill north of Narrandera, Coolamon, and several sites west of Wagga Wagga, Condobolin-Nymagee road, Wattamondara towards Cowra, Eugowra, Girilambone, Dubbo and Cooyal, in the Central West (OEH 2017b).

Effects from varying disturbance regimes (e.g. grazing, fire) are not known, although the species is usually recorded from disturbed habitats (OEH 2017b).

D. tricolor grows in sclerophyll forest among grass, often with *Callitris spp*. It is found in sandy soils, either on flats or small rises. It has also been recorded from a red earth soil in a *Eucalyptus populnea* community in western NSW. The understorey the species grows in is often grassy with herbaceous plants such as *Bulbine species. D. tricolor* usually flowers between September and November (National Herbarium of NSW 2017). Numerous flowering examples were observed in the region by ELA at the time of the survey, indicating that *D. tricolor* is locally common and was detectable at the time of the field surveys, however it was not recorded in the field survey.

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	This species has not been recorded in the Modification Disturbance Footprint despite targeted survey during confirmed optimal survey times. Clearing and removal of the potential habitat of this species may cause direct mortality to individuals in the unlikely event they are present and were not identified in the field survey. If any individuals were to be removed, this may impact processes critical to the species lifecycle, such as pollination and maintenance of genetic variability. Alteration to the understorey as a result of clearing would also impact conditions to support recruitment and growth. However, due to the absence of this species in the survey, a viable local population is not likely to be placed at risk.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	This species was not identified in the Modification Disturbance Footprint despite targeted survey at optimal survey times (confirmed by presence of flowering individuals at known locations in the area). Potential habitat for this species would be removed by the Modification, however, impacts would be restricted to the Modification Disturbance Footprint only and areas of potential and known habitat for this species would remain in the surrounding area.

Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known limit of the distribution of *D. tricolor*.
How is the proposal likely to affect current disturbance regimes?	Dust produced from mining activity in the region would be further exacerbated by the Modification. Potential increases in dust from the Modification are considered negligible given the existing dust impacts associated with the existing/approved mining operations in the locality. Nonetheless, the extent of this impact is expected to be small and restricted to the vegetation immediately adjacent the Modification Disturbance Footprint. The *D. tricolor* (if it were to be present) would be likely to continue to survive in these areas, as well as the unmodified habitat present in surrounding areas.
How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

***Pomaderris queenslandica* (Scant Pomaderris)**

Pomaderris queenslandica (Scant Pomaderris) occurs in Queensland and NSW. In NSW, it is found in dry sclerophyll woodlands (OEH 2017b). In the local area, it has been reported in a protected valley (OEH 2017b). This species is assessed in combination with *Pomaderris reperta* given the similarities in habitat requirements.

***Pomaderris reperta* (Denman Pomaderris)**

This species has historically been recorded in a range of environments, although up until recently was thought to be restricted to the upper Hunter Valley (OEH 2017b). More recently it has had a significant range extension from the sandstone geology of the Hunter Valley to the metasediments of the Central Tablelands of NSW. Occurs in a wide range of sclerophyll vegetation communities (OEH 2017a).

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	These species were not identified in the Modification Disturbance Footprint during the survey and have not been recorded previously, although *P. queenslandica* has been recorded in the surrounds of the Modification Disturbance Area. If any individuals were to be removed by the Modification, this may impact processes critical to the species lifecycle, such as pollination and maintenance of genetic variability. Alteration to the understorey as a result of clearing would also impact conditions to support recruitment and growth. However, due to the absence of these species in the survey, a viable local population is not likely to be placed at risk.

How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	Potential habitat for these species would be removed by the Modification, however, impacts would be restricted to the Modification Disturbance Footprint only and areas of potential and known habitat for these species would remain in the surrounding area.
Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known limit of the distribution of *P. queenslandica* or *P. reperta*.
How is the proposal likely to affect current disturbance regimes?	Dust produced from mining activity in the region would be further exacerbated by the Modification. Potential increases in dust from the Modification are considered negligible given the existing dust impacts associated with the existing/approved mining operations in the locality. Nonetheless, the extent of this impact is expected to be small and restricted to the vegetation immediately adjacent the Modification Disturbance Footprint. These species (if they were to be present) would be likely to continue to survive in these areas, as well as the unmodified habitat present in surrounding areas.
How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

Homoranthus darwinioides

This species grows in in various woodland habitats with shrubby understoreys, usually in gravely sandy soils. Landforms the species has been recorded growing on include flat sunny ridge tops with scrubby woodland, sloping ridges, gentle south-facing slopes, and a slight depression on a roadside with loamy sand. It forms small shrubs or shrublets, often in tangled masses. It has a localised distribution and may be the dominant undershrub at some sites. Its abundance in populations ranges from rare (only one plant at site) to locally very abundant. (OEH 2017b).

Homoranthus darwinioides is rare in the central tablelands and western slopes of NSW, occurring from Putty to the Dubbo district. It is found west of Muswellbrook between Merriwa and Bylong, and north of Muswellbrook to Goonoo SCA. The species has been collected from Lee's Pinch (OEH 2017b).

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	This species has not been recorded in the Modification Disturbance Footprint and there are no recent records in the region. Clearing and removal of the potential habitat of this species may cause direct mortality to individuals in the unlikely event they are present and were not identified in the field survey. If any individuals were to be removed, this may impact processes critical to the species lifecycle, such as pollination and maintenance of genetic variability. Alteration to the understorey as a result of clearing would also impact conditions to support recruitment and growth. However, due to the absence of this species in the survey, a viable local population is not likely to be placed at risk.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	This species was not identified in the Modification Disturbance Footprint. Potential habitat for this species would be removed by the Modification, however, impacts would be restricted to the Modification Disturbance Footprint only and areas of potential and known habitat for this species would remain in the surrounding area.
Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known limit of the distribution of *Homoranthus darwinioides.*
How is the proposal likely to affect current disturbance regimes?	Dust produced from mining activity in the region would be further exacerbated by the Modification. Potential increases in dust from the Modification are considered negligible given the existing dust impacts associated with the existing/approved mining operations in the locality. Nonetheless, the extent of this impact is expected to be small and restricted to the vegetation immediately adjacent the Modification Disturbance Footprint.
How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

Threatened Ecological Communities

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland EEC

White Box – Yellow Box – Blakely's Red Gum Woodland EEC is an open woodland community (sometimes occurring as a forest formation) in which the diagnostic canopy tree species consist of one or more of the following: *White Box*, *E. melliodora* or *E. blakelyi*. Intact sites contain a high diversity of plant species, including the main tree species, occasional additional tree species, a small selection of shrub species, climbing plant species, many grasses and a very high diversity of herbs (OEH 2017b).

The community often exists in a modified condition and may occur as an intact tree layer and predominately native ground layer, or as a characteristic ground layer with a high diversity of native herb and grass species and scattered trees or no remaining tree layer at all (OEH 2017b).

Factor	Assessment
How is the proposal likely to affect the lifecycle of a threatened species and/or population?	The Modification would remove an additional area of this EEC of approximately 4 ha (comprising 2 ha of woodland and 2 ha of derived native grasslands). Some areas would remain within the surrounds of the Modification Disturbance Footprint. The composition and structure of this EEC in the Modification Disturbance Footprint has been modified in some parts, while others remain largely undisturbed and intact. Good quality remnants of this EEC would remain in areas surrounding the Modification which would ensure continuation of the lifecycle of this community in the region.
How is the proposal likely to affect the habitat of a threatened species, population or ecological community?	The Modification would remove an additional area of this EEC of approximately 4 ha (comprising 2 ha of woodland and 2 ha of derived native grasslands). Good quality remnants of this EEC would remain in areas surrounding the Modification. Post mining rehabilitation would be undertaken in accordance with the RMP.
Does the proposal affect any threatened species that are at the limit of its known distribution?	No, the Modification Disturbance Footprint is not at the known extent of this ECC.
How is the proposal likely to affect current disturbance regimes?	The Modification would remove an additional area of approximately 4 ha. The Modification would contribute to the disturbance regimes in the locality, however, management and mitigation through rehabilitation and potential offsetting would ensure continuation of this EEC in surrounding areas.
How is the proposal likely to affect habitat connectivity?	The Modification Disturbance Footprint comprises areas that have previously been modified (from historical agricultural activity) or occur in very close proximity to existing mining activity. The Modification would unlikely affect the overall connectivity of vegetation within the locality. A large connected patch of remnant vegetation occurs adjacent to the Modification Disturbance Footprint. The adjacent patch connects wooded and forested areas to the east, and a large regional corridor with Goulburn River NP and Munghorn Gap Nature Reserve. This connectivity would be unaffected by the Modification.

Appendix G – EPBC Act Significant Impact Guidelines

The EPBC Act Administrative Guidelines on Significance set out **'Significant Impact Criteria'** that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance relevant to this BAR include:

- Listed threatened species and ecological communities
- Listed migratory species

'Significant Impact Criteria' are provided under the Act with specific criteria provided for threatened species, and ecological communities listed as Endangered or Critically Endangered.

The relevant Significant Impact Criteria have been applied to the following species and communities:

- *Anthochaera phrygia* (Regent Honeyeater)
- *Grantiella picta* (Painted Honeyeater)
- *Lathamus discolour* (Swift Parrot)
- *Dasyurus maculatus* (Spotted-tailed Quoll)
- *Phascolarctos cinereus* (Koala)
- *Petrogale penicillata* (Brush-tailed Rock-wallaby)
- *Nyctophilus corbeni* (Corben's Long-eared Bat)
- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Homoranthus darwinioides*
- *Dichanthium setosum* (Bluegrass)
- Central Hunter Valley Eucalypt Forest and Woodland CEEC
- White Box – Yellow Box – Blakely's Red Gum Woodland and Derived Native Grasslands CEEC

Nomadic Nectarivorous birds – Regent Honeyeater, Swift Parrot, Painted Honeyeater

An action is likely to have a significant impact on an endangered or vulnerable species if there is a real chance or possibility that it will:

Criterion 1: lead to a long-term decrease in the size of an important population of a species

The proposed works would impact vegetation containing White Box, an important feed tree for these species. It is therefore likely that the study area may represent potential foraging habitat.

Evidence of foraging by Regent Honeyeater and Swift Parrot or breeding by Regent Honeyeater has not been recorded in the study area by detailed ecological surveys over several years and ongoing monitoring of adjacent areas. Painted Honeyeater records exist however it was not recorded during the field survey. Given this, it is unlikely to lead to a long-term decrease in the size of an important population of a species.

Criterion 2: reduce the area of occupancy of an important population

These species show high site fidelity, returning to sites that have previously been used on a cyclic basis. However, as site use depends on the availability of foraging resources, the species are unlikely to be recorded at the same site every year (DotEE 2017b). The proposed works would not reduce the area of occupancy of an important population of these species.

Criterion 3: fragment an existing important population into two or more populations

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not fragment an existing important population into two or more populations.

Criterion 4: adversely affect habitat critical to the survival of a species

The Modification would remove approximately 19.5 ha of woodland (in addition to what is already approved) which would serve as potential foraging habitat for the Swift Parrot and Painted Honeyeater and approximately 20.5 ha of habitat for the Regent Honeyeater. These species are highly mobile and a large expanse of contiguous and suitable habitat is available in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat critical to the survival of a species.

Criterion 5: disrupt the breeding cycle of an important population

Due to the species being highly mobile it is unlikely that the impact to foraging habitat would disrupt the breeding cycle of an important population of Regent Honeyeater or Painted Honeyeater. The Swift Parrot does not breed on mainland Australia so this Criterion does not apply to the species.

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Modification would impact upon 19.5 ha of potential foraging habitat, including potential winter foraging habitat for the Swift Parrot and Painted Honeyeater and approximately 20.5 ha of habitat for the Regent Honeyeater and is therefore unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**.** Measures to rehabilitate habitats would continue to be implemented in accordance with MCO's BMP and Biodiversity Offset Strategy.

Criterion 7: result in invasive species that are harmful to an endangered or vulnerable species becoming established in the species' habitat

The proposed works would not result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered species' habitat.

Criterion 8: introduce disease that may cause the species to decline.

The Modification would not introduce disease that may cause the species to decline.

Criterion 9: interfere with the recovery of a vulnerable species.

Recovery actions for the Regent Honeyeater centre upon the maintenance and enhancement of habitat at key sites. MCO's BMP would minimise impacts on habitat for these species and rehabilitation efforts would replace potential habitat.

Spotted-tailed Quoll

An action is likely to have a significant impact on an endangered or vulnerable species if there is a real chance or possibility that it will:

Criterion 1: lead to a long-term decrease in the size of an important population of a species

The proposed works would disturb an additional 19.5 ha of woodland habitat for this species as a result of vegetation clearing in the disturbance areas. An extensive area of remnant habitat, suitable for foraging and potential den sites would remain unimpacted in the surrounding areas. Given this, it is unlikely to lead to a long-term decrease in the size of an important population of a species.

Criterion 2: reduce the area of occupancy of an important population

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not reduce the area of occupancy of an important population.

Criterion 3: fragment an existing important population into two or more populations

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not fragment an existing important population into two or more populations.

Criterion 4: adversely affect habitat critical to the survival of a species

The Modification would remove an additional 19.5 ha of potential woodland habitat for this species. This species has a very large home range (up to 750 ha for females and up to 3,500 ha for males) and a large expanse of contiguous and suitable habitat is available in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat critical to the survival of this species.

Criterion 5: disrupt the breeding cycle of an important population

It is possible that the woodland in the survey area may support den sites, to which impacts could potentially occur as part of the Modification, however this is highly unlikely given the disturbance area is adjacent to previously disturbed areas impacted by agricultural use. However, no important populations are known within the Modification Disturbance Footprint.

Therefore, it is unlikely that the Modification would disrupt the breeding cycle of an important population. Potential impacts would be mitigated through the continued implementation of the VCP.

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

It is possible that potential den habitat for this species would be impacted by the Modification through removal of approximately 19.5 ha of woodland, however this is highly unlikely given the disturbance area is adjacent to previously disturbed areas impacted by agricultural use. This has a large home range and a large expanse of contiguous and suitable habitat is available in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat to the extent that it would cause a decline to this species.

Criterion 7: result in invasive species that are harmful to an endangered or vulnerable species becoming established in the species' habitat

The proposed works would not result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered species' habitat.

Criterion 8: introduce disease that may cause the species to decline.

The Modification would not introduce disease that may cause the species to decline.

Criterion 9: interfere with the recovery of a vulnerable or endangered species.

As no key populations have been identified in the area surrounding the Modification Disturbance Footprint, the Modification would not interfere with any recovery objective.

Koala

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Criterion 1: lead to a long-term decrease in the size of an important population of a species

The proposed works would remove approximately 3.5 ha of additional potential Koala habitat from within the proposed works area. Individual specimens of Koala food-tree species may be removed during the development, although the numbers of trees would be insignificant compared to the volume of suitable foraging and sheltering habitat which would remain in the surrounding adjacent vegetation. Given this, the proposed works are unlikely to lead to a long-term decrease in the size of an important population of a species.

Criterion 2: reduce the area of occupancy of an important population

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not reduce the area of occupancy of an important population.

Criterion 3: fragment an existing important population into two or more populations

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not fragment an existing important population into two or more populations.

Criterion 4: adversely affect habitat critical to the survival of a species

The Modification would remove an additional approximately 3.5 ha of potential habitat for this species. A large expanse of contiguous and suitable habitat is available in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat critical to the survival of a species.

Criterion 5: disrupt the breeding cycle of an important population

The Modification Disturbance Footprint does not support an important population of Koala, nor have there been any sightings of breeding females. Therefore, it is unlikely that the Modification would disrupt the breeding cycle of an important population.

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Modification would remove an additional approximately 3.5 ha of potential habitat for this species. A large expanse of contiguous and suitable habitat is available in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat to the extent that it would cause a decline to this species.

Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat

The proposed works would not result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered species' habitat.

Criterion 8: introduce disease that may cause the species to decline.

The Modification would not introduce disease that may cause the species to decline.

Criterion 9: interfere with the recovery of a vulnerable species.

As no important populations have been identified in the area surrounding the Modification Disturbance Footprint, the Modification would not interfere with any recovery objective.

Brush-tailed Rock-wallaby

An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

Criterion 1: lead to a long-term decrease in the size of an important population of a species

Habitat for this species includes rocky outcrops, boulder piles, cliffs, gorges and steep rocky slopes in sclerophyll forest and woodland (ALA 2017). The Modification would disturb an additional approximately 26.5 ha of woodland which is likely to provide habitat for this species, although no records exist within the Modification Disturbance Footprint (the nearest record is 15 km to the north of the MCC). An extensive area of remnant habitat, suitable for these species would remain un-disturbed in the surrounding areas. Given this, it is unlikely to lead to a long-term decrease in the size of an important population of a species.

Criterion 2: reduce the area of occupancy of an important population

There are no records of this species in the Modification Disturbance Footprint and it has not been identified as supporting an important population and is not near the limit of the species range. The nearest record of this species is approximately 15 km to the north of the MCC. Therefore, the Modification would not reduce the area of occupancy of an important population.

Criterion 3: fragment an existing important population into two or more populations

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not fragment an existing important population into two or more populations.

Criterion 4: adversely affect habitat critical to the survival of a species

The Modification would remove an additional approximately 26.5 ha of potential habitat for this species. This species is highly territorial and have an average home range of about 15 ha. There are large tracts of more suitable habitat in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat critical to the survival of a species.

Criterion 5: disrupt the breeding cycle of an important population

No records of this species or important populations are known within the Modification Disturbance Footprint. Therefore, it is unlikely that the Modification would disrupt the breeding cycle of an important population.

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

This species is highly territorial and have an average home range of about 15 ha. There are large tracts of more suitable habitat in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat to the extent that it would cause a decline to these species.

Criterion 7: result in invasive species that are harmful to an endangered species becoming established in the species' habitat

The proposed works would not result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered species' habitat.

Criterion 8: introduce disease that may cause the species to decline.

The Modification would not introduce disease that may cause the species to decline.

Criterion 9: interfere with the recovery of an endangered species.

As no key populations have been identified in the area surrounding the Modification Disturbance Footprint, the Modification would not interfere with any recovery objective.

Corben's Long-eared Bat

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Criterion 1: lead to a long-term decrease in the size of an important population of a species

The proposed works would remove an additional 19.5 ha of potential habitat from within the proposed works area in the form of open woodland. Suitable foraging and sheltering habitat would remain in the surrounding adjacent vegetation. Given this, the proposed works are unlikely to lead to a long-term decrease in the size of an important population of a species.

Criterion 2: reduce the area of occupancy of an important population

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not reduce the area of occupancy of an important population.

Criterion 3: fragment an existing important population into two or more populations

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not fragment an existing important population into two or more populations.

Criterion 4: adversely affect habitat critical to the survival of a species

The Modification would remove an additional 19.5 ha of potential woodland habitat for this species. This species is highly mobile and a large expanse of contiguous and suitable habitat is available in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat critical to the survival of a species.

Criterion 5: disrupt the breeding cycle of an important population

No important populations are known in the survey area. Due to the species being highly mobile it is unlikely to that disturbance to foraging habitat would disrupt the breeding cycle of an important population of South-eastern Long-eared Bat.

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The Modification would remove an additional 19.5 ha of potential woodland habitat for this species. A large expanse of contiguous and suitable habitat is available in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat to the extent that it would cause a decline to this species.

Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the species' habitat

The proposed works would not result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered species' habitat.

Criterion 8: introduce disease that may cause the species to decline.

The Modification would not introduce disease that may cause the species to decline.

Criterion 9: interfere with the recovery of a vulnerable species.

As no important populations have been identified in the area surrounding the Modification Disturbance Footprint, the Modification would not interfere with any recovery objective.

***Chalinolobus dwyeri* (Large-eared Pied Bat)**

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

Criterion 1: lead to a long-term decrease in the size of an important population of a species

The potential habitat to be removed in Modification Disturbance Footprint (cliff lines, caves and rocky outcrops; woodland and grassland foraging habitat) has not been identified as supporting an important population and is not near the limit of the species range. Alternative habitat would remain in surrounding areas; therefore, it is unlikely that the removal of habitat from the Modification would lead to a long-term decrease in the size of an important population of the Large-eared Pied Bat.

Criterion 2: reduce the area of occupancy of an important population

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not reduce the area of occupancy of an important population.

Criterion 3: fragment an existing important population into two or more populations

The Modification Disturbance Footprint has not been identified as supporting an important population and is not near the limit of the species range. Therefore, the Modification would not fragment an existing important population into two or more populations.

Criterion 4: adversely affect habitat critical to the survival of a species

The Modification would remove an additional 27 ha of potential roosting, breeding and foraging habitat for this species associated with cliff lines and rocky outcrops, as well areas of woodland and derived grassland which would serve as potential foraging habitat. This species is highly mobile and a large expanse of contiguous and suitable habitat is available in the areas surrounding the Modification Disturbance Footprint. It is therefore unlikely that the Modification would affect habitat critical to the survival of a species.

Criterion 5: disrupt the breeding cycle of an important population

It is possible that the cliff lines, caves and rocky outcrops may support breeding habitat, to which impacts could potentially occur as part of the Modification. However, no important populations are known within the Modification Disturbance Footprint. Therefore, it is unlikely that the Modification would disrupt the breeding cycle of an important population of Large-eared Pied Bat. Potential impacts would be mitigated through the continued implementation of the VCP.

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

It is possible that potential roosting and breeding habitat for this species would be impacted by the Modification through removal of approximately 0.93 km of cliff lines containing caves, overhangs and rocky outcrops, although this has not been confirmed as breeding habitat.

A maximum additional clearance of approximately 27 ha of potential breeding, roosting and foraging habitat (cliff lines and rocky outcrops, derived grassland and woodland) for this species would occur as a result of the Modification.

Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

Pest species including the European Red Fox, Feral Cat and Rabbit may also be displaced from the Modification Disturbance Footprint, resulting in increased impacts from these species in surrounding areas. It is unlikely that these species would impact habitat for the Large-eared Pied Bat, and pest management would be undertaken to mitigate potential impacts to surrounding areas.

Criterion 8: introduce disease that may cause the species to decline.

The Modification would not introduce disease that may cause the species to decline.

Criterion 9: interfere with the recovery of a vulnerable species.

A national recovery plan has been prepared for the Large-eared Pied Bat. The objective of the recovery plan is "to ensure the persistence of viable populations of the large-eared pied bat throughout its geographic range".

As no key populations have been identified in the area surrounding the Modification Disturbance Footprint, the Modification would not interfere with this recovery objective.

Threatened flora: *Homoranthus darwinioides* and *Dicanthium setosum* (Bluegrass)

Criterion 1: lead to a long-term decrease in the size of an important population of a species

The medium sized shrub *Homoranthus darwinioides* has not been located in the Modification Disturbance Footprint, nor has the upright grass *Dicanthium setosum*. Populations of Homoranthus darwinioides nearby are over an area of a hectare of more. If the species is found during clearing operations, being from the Myrtaceae family transplanting and propagation should be very feasible.

Criterion 2: reduce the area of occupancy of an important population

These species were not identified during the field surveys despite targeted flora surveys. It is highly unlikely that an important population would be disturbed by the Modification.

Criterion 3: fragment an existing important population into two or more populations

These species were not identified during the field surveys despite targeted flora surveys. It is highly unlikely that an important population would be disturbed by the Modification.

Criterion 4: adversely affect habitat critical to the survival of a species

Unlikely, as these species are known from a number of other locations, including private properties for *Dicanthium setosum* and current known locations in the upper Goulburn River for *Homoranthus darwinioides* being near roads indicate that with further searching more populations would be found.

Criterion 5: disrupt the breeding cycle of an important population

These species were not identified during the field surveys despite targeted flora surveys. It is highly unlikely that an important population would be disturbed by the Modification.

Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

Unknown, as at this stage no populations are known to occur which would be impacted by the Modification.

Criterion 7: result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat

Unlikely, as mining activities in the Moolarben area do not have a history of promoting invasive species.

Criterion 8: introduce disease that may cause the species to decline, or interfere substantially with the recovery of the species.

Unlikely to interfere with recovery of endangered species. No diseases common to native shrub plants.

Criterion 9: interfere with the recovery of an endangered species.

These species are found in known locations throughout their regional habitat distribution (OEH 2017b) and are not known to occur in the Modification Disturbance Footprint. In the unlikely event that isolated individuals are impacted by the Modification, this would not interfere with the recovery of these species.

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland

In the Modification Disturbance Footprint, this CEEC occurs in both the woodland and DNG forms (PCT 281 and PCT 618).

An action is likely to have a significant impact on a Critically Endangered or Endangered ecological community if there is a real chance or possibility that it will:

Criterion 1: reduce the extent of an ecological community

The Modification would remove an additional approximately 3.5 ha of the CEEC (comprising 2 ha of woodland and 2 ha of derived native grassland), resulting in a reduction in its extent. Areas of the CEEC would remain in the surrounds of the Modification Disturbance Footprint, as well as in large areas of intact vegetation associated with the Goulburn River NP and Munghorn Gap Nature Reserve.

Criterion 2: fragment or increase fragmentation of an ecological community

Existing mining operations and clearing associated with historic agricultural practices have led to existing fragmentation of the community in the Modification Disturbance Footprint. Removal of approximately 4 ha of this CEEC (comprising 2 ha of woodland and 2 ha of derived native grassland), is unlikely to increase fragmentation of this community, given the small patches to be removed are already fragmented and immediately adjacent to existing/approved mining operations. Areas of the CEEC would remain in the surrounds of the Modification Disturbance Footprint, as well as in large areas of intact vegetation associated with the Goulburn River NP and Munghorn Gap Nature Reserve.

Criterion 3: adversely affect habitat critical to the survival of an ecological community

4 ha of the CEEC would be removed by the Modification. Disturbance activities would be limited to the Modification Disturbance Footprint and would not result in impacts to habitat for this community in surrounding areas.

Criterion 4: modify or destroy abiotic factors necessary for an ecological community's survival, including reduction in groundwater levels, or substantial alteration of surface water drainage patterns.

The Modification has the potential to temporarily alter surface water runoff by reducing the shrub layer, ground layer and woody debris that intercept water flow. However, these impacts would be mitigated by the construction of appropriate sediment and runoff control structures. Therefore, major hydrological patterns would remain unchanged.

Criterion 5: cause substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species.

The Modification would impact approximately 4 ha of the CEEC; however, it would not significantly change the species composition of the total CEEC occurrence within the surrounding area. Inspection of previously modified DNG forms of this CEEC in the Modification Disturbance Footprint showed that there were imperceptible differences between surrounding vegetation and the modified areas, such as those containing roads or tracks.

Criterion 6: cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- **assisting invasive species, that are harmful to the listed ecological community, to become established, or**
- **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community**

Invasive plant species could establish within or on the peripheries of the Modification Disturbance Footprint following vegetation clearance. Weeds would be managed in accordance with the BMP, including noxious species, to avoid and mitigate impacts to surrounding vegetation. Previous activities at the MCC have not resulted in perceptible weed invasion. It is therefore unlikely that there would be a substantial reduction in quality or integrity of the CEEC surrounding the Modification Disturbance Footprint.

Criterion 7: interfere with the recovery of an ecological community.

The Modification would impact approximately 4 ha of the CEEC. However, areas of the CEEC would remain in the surrounds of the Modification Disturbance Footprint, as well as in large areas of intact vegetation associated with the Goulburn River NP and Munghorn Gap Nature Reserve.

Central Hunter Valley Eucalypt Forest and Woodland Ecological Community

In the Modification Disturbance Footprint, this community occurs as Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion (PCT 1176).

An action is likely to have a significant impact on a Critically Endangered or Endangered ecological community if there is a real chance or possibility that it will:

Criterion 1: reduce the extent of an ecological community

The Modification would impact approximately 2 ha of the CEEC, however 3.5 ha is located within the Relinquishment areas resulting in a net increase in extent compared to the approved MCC. In addition, areas of the CEEC would remain in the surrounds of the Modification Disturbance Footprint, as well as in large areas of intact vegetation associated with the Goulburn River NP and Munghorn Gap Nature Reserve.

Criterion 2: fragment or increase fragmentation of an ecological community

This CEEC is present in an already fragmented form in the Modification Disturbance Footprint due to indication of disturbance from historic agricultural processes, such as clearing and potentially cultivating. Areas of the CEEC would remain in large areas of intact vegetation associated with the Goulburn River NP and Munghorn Gap Nature Reserve.

Criterion 3: adversely affect habitat critical to the survival of an ecological community

Removal of the CEEC within the Modification Disturbance Footprint would occur, also removing habitat for this species. Disturbance activities would be limited to the Modification Disturbance Footprint and would not result in impacts to habitat for this community in surrounding areas.

Criterion 4: modify or destroy abiotic factors necessary for an ecological community's survival, including reduction in groundwater levels, or substantial alteration of surface water drainage patterns.

The Modification has potential to temporarily alter surface water runoff by reducing the shrub layer, ground layer and woody debris that intercept water flow. However, these impacts should be mitigated by the construction of appropriate sediment and runoff control structures. Therefore, major hydrological patterns would remain unchanged

Criterion 5: cause substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species.

The Modification would not cause substantial change to species composition of an ecological community or a decline or loss of functionally important species.

Criterion 6: cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- **assisting invasive species, that are harmful to the listed ecological community, to become established, or**
- **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community**

Invasive plant species could establish on the peripheries and in the Modification Disturbance Footprint following vegetation clearance. The condition thresholds of this CEEC centre on levels of perennial native vegetation, and weed establishment in the CEEC has the potential to cause quality of the patch to decline. Weeds would be managed in accordance with the BMP, including noxious species, in order to avoid and mitigate impacts to surrounding vegetation. Previous activities at the MCC have not resulted in perceptible weed invasion. It is therefore unlikely that there would be a substantial reduction in quality or integrity of the CEEC surrounding the Modification Disturbance Footprint.

Criterion 7: interfere with the recovery of an ecological community.

The Modification would impact approximately 2 ha of the CEEC, however 3.5 ha is located within the relinquishment areas resulting in a net increase in extent of the ecological community compared to the approved MCC. In addition, areas of the CEEC would remain in the surrounds of the Modification Disturbance Footprint, as well as in large areas of intact vegetation associated with the Goulburn River NP and Munghorn Gap Nature Reserve.

Appendix H – Credit Calculator for Major Projects and BioBanking Reports

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 22/10/2017 Time: 7:28:39PM Calculator version: v4.0

Major Project details

Proposal ID:	227/2017/4415MP
Proposal name:	Moorlarben Optimisation Modification
Proposal address:	MCO Moorlarben NSW
Proponent name:	tba
Proponent address:	
Proponent phone:	9999 9999
Assessor name:	Alex Pursche
Assessor address:	Suite 28 & 29, Level 7 19 Bolton Street Newcastle NSW 2300
Assessor phone:	+61 2 4910 3406
Assessor accreditation:	227

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter	7.45	354.00
Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	3.65	237.00
Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	13.54	827.00
Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin	4.48	233.00
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 Bioregion	1.33	53.00
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	1.79	108.07
White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	3.06	190.00
White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	3.60	112.22
Total	38.90	2,114

Credit profiles

1. Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter, (HU910)

Number of ecosystem credits created	191
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter, (HU910) Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley, (HU652) White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley, (HU730) Grey Gum - Forest Red Gum - Yellow Box grassy tall open forest on mid-slopes of the Hunter Valley - North Coast escarpment, (HU691) Narrow-leaved Ironbark +/- Grey Box grassy woodland of the upper Hunter Valley, mainly Sydney Basin Bioregion, (HU701) Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter, (HU817) Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter, (HU818) Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905) Bull Oak grassy woodland of the central Hunter Valley, (HU906)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter, (HU910)

Number of ecosystem credits created	163
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter, (HU910) Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley, (HU652) White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley, (HU730) Grey Gum - Forest Red Gum - Yellow Box grassy tall open forest on mid-slopes of the Hunter Valley - North Coast escarpment, (HU691) Narrow-leaved Ironbark +/- Grey Box grassy woodland of the upper Hunter Valley, mainly Sydney Basin Bioregion, (HU701) Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter, (HU817) Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter, (HU818) Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905) Bull Oak grassy woodland of the central Hunter Valley, (HU906)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. 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 Bioregion, (HU714)

Number of ecosystem credits created	53
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
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 Bioregion, (HU714) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (HU547) Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion, (HU732) Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley, (HU690) Yellow Box grassy woodland on basalt soils of the upper Hunter, (HU909)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley, (HU730)

Number of ecosystem credits created	112
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley, (HU730) Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley, (HU652) Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter, (HU820)

Number of ecosystem credits created	190
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter, (HU820) Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion, (HU573) Narrow-leaved Peppermint - Mountain Ribbon Gum grassy open forest of the eastern New England Tableland Bioregion, (HU576) Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of the upper Hunter Valley, south western New England Tableland Bioregion and southern NSW North Coast Bioregion, (HU603) Mountain Gum - Broad-leaved Stringybark shrubby open forest on granites of the New England Tableland Bioregion, (HU696) Silvertop Stringybark - Ribbon Gum - Rough-barked Apple open forest on basalt hills of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion, (HU718) Silvertop Stringybark - Rough-barked Apple grassy open forest of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion, (HU719) Narrow-leaved Peppermint - Forest Ribbon Gum grassy open forest of the New England Tablelands, (HU767)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618)

Number of ecosystem credits created	108
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618) Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (HU698) Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion, (HU707) Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/ - Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio, (HU702) Narrow-leaved Ironbark - box - Mock Olive shrubby open forest mainly on basalt slopes over sandstone in the upper Hunter Valley, Brigalow Belt South Bioregion and Sydney Basin Bioregion, (HU700) White Box - Black Cypress Pine shrubby woodland of the Western Slopes, (HU824) Narrow-leaved Ironbark - Grey Gum shrubby open forest on sandstone ranges of the upper Hunter Valley, (HU868) Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin, (HU869) Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875) Narrow-leaved Stringybark - Ironbark heathy open forest on sandstone ranges of the upper Hunter, (HU882) Broom Bush - Allocasuarina gymnanthera heathy woodland on sandstone outcrops of the Sydney Basin, (HU923)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

7. Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin, (HU843)

Number of ecosystem credits created	827
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions

Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin, (HU843)

Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618)

Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (HU698)

Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo), (HU682)

Narrow-leaved Wattle low open forest / very tall shrubland on ridges in northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion, (HU704)

Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion, (HU707)

Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/ - Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio, (HU702)

Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone in the Upper Hunter region of the Sydney Basin Bioregion, (HU678)

Mugga Ironbark - Black Cypress Pine shrub/grass open forest of the upper Hunter Valley, mainly Sydney Basin Bioregion, (HU697)

Narrow-leaved Ironbark - box - Mock Olive shrubby open forest mainly on basalt slopes over sandstone in the upper Hunter Valley, Brigalow Belt South Bioregion and Sydney Basin Bioregion, (HU700)

White Box - Black Cypress Pine shrubby woodland of the Western Slopes, (HU824)

Narrow-leaved Ironbark - Grey Gum shrubby open forest on sandstone ranges of the upper Hunter Valley, (HU868)

Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin, (HU869)

Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin, (HU870)

Bulga Wattle low closed forest on sandstone slopes of the central Hunter, (HU871)

Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South, (HU874)

Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875)

Tumbledown Red Gum - Spinifex grass heathy low open woodland on sandstone slopes of the Sydney Basin, (HU877)

Narrow-leaved Stringybark - Ironbark heathy open forest on sandstone ranges of the upper Hunter, (HU882)

Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin, (HU883)

Brown Bloodwood - Dwyer's Red Gum - Red Ironbark heathy woodland on sandstone ranges of the Sydney Basin, (HU885)

Kerrabee - Hunter/Central Rivers

and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Red Ironbark - Grey Gum - Black Pine heathy woodland on sandstone ranges of the Sydney Basin, (HU886) Red Ironbark - Brown Bloodwood - Black Pine heathy open forest on sandstone ranges of the Sydney Basin, (HU888) Grey Gum - Scribbly Gum - Black Pine heathy open forest on sandstone ranges of the Sydney Basin, (HU890) Caley's Ironbark - Red Ironbark - Currawang shrubby woodland on sandstone ranges of the Sydney Basin, (HU891) Brown Bloodwood - Currawang - Caley's Ironbark shrubby woodland on sandstone ranges of the Sydney Basin, (HU892) Dywer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin, (HU893) Dywer's Red Gum - Micromyrtus sessilis heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin, (HU894) Broom Bush - Allocasuarina gymnanthera heathy woodland on sandstone outcrops of the Sydney Basin, (HU923) Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin, (HU925) Narrow-leaved Ironbark - Red Stringybark - Black Pine woodlands on sandstone substrates of the Brigalow Belt South, (HU984)	

8. Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875)

Number of ecosystem credits created	237
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875) Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618) Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (HU698) Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/ - Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio, (HU702) Narrow-leaved Ironbark - box - Mock Olive shrubby open forest mainly on basalt slopes over sandstone in the upper Hunter Valley, Brigalow Belt South Bioregion and Sydney Basin Bioregion, (HU700) White Box - Black Cypress Pine shrubby woodland of the Western Slopes, (HU824) Narrow-leaved Stringybark - Ironbark heathy open forest on sandstone ranges of the upper Hunter, (HU882) Broom Bush - Allocasuarina gymnanthera heathy woodland on sandstone outcrops of the Sydney Basin, (HU923)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

9. Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin, (HU883)

Number of ecosystem credits created	233
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions

Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin, (HU883) Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618) Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (HU698) Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo), (HU682) Narrow-leaved Wattle low open forest / very tall shrubland on ridges in northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion, (HU704) Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion, (HU707) Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/ - Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio, (HU702) Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone in the Upper Hunter region of the Sydney Basin Bioregion, (HU678) Mugga Ironbark - Black Cypress Pine shrub/grass open forest of the upper Hunter Valley, mainly Sydney Basin Bioregion, (HU697) Narrow-leaved Ironbark - box - Mock Olive shrubby open forest mainly on basalt slopes over sandstone in the upper Hunter Valley, Brigalow Belt South Bioregion and Sydney Basin Bioregion, (HU700) White Box - Black Cypress Pine shrubby woodland of the Western Slopes, (HU824) Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin, (HU843) Narrow-leaved Ironbark - Grey Gum shrubby open forest on sandstone ranges of the upper Hunter Valley, (HU868) Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin, (HU869) Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin, (HU870) Bulga Wattle low closed forest on sandstone slopes of the central Hunter, (HU871) Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South, (HU874) Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875) Tumbledown Red Gum - Spinifex grass heathy low open woodland on sandstone slopes of the Sydney Basin, (HU877) Narrow-leaved Stringybark - Ironbark heathy open forest on sandstone ranges of the upper Hunter, (HU882) Brown Bloodwood - Dwyer's Red Gum - Red Ironbark heathy woodland on sandstone ranges of the Sydney Basin, (HU885)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Red Ironbark - Grey Gum - Black Pine heathy woodland on sandstone ranges of the Sydney Basin, (HU886) Red Ironbark - Brown Bloodwood - Black Pine heathy open forest on sandstone ranges of the Sydney Basin, (HU888) Grey Gum - Scribbly Gum - Black Pine heathy open forest on sandstone ranges of the Sydney Basin, (HU890) Caley's Ironbark - Red Ironbark - Currawang shrubby woodland on sandstone ranges of the Sydney Basin, (HU891) Brown Bloodwood - Currawang - Caley's Ironbark shrubby woodland on sandstone ranges of the Sydney Basin, (HU892) Dywer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin, (HU893) Dywer's Red Gum - Micromyrtus sessilis heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin, (HU894) Broom Bush - Allocasuarina gymnanthera heathy woodland on sandstone outcrops of the Sydney Basin, (HU923) Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin, (HU925) Narrow-leaved Ironbark - Red Stringybark - Black Pine woodlands on sandstone substrates of the Brigalow Belt South, (HU984)	

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala	Phascolarctos cinereus	3.62	94
Brush-tailed Rock-wallaby	Petrogale penicillata	36.94	960
Regent Honeyeater	Anthochaera phrygia	30.79	2,371

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 28/09/2017 Time: 4:14:31PM Calculator version: v4.0

Major Project details

Proposal ID:	227/2017/4483D
Proposal name:	7616_MCO_Relinquishment_Development
Proposal address:	tba tba NSW 2000
Proponent name:	tba
Proponent address:	tba tba NSW 2000
Proponent phone:	9999 9999
Assessor name:	Alex Pursche
Assessor address:	Suite 28 & 29, Level 7 19 Bolton Street Newcastle NSW 2300
Assessor phone:	+61 2 4910 3406
Assessor accreditation:	227

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter	0.40	23.00
Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	0.94	33.00
Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	1.41	57.00
Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	6.63	416.00
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 Bioregion	0.48	18.00
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of the upper Hunter Valley, south western New England Tableland Bioregion and southern NSW North Coast Bioregion	1.04	40.00
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	3.27	188.43
White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	0.53	39.00
Total	14.70	814

Credit profiles

1. Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905)

Number of ecosystem credits created	57
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905) Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley, (HU652)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter, (HU910)

Number of ecosystem credits created	23
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Blakely's Red Gum - Rough-barked Apple shrubby woodland of central and upper Hunter, (HU910) Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley, (HU652) White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley, (HU730) Grey Gum - Forest Red Gum - Yellow Box grassy tall open forest on mid-slopes of the Hunter Valley - North Coast escarpment, (HU691) Narrow-leaved Ironbark +/- Grey Box grassy woodland of the upper Hunter Valley, mainly Sydney Basin Bioregion, (HU701) Narrow-leaved Ironbark - Bull Oak - Grey Box shrub - grass open forest of the central and lower Hunter, (HU817) Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter, (HU818) Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905) Bull Oak grassy woodland of the central Hunter Valley, (HU906)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

3. 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 Bioregion, (HU714)

Number of ecosystem credits created	18
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
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 Bioregion, (HU714) Fuzzy Box Woodland on alluvial brown loam soils mainly in the NSW South Western Slopes Bioregion, (HU547) Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion, (HU732) Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley, (HU690) Yellow Box grassy woodland on basalt soils of the upper Hunter, (HU909)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

4. White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley, (HU730)

Number of ecosystem credits created	39
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley, (HU730) Weeping Myall - Coobah - Scrub Wilga shrubland of the Hunter Valley, (HU652) Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter, (HU905)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

5. Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of the upper Hunter Valley, south western New England Tableland Bioregion and southern NSW North Coast Bioregion, (HU603)

Number of ecosystem credits created	40
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Rough-barked Apple - Silvertop Stringybark - Red Stringybark grassy open forest of the upper Hunter Valley, south western New England Tableland Bioregion and southern NSW North Coast Bioregion, (HU603) Narrow-leaved Peppermint - Mountain Ribbon Gum grassy open forest of the eastern New England Tableland Bioregion, (HU576) Mountain Gum - Broad-leaved Stringybark shrubby open forest on granites of the New England Tableland Bioregion, (HU696) Silvertop Stringybark - Ribbon Gum - Rough-barked Apple open forest on basalt hills of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion, (HU718) Silvertop Stringybark - Rough-barked Apple grassy open forest of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion, (HU719)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

6. Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618)

Number of ecosystem credits created	188
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618) Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (HU698) Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion, (HU707) Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/ - Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio, (HU702) Narrow-leaved Ironbark - box - Mock Olive shrubby open forest mainly on basalt slopes over sandstone in the upper Hunter Valley, Brigalow Belt South Bioregion and Sydney Basin Bioregion, (HU700) White Box - Black Cypress Pine shrubby woodland of the Western Slopes, (HU824) Narrow-leaved Ironbark - Grey Gum shrubby open forest on sandstone ranges of the upper Hunter Valley, (HU868) Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin, (HU869) Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875) Narrow-leaved Stringybark - Ironbark heathy open forest on sandstone ranges of the upper Hunter, (HU882) Broom Bush - Allocasuarina gymnanthera heathy woodland on sandstone outcrops of the Sydney Basin, (HU923)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

7. Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin, (HU843)

Number of ecosystem credits created	416
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions

Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin, (HU843)

Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618)

Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (HU698)

Blue-leaved Ironbark - Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo), (HU682)

Narrow-leaved Wattle low open forest / very tall shrubland on ridges in northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion, (HU704)

Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion, (HU707)

Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/ - Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio, (HU702)

Black Cypress Pine - ironbark +/- Narrow-leaved Wattle low open forest mainly on Narrabeen Sandstone in the Upper Hunter region of the Sydney Basin Bioregion, (HU678)

Mugga Ironbark - Black Cypress Pine shrub/grass open forest of the upper Hunter Valley, mainly Sydney Basin Bioregion, (HU697)

Narrow-leaved Ironbark - box - Mock Olive shrubby open forest mainly on basalt slopes over sandstone in the upper Hunter Valley, Brigalow Belt South Bioregion and Sydney Basin Bioregion, (HU700)

White Box - Black Cypress Pine shrubby woodland of the Western Slopes, (HU824)

Narrow-leaved Ironbark - Grey Gum shrubby open forest on sandstone ranges of the upper Hunter Valley, (HU868)

Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin, (HU869)

Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin, (HU870)

Bulga Wattle low closed forest on sandstone slopes of the central Hunter, (HU871)

Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South, (HU874)

Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875)

Tumbledown Red Gum - Spinifex grass heathy low open woodland on sandstone slopes of the Sydney Basin, (HU877)

Narrow-leaved Stringybark - Ironbark heathy open forest on sandstone ranges of the upper Hunter, (HU882)

Red Ironbark - Grey Gum - Narrow-leaved Stringybark - Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin, (HU883)

Brown Bloodwood - Dwyer's Red Gum - Red Ironbark heathy woodland on sandstone ranges of the Sydney Basin, (HU885)

Kerrabee - Hunter/Central Rivers

and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Red Ironbark - Grey Gum - Black Pine heathy woodland on sandstone ranges of the Sydney Basin, (HU886) Red Ironbark - Brown Bloodwood - Black Pine heathy open forest on sandstone ranges of the Sydney Basin, (HU888) Grey Gum - Scribbly Gum - Black Pine heathy open forest on sandstone ranges of the Sydney Basin, (HU890) Caley's Ironbark - Red Ironbark - Currawang shrubby woodland on sandstone ranges of the Sydney Basin, (HU891) Brown Bloodwood - Currawang - Caley's Ironbark shrubby woodland on sandstone ranges of the Sydney Basin, (HU892) Dywer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin, (HU893) Dywer's Red Gum - Micromyrtus sessilis heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin, (HU894) Broom Bush - Allocasuarina gymnanthera heathy woodland on sandstone outcrops of the Sydney Basin, (HU923) Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin, (HU925) Narrow-leaved Ironbark - Red Stringybark - Black Pine woodlands on sandstone substrates of the Brigalow Belt South, (HU984)	

8. Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875)

Number of ecosystem credits created	33
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin, (HU875) Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618) Dapper Mugga Ironbark - Western Grey Box - Blakely's Red Gum - Black Cypress Pine grass shrub hill woodland (southern Brigalow Belt South Bioregion), (HU698) Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/ - Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio, (HU702) Narrow-leaved Ironbark - box - Mock Olive shrubby open forest mainly on basalt slopes over sandstone in the upper Hunter Valley, Brigalow Belt South Bioregion and Sydney Basin Bioregion, (HU700) White Box - Black Cypress Pine shrubby woodland of the Western Slopes, (HU824) Narrow-leaved Stringybark - Ironbark heathy open forest on sandstone ranges of the upper Hunter, (HU882) Broom Bush - Allocasuarina gymnanthera heathy woodland on sandstone outcrops of the Sydney Basin, (HU923)	Kerrabee - Hunter/Central Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Regent Honeyeater	Anthochaera phrygia	10.43	803
Brush-tailed Rock-wallaby	Petrogale penicillata	10.28	267
Koala	Phascolarctos cinereus	0.65	17

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 11/10/2017 Time: 3:11:09PM Calculator version: v4.0

Biobank details

Proposal ID:	227/2017/4471B
Proposal name:	MCO Offsets - Gilgal
Proposal address:	tba tba NSW 2000
Proponent name:	tba
Proponent address:	tba tba NSW 2000
Proponent phone:	9999 9999
Assessor name:	Alex Pursche
Assessor address:	Suite 28 & 29, Level 7 19 Bolton Street Newcastle NSW 2300
Assessor phone:	+61 2 4910 3406
Assessor accreditation:	227

Additional information required for approval:

☐ Use of local benchmark

- Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South

☐ Expert report...

- Brush-tailed Rock-wallaby — Petrogale penicillata
- Koala — Phascolarctos cinereus
- Regent Honeyeater — Anthochaera phrygia

☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Dywer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin	3.51	27.00
Grey Myrtle - Rusty Fig dry rainforest in sandstone gorges of the upper Hunter Valley, mainly Sydney Basin Bioregion	0.66	6.00
Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio	185.33	1,709.00
Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South	130.87	1,023.00
Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	18.62	155.00
Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	19.22	153.00
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 Bioregion	32.45	224.00
Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	160.14	1,117.00
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	33.41	291.00
White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	16.15	175.00
Total	600.36	4,880

Credit profiles

1. Grey Myrtle - Rusty Fig dry rainforest in sandstone gorges of the upper Hunter Valley, mainly Sydney Basin Bioregion, (HU693)

Number of ecosystem credits created	6
IBRA sub-region	Kerrabee - Hunter/Central Rivers

2. 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 Bioregion, (HU714)

Number of ecosystem credits created	224
IBRA sub-region	Kerrabee - Hunter/Central Rivers

3. White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter, (HU820)

Number of ecosystem credits created	175
IBRA sub-region	Kerrabee - Hunter/Central Rivers

4. Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion, (HU618)

Number of ecosystem credits created	291
IBRA sub-region	Kerrabee - Hunter/Central Rivers

5. Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion, (HU707)

Number of ecosystem credits created	155
IBRA sub-region	Kerrabee - Hunter/Central Rivers

6. Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio, (HU702)

Number of ecosystem credits created	1,709
IBRA sub-region	Kerrabee - Hunter/Central Rivers

7. Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region, (HU713)

Number of ecosystem credits created	153
IBRA sub-region	Kerrabee - Hunter/Central Rivers

8. Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South, (HU874)

Number of ecosystem credits created	1,023
IBRA sub-region	Kerrabee - Hunter/Central Rivers

9. Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin, (HU889)

Number of ecosystem credits created	1,117
IBRA sub-region	Kerrabee - Hunter/Central Rivers

10. Dywer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin, (HU893)

Number of ecosystem credits created	27
IBRA sub-region	Kerrabee - Hunter/Central Rivers

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Regent Honeyeater	Anthochaera phrygia	589.00	4,182
Brush-tailed Rock-wallaby	Petrogale penicillata	532.59	3,781
Koala	Phascolarctos cinereus	9.00	64

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Brush-tailed Rock-wallaby	Feral and/or over-abundant native herbivore control
Brush-tailed Rock-wallaby	Fox control
Dywer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin	Exclude miscellaneous feral species
Dywer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin	Feral and/or over-abundant native herbivore control
Dywer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin	Fox control
Dywer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin	Slashing
Grey Myrtle - Rusty Fig dry rainforest in sandstone gorges of the upper Hunter Valley, mainly Sydney Basin Bioregion	Exclude miscellaneous feral species
Grey Myrtle - Rusty Fig dry rainforest in sandstone gorges of the upper Hunter Valley, mainly Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Grey Myrtle - Rusty Fig dry rainforest in sandstone gorges of the upper Hunter Valley, mainly Sydney Basin Bioregion	Fox control
Koala	Exclude miscellaneous feral species
Koala	Slashing
Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio	Exclude commercial apiaries
Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio	Exclude miscellaneous feral species

Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio	Feral and/or over-abundant native herbivore control
Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio	Fox control
Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bio	Slashing
Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South	Exclude miscellaneous feral species
Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South	Feral and/or over-abundant native herbivore control
Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South	Fox control
Narrow-leaved Ironbark heathy woodland on sandstone ranges of the Sydney Basin and Brigalow Belt South	Slashing
Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	Exclude commercial apiaries
Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	Exclude miscellaneous feral species
Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	Feral and/or over-abundant native herbivore control
Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	Fox control
Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	Slashing
Regent Honeyeater	Exclude miscellaneous feral species
Regent Honeyeater	Feral and/or over-abundant native herbivore control
Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	Exclude commercial apiaries
Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	Exclude miscellaneous feral species
Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	Feral and/or over-abundant native herbivore control

Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	Fox control
Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	Slashing
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 Bioregion	Exclude commercial apiaries
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 Bioregion	Exclude miscellaneous feral species
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 Bioregion	Feral and/or over-abundant native herbivore control
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 Bioregion	Fox control
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 Bioregion	Slashing
Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	Exclude commercial apiaries
Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	Exclude miscellaneous feral species
Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	Feral and/or over-abundant native herbivore control
Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	Fox control
Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	Slashing
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	Exclude commercial apiaries
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	Exclude miscellaneous feral species
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	Fox control
Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	Slashing

White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	Exclude commercial apiaries
White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	Exclude miscellaneous feral species
White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	Feral and/or over-abundant native herbivore control
White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	Fox control
White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	Slashing

Appendix I – Gilgal Property Biodiversity Assessment Report

Vegetation mapping

Vegetation mapping of the Gilgal property was undertaken by ELA during June 2017 (ELA 2017b) and involved both desktop analysis and field survey. Desktop analysis included review of previous mapping of the property undertaken by ELA (ELA 2014). The results of the desktop analysis were used to inform the design and undertaking of field survey. Field survey involved the completion of rapid assessments throughout the property to determine the BVT present, along with the presence of potential EECs.

The presence and location of EECs within the property was confirmed during the floristic surveys with refinements to the vegetation mapping also made following the surveys. The data from both the June vegetation mapping surveys and the August floristic surveys was consolidated to produce finalised BVT and EEC maps for the Gilgal property (see **Figure I-2** and **Figure I-3**).

Site identification

The number of floristic plots to be surveyed were calculated based upon the requirements of the BioBanking Assessment Methodology (BBAM) (OEH 2014). Table 3 of the BBAM outlines the minimum number of plots required to be surveyed per vegetation zone area. The requirements of this table were then cross-referenced with the areas of each vegetation zone present within the Gilgal property to determine how many plots were required for each BVT. **Table I-1** details the results of this analysis. Vegetation communities are shown for the original survey area in **Figure I-1**. The final vegetation community mapping and plot locations are shown in **Figure I-2**.

During the original vegetation mapping undertaken at Gilgal, BVT's HU713 and HU714 were mapped as a mosaic community. For the purposes of determining the number of plots required for survey, we estimated that each community occupied 50% the area of the mapped mosaic. A similar approach was undertaken with the mosaic area of HU702 and HU889.

Preliminary locations for each plot were identified prior to field work based upon the existing vegetation mapping and ELAs prior experience with the property. The plots were spread across the extent of the property where possible, in order to capture the variation that exists within each vegetation community. The final location of the plots to be surveyed was made in the field.

No plots were surveyed within cleared land.

Table I-1: Vegetation communities - Gilgal

BVT No.	BVT Name	Area (ha)	No. plots
CW242	Blue-leaved Stringybark open forest of the Mudgee region NSW central western slopes	130.87	6
HU618	Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	33.41	4
HU693	Grey Myrtle - Rusty Fig dry rainforest in sandstone gorges of the upper Hunter Valley, mainly Sydney Basin Bioregion	0.66	1
HU702	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	185.33	6
HU707	Red Ironbark - Black Cypress Pine - Stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	18.62	3
HU713	Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	19.22	3
HU713/HU714	Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region / 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 Bioregion	32.45	4
HU820	White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter	16.15	3
HU889	Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin	48.22	4
HU889/HU702	Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin / Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	111.92	5
HU893	Dwyer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin	3.51	2
Cleared land		6.54	-
	Total	**606.9**	**41**

BioMetric floristic surveys

ELA ecologists David Allworth, Cassandra Holt, Tomas Kelly, and Angelina Siegrist undertook BioMetric floristic surveys throughout the Gilgal property from 9 August to 16 August 2017. Field survey involved the establishment of BioMetric plots consisting of a 20 m x 20 m quadrat nested within a 50 m x 20 m plot. BioMetric plots were surveyed in accordance with the BBAM (OEH 2014).

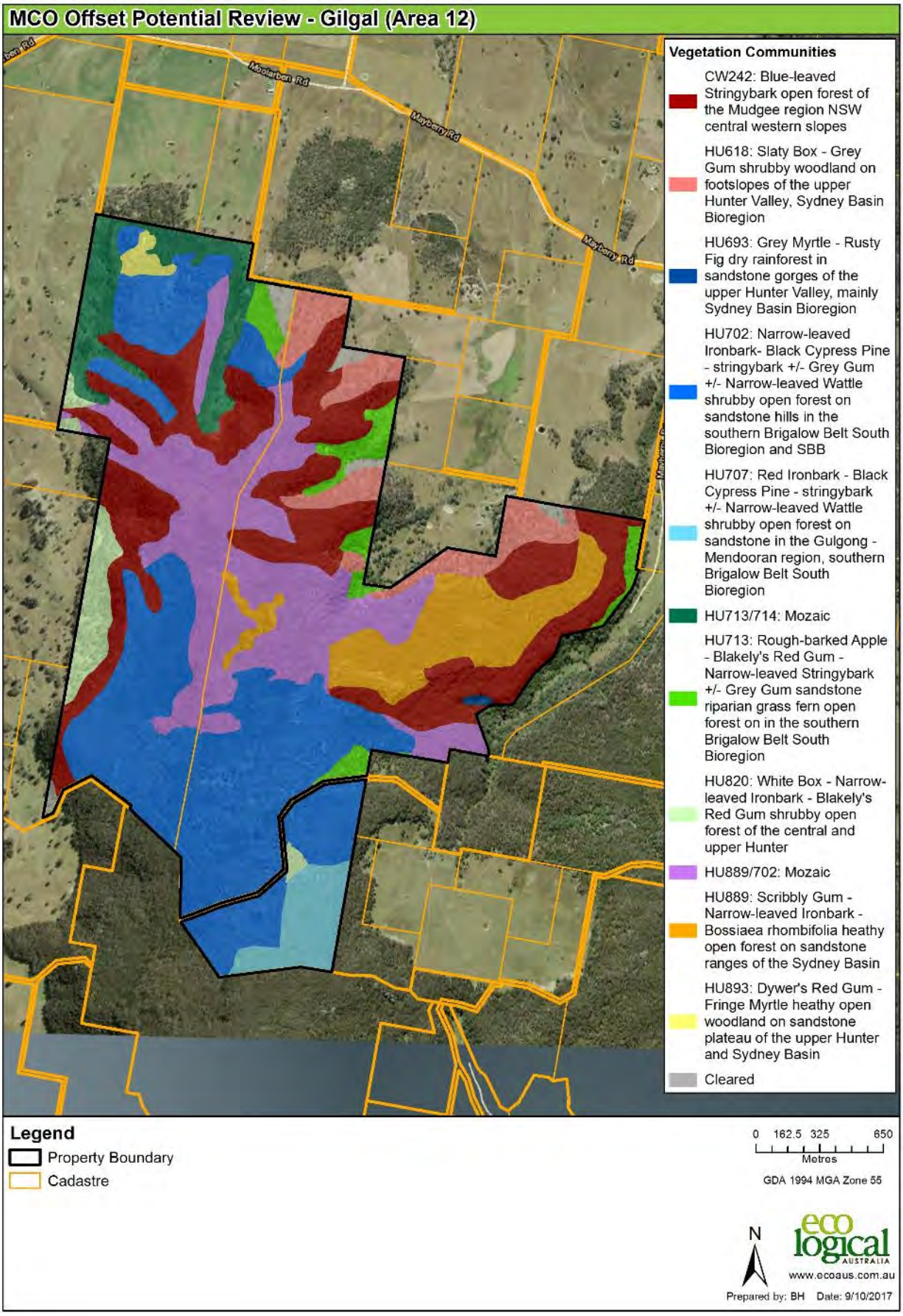

Figure I-1: Vegetation communities (original boundary)

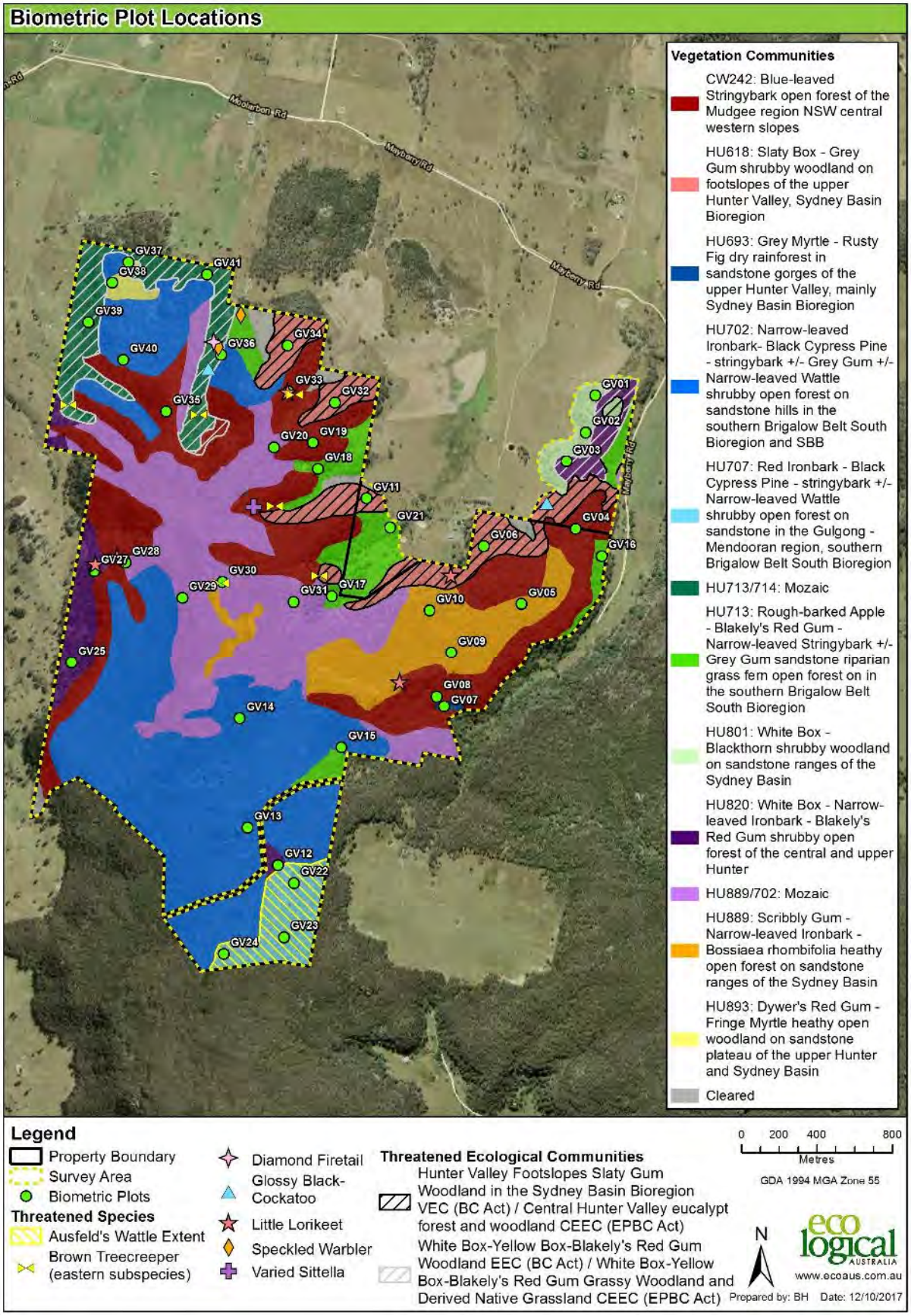

Figure I-2: Vegetation communities and plot locations – final boundary

BioBanking calculations

Following the completion of the BioMetric floristic surveys, the relevant data was consolidated and entered into the Credit Calculator.

Landscape features

Table I-2: Landscape feature assessment within the Credit Calculator for the offset

<table>
<tr><th>Landscape Feature</th><th colspan="7">Data input into Credit Calculator</th></tr>
<tr><td>IBRA bioregions and subregions</td><td colspan="7">NSW South Western Slopes Bioregion, Kerrabee IBRA subregion, Hunter – Central Rivers Major Catchment Area</td></tr>
<tr><td>Mitchell Landscape</td><td colspan="7">Wollemi Ranges (5% cleared)</td></tr>
<tr><td>Assessment circle size</td><td colspan="7">Outer 2000 ha, inner 200 ha</td></tr>
<tr><td>Native vegetation extent within outer assessment circle</td><td colspan="7"><table>
<tr><td></td><td colspan="3">Before</td><td colspan="3">After</td></tr>
<tr><td></td><td>ha</td><td>%</td><td>Cat</td><td>ha</td><td>%</td><td>Cat</td></tr>
<tr><td>Outer</td><td>1310</td><td>65.5</td><td>66 - 70</td><td>1317</td><td>65.8</td><td>66 - 70</td></tr>
<tr><td>Inner</td><td>126.8</td><td>63.4</td><td>61 – 65</td><td>131.87</td><td>65.9</td><td>66 - 70</td></tr>
</table></td></tr>
<tr><td>Rivers and streams present</td><td colspan="7">No 3rd order stream (or higher) present</td></tr>
<tr><td>Wetlands within, adjacent, or downstream of the site</td><td colspan="7">None present</td></tr>
<tr><td colspan="8">Landscape score components:</td></tr>
<tr><td>Method applied</td><td colspan="7">Site based assessment</td></tr>
<tr><td>Percent native vegetation cover within the landscape</td><td colspan="7">66 - 70</td></tr>
<tr><td>Connectivity value</td><td colspan="7">0</td></tr>
<tr><td>Patch size</td><td colspan="7">1001 ha</td></tr>
<tr><td>Area to perimeter ratio</td><td colspan="7">N/A</td></tr>
<tr><td>Landscape value score</td><td colspan="7">12.4</td></tr>
</table>

Native vegetation

Table I-3: Native vegetation assessment within the Credit Calculator for the offset

Native Vegetation Feature	Data input into Credit Calculator
Description of PCTs including vegetation class, vegetation type, area (ha) of each vegetation type, species relied upon for identification of vegetation type and relative abundance, justification of evidence used to identify a PCT, EEC status, and estimate percent cleared value of PCT	Data relating to selection of PCTs is contained within the following **BVT Decsriptions** section of this report.
Vegetation zones within the offset aera including condition class and subcategory, area, and survey effort	All vegetation zones are as described below and shown in **Figure I-1**. Survey effort for each vegetation zone is summarised in BioMetric vegetation survey sections of this report.

Threatened Species

Table I-4: Threatened species assessment within the Credit Calculator for the offset

Threatened species criteria	Data input into Credit Calculator
Identify ecosystem credit species associated with PCTs	No input required.
Species credit assessment	As described in Appendix H of this report..
List of candidate species	As described in Appendix A of this report.
Justification for inclusions and exclusions based on habitat features	N/A
Details of targeted survey technique, effort, timing, and weather	N/A
Species polygons	N/A

BVT descriptions

CW242: Blue-leaved Stringybark open forest of the Mudgee region NSW central western slopes

Blue-leaved Stringybark open forest exists along the upper slopes and ridge-tops in the north and east of the Gilgal property.

It is a tall forest dominated by *Eucalyptus agglomerata* (Blue-leaved Stringybark) and Grey Gum. It has a mid-storey featuring *Goodenia ovata* (Hop Goodenia), Narrow-leaved Wattle, *Bursaria spinosa* (Blackthorn) and Narrow-leaved Geebung, with a groundcover dominated by native rushes including *Lomandra confertifolia* (Mat-rush) and *Lepidosperma laterale.*

HU618: Slaty Box - Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion

Slaty Box – Grey Gum shrubby woodland is present in small to medium patches on slopes of gullies to the north and east of the Gilgal property.

The canopy is dominated by Slaty Box, with Grey Gum and White Box also present. The midstorey contains *Acacia decora* (Western Silver Wattle) and *Allocasuarina luehmannii* (Buloke), with native rushes dominating the ground layer including *Lepidosperma laterale* and Mat-rush.

Slaty Box - Grey Gum shrubby woodland in the Gilgal property meets the criteria for listing as Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion VEC under the BC Act and Central Hunter Valley eucalypt forest and woodland Critically CEEC under the EPBC Act.

HU693: Grey Myrtle - Rusty Fig dry rainforest in sandstone gorges of the upper Hunter Valley, mainly Sydney Basin Bioregion

A small patch of the Grey Myrtle - Rusty Fig dry rainforest occurs in a gully on the eastern boundary of the Gilgal property near the southern end of the Moolarmoo BOA.

The canopy in this patch is dominated by *Ficus rubiginosa* (Rusty Fig) and Rough-barked Apple, with Blackthorn in the mid-storey. Both the shrub and ground layer are dominated by ferns including *Pteridium esculentum* (Common Bracken) and *Todea barbara* (King Fern).

HU702: Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion

This community occurs extensively within the Gilgal property, dominating the upper slopes and ridges throughout the property.

It is a tall open forest dominated by Narrow-leaved Ironbark, Grey Gum and Black Cypress Pine. The mid-storey is dominated by *Sannantha cunninghamii* and Blunt Beard-heath) whilst the ground cover contains a mix of native grasses, forbs and rushes including *Arundinella nepalensis* (Reed Grass), *Astroloma humifusum* (Native Cranberry) and Mat-rush.

HU707: Red Ironbark - Black Cypress Pine - Stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion

This community is present on flat ridgetops on poor, shallow soils in the south-eastern corner of the study area.

It is dominated by Red Stringybark with Black Cypress Pine and *Eucalyptus macrorhyncha* (Red Stringybark) also present. Narrow-leaved Wattle is also present in the lower canopy. The mid-storey is relatively dense and contains a variety of species including *Phyllanthus hirtellus, Hibbertia obtusifolia, Melichrus urceolatus, Cassinia laevis,* Narrow-leaved Geebung*, Lissanthe strigosa subsp. strigosa,* and Blackthorn*.* Groundcover is sparse but dominated by native grasses, such as *Rytidosperma pallidum* (Silvertop Wallaby Grass) and Mat-rushes. The community contained a very large population of the BC Act listed Acacia ausfeldii (Ausfeld's Wattle).

HU713: Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region

This community occurs in riparian areas, valley floors and low slopes in the northern half of the Gilgal property.

The canopy is dominated by Rough-barked Apple*,* Blakely's Red Gum and Grey Gum*.* The mid-storey is relatively sparse but does include *Styphelia triflora, Hibbertia obtusifolia,* Narrow-leaved Geebung, and *Xanthorrhoea johnsonii.* Dominant groundcover species include both native grasses and herbs including Weeping Grass*, Echinopogon* spp., *Dichondra repens* and *Cheilanthes sieberi* (Rock fern)*.*

HU714: 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 Bioregion

Rough-Barked Apple - red gum - Yellow Box woodland occurs throughout the low-lying valleys in the north of the Gilgal property.

This community has a canopy dominated by Rough-barked Apple, with Blakely's Red Gum and Yellow Box also scattered throughout the community. The mid-storey includes Black Cypress Pine and *Acacia* spp., with the ground layer dominated by native grasses, including Purple Wiregrass, *Austrodanthonia* sp. (Wallaby Grass) and Weeping Grass.

Rough-Barked Apple - red gum - Yellow Box woodland within the Gilgal property meets the criteria for listing as White Box-Yellow Box-Blakely's Red Gum Woodland EEC under the BC Act and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act.

HU820: White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter

An area of White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter exists on the lower to mid slopes along the western boundary of the Gilgal property. An additional area of HU820 was identified in the north-eastern section of the property also during more detailed assessments undertaken during the baseline surveys.

This is an open forest with a canopy dominated by White Box. The mid-storey contains *Cassinia quinquefaria*, *Olearia elliptica* (Sticky Daisy Bush) and the BC Act listed Ausfeld's Wattle, with the ground cover consisting of a range of native grasses and forbs including Weeping Grass, *Austrodanthonia* spp., and Kidney Weed*.*

The area mapped as HU820 at Gilgal is a grassy variant of the community, and as such meets the criteria for listing as White Box-Yellow Box-Blakely's Red Gum Woodland EEC under the BC Act and White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC under the EPBC Act.

HU889: Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin

This community occurs extensively throughout the Gilgal property, occupying areas of poor, sandy soils on plateaus and flat ridgetops.

The canopy is dominated by Inland Scribbly Gum, with Narrow-leaved Ironbark and Black Cypress Pine also present. The mid-storey contains Blunt Beard-heath and Narrow-leaved Geebung, with a sparse ground layer dominated by *Pomax umbellata* and *Lomandra* spp.

HU893: Dwyer's Red Gum - Fringe Myrtle heathy open woodland on sandstone plateau of the upper Hunter and Sydney Basin

A small patch of Dwyer's Red Gum - Fringe Myrtle heathy open woodland exists on granite-derived soils on the upper slopes in the north-west of the study area.

It occurs as a low open forest with a dense, shrubby mid-storey and a canopy including *Eucalyptus dwyeri* and *Acacia doratoxylon.* Mid-storey species are diverse and include *Leptospermum parvifolium*, *Allocasuarina gymnanthera*, *Calytrix tetragona* and Blunt Beard-heath. Dominant ground cover species include both native grasses and herbs such as, *Cleistochloa rigida*, *Cheilanthes sieberi*, *Pomax umbellata* and *Digitaria ramularis*.

Threatened ecological communities

A summary of the TECs identified within the Gilgal property is included below in **Table I-5** and displayed in **Figure I-3**.

Table I-5: Threatened Ecological Communities in the survey area

Conservation Status		Associated BVT
BC Act	EPBC Act	
Endangered: White Box Yellow Box Blakely's Red Gum Woodland	**Critically Endangered:** White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	HU714 HU820
Vulnerable: Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion (note that VEC's are not considered TECs under NSW EP&A Act (s.5D))	**Critically Endangered:** Central Hunter Valley eucalypt forest and woodland	HU618

Sections of the Rough-Barked Apple - red gum - Yellow Box woodland (HU714) present within the Gilgal property is deemed to meet the criteria for the BC Act listed White Box-Yellow Box-Blakely's Red Gum Woodland EEC (NSW Scientific Committee 2002) due to the following:

- it occurs in the Sydney Basin Bioregion;
- it contains native species in the understorey and is likely to respond to assisted natural regeneration;
- it contains and/or previously contained Yellow Box and Blakely's Red Gum;
- grass and herbaceous species characterise the ground layer.

HU714 is also deemed to meet the criteria for the EPBC listed White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC (DotEE 2006) due to the following:

- having, or previously having Yellow Box and Blakely's Red Gum as a common overstorey species;
- having a predominantly native understorey comprising at least 12 native understorey species including at least one important species;
- being in patches greater than 0.1 ha in size.

Further delineation of the extent of HU714 containing common overstorey species is required to confirm the extent of the EEC. Both Blakely's Red Gum and Yellow Box were absent in the plots undertaken within the mosaic community, however, they are known to be present within the mosaic. Based on the results of the field survey, it is understood that both Blakely's Red Gum and Yellow Box may have previously occurred in higher densities, as evidenced in partially cleared areas of this community which are now dominated by regenerating Rough-barked Apple. Additional field survey is proposed to specifically map areas of the HU714 community which meet the above criteria for EEC if required.

The Slaty Box – Grey Gum shrubby woodland (HU618) within the Gilgal property is also considered to meet the definition of the Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion VEC listed under the BC Act (NSW Scientific Committee 2017) due to the following:

- it occurs on exposed footslopes at the interface of Triassic sandstone and Permian sediments in the Sydney Basin Bioregion;
- it forms a woodland community dominated by Slaty Gum/Box with a native, sparse ground cover.

HU618 is also considered to meet the definition of the Central Hunter Valley eucalypt forest and woodland CEEC (DotEE 2015) listed under the EPBC Act due to the following:

- it occurs on lower hillslopes on soils derived from Permian sedimentary rocks;
- it is a woodland with a projected canopy cover greater than 10% which is dominated by Slaty Gum/Box;
- a ground layer is present as a sparse layer of native grasses, herbs and shrubs;
- the vegetation community patch (inclusive of the surrounding area) is greater than 0.5 ha, with greater than 70% of the perennial vegetative cover in each layer being native, including at least 12 native understorey species.

BioMetric surveys

The BioMetric results from each plot are presented below in **Table I-6**. A full flora species list was compiled. A total of 262 individual species were recorded during the BioMetric vegetation surveys comprising 240 native and 22 exotic species.

Table I-6: Biometric plot results

BVT No.	Site	NSR	NOS	NMS	NGCG	NGCS	NGCO	EC	NTH	OR	FL
CW242	GV04	15	3.5	0	0	2	0	6	1	121	3.5
	GV08	27	0	0	2	12	0	0	1	85	0
	GV19	18	1	0	0	6	0	3	1	125	1
	GV28	28	7	6	10	10	0	7	1	63	7
	GV33	22	13	0	4	6	0	2	1	78	13
	GV35	19	1.5	18	0	6	0	2	1	44	1.5
HU618	GV06	18	28.7	0	0	0	0	0	1	1	9
	GV11	17	25	0	0	0	2	0	2	1	35
	GV32	29	15.5	9	0	2	14	0	3	1	61
	GV34	24	12.5	10	4	2	18	0	2	1	64
HU693	GV07	21	49	11	6	0	44	0	0	1	15
HU702	GV13	32	16	6	4	16	0	0	1	1	0
	GV14	27	17	2.2	2	0	14	0	0	1	45
	GV15	30	11.5	2	2	4	6	0	0	1	6
	GV30	21	20	8	2	2	6	0	6	1	58
	GV31	22	19	17.5	0	10	12	0	1	1	95
	GV40	24	15.5	6	36	0	20	0	0	1	42
HU707	GV22	37	14.7	1.4	22	0	1	0	0	0.66	73
	GV23	28	13.1	3.5	20	0	11	0	1	0.66	95
	GV24	27	12.3	1.4	8	2	0	0	2	0.66	68
HU713	GV16	21	4.5	12.2	2	4	8	0	0	1	75
	GV17	26	12	13	24	2	34	0	1	1	105
	GV18	34	48	2	12	2	12	0	0	1	35
	GV21	17	35	0	34	2	20	0	0	1	55
HU714	GV36	44	26.5	1	48	0	18	0	0	1	35
	GV39	31	18	1	46	0	8	0	1	1	32
	GV41	43	24	0	26	0	24	0	1	1	54
HU801	GV01	40	10	5	28	0	22	0	0	1	50
	GV02	29	22.5	3.2	10	0	14	0	2	1	70
	GV03	23	0	0	72	0	8	14	0	1	0
HU820	GV12	21	15.7	1.9	10	9	8	0	0	1	0
	GV25	28	10.2	1.7	56	0	6	0	1	1	57
	GV27	24	22.5	5	4	2	0	0	1	1	61
HU889	GV05	20	19.5	4	0	0	3	0	6	1	49
	GV09	21	11.5	14.7	0	0	4	0	3	1	46
	GV10	26	17.5	1.3	0	2	4	0	2	1	65
	GV20	24	12.5	7	0	2	10	0	3	1	70
	GV29	19	14	3.5	0	2	4	0	7	1	64
HU893	GV37	15	0	30	4	52	8	0	0	1	0
	GV38	17	19.5	2	38	2	10	0	0	1	48

Threatened flora

Threatened flora species were opportunistically recorded, where encountered, across the Gilgal property. Ausfeld's Wattle was recorded extensively within the patch of Red Ironbark – Black Cypress Pine – stringybark +/- Narrow-leaved Wattle shrubby open forest (HU707) in the southern section of the property (**Figure 23**). This species is listed as vulnerable under the BC Act. No targeted surveys were conducted for potentially occurring threatened flora species.

Threatened fauna

A range of threatened woodland birds were opportunistically recorded throughout the Gilgal property with their species and locations presented in **Figure I-4**. Searches for Koala scats and scratches were undertaken at random, targeting both White Box and Grey Gum trees which are listed as primary feed tree species under SEPP 44 (NSW Government 1995). No evidence of Koala habitation was observed as a result of these searches.

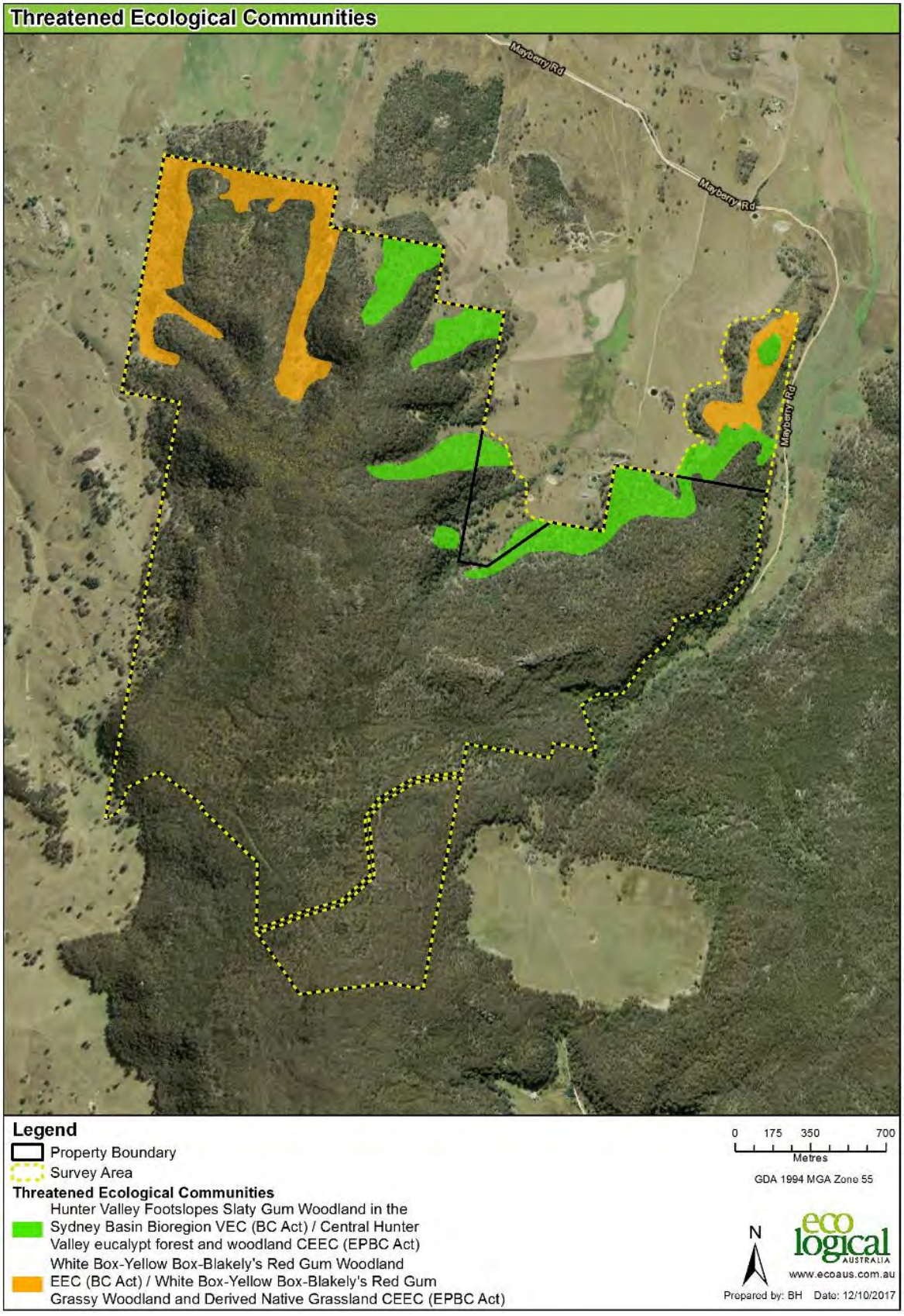

Figure I-3: Threatened Ecological Communities present at the Gilgal property

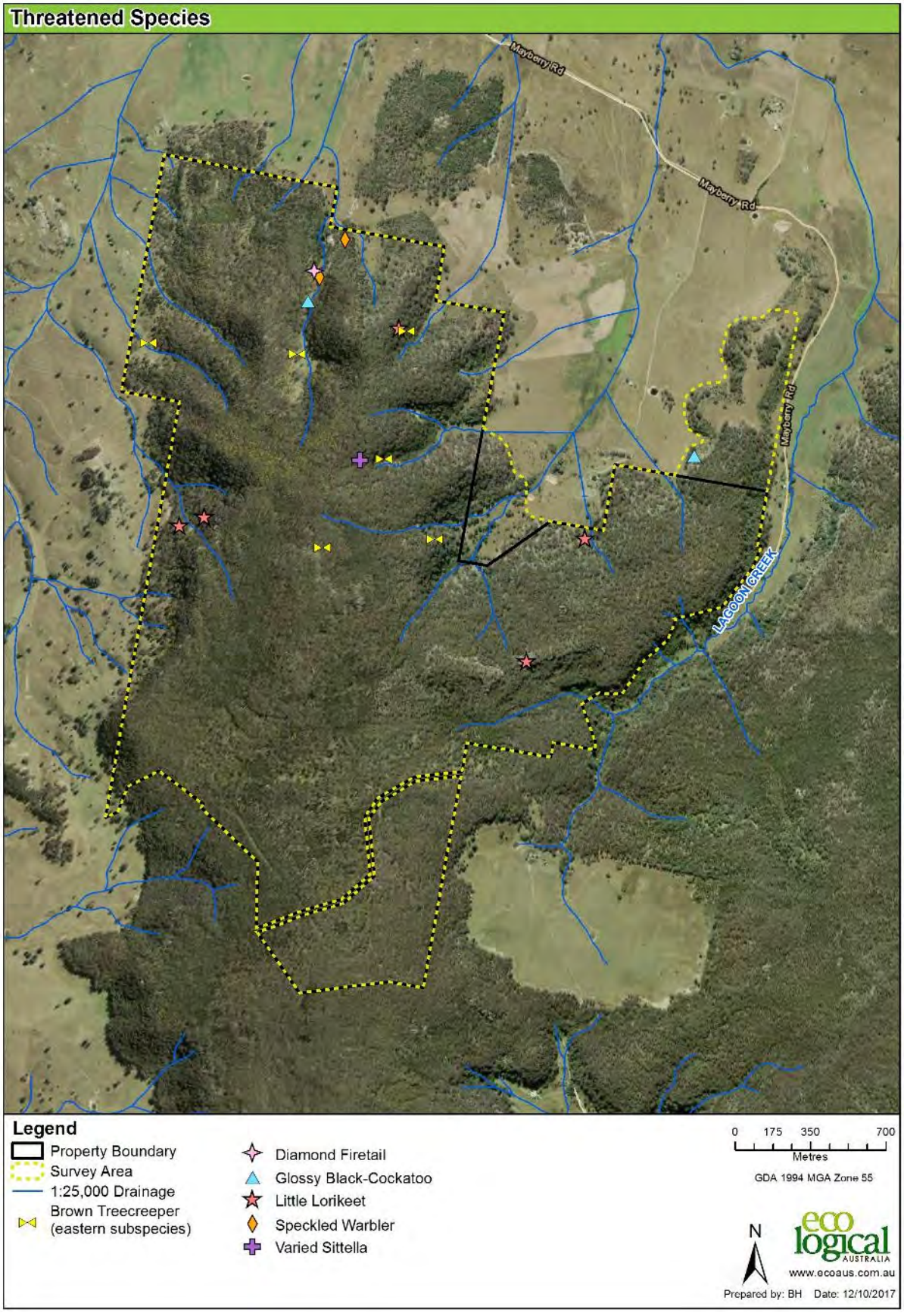

Figure I-4: Threatened flora and fauna species observed at the Gilgal property

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