Appendix P

Biodiversity Development Assessment Report

HANSEN BAILEY

MAY 2021

BOGGABRI COAL MINE – MODIFICATION 8

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

Question today
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Boggabri Coal Mine – Modification 8
Biodiversity Development Assessment Report

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REV	DATE	DETAILS
A	4/09/2020	Draft – BDAR Stage 1
B	10/09/2020	Draft – BDAR Stage 1 and Stage 2
C	6/10/2020	Draft – Hansen Bailey comments addressed
D	7/12/2020	Draft – Boggabri Coal Operations Pty Limited comments addressed. Inclusion of additional MNES information from DAWE pre-lodgement meeting
E	1/04/2021	Draft – Inclusion of additional GDE information
F	5/05/2021	Final

	NAME	DATE	SIGNATURE
Prepared by:	Tanya Bangel, Nathan Cooper, Troy Jennings	4/09/2020	
Reviewed by:	Toby Lambert	10/09/2020	
Approved by:	Alex Cockerill	14/09/2020	

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GLOSSARY

Avoid	Measures taken by a proponent such as careful site selection or actions taken through the design, planning, construction and operational phases of the development to completely avoid impacts on biodiversity values, or certain areas of biodiversity.
Biodiversity credits	Ecosystem credits or species credits
Biodiversity Credit Report	The report produced by the Biodiversity Credit Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site (OEH, 2017).
Biodiversity offsets	Management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development.
Biodiversity value	Are the following values: — vegetation integrity--being the degree to which the composition, structure and function of vegetation at a particular site and the surrounding landscape has been altered from a near natural state — habitat suitability--being the degree to which the habitat needs of threatened species are present at a particular site biodiversity values, or biodiversity-related values, prescribed by the regulations.
Development footprint	Refers to the area that would be directly impacted by both construction and operation of the proposal including all proposal infrastructure elements as well as locations for construction elements such as access tracks and site access points, laydown and staging areas and site offices. Disturbance area has the same meaning as 'Development site' as defined in the BAM.
Ecosystem credit	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at a biodiversity stewardship site.
Ecosystem credit species	A measurement of the value of threatened species habitat for species that can be reliably predicted to occur with a PCT (OEH, 2017).
Groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface i.e. the water table marks the upper surface of groundwater systems.
Hollow bearing tree	A living or dead tree that has at least one hollow. A tree is considered to contain a hollow if: (a) the entrance can be seen; (b) the entrance width is at least 5cm; (c) the hollow appears to have depth (i.e. you cannot see solid wood beyond the entrance); (d) the hollow is at least 1m above the ground. Trees must be examined from all angles.
IBRA region	A bioregion identified under the Interim Biogeographic Regionalisation for Australia (IBRA) system3, which divides Australia into bioregions on the basis of their dominant landscape-scale attributes.
IBRA subregion	A subregion of a bioregion identified under the IBRA system.

Indirect impact	An impact on biodiversity values that occurs when development related activities affect threatened species, threatened species habitat, or ecological communities in a manner other than direct impact. Compared to direct impacts, indirect impacts often: — occur over a wider area than just the site of the development — have a lower intensity of impact in the extent to which they occur compared to direct impacts — occur off site — have a lower predictability of when the impact occurs — have unclear boundaries of responsibility (OEH, 2017).
Local population	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately (OEH, 2017).
Minimise	A process applied throughout the development planning and design life cycle which seeks to reduce the residual impacts of the proposal on biodiversity values.
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000.
Mitigation	Action to reduce the severity of an impact.
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Native vegetation	Means any of the following types of plants native to New South Wales: — trees (including any sapling or shrub or any scrub) — understorey plants — groundcover (being any type of herbaceous vegetation) — plants occurring in a wetland.
Patch size	an area of intact native vegetation that: — occurs on the development site or biodiversity stewardship site — includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤30m for non-woody ecosystems). Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site.
PCT classification system	The system of classifying native vegetation approved by the NSW Plant Community Type Control Panel and described in the BioNet Vegetation Classification.
Plant community type	A NSW plant community type identified using the PCT classification system.
Population	A group of organisms, all of the same species, occupying a particular area.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Species credit species	Threatened species that are assessed in accordance with section 6.4 of the BAM.
Stage 1: Biodiversity Assessment	Stage 1 of the Biodiversity Assessment Method. It establishes a single consistent approach to assessing the biodiversity values on land subject to the proposal.

Stage 2: Impact Assessment	Stage 2 of the Biodiversity Assessment Method. It provides for an impact assessment on biodiversity values on land subject to the proposal.
Species credit	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection.
Species credit species	Are threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits.
Threatened Biodiversity Data Collection	Part of the BioNet database, published by EES and accessible from the BioNet website at www.bionet.nsw.gov.au
Threatened ecological community	Means a critically endangered ecological community, an endangered ecological community or a vulnerable ecological community listed in Schedule 2 of the BC Act.
Threatened species	Critically endangered, endangered or vulnerable threatened species as defined by Schedule 1 of the BC Act, or any additional threatened species listed under Part 13 of the EPBC Act as critically endangered, endangered or vulnerable.
Vegetation class	A level of classification of vegetation communities defined in Keith (2004). There are 99 vegetation classes in NSW.
Vegetation formation	A broad level of vegetation classification as defined in Keith (2004). There are 16 vegetation formations and sub-formations in NSW.
Vegetation integrity	The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT.
Vegetation integrity score	The quantitative measure of vegetation condition.
Vegetation type	A NSW plant community type
Vegetation zone	A relatively homogenous area of native vegetation that is the same PCT and broad condition state.

ABBREVIATIONS

BAM	Biodiversity Assessment Methodology
BAM-C	Biodiversity Assessment Methodology Calculator
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BCM	Boggabri Coal Mine
BCOPL	Boggabri Coal Operations Pty Limited
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	*Biosecurity Act 2015* (NSW)
BOP-C	Biodiversity Offset Payment Calculator
BOS	NSW Biodiversity Offset Scheme
BTM Complex	Boggabri, Tarrawonga and Maules Creek Mines
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
EES	Environment, Energy and Science Group
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2000 (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
FM Act	*Fisheries Management Act 1994* (NSW)
ha	Hectare
IAR	Idemitsu Australia Resources
IBRA	Interim Biogeographic Regionalisation for Australia
km	Kilometre
LGA	Local Government Area
m	Metre
MNES	Matters of National Significance
MOD	Modification
Mtpa	Million tonnes per annum
NSW	New South Wales
PA	Project Approval granted under the former Part 3A of the EP&A Act

PCT	Plant Community Type
ROM	Run of Mine
TEC	Threatened Ecological Community
TBDC	Threatened Biodiversity Data Collection

1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Boggabri Coal Mine (BCM) is an open cut coal mine located approximately 15 km north east of the Boggabri township in north-western New South Wales (NSW) (Figure 1.1). Boggabri Coal Operations Pty Ltd (BCOPL) has operated BCM on behalf of Idemitsu Australia Resources (IAR) and its joint venture partners since 2006.

BCM Extension was granted Project Approval (PA) 09_0182 from the Planning Assessment Commission under the former Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) on 18 July 2012. BCM operates within the Leard State Forest Mining Precinct and is immediately adjacent to the Tarrawonga Coal Mine in the south and Maules Creek Coal Mine in the north (Figure 1.1).

PA 09_0182 (which is now known as SSD 09_0182) is supported by the '*Continuation of Boggabri Coal Mine Environmental Assessment'* (Hansen Bailey, 2010) and is valid to December 2033. SSD 09_0182 has been modified on six occasions to date and provides approval for the following:

- Continuation of open cut mining operations at BCM for a further 21 years, until 31 December 2033.
- Production of up to 8.6 million tonnes per annum (Mtpa) product coal.
- Overburden emplacement area to a maximum height of RL 395 metres (m).
- Construction of a Coal Handling and Preparation Plant and associated auxiliary equipment including conveyors and an ultrafines plant with a capacity to process up to 4.2 Mtpa of ROM coal, including up to 3 Mtpa of ROM coal from Tarrawonga Coal Mine (subject to commercial agreement).
- Closure of a section of Leard Forest Road and widening of the private coal haul road.
- Ongoing use and upgrades to existing infrastructure (such as workshops and bathhouse), construction of additional Run of Mine (ROM) coal hoppers, the extension of coal stockpiles and the construction and operation of a borefield to supplement water supplies.
- Construction of 17 km rail spur and loop including a bridge over the Namoi River, Therribri Road and the Kamilaroi Highway to facilitate the transport of up to 10 Mtpa of product coal, including up to 8.6 Mtpa from BCM and 3 Mtpa from Tarrawonga Coal Mine (subject to commercial agreement).
- Construction of a 132 kV power line from near the Boggabri Coal Terminal to the mine infrastructure.

1.2 DESCRIPTION OF MODIFICATION 8

1.2.1 KEY MODIFICATION 8 PROPOSAL FEATURES

BCOPL seeks a modification to SSD 09_0182 under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to increase the depth of approved mining operations, and to construct a fauna movement crossing over the existing haul road at Boggabri Coal Mine (BCM) (MOD 8).

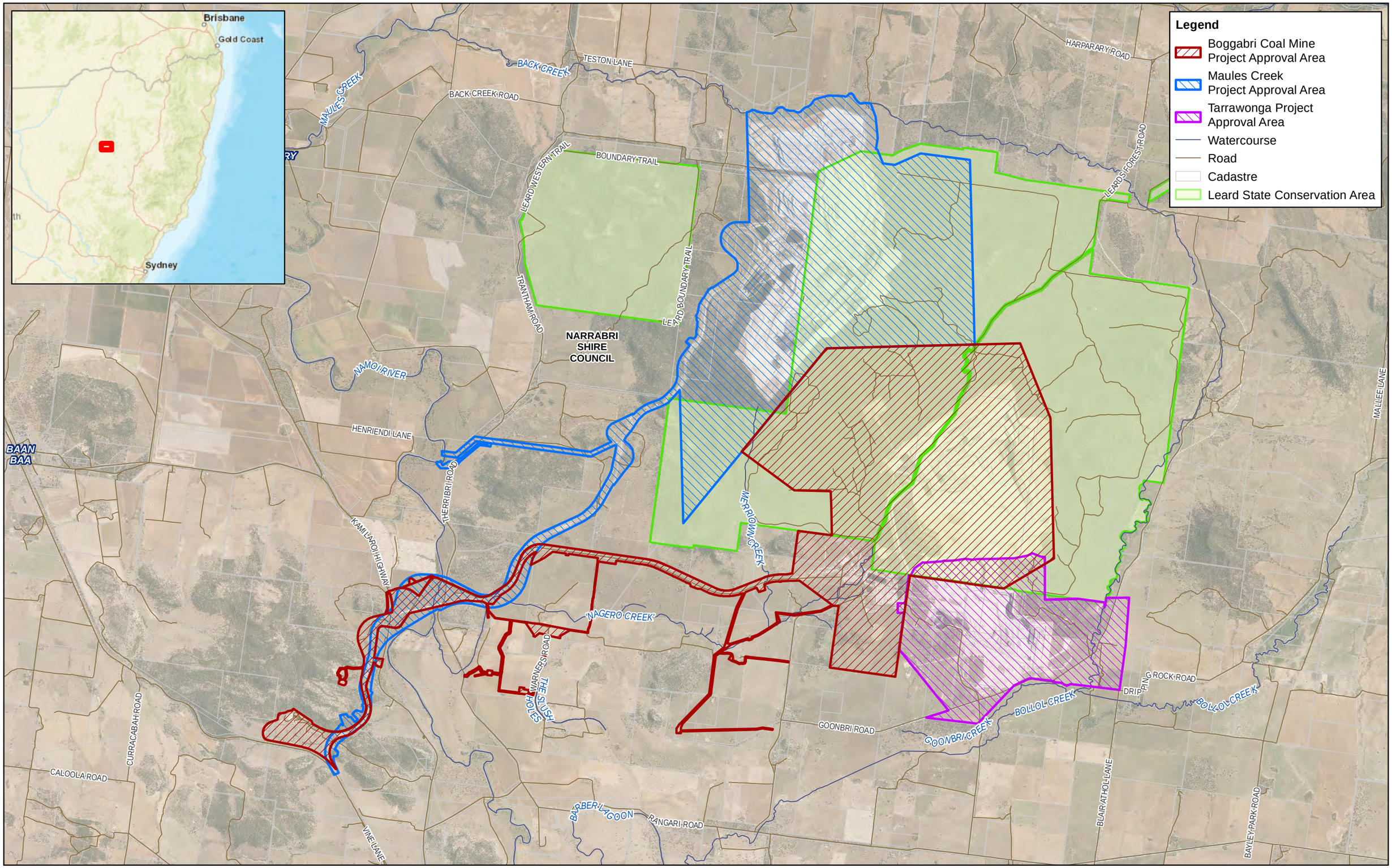
A conceptual layout of MOD 8 is shown on Figure 1.2 and generally comprises the following:

- Increasing the approved maximum depth of mining down to the Templemore Coal Seam to recover an additional 61.6 Million tonnes (Mt) of Run of Mine (ROM) coal within the currently approved Mine Disturbance Boundary. It is expected that the additional ROM coal will be suitable for producing a lower ash, higher energy thermal, semi-soft coking and pulverised coal injection (PCI) quality products for sale to the export market. This will result in the extension of the mine life by six (6) years.
- Construction of a specifically designed fauna movement crossing over the existing haul road between the overburden emplacement area (OEA) and the western side of the regional biodiversity corridor. The establishment of the fauna movement crossing is proposed to improve the movement of fauna from the Leard State Forest through the Southern Rehabilitation Area (SRA).

The current approved mining operations allow an annual ROM coal extraction of up to 8.6 Mtpa. Under MOD 8, ROM coal production will generally remain within this approved rate, however a minor increase in the currently approved maximum production rate to 9.1 Mtpa of ROM coal will be required to facilitate efficient mine planning.

The proposed changes to mining operations will remain within the currently approved Mine Disturbance Boundary. Some very minor substitution of disturbance (less than 1.21 ha) will be required to facilitate the construction of the fauna movement crossing. However, this will be immediately rehabilitated as part of the crossing construction program and overall there will be a net decrease in disturbance area of the project of approximately 2.06 ha. This proposed substitution will result in no additional offset requirements due to an existing surplus of biodiversity offsets for the BCM.

MOD 8 does not seek to make changes to various aspects of the BCM including (but not limited to): the approved Mine Disturbance Boundary, operational hours, mining methods, mining related infrastructure, coal handling, processing and transport methods and rates and access to the site. MOD 8 will facilitate the continued operations at BCM for a further six years, create additional direct and indirect employment and provide further royalties to the State Government.



0 1 2 km

Scale 1:75,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL 2017
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI,

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AUTHOR.	suansrir
EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

IDEMITSU
BOGGABRI COAL

FIGURE 1-1

TITLE. LOCATION OF PROJECT

DRAWING: \\corp.pbwan.net\ANZ\Projects\AU\PS120xxx\PS120722_Boggabri_MOD_8_Ecl5_Shared\GIS\BC2020_PS120722_BDAR_001_A1.mxd

1.2.2 MODIFICATION STUDY AREA AND DEVELOPMENT FOOTPRINT

The proposed mining activities described in Section 1.2.1 will remain within the currently approved SSD 09_0182 project boundary. There are however, some minor additional disturbances which may be required to facilitate the construction of infrastructure for the fauna movement crossing of the existing haul road. These additional disturbances, which occur outside the approved Mine Disturbance Boundary, are the subject of this Biodiversity Development Assessment Report (BDAR).

For the purposes of this report the following terminology has been used:

- **Project:** BCM project operated by BCOPL on behalf of its joint venture partners.
- **Proposed Modification:** proposed modification to the BCM project as described in Section 1.2.1.
- **Modification study area:** the development footprint and adjacent areas of vegetation and associated habitat surveyed as part of this investigation which may be subject to direct or indirect impacts as a result of the proposed Modification.
- **Development footprint:** the area of land that would be directly impacted on by the proposed Modification outside the approved Mine Disturbance Boundary. The development footprint assessed in this report includes a 300 m x 110 m area for the design and construction of a fauna movement crossing. This development footprint will facilitate the completion of a conservative assessment to allow flexibility for the fauna crossing during the detailed design phase pending engineering requirements and specifications. The final development footprint of the fauna movement crossing would be a 110 m x 110 m area (1.21 ha) within the development footprint. The final development footprint would also include the additional disturbance outside of the approved Mine Disturbance Boundary for all access roads and construction compounds required for storage of construction materials and equipment.
- **Locality:** is defined as an approximate 10 km radius around the Modification study area.

An overview depicting the facets of the proposed Modification in respect to the approved project boundary is provided in Figure 1.2.

1.3 PURPOSE OF THIS THIS TECHNICAL REPORT

This BDAR has been prepared in accordance with the Biodiversity Assessment Methodology (BAM) (Office of Environment & Heritage, 2017) and supplementary BAM Operational Manuals – Stage 1 and Stage 2 (Department of Planning Industry and Environment, 2019; Office of Environment & Heritage, 2018a) to specifically consider matters in relation to biodiversity. The purpose of this report is to describe biodiversity values present and to assess the potential impacts of the construction and operation of the proposal on biodiversity values. This BDAR supports the overarching Modification Report prepared to address the potential impacts on the environmental associated with the Modification.

The report has the following objectives:

- Provide a brief overview of the proposal and identify the proposals key legislative requirements.
- Provide a 'Stage 1 Biodiversity assessment' and 'Stage 2 Impact assessment (biodiversity values and prescribed impacts)' of biodiversity values within the Modification study area in accordance with BAM.
- Summarise steps taken to 'avoid, minimise and mitigate' impacts on biodiversity associated with the Modification.
- Identify and describe threatened species and communities pursuant to the *Fisheries Management Act 1994* (FM Act).
- Identify and describe Matters of National Significance (MNES) which occur within the Modification study area and assess the proposal's impacts on MNES entities by completing significant impact assessments pursuant to '*Matters of National Environmental Significance Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999'* (Department of the Environment, 2013).
- Identify appropriate biodiversity offsets to compensate for residual impacts on protected matters arising from the proposal in accordance with the NSW Biodiversity Offset Scheme.

1.4 STRUCTURE OF THIS REPORT

The structure and content of this report is as follows:

- Section 1 – Introduction: Outlines the background and need for the proposal, and the purpose of this report.
- Section 2 – Legislative and policy context: Provides an overview of the key legislative requirements and policy guidelines relating to the proposal.
- Section 3 – Methodology: Provides an overview of methodologies implemented as part of this biodiversity assessment.

Stage 1 – Biodiversity assessment

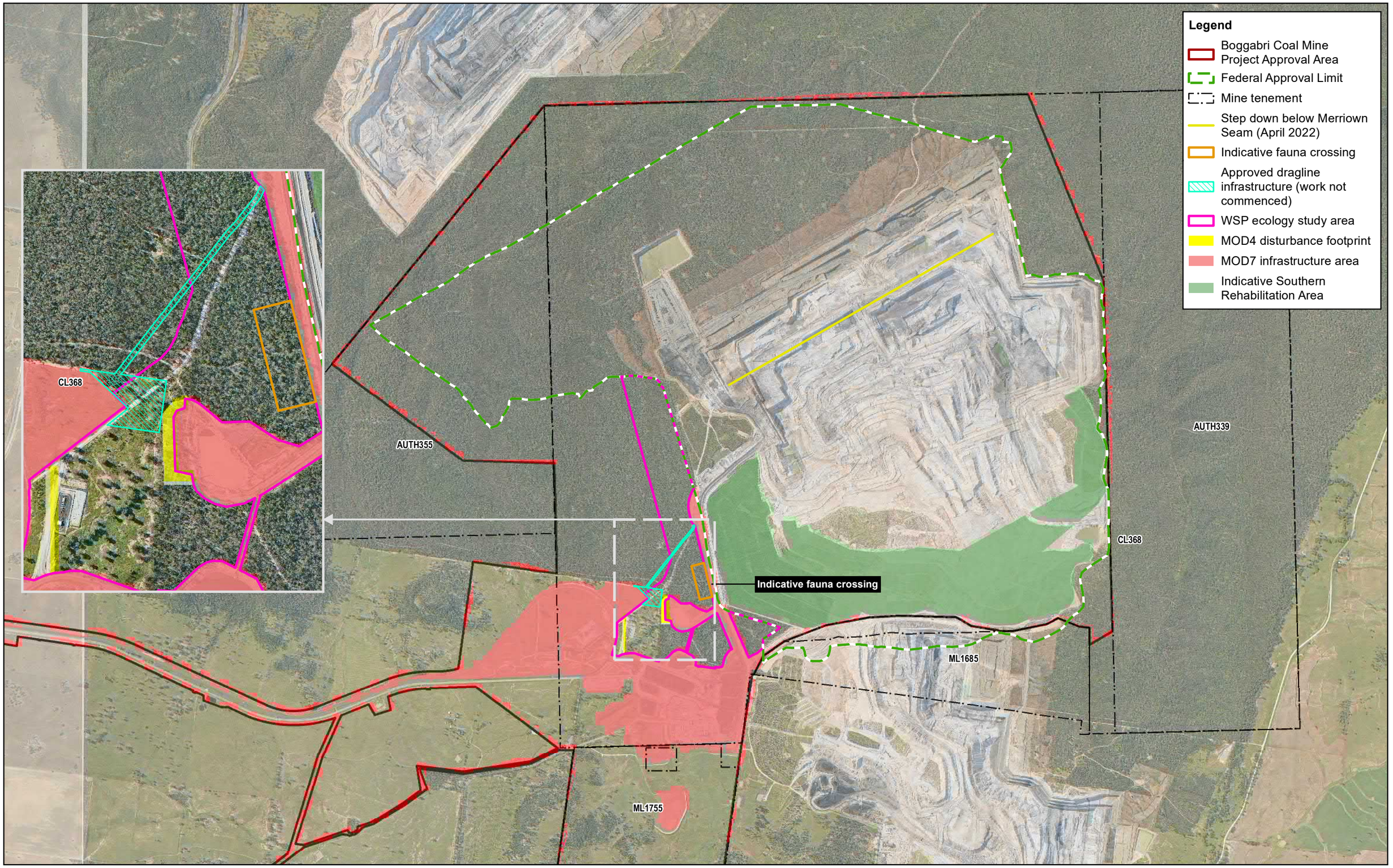
- Section 4 – Landscape context: Provides information on a range of landscape features in accordance with Section 4 of the BAM that occur on the proposal Modification study area and broader locality.
- Section 5 – Native vegetation: Provides information on native vegetation in accordance with Section 5 of the BAM and matters relating to the BC Act.
- Section 6 – Threatened species: Provides information on threatened species in accordance with Section 6 of the BAM and matters relating to the BC Act.
- Section 7 – Matters on National Environmental Significance: Describes biodiversity matters relating to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Stage 2 – Impact assessment

- Section 8 – Avoid and minimise: Provides information on avoiding and minimising impacts on biodiversity values through the planning and design phase of the proposal in accordance with Section 8 of the BAM.
- Section 9 – Impacts summary: Describes the potential construction and operational impacts associated with the proposal. This chapter also includes potential cumulative impacts with respect to other known developments within the vicinity of the proposal.
- Section 10 – Mitigation and management measures: Outlines the proposed mitigation measures for the proposal on biodiversity matters.
- Section 11 – Biodiversity credit report: Provides an overview of the Biodiversity Assessment Methodology Calculator (BAM-C) and biodiversity credit report output.
- Section 12 – Conclusion: Provides a conclusion of the potential impacts of the proposal on biodiversity.
- Section 13 – References: Identifies the key reports and documents used to generate this report.

Appendices to this report includes:

- Appendix A – Native vegetation
- Appendix B – Recorded fauna
- Appendix C – Threatened species
- Appendix D – Matters of National Environmental Significance
- Appendix E – Biodiversity Credit Report.



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Scale 1:30,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL 2020, 2017

DOCUMENT	BC2020_PS120722_BDAR_002_A3
AUTHOR.	suansrir
EDITED BY.	SuansriR
DATE.	2020-12-04

IDEMITSU
BOGGABRI COAL

FIGURE **1-2**

TITLE. **PROJECT AND MODIFICATION 8 LAYOUT**

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1.5 CURRENCY OF BIODIVERSITY ASSESSMENT REPORT

I Tanya Bangel (BAM Accredited Assessor (BAAS18076)) certify that this BDAR has been prepared on the basis of the requirements of (and information provided under) the current biodiversity assessment method dated October 2020 available from https://www.environment.nsw.gov.au/research-and-publications/publications-search/biodiversity-assessment-method.

2 LEGISLATIVE CONTEXT

2.1 COMMONWEALTH

2.1.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

Under the EPBC Act, any action that has, would have, or is likely to have a significant impact on a Matter of National Environmental Significance (MNES) or on Commonwealth land, triggers the Act and may require assessment and approval from the Commonwealth Minister for the Environment.

The nine MNES protected under the EPBC Act are:

- listed threatened species and ecological communities
- listed migratory species
- wetlands of international importance (listed under the Ramsar Convention)
- Commonwealth marine areas
- world heritage properties
- national heritage places
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

Based on the potential impacts of the Modification to EPBC Act listed threatened species and water resources, a referral under the EPBC Act is being prepared and will be submitted to the Department of Agriculture, Water and the Environment (DAWE) to determine whether it comprises a controlled action.

2.2 STATE

2.2.1 BIODIVERSITY CONSERVATION ACT 2016

The BC Act, together with the NSW Biodiversity Conservation Regulation 2017 (BC Regulation), outlines the framework for assessment and approval of biodiversity impacts associated with developments that require consent under the EP&A Act.

The Biodiversity Offsets Scheme (BOS) has been established under the BC Act to provide a framework to avoid, minimise and offset impacts on biodiversity from development and clearing. The proponent for a development to which the BOS applies is required to prepare a BDAR in support of an application for approval to undertake that development. The BDAR uses the BAM to provide a methodology for determining the number and type of biodiversity credits required to offset biodiversity impacts.

Application of the BOS is required where a proposal exceeds the following BOS thresholds:

- Where the area of native vegetation being cleared exceeds the threshold areas identified in Table 2.1; or
- Whether the impacts occur within an area where significant biodiversity values have been identified on the Biodiversity Values Map published by the Minister of Environment; or
- Where the impacts are likely to result in a significant impact on any threatened species, populations or ecological communities.

Table 2.1 BOS area clearing thresholds

MINIMUM LOT SIZE ASSOCIATED WITH THE LAND	THRESHOLD FOR CLEARING, ABOVE WHICH THE BAM & BOS APPLY	ASSESSMENT UPDATE[1]
Less than 1 ha	0.25 ha or more	The development footprint is largely located within land zoned as RU3 (Forestry) under the Narrabri Local Environment Plan 2012. Lot Size Map Sheet LSZ_004 does not have a minimum lot size for areas of land within Leard State Forest (LSF) zoned as RU3. Land surrounding LSF is zoned as having a minimum lot size of 100 ha, including the southern extent of the Modification study area. A worst case vegetation clearing scenario of approximately 3.31 ha associated with the proposed Modification exceeds the BOS threshold; as such the BAM is triggered.
1 ha to less than 40 ha	0.50 ha or more	
40 ha to less than 1,000 ha	1 ha or more	
1,000 ha of more	2 ha or more	

(1) The development footprint (3.31 ha) was selected to enable flexibility in the detailed engineering design, micro-siting of fauna connectivity structures and represents a worst case scenario. It estimated that a final disturbance footprint of 1.21 ha (110 m x 110 m) will be required for construction of the Modification.

An assessment of the development footprint against the BOS thresholds concluded that the proposed Modification does trigger assessment in accordance with BAM via the preparation of a BDAR as it exceeds the following thresholds:

- Native vegetation removal is likely to exceed the minimum lot size clearing area threshold (i.e. Modification is likely to impact greater than 1 ha of native vegetation within land which has a minimum lot size of 100 ha).

This BDAR has been specifically prepared to address the BAM and associated guidance documents to enable approval of the proposed Modification under Section 4.55 of the EP&A Act.

2.2.2 BIOSECURITY ACT 2015

The NSW *Biosecurity Act 2015* (Biosecurity Act) provides for risk-based management of biosecurity in NSW. It provides a statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter.

In NSW, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.

Priority weeds recorded in the Modification study area and their control measures are detailed in Section 5.3.

2.2.3 ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

The EP&A Act provides the statutory controls that establish a framework governing what development is permitted or prohibited, and the processes for how assessment and gaining approval for development is undertaken in NSW. It is supported by the NSW Environmental Planning and Assessment Regulation 2000 (EP&A Regulation) which provides additional detail and gives effect to the legislation.

Of relevance to the proposed Modification is Section 4.55 (formerly Section 96) of the EP&A Act, which deals with Modifications to consents of existing approved projects.

2.2.4 FISHERIES MANAGEMENT ACT 1994

The *Fisheries Management Act 1994* (FM Act) was introduced to conserve, develop and share the fishery resources of the State for the benefit of present and future generations. The Act provides for the listing of threatened species, populations and ecological communities, listing of 'Key Threatening Processes', and the requirements to assess potential impacts on aquatic resources.

One of the objectives of the FM Act is to 'conserve key fish habitats ', which includes aquatic habitats that are important to the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. To assist in the protection of key fish habitats, the Department of Primary Industries (DPI) has produced the *'Policy and guidelines for fish habitat conservation and management'* (Department of Primary Industries, 2013). This policy applies to the following developments, works or activities, each of which can impact on key fish habitat:

- dredging or reclamation
- impeding fish passage
- damaging marine vegetation
- de-snagging.

Part 7 of the FM Act relates to the protection of fish and aquatic habitats with the objective of conserving the biodiversity of fish and aquatic vegetation. It provides for the management of certain works located on land that is permanently or intermittently submerged by water. Pursuant to sections 201, 205 and 219 of the FM Act, works and activities such as those listed above, may be undertaken under the authority of a permit.

The proposed Modification will not result in any direct impacts to natural aquatic habitats. Nevertheless, Section 6.4 addresses biodiversity matters relating to threatened aquatic entities listed under the FM Act.

2.2.5 LOCAL LAND SERVICES ACT 2013

The LLS Act was introduced to provide direction around programs and services associated with agricultural production, biosecurity, natural resource management and emergency management. It aims to ensure the proper management of natural resources in the social, economic and environmental interests of the State, consistent with the principles of ecologically sustainable development. One of the ways that it intends to achieve this is through the regulation of clearing of native vegetation. Part 5A of the LLS Act sets out the ways in which the regulation of activities (associated with land management) would occur and the areas of the State to which they would apply. Section 60A identifies rural areas to which Part 5A apply, which includes land associated with the Modification study area.

Under the BC Act, Section 6.8(3) regulates that the BAM is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land (within the meaning of Part 5A Section 60H of LLS Act).

Category 1-exempt land is defined under the LLS Act (Part 5A Division 2 Section 60H) as:

Land is to be designated as Category 1-exempt land if the Environment Agency Head reasonably believes that:

- *the land was cleared of native vegetation as at 1 January 1990, or*
- *the land was lawfully cleared of native vegetation between 1 January 1990 and the commencement of this Part.*

Land is to be designated as Category 1-exempt land if the Environment Agency Head reasonably believes that:

- *the land contains low conservation value grasslands, or*
- *the land contains native vegetation that was identified as regrowth in a property vegetation plan referred to in section 9 (2) (b) of the Native Vegetation Act 2003, or*
- *the land is of a kind prescribed by the regulations as Category 1-exempt land.*

All other rural lands that do not meet Category 1 definition would form part of Category 2 – regulated land or excluded lands as defined under the LLS Act. This BDAR applies to all lands containing native vegetation with the exception of Category 1 – exempt land. The method for considering Category 1 – exempt land for this Modification is outlined in Section 5.1.

3 METHODOLOGY

This section provides a detailed description of the methodologies used in the preparation of this BDAR. Methodologies used included a combination of desk-based searches of relevant databases and historical records, as well as a field inspection of the Modification study area to identify and assess biodiversity values in accordance with Stage 1 and Stage 2 of the BAM.

All work was carried out under the appropriate licences, including scientific licences as required under Part 2 of the BC Act (License Number: SL100630) and an Animal Research Authority issued by the DPI (Agriculture).

3.1 PERSONNEL

The contributors to the preparation of this paper, their qualifications and roles are listed in Table 3.1.

Table 3.1 Personnel

NAME	QUALIFICATIONS	POSITION AND ROLE
Alex Cockerill	Bachelor of Science (Hons), Accredited BAM Assessor (BAAS17020)	Principal Ecologist – technical review, project director
Nathan Cooper	Bachelor of Environmental Science, Graduate Diploma Ornithology and has completed BAM training	Senior Ecologist – project manager, technical review
Toby Lambert	Bachelor of Environmental Science, Accredited BAM Assessor (BAAS17046)	Principal Ecologist – technical review
Tanya Bangel	Bachelor of Environmental Management and Science (Hons), Diploma of Conservation and Land Management, BAM Accredited Assessor (BAAS18076)	Senior Ecologist – field survey, report preparation and BAM calculations
Allan Richardson	Bachelor of Environmental Science (Hons) and has completed the BAM training	Senior Ecologist – field survey
Julia Emerson	Bachelor of Environment, Certificate 3 Conservation and Land Management, BAM Accredited Assessor (BAAS18034)	Ecologist – field survey
Troy Jennings	Master of Wildlife Management, Bachelor of Biodiversity and Conservation, Certificate 3 Conservation and Land Management, BAM Accredited Assessor (BAAS18172)	Ecologist – field survey and reporting
Clementine Watson	Bachelor of Environmental Science and Management, BAM Accredited Assessor (BAAS18186)	Ecologist – field survey and reporting
Gavin Shelley	Bachelor of Environmental Science and Management	Ecologist – field survey
Emily Mitchell	Bachelor of Development Studies, Master of Information Technology	GIS Consultant – data management and figure preparation
Robert Suansri	Bachelor of Science	Senior GIS Consultant – data management and figure preparation

3.2 NOMENCLATURE

Names of vegetation communities used in this report are based on the Plant Community Type (PCT) used in the NSW BioNet Vegetation Classification Database (Environment Energy and Science Group, 2020c).

These names are cross-referenced with those used for threatened ecological communities listed under the BC Act and/or the EPBC Act.

Names of plants used in this document follow PlantNet (Royal Botanic Gardens, 2020). Scientific names are used in this report for species of plant. The names of introduced species are denoted with an asterisk (*).

For threatened species of plants, the names used in the BioNet Atlas of NSW Wildlife (Environment Energy and Science Group, 2020b) are also provided where these differ from the names used in the PlantNet database.

Names of vertebrate fauna follow the Australian Faunal Directory maintained by the DAWE (2020a). Common names are used in the report for species of animal. Both common and scientific names are provided in appendices.

For threatened species of animals, the names used in the BioNet Atlas of NSW Wildlife and DPI Spatial Data Portal (2020a) are provided.

3.3 SOURCES OF INFORMATION USED IN THIS ASSESSMENT

3.3.1 SPATIAL AND REGIONAL SPECIFIC DATA

The following information sources were used to inform the preparation of this report:

- Aerial photographic imagery taken 31/3/2020 and supplied by BCOPL.
- Boggabri Operations Viewer (WSP, 2020c).
- NSW Mitchell Landscapes (Department of Planning Industry and Environment, 2020a).
- Interim Biogeographic Regionalisation of Australia (IBRA version 7.0) (Department of the Environment and Energy, 2016).
- Atlas of Groundwater Dependent Ecosystems (GDE) (Bureau of Meteorology, 2020).
- Directory of Important Wetlands of Australia (Department of Environment and Energy, 2020b).
- Register of Declared Areas of Outstanding Biodiversity Value – Critical habitat declarations in NSW (Environment Energy and Science Group, 2020a).
- Register of Critical Habitat (Department of Agriculture Water and the Environment, 2020c).
- State Vegetation Type Map: Boarder Rivers Gwydir / Namoi Region Version 2.0. VIS_ID 4467 (Office for Environment & Heritage, 2016).
- BioNet Threatened Species Profile Database (Environment Energy and Science Group, 2020d).
- BioNet Atlas of NSW Wildlife (Environment Energy and Science Group, 2020b).
- BioNet Vegetation Classification Database (Environment Energy and Science Group, 2020c).
- EPBC Act Protected Matters Search Tool (Department of Environment and Energy, 2020c).
- Species Profiles and Threats Database (Department of Agriculture Water and the Environment, 2020d).
- NSW Flora Online (PlantNet) (Royal Botanic Gardens, 2020).
- Atlas of Living Australia – interactive map search (Atlas of Living Australia, 2020).

3.3.2 PREVIOUS SURVEYS AND ASSESSMENTS

Biodiversity values within and immediately surrounding the LSF have been subject to an array of previous survey and assessment as part of the establishment and ongoing operation of the BCM, Tarrawonga Coal Mine and Maules Creek Coal Mine projects. Previous ecological survey and assessment that have been considered in the preparation of this report are provided in Table 3.2.

Table 3.2 Previous ecological investigations

ECOLOGICAL INVESTIGATION	YEAR	REFERENCE
Annual Biodiversity Monitoring of Leard State Forest	2006 to 2019	WSP (2020a); WSP (2019a); WSP (2018a); WSP Parsons Brinckerhoff (2017a); WSP Parsons Brinckerhoff (2016b); Parsons Brinckerhoff (2014c); Parsons Brinckerhoff (2014b); Parsons Brinckerhoff (2013b)
Annual Monitoring of Leard State Forest Biodiversity Corridor	2013 to 2019	WSP (2020d); WSP (2019b); WSP (2017); WSP Parsons Brinckerhoff (2016a); Parsons Brinckerhoff (2015a); Parsons Brinckerhoff (2014a); Parsons Brinckerhoff (2013a)
Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment	2010	Parsons Brinckerhoff (2010a)
Biodiversity surveys of BCM mine lease within Leard State Forest	2018 to 2020	WSP (2019d)
BCM Tree Clearing Reports	2013 to 2020	WSP (2020b); WSP (2019c); WSP (2018d); WSP Parsons Brinckerhoff (2017b); Parsons Brinckerhoff (2016); Parsons Brinckerhoff (2015c); Parsons Brinckerhoff (2015b); Parsons Brinckerhoff (2014d)
Alternative Biodiversity Corridor Strategy	2016	WSP | Parsons Brinckerhoff (2016)
Maules Creek Coal Mine Biodiversity Impact Assessment	2011	Cumberland Ecology (2011)
Tarrawonga Coal Project Environmental Assessment – Appendix E (Fauna Assessment) and Appendix F (Flora Assessment)	2011	Bower (2011); Resource Strategies and Cenwest Environmental Services (2011)

3.4 DATABASE SEARCHES

The aim of the background research was to identify threatened flora and fauna species, populations and ecological communities, Commonwealth listed migratory species or critical habitat recorded previously or predicted to occur in the locality of the Modification study area.

This allowed for known habitat characteristics to be compared with those present in the Modification study area to determine the habitat suitability of each species or population. It further enabled justification for inclusion of any additional predicted or candidate threatened flora and fauna species not identified by the BAM-C.

Records of threatened species, populations and ecological communities known or predicted to occur in the locality of the Modification study area were obtained from a range of databases as detailed in Table 3.3.

Table 3.3 Database searches

DATABASE	SEARCH DATE	AREA SEARCHES	REFERENCE
PlantNet Database	12/08/2020	Narrabri LGA	Royal Botanic Gardens (2020)
BioNet Atlas of NSW Wildlife	12/08/2020	10 km x 10 km centred on the Modification study area	Environment Energy and Science Group (2020b)
EPBC Act Protected Matters Search Tool (PMST)	12/08/2020	10 km x 10 km centred on the Modification study area	Department of Agriculture Water and the Environment (2020b)
Biodiversity Assessment Calculator (BAM-C)	06/08/2020	Based on IBRA Bioregion/ Subregions and PCT VI plot data collected and imported.	NSW Government (2020a)
Fisheries Spatial Data Portal	18/08/2020	10 km x 10 km centred on the Modification study area	Department of Primary Industries (2020a)

3.4.1 LIKELIHOOD OF OCCURRENCE ASSESSMENT

An assessment was completed to assess the likelihood of occurrence of each threatened species, population and community (threatened biodiversity) identified with the potential to occur in the Modification study area. All threatened biodiversity identified during background research conducted (refer to Table 3.3) were considered in this assessment. This likelihood of occurrence assessment was utilised to inform the identification of candidate species which would require targeted surveys.

The assessment was based on the habitat profile for the species and other habitat information in the *Threatened Biodiversity Data Collection* (TBDC) (Department of Planning Industry and Environment, 2020b) and the *Species Profile and Threats Database* (Department of Agriculture Water and the Environment, 2020d). The assessment also included consideration of the dates and locations of nearby records and information about species populations in the locality. The assessment results are provided in full in Appendix C.

For this assessment, the likelihood of occurrence of threatened and migratory species and populations was determined based on the criteria shown in Table 3.4 and Table 3.5.

Table 3.4 Likelihood of occurrence criteria for threatened flora species

LIKELIHOOD	CRITERIA
Known	The species was observed in the Modification study area either during the current survey or during another survey less than one year prior.
High	A species has a high likelihood of occurrence if: — the Modification study area contains or forms part of a large area of high-quality suitable habitat that has not been subject to recent disturbance (e.g. fire), the species is known to form a persistent soil seedbank and the species has been recorded recently (within 10 years) in the locality — the species is a cryptic flowering species that has been recorded recently (within 10 years) in the locality and has a large area of high-quality potential habitat within the development footprint that was not seasonally targeted by surveys.

LIKELIHOOD	CRITERIA
Moderate	A species has a moderate likelihood of occurrence if: — the species: — has a large area of high-quality suitable habitat in the Modification study area that has not been subject to Recent disturbance (e.g. fire) — the species is known to form a persistent soil seedbank, but — the species has not been recorded recently (within 10 years) in the locality — the species: — has a small area of high-quality suitable habitat or a large area of marginal habitat in the Modification study area That has not been subject to recent disturbance (e.g. fire) — the species is known to form a persistent soil seedbank — the species has been recorded recently (within 10 years) in the locality — the species is a cryptic flowering species, with a small area of high-quality potential habitat or a large area of marginal habitat within the development footprint, that was not seasonally targeted by surveys.
Low	A species has a low likelihood of occurrence if: — it is not a cryptic species, nor a species known to have a persistent soil seedbank species and was not detected despite targeted searches — the species is a cryptic flowering species, with a small area of high-quality potential habitat or a large area of marginal habitat within the development footprint, that was not seasonally targeted by surveys as the species has not been recorded within 50 years in the locality.
None	Suitable habitat is absent from the development footprint.

Table 3.5 Likelihood of occurrence criteria for threatened fauna species

LIKELIHOOD	CRITERIA
Known	The species was observed in the Modification study area either during the current survey or during another survey less than one year prior.
High	A species has a high likelihood of occurrence if: — the Modification study area contains or forms part of a large area of high-quality suitable habitat — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are abundant within the Modification study area — the species has been recorded recently in similar habitat in the locality — the Modification study area is likely to support resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration.

LIKELIHOOD	CRITERIA
Moderate	A species has a moderate likelihood of occurrence if: — the Modification study area contains or forms part of a small area of high-quality suitable habitat — the Modification study area contains or forms part of a large area of marginal habitat — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are sparse or absent within the Modification study area — the Modification study area is unlikely to support resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration but is likely to be used occasionally during seasonal movements and/or dispersal.
Low	A species has a low likelihood of occurrence if: — potentially suitable habitat exists but the species has not been recorded recently (previous 10 years) in the locality despite intensive survey (i.e. the species is considered to be locally extinct) — the species is considered to be a rare vagrant, likely only to visit the Modification study area very rarely; e.g. during juvenile dispersal or exceptional climatic conditions (e.g. extreme drought conditions in typical habitat of inland birds).
None	Suitable habitat is absent from the Modification study area.

3.4.2 IDENTIFICATION OF CANDIDATE SPECIES

Candidate species are those that have been assessed as having a moderate to high likelihood of occurring in the Modification study area based on desktop assessment and field assessment. Candidate species can form ecosystem credit species or species credit species as defined under the BAM:

- Ecosystem species credits: are a measurement of the value of threatened communities and habitat for those species that can be reliably predicted to occur with a PCT.
- Species credits: are generated by those species that were either recorded during field surveys (or recorded during previous surveys) or have been identified as requiring species credit offsets (as per BAM).
- Targeted surveys were undertaken for candidate species as outlined in Section 3.5.

As stated in the BAM subsection 6.4.1.17 (Office of Environment & Heritage, 2017), a candidate species credit species will be considered unlikely to occur on the study area if:

- After carrying out a field assessment of the habitat constraints or microhabitats on the study area, the assessor determines that the habitat is substantially degraded such that the species is unlikely to utilise the study area; or
- An expert report that is prepared in accordance with subsection 6.5.2 states that the species is unlikely to be present on the study area or specific vegetation zones.

A candidate species credit species that is not considered to have suitable habitat on the study area does not require further assessment on the study area (Office of Environment & Heritage, 2017). A likelihood of occurrent assessment has been undertaken for all identified threatened species in Appendix C.

3.5 FIELD SURVEY

The Modification study area was inspected during daylight and nocturnal hours by qualified ecologists over a series of survey periods between Spring 2018 and Spring 2020. The field surveys sought primarily to identify key ecological constraints by assessing the type, extent and condition of vegetation and associated habitats, especially as it pertained to threatened species and ecological communities.

The methodology of the surveys completed to inform this BDAR is detailed in the following sections.

3.5.1 SURVEY TIMING AND WEATHER CONDITIONS

Weather conditions during the field surveys varied greatly as they were conducted over a range of seasons and years. A summary of the weather conditions received within the region during the survey periods is provided in Table 3.6.

Table 3.6 Weather conditions during survey periods

DATE	TEMPERATURE		RAIN (mm)	WIND (DIRECTION / SPEED (km/hr))
	MINIMUM (°C)	MAXIMUM (°C)		
04/09/2018	8.8	19.0	6.0	N / 43
05/09/2018	7.2	21.3	11.4	NE / 43
06/09/2018	11.1	20.0	0.2	E / 22
07/09/2018	10.1	22.3	7.2	WNW / 41
24/05/2019	n/a	17.7	0	n/a
21/09/2019	15.8	28.4	0	NW / 41
22/09/2019	14.5	25.7	0	NW / 50
23/09/2019	5.5	24.4	2.4	WSW / 50
2/10/2019	8.6	27.7	0	SSE / 24
9/12/2019	20.5	38.7	0	NNW / 39
10/12/2019	19.4	40.9	0	NW / 39
11/12/2019	22.1	42.2	0	SW / 59
12/12/2019	17.4	38.4	0.6	SSW / 41
13/12/2019	18.7	35.3	0	SSE / 41
14/12/2019	16.6	36.3	0	SW / 39
15/12/2019	20.0	38.5	0	WSW / 46
11/01/2020	28.2	36.4	0	WSW / 52
12/01/2020	19.2	34.1	0	SSE / 52
13/01/2020	18.5	35.0	0	SSE / 46
14/01/2020	19.5	37.1	0	SSE / 46
15/01/2020	20.4	34.5	0	NE / 43
16/01/2020	22.4	30.7	0	S / 67
28/07/2020	9.5	13.6	1.6	NW / 28
29/07/2020	10.6	17.1	1.6	N / 17
30/07/2020	1.8	17.8	0.2	SSE / 28
31/07/2020	2.9	17.4	0	SE / 26
1/08/2020	1.8	19.2	0.2	WNW / 22

Source: Bureau of Meteorology – Gunnedah Resource Centre (Automatic Weather Station (AWS) 055024).

3.5.1.1 REGIONAL RAINFALL AND DROUGHT CONDITIONS

Over the past several years, the region has experienced severe drought conditions, not dissimilar to that experienced by the rest of the state. Table 3.7 compares the seasonal and annual rainfall means of the locality as received by the Boggabri Post Office AWS (55007).

AWS 55007 is located approximately 12 km south west of the Modification study area. The long-term mean annual rainfall (1884-2020) recorded at this weather station is 590.2 millimeters (mm). Whilst annual rainfall was lower than the long-term mean for the locality between 2017 and 2019, 2020 appears to be on a trajectory to meet the long-term annual mean.

Drought conditions are likely to have influenced the diversity and cover of all species in the ground and shrub stratum as well as the detectability of threatened flora species during the surveys carried out in 2018 and 2019. A large amount of rain was received between January and April 2020 (collectively 420.2 mm across the four-month period) which is higher than the long-term average for that time within the locality. This rainfall created more favourable conditions for field surveys completed in 2020.

Table 3.7 Rainfall averages 2015 - 2020

PERIOD	SUMMER	AUTUMN	WINTER	SPRING	ANNUAL
2015	112.8	208.2	115	155	591
2016	172.3	95.6	239	173	679.9
2017	90.5	139.1	65.4	184.5	479.5
2018	156	37.1	47	154.1	394.2
2019	2.2	151.7	21.3	42.8	218
2020	253.8	195.2	41.3*	TBC*	490.3*
Mean	**197.2**	**121.2**	**121.5**	**147.1**	**590.2**

Source: Bureau of Meteorology – Boggabri Post Office (AWS 055007). Asterisk (*) indicates that data is subject to change pending availability of future data. Mean average rainfall determined by AWS 055007 summary statistics of all years (i.e. 1884-2020).

3.5.2 FLORA SURVEYS

3.5.2.1 NATIVE VEGETATION SURVEY METHOD

METHOD FOR DETERMINING CATEGORY 1 - -EXEMPT LAND

Category 1-exempt land has not currently been mapped for use in NSW and as such native vegetation regulatory mapping has been determined based on an analysis of the following datasets:

- Historical and current aerial imagery of the proposed Modification study area.
- Historical and current land use component - NSW Land use 2017 (Department of Planning Industry and Environment, 2017). This dataset is used to classify areas as either cleared/highly disturbed, impacted affected areas of native vegetation and undisturbed or protected areas of native vegetation.
- Detectable woody vegetation clearing component - NSW Woody Vegetation Extent 2011 (Department of Planning Industry and Environment, 2018). This dataset is used to identify areas of extant remnant vegetation and cleared lands/non-woody vegetation.
- Sensitive regulated and vulnerable regulated lands on the Native Vegetation Regulatory Map Viewer (NSW Government, 2020b).
- Field validated high resolution vegetation mapping of the proposed Modification study area.
- State Vegetation Type Map: Border Rivers Gwydir / Namoi Region Version 2.0 VIS_ID 4467 (Office for Environment & Heritage, 2016).

STRATIFICATION AND VERIFICATION OF EXISTING NATIVE VEGETATION MAPPING

Preliminary mapping of vegetation community boundaries was undertaken through analysis of existing vegetation mapping and aerial photograph interpretation.

Vegetation within the Modification study area and locality has been mapped at the regional scale in:

- State Vegetation Type Map: Border Rivers Gwydir / Namoi Region Version 2.0 VIS_ID 4467 (Office for Environment & Heritage, 2016)
- Refinement of Vegetation Mapping in the Namoi Catchment: Extant and pre-European (Eco Logical Australia, 2013)
- Report on the botany, wildlife and ecology of the Leard State Forest (James B. Croft and Associates, 1983).

This mapping has been further refined within the Modification study area as part of biodiversity surveys completed for the Continuation of Boggabri Coal Mine Biodiversity Impact Assessment (Parsons Brinckerhoff, 2010b).

Data on geology, dominant canopy species, native species richness, vegetation structure and condition was collected from areas able to be accessed during field surveys to validate and refine this existing vegetation mapping to determine their associated PCT in accordance with the BioNet Vegetation Classification System (Environment Energy and Science Group, 2020c).

MAPPING OF NATIVE VEGETATION ZONES

The vegetation within the Modification study area was firstly assessed to a PCT level and then aligned to a vegetation zone which is defined in the BAM as *'an area of native vegetation on the study area that is the same PCT and has a similar broad condition state'* (Office of Environment & Heritage, 2017). A broad condition state infers that the vegetation has a similar tree cover, shrub cover, ground cover, weediness or combinations of these attributes which determine vegetation condition.

Broad condition state is used for stratifying areas of the same PCT into a vegetation zone for determining the vegetation integrity score. Broad condition states used for this report are outlined in Table 3.8.

Table 3.8 Native vegetation broad condition states

BROAD CONDITION STATE	DESCRIPTION
Intact	Vegetation structurally and floristically characteristic of assigned vegetation community. The vegetation displays resilience to weed invasion due to intact groundcover, shrub and canopy layers. Native species diversity is relatively high. Weeds may exist in this vegetation type but generally exhibit a low foliage cover or refined to minor edge effects.
Modified	Vegetation has retained a native canopy, but the mid and/or ground stratum vegetation is either absent or co-dominated by exotic species. The modified condition of this vegetation may be as a result of historic clearing and/or past/current grazing.
Shrubby regrowth	Vegetation is structurally modified and exhibits a shrubby regrowth form as a result of historic clearing. Canopy is either absent or very sparse with a dense midstorey present.
Derived	Vegetation no longer retains a native canopy or midstratum vegetation. Ground stratum vegetation is generally in good condition with <50% exotic species coverage and displaying high native species diversity. Natural regeneration of canopy and shrub species may be present in low numbers.

VEGETATION INTEGRITY PLOTS

Vegetation integrity plots were completed in accordance with BAM (Office of Environment & Heritage, 2017) and as described below. A schematic diagram illustrating the layout of each vegetation integrity plot is provided in Figure 3.1.

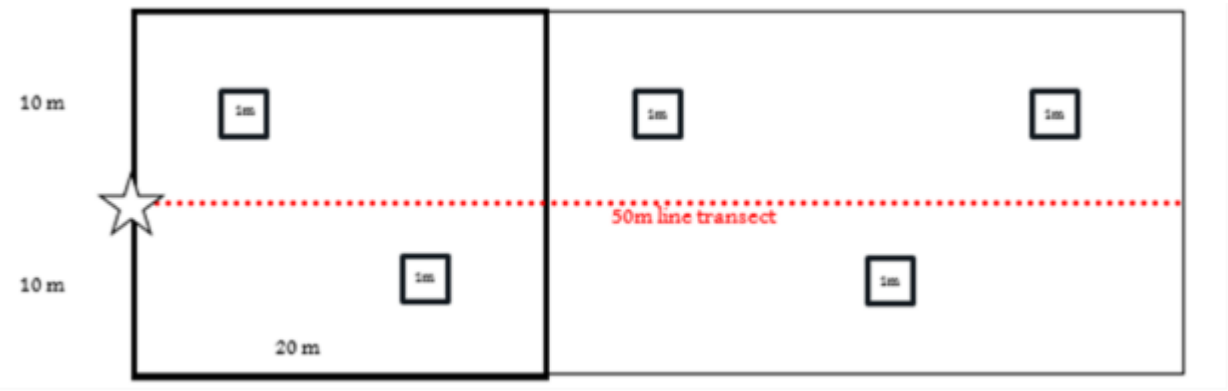


Figure 3.1 Vegetation integrity plot layout

The following site attributes were recorded at each vegetation integrity plot location:

- Location (easting – northing grid type MGA 94, Zone 56).
- Vegetation structure and dominant species and vegetation condition. Vegetation structure was recorded through estimates of percentage foliage cover, average height and height range for each vegetation layer.
- Native and exotic species richness (within a 400-metre squared quadrat): This consisted of recording all species by systematically walking through each 20 metre x 20 metre plot. The cover and abundance (percentage of area of quadrat covered) of each species was estimated. The growth form, stratum/layer and whether each species was native/exotic/high threat weed was also recorded.
- Number of trees with hollows (1000 metre squared quadrat): This was the frequency of hollows within living and dead trees within each 50 metre x 20 metre plot. A hollow was only recorded if (a) the entrance could be seen: (b) the estimated entrance width was at least 5 centimetres across: (c) the hollow appeared to have depth: (d) the hollow was at least 1 metre above the ground and the (e) the centre of the tree was located within the sampled quadrat.
- Number of large trees and stem size diversity (1000 metre squared quadrat): tree stem size diversity was calculated by measuring the diameter at breast height (DBH) (i.e. 1.3 metre from the ground) of all living trees (>5 centimetre DBH) within each 50 metre x 20 metre plot. For multi-stemmed living trees, only the largest stem was included in the count. Number of large trees was determined by comparing living tree stem DBH against the PCTs benchmarks.
- Total length of fallen logs (1000 metre squared quadrat): This was the cumulative total of logs within each 50 metre x 20 metre plot with a diameter of at least 10 centimetres and a length of at least 0.5 metre.
- Litter cover: This comprised estimating the average percentage groundcover of litter (i.e. leaves, seeds, twigs, branchlets and branches with a diameter <10 centimetre which is detached from a living plant) from within five 1 metre x 1 metre sub-plots spaced evenly either side of the 50-metre central transect.
- Evaluation of regeneration: This was estimated as the presence/absence of overstorey species present at the site that was regenerating (i.e. saplings with a diameter at breast height ≤5 centimetre).

Prior to establishing plot survey locations, vegetation stratification was undertaken to provide a representative vegetation zone for sampling. Stratification involved marking waypoints and bearings randomly to provide a representative assessment of the vegetation integrity of the vegetation zone in the Modification study area and establishing the required number of plots at some of these waypoints.

NATIVE VEGETATION SURVEY EFFORT

A total of 24 vegetation integrity plots were undertaken as outlined in the methodology contained within the BAM as described above. The location of these vegetation integrity plots is presented in Figure 3.2.

The co-ordinates, orientations and vegetation type sampled for at each plot is summarised in Table 3.9 whilst a comparison of the plots completed against BAM plot requirements is provided in Table 3.10. Full vegetation integrity plot data is presented in Appendix A.

Table 3.9 Location and orientation of vegetation integrity plots completed

PLOT ID	VEGETATION TYPE AND ZONE	EASTING[1]	NORTHING[1]	ORIENTATION
24	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Intact)	226548	6609012	330
28	PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (Intact)	225971	6610604	175
29	PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion (Intact)	226086	6610105	30
36	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Intact)	226367	6609192	120
37	PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion (Intact)	226538	6609342	270
38	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Intact)	226332	6609044	90
39	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Derived Native Grassland)	226536	6608526	315
40	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Intact)	226607	6608633	20
41	PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion (Modified)	226080	6608693	40
42	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Modified)	226190	6608985	180
43	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Shrubby Regrowth)	226108	6608903	220
44	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Modified)	226061	6608592	220
45	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Derived Native Grassland)	226145	6608661	210
46	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Intact)	227049	6608710	250

PLOT ID	VEGETATION TYPE AND ZONE	EASTING[1]	NORTHING[1]	ORIENTATION
47	PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (Intact)	226181	6610411	250
48	PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion (Intact)	226267	6610163	192
49	PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion (Intact)	226242	6609585	195
50	PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (Intact)	226376	6609591	30
51	PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (Intact)	226483	6609453	345
52	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Shrubby Regrowth)	225876	6608778	210
53	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Derived Native Grassland)	225825	6608563	10
54	PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion (Intact)	226564	6608932	120
55	PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion (Intact)	226414	6609900	315
56	PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Derived Native Grassland)	226115	6608591	290

(1) GPS Co-ordinates – Zone 56.

Table 3.10 Minimum number of vegetation integrity plots required per vegetation zone

VEGETATION TYPE	VEGETATION ZONE	EXTENT WITHIN DISTURBANCE AREA (ha)	BAM MINIMUM PLOT REQUIREMENT	PLOTS COMPLETED
PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Intact[1]	3.31	2	Q24, Q36, Q38, Q40 & Q46
	Modified	-	-	Q42 & Q44
	Shrubby regrowth	-	-	Q43 & Q52
	Derived native grassland	-	-	Q39, Q45, Q53 & Q56

VEGETATION TYPE	VEGETATION ZONE	EXTENT WITHIN DISTURBANCE AREA (ha)	BAM MINIMUM PLOT REQUIREMENT	PLOTS COMPLETED
PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Intact	-	-	Q37 & Q54
	Modified	-	-	Q41
PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Intact	-	-	Q28, Q47, Q50, Q51 & Q55
PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion	Intact	-	-	Q29, Q48 & Q49
Total		**3.31**	**2**	**24**

(1) BAM vegetation integrity plots used for BAM-C calculations included Q40 and Q46. Although Q24, Q36 and Q38 were in closer proximity to the development footprint these plots were completed during drought conditions. Conversely, Q40 and Q46 were completed in more optimal conditions following significant rainfall and were considered a more accurate depiction of biodiversity values within the development footprint.

3.5.2.2 CANDIDATE THREATENED FLORA SPECIES SURVEY METHOD

This section outlines the flora survey effort completed for candidate threatened flora species that were predicted to have a moderate to high likelihood of occurrence within the Modification study area based on the BAM-C, database searches and habitat assessments outlined provided in Appendix C.

FIELD SURVEY APPROACH

Targeted threatened flora surveys were planned using a two-phase approach, which included:

1. Designing the survey program to maximise the likelihood of detecting candidate threatened flora species. This involved grouping species as per their optimal survey periods (Environment Energy and Science Group, 2020d) and associated habitat preferences/constraints.
2. Implementing appropriate survey techniques to areas of associated habitat based on the type and number of species, likelihood of habitat to support candidate species and condition and presence of associated microhabitats. The field survey techniques used to survey candidate species included:
    a. Parallel field traverses
    b. Systematic surveys
    c. Active searches whilst completing BAM vegetation integrity plots
    d. Random meanders
    e. Opportunistic observations whilst completing other surveys.

Each of these field survey techniques is described in more detail below.

TARGETED CANDIDATE THREATENED FLORA TECHNIQUES

Most of targeted surveys for candidate threatened flora species were completed in 2019 and early 2020, prior to DPIE publishing the '*Surveying threatened plants and their habitats – NSW survey guide for the Biodiversity Assessment Method*' (2020). Due to this, the threatened flora targeted survey techniques implemented were determined by considering methods detailed in the *'NSW Guide to Surveying Threatened Plants'* (Office of Environment & Heritage, 2016). Given the scale of the proposed Modification study area and large area of potential habitat present, being over 100 ha in size, a modified version of the methods in this guideline were implemented.

Surveys completed after April 2020 were completed taking into consideration the proposed methods detailed in the '*Surveying threatened plants and their habitats – NSW survey guide for the Biodiversity Assessment Method*' (Department for Planning Industry and Environment, 2020).

PARALLEL TRAVERSES

Parallel field traverses are a technique which involve searching along a grid of parallel traverses, at set distances apart across areas of habitat to search for threatened flora species (Office of Environment & Heritage, 2016). Parallel field traverses were used across all vegetation types considered to provide the most suitable habitat for candidate threatened flora species within the Modification study area. This involved two botanists walking on a fixed bearing at a distance of 20 m apart, which was deemed appropriate given the scale of the Modification study area.

TWO-PHASE GRID-BASED SYSTEMATIC SURVEYS

Two-phase grid-based systematic surveys are a technique used to search for threatened flora species over large areas of potential habitat, which are determined as areas of suitable habitat greater than 50 ha in size. This technique involves positioning survey locations on a grid transect enabling rapid assessments across larger areas (Department for Planning Industry and Environment, 2020).

Large areas of suitable habitat requiring targeted surveys from April 2020 involved completing systematic surveys with reference to the '*Surveying threatened plants and their habitats – NSW survey guide for the Biodiversity Assessment Method*' (Department for Planning Industry and Environment, 2020).

RANDOM MEANDERS

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random meander throughout the Modification study area recording dominant and key plant species (e.g. threatened species, priority weeds), boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

Random meander surveys were conducted to complete flora habitat assessments, vegetation mapping and opportunistically search for threatened species within the areas of suitable habitat.

OPPORTUNISTIC OBSERVATIONS

Opportunistic sightings of threatened flora species were recorded during field surveys whilst completing other field surveys such as undertaking BAM vegetation integrity plots, vegetation type/condition validation etc. During these surveys, a hand-held GPS was used to record the locations of any threatened flora species observed.

SURVEY EFFORT SUMMARY

A summary of the survey effort employed to determine the presence or absence of candidate threatened flora species in accordance with Section 6 of the BAM is presented in Table 3.11.

Table 3.11 Summary of targeted candidate threatened flora survey effort

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII[3]	OPTIMAL SURVEY PERIOD (TBDC)	VEGETATION TYPES AND HABITAT CONSTRAINTS	SURVEY EFFORT
Cyperus conicus	-	E	-	No	January to May Survey notes: after rain, use flowers to identify.	PCT 88 and PCT 1313 Soils are usually sandy or silty and damp to wet.	Note: survey effort focused on areas wet/damp areas within PCT 88 and PCT 1313. Parallel field traverses — 11 to 16 January 2020 Systematic surveys — 28 July to 1 August 2020 – although outside optimal survey period region had experienced high rainfall in months prior and areas of these PCTs contained damp/wet soils during this time. Active searches during BAM plot surveys — 11 to 16 January 2020 — 28 July to 1 August 2020 Random meanders and opportunistic surveys — 11 to 16 January 2020 — 28 July to 1 August 2020
Dichanthium setosum	Bluegrass	V	V	No	November to May Survey notes: 3-4 weeks after effective rainfall, use seed-head to identify.	PCT 599, PCT 1313 and PCT 1383 Associated with heavy basaltic black soils and red-brown loams with clay subsoil.	Parallel field traverses (PCT 599, PCT 1313 and PCT 1383) — 9 to 15 December 2019 — 11 to 16 January 2020 Systematic surveys (PCT 88 and PCT 1313) — 28 July to 1 August 2020 – although outside optimal survey period region had experienced high rainfall in months prior to this survey. Active searches during BAM plot surveys (PCT 599, PCT 1313 and PCT 1383) — 9 to 15 December 2019 — 28 July to 1 August 2020

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII[3]	OPTIMAL SURVEY PERIOD (TBDC)	VEGETATION TYPES AND HABITAT CONSTRAINTS	SURVEY EFFORT
							Random meanders and opportunistic surveys (PCT 599, PCT 1313 and PCT 1383) — 9 to 15 December 2019 — 11 to 16 January 2020 — 28 July to 1 August 2020
Digitaria porrecta	-	E	-	No	January to February Survey notes: mid-January to late February, use flowers to identify.	PCT 599 and PCT 1383 Native grassland, woodlands or open forest with a grassy understorey, on richer soils.	Parallel field traverses (PCT 599 and PCT 1383) — 11 to 16 January 2020 Systematic surveys (PCT 1383) — 28 July to 1 August 2020 – although outside optimal survey period region had experienced high rainfall in months prior to this survey. Active searches during BAM plot surveys (PCT 599 and PCT 1313) — 11 to 16 January 2020 — 28 July to 1 August 2020 Random meanders and opportunistic surveys (PCT 599 and PCT 1313) — 11 to 16 January 2020 — 28 July to 1 August 2020
Lepidium aschersonii	Spiny Peppercress	V	V	No	November to April Survey notes: usually in warmer months, use fruit to identify.	PCT 88 Typically, found on ridges of gilgai clays dominated by Brigalow (*Acacia harpophylla*), Belah (*Casuarina cristata*), Buloke (*Allocasuarina luehmanii*) and Grey Box (*Eucalyptus microcarpa*).	Note: no gilgai clays within the Modification study area, survey effort focused on areas wet/damp areas dominated by *Allocasuarina luehmanii* within PCT 88. Parallel field traverses — 9 to 15 December 2019 — 11 to 16 January 2020 Systematic surveys — 28 July to 1 August 2020 – although outside optimal survey period region had experienced high rainfall in months prior to this survey.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII[3]	OPTIMAL SURVEY PERIOD (TBDC)	VEGETATION TYPES AND HABITAT CONSTRAINTS	SURVEY EFFORT
							Active searches during BAM plot surveys — 9 to 15 December 2019 — 28 July to 1 August 2020 Random meanders and opportunistic surveys — 9 to 15 December 2019 — 11 to 16 January 2020 — 28 July to 1 August 2020
Pomaderris queenslandica	Scant Pomaderris	E	-	No	All year Survey notes: flowers useful to use to identify however can be distinguished by leaf morphology.	PCT 599 and PCT 1313	Parallel field traverses (PCT 599 and PCT 1313) — 9 to 15 December 2019 — 11 to 16 January 2020 — 24 September 2020 Systematic surveys (PCT 1313) — 28 July to 1 August 2020 – although outside optimal survey period region had experienced high rainfall in months prior to this survey. Active searches during BAM plot surveys (PCT 599 and PCT 1313) — 9 to 15 December 2019 — 28 July to 1 August 2020 Random meanders and opportunistic surveys (PCT 599 and PCT 1313) — 6 to 7 September 2018 and 21 to 23 September 2019 — 24 May 2019 — 2 October 2019 — 9 to 15 December 2019 — 11 to 16 January 2020 — 28 July to 1 August 2020 — 24 September 2020

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII[3]	OPTIMAL SURVEY PERIOD (TBDC)	VEGETATION TYPES AND HABITAT CONSTRAINTS	SURVEY EFFORT
Swainsona murrayana	Slender Darling Pea	V	V	No	September	PCT 1383	Parallel field traverses — 21 to 23 September 2019 — 24 September 2020 Systematic surveys — 28 July to 1 August 2020 – although outside optimal survey period region had experienced high rainfall in months prior to this survey. Random meanders and opportunistic surveys — 6 to 7 September 2018 — 21 to 23 September 2019 — 28 July to 1 August 2020 — 24 September 2020
Thesium australe	Austral Toadflax	V	V	No	November to December	PCT 599 and PCT 1383 Occurs in grassy woodland away from the coast, often in association with *Themeda triandra* (Kangaroo Grass).	Note: targeted surveys focused on grassy woodlands and areas with *Themda triandra* within PCT 599 and PCT 1383. Parallel field traverses (PCT 1383) — 9 to 15 December 2019 Active searches during BAM plot surveys (PCT 599 and PCT 1383) — 9 to 15 December 2019 — 28 July to 1 August 2020 – although outside optimal survey period region had experienced high rainfall in months prior to this survey. Random meanders and opportunistic surveys (PCT 599 and PCT 1383) — 9 to 15 December 2019 — 28 July to 1 August 2020
Tylophora linearis	-	V	E	No	October to May Survey notes: use flowers and fruit to	PCT 88, PCT 599, PCT 1313 and PCT 1383	Note: due to surveyor's experience and knowledge of *Tylophora linearis* and species with similar appearing species within LSF, surveys were conducted all year round for this species. Prior to the

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII[3]	OPTIMAL SURVEY PERIOD (TBDC)	VEGETATION TYPES AND HABITAT CONSTRAINTS	SURVEY EFFORT
					locate and identify, easily confused with other climbers when not in flower and fruit. Surveyor observations: within the locality species is rarely observed in flower or fruit. Has been recorded year around within fertile material as part of other surveys/monitoring programs.	Surveyor observations: previously recorded in LSF from within a range of communities including PCT 1383 and PCT 1313.	commencement of each survey period a reference population within the Modification study area was inspected. This was done to ensure the species contained aboveground vegetative material thereby confirming that the species could be identified during each survey period. Parallel field traverses — 9 to 15 December 2019 — 11 to 16 January 2020 — 24 September 2020 Systematic surveys — 28 July to 1 August 2020 – although outside optimal survey period region had experienced high rainfall in months prior to this survey. Active searches during BAM plot surveys — 9 to 15 December 2019 — 28 July to 1 August 2020 Random meanders and opportunistic surveys — 6 to 7 September 2018 and 21 to 23 September 2019 — 24 May 2019 — 2 October 2019 — 9 to 15 December 2019 — 11 to 16 January 2020 — 28 July to 1 August 2020 — 24 September 2020
Androcalva procumbens	-	V	V	No	August to May	PCT 88, PCT 1313 and PCT 1383 Habitat constraints: Pilliga sandstone and sandy soils.	Note: targeted surveys focused on areas with sandier soils. Parallel field traverses — 9 to 15 December 2019 — 11 to 16 January 2020

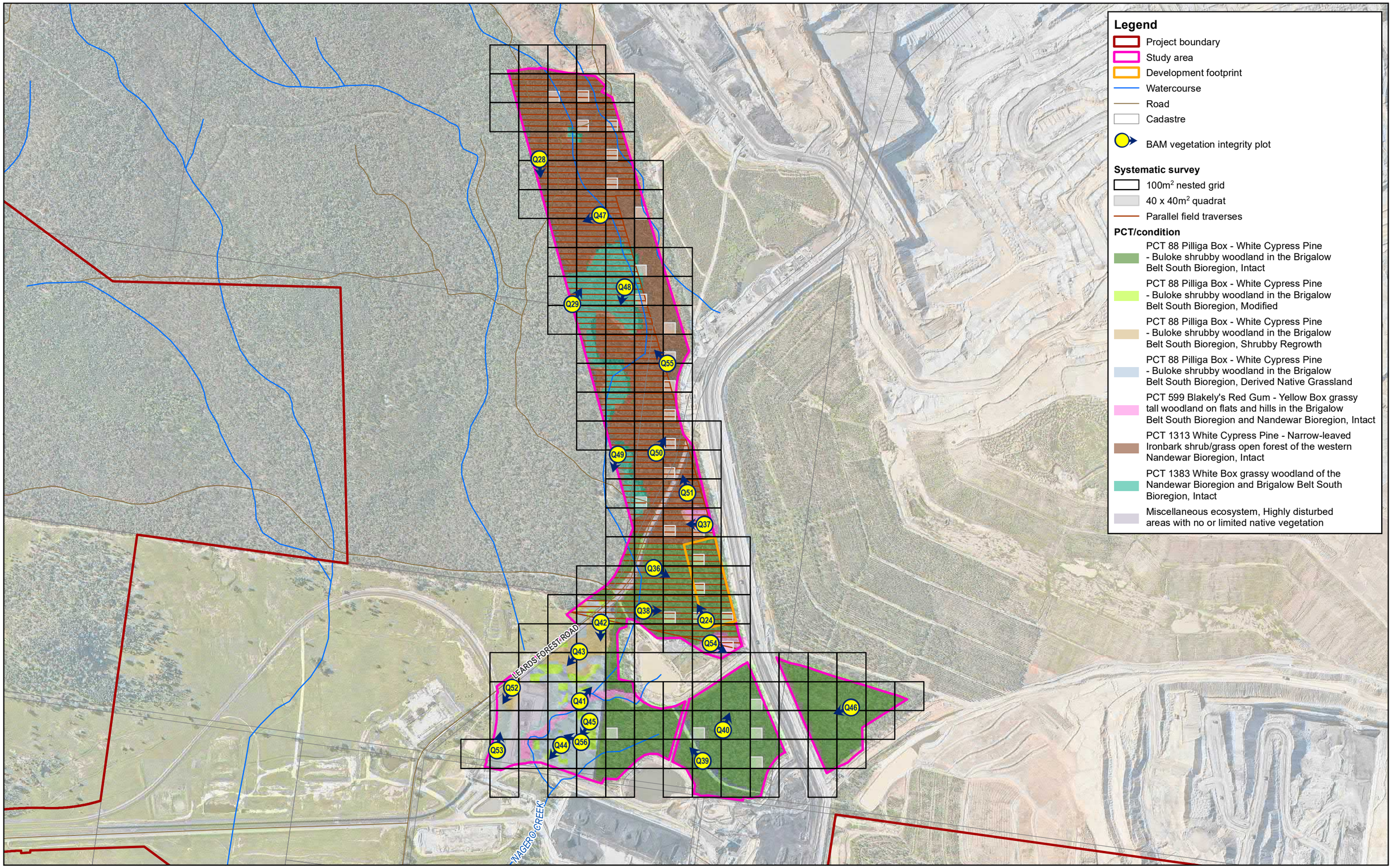
SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII[3]	OPTIMAL SURVEY PERIOD (TBDC)	VEGETATION TYPES AND HABITAT CONSTRAINTS	SURVEY EFFORT
							— September 2020 within development footprint Systematic surveys — 28 July to 1 August 2020 Active searches during BAM plot surveys — 9 to 15 December 2019 — 28 July to 1 August 2020 Random meanders and opportunistic surveys — 24 May 2019 — 6 to 7 September 2018 and 21 to 23 September 2019 — 2 October 2019 — 9 to 15 December 2019 — 11 to 16 January 2020 — 28 July to 1 August 2020
Diuris tricolor	Pine Donkey Orchid	V	-	No	September to October	PCT 88 and PCT 1313	Parallel field traverses — 24 September 2020 Systematic surveys — 28 July to 1 August 2020 - although just outside optimal survey period region had experienced high rainfall in months prior to this survey. Active searches during BAM plot surveys — 28 July to 1 August 2020 Random meanders and opportunistic surveys — 6 to 7 September 2018 and 21 to 23 September 2019 — 2 October 2019 — 28 July to 1 August 2020

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII[3]	OPTIMAL SURVEY PERIOD (TBDC)	VEGETATION TYPES AND HABITAT CONSTRAINTS	SURVEY EFFORT
							— 24 September 2020
Lepidium monoplocoides	Winged Peppercress	E	E	No	November to February Survey notes: survey about 1 month after rain and only persists for a few months, use seed-heads to identify.	PCT 88 Occurs on seasonally moist to waterlogged sites, on heavy fertile soils usually in open woodland dominated by *Allocasuarina luehmannii* (Buloke) and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box).	Note: targeted surveys focused on areas which are seasonally moist and dominated by *Allocasuarina luehmannii* and *Eucalyptus populnea* within PCT 88. Parallel field traverses — 9 to 15 December 2019 — 11 to 16 January 2020 Systematic surveys — 28 July to 1 August 2020 - although outside optimal survey period region had experienced high rainfall in months prior to this survey. Active searches during BAM plot surveys — 9 to 15 December 2019 — 28 July to 1 August 2020 Random meanders and opportunistic surveys — 9 to 15 December 2019 — 11 to 16 January 2020 — 28 July to 1 August 2020

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered

(2) Threat status under the EPBC Act: V = Vulnerable, E = Endangered

(3) SAII – Serious and Irreversible Impact species.



Legend

- Project boundary
- Study area
- Development footprint
- Watercourse
- Road
- Cadastre
- BAM vegetation integrity plot

Systematic survey

- 100m² nested grid
- 40 x 40m² quadrat
- Parallel field traverses

PCT/condition

- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, Intact
- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, Modified
- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, Shrubby Regrowth
- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, Derived Native Grassland
- PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion, Intact
- PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion, Intact
- PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, Intact
- Miscellaneous ecosystem, Highly disturbed areas with no or limited native vegetation

0 200 400 m

Scale 1:12,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL 2020

DOCUMENT	BC2020_PS120722_BDAR_003_A1
AUTHOR.	suansrir
EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

IDEMITSU BOGGABRI COAL

FIGURE **3-2**

TITLE. **NATIVE VEGETATION AND THREATENED FLORA TARGETED SURVEY EFFORT**

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3.5.3 FAUNA SURVEYS

This section outlines the fauna survey effort completed for candidate species that were predicted to have a moderate to high likelihood of occurrence within the Modification study area based on database searches outlined in section 3.4.1. Threatened fauna surveys completed within the Modification study area were carried out as described below and where applicable, considering the methodology detailed in:

- Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities – Working Draft 2004 (Department of Environment and Conservation, 2004)
- Survey Guidelines for Australia's Threatened Birds (Department of Environment Water Heritage and the Arts, 2010),
- Threatened Species survey and assessment guidelines: field survey and methods for fauna-Amphibians (Department of Environment and Climate Change, 2009)
- Survey guidelines for Australia's threatened frogs (Department of the Environment Water Heritage and the Arts, 2010)
- 'Species credit' threatened bats and their habitats – NSW survey guide for the Biodiversity Assessment Method (Office of Environment & Heritage, 2018b)
- Threatened Species Profile Database (Environment Energy and Science Group, 2020d)

Table 3.14 provides a summary of fauna surveys completed and Figure 3.3 illustrates where the fauna surveys were completed.

3.5.3.1 FAUNA HABITAT ASSESSMENTS

Fauna habitat assessments were undertaken to assess the likelihood of threatened species of animal (those species known or predicted to occur within the locality from the literature and database review) occurring within the Modification study area. Fauna habitat assessments were the primary assessment tool in assessing whether threatened species were likely to occur within the Modification study area. Fauna habitat characteristics assessed included:

- structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources
- presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, forest owls, birds and reptiles
- presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians
- presence of waterways (ephemeral or permanent) and water bodies
- presence of mad-made structures (e.g. culverts) for roosting/breeding microchiropteran bats.

The criteria were used to evaluate the condition of habitat values is outlined in Table 3.12.

Table 3.12 Fauna habitat assessment evaluation criteria

HABITAT VALUE	EVALUATION CRITERIA
Good	A full range of fauna habitat components are usually present (for example, old growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
Moderate	Some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
Poor	Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

3.5.3.2 OPPORTUNISTIC RECORDING OF FAUNA SPECIES AND EVIDENCE OF FAUNA ACTIVITY

Opportunistic sightings of animals were recorded during field surveys. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc., was also noted. This provided indirect information on animal presence and activity. During these surveys, a hand-held GPS was used to record the locations of:

- significant hollow-bearing trees
- aquatic habitat
- rock outcrops.

3.5.3.3 DIURNAL BIRD SURVEYS

GENERAL BIRD SURVEYS

Formal 20-minute diurnal bird searches were completed within the Modification study area. Bird surveys were completed by actively walking through the Modification study area over a period of 20 minutes. All birds were identified to the species level, either through direct observation or identification of calls. Bird surveys were completed during different times of the day, but generally occurred during morning hours or late afternoon. Birds were also recorded opportunistically during all other surveys.

Wherever threatened bird species were absent from the site, habitat assessments were conducted to determine the likelihood that the Modification study area might support those species that are known to occur in the region.

TARGETED REGENT HONEYEATER AND SWIFT PARROT SURVEYS

The distribution of blossom nomads, such as the Swift Parrot and Regent Honeyeater, is reliant upon the distribution of blossom and lerps at any one time. The distribution of blossom and lerp varies considerably season to season in response to climatic variations and tree species cyclic blossoming intervals. Due to variations in the distribution of blossom from year to year their distribution may shift from the NSW western slopes to the coast or in the tablelands. Therefore, whilst they can occur throughout much of NSW, Victoria and south-east Queensland they are likely only to reside in areas where blossom and lerp resources are plentiful (i.e. may occur in discrete areas were localised resources occur such as winter flowering Eucalypts).

Targeted seasonal surveys (diurnal bird surveys) for endangered blossom nomads (i.e. Regent Honeyeater and Swift Parrot) was undertaken in August 2019 and August 2020 to identify presence for blossoming eucalypts and nectar resources, along with potential habitat utilisation by threatened blossom nomads. Where seasonal conditions for some species including flowering eucalypts were not suitable during the timing of onsite investigations, likelihood of occurrence assessments were conducted by the presence/absence of suitable habitat and its condition. It should be noted that both the Regent Honeyeater and Swift Parrot are rare species with Swift Parrots blending all too easily into canopy foliage and Regent Honeyeaters characterised by relatively quiet dispositions and so not easily detectable for bird surveyors to pick up. Therefore, survey methodologies for these species rely heavily on observing the distribution of blossom resources and other associated indicators, such as the occurrence of high nectarivorous bird density and diversity.

3.5.3.4 MICROCHIROPTERAN BATS

PASSIVE DETECTION

Passive Ultrasonic Anabat Bat detection (Anabat SD1/SD2 or Anabat Express unit (Titley Scientific, Brendale QLD) was used to record and identify the echolocation calls of microchiropteran bats foraging at each survey site. Passive monitoring of survey sites was achieved by setting Anabat bat detectors to record throughout the night.

Anabat Bat detectors recorded bat vocalisations throughout the full night, with the recording starting before dusk. Bat activity throughout the night does vary (Department of Environment and Conservation, 2004; Taylor & Oneill, 1988), but the peak in activity is usually within a few hours of dusk. For this study, the sampled population was defined as those active up to two hours after last light. Bat activity is used as a substitute for abundance and is based on the number of

microchiropteran bat calls recorded during the survey period, including those calls assigned to a species complex (i.e. not positively attributable to an individual species). Calls were analysed using Analook (Version 4.7) software with reference to 'Bat Calls of NSW: Region Based Guide to the Echolocation Calls of Microchiropteran Bats' (Pennay, Law, & Reinhold, 2004).

3.5.3.5 SPOTLIGHTING

Spotlighting was used to target arboreal, flying and ground-dwelling mammals, as well as, nocturnal birds, reptiles and amphibians. Spotlighting was completed after dusk and completed on foot using high-powered headlamps and hand torches. Sighted animals were identified to the species level.

3.5.3.6 CALL PLAY-BACK

Call playback was used to survey for nocturnal birds (i.e. Barking Owl) and nocturnal mammals (i.e. Squirrel Glider), using standard methods (Debus, 1995). Call playback was completed after dusk within the Modification study area around key fauna habitat such as ephemeral creek lines or large hollow-bearing trees.

For each survey, an initial listening period of 10 to 15 minutes was undertaken, followed by a spotlight search for 10 minutes to detect any animals in the immediate vicinity. The calls of the target species were then played intermittently for five minutes followed by a 10-minute listening period. Calls from (Stewart, 1998) were broadcast using a portable media player and megaphone.

3.5.3.7 STAG WATCHES

Stag watches were undertaken at dusk in areas where hollow-bearing trees were identified within or adjacent to the Modification study area. The aim of dusk stag watches is to identify hollow dwelling fauna including owls, micro bats and arboreal mammals that are using any hollow-bearing trees within the Modification study area for breeding purposes. Following stag watches, spotlighting transects were to be undertaken near known or likely utilised hollow-bearing trees.

3.5.3.8 HAIRTUBES

Medium sized (90 millimetres) hair tubes were used to target arboreal mammal species. Hair tubes were placed in appropriate habitat and positioned in close proximity to known food sources (flowering trees, areas of large fallen timber and thick understorey vegetation). Hair tubes targeting arboreal mammals were baited with a suitable food source containing mixed oats, honey and peanut butter, and each trap and immediate location was sprayed with an attractant of honey/vanilla essence water mix. Fifteen 90 millimetre hair tubes were set in the field for over a two-week period (12 nights) in September 2018.

3.5.3.9 KOALA SPOT ASSESSMENT TECHNIQUE (SAT)

In addition to habitat assessment, targeted searches for the Koala were completed at six locations in the Modification study area in areas of suitable habitat. Koala feed trees observed in the Modification study area predominately consisted of *Eucalyptus pilligaensis* (Pilliga Box), *Eucalyptus blakelyi* (Blakely's Red Gum), *Eucalyptus albens* (White Box) and *Eucalyptus populnea* (Poplar Box). At each sampling point, Spot Assessment Technique (SAT) methodology (Biolink Ecological Consultants, 2009) was employed, which involved actively searching for Koala faecal pellets for approximately one metre around the trunk of each of 30 trees; specifically targeting feed tree species where possible.

3.5.3.10 REMOTE CAMERAS

Remote cameras were employed for observations of fauna using the habitats associated with the Modification study area. Seventeen cameras were used for a minimum of four nights, totalling 153 trap nights. Cameras were baited with honey, nut and oat bars and trees were sprayed with a strong honey water mixture. Seven traps were positioned in late October 2019 and a further 10 cameras set in July / August 2020.

3.5.3.11 SURVEY EFFORT SUMMARY

The BAM Calculator identified 24 candidate threatened fauna species that may utilise the Modification study area. Of these, 16 are not considered to be candidate species as the Modification study area did not provide habitat or microhabitats that these species depend on, or the Modification study area is outside the species known range, and as such did not require targeted surveys to be undertaken (refer to Appendix C).

A total of nine threatened fauna species were identified as having potential habitat within the Modification study area and became candidate species. These species were the focus of detailed targeted surveys. A summary of survey effort for each candidate threatened fauna species is outlined in Table 3.14.

In addition to the targeted surveys stated in Table 3.14, BCM undertakes annual biodiversity monitoring in the LSF. One replicate monitoring location, Leard State Forest Monitoring Site 3 'LSF3', occurs adjacent (<200 m) from the Modification study area. Data obtained from monitoring at 'LSF3' provides relevant data that is considered as survey effort for the identified candidate species within this report. A summary of the survey effort undertaken at this point is outlined in Table 3.13.

Table 3.13 Leard State Forest monitoring point 3 – survey effort

FAUNA GROUP	SURVEY YEARS	SURVEY EFFORT EACH YEAR	TOTAL EFFORT
Threatened woodland birds	2018-2020	2 x Diurnal bird surveys	6 x Diurnal bird surveys
Threatened micro bats	2018-2020	2 x Anabat recording nights	6 x Anabat recording nights
All threatened species	2018-2020	5 person hours of opportunistic surveys	15 person hours of opportunistic surveys

Table 3.14 Summary of candidate threatened fauna survey effort

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	OPTIMUM SURVEY PERIOD[3]	HABITAT FEATURES	WSP SURVEY EFFORT
Birds (6)						
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	April-August	Breeding habitat i.e. Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground.	— 20 diurnal bird surveys (September 2018, August 2019 and August 2020) — 110 person hours opportunistic surveys — Habitat Assessments to determine habitat features
Hieraaetus morphnoides	Little Eagle	V	-	August-October	Breeding habitat i.e. Nest trees - live (occasionally dead) large old trees within vegetation.	— 20 diurnal bird surveys (September 2018, August 2019 and August 2020) — 110 person hours opportunistic surveys — Habitat Assessments to determine habitat features
Lophoictinia isura	Square-tailed Kite	V	-	September-January	Breeding habitat i.e. Nest trees	— 20 diurnal bird surveys (September 2018, August 2019 and August 2020) — 110 person hours opportunistic surveys — Habitat Assessments to determine habitat features
Ninox connivens	Barking Owl	V	-	May-December	Breeding habitat i.e. Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	— 20 diurnal bird surveys (September 2018, August 2019 and August 2020) — 8 call playback nights (September 2018 & August 2020) — 8 person hours spotlighting (September 2018 and August 2020) — 8 nights stagwatching hollow-bearing trees (September 2018 and August 2020) — 8 nights of opportunistic surveys — Habitat Assessments to determine habitat features

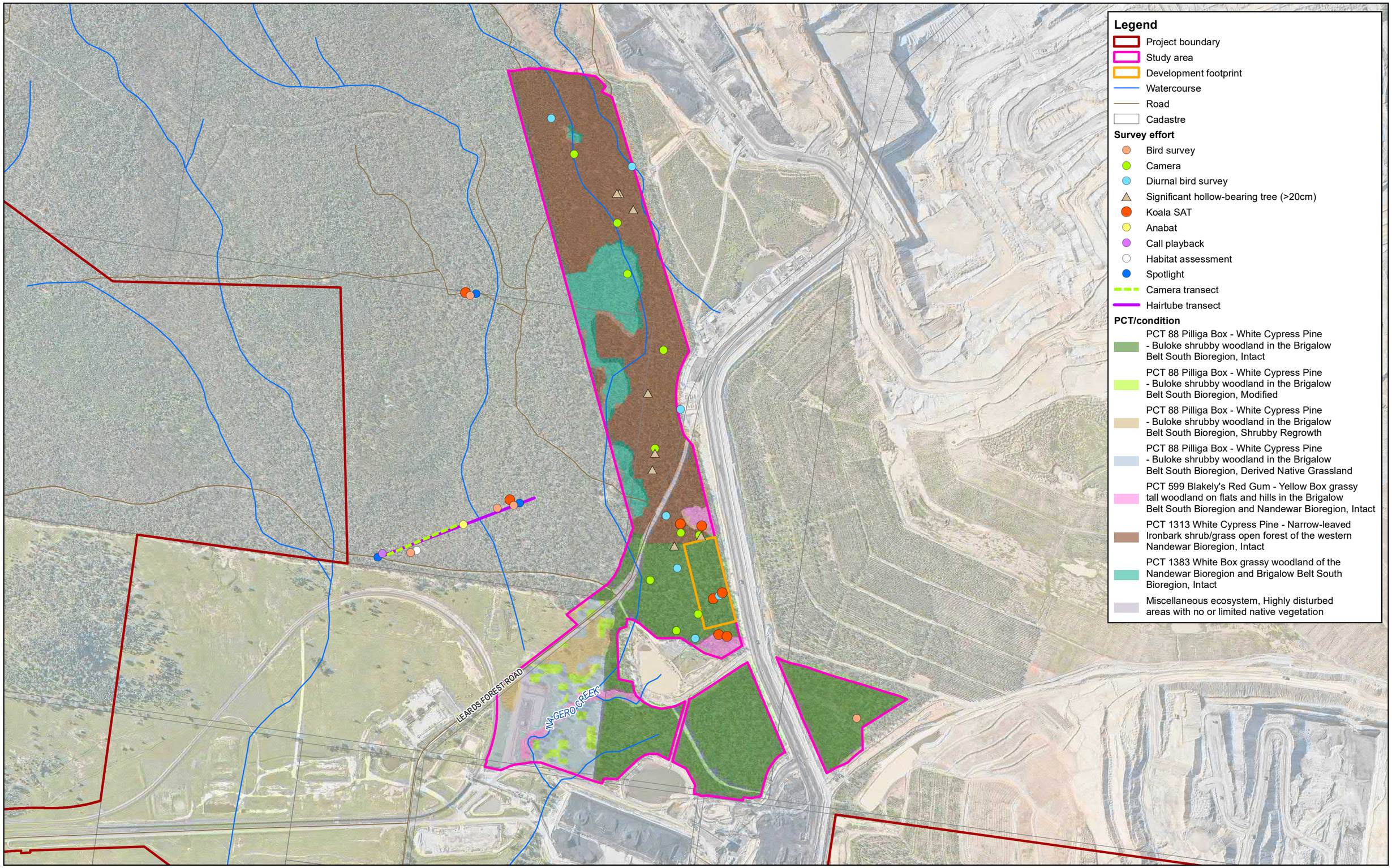
SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	OPTIMUM SURVEY PERIOD[3]	HABITAT FEATURES	WSP SURVEY EFFORT
Ninox strenua	Powerful Owl	V	-	May-August	Breeding habitat i.e. living or dead trees with hollow greater than 20cm diameter.	— 20 diurnal bird surveys (September 2018, August 2019 and August 2020) — 8 call playback nights (September 2018 and August 2020) — 8 person hours spotlighting (September 2018 and August 2020) — 8 nights stagwatching hollow-bearing trees (September 2018 and August 2020) — 8 nights of opportunistic surveys — Habitat Assessments to determine habitat features
Tyto novaehollandiae	Masked Owl	V	-	May-August	Breeding habitat i.e. Living or dead trees with hollows greater than 20cm diameter.	— 20 diurnal bird surveys (September 2018, August 2019 and August 2020) — 8 call playback nights (September 2018 and August 2020) — 8 person hours spotlighting (September 2018 and August 2020) — 8 nights stagwatching hollow-bearing trees (September 2018 & August 2020) — 8 nights of opportunistic surveys — Habitat Assessments to determine habitat features
Mammals (2)						
Petaurus norfolcensis	Squirrel Glider	V	-	All year	Relies on large old trees with hollows for breeding and nesting.	— 153 remote camera trap nights (September 2018 and August 2020) — 210 hairtube trap nights (September 2018) — 8 nights stagwatching hollow-bearing trees (September 2018 and August 2020) — 8 person hours spotlighting (September 2018 and August 2020) — Habitat Assessments to determine habitat features

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	OPTIMUM SURVEY PERIOD[3]	HABITAT FEATURES	WSP SURVEY EFFORT
Phascolarctos cinereus	Koala	V	V	All year	Important habitat i.e. Areas identified via survey as important habitat.	— 8 Koala SATs — 8 person hours spotlighting (September 2018 and August 2020) — 8 call playback nights (September 2018 and August 2020) — 110 person hours opportunistic surveys (September 2018, August 2019 and August 2020) — Habitat Assessments to determine habitat features
Reptiles (1)						
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	November-March	n/a	— 8 person hours spotlighting (September 2018 and August 2020) — Habitat Assessments to determine habitat features — 8 nights of opportunistic surveys (16 person hours)

(1) V = Vulnerable, E = Endangered as listed under the *Biodiversity Conservation Act 2016* (BC Act)

(2) V = Vulnerable, E = Endangered, M = Migratory as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

(3) Optimum survey period and vegetation type / habitat constraints for NSW listed species were obtained from the BAM-C (ESS Group, 2020b).



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Coordinate System: GDA 1994 MGA Zone 56
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Imagery: BCOPL 2020

DOCUMENT	BC2020_PS120722_BDAR_004_A1
AUTHOR.	suansrir
EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

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FIGURE **3-3**

TITLE. **NATIVE VEGETATION AND THREATENED FAUNA TARGETED SURVEY EFFORT**

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STAGE 1 – BIODIVERSITY ASSESSMENT

4 LANDSCAPE CONTEXT

This chapter addresses the landscape context in accordance with Section 4 of the BAM and provides information on a range of landscape features that occur in the Modification study area and surrounding areas.

The landscape features outlined below are used to inform the habitat suitability of the Modification study area for threatened species and the potential movement of species across the landscape.

4.1 LANDSCAPE FEATURES

An overview of landscape features associated with the Modification study area are presented in Table 4.1 and depicted in Figure 4.1.

Table 4.1 Summary of Modification study area landscape features

LANDSCAPE FEATURE	OCCURRENCE IN MODIFICATION STUDY AREA
IBRA bioregion	Brigalow Belt South
IBRA subregion	Liverpool Plains
NSW landscape regions (Mitchell landscapes)	The Modification study area occurs within the Bugaldie Uplands and Liverpool Alluvial Plains NSW landscape regions. For BAM-C purposes, the Liverpool Alluvial Plains has been selected based on it covering 100% of the development footprint.
Local Government Area (LGA)	Narrabri Shire Council
Local Land Service (LLS) region	North West
Botanical subregion	Border of North Western Slopes and North Western Plains
Rivers, streams and estuaries	No waterways occur within the development footprint. An unnamed first order stream which forms a tributary of Nagero Creek does however occur within the Modification study area. This tributary will not be impacted by the Modification.
Important and local wetlands	No important wetlands have been recorded within the Modification study area.
Connectivity features	Leard State Forest occurred as a large patch of remnant native vegetation surrounded by agriculture tenures, which effectively isolated it from other large patches of native vegetation in the locality. Three open cut coal mines currently operate within and immediately adjacent to Leard State Forest, progressively reducing its footprint. The Modification study area is positioned near the southern boundary of Leard State Forest and immediately west of Boggabri Coal Mine's ROM haul road. Whilst the Modification study area is contiguous with and retains connectivity with Leard State Forest to the north and west, the existing ROM haul road is likely to significantly impede the movement of sedentary or less mobile species to the Modification study area's east.
Areas of geological significance and soil hazard features	The Modification study area is comprised predominantly of soils derived from Permian geology (Maules Creek Formation) consisting predominantly of conglomerate and sandstone with minor siltstone, claystones and intercalated coal seams (Australian Groundwater & Environmental Consultants Pty Ltd, 2010).
Areas of outstanding biodiversity value	No areas of outstanding biodiversity value have been declared for this area.

4.2 SITE CONTEXT

4.2.1 NATIVE VEGETATION COVER

Native vegetation cover of the development footprint and a 1,500 m buffer area surrounding the development footprint was determined in accordance with Subsection 4.2.2 of the BAM. A summary of this assessment is provided Table 4.2 and Figure 4.2.

Table 4.2 Native vegetation cover assessment

ASSESSMENT AREA	TOTAL ASSESSMENT AREA (HA)	AREA OF NATIVE VEGETATION COVER (HA)	NATIVE VEGETATION PERCENTAGE COVER (%)
Development footprint	3.31	3.31	100%
Buffer area	832.58	466.43	56%
Total	**835.89**	**469.74**	**56%**

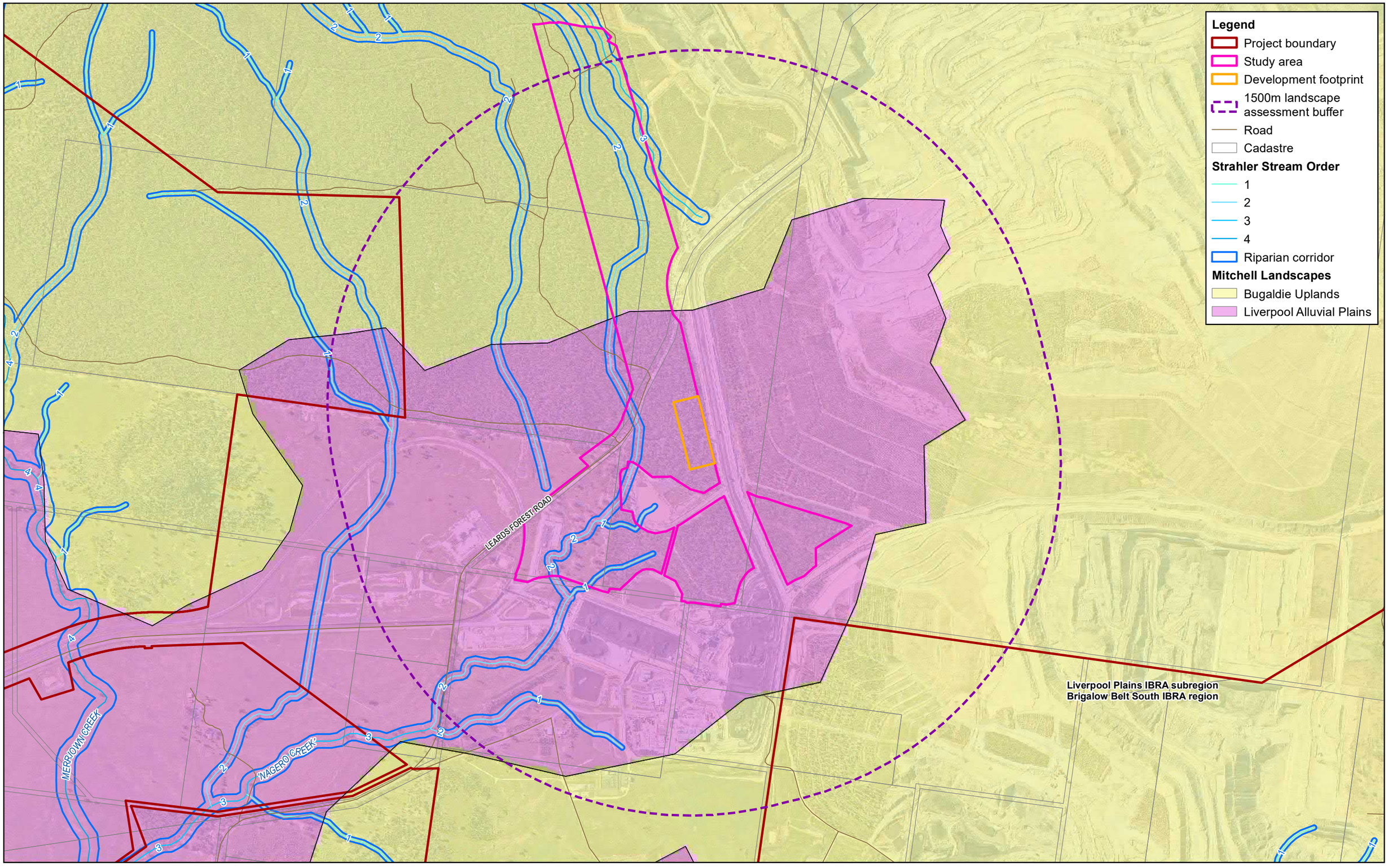
4.2.2 PATCH SIZE

Patch size is defined under the BAM (Office of Environment & Heritage, 2017) as an area of native vegetation that:

- occurs in the development area; and
- includes native vegetation that has a gap of less than 100 m from the next area of moderate to good native vegetation (or ≤30 m of non-woody ecosystems).

Patch size may extend onto adjoining land that is not part of the development footprint. Patch size is assigned to each vegetation zone within the development footprint as a class, being either <5 ha, 5-24 ha, 25-100 ha or ≥100 ha.

Given the large areas of contiguous native vegetation recorded within and adjacent to the development footprint the patch size class for all native vegetation zones has been assessed as meeting the ≥100 hectares class. As such, for BAM calculation purpose all native vegetation zones have been applied with a patch size area of 101 hectares.



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Coordinate System: GDA 1994 MGA Zone 56
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EDITED BY.	Emily.Mitchell
DATE.	1/10/2020

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FIGURE **4-1**

TITLE. **LANDSCAPE FEATURES**

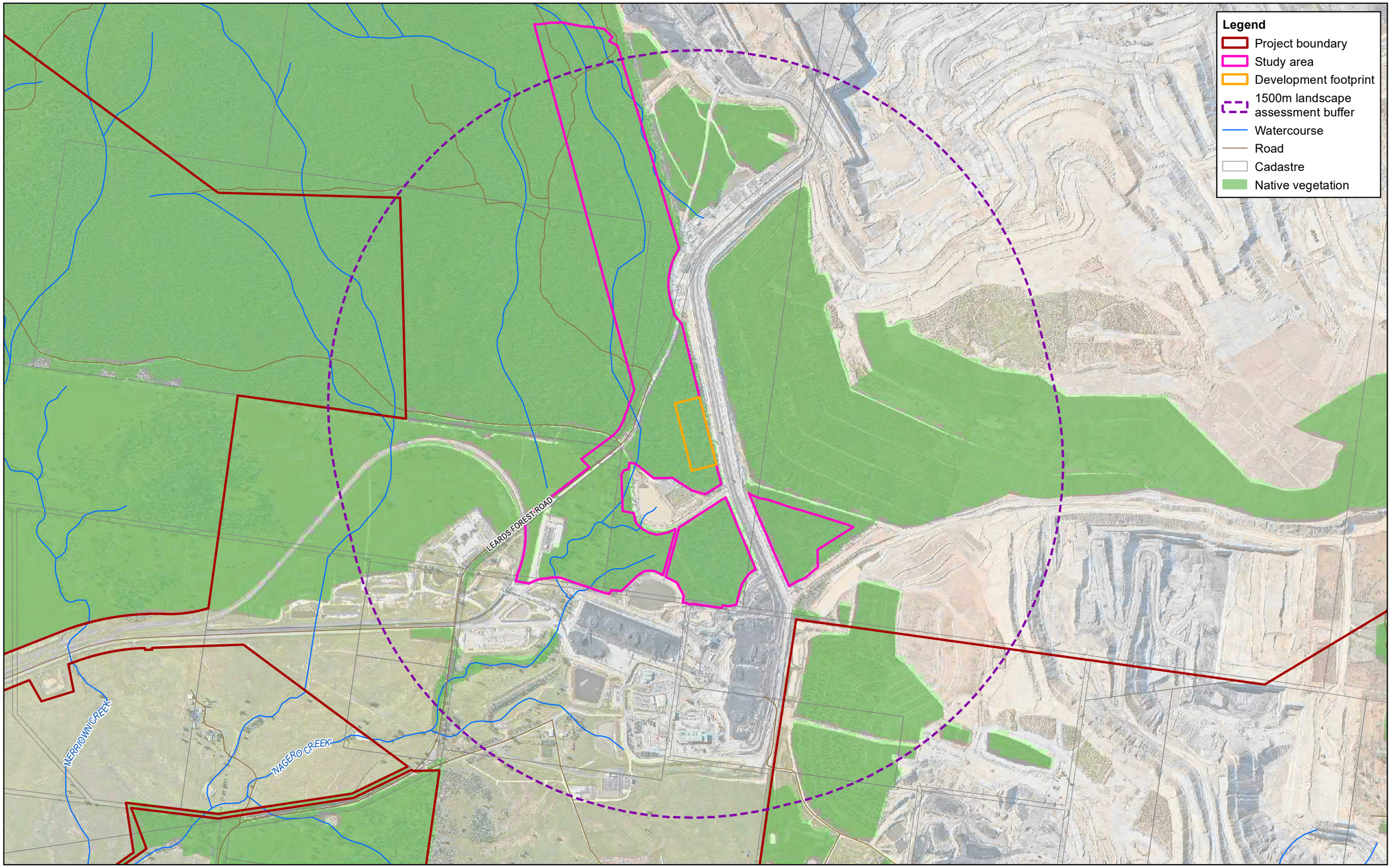

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FIGURE **4-2**

TITLE. **NATIVE VEGETATION COVER**

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5 NATIVE VEGETATION

This chapter address native vegetation in accordance with Section 5 of the BAM and matters relating to the BC Act.

5.1 NATIVE VEGETATION REGULATORY MAPPING – CATEGORY 1 'EXEMPT LANDS'

An analysis of appropriate datasets identified that most of the proposed Modification study area contains native vegetation cover that is defined as Category 2 – regulated land and therefore would be subject to assessment under the BAM if impacted. No sensitive regulated land as identified on the Native Vegetation Regulatory Map, that would also be classified as Category 2 – regulated land, occurs within the Modification study area.

There are areas of land within the Modification study area that meet Category 1 – exempt lands. These lands are mostly comprised of transport corridors (roads and tracks) through Leard State Forest and areas previously cleared under the BCMs previous approvals. The entirety of land contained within the development footprint is classified as Category 2 regulated land and therefore is subject to assessment in accordance with the BAM.

5.2 NATIVE VEGETATION RECORDED

The Border Rivers Gwydir / Namoi Region State Vegetation Type Map (Office for Environment & Heritage, 2016) has mapped the following vegetation types as occurring within the Modification study area at a regional scale:

- PCT 1 Candidate Native Grasslands
- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion
- PCT 435 White Box – White Cypress Pine shrub grass hills woodland in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT 592 Narrow-leaved Ironbark – cypress pine – White Box shrubby open forest in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT 588 White Box – White Cypress Pine shrubby hills open forest mainly in the Nandewar Bioregion
- PCT 101 Poplar Box – Yellow Box – Western Grey Box grassy woodland on cracking clay soils mainly in the Liverpool Plains, Brigalow Belt South Bioregion
- PCT 0 Non-native vegetation.

Two of these PCTs were verified as occurring within the Modification study area during the field surveys; being PCT 88 and PC 592. It is noted however that PCT 1313 was assigned to native vegetation consistent with PCT 592 to provide consistency of PCT assignment for mapping previously conducted by the BCM, neighbouring coal mines and BioBanks in the locality. This is further explained in the PCT description in Section 5.2.3. Two additional PCTs not mapped by the regional mapping were also identified as occurring within the Modification study area; being:

- PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion.

In summary, four native PCTs and one miscellaneous ecosystem were recorded within the Modification study area (Table 5.1 and Figure 5.1). The four PCTs have been categorised into eight vegetation zones based on the broad condition categories described in Table 3.8.

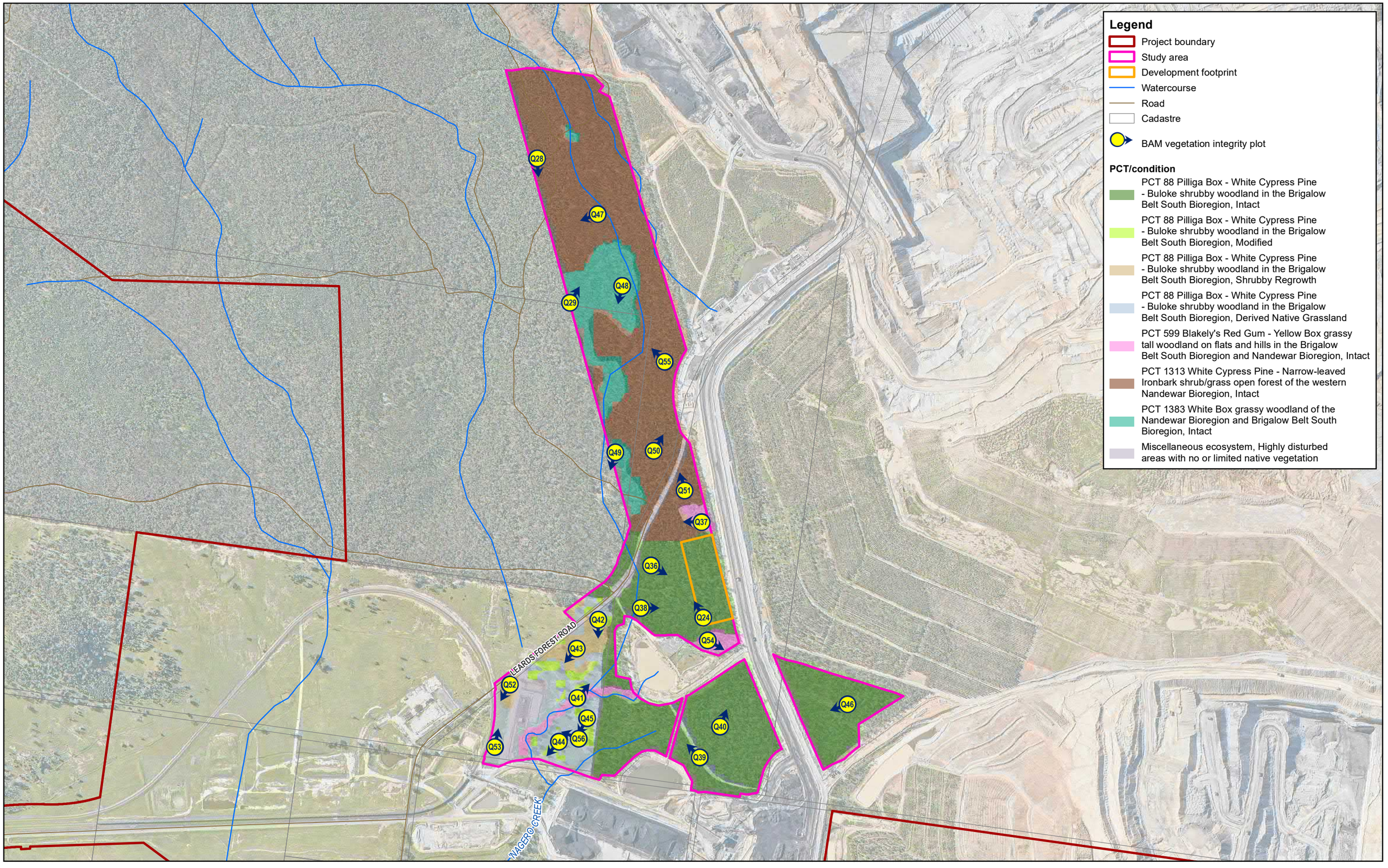
A detailed description of each PCT recorded, including PCT selection justification, floristic and structural composition along with representative photos are provided in Section 5.2.1 to Section 5.2.5. The BAM vegetation integrity plot data and a summary of the data against BAM benchmarks for the Brigalow Belt South IBRA Bioregion are also provided in Appendix A.

Table 5.1 Plant community types and threatened ecological communities recorded within the Modification study area

VEGETATION TYPE	CONDITION	VEGETATION FORMATION	VEGETATION CLASS	BC ACT STATUS	EPBC ACT STATUS	AREA WITHIN MODIFICATION STUDY AREA (HA)	AREA WITHIN DEVELOPMENT FOOTPRINT (HA)
Native Plant Community Types							
PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Intact	KF_CH5A Dry Sclerophyll Forests (Shrub/grass sub-formation)	Pilliga Outwash Dry Sclerophyll Forests	Not listed	Not listed	37.96	3.31
	Modified					1.83	-
	Shrubby regrowth					2.90	-
	Derived Native Grasslands (DNG)					8.24	-
PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Intact	KF_CH3 Grassy Woodlands	Western Slopes Grassy Woodlands	Critically Endangered[1]	Critically Endangered[2]	3.21	-
PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion	Intact	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Not listed	Not listed	41.68	-
PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion	Intact	KF_CH3 Grassy Woodlands	Western Slopes Grassy Woodlands	Critically Endangered[1]	Critically Endangered[2]	8.99	-
Sub-total of native vegetation (ha)						**104.81**	**3.31**
Miscellaneous ecosystems							
Highly disturbed areas with no or limited native vegetation	n/a	n/a	n/a	Not listed	Not listed	4.35	-
Sub-total of miscellaneous ecosystems (ha)						**4.35**	**-**
Total area (ha)						**109.16**	**3.31**

(1) Listed as Critically Endangered under BC Act listing for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland

(2) Listed as Critically Endangered under the BC Act listing for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.



Legend

- Project boundary
- Study area
- Development footprint
- Watercourse
- Road
- Cadastre
- BAM vegetation integrity plot

PCT/condition

- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, Intact
- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, Modified
- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, Shrubby Regrowth
- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion, Derived Native Grassland
- PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion, Intact
- PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion, Intact
- PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, Intact
- Miscellaneous ecosystem, Highly disturbed areas with no or limited native vegetation

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Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL 2020

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EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

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FIGURE **5-1**

TITLE. **NATIVE VEGETATION RECORDED**

5.2.1 PCT 88 PILLIGA BOX - WHITE CYPRESS PINE - BULOKE SHRUBBY WOODLAND IN THE BRIGALOW BELT SOUTH BIOREGION

Broad scale vegetation mapping of the Modification study area had mapped areas of vegetation within the southern portion of the Modification study area as PCT 88 Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion (Office for Environment & Heritage, 2016). The field surveys confirmed the presence of PCT 88 as the dominate PCT within the southern portion of the Modification study area.

A summary of PCT 88 characteristics within the Modification study area is provided in Table 5.2 and depicted in Photo 5.1 to Photo 5.4. The extent of PCT 88 within the Modification study area is illustrated in Figure 5.1.

Table 5.2 Summary of PCT 88 Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion

DESCRIPTION	
PCT justification	PCT 88 within the Modification study area occurred typically as a tall open dry sclerophyll forest dominated by *Eucalyptus pilligaensis* (Narrow-leaved Grey Box), *Callitris glaucophylla* (White Cypress Pine) and *Allocasuarina leuhmannii* (Buloke) all diagnostic species of PCT 88. The community occurred on sandier soils towards the south of the Modification study area and transitioned into PCT 599 and PCT 1313. Following rainfall in 2020 areas of PCT 88 within the development footprint contained areas of standing water. This is considered a result of indirect impacts associated with the existing infrastructure (i.e. haul road and contour bank) within the development footprint. The construction of these features has created artificial barriers, which appear to have had minor alterations to natural surface water filtration of the immediate area during rainfall events leading to pools of standing water. Based on floristic, geographic and geological characteristics, this vegetation type is considered consistent with the scientific description and distribution information outlined for PCT 88 within the BioNet Vegetation Classification (Environment Energy and Science Group, 2020c).
Conservation status	This PCT does not align to any threatened ecological communities. It does however provide potential habitat for numerous threatened species including *Tylophora linearis* which was recorded within PCT 88 in the Modification study area.
% cleared	38
Vegetation Class	Pilliga Outwash Dry Sclerophyll Forests
Vegetation Formation	KF_CH5A Dry Sclerophyll Forests (Shrub/grass sub-formation)
Extent	50.93 ha within the Modification study area, of which 3.31 ha occurs within the development footprint.
Condition	This PCT was stratified into four broad condition classes based on current condition and disturbances including: — Intact – The vegetation displayed a relatively intact groundcover, shrub and canopy layers. Native species diversity was high and weed diversity and cover was relatively low. — Modified: Although the canopy was structurally intact, understorey components were modified in nature due to past clearing pressures. — Shrubby regrowth: Sparse mid-stratum of naturally regenerating shrub and mid-storey species. Canopy was absent and understorey was comprised largely by grasslands with >50% native groundcover. — Derived Native Grassland – Canopy and midstorey stratum were absent from this condition type. Grasslands contained >50% native perennial groundcover and were comprised of a mix of native grasses, herbs and forbs.

DESCRIPTION			
Strata	**Height range & average**	**Percentage Foliage Cover range**	**Dominant Species**
Canopy	12–28 m	15-45%	Dominated by *Eucalyptus pilligaensis* (Narrow-leaved Grey Box) with *Eucalyptus populnea* subsp. *bimbil* (Bimble Box). Occurrences of *Eucalyptus crebra* (Narrow-leaved Ironbark) in areas where PCT 88 transitioned into PCT 1313.
Sub-canopy	4–10 m	20-60%	*Callitris glaucophylla* (White Cypress Pine) and *Allocasuarina leuhmannii* (Buloke) with *Notelaea microcarpa* var. *microcarpa* (Native Olive), *Geijera parviflora* (Wilga) and occasional *Atalaya hemiglauca* (Whitewood).
Shrub stratum	0.3-3.5 m	0-30%	*Acacia deanei* subsp. *deanei* (Deane's Wattle), *Dodonaea viscosa* subsp. *angustifolia* (Sticky Hop-bush), *Geijera parviflora* (Wilga), *Allocasuarina leuhmannii* (Buloke), *Dodonaea viscosa* subsp. *cuneata* (Wedge-leaf Hop-bush), *Notelaea microcarpa* var. *microcarpa* (Native Olive), *Acacia decora* (Western Silver Wattle), *Rhagodia parabolica* (Mealy Saltbush), *Maireana microphylla* (Small-leaved Bluebush) and *Pimelea neo-anglica* (Poison Pimelea). In disturbed areas *Sclerolaena birchii* (Galvanised Burr) and *Sclerolaena muricata* var. *muricata* (Black Rolypoly) also occurred.
Ground layer	0.1-1.2 m	50-95%	High diversity of grasses, herbs and forbs including *Aristida ramosa* (Purple Wiregrass), *Digitaria brownii* (Cotton Panic Grass), *Digitaria diffusa* (Open Summer-grass), *Austrostipa scabra* subsp. *scabra* (Spear Grass), *Cyperus gracilis* (Slender Flat-sedge), *Eragrostis brownii* (Brown's Lovegrass), *Bothriochloa macra* (Red Grass), *Austrostipa verticillata* (Slender Bamboo Grass), *Cymbopogon refractus* (Barbed Wire Grass), *Boerhavia dominii* (Tarvine), *Cheilanthes sieberi* subsp. *sieberi* (Poison Rock Fern), *Oxytes brachypoda* (Large Tick-trefoil), *Erodium crinitum* (Blue Storksbill), *Eragrostis parviflora* (Weeping Lovegrass), *Enteropogon acicularis, Panicum effusum* (Hairy Panic), *Einadia nutans* subsp. *linifolia, Desmodium varians* (Slender Tick-trefoil), *Brunoniella australis* (Blue Trumpet), *Eremophila debilis* (Winter Apple), *Sporobolus creber* (Slender Rats Tail Grass), *Glycine clandestina* (Twinging Glycine), *Evolvulus alsinoides* var. *decumbens*, *Dactyloctenium radulans* (Button Grass), *Eriochloa pseudoacrotricha* (Early Spring Grass), *Panicum buncei*, *Solanum parvifolium* subsp. *parvifolium, Chloris truncata* (Windmill Grass), *Goodenia cycloptera, Vittadinia sulcata, Vittadinia cervicularis* subsp. *subcervularis, Calotis lappulaceae* (Yellow Burr-daisy), *Phyllanthus virgatus* and *Rostellularia adscendens var. adscendens.* During the 2020 winter survey, exotic species such as *Solanum nigrum** (Blackberry Nighshade), *Hypochaeris radicata** (Catsear) and *Sonchus oleraceus** (Common Snowthistle) were observed in low to high densities in response to above average rainfall received.

Photo 5.1 PCT 88 Intact

Photo 5.2 PCT 88 Modified

Photo 5.3 PCT 88 Shrubby regrowth

Photo 5.4 PCT 88 Derived native grassland

5.2.2 PCT 599 BLAKELY'S RED GUM - YELLOW BOX GRASSY TALL WOODLAND ON FLATS AND HILLS IN THE BRIGALOW BELT SOUTH BIOREGION AND NANDEWAR BIOREGION

Broad scale vegetation mapping of the Modification study area did not identify PCT 599 Blakey's Red Gum – Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion (Office for Environment & Heritage, 2016). The field surveys however confirmed the presence of PCT 599 as occurring along the ephemeral drainage lines and depressions towards the south of the Modification study area.

A summary of PCT 599 characteristics within the Modification study area is provided in Table 5.3 and depicted in Photo 5.5 and Photo 5.6. The extent of PCT 599 within the Modification study area is illustrated in Figure 5.1.

Table 5.3 Summary of PCT 599 Blakey's Red Gum – Yellow Box grassy tall woodland on flats and hills of the Brigalow Belt South Bioregion and Nandewar Bioregion

DESCRIPTION	
PCT justification	PCT 599 within the Modification study area occurred as a tall grassy woodland forming linear intact patches of vegetation along drainage depressions. These areas are ephemeral in nature and appear to only be exposed to water during high rainfall events. The community contained a canopy stratum largely dominated by diagnostic species of PCT 599 including *Eucalyptus melliodora* (Yellow Box) and/or *Eucalyptus blakelyi* (Blakely's Red Gum). The shrub stratum was generally sparse, and the groundcover contained a high diversity of grasses, forbs and herbs characteristic of PCT 599. Based on floristic, geographic and geological characteristics, this vegetation type is considered consistent with the scientific description and distribution information outlined for PCT 599 within the BioNet Vegetation Classification (Environment Energy and Science Group, 2020c).
Conservation status	Aligns to the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland threatened ecological community which is listed as Critically Endangered under the BC Act and EPBC Act. PCT 599 also provides habitat for numerous threatened species.
% cleared	80
Vegetation Class	Western Slopes Grassy Woodlands
Vegetation Formation	KF_CH3 Grassy Woodlands
Extent	3.21 ha within the Modification study area, no areas of PCT 599 occurs within the development footprint.
Condition	This PCT was stratified into two broad condition classes based on current condition and disturbances including: — Intact – The vegetation displayed a relatively intact groundcover, shrub and canopy layers. Native species diversity was high and weed diversity and cover was relatively low. — Modified: Although the canopy was structurally intact, understorey components were modified in nature due to past clearing pressures.

Strata	Height range & average	Percentage Foliage Cover range	Dominant Species
Canopy	16–26 m	20-40%	Dominated by *Eucalyptus melliodora* (Yellow Box) and/or *Eucalyptus blakelyi* (Blakely's Red Gum). Occasional *Eucalyptus populnea* subsp. *bimbil* (Bimble Box) and *Eucalyptus albens* (White Box) were observed in transitional areas with PCT 88 and PCT 1383.
Sub-canopy	5–9 m	5-10%	*Callitris glaucophylla* (White Cypress Pine), *Notelaea microcarpa* var. *microcarpa* (Native Olive), *Geijera parviflora* (Wilga). Occasional *Atalaya hemiglauca* (Whitewood) and *Allocasuarina leuhmannii* (Buloke) were also observed where the community transitioned with PCT 88.
Shrub stratum	1.5-3 m	5-25%	*Acacia deanei* subsp. *deanei* (Deane's Wattle), *Acacia decora* (Western Silver Wattle), *Dodonaea viscosa* subsp. *angustifolia* (Sticky Hop-bush), *Notelaea microcarpa* var. *microcarpa* (Native Olive), *Geijera parviflora* (Wilga), *Rhagodia parabolica* (Mealy Saltbush), *Maireana microphylla* (Small-leaved Bluebush) and *Pimelea neo-anglica* (Poison Pimelea).
Ground layer	0.1-1.2 m	60-100%	*Austrostipa verticillata* (Slender Bamboo Grass), *Lomandra longifolia* (Spiny-headed Mat-rush), *Aristida ramosa* (Purple Wiregrass), *Anthosachne scabra* (Wheatgrass), *Glycine tabacina* (Variable Glycine), *Carex inversa*, *Cyperus gracilis* (Slender Flat-sedge), *Dichondra* sp. A (Kidney Weed), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Sporobolus creber* (Slender Rats Tail Grass), *Bothriochloa macra* (Red Grass), *Bothriochloa decipiens* var. *decipiens* (Red Grass), *Dichanthium sericeum* subsp. *sericeum* (Queensland Bluegrass), *Chloris ventricosa* (Plump Windmill Grass), *Geranium solanderi* (Native Geranium), *Rumex brownii* (Swamp Dock), *Dichelachne micrantha* (Shorthair Plumegrass) and *Eremophila debilis* (Winter Apple).

Photo 5.5 PCT 599 Intact

Photo 5.6 PCT 599 Modified

5.2.3 PCT 1313 WHITE CYPRESS PINE - NARROW-LEAVED IRONBARK SHRUB/GRASS OPEN FOREST OF THE WESTERN NANDEWAR BIOREGION

Broad scale vegetation mapping of the Modification study area did not identify PCT 1313 White Cypress Pine – Narrow – leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion as occurring with the Modification study area (Office for Environment & Heritage, 2016). Alternatively, this vegetation type has been mapped at a regional scale within the Modification study area as PCT 592 Narrow-leaved Ironbark - cypress pine - White Box shrubby open forest in the Brigalow Belt South Bioregion and Nandewar Bioregion.

Whilst the vegetation within the Modification study area is considered more likely to be consistent with PCT 592, it has been assigned to PCT 1313 in this assessment. This has been done to retain consistency of vegetation mapping conducted for the BCM and surrounding mining projects within Leard State Forest and nearby offset properties as well as an established BioBank in the locality, which all contain similar vegetation mapped as PCT 1313.

A summary of PCT 1313 characteristics within the Modification study area is provided in Table 5.4 and depicted in Photo 5.7 and Photo 5.8. The extent of PCT 1313 within the Modification study area is illustrated in Figure 5.1.

Table 5.4 Summary of PCT 1313 White Cypress Pine – Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion

DESCRIPTION	
PCT justification	This vegetation type occurred as tall open forest dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Callitris glaucophylla* (White Cypress Pine) on soils derived of Permian geology on flats and lower slopes of the Modification study area. Attributes of this vegetation was similar to two PCTs considered in this assessment. These PCTs included PCT 1313 and PCT 592. Both PCTs are similar in structure, floristic composition and are classified under the Dry Sclerophyll Forests (Shrubby sub-formation) Vegetation Formation and Western Slopes Dry Sclerophyll Forests Vegetation Class as described by Keith (2004). Furthermore, as both PCTs have similar extents (PCT 592 – 52% and PCT 1313 – 55%) they form part of the same BAM offset trading group (i.e. Western Slopes Dry Sclerophyll Forests; >=50% and <70%). The BioNet Vegetation Classification Database profile for PCT 1313 contains limited information compared to the comprehensive profile of PCT 592 making it difficult to compare and analyse the two PCTs against one another. In considering both PCTs it was determined that the vegetation on site is likely to be a closer fit with PCT 592 given it reference to the '*Vegetation and floristics of Leard State Conservation Areas'* (Cannon et al., 2002) as Leard State Conservation Area occurs approx. 5 km to the north west of the Modification study area. The profile for PCT 1313, whilst limited, conversely notes that the community occurs '*along the western side of the Nandewar Bioregion'*. Furthermore, the profile description of PCT 592 details floristic, geographic and geological characteristics which are most like vegetation observed within the Modification study area. Whilst the vegetation within the Modification study area is considered more likely to be consistent with PCT 592, it has been assigned to PCT 1313 in this assessment. This has been done to retain consistency of vegetation mapping conducted for the BCM and surrounding mining projects within the LSF and nearby offset properties as well as an established BioBank in the locality which all contain similar vegetation mapped as PCT 1313.
Conservation status	This PCT does not align to any threatened ecological communities. It does however provide potential habitat for numerous threatened species.
% cleared	55

DESCRIPTION			
Vegetation Class	Western Slopes Dry Sclerophyll Forests		
Vegetation Formation	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)		
Extent	41.68 ha occurs within the Modification study area, no areas of PCT 1313 occurs within the development footprint.		
Condition	Intact – The vegetation displayed a relatively intact groundcover, shrub and canopy layers. PCT 1313 showed evidence of past clearing associated with forestry practices i.e. predominately young tree cohort with occasional large old trees. Native species diversity was high and weed diversity and cover was relatively low. During the 2020 winter surveys abundance and cover of annual weed species was low to high due to above average rainfall received.		
Strata	**Height range & average**	**Percentage Foliage Cover range**	**Dominant Species**
Canopy	14–25 m	25-45%	Dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Callitris glaucophylla* (White Cypress Pine). Community also contains the occasional *Eucalyptus albens* (White Box) where it transitions into PCT 1383.
Sub-canopy	4–8 m	0-20%	Juvenile *Eucalyptus crebra* (Narrow-leaved Ironbark) and *Callitris glaucophylla* (White Cypress Pine) with *Pittosporum angustifolium* (Weeping Pittosporum), *Denhamia cunninghamii*, *Notelaea microcarpa* var. *microcarpa* (Native Olive), *Geijera parviflora* (Wilga), *Psydrax odorata* subsp. *australiana.* PCT 1313 also comprised of the occasional *Allocasuarina luehmannii* (Buloke) where it transitions into PCT 88.
Shrub stratum	0.3-2.5 m	0-25%	*Beyeria viscosa* (Pinkwood), *Dodonaea viscosa* subsp. *angustifolia* (Sticky Hop-bush), *Notelaea microcarpa* var. *microcarpa* (Native Olive), *Acacia deanei* subsp. *deanei* (Deane's Wattle), *Indigofera adesmiifolia* (Tick Indigo), *Acacia decora* (Western Silver Wattle), *Rhagodia parabolica* (Mealy Saltbush), *Melichrus urceolatus* (Urn Heath) and *Pimelea neo-anglica* (Poison Pimelea).
Ground layer	0.1-1 m	60-90%	High diversity of grasses, herbs and forbs including *Aristida ramosa* (Purple Wiregrass), *Digitaria brownii* (Cotton Panic Grass), *Solanum parvifolium* subsp. *parvifolium, Digitaria diffusa* (Open Summer-grass), *Austrostipa scabra* subsp. *scabra* (Spear Grass), *Cyperus gracilis* (Slender Flat-sedge), *Cymbopogon refractus* (Barbed Wire Grass), *Cheilanthes sieberi* subsp. *sieberi* (Poison Rock Fern), *Oxytes brachypoda* (Large Tick-trefoil), *Glycine tabacina* (Variable Glycine), *Desmodium varians* (Slender Tick-trefoil), *Brunoniella australis* (Blue Trumpet), *Dichondra* sp. A (Kidney Weed), *Eremophila debilis* (Winter Apple), *Microlaena stipoides* var. *stipoides* (Weeping Grass), *Rytidosperma racemosum* var. *obtusatum*, *Enneapogon gracilis* (Slender Bottle-washers), *Sporobolus creber* (Slender Rats Tail Grass), *Glycine clandestina* (Twinging Glycine), *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat-rush). *Brachyscome multifida*

DESCRIPTION			
			var. *multifida* (Cut-leaf Daisy) and *Ranunculus pumilio* var. *pumilio* (Ferny Buttercup). During the 2020 winter survey, exotic species such as *Solanum nigrum** (Blackberry Nighshade), *Hypochaeris radicata** (Catsear) and *Sonchus oleraceus** (Common Snowthistle) were observed in low to high densities in response to above average rainfall received.
Climbers	0.1-5 m	<1%	*Clematis microphylla* (Small-leaved Clematis), *Parsonsia eucalyptophylla* (Gargaloo) and *Marsdenia viridiflora* subsp. *viridiflora* (Native Pear).

Photo 5.7 PCT 1313 Intact

Photo 5.8 PCT 1313 Intact

5.2.4 PCT 1383 WHITE BOX GRASSY WOODLAND OF THE NANDEWAR BIOREGION AND BRIGALOW BELT SOUTH BIOREGION

Broad scale vegetation mapping of the Modification study area did not identify PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion as occurring in the Modification study area (Office for Environment & Heritage, 2016). However, field surveys confirmed the presence of PCT 1383 in moderate sized patches adjoining PCT 1313 towards the centre of the Modification study area.

A summary of PCT 1383 characteristics within the Modification study area is provided in Table 5.5 and depicted in Photo 5.9 and Photo 5.10. The extent of PCT 1383 within the Modification study area is illustrated in Figure 5.1.

Table 5.5 Summary of PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion

DESCRIPTION	
PCT justification	PCT 1383 within the Modification study area occurred as an open grassy woodland on soils derived from Permian geology. The community occurred within a flat landscape, which is more characteristic of PCT 1383 rather than PCT 435, which was mapped in the Modification study area by the State Vegetation Type regional mapping (PCT 435 occurs on hillslopes, hill crests and gullies) (Office for Environment & Heritage, 2016). The community contained a canopy stratum largely dominated by *Eucalyptus albens* (White Box) which is a diagnostic species of PCT 1383. Furthermore, the ground stratum contained diagnostic species such as *Austrostipa scabra* subsp. *scabra* (Spear Grass), *Aristida ramosa* (Purple Wiregrass), *Cyperus gracilis* (Slender Flat-sedge), *Cymbopogon refractus* (Barbed Wire Grass), *Dichanthium sericeum* subsp. *sericeum* (Queensland Bluegrass), *Oxytes brachypoda* (Large Tick-trefoil) and *Glycine tabacina* (Variable Glycine). Based on floristic, geographic and geological characteristics, this vegetation type is considered consistent with the scientific description and distribution information outlined for PCT 1383 within the BioNet Vegetation Classification (Environment Energy and Science Group, 2020c).
Conservation status	Aligns to the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland threatened ecological community which is listed as Critically Endangered under the BC Act and EPBC Act. PCT 1383 also provides habitat for numerous threatened species, including *Tylophora linearis.*
% cleared	88
Vegetation Class	Western Slopes Grassy Woodlands
Vegetation Formation	KF_CH3 Grassy Woodlands
Extent	8.99 ha occurs within the Modification study area, no areas of PCT 1383 occurs within the development footprint.
Condition	Intact – The vegetation displayed relatively intact groundcover, shrub and canopy layers. PCT 1383 showed evidence of past clearing associated with forestry practices. Native species diversity was high and weed diversity and cover was relatively low.

DESCRIPTION			
Strata	**Height range & average**	**Percentage Foliage Cover range**	**Dominant Species**
Canopy	16–25 m	30-40%	Dominated by *Eucalyptus albens* (White Box) with the occasional *Eucalyptus crebra* (Narrow-leaved Ironbark), predominately where PCT 1383 transitioned into PCT 1313.
Sub-canopy	4-8 m	10-15%	*Callitris glaucophylla* (White Cypress Pine), *Geijera parviflora* (Wilga), *Notelaea microcarpa var. microcarpa* (Native Olive) and occasional *Pittosporum angustifolium* (Weeping Pittosporum) and *Alstonia constricta* (Quinine Bush).
Shrub stratum	0.5-2.5 m	0-20%	Generally sparse cover of shrubs including *Acacia decora* (Western Silver Wattle), *Acacia deanei* subsp. *deanei* (Deane's Wattle), *Rhagodia parabolica* (Mealy Saltbush), *Notelaea microcarpa var. microcarpa* (Native Olive) and *Pittosporum angustifolium* (Weeping Pittosporum). Some areas contain regrowth *Callitris glaucophylla* (White Cypress Pine).
Ground layer	0.1-1.5 m	40-80%	High diversity of grasses, forbs and herbs including *Austrostipa scabra* subsp. *scabra* (Spear Grass), *Aristida ramosa* (Purple Wiregrass), *Cyperus gracilis* (Slender Flat-sedge), *Chloris ventricosa* (Plump Windmill Grass), *Cymbopogon refractus* (Barbed Wire Grass), *Dichanthium sericeum* subsp. *sericeum* (Queensland Bluegrass), *Bothriochloa macra* (Red Grass), *Oxytes brachypoda* (Large Tick-trefoil), *Glycine tabacina* (Variable Glycine), *Desmodium varians* (Slender Tick-trefoil), *Brunoniella australis* (Blue Trumpet), *Cynoglossum australe, Dichondra* sp. A (Kidney Weed), *Einadia nutans* subsp. *linifolia, Eremophila debilis* (Winter Apple), *Rostellularia adscendens* var. *adscendens, Calotis lappulacea* (Yellow Burr-daisy), *Chrysocephalum apiculatum* (Common Everlasting) and *Glossocardia bidens* (Cobbler's Tack).

Photo 5.9 PCT 1383 Intact

Photo 5.10 PCT 1383 Intact

5.2.5 MISCELLANEOUS ECOSYSTEM: HIGHLY DISTURBED AREAS WITH NO OR LIMITED NATIVE VEGETATION

This non-native vegetation type was dominated by either exotic grassland or occurred as bare earth. Highly disturbed areas with no or limited native vegetation were recorded predominantly within the existing tracks and roads and along corridors previously used for mine infrastructure.

Highly disturbed areas with no or limited native vegetation were generally dominated by exotic herbaceous species such as *Rapistrum rugosum** (Giant Mustard), *Gomphocarpus fruticosus** (Narrow-leaved Cotton Bush), *Hypochaeris radicata** (Catsear), *Echium plantagineum** (Paterson's Curse), *Sisymbrium irio** (London Rocket) and *Sisymbrium orientale** (Indian Hedge Mustard). Occasional disturbance tolerant native species were also present in low numbers such as *Sclerolaena birchii* (Galvanised Burr) and *Sclerolaena muricata* var. *muricata* (Black Rolypoly).

This vegetation type is shown in Photo 5.11 and Photo 5.12 and is illustrated in Figure 5.1.

Photo 5.11 Exotic grassland within highly disturbed areas

Photo 5.12 Along existing tracks

5.3 PLANT SPECIES RECORDED

A total of 285 plant species were recorded within the Modification study area, of which 229 were native (80%) and 56 were exotic (20%).

Of the 55 exotic species recorded five are listed as Priority Weeds under the Biosecurity Act for the North West Region (Department of Primary Industries, 2020b). These five species are also listed as Weeds of National Significance (WONS) (Australian Weeds Committee, 2020). Under the Biosecurity Act, land managers are required to follow the regional and non-regional duties which have been allocated to each Priority Weed.

All Priority Weeds and WONs recorded within the Modification study area and their associated duties under the Biosecurity Act are outlined below in Table 5.6.

Table 5.6 Priority Weeds and WONS recorded within the Modification Study Area

SCIENTIFIC NAME	COMMON NAME	WONS	HIGH THREAT WEED (BC ACT)	PRIORITY WEED – BIOSECURITY ACT DUTY
*Lycium ferocissimum**	African Boxthorn	Yes	Yes	**Prohibition of dealings -** Must not be imported into the State or sold. **Regional recommended measure -** Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. Land managers reduce impacts from the plant on priority assets.
*Opuntia stricta**	Common Pear	Yes	Yes	**Prohibition of dealings -** Must not be imported into the State or sold.
*Cylindropuntia imbricata**	Rope Pear	Yes	Yes	**Prohibition of dealings** - Must not be imported into the State or sold. **Regional recommended measure -** Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land.
*Opuntia tomentosa**	Velvety Tree Pear	Yes	Yes	**Prohibition of dealings -** Must not be imported into the State or sold.
*Opuntia aurantiaca**	Tiger Pear	Yes	Yes	**Prohibition of dealings** - Must not be imported into the State or sold. **Regional recommended measure -** Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. Land managers reduce impacts from the plant on priority assets. The plant should not be bought, sold, grown, carried or released into the environment.

Asterisk (*) denotes introduced species.

In addition to the Priority Weeds and WONS, the following troublesome weeds were recorded:

- *Emex australis** (Spiny Emex)
- *Xanthium spinosum** (Bathurst Burr)
- *Carthamus lanatus** (Slender Thistle)
- *Lycium ferocissimum** (African Boxthorn)
- *Megathyrsus maximus** (Guinea Grass).

These species are classified as High Threat Weeds under the BC Act due to their potential to out complete with native flora species is not controlled.

5.4 THREATENED ECOLOGICAL COMMUNITIES

One threatened ecological community listed under the BC Act was recorded in the Modification study area; being White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland. This threatened ecological community is listed as Critically Endangered under both the BC Act and EPBC Act.
Two PCTs recorded within the Modification study area were considered candidates for the Critically Endangered White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland threatened ecological community, these are:

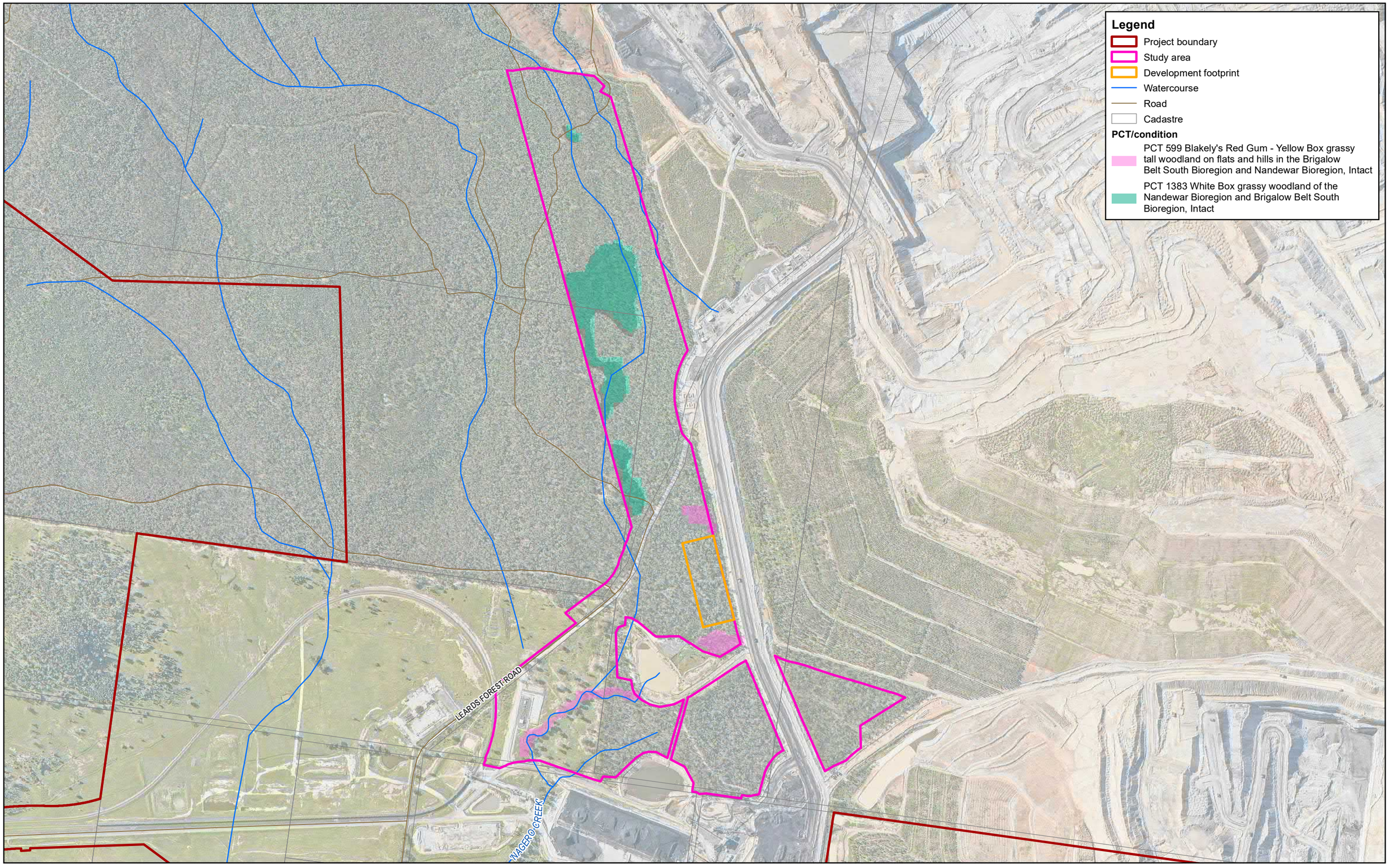
- PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion.

A comparison of PCT 599 and PCT 1383 within the Modification study area against the NSW Scientific Committee Final Determination (Office of Environment & Heritage, 2018c) is provided in Table 5.7. This comparison confirms that all patches of PCT 599 and PCT 1383 recorded in the Modification study area forms part of the BC Act Critically Endangered listing for the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland threatened ecological community (Figure 5.2).
An assessment of PCT 599 and PCT 1383 against the EPBC Act criteria outlined in the *EPBC Act policy statement 3.5 – White box – Yellow box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* (Department of the Environment and Heritage, 2006) is provided in Section 7.

Table 5.7 Correlation of PCT 599 and PCT 1383 against scientific determination criteria for White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland threatened ecological community

	PCT 599 (INTACT & MODIFIED)	**PCT 1383 (INTACT)**
Location: occurs within the Brigalow Belt South, Nandewar, New England Tableland, Sydney Basin, North Coast, South Eastern Highlands, South East Corner, South Western Slopes and Riverina IBRA Bioregions in NSW.	Yes, the Modification study area occurs within the Brigalow Belt South Bioregion.	
Topography: it typically at low elevations in flat to hilly and undulating landscapes (generally occurs below 600-700 m ASL however can occur at elevations to 1200 m in some regions).	Yes, the Modification study area occurs on flats and along non-permanent water courses below 600 ASL.	
Geology: typically found on soils of moderate fertility derived from a range of lithologies, including alkaline and acid volcanics, granites, sediments, serpentinites and metamorphics.	The Modification study area is comprised predominantly of soils which have moderate fertility derived from Permian geology (Maules Creek Formation) consisting predominantly of conglomerate and sandstone with minor siltstone, claystones and intercalated coal seams (Australian Groundwater & Environmental Consultants Pty Ltd, 2010).	

	PCT 599 (INTACT & MODIFIED)	PCT 1383 (INTACT)
Structure: occurs as either a grassy open woodland or as derived native grasslands.	Yes, occurs as open grassy woodlands with a shrub component less than 30%.	
Floristic canopy composition: community is characterised by a canopy of *Eucalyptus albens* (White Box) although may be co-dominant or dominant by *E. melli*odora (Yellow Box) and/or *E. blakelyi* (Blakely's Red Gum) in localised areas such as along non-permanent water courses and in deeper soils associated with valley floors.	Yes, PCT 599 within the Modification study area is dominated by *E. melli*odora (Yellow Box) and/or *E. blakelyi* (Blakely's Red Gum).	Yes, PCT 1383 within the Modification study area is dominated by *Eucalyptus albens* (White Box).
Floristic composition as detailed in Part 1 of the Scientific Determination.	A high number of the characteristic species identified in the Scientific Determination were recorded from PCT 599 and PC T1383 within the Modification study area.	
Meets the BC Act listing criteria of the threatened ecological community?	**Yes, meets criterion**	**Yes, meets criterion**



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Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL 2020

DOCUMENT	BC2020_PS120722_BDAR_008_A1
AUTHOR.	suansrir
EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

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FIGURE **5-2**

TITLE. **THREATENED ECOLOGICAL COMMUNITIES**

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5.5 GROUNDWATER DEPENDANT ECOSYSTEMS

Groundwater dependent ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater (Department of Land and Water Conservation, 2002). When considering GDEs, groundwater is generally defined as the saturated zone of the regolith (the layer of loose rock resting on bedrock, constituting the surface of most land) and its associated capillary fringe, however it excludes soil water held under tension in soil pore spaces (the unsaturated zone or vadose zone) (Eamus, Froend, Loomes, Hose, & Murray, 2006).

GDEs include a diverse range of ecosystems from those entirely dependent on groundwater to those that may use groundwater while not having a dependency on it for survival (i.e. ecosystems or organisms that use groundwater opportunistically or as a supplementary source of water) (Hatton & Evans, 1998). Eamus *et al.* (2006) considers the following broad classes of these ecosystems:

- Aquifer and cave ecosystems, where stygofauna (groundwater-inhabiting organisms) may reside within the groundwater resource. The hyporheic zones (see ecosystem 5 in Figure 5.3) of rivers and floodplains are also included in this category because these ecotones often support stygobites (obligate groundwater inhabitants).
- All ecosystems dependent on the surface expression of groundwater. This category includes base-flow rivers and streams, wetlands (see ecosystems 2 and 3 in Figure 5.3), some floodplains and mound springs and estuarine seagrass beds. While it is acknowledged that plant roots are generally below ground, this class of GDEs requires a surface expression of groundwater, which may, in many cases, then soak below the soil surface and thereby become available to plant roots.
- All ecosystems dependent on the subsurface presence of groundwater, often accessed via the capillary fringe (non-saturated zone above the saturated zone of the water table) when roots penetrate this zone. This class includes terrestrial ecosystems such as River Red Gum (*Eucalyptus camaldulensis*) forests on the Murray–Darling basin (see ecosystems 1 and 4 in Figure 5.3). No surface expression of groundwater is required in this class of GDE.

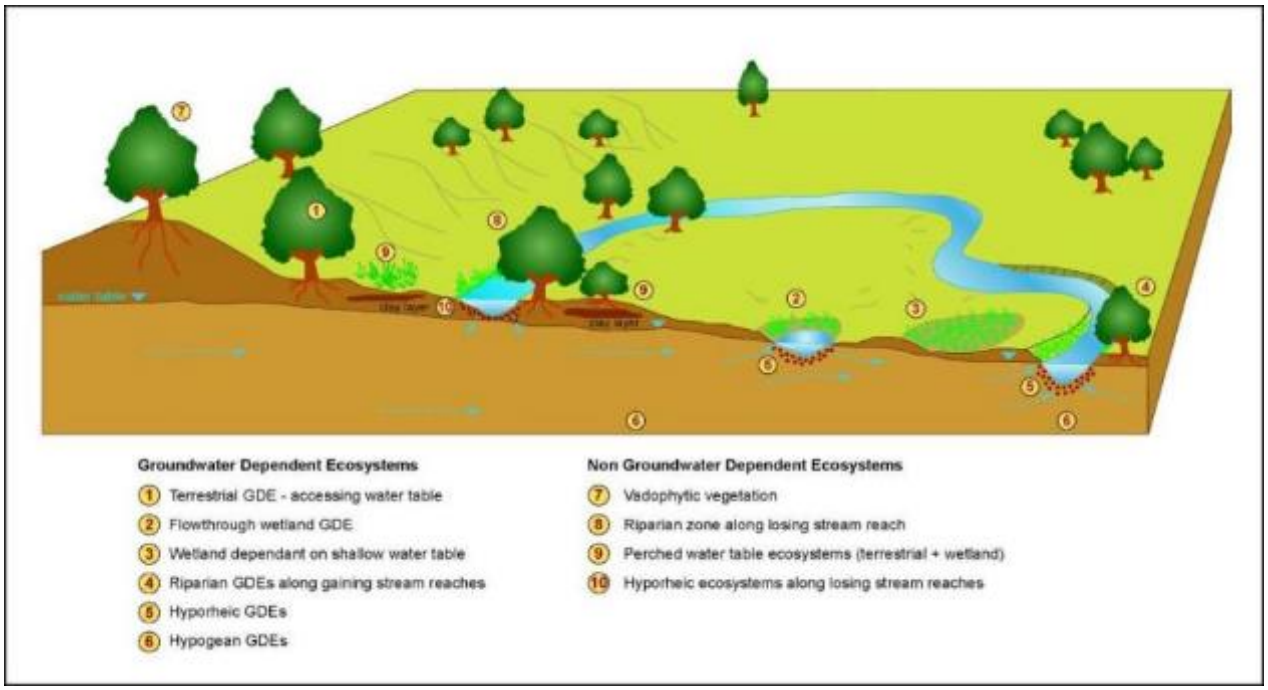


Figure 5.3 Conceptual biophysical model of groundwater dependant ecosystems

GDEs possess a range of values, including being important and sometimes rare ecosystems in themselves, as well as providing important ecosystem services such as water purification (Department of Land and Water Conservation, 2002).

The dependence (or interaction) of the vegetation communities identified in the development footprint on groundwater was determined by aligning them with the GDEs types identified by Eamus *et al.* (2006) (Figure 5.3).

The vegetation mapped within and immediately surrounding the Modification study area by the GDE Atlas (including vegetation types equivalent to PCT 88, PCT 1313 and PCT 1383) is assessed as having a low potential to be GDEs (national assessment) (Bureau of Meteorology, 2020). These PCTs are considered likely to be classified as "Vadophytic vegetation" hydrological ecosystems (Figure 5.3).

The field validated mapping completed as part of this assessment identified an additional vegetation type not mapped by the GDE Atlas; being PCT 599. PCT 599 is considered to have GDE potential based on regional studies as it is reliant on surface expressions of groundwater or on subsurface groundwater. PCT 599 is a riparian zone along a losing stream branch hydrological ecosystem, which is likely to be associated with moisture holding soils and/or shallow perched water tables over impermeable clay lenses rather than phreatophytic vegetation fed by sub-surface aquifers. Furthermore, groundwater monitoring within the alluvial plain of the locality indicates that the groundwater table is typically greater than 7m below ground level. As such, it is considered unlikely that this PCT would have a significant connection to the groundwater table. Based on this, PCT 599 within the Modification study area is considered unlikely to be a GDE.

No groundwater aquifer or cave systems, or wetlands were identified within the Modification study area from the field surveys and desktop assessment.

Although no GDEs reliant on the groundwater table were identified within the Modification study area, the GDE Atlas (Bureau of Meteorology, 2020) has identified vegetation with high potential aquatic/terrestrial GDE potential along several drainage features within the locality including the Namoi River, Barber's Lagoon, Maules Creek and its unnamed tributaries, Back Creek, Goonbri Creek, the upper reaches of Bollol Creek and parts of the Driggle Draggle Creek.

Detailed ecological surveys have been previously completed within the broader locality of the Modification study area as part of other investigations for the BCM project, including the original project approval, past modifications and as part of the establishment and monitoring of BCMs Biodiversity Offset Areas (BOAs). An analysis of the vegetation mapping completed as part of these investigations and each vegetation types potential dependence (or interaction) with groundwater against the GDE types identified by Murray *et al.* (2003) and Eamus *et al.* (2006) was completed as part of the MOD5 GDE impact assessment (WSP | Parsons Brinckerhoff, 2016). Of the vegetation types recorded, four terrestrial and one river base flow ecosystem types were considered to have potential for at least a partial dependency on groundwater resources; being:

- Terrestrial ecosystems:
  - Weeping Myall Woodland.
  - Pilliga Box – Poplar Box – White Cypress Pine grassy open woodland.
  - Plains grassland.
- River base flow ecosystems:
  - River Red Gum very tall open forest.

The three terrestrial vegetation communities listed above are restricted to the lower lying floodplain area to the south west of the Modification study area in association with Bollol Creek and Nagero Creek. These communities are considered to primarily utilise water in the unsaturated zone above the watertable (i.e. vadophyic vegetation) and be associated with moisture holding soils and/or shallow perched watertables over impermeable clay lenses rather than fed by sub-surface aquifers (i.e. phreatophytic vegetation). This is supported by the groundwater monitoring network within the alluvial plain which indicates that groundwater is typically 7 m below ground level within areas where these communities occur. As such, these communities are considered unlikely to have a significant connection to the groundwater table and therefore are not considered to be GDEs similarly to PCT 599 as described above.

The River Red Gum very tall open forest vegetation community is largely associated with the Namoi River (approximately 9 km from the Modification study area) where River Red Gums (*Eucalyptus camaldulensis*) obtain water from their deep and extensive taproot system which source water from adjacent stream sediments, shallow groundwater aquifers within the alluvial sediments and buried rock. As the River Red Gum's extensive root system typically extends greater than 10 m in depth (Davies, 1953), at least 20 m in horizontal spread (Dexter, 1967) and the groundwater depths within the locality are typically greater than 7 m in depth, it is likely that this community has proportional dependence on both groundwater and surface groundwater associated with the Namoi River resource.

Furthermore, studies completed by Cumberland Ecology (2011) have identified the presence of Melaleuca riparian woodland along the alignment of Back Creek, which are expected to have a root zone extending approximately 2 m to 3 m below the land surface. Groundwater monitoring along Back Creek indicates that the water table is greater than 10 m below the ground level suggesting that this vegetation within the area is unlikely to be accessing groundwater either. Given no GDEs were recorded witin the Modification study area, potential hydrological impacts would be limited to indirect impacts as discussed in Section 9.2, Section 9.3 and Section 9.7.

6 THREATENED SPECIES

This chapter address threatened species in accordance with Section 6 of the BAM and matters relating to the BC Act.

In applying the BAM, threatened species are divided into two categories, being ecosystem credit species and species credit species. An assessment of each of these species categories is provided in this chapter.

6.1 THREATENED SPECIES RECORDED

A total of 74 species of fauna were recorded (Appendix B) during field surveys within and adjacent to the Modification study area. Of the 74 species recorded, six were threatened species listed under the BC Act (Table 6.1, Figure 6.1).

Table 6.1 Threatened fauna recorded during surveys

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V
Little Lorikeet	*Glossopsitta pusilla*	V
Speckled Warbler	*Chthonicola sagittata*	V
Turquoise Parrot	*Neophema pulchella*	V
Varied Sittella	*Daphoenositta chrysoptera*	V

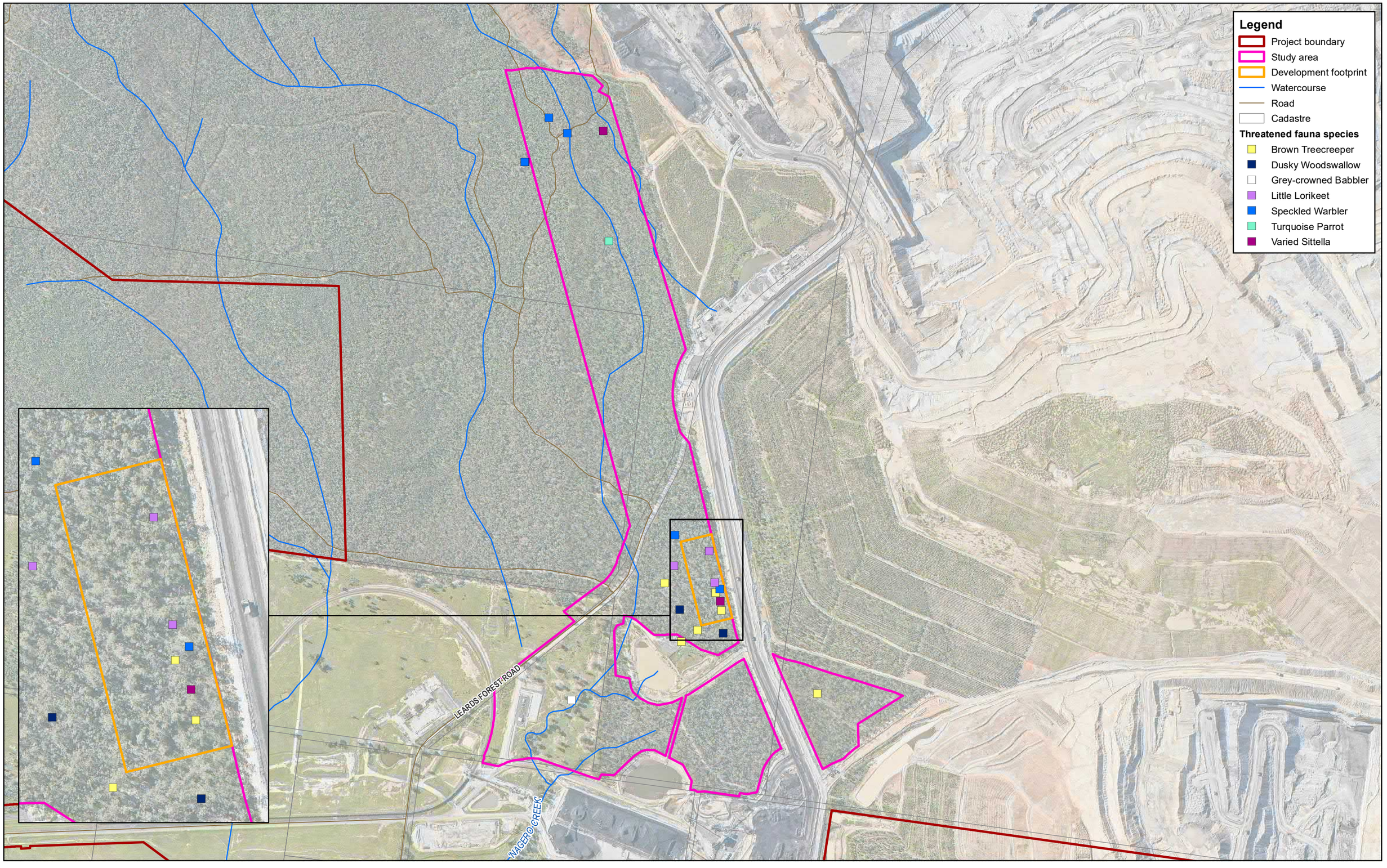
(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered.

6.2 ECOSYSTEM CREDIT SPECIES

Ecosystem credit species are those that can be predicted by vegetation surrogates and landscape features or are those species for which targeted survey has a low probability of detection. Targeted survey is not required for ecosystem credit species. Ecosystem credit threatened species were assessed using information about site context, PCTs and vegetation integrity attributes collected during the field surveys, and data from the Threatened Biodiversity Data Collection (Environment Energy and Science Group, 2020d) as required by Section 6.1.1.3 and Section 6.2.1.2 of the BAM.

An overview of the process for determining predicted ecosystem credit species is presented below:

- Step 1: All PCTs, associated vegetation zones and plot data from within the Modification study area are loaded into the BAM-C (see Section 5)
- Step 2: A list of predicted ecosystem credit species is generated from the BAM-C (see Section 6.2.1 and Table 6.2)
- Step 3: Justification for inclusion of any additional predicted ecosystem credit species based on the outcome from other database searches, local data sources and habitat suitability assessments (see Section 6.2.2, Table 6.3 and Appendix C)
- Step 4: Justification for exclusion of any predicted ecosystem credit species identified in the steps above (see Section 6.2.3, Table 6.4 and Appendix C)
- Step 5: Finalise predicted ecosystem credit species associated with each vegetation zone within the development footprint (see Section 8 & 11 and Appendix E).



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EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

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FIGURE **6-1**

TITLE. **THREATENED FAUNA SPECIES RECORDED**

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6.2.1 PREDICTED ECOSYSTEM CREDIT SPECIES GENERATED FROM BAM-C

A preliminary list of predicted ecosystem credit species was generated from the BAM-C based on associated vegetation types. This preliminary predicted ecosystem credit species list is presented in Table 6.2.

Table 6.2 List of BAM-C predicted ecosystem species

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	NATIVE VEGETATION TYPE(S)
Birds (24)			
Barking Owl	*Ninox connivens*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Black-breasted Buzzard	*Hamirostra melanosternon*	V	PCT 88
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Diamond Firetail	*Stagonopleura guttata*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Flame Robin	*Petroica phoenicea*	V	PCT 599
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	PCT 88, PCT 599 and PCT 1313
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Hooded Robin (south-eastern subspecies)	*Melanodryas cucullata cucullata*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Little Eagle	*Hieraaetus morphnoides*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Little Lorikeet	*Glossopsitta pusilla*	V	PCT 599, PCT 1313 and PCT 1383
Masked Owl	*Tyto novaehollandiae*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Painted Honeyeater	*Grantiella picta*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Powerful Owl	*Ninox strenua*	V	PCT 1383
Regent Honeyeater	*Anthochaera phrygia*	CE	PCT 599, PCT 1313 and PCT 1383
Scarlet Robin	*Petroica boodang*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Speckled Warbler	*Chthonicola sagittata*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Spotted Harrier	*Circus assimilis*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Square-tailed Kite	*Lophoictinia isura*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Superb Parrot	*Polytelis swainsonii*	V	PCT 88 and PCT 1383
Swift Parrot	*Lathamus discolor*	E	PCT 88, PCT 599, PCT 1313 and PCT 1383
Turquoise Parrot	*Neophema pulchella*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Varied Sittella	*Daphoenositta chrysoptera*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	NATIVE VEGETATION TYPE(S)
Mammals (5)			
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Koala	*Phascolarctos cinereus*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Little Pied Bat	*Chalinolobus picatus*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383
Spotted-tailed Quoll	*Dasyurus maculatus*	V	PCT 599, PCT 1313 and PCT 1383
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	PCT 88, PCT 599, PCT 1313 and PCT 1383

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered.

6.2.2 JUSTIFICATION FOR INCLUSION OF ANY ADDITIONAL PREDICTED ECOSYSTEM CREDIT SPECIES

In identifying an ecosystem credit species list for further assessment, three additional species were included to the BAM-C for consideration (Table 6.3).

Table 6.3 Justification for inclusion of any additional predicted ecosystem credit species

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	JUSTIFICATION FOR INCLUSION
Pied Honeyeater	*Certhionyx variegatus*	V	Associated habitats, including eucalypt woodlands with presence of mistletoes recorded. May intermittently occur during nomadic movements and seasonal flowering/fruiting of feed species. Has been recorded in greater locality.
Black Falcon	*Falco subniger*	V	Potential habitat within Modification study area. Species is known to occur locally.
Large Bent-wing Bat	*Miniopterus orianae oceanensis*	V	Suitable foraging habitat in Modification study area. Records in greater locality.

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered.

6.2.3 JUSTIFICATION FOR EXCLUSION OF ANY PREDICTED ECOSYSTEM CREDIT SPECIES

In refining the candidate ecosystem species list for further assessment, three ecosystem credit species predicted by the BAM-C were excluded from the BAM-C candidate list. A summary of the justification for these exclusions is provided in Table 6.4.

Table 6.4 Justification for exclusion of BAM-C predicted ecosystem credit species

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	JUSTIFICATION FOR EXCLUSION
Black-striped Wallaby	*Macropus dorsalis*	E	Lacks preferred habitat of dense vegetation, including brigalow, ooline and semi-evergreen vine thicket. No records within locality. Majority of records occur further to the west in relation to the Pilliga forests and reserves.
Pilliga Mouse	*Pseudomys pilligaensis*	V	Modification study area lacks preferred habitat. No records within locality. Majority of records confined to the Pilliga. Known to occur in recently burnt moist gullies, areas dominated by broombush and areas containing an understorey of kurricabah (*Acacia burrowii*) with a bloodwood (*Corymbia trachyphloia*) overstorey, this habitat does not occur within the Modification study area.

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	JUSTIFICATION FOR EXCLUSION
White-bellied Sea-eagle	*Haliaeetus leucogaster*	V	The Modification study area lacks important breeding habitat in the form of living or dead mature trees in suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines. The Modification study area also provides marginal foraging habitat, it is unlikely the species relies or utilises the habitat for foraging due to the lack of waterbodies within the Modification study area. Due to the lack of the important breeding and foraging habitat features the species is considered not to be a predicted species.

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered.

6.3 SPECIES CREDIT SPECIES

Species credit species are those species that cannot be confidently predicted to occur based on habitat surrogates and landscape features. These species can also be reliably detected by survey. Species credit species were assessed using information about site context, PCTs and vegetation integrity attributes collected during field surveys, and data from the Threatened Biodiversity Data Collection (Environment Energy and Science Group, 2020d), as required by Section 6.3.1.1 of the BAM in conjunction with a habitat assessment.

An overview of the process for determining candidate species credit species is presented below:

- Step 1: All PCTs, associated vegetation zones and plot data from within the Modification study area are loaded into the BAM-C (see Section 5)
- Step 2: A list of preliminary candidate species credit species is generated from the BAM-C (see Section 6.3.1.1 and Section 6.3.2.1)
- Step 3: Justification for inclusion of any additional species credit species based on the outcome from other database searches, local data sources and habitat suitability assessments (see Section 6.3.1.2, Section 6.3.2.2 and Appendix C)
- Step 4: Justification for exclusion of any BAM-C predicted candidate species credit species identified in the Step 2 above (see Section 6.3.1.3, Section 6.3.2.3 and Appendix C)
- Step 5: Finalise candidate species credit species associated with each vegetation zone (see Section 6.3.2)
- Step 6: Undertake target surveys for candidate threatened species or prepare an expert report or assume presence (see Section 3.5.2.2 and Section 3.5.3)
- Step 7: Assessment of candidate threatened species to determine the proposal affected species list (see Section 6.3.1.4 and Section 6.3.2.4)
- Step 8: Define threatened species impact (individual count or species polygon area count) (see Section 9.1.3.1)
- Step 9: Calculate threatened species impact using BAM-C (see Section 11 and Appendix E).

6.3.1 THREATENED FLORA SPECIES CREDIT SPECIES

6.3.1.1 CANDIDATE THREATENED FLORA SPECIES CREDIT SPECIES GENERATED BY THE BAM-C

A preliminary list of candidate threatened flora species credit species was generated from the BAM-C based on associated vegetation types recorded within the Modification study area. This preliminary candidate threatened flora species are presented in Table 6.5.

Table 6.5 List of preliminary BAM-C candidate threatened flora species credit species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S)
Cyperus conicus	-	E	No	PCT 88 and PCT 1313
Dichanthium setosum	Bluegrass	V	No	PCT 599, PCT 1313 and PCT 1383
Digitaria porrecta	-	E	No	PCT 599 and PCT 1383
Lepidium aschersonii	Spiny Peppercress	V	No	PCT 88
Polygala linariifolia	Native Milkwort	E	No	PCT 88, PCT 1313 and PCT 1383
Pomaderris queenslandica	Scant Pomaderris	E	No	PCT 599 and PCT 1313
Swainsona murrayana	Slender Darling Pea	V	No	PCT 1383
Thesium australe	Austral Toadflax	V	No	PCT 599 and PCT 1383
Tylophora linearis	-	V	No	PCT 88, PCT 599, PCT 1313 and PCT 1383

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered.

6.3.1.2 JUSTIFICATION FOR INCLUSION OF ANY ADDITIONAL THREATENED FLORA SPECIES CREDIT SPECIES

In identifying a candidate threatened flora species list for further assessment, three additional species were included to the BAM-C preliminary candidate list for consideration (Table 6.6).

Table 6.6 Justification for inclusion of any additional threatened flora species credit species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	JUSTIFICATION FOR INCLUSION
Androcalva procumbens	-	V	No	Potential habitat in the form of PCT 88, PCT 1313 and PCT 1383. Species has also been recorded in the broader locality (nearest records approx. 25 km west).
Diuris tricolor	Pine Donkey Orchid	V	No	Potential habitat in the form of PCT 88 and PCT 1313. Species has also been recorded in the broader locality (nearest records approx. 30 km west).
Lepidium monoplocoides	Winged Peppercress	E	No	Potential habitat in the form of PCT 88. Species has also been recorded in the broader locality (nearest records approx. 12 km south east of the Modification study area).

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered.

6.3.1.3 JUSTIFICATION FOR EXCLUSION OF ANY ADDITIONAL THREATENED FLORA SPECIES CREDIT SPECIES

In refining the candidate threatened flora species list for further assessment, one threatened flora species predicted by the BAM-C was excluded from the BAM-C candidate list. A summary of the justification for this exclusion is provided in Table 6.7.

Table 6.7 Justification for exclusion of BAM-C predicted candidate threatened flora species credit species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	JUSTIFICATION FOR EXCLUSION
Polygala linariifolia	Native Milkwort	E	No	Whilst vegetation associations within the development footprint were recorded (in the form of PCT 88, PCT 1313 and PCT 1383), the Modification study area does not however contain soils derived from granite geologies, which is the preferred habitat of the species. Soils in the north of the Modification study area are derived from Permian geology consisting of conglomerates, shales, sandstone with underlying coal measures. Soils in the south are derived from Quaternary sediments associated with alluvial deposits and consist of sands, silts and gravels (New England University and Regional Geology, 1973). Furthermore, species hasn't been recorded in the locality, nearest records >40 km from the Modification study area.

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered.

6.3.1.4 ASSESSMENT OF CANDIDATE FLORA DETERMINED TO BE AFFECTED

Eleven candidate threatened flora species were considered to have potential associated habitat within the Modification study area and as such, were subject to targeted survey. One candidate threatened flora species was recorded during targeted surveys completed for this investigation; being *Tylophora linearis*, which is listed as Vulnerable under the BC Act.

A discussion of *Tylophora linearis* within the Modification study area and the results of targeted survey completed for all candidate threatened flora species credit species is presented in Table 6.8.

Table 6.8 Summary results of targeted seasonal surveys completed for candidate threatened flora species credit species

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S)	SPECIES PRESENCE	AFFECTED SPECIES?
Cyperus conicus	-	E	No	PCT 88 and PCT 1313	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Cyperus conicus* and as such it is not considered an affected species.
Dichanthium setosum	Bluegrass	V	No	PCT 599, PCT 1313 and PCT 1383	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Dichanthium sericium* and as such it is not considered an affected species.
Digitaria porrecta	-	E	No	PCT 599 and PCT 1383	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Digitaria porrecta* and as such it is not considered an affected species.
Lepidium aschersonii	Spiny Peppercress	V	No	PCT 88	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Lepidium aschersonii* and as such it is not considered an affected species.
Pomaderris queenslandica	Scant Pomaderris	E	No	PCT 599 and PCT 1313	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Pomaderris queenslandica* and as such it is not considered an affected species.
Swainsona murrayana	Slender Darling Pea	V	No	PCT 1383	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Swainsona murrayana* and as such it is not considered an affected species.
Thesium australe	Austral Toadflax	V	No	PCT 599 and PCT 1383	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Thesium australe* and as such it is not considered an affected species.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S)	SPECIES PRESENCE	AFFECTED SPECIES?
Tylophora linearis	-	V	No	PCT 88, PCT 599, PCT 1313 and PCT 1383	Yes (surveyed)	No Targeted surveys recorded seven *Tylophora linearis* individuals in the Modification study area. However, this species was not recorded from the development footprint, and as such, it is not considered an affected species.
Androcalva procumbens	-	V	No	PCT 88, PCT 1313 and PCT 1383	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Androcalva procumbens* and as such it is not considered an affected species.
Diuris tricolor	Pine Donkey Orchid	V	No	PCT 88 and PCT 1313	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Diuris tricolor* and as such it is not considered an affected species.
Lepidium monoplocoides	Winged Peppercress	E	No	PCT 88	No (surveyed)	No Targeted surveys within the Modification study area did not record any specimens of *Lepidium monoplocoides* and as such it is not considered an affected species.

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered.

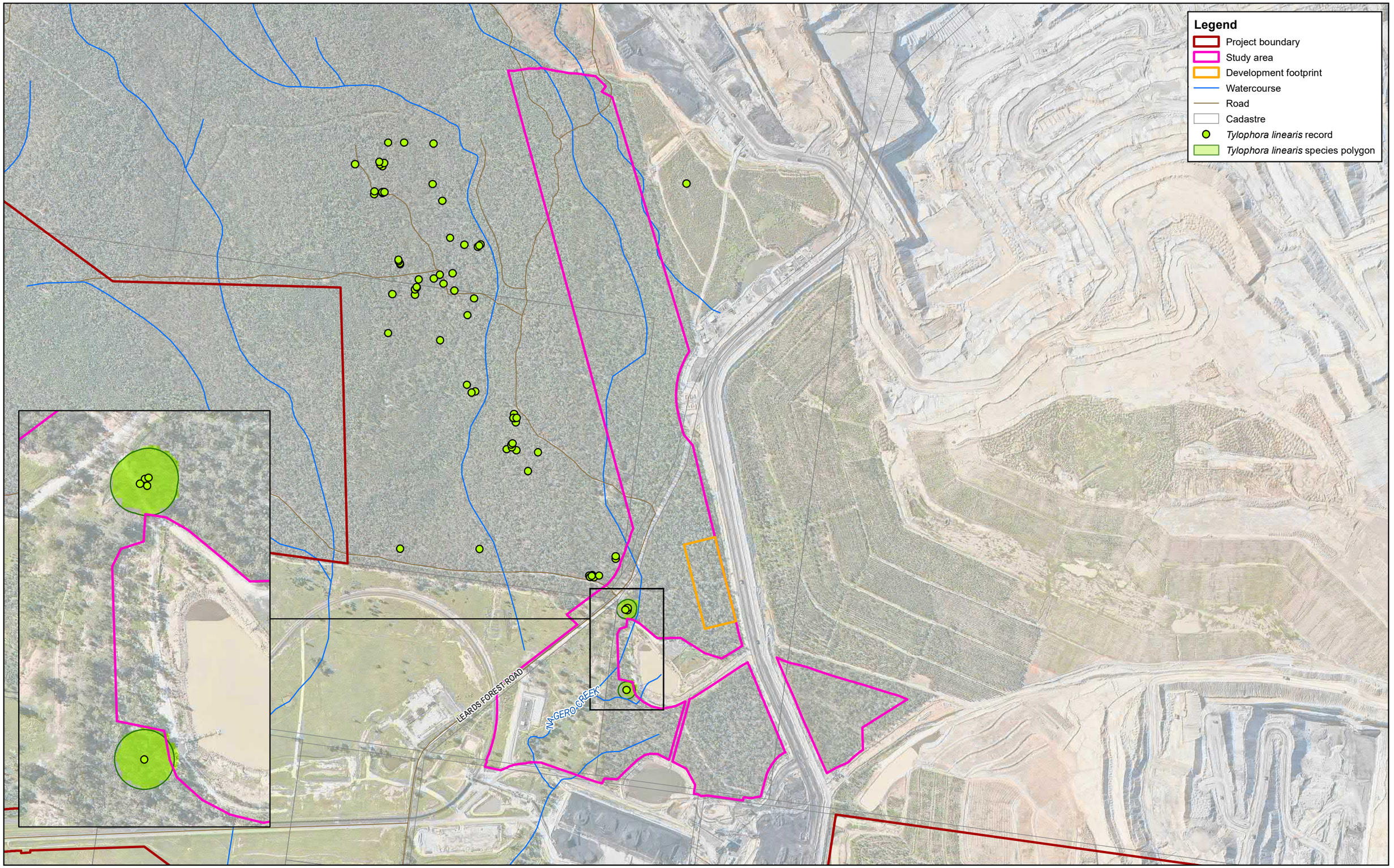
TYLOPHORA LINEARIS

Tylophora linearis is listed as Vulnerable under the BC Act and Endangered under the EPBC Act. It is a slender twiner with narrow linear dark green leaves and clear sap which produces tiny purple flowers in groups of 3-8. The species is known to grow on flats and hills in dry scrub, open forest and dry woodlands in association with *Eucalyptus albens, Callitris glaucophylla, Callitris endlicheri, Eucalypts fibrosa, Eucalyptus sideroxylen* and *Allocasuarina luehmannii* (Environment Energy and Science Group, 2020d).

Thousands of *Tylophora linearis* have been recorded throughout Leard State Forest as part of previous surveys completed for BCM as part of tree clearing operations, biodiversity monitoring and targeted surveys. Within Leard State Forest, the species has been recorded from within a range of vegetation types including PCT 88, PCT 1313 and PCT 1383, all of which occur in the Modification study area.

Surveys conducted as part of the current investigation identified seven *Tylophora linearis* individuals as occurring within the Modification study area (Figure 6.2). None of these individuals occurred within the development footprint, and as such, the species will not be directly impacted by the proposed Modification. Within the Modification study area, the species was observed as a small herbaceous plant short and erect (to 50 cm tall) with a climbing habit with some individuals attached to dead/alive shrubs. The plant generally occurred as scattered individuals or small groups scattered across the area is which it occupied.

The species was observed growing within PCT 88 in association with *Eucalyptus pilligaensis, Allocasuarina luehmannii, Callitris glaucophylla, Notelaea microcarpa* var. *microcarpa, Geijera parviflora, Acacia deanei* subsp. *deanei, Solanum parvifolium, Dodonaea viscosa* subsp. *angustifolia, Olearia eliptica, Austrostipa scabra, Aristida ramosa, Einadia nutans* subsp. *linifolia* and *Oxytes brachypodium.*



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AUTHOR.	suansrir
EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

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FIGURE **6-2**

TITLE. ***TYLOPHORA LINEARIS***

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6.3.2 THREATENED FAUNA SPECIES CREDIT SPECIES

6.3.2.1 CANDIDATE THREATENED FAUNA SPECIES CREDIT SPECIES GENERATED BY THE BAM-C

A preliminary list of candidate threatened fauna species credit species was generated from the BAM-C based on associated vegetation types and habitat features recorded within the Modification study area. This preliminary candidate threatened fauna species are presented in Table 6.9.

Table 6.9 List of preliminary BAM-C candidate threatened fauna species credit species

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	SAII	HABITAT FEATURES
Birds (6)				
Barking Owl	*Ninox connivens*	V	No	Breeding habitat i.e. Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	No	Breeding habitat i.e. Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground.
Little Eagle	*Hieraaetus morphnoides*	V	No	Breeding habitat i.e. Nest trees - live (occasionally dead) large old trees within vegetation.
Masked Owl	*Tyto novaehollandiae*	V	No	Breeding habitat i.e. Living or dead trees with hollows greater than 20 cm diameter.
Powerful Owl	*Ninox strenua*	V	No	Breeding habitat i.e. living or dead trees with hollow greater than 20 cm diameter.
Square-tailed kite	*Lophoictinia isura*	V	No	Breeding habitat i.e. Nest trees
Mammals (2)				
Koala	*Phascolarctos cinereus*	V	No	Important habitat i.e. Areas identified via survey as important habitat.
Squirrel Glider	*Petaurus norfolcensis*	V	No	Relies on large old trees with hollows for breeding and nesting.
Reptiles (1)				
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	No	n/a

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered.

6.3.2.2 JUSTIFICATION FOR INCLUSION OF ANY ADDITIONAL THREATENED FAUNA SPECIES CREDIT SPECIES

No additional candidate threatened species credit species were identified to be included to the BAM-C preliminary candidate species credit list for consideration.

6.3.2.3 JUSTIFICATION FOR EXCLUSION OF ANY ADDITIONAL THREATENED FAUNA SPECIES CREDIT SPECIES

In refining the candidate threatened fauna species list for further assessment, 16 threatened fauna species predicted by the BAM-C were excluded from the BAM-C candidate species credit list. A summary of the justification for this exclusion is provided in Table 6.10.

Table 6.10 Justification for exclusion of BAM-C predicted candidate threatened fauna species credit species

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	SAII	HABITAT FEATURE(S)	JUSTIFICATION FOR EXCLUSION
Birds (7)					
Australian Bustard	*Ardeotis australis*	V	No	n/a	No records within the locality of the Modification study area. Species mainly occurs in inland Australia and is now scarce or absent from more eastern parts of NSW. Predominately found in the north-west corner and less often recorded in the lower western and central west plains regions. Occasional vagrants are still seen as far east as the western slopes and Riverine plain. Breeding now only occurs in the north-west region of NSW. Given the lack of observations in the locality and the species predominately occurs further west in arid regions, the Modification study area is not likely to occur as important habitat and therefore the species is unlikely to be affected and not considered as a candidate species.
Black-breasted Buzzard	*Hamirostra melanosternon*	V	No	Breeding habitat – land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts	Limited records within the locality. Species is known to occur in arid regions of NSW further to the west. The Modification study area lacks important breeding habitat in the form of riparian woodland along watercourses. Due to the lack of breeding habitat and limited records of individuals in the locality it is unlikely the species would rely on the Modification study area for either foraging or breeding habitat.
Bush Stone-curlew	*Burhinus grallarius*	V	No	n/a	The Bush Stone-curlew is now only common in northern Australia. In south-east Australia it is either rare or extinct throughout its former range. It prefers low shrublands and low open grassy woodlands and is occasionally seen in pastoral and cropping country. Roosts on ground among shrubs and long grasses or under trees in more open country. The Modification study area does not contain preferred habitat and lacks more 'open' woodland for breeding habitat. Due to its major contraction from its former range; limited recent (<10 years) records within the locality and lack of preferred breeding habitat, it is unlikely the species would occur in the Modification study area or that the species persists within the locality or region.

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	SAII	HABITAT FEATURE(S)	JUSTIFICATION FOR EXCLUSION
Regent Honeyeater	*Anthochaera phrygia*	CE	Yes	Mapped important areas	No key breeding areas identified in the National Recovery Plan or other key mapped important breeding areas occur within locality of the Modification study area. Given this species nomadic nature it cannot be discounted. Foraging habitat for this species occurs in the form of *Eucalyptus albens* and is considered further as a predicted ecosystem species.
Superb Parrot	*Polytelis swainsonii*	V	No	Breeding habitat i.e. Living or dead *E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta* with hollows greater than 5cm diameter; greater than 4m above ground or trees with a DBH of greater than 30cm.	Core breeding area for Superb Parrot occurs between the Cowra and Yass region, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The Modification study area does not occur within core breeding areas and individuals would likely only occur within the Modification study area outside their breeding periods during winter for foraging purposes. The species prefers nesting in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or woodland. The Modification study area does not occur within core breeding habitat nor does the habitat within the Modification study area occur within riparian areas or along waterbodies. Due to the lack of the important breeding habitat features the species is not considered to be a candidate species.
Swift Parrot	*Lathamus discolor*	E	Yes	Mapped important areas	The species is a winter migrant to NSW typically occurring on the Australian mainland between March and September. The Modification study area does not occur within important mapped areas. Given this species is nomadic with respect to the temporal availability of blossom resources, Swift Parrot presence cannot be discounted, as foraging habitat associated with *Eucalyptus albens* occurs in the Modification study area. The Swift Parrot is considered further as a predicted ecosystem species.
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	No	Breeding habitat - Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	The Modification study area lacks important breeding habitat in the form of living or dead mature trees in suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines. Due to the lack of the important breeding habitat features the species is considered not to be a candidate species.

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	SAII	HABITAT FEATURE(S)	JUSTIFICATION FOR EXCLUSION
Mammals (7)					
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	No	n/a	In NSW the Brush-tailed Phascogale is mainly found east of the Great Dividing Range, with sparse records occurring to the west of the Great Dividing Range. Due to the lack of records for this species in the Modification study area and wider locality and that Leard State Forest occurs outside the known mapped distribution of the species, it is unlikely that the Brush-tailed Phascogale occurs locally and therefore it is not considered a candidate species.
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	Yes	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines	The Modification study area does not provide the important habitat of rocky escarpments, outcrops and cliffs. No records within the Modification study area or locality. Due to the lack of the important breeding habitat features, the species is not considered to be a candidate species.
Eastern Cave Bat	*Vespadelus troughtoni*	V	Yes	No presence of breeding habitat identified within Modification study area – i.e. caves or areas within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds.	The Modification study area does not contain important breeding habitat in the form of caves or areas within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles. The Modification study area consisted of potential foraging habitat for the species and the species is known to occur in the locality. However, due to the lack of the important breeding habitat features, the species is not considered be a candidate species.
Eastern Pygmy-possum	*Carcartetus nanus*	V	No	n/a	The species range appears to be patchily distributed and its overall abundance is low. The Eastern Pygmy-possum is known to occur to the west of the Modification study area in the Pilliga forests, however, no records occur in the Modification study area or locality. The Eastern Pygmy-possums prefers heathy woodlands with thick/ dense understorey of banksias, eucalypts and bottlebrushes. Due to the lack of important preferred habitat of thick understorey and the lack of records within the Modification study area and locality, this species is unlikely to occur in the Modification study area and is not considered to be a candidate species.

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	SAII	HABITAT FEATURE(S)	JUSTIFICATION FOR EXCLUSION
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	No	Lack of important habitat – i.e. breeding camps	The Modification study area does not provide important breeding habitat, nor were any breeding camps identified in the Modification study area. The Modification study area is outside mapped known distribution for the species and the species is predominantly known to occur within 200 km of the coast, with some nomadic foraging movements west of the Great Dividing Range. In addition, the species prefers establishing breeding camps in vegetation with a dense canopy and close to water. Due to the lack of the important breeding habitat features the species is not considered to be a candidate species.
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	Yes	No presence of breeding habitat identified within Modification study area – i.e. caves and areas within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	The Modification study area does not provide important breeding habitat in the form of caves and areas within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within 2 km of old mines or tunnels. The Modification study area does provide foraging habitat for the species and the species is known to occur in the locality. However, due to the lack of the important breeding habitat features the species is not considered to be a candidate species.
Rufous Bettong	*Aepyprymnus rufescens*	V	No	n/a	In NSW, the Rufous Bettong has largely vanished from inland areas, but there are sporadic, unconfirmed records from the Pilliga and Torrington districts. The Modification study area is outside the species current known mapped distribution. No records occur in the locality of the Modification study area. In addition, the species prefers a dense cover of tall native grasses as its preferred shelter. This important microhabitat features is limited and lacking within the Modification study area. Based on the lack of records, the Modification study area being outside the current known distribution and the lack of preferred habitat, the Rufous Bettong is not considered to be a candidate species.

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	SAII	HABITAT FEATURE(S)	JUSTIFICATION FOR EXCLUSION
Reptiles (2)					
Border Thick-tailed Gecko	*Uvidicolus sphyrurus*	V	No	n/a	In NSW, the Border Thick-tailed Gecko predominately occurs in granite country of the New England Tablelands. It is most common on rocky slopes and outcrops. It is known to prefer habitats that occur on steep rocky or scree slopes, especially granite, of which do not occur within the Modification study area. No records occur in the Modification study area locality. Based on the lack of records, the Modification study area occurring outside the mapped known distribution and the lack of preferred habitat, the Border Thick-tailed Gecko is not considered to be a candidate species.
Pink-tailed Worm Lizard (syn. Pink-tailed Legless Lizard)	*Aprasia parapulchella*	V	No	Rocky areas, or within 50m of rocky areas	The Pink-tailed Worm-lizard is only known from the Central and Southern Tablelands, and the South Western Slopes, with a small disjunct population occurring at Gunnedah. This species inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass. Additionally, sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. These preferred microhabitats do not occur within the Modification study area. No records occur in the Modification study area locality. Based on the lack of records; the Modification study area occurring outside the mapped known distribution and the lack of preferred habitat, this species is not considered to be a candidate species.

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered.

6.3.2.4 ASSESSMENT OF CANDIDATE FAUNA DETERMINED TO BE AFFECTED

Nine candidate threatened fauna species were considered to have potential associated habitat within the Modification study area and as such, were subject to targeted surveys. No candidate threatened fauna species were recorded during targeted surveys completed for this investigation.

Three candidate fauna species have been assumed present based on associated suitable habitat, survey seasonality constraints and threatened species records from within Leard State Forest and surveys completed as part of the BCM project. These species include:

- Koala
- Squirrel Glider
- Pale-headed Snake.

A discussion of the three threatened species assumed to occur within the Modification study area is provided below and the results of targeted surveys completed for all candidate threatened fauna species credit species is presented in Table 6.11.

Table 6.11 Summary results of targeted seasonal surveys completed for candidate threatened fauna species credit species

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S) & FEATURES	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
Birds (6)							
Barking Owl	*Ninox connivens*	V	No	Breeding habitat i.e. Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground.	No (surveyed)	**No**. Targeted surveys were undertaken during recommended survey months (May-Dec). Breeding habitat was recorded during habitat assessments. Nocturnal surveys, stagwatches, call playback and opportunistic sightings did not record any individuals in Modification study area and no individuals were recorded nesting or utilising hollow-bearing trees within the Modification study area for breeding. As such, breeding habitat for this species is considered unlikely to be affected.	Not considered further as a species credit species.
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	No	Breeding habitat i.e. Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground.	No (surveyed)	**No**. Targeted surveys were undertaken during recommended survey months (Mar-Aug). Breeding habitat was recorded during habitat assessments. Diurnal surveys and opportunistic sightings did not record any individuals in Modification study area and no individuals were recorded nesting or utilising hollow-bearing trees within the Modification study area for breeding. As such, breeding habitat for this species is considered unlikely to be affected.	Not considered further as a species credit species.
Little Eagle	*Hieraaetus morphnoides*	V	No	Breeding habitat i.e. Nest trees - live (occasionally dead) large old trees within vegetation.	No (surveyed)	**No**. Targeted surveys were undertaken during recommended survey months (Aug-Oct). Breeding habitat was recorded during habitat assessments. Diurnal surveys and opportunistic sightings did not record any individuals in Modification study area and no individuals were recorded nesting or utilising hollow-bearing trees within the Modification study area for breeding. As such, breeding habitat for this species is considered unlikely to be affected.	Not considered further as a species credit species.

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S) & FEATURES	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
Masked Owl	*Tyto novaehollandiae*	V	No	Breeding habitat i.e. Living or dead trees with hollows greater than 20cm diameter.	No (surveyed)	**No**. Targeted surveys were undertaken during recommended survey months (May-Aug). Breeding habitat was recorded during habitat assessments. Nocturnal surveys, stagwatches, call playback and opportunistic sightings did not record any individuals in Modification study area and no individuals were recorded nesting or utilising hollow-bearing trees within the Modification study area for breeding. As such, breeding habitat for this species is considered unlikely to be affected.	Not considered further as a species credit species.
Powerful Owl	*Ninox strenua*	V	No	Breeding habitat i.e. living or dead trees with hollow greater than 20cm diameter.	No (surveyed)	**No**. Targeted surveys were undertaken during recommended survey months (May-Aug). Breeding habitat was recorded during habitat assessments. Nocturnal surveys, stagwatches, call playback and opportunistic sightings did not record any individuals in Modification study area and no individuals were recorded nesting or utilising hollow-bearing trees within the Modification study area for breeding. As such, breeding habitat for this species is considered unlikely to be affected.	Not considered further as a species credit species.
Square-tailed kite	*Lophoictinia isura*	V	No	Breeding habitat i.e. Nest trees	No (surveyed)	**No**. Targeted surveys were undertaken during recommended survey months (Sep-Jan). Breeding habitat was recorded during habitat assessments. Diurnal surveys and opportunistic sightings did not record any individuals in Modification study area and no individuals were recorded nesting in the Modification study area for breeding. As such, breeding habitat for this species is considered unlikely to be affected.	Not considered further as a species credit species.

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	SAII	NATIVE VEGETATION TYPE(S) & FEATURES	SPECIES PRESENCE	AFFECTED SPECIES?	OUTCOME
Mammals (2)							
Koala	*Phascolarctos cinereus*	V	No	Important habitat i.e. Areas identified via survey as important habitat.	No (surveyed)	**Yes.** Despite the species not being recorded during targeted field survey, the Koala is cryptic in nature and is known from Leard State Forest. Detailed systematic surveys previously undertaken in Leard State Forest identified a low population density of Koala with a core activity area in the southern portion of Leard State Forest, which incorporated the Modification study area. In addition, the Modification study area retained four Koala feed tree species, *Eucalyptus pilligaensis, E. blakelyi*, *E. albens* and *E.* populnea. Therefore, despite the absence of Koala use during current survey, due to the presence of Koala feed tree species and previous Koala activity, it is likely that Modification study area may be used on an intermittent basis as a movement corridor in the broader landscape to access preferred habitat.	**Species credit** (Figure 6.3)
Squirrel Glider	*Petaurus norfolcensis*	V	No	Relies on large old trees with hollows for breeding and nesting.	No (surveyed)	**Yes**. Despite the species not being recorded during field surveys, the species can be difficult to recorded due to their cryptic nature. The species has been recorded in the locality and is known to occupy Leard State Forest. It is assumed based on records in locality and the occurrence of important habitat features that the species is likely to use the Modification study area for both foraging and breeding purposes.	**Species credit** (Figure 6.3)
Reptiles (1)							
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	No	n/a	Assumed present	**Yes**. Surveys did not occur within required survey period (Nov-Mar), however despite this, the species has previously been recorded within the Modification study area and within the locality and therefore highly likely to utilise the Modification study area for both foraging and breeding purposes.	**Species credit** (Figure 6.3)

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered.

KOALA

Koala is listed as Vulnerable under both the BC and EPBC Act. In New South Wales, Koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range. The most notable population west of the Great Dividing Range is the Gunnedah population and those occupying the Pilliga forests. The Gunnedah population remains as 'islands' of native vegetation in a dominated rural landscape which has been cleared for agricultural purposes. Majority of Koala records within the Gunnedah region seem to be associated with areas on the lower slopes, along riparian corridors and floodplains.

Studies have been undertaken for Koala occurrence proximate to the Boggabri Coal Mine in the Leard State Forest in relation to previous Biodiversity Impact Assessments and associated subsequent surveys. Ninety-four survey sites were sampled within the Project Boundary and 52 survey sites were assessed within the remaining owned Boggabri Coal Mine lease. A further 20 survey sites were assessed within the Project Boundary during March/April 2009. A total of 2,858 trees were assessed, comprising nine species of Eucalyptus and one species of non-eucalypt. The most common tree species sampled were *E. crebra*, *E. albens* and *E. pilligaensis*.

Evidence of habitat use by Koalas (i.e. presence of Koala scats) was recorded in 3 % (five of 166 survey sites) of the sampled sites. Koala activity within these sites was typically low, ranging from <5 to 20 %, with a mean activity score (active sites only) of 11 %.

Koala scats were observed under four species, including *E. crebra*, *E. albens*, *E. pilligaensis* and *E. blakelyi*. One Koala was observed at a survey location in the Boggabri Coal lease area during systematic searches for this species in 2009. Another Koala was recorded opportunistically during other survey efforts during March/April 2009.

In addition to the above surveys, the following surveys were undertaken within and adjacent to the Modification study area during field investigations informing this report:

— 8 Koala SATs (September 2018 and August 2020)
— 8 person hours spotlighting (September 2018 and August 2020)
— 8 call playback nights (September 2018 and August 2020)
— 110 person hours opportunistic surveys (September 2018, August 2019 & August 2020).

No Koala activity was recorded regarding these surveys, however, based on previous ecological studies and previous records, the species is known to occur within the locality, has previously been recorded in the Modification study area, and is likely to use habitat therein during seasonal movements. Koala habitat within the Modification study area is associated with PCT 88, PCT 599, PCT 1313 and PCT 1383 (Figure 6.3). Koalas show a strong feeding preference between Eucalyptus species with some Eucalypts consumed at a significantly higher rate than others. Regarding the Modification study area, Koalas would predominately use food trees, as detailed in Table 6.12.

Table 6.12 Koala feed tree species in the Western Slopes and Plains Koala Management area

PRIMARY FOOD TREES	SECONDARY FOOD TREES	SUPPLEMENTARY FOOD/SHELTER TREES[1]
E. camaldulensis	*E. pilligaensis*	*Casuarina cristata*
	E. populnea	*Callitris glaucophylla*
	E. melliodora	*E. crebra*
	E. albens	
	E. dwyeri	
	E. blakelyi	

SQUIRREL GLIDER

The Squirrel Glider is listed as Vulnerable under the BC Act. The species inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range. It prefers mixed species stands with a shrub or *Acacia* midstorey. The species relies on large old trees with hollows for breeding and nesting. The following surveys were undertaken in and immediately adjacent to the Modification study area:

- 153 remote camera trap nights (September 2018 and August 2020)
- 210 hairtube trap nights (September 2018)
- 8 nights stagwatching hollow-bearing trees (September 2018 and August 2020)
- 8 person hours spotlighting (September 2018 and August 2020).

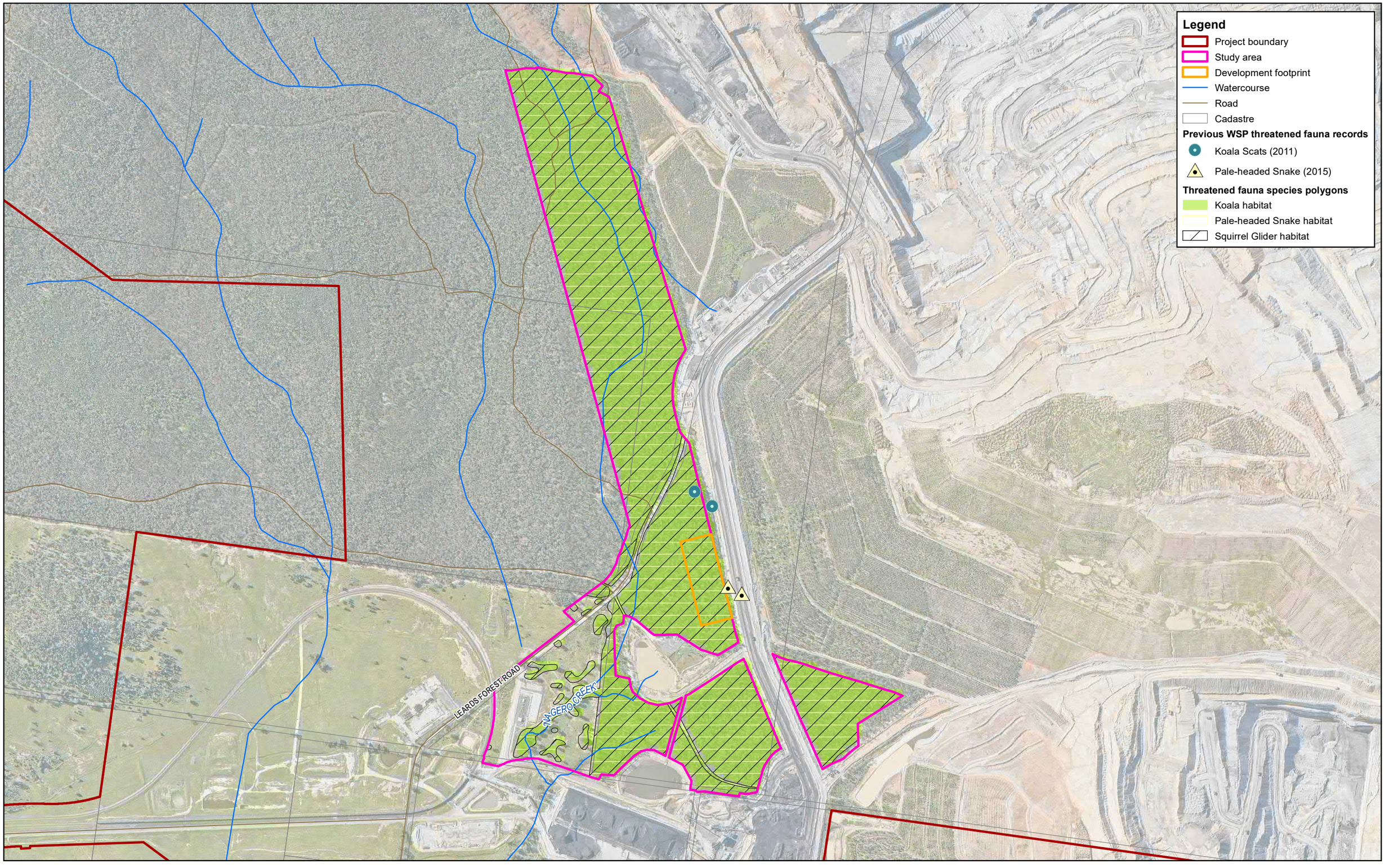
The targeted surveys did not record the species within the Modification study area, however, based on recent records within the Modification study area locality; the presence of foraging habitat; the abundance of large old trees with hollows for breeding and nesting and the general cryptic nature of the species, it is considered that the Modification study area would form part of the species home range and thus likely be utilised by the species (Figure 6.3).

PALE-HEADED SNAKE

The Pale-headed Snake is listed as Vulnerable under the BC Act. The species has a patchy distribution from north-east Queensland to the north-eastern quarter of NSW. In NSW, it has historically been recorded from as far west as Mungindi and Quambone on the Darling Riverine Plains, across the north west slopes. The Pale-headed Snake is a highly cryptic species that can spend weeks at a time hidden in tree hollows. The species is found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. The following surveys were undertaken in and immediately adjacent to the Modification study area:

- 8 person hours spotlighting (September 2018 and August 2020)
- habitat assessments to determine habitat features
- 8 nights of opportunistic surveys (16 person hours).

Targeted surveys did not record this species within the Modification study area, however, the species has previous been recorded immediately adjacent to the Modification study area during clearing operations as part of the existing ROM haul road (Figure 6.3). In addition, the species has been regularly recorded during annual tree clearing operations associated with BCM. Based on recent records within the Modification study area locality; the presence of foraging habitat; the abundance of hollow-bearing trees and the general cryptic nature of the species, it is considered that the species would inhabit the Modification study area (Figure 6.3).



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Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL 2020

DOCUMENT	BC2020_PS120722_BDAR_012_A1
AUTHOR.	suansrir
EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

IDEMITSU
BOGGABRI COAL

FIGURE **6-3**

TITLE. **CANDIDATE THREATENED FAUNA SPECIES POLYGONS**

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6.4 THREATENED AQUATIC SPECIES

6.4.1 FM ACT LISTED THREATENED SPECIES

No threatened aquatic habitat occurs in the Modification study area. However, several drainage lines (Strahler 4/5th Order streams), occur to the south and west of the Modification study area, flowing intermittently following sustained and substantial local rainfall. These drainage lines flow to the Namoi River through Cooboobindi Creek in a general south-west direction.

Within the wider locality, threatened aquatic habitat is associated with the Namoi River, Maules Creek and Bollol Creek. Threatened species associated with these drainage lines include Eel-tailed Catfish (Endangered), Olive Perchlet, Purple Spotted Gudgeon and Silver Perch (Vulnerable).

6.4.2 FM ACT LISTED ENDANGERED ECOLOGICAL COMMUNITIES

No Endangered Ecological Communities listed under the FM Act have the potential to occur in the Modification study area.

7 MATTERS OF NATIONAL SIGNIFICANCE

This chapter describes Matters of National Environmental Significance (MNES) relating to Commonwealth legislation under the EPBC Act.

7.1 THREATENED SPECIES AND ECOLOGICAL COMMUNITIES

7.1.1 THREATENED ECOLOGICAL COMMUNITIES

Based on broad-scale state vegetation mapping and database searches, a total of two candidate threatened ecological communities listed under the EPBC Act were considered likely to occur. These are:

- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands
- Poplar Box Grassy Woodland on Alluvial Plains.

A comparative assessment of native vegetation recorded within the Modification study area against each of these EPBC Act listed threatened ecological communities is provided below in Section 7.1.1.1 and Section 7.1.1.2.

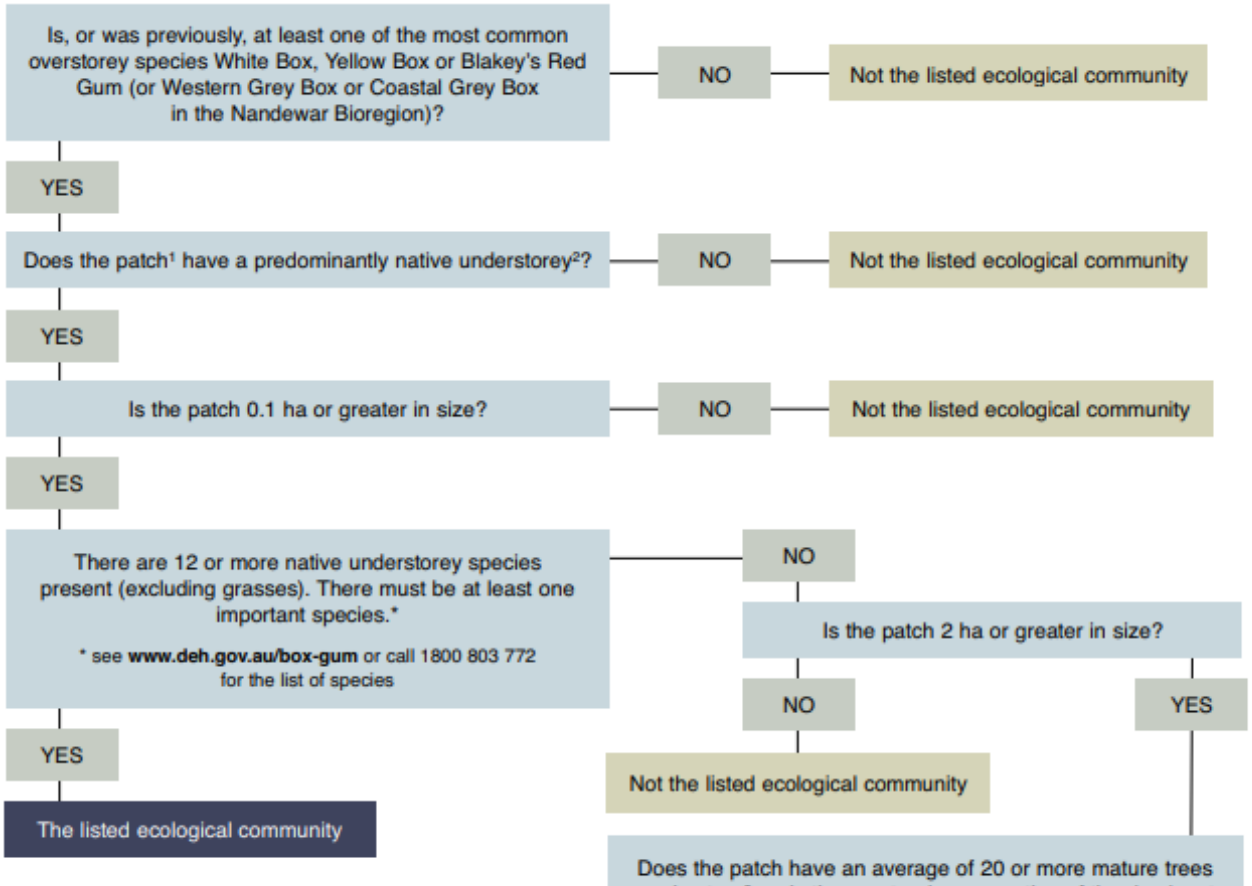
7.1.1.1 WHITE BOX – YELLOW BOX – BLAKELY'S RED GUM GRASSY WOODLAND AND DERIVED NATIVE GRASSLANDS

Two PCTs recorded in the Modification study area were considered a candidate to form part of the '*White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands'* threatened ecological community listed as Critically Endangered under the EPBC Act; being:

- PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion
- PCT 1383 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion.

To be considered consistent with the Critically Endangered listing under the EPBC Act, the vegetation must be consistent with the criteria outlined in the *EPBC Act policy statement 3.5 – White box – Yellow box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* (Department of the Environment and Heritage, 2006) and as summarised in Figure 7.1. An assessment of PCT 1383 against these criteria is provided in Table 7.1.

The assessment concluded that all patches of PCT 599 and PCT 1383 meet the criteria of the EPBC Act listing for White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.



Please note: for criteria relating to the understorey, apply this flowchart to the 0.1 hectare of your patch that contains the most native species in the ground layer.

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[1] Patch – a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and is not, included within any individual patch. The patch is the larger of:

- an area that contains five or more trees in which no tree is greater than 75 m from another tree, or
- the area over which the understorey is predominantly native.

Patches must be assessed at a scale of 0.1 ha (1000m²) or greater.

[2] A predominantly native ground layer is one where at least 50 per cent of the perennial vegetation cover in the ground layer is made up of native species. The best time of the year to determine this is late autumn when the annual species have died back and have not yet started to regrow. (At other times of the year, you can determine whether something is perennial or not is if it is difficult to pull out of the soil. Annual species pull out very easily.)

[3] Mature trees are trees with a circumference of at least 125 cm at 130 cm above the ground.

[4] Natural regeneration of the dominant overstorey eucalypts when there are mature trees plus regenerating trees of at least 15 cm circumference at 130 cm above the ground.

Figure 7.1 Commonwealth White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands

Table 7.1 Assessment against White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands EPBC Act determining criteria

CRITERIA	PCT 1383 (INTACT)	PCT 599 (INTACT & MODIFIED)
Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakely's Red Gum?	Yes, canopy if dominated by White Box.	Yes, canopy dominated by either Yellow Box or Blakely's Red Gum.
Does the patch have a predominantly native understorey?	Yes, native groundcover is greater than 50% cover.	Yes, native groundcover is greater than 50% cover.
Is the patch 0.1 ha or greater in size?	Yes, patches are greater than 0.1 ha in size.	Yes, patches are greater than 0.1 ha in size.
There are 12 or more native understorey species present (excluding grasses). There must be at least one important species.	Yes, patches contain >12 native understory species and at least one important species.	Yes, patches contain >12 native understory species and at least one important species.
Meet EPBC Act listing criteria?	**Yes, meets EPBC Act listing criteria**	**Yes, meets EPBC Act listing criteria**

7.1.1.2 POPLAR BOX GRASSY WOODLAND AND ALLUVIAL PLAINS

One PCT recorded in the Modification study area was considered a candidate to form part of the '*Poplar Box Grassy Woodland and Alluvial Plains'* threatened ecological community listed as Endangered under the EPBC Act; being PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion.

To be considered consistent with the Endangered listing under the EPBC Act, the vegetation must be consistent with the criteria outlined in the *EPBC Act Conservational Advice (including listing advice) for the Poplar Box Grassy Woodland and Alluvial Plains* (Department of Environment and Energy, 2019).

Specifically, the vegetation must meet:

- the key diagnostic characteristics AND
- at least the minimum condition thresholds for Category D (moderate quality condition).

KEY DIAGNOSTIC CHARACTERISTICS

A comparison of PCT 88 patches against the key diagnostic characteristics for Poplar Box Grassy Woodlands and Alluvial Plains is provided in Table 7.2. The assessment concluded that PCT 88 within the Modification study area does not meet the key diagnostic characteristics of Poplar Box Grassy Woodland and Alluvial Plains. As such, this threatened ecological community has not been considered further.

Table 7.2 Comparison of PCT 88 against EPBC Act Poplar Box Grassy Woodland and Alluvial Plains key diagnostic characteristics

KEY DIAGNOSTIC CHARACTERISTICS	PCT 88 CONDITION TYPES			
	INTACT	**MODIFIED**	**SHRUBBY REGROWTH**	**DNG**
Occurs in the Brigalow Belt North, Brigalow Belt South, Southeast Queensland, Cobar Peneplains, Darling Riverine Plains, NSW South Western Slopes, Riverina and Murray Darling Depression IBRA bioregions.	Yes, Modification study area occurs within the Brigalow Belt South IBRA Bioregion.			
Associated with ancient and recent depositional alluvial plains with clay, clay-loam, loam and sandy loam, typically duplex soils or sodosols. This includes areas that may not be part of currently defined floodplains.	Partially, areas of PCT 88 in proximity to PCT 599 may be associated within minor alluvial plains where they transition with one another. PCT 88 however typically occurred as a dry sclerophyll forest. Conversely, PCT 599 is a grassy woodland community which grows on flats and along ephemeral drainage lines within the Modification study area. It is noted that following rainfall in 2020 areas of PCT 88 within the development footprint contained areas of standing water. This is considered a result of indirect impacts associated with the existing infrastructure (i.e. haul road and contour bank) within the development footprint. The construction of these features has created artificial barriers which appear to have had minor alterations to natural surface water filtration of the immediate area during rainfall events leading to pools of standing water.			
A grassy woodland to grassy open woodland with a tree crown cover of 10% or more at patch scale.	Yes, tree crown cover is 10% or more at patch scale.		No, tree crown cover is absent or less than 10%.	
A tree canopy must be present that shows these features: — Canopy tree species are capable of reaching 10m or more in height — *Eucalyptus populnea* (Poplar Box) must be present in the canopy and is the dominant tree species — Where hybrids of Poplar Box and Eucalyptus spp. are present, they should be counted as part of the *Eucalyptus populnea* component of the tree canopy when assessing previous criterion.	No, whilst canopy cover exceeds 10 m in height and *Eucalyptus populnea* (Poplar Box) does occur as a canopy tree within the Modification study area it is not the dominant species. PCT 88 is largely dominated by *Eucalyptus pilligaensis* (Narrow-leaved Grey Box) occurring with *Eucalyptus populnea* (Poplar Box) and *Eucalyptus crebra* (Narrow-leaved Ironbark). Within the development footprint occurrences of *Eucalyptus populnea* are rare.		No, no canopy occurs within these condition types.	
Mid layer (1-10m) crown cover of shrubs to small trees is low, about 30% or less	No, mid layer crown cover of shrubs and small trees was largely greater than 30% cover and usually dominated by *Allocasuarina luehmannii* (Bulloak).	Yes, mid layer crown cover of shrubs and small trees is general less than 30% cover.	No, mid layer crown cover of shrubs and small trees was largely greater than 30% cover.	Yes, no mid layer cover present.
Meet EPBC Act key diagnostic characteristics?	**No, failed to meet one or more key diagnostic characteristics.**			

7.1.2 THREATENED FLORA SPECIES

Fourteen EPBC ACT listed threatened flora species are known to occur or are predicted to occur within the locality of the Modification study area. Of these, seven have been identified to have a moderate or higher likelihood of occurrence based on previous records and availability of potential habitat (Appendix C and Table 7.3). As such, these species were considered further as candidate species with potential to be impacted and were subjected to further assessment as summarised below in Table 7.3.

One EPBC Act listed threatened flora species was recorded within the Modification study area during targeted surveys completed; being *Tylophora linearis* (refer to Section 6.3.1 and Figure 7.1). Avoidance measures, proposed mitigation measures and residual impacts on the species are described in Section 8 and Section 10. The residual adverse impacts likely to occur to *Tylophora linearis* after avoidance and mitigation have been calculated in accordance with the BAM (in the form of biodiversity species credits) and are presented in Section 11 and Appendix E.

An assessment of significance has also been completed for this species in accordance with the EPBC Act *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Department of the Environment, 2013). This assessment is provided in Appendix D.

Table 7.3 EPBC Act threatened flora species considered for assessment

SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	ASSESSMENT DETAILS	SPECIES IMPACTED BY MODIFICATION?
Androcalva procumbens	-	V	Candidate species credit species. Potential habitat in the form of PCT 88, PCT 1313 and PCT 1383 subject to targeted surveys in Dec 2019 and Jan 2020. Species not recorded during targeted surveys.	No – although potential habitat occurs, the species was not identified during targeted surveys. As such species is considered unlikely to occur within the development footprint and is not considered further.
Dichanthium setosum	Bluegrass	V	Candidate species credit species. Potential habitat in the form of PCT 599, PCT 1313 and PCT 1383 subject to targeted surveys in Dec 2019 and Jan 2020. Species not recorded during targeted surveys.	No – although potential habitat occurs, the species was not identified during targeted surveys. As such species is considered unlikely to occur within the development footprint and is not considered further.
Lepidium aschersonii	Spiny Peppercress	V	Candidate species credit species. Potential habitat in the form of PCT 88 subject to targeted surveys in Dec 2019 and Jan 2020. Species not recorded during targeted surveys.	No – although potential habitat occurs, the species was not identified during targeted surveys. As such species is considered unlikely to occur within the development footprint and is not considered further.
Lepidium monoplocoides	Winged Peppercress	E	Candidate species credit species. Potential habitat in the form of PCT 88 subject to targeted surveys in Dec 2019 and Jan 2020. Species not recorded during targeted surveys.	No – although potential habitat occurs, the species was not identified during targeted surveys. As such species is considered unlikely to occur within the development footprint and is not considered further.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS[1]	ASSESSMENT DETAILS	SPECIES IMPACTED BY MODIFICATION?
Swainsona murrayana	Slender Darling Pea	V	Candidate species credit species. Potential habitat in the form of PCT 1383 subject to targeted surveys in Sept 2019. Species not recorded during targeted surveys.	No – although potential habitat occurs, the species was not identified during targeted surveys. As such species is considered unlikely to occur within the development footprint and is not considered further.
Thesium australe	Austral Toadflax	V	Candidate species credit species. Potential habitat in the form of PCT 599 and PCT 1383 subject to targeted surveys in Dec 2019 and Jan 2020. Species not recorded during targeted surveys.	No – although potential habitat occurs, the species was not identified during targeted surveys. As such species is considered unlikely to occur within the development footprint and is considered further.
Tylophora linearis	-	E	Candidate species credit species. Potential habitat in the form of PCT 88, PCT 599, PCT 1313 and PCT 1383 subject to targeted surveys in Dec 2019, Jan 2020 and August 2020. Species recorded during targeted surveys.	No – although species was recorded within the Modification study area, it was not recorded in the development footprint during targeted searches. Refer to Section 6.3.1 and Figure 7.1 for further details. The EPBC Act significance assessment for this species is detailed in Appendix D.

(1) Threat status under the EPBC Act: V = Vulnerable, E = Endangered.

7.1.3 THREATENED FAUNA SPECIES

Nineteen EPBC ACT listed threatened fauna species are known to occur or are predicted to occur within the locality of the Modification study area. This comprised 10 species of bird, six mammals, two reptiles and one fish (Appendix C). Of these, nine were identified to have a moderate or higher likelihood of occurrence based on previous records and availability of potential habitat (Appendix C and Table 7.4).

No threatened fauna species listed under the EPBC Act were recorded in the Modification study area during targeted surveys. Avoidance measures, proposed mitigation measures and residual impacts on these species are described in Section 8 and Section 10. The residual adverse impacts likely to occur to these species after avoidance and mitigation have been calculated in accordance with the BAM (in the form of biodiversity species credits) and are presented in Section 11 and Appendix E.

A significance assessments has been completed for EPBC Act threatened fauna species considered to be impacted by the proposed Modification in accordance with the EPBC Act *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (Department of the Environment, 2013). These assessments are provided in Appendix D.

Table 7.4 Listed EPBC Act threatened fauna species considered for assessment

COMMON NAME	SCIENTIFIC NAME	EPBC ACT[1]	ASSESSMENT DETAILS	SPECIES IMPACTED BY MODIFICATION?
Birds (5)				
Anthochaera phrygia	Regent Honeyeater	CE	Candidate species credit species Predicted habitat occurs within PCT 599, PCT 1313 and PCT 1383 No local records but nomadic species that may occur in association with profuse flowering *Eucalyptus albens*	Potentially. However, the removal of potential foraging habitat is not considered to be significant.
Grantiella picta	Painted Honeyeater	V	Predicted ecosystem credit species Predicted habitat occurs within PCT 88, PCT 599, PCT 1313 and PCT 1383 Species regularly recorded in association with *Acacia pendula* immediately south of Leard State Forest. Primary food source in mistletoe (*Amyema* genus) recorded in Modification study area	Potentially. However, the removal of potential foraging habitat is not considered to be significant.
Hirundapus caudacutus	White-throated Needletail	V, M	Species previously recorded in aerial habitats over Leard State Forest	Potentially. However, the impact is not considered to be significant.
Lathamus discolor	Swift Parrot	CE	Predicted ecosystem credit species Predicted habitat occurs within PCT 88, PCT 599, PCT 1313 and PCT 1383 Species previously recorded in Leard State Forest in association with profuse flowering *Eucalyptus albens*	Potentially. However, the removal of potential foraging habitat is not considered to be significant.
Polytelis swainsonii	Superb Parrot	V	Predicted ecosystem credit species Predicted habitat in PCT 88 and PCT 1383 No records in the locality, but a portion of the species population undertake annual winter migration from breeding grounds in south-western NSW, north to Narrabri/ Moree area.	Potentially. However, the removal of potential foraging habitat is not considered to be significant.

COMMON NAME	SCIENTIFIC NAME	EPBC ACT[1]	ASSESSMENT DETAILS	SPECIES IMPACTED BY MODIFICATION?
Mammals (9)				
Dasyurus maculatus	Spotted-tailed Quoll	E	Predicted ecosystem credit species Predicted habitat occurs within PCT 599, PCT 1313 and PCT 1383 Local records are sparse, but a wide-ranging species and potential habitat recorded in Modification study area	Potentially. However, the impact is not considered to be significant.
Chalinolobus dwyeri	Large-eared Pied Bat	V	Candidate species credit species Predicted habitat occurs within PCT 88, PCT 599, PCT 1313 and PCT 1383 Potential foraging habitat recorded in the Modification study area	Potentially. However, the removal of potential foraging habitat is not considered to be significant.
Nyctophilus corbeni	Corben's Long-eared Bat	V	Predicted ecosystem credit species Predicted habitat occurs within PCT 88, PCT 599, PCT 1313 and PCT 1383 Species previously recorded in Leard State Forest	**Yes**. However, the impact is not considered to be significant.
Phascolarctos cinereus	Koala	V	Candidate species credit species Predicted habitat occurs within PCT 88, PCT 599, PCT 1313 and PCT 1383 Several food tree species identified in the Modification study area and species previously recorded in a low population density in Leard State Forest	**Yes**. However, the impact is not considered to be significant.

(2) Threat status under the EPBC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory.

7.1.3.1 KOALA

The Koala is listed as Vulnerable under the EPBC Act. There are scattered records in Leard State Forest and the wider locality and considering the 2019 / 2020 bushfire season, any remaining population could be regarded as a population that is important within the North-West Slopes and Plains of NSW.

Under the EPBC Act an 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The Modification study area contained four Koala feed tree species, including *Eucalyptus pilligaensis, E. blakelyi*, *E. albens* and *E. populnea*.

No Koala activity was recorded in the Modification study area (or its immediate vicinity) via Spot Assessment Technique (SAT) results or other signs such as scratches, observations or vocalisations. SAT searches were completed at 14 locations within and immediately adjacent the Modification study area (Figure 3.3), including the development footprint,

targeting the abovementioned feed tree species. However, detailed systematic surveys previously undertaken in Leard State Forest identified a low population density of Koala with a core activity area in the southern portion of Leard State Forest, which incorporated the Modification study area. Despite the absence of Koala habitat use during current surveys, due to the presence of Koala feed tree species and previous Koala activity, it is likely that Modification study area may be used on an intermittent basis as a movement corridor in the broader landscape to access preferred habitat.

The Koala Habitat Assessment Tool within the '*EPBC Act referral guidelines for the vulnerable Koala'* (Department of the Environment, 2014) was used to determine whether Koala habitat within the Modification study area classifies as '*habitat critical to the survival of the Koala'* (Figure 7.2). To be classified as habitat critical to the survival of the Koala vegetation must score 5 or above using the habitat assessment tool. A summary of the key assessment criteria and scoring for the Modification study area against the referral guidelines is provided in Table 7.5 and illustrated in Figure 7.2.

Koala habitat in the Modification study area scored 7 out of 10 (Table 7.5) using the Koala Habitat Assessment Tool. Therefore, habitat in the Modification study area technically constitutes habitat critical to the survival of the species.

Table 7.5 Koala habitat assessment tool

ATTRIBUTE	SCORE	HABITAT APPRAISAL	
Koala occurrence	1	Desktop	Database searches identified three Koala records within 2 km the Modification study area in the last 10 years. No records for Koala have been recorded in the past two years.
		On-site	No Koala individuals or traces of Koalas (scats, scratching etc.) were recorded within the development footprint or Modification study area during survey informing this report. However, Koalas have previously been recorded in the Modification study area (2009) during the Continuation of Boggabri Coal Mine Biodiversity Impact Assessment (Parsons Brinckerhoff, 2010).
Vegetation structure and composition	2	Desktop	Not applicable
		On-site	Habitat ground-truthing was completed during field surveys, which identified four Koala feed tree species listed under Schedule 2 of State Environmental Planning Policy (Koala Habitat Protection) 2019, including *E. pilligaensis, E. blakelyi*, *E. albens* and *E. populnea.* All of these species are identified as secondary feed tree species for the Western Slopes and Plains Koala Management Area, as listed on the Department of Planning, Industry and Environment web page.
Habitat connectivity	2	The Modification study area is a part of a contiguous landscape that is >1000 ha.	
Key existing threats	1	Desktop	No records of Koala mortality or dog attack were identified within 2 km of the Modification study area on BioNet. However, the Modification study area is located adjacent to active open cut mine operations and forestry trails that are frequented by light vehicle and occasionally heavy vehicles that may increase roadkill risk.
		On-site	The status of wild dog populations and level of predation is not known. No evidence of Koala mortality from vehicle strike was observed in the Modification study area during surveys completed. However, there are historical records of Koala within tree clearing areas/ active mine operation areas.

ATTRIBUTE	SCORE	HABITAT APPRAISAL
Recovery value	1	The Modification study area is subject to existing edge effects and fragmentation associated open cut coal mine operations and ROM haul road immediately to the east of the Modification study area. It is however connected to large areas of Koala habitat in association with the remainder of Leard State Forest.
Total	**7**	**Decision: a score of 7 obtained, therefore Modification study area technically contains potential critical habitat.**

A comparison of the Modifications potential impacts was assessed against Figure 2 of the '*EPBC Act referral guidelines for the vulnerable Koala'* (Department of the Environment, 2014) to determine where impacts were likely to be adverse. As illustrated in Figure 7.3, it was concluded that the Modification is unlikely to have an adverse impact on the habitat critical for the species due to the following:

- Leard State Forest does not occur as an '*Area of Regional Koala Significance*'. With relevance to the Modification study area, such areas are mapped to the south and west in association with Gunnedah and the Pilliga forests respectively (Department of Environment and Energy, 2020d).
- Vegetation within the Modification study area and development footprint contained supplementary feed tree species only.
- Despite the absence of observed Koala habitat use during current surveys, due to the presence of Koala feed tree species and previous Koala activity, it is likely that Modification study area may be used on an intermittent basis with movements through the broader landscape to access preferred habitat.
- The maximum development footprint will impact approximately 3.31 ha of potential Koala habitat. However, due to the requirement for engineering flexibility and micro-siting of structures, it is anticipated that the final development footprint would encompass approximately 1.2 ha.

The EPBC Act significant impact assessment concluded that the Modification is unlikely to have a significant impact on the Koala (Appendix D).

Attribute	Score	Inland	Coastal
Koala occurrence	+2 (high)	Evidence of one or more koalas within the last 5 years.	Evidence of one or more koalas within the last 2 years.
	+1 (medium)	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 10 years.	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years.
	0 (low)	None of the above.	None of the above.
Vegetation composition	+2 (high)	Has forest, woodland or shrubland with emerging trees with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.	Has forest or woodland with 2 or more known koala food tree species, **OR** 1 food tree species that alone accounts for >50% of the vegetation in the relevant strata.
	+1 (medium)	Has forest, woodland or shrubland with emerging trees with only 1 species of known koala food tree present.	Has forest or woodland with only 1 species of known koala food tree present.
	0 (low)	None of the above.	None of the above.
Habitat connectivity	+2 (high)	Area is part of a contiguous landscape ≥ 1000 ha.	Area is part of a contiguous landscape ≥ 500 ha.
	+1 (medium)	Area is part of a **contiguous landscape** < 1000 ha, but ≥ 500 ha.	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha.
	0 (low)	None of the above.	None of the above.
Key existing threats	+2 (high)	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present	
	+1 (medium)	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, **OR** Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present.	
	0 (low)	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the study area at present, **OR** Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present.	
Recovery value	+2 (high)	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	+1 (medium)	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	
	0 (low)	Habitat is unlikely to be important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1.	

Figure 7.2 Assessment of habitat critical to the survival of the Koala

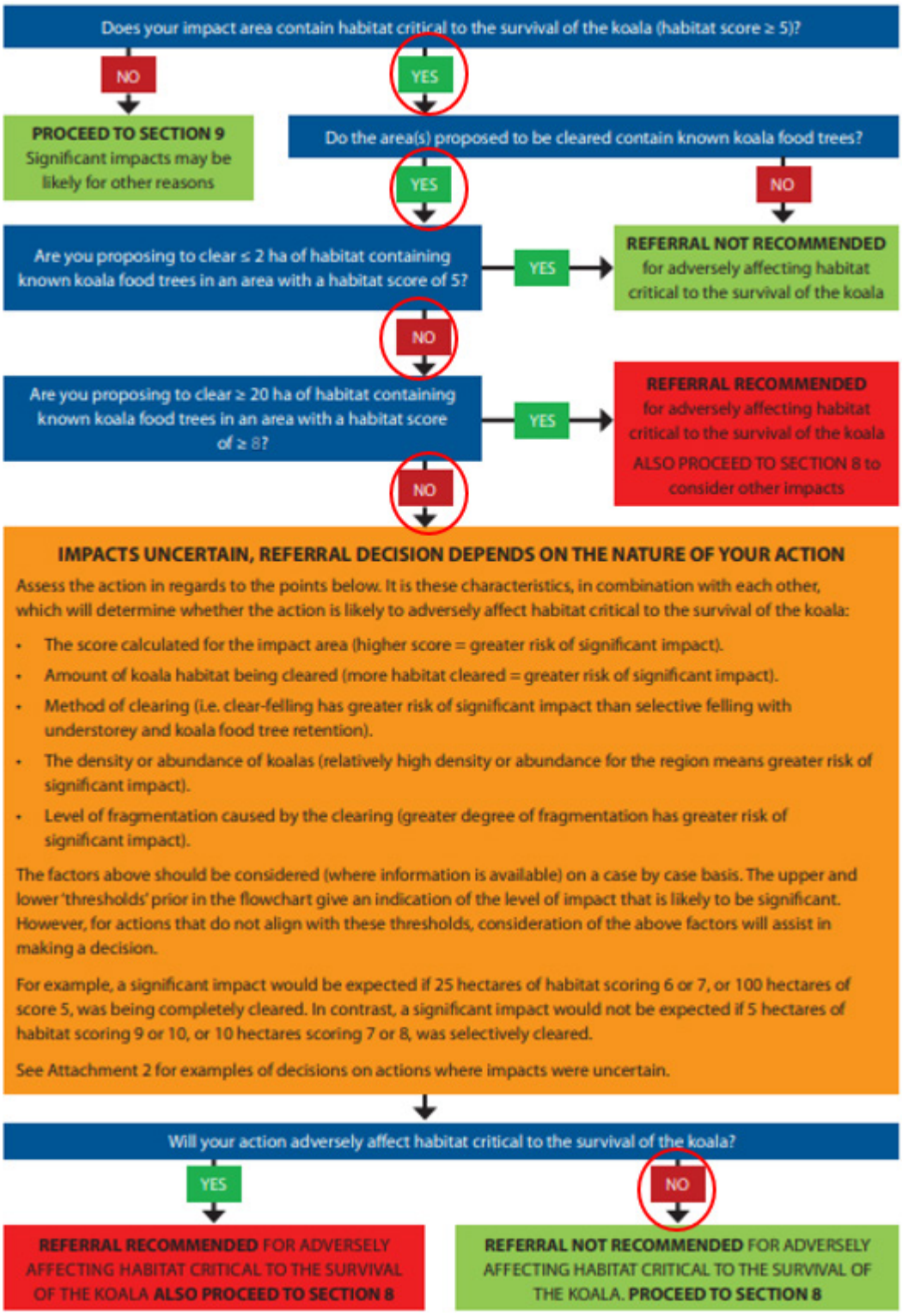


Figure 7.3 EPBC Act referral guidelines for the Vulnerable Koala – assessment of impact

7.2 MIGRATORY SPECIES

Migratory species are protected under international agreements, to which Australia is a signatory, including JAMBA, CAMBA, RoKAMBA and the Bonn Convention on the Conservation of Migratory species of Wild Animals. Migratory species are considered MNES and are protected under the EPBC Act.

A total of 10 EPBC Act listed migratory species are known or predicted to occur within the locality of the Modification study area based on the results of database searches completed. No migratory species were recorded during surveys completed however the Modification study area provides foraging habitat for two of these species, including the Fork-tailed Swift and White-throated Needletail (Table 7.6).

Table 7.6 Migratory species with suitable habitat within the Modification study area

SCIENTIFIC NAME	COMMON NAME	EPBC STATUS[1]	HABITAT SUITABILITY
Apus pacificus	Fork-tailed Swift	M	**Moderate.** May occur in aerial habitats over the proposal Modification study area on a seasonal basis.
Hirundapus caudacutus	White-throated Needletail	V; M	**Moderate.** Although local records are sparse, due to wide ranging habitats may occur in aerial habitats over the Modification study area on a seasonal basis.

(1) Threat status under the EPBC Act: V = Vulnerable, E = Endangered, M = Migratory.

While terrestrial migratory and marine migratory species of bird may potentially use the Modification study area, the site would not be classed as 'important habitat' as defined by the '*Significant Impact Guidelines 1.1 – Matters of National Environmental Significance*' (Department of the Environment, 2013) as the site does not contain habitat:

- utilised by a migratory species occasionally or periodically within a region that supports an ecological significant proportion of the population of the species
- utilised by a migratory species which is at the limit of the species range
- within an area where the species is declining.

As such, it is not likely that the Modification would significantly affect migratory species and therefore this group has not been considered further.

One species of migratory bird, the White-throated Needletail, is however listed as Vulnerable, and as such, the Modification study area could be considered to contain potential habitat where this species is declining. As the White-throated Needletail is listed as migratory and threatened under the EPBC Act, an assessment of significance is carried out using the threatened species criteria (Appendix D).

7.3 CRITICAL HABITAT

No EPBC Act listed critical habitat has been recorded or is considered likely to occur within the Modification study area.

7.4 WORLD AND NATIONAL HERITAGE

Based on the PMST, no World Heritage Properties or National Heritage Places are located within or nearby the Modification study area and therefore will not be impacted by the Modification.

7.5 WETLANDS OF NATIONAL AND INTERNATIONAL IMPORTANCE

Wetlands are important habitat for a diverse range of animals including waterbirds, amphibians, invertebrates and fish species as well as aquatic and water loving plants such as sedges and rushes. Tree species such as River Red Gum also rely on these environments. Wetlands are important provide strategic refuge during drought and frequently support threatened species. Most of the migratory bird species listed under international convention agreements with Australia may be found in these wetlands.

7.5.1 NATIONALLY IMPORTANT WETLANDS

No nationally important wetlands were identified by the PMST as occurring within or in proximity to the Modification study area. As such, the Modification is unlikely to impact on nationally important wetlands.

The proposed Modification mitigation measures would ensure that no indirect downstream impacts would occur. Impacts on water quality, water bodies and hydrological processes are discussed in Stage 2.

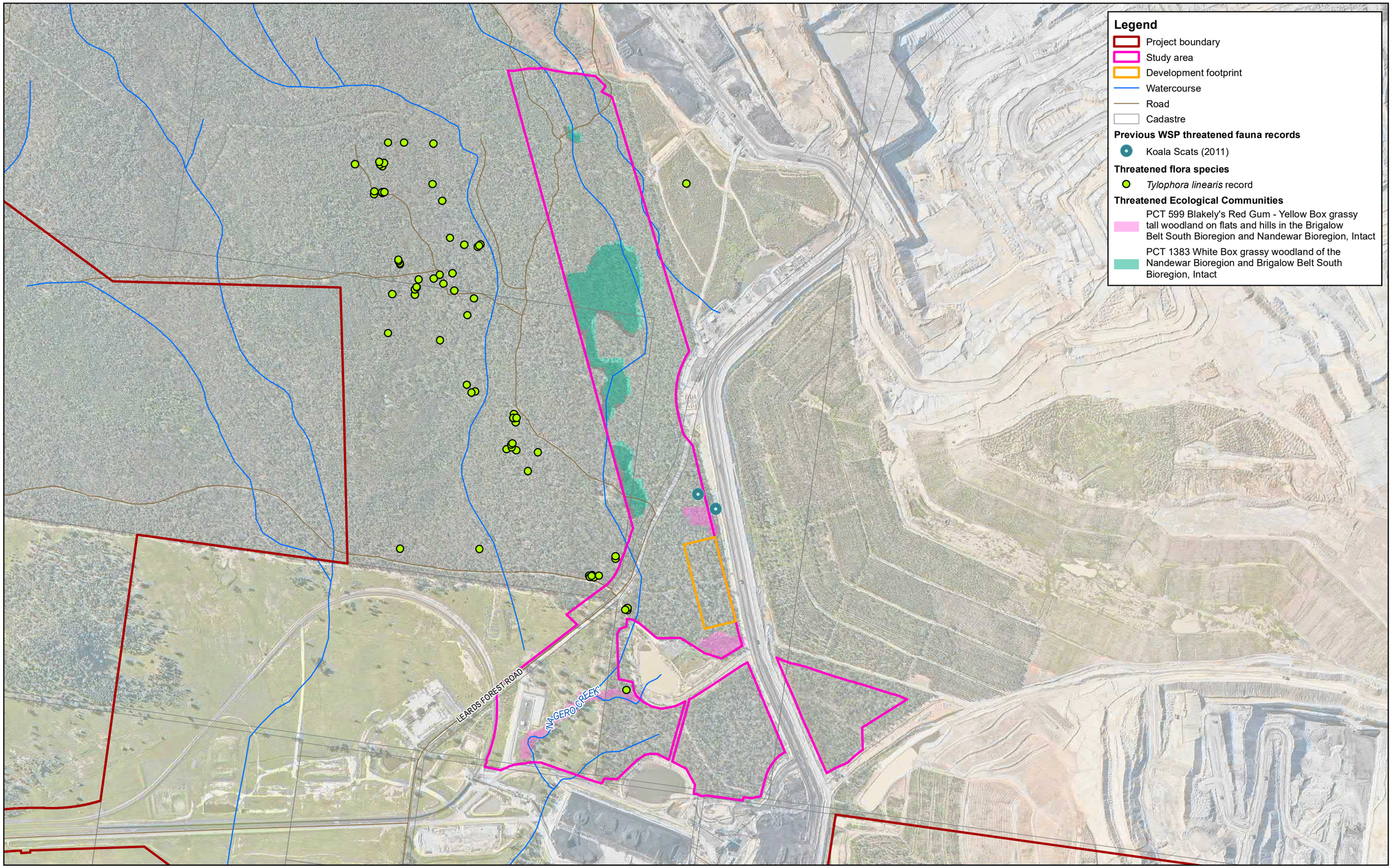
7.5.2 WETLANDS OF INTERNATIONAL IMPORTANCE (RAMSAR WETLANDS)

Three RAMSAR wetlands or Wetlands of International importance were identified by database searches. These include:

- Banrock station wetland complex – located 900 – 1,000 km upstream of the development site
- Riverland – located 900 – 1,000 km upstream of the development site
- The coorong, and lakes alexandra and albert wetland – located 1,100 – 1,200 km from the development site.

All these Wetlands of International Significance are located more than 900 km from the Modification study area and are unlikely to be directly or indirectly impacted by the Modification.

The implementation of existing and proposed surface water management and mitigation measures will ensure that no indirect downstream impacts would occur. Impacts on water quality, water bodies and hydrological processes are discussed in Stage 2.



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Imagery: BCOPL 2020

DOCUMENT	BC2020_PS120722_BDAR_011_A1
AUTHOR.	suansrir
EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

IDEMITSU
BOGGABRI COAL

FIGURE **7-4**

TITLE. **OVERVIEW OF MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE**

7.6 BUSHFIRE AFFECTED SPECIES

In January 2020, DAWE released an initial list of threatened and migratory species which have more than 10 % of their known or predicted distribution in areas affected by bushfires in southern and eastern Australia from 1 August 2019 and 13 January 2020 (Department of Environment and Energy, 2020a). Most of these animals have potentially had at least 30 % of their range lost to bushfires, with many having lost substantially more. In September 2020, DAWE identified priority management interventions for 119 animal species identified as high priority for urgent management intervention following the 2019/2020 bushfires (Department of Agriculture, 2020).

Table 7.7 details EPBC Act listed threatened species of animal considered with a moderate or higher likelihood of occurrence in the Modification study area and their percentage of modelled habitat within fire affected areas.

Table 7.7 Department of Agriculture, Water and the Environment identified priority species for management

THREATENED SPECIES	HIGH PRIORITY FOR MANAGEMENT INTERVENTION[1]	PERCENTAGE OF MODELLED LIKELY AND KNOWN DISTRIBUTION WITHIN FIRE AFFECTED AREAS[2]	PERCENTAGE OF POTENTIAL HABITAT AFFECTED BY BUSHFIRE IN MOD 8 LOCALITY[3]
Birds			
Regent Honeyeater (*Anthochaera phrygia*)	Yes	10 to <30 %	0 %
Painted Honeyeater (*Grantiella picta*)	No	Not detailed	0 %
White-throated Needletail (*Hirundapus caudacutus*)	No	10 to <30 %	0 %
Swift Parrot (*Lathamus discolour*)	No	10 to <30 %	0 %
Superb Parrot (*Polytelis swainsonii*)	No	Not detailed	0 %
Mammals			
Spotted-tailed Quoll (*Dasyurus maculatus*)	Yes	10 to <30 %	0 %
Large-eared Pied Bat (*Chalinolobus dwyeri*)	No	Not detailed	0 %
Corben's Long-eared Bat (*Nyctophilus corbeni*)	No	Not detailed	0 %
Koala (*Phascolarctos cinereus*)	Yes	10 to <30 %	0 %

(1) Species identified as high priority for urgent management intervention following the 2019/2020 bushfires (Department of Agriculture, 2020)

(2) Analysis of species listed under the EPBC Act that occur in areas afferted by bushfires between 1 August 2019 and 13 January 2020 in southern and eastern Australia (Department of Environment and Energy, 2020a)

(3) Analysis of known and potential habitat affected by bushfire within a 10 km radius of the project (Figure 7.5).

7.6.1 EXTENT OF BUSHFIRE IMPACTS IN THE MODIFICATION LOCALITY

Following a pre-lodgement meeting with DAWE (the Department) in November 2020, the Department specifically requested discussion of the importance and capacity of remaining habitat within the development footprint and Boggabri Coal's proposed offset areas in context of the bushfires. Furthermore, as the Boggabri Coal Mine Extension (EPBC 2009/5256) action was found by a predecessor of DAWE to have a significant impact on Swift Parrot, Regent Honeyeater and Greater Long-eared Bat (now Corben's Long-eared Bat), these species are discussed further with respect to impacts of the 2019/2020 bushfires.

- The area (in hectares) of habitat for the above-listed significantly impacted species within the referral area and proposed offset areas directly impacted by the fires (if any)

No known or potential habitat of the Regent Honeyeater, Swift Parrot or Corben's Long-eared Bat was directly impacted by the 2019/2020 bushfires in the Boggabri locality, encompassing the development footprint, larger Leard State Forest remnant, and Boggabri Coal's BOAs (Figure 7.5).

- Any available information regarding the impacts of the fires on the population size of the above-listed significantly impacted species within and surrounding the referral area and proposed offset areas.

There is little publically available information regarding the impact of the 2019/2020 bushfire event on the population size of the Regent Honeyeater or Swift Parrot. However, it is estimated that between 10 to <30 % of the Regent Honeyeater and Swift Parrots modelled likely and known distribution occurred within fire affected areas. Corben's Long-eared Bat was not listed as a priority species for management intervention and no estimate of the species modelled likely and known distribution is available. Nevertheless, the Liverpool Plains Interim Biogeographic Regionalisation of Australia (IBRA) Sub-region, within which the Modification occurs, was largely spared the extent of bushfire impacts observed in southern and eastern NSW. Therefore, any portion of the three species populations residing in the project locality are unlikely to have been significantly impacted by the 2019/2020 bushfire event.

REGENT HONEYEATER

The Regent Honeyeater is believed to consist of a single population with some interchange of individuals between the most frequently used locations (Department of the Environment, 2016). Due to their nectarivorous habits they are not strictly resident in any region, but their stronghold is generally recognised as occurring in the west of and on the slopes of the Great Dividing Range (Higgins, Peter, & Steele, 2001). Colour banding of Regent Honeyeaters has shown that the species can undertake large-scale nomadic movements in the order to hundreds of kilometres (Higgins et al., 2001). Whilst the exact nature of these movements is still poorly understood, it is likely that movements are dependent on spatial and temporal flowering and other resource patterns.

While the Regent Honeyeater has not been recorded in association with the project, the project is situated approximately 50 km to the south-west of one of two main breeding areas for the species in NSW; being the Bundarra-Barraba area. Within the North-West Slopes and Plains Region of NSW, the Regent Honeyeater is largely observed in the east between Tamworth and Inverell, and in the west in association with the Pilliga Forests and the Warrumbungles National Park (Environment Energy and Science Group, 2020b). However, there is a general paucity of records for the species in the Liverpool Plains IBRA Sub-region, with four observations recorded between 1998 and 2016 (Environment Energy and Science Group, 2020b); the most recent of which was located approximately 13 km to the north-west of the development footprint.

Although it appears that Regent Honeyeaters are usually associated with habitats to the east and west of the project, it is likely that the species may use habitat resources in proximity to the project on at least a transient basis. Regent Honeyeaters are more likely to occur when the dominant canopy species in the area, *Eucalyptus albens* (White Box), experience profuse winter flowering events. Large tracts of remnant White Box woodland and open forest occur in Leard State Forest and the project's currently approved BOAs. Approximately 7,120 ha of extant remnant habitat are currently reserved within the BOAs. Of particular importance for the Regent Honeyeater is the reservation of 2,272 ha of Riverine Woodland and Grassy Woodland on Fertile Soils habitat types.

SWIFT PARROT

The Swift Parrot distribution extends generally from Brisbane in the north to Tasmania in the south and across to Adelaide in the west (Higgins, 1999). The entire population resides in Tasmania from September to April during the breeding period, and no Swift Parrots breed on the mainland. On the mainland during the winter months they are widely nomadic in response to the varying distribution of blossom (Higgins, 1999). Swift Parrot movements locally vary from year to year in response to resources in their range, and the presence of good resources locally is not a good indicator that they will necessary be present at a given location. Although blossom is used by Swift Parrots, they also frequently take lerps, even when blossom is present.

The Swift Parrot has previously been recorded in association with the project, having been recorded in Leard State Forest in 2012 and 2014 in conjunction with profuse White Box flowering events. Similarly, the species was recorded in the project's BOAs in 2012 and again in 2018. Although there are only a handful of records for the Swift Parrot in the Liverpool Plains IBRA Sub-region, large tracts of remnant White Box dominated woodland and open forest occur in Leard State Forest and the project's currently approved BOAs. Approximately 7,120 ha of extant remnant habitat are currently reserved within the BOAs.

CORBEN'S LONG-EARED BAT

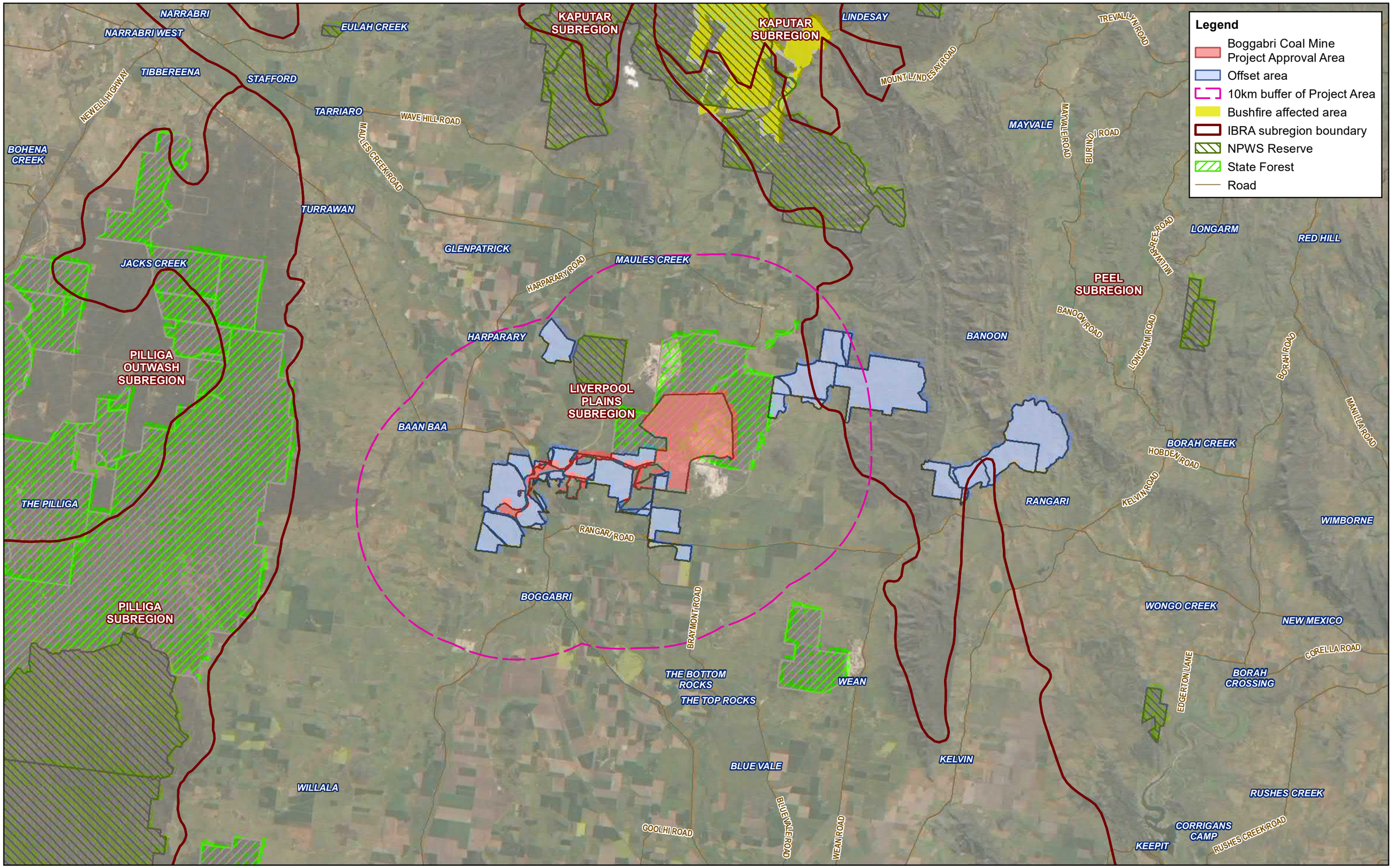
Corben's Long-eared Bat distribution coincides approximately with the Murray Darling Basin, with the Pilliga Forest region being the distinct stronghold (Environment Energy and Science Group, 2020d). The core of this species range in NSW largely avoided impacts associated with the 2019/2020 bushfire event. BCOPL undertake annual targeted trapping events for the species in accordance with the project's Commonwealth conditions of approval. Corben's Long-eared Bat has been recorded annually since 2014, encompassing the project's BOAs (Eastern, Central, Namoi and Western Offsets) and Leard State Forest Biodiversity Corridor. Large tracts of known habitat occur in Leard State Forest and the project's currently approved BOAs with approximately 7,120 ha of extant remnant habitat are currently reserved therein.

- The area of regional habitat for each species that was burnt and remained unburnt in the fires (IBRA Sub-region)

Although some 5.4 million hectares of land in NSW was affected by the 2019/2020 bushfires, no bushfires occurred within the Boggabri Coal Mine Lease, the larger Leard State Forest remnant, or the project's associated BOAs. The Liverpool Plains IBRA Sub-region, within which the Modification occurs, was largely spared the extent of bushfire impacts observed in southern and eastern NSW. Mount Kaputar National Park, which largely occurs in the adjacent Kaputar and Peel IBRA Sub-regions, experienced the largest bushfire in proximity to the Modification; affecting more than 17,000 ha. Small incursions of this fire extended into the Liverpool Plains IBRA Sub-region around Sugarloaf Hill, NSW; some 20 km to the north of the Modification (Figure 7.5). Approximately 97 ha of potential habitat for the Regent Honeyeater, Swift Parrot and Corben's Long-eared Bat in the Liverpool Plains IBRA Sub-region was impacted during the 2019/2020 bushfire event. The project's BOAs alone reserve approximately 7,120 ha of known and potential extant remnant habitat for Regent Honeyeater, Swift Parrot and Corben's Long-eared Bat.

- Discussion regarding the importance and capacity of the remaining habitat within the development footprint and proposed offset areas for supporting remaining populations of each species.

With respect to the development footprint, the Modification is likely to have a worst case scenario impact of approximately 3.31 ha of Pilliga Box - White Cypress Pine - Buloke shrubby woodland. The final development footprint of the fauna movement crossing would be a 110 m x 110 m area (1.21 ha) within the development footprint. Given that the Liverpool Plains IBRA Sub-region did not experience the extent of bushfire impacts associated with other sub-regions and large tracts of known and potentially suitable extant habitat remain in the Leard State Forest remnant and BOAs (7,120 ha of extant remnant habitat), the development footprint is not likely to be critical for supporting remaining populations of the Regent Honeyeater, Swift Parrot or Corben's Long-eared Bat.



0 2.5 5 7.5 km

Scale 1:250,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL 2020, 2017
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,

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DATE.	4/12/2020

IDEMITSU BOGGABRI COAL

FIGURE **7-5**

TITLE. **BUSHFIRE AFFECTED AREAS**

Idemitsu Australia Resources Pty Ltd

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STAGE 2 – IMPACT ASSESSMENT

8 AVOID AND MINIMISE IMPACTS

The following provides information on avoiding and minimising impacts on biodiversity values through the planning and design phase of the proposal. This information is provided to directly address section 8 of the BAM.

8.1 AVOID AND MINIMISE IMPACTS ON NATIVE VEGETATION AND ASSOCIATED HABITAT

In accordance with Section 8.1.1 of the BAM, efforts to avoid and minimise direct impact on native vegetation and habitat through proposal are further addressed in Table 8.1.

Table 8.1 Efforts to avoid and minimise impacts on native vegetation and habitat during proposal design

PRINCIPLES	PROJECT CONSISTENCY
Locating the Project to avoid and minimise impacts on native vegetation (section 8.1.1.3 of BAM)	
(a) Locating the Project in areas where there are no biodiversity values	Areas of biodiversity value could not be entirely avoided; however, the development footprint has been designed to avoid impact to intact vegetation as far as practicable. The Modification has been refined and located in areas where impact to TECs will not occur.
(b) Locating the Project in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)	The development footprint has been designed to impact the minimal amount of native vegetation or threatened species habitat and to avoid TECs. Whilst the development footprint includes a maximum impact of approximately 3.31 ha, this area allows flexibility for micro-siting proposed infrastructure that is likely to disturb an approximate 1.2 ha area therein.
(c) Locating the Project in areas that avoid habitat for species that have a high biodiversity risk weighting or native vegetation that is a critically endangered ecological community (CEEC) or an endangered ecological community (EEC)	The development footprint has been designed to minimise impact to areas of TECs. Refinement of the design has resulted in the location of the proposed Modification to avoid areas of mapped TECs within the Modification study area. As a result, no TEC will be impacted as part of the proposed Modification.
(d) Locating the Project such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained.	The proposed Modification has been located on the edge of existing cleared areas and as a result, will not fragment any patches of habitat or cause further loss of connectivity for the movement of species between areas. The proposed Modification will incorporate measures to increase connectivity between the Leard State Forest and the established mine rehabilitation areas across the existing ROM haul road adjacent to the Modification study area.
Consideration of alternatives (section 8.1.1.4 of the BAM)	
(a) an analysis of alternative modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology	Detailed design and construction works will be recommended to avoid impacts to any important habitat features (i.e. hollow-bearing trees) and where possible retain and replace any important habitat features surrounding the Modification.

PRINCIPLES	PROJECT CONSISTENCY
(b) an analysis of alternative routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route	Multiple design options were workshopped and reviewed to ensure the development footprint was developed with the highest retention of biodiversity values (i.e. highest vegetation integrity score). The following design recommendations were implemented: Avoidance hierarchy containing: — Threatened Ecological Communities — Threatened species and their habitat — Native vegetation recorded as Intact — Native vegetation recorded as Modified — Miscellaneous Ecosystem (non-native vegetation) As a result of design refinement, the proposed modification was positioned where minimal important habitat features are likely to be disturbed and no TECs will be impacted.
(c) an analysis of alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location	
(d) an analysis of alternative sites within a property on which the Project is proposed that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site.	
Designing a project to avoid and minimise impact on native vegetation and habitat (section 8.1.2.1 of BAM)	
(a) Reducing the clearing footprint of the Project	During detailed design phases of the proposed Modification, the development footprint and layout of temporary construction sites and permanent sites will be determined; however, these will be contained within the development footprint. Design and construction works will avoid direct impacts to vegetation commensurate with TECs and other intact vegetation surrounding the proposed Modification. In addition, recommendations to avoid disturbance to important habitat features (i.e. hollow bearing trees) will be implemented where practicable.
(b) Locating ancillary facilities in areas where there are no biodiversity values	
(c) Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower vegetation integrity score)	
(d) Locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC)	
(e) Providing structures to enable species and genetic material to move across barriers or hostile gaps	Impacts mostly occur within modified vegetation with limited connectivity. The expected impact to intact vegetation does not dissect patches and the connectivity between habitats, which allows the movement of species and genetic material, is unlikely to be affected. The development footprint is not considered likely to further isolate any area of biodiversity value such that genetic material will become unable to move across barriers of hostile gaps within the Modification and surrounding land uses. The proposed Modification would enable the installation of a fauna connectivity structure in association with the ROM haul road to enable species movement between habitat patches within the Leard State Forest and established mine rehabilitation.
(f) Making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.	Mitigation measures will be developed to address the direct and indirect impacts of the proposed Modification, which are outlined in Section 10. These will be reviewed and updated with future detailed design phases.

8.2 AVOID AND MINIMISE IMPACTS ON PRESCRIBED BIODIVERSITY

This section addresses prescribed biodiversity impacts that may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical in accordance with Section 8.2.1.2 & 8.2.2 of the BAM. Prescribed biodiversity impacts relevant to the proposed Modification have been identified in Table 8.2.

Table 8.2 Efforts to avoid and minimise impacts on prescribed biodiversity during proposal planning and location

PRESCRIBED BIODIVERSITY IMPACTS	PROPOSAL PLANNING
Designing a project location to avoid and minimise impact on prescribed biodiversity (section 8.2.2.1 of BAM)	
(a) locating the envelope of surface works to avoid direct impacts on the habitat features	Areas of habitat features could not be entirely avoided; however, the development footprint has been designed to avoid impact to intact vegetation as much as practicable and where habitat features (i.e. hollow-bearing trees) are to be impacted, these features may be retained and utilised within adjacent habitat, mine rehabilitation or biodiversity offset areas. This process would be guided and implemented in accordance with BCOPLs comprehensive Biodiversity Management Plan (WSP, 2018b); specifically including Appendix B – Clearing and Fauna Management Procedure.
(b) locating the envelope of sub-surface works, both in the horizontal and vertical plane, to avoid and minimise operations beneath the habitat features, e.g. locating longwall panels away from geological features of significance or water dependent plant communities and their supporting aquifers	The proposed Modification has not been located in an area where subsurface works would impact habitat features. Therefore, the proposed Modification is unlikely to directly or indirectly interfere with subsurface or groundwater flows associated with any habitat features or vegetation communities.
(c) locating the proposal to avoid severing or interfering with corridors connecting different areas of habitat, migratory flight paths to important habitat or local movement pathways	The proposed Modification has been located on the edge of existing cleared areas. Consequently, the Modification will not fragment any patches of habitat or cause further loss of connectivity for the movement of species between areas. The proposed modification will enable the construction of connectivity structures in association with the existing ROM haul road adjacent to the Modification study area, to enable species movement between habitat patches.
(d) optimising proposal layout to minimise interactions with threatened species and ecological communities, e.g. designing turbine layout to allow buffers around features that attract and support aerial species, such as forest edges, riparian corridors and wetlands, ridgetops and gullies	The development footprint has been designed to impact the minimal amount of native vegetation or threatened species habitat and to avoid TECs. The proposed Modification has been situated away from important habitat features such as water bodies. Whilst the development footprint includes a maximum impact of approximately 3.31 ha, this area allows flexibility for micro-siting proposed infrastructure that is likely to disturb an approximate 1.2 ha area therein.
(e) locating the proposal to avoid direct impacts on water bodies.	The proposed Modification will not directly impact any mapped water bodies. Mitigation measures incorporating sedimentation and hydrology controls are outlined in Section 10.

Designing a project location to avoid and minimise impact on prescribed biodiversity (section 8.2.2.2 of BAM)	
(a) an analysis of alternative modes or technologies that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed mode or technology	Detailed design and construction works will be recommended to avoid impacts to any identified important habitat features. The proposed Modification will not impact any prescribed biodiversity values.
(b) an analysis of alternative routes that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed route	
(c) an analysis of alternative locations that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed location	
(d) an analysis of alternative sites within a property on which the proposal is proposed that would avoid or minimise prescribed biodiversity impacts and justification for selecting the proposed site.	

9 ASSESSMENT OF IMPACTS

9.1 ASSESSMENT OF DIRECT IMPACTS

Assessment of direct impacts unable to be avoided is prepared in accordance with Section 9.1 of the BAM.

9.1.1 IMPACTS ON NATIVE VEGETATION

The impacts of the development footprint on native vegetation including each PCT, broad condition state, its legislative status and area to be impacted within the development footprint is shown below in Table 9.1.

Table 9.1 Direct impacts on native vegetation and change in vegetation integrity within Modification study area

VEGETATION TYPE	VEGETATION ZONE	CURRENT VEGETATION INTEGRITY	CHANGE IN VEGETATION INTEGRITY	FUTURE VEGETATION INTEGRITY	DIRECT IMPACT (ha)[1]
PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Intact	96.5	-96.5	0	3.31

(1) The area impacted was selected to enable flexibility in the detailed engineering design, micro-siting of fauna connectivity structures and represent a worst case scenario. It estimated that a final disturbance footprint of 1.21 ha (110 m x 110 m) will be required for construction of the Modification.

9.1.2 IMPACTS ON THREATENED ECOLOGICAL COMMUNITIES

The proposed Modification will not directly impact any threatened ecological community. As outlined within Section 8, the Modification disturbance footprint has been specifically designed to avoid impacts to TECs.

9.1.3 IMPACTS ON THREATENED SPECIES AND HABITAT

9.1.3.1 DIRECT IMPACTS ON PREDICTED ECOSYSTEM CREDIT SPECIES

Direct impacts on predicted ecosystem credit species due to the Modification is outlined in Table 9.2.

Table 9.2 Direct Impact on predicted ecosystem species

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	PREDICTED HABITAT IMPACTED (ECOSYSTEM CREDIT)
Birds (20)			
Barking Owl	*Ninox connivens*	V	PCT 88
Black-breasted Buzzard	*Hamirostra melanosternon*	V	PCT 88
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	PCT 88
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	PCT 88
Diamond Firetail	*Stagonopleura guttata*	V	PCT 88
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	PCT 88

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	PREDICTED HABITAT IMPACTED (ECOSYSTEM CREDIT)
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	PCT 88
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	PCT 88
Hooded Robin (south-eastern subspecies)	*Melanodryas cucullata cucullata*	V	PCT 88
Little Eagle	*Hieraaetus morphnoides*	V	PCT 88
Masked Owl	*Tyto novaehollandiae*	V	PCT 88
Painted Honeyeater	*Grantiella picta*	V	PCT 88
Scarlet Robin	*Petroica boodang*	V	PCT 88
Speckled Warbler	*Chthonicola sagittata*	V	PCT 88
Spotted Harrier	*Circus assimilis*	V	PCT 88
Square-tailed Kite	*Lophoictinia isura*	V	PCT 88
Superb Parrot	*Polytelis swainsonii*	V	PCT 88
Swift Parrot	*Lathamus discolor*	E	PCT 88
Turquoise Parrot	*Neophema pulchella*	V	PCT 88
Varied Sittella	*Daphoenositta chrysoptera*	V	PCT 88
Mammals (4)			
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	PCT 88
Koala	*Phascolarctos cinereus*	V	PCT 88
Little Pied Bat	*Chalinolobus picatus*	V	PCT 88
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	PCT 88

(1) Listed under the BC Act – CE = Critically Endangered, E = Endangered, V = Vulnerable.

9.1.3.2 DIRECT IMPACTS ON THREATENED SPECIES CREDIT SPECIES

Direct impacts on candidate species credit species due to the proposed Modification is outlined in Table 9.3.

Table 9.3 Direct impacts on threatened species credit species within the development footprint

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	ASSOCIATED NATIVE VEGETATION TYPES AND HABITAT FEATURES	DIRECT IMPACT (AREA / INDIVIDUALS)
Koala	*Phascolarctos cinereus*	V	PCT 88 – Areas identified via survey as important habitat	3.31 ha (PCT 88)
Squirrel Glider	*Petaurus norfolcensis*	V	PCT 88 and large old trees with hollows for breeding and nesting	
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	PCT 88 and hollow-bearing trees	

(1) Listed under the BC Act – CE = Critically Endangered, E = Endangered, V = Vulnerable.

9.2 ASSESSMENT OF INDIRECT IMPACTS

The assessment of indirect impacts has been prepared in accordance with Section 9.1.4 of the BAM. Indirect impacts have been considered in terms of the nature, extent and duration of impacts on native vegetation, threatened ecological communities and threatened species habitats likely to be affected. The assessment of indirect impacts is presented in Table 9.4.

Table 9.4 Assessment of indirect impacts

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE	EXTENT	DURATION	CONSEQUENCE
Inadvertent impacts on adjacent habitat or vegetation	Construction	All PCTs Threatened species Threatened ecological communities Aquatic habitat	All PCTs Aquatic habitats associated with creeks and rivers	Short term	**Low.** Inadvertent impacts on adjacent vegetation can include a range of indirect impacts including soil disturbance, introduction of weeds, erosion, sedimentation, enriched run-off and water quality. Construction of the Modification has the potential to result in sedimentation and erosion and mobilisation of contaminants within the development footprint and into adjoining native vegetation and ephemeral drainage lines, through soil disturbance and construction activities. Sediment laden runoff and spills affect water quality and adversely affect aquatic life particularly during construction near creek lines. The Modification will be carefully designed to minimise impact to these sensitive environmental receivers. The mobilisation of sediments would be contained within the disturbance area as sediment containment measures would be implemented as part of mitigation measures.
Inadvertent impacts on hydrology and GDEs	Construction / operational	Hydrology	All PCTs Aquatic habitats associated with creeks and rivers	Long term	**Negligible.** Inadvertent impacts on surface water within proximity to disturbance footprint. Indirect impacts could include enriched run-off, decreased in water quality and/or minor alterations to hydrology. Potential indirect impacts on hydrology are unlikely to significantly exacerbate hydrological impacts associated with the project. The Modification would not require the extraction of groundwater and would only have potential to indirectly impact surface water hydrology within proximity to the disturbance footprint. Although no indirect impacts to GDEs within the Modification study area are predicted, there may be negligible drawdown impacts to the alluvium located immediately south west of the BCM mining area (currently covered by mine infrastructure), this is predicted to be an additional drawdown impact of 0.6 m to the existing BCM project's drawdown impact. Additional depressurisation is also predicted to occur within the Permian coal seams, however these impacts are considered fundamentally equivelant to the existing approved mining (i.e. coal seams impacts in both scenarios) (Australian Groundwater & Environmental Consultants Pty Ltd, 2021). The groundwater assessment completed for the Modification concluded that these impacts are

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE	EXTENT	DURATION	CONSEQUENCE
					fundamentally equivelant to the approved mining (Australian Groundwater & Environmental Consultants Pty Ltd, 2021). The Modification will be undertaken in accordance with Boggabri Coal Mine's Groundwater Management Plan (2017a) and Surface Water Management Plan (2017b) to ensure potential indirect impacts are avoided and minimised.
Reduced viability of adjacent habitat due to edge effects	Construction / operational	Native vegetation	All PCTs	Long term	**Negligible.** Although the Modification involves clearing intact vegetation, which may impact adjacent vegetation integrity and introduce weed issues and/or exacerbated weed incursions that already occur in the Modification study area, the Modification study area is currently impacted by edge effects associated with adjacent open cut coal lime operations and ROM haul road. Mitigation measures will ensure biosecurity is managed during construction to reduce the chance of novel weeds becoming established in the Modification study area. During operational phase, all maintenance and associated works will be subject to BCMs biosecurity protocols and comprehensive Biodiversity Management Plan (2018), which will ensure any residual indirect impact is unlikely to reduce the viability of adjacent habitat due to edge effects during both the construction and operational phases of the Modification.
Reduced viability of adjacent habitat due to noise, dust or light spill	Construction / operational	Native vegetation Threatened species Threatened ecological communities	All PCTs	Short term	**Negligible.** The Modification study area occurs immediately adjacent to existing open cut coal mine operations and ROM haul road. It is unlikely the Modification would further exacerbate noise, dust or light spill any more than that experienced in the Modification study area and adversely reduce the viability of adjacent habitats. During construction increased levels of noise and dust are likely, however these will be short-term and mostly associated with vehicle movements, vegetation clearing and construction of crossing structures. A short-term increase in construction noise will be mostly limited to daylight hours and unlikely to have long-term adverse effects on the viability of adjacent habitats. In terms of increased dust, construction impacts associated with vegetation clearing is limited to the disturbance footprint. The disturbance footprint will have limited dust generation post construction.

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE	EXTENT	DURATION	CONSEQUENCE
Transport of weeds and pathogens from the site to adjacent vegetation	Construction / operational	Native vegetation Threatened flora species Threatened ecological communities	PCT 88	Long term	**Negligible.** Whilst this type of indirect impact has the potential to lead to a reduction of native vegetation integrity in surrounding habitats, mitigation measure will be implemented to ensure biosecurity is managed during construction. Construction and operational activities will be guided by BCMs comprehensive Biodiversity Management Plan (2018).
Increased risk of starvation, exposure and loss of shade or shelter	Construction	All fauna species	PCT 88	Short term	**Negligible.** Displacement of resident fauna species during native vegetation clearing is considered relatively low due to the extensive vegetation adjacent to the development footprint. Given the small-scale impact (3.31 ha) associated with the Modification and mobile nature of most potential resident fauna species, the increased risk of starvation, exposure and loss of shade or shelter due to the Modification is likely to be low.
Loss of breeding habitats	Construction	All fauna species	PCT 88	Long term	**Low.** The loss of breeding habitat such as hollow-bearing trees and fallen timber has the potential to affect native animals such as: — Hollow-dependent mammals — Hollow-nesting and canopy-nesting birds — Arboreal mammals — Reptiles. The loss of breeding habitats is unlikely to extend beyond the disturbance footprint. Impacts beyond this area would be avoided through mitigation and management measures. Vegetation clearing activities would be undertaken in accordance with BCMs comprehensive Biodiversity Management Plan (2018); specifically including Appendix B – Clearing and Fauna Management Procedure (WSP, 2018b).
Trampling of threatened flora species	Construction / operation	*Tylophora linearis* associated with PCT 88	PCT 88	Short term	**Low.** Reduction in population extent and available habitat of threatened flora species that occur in the ground stratum could occur due to trampling or unauthorised material, storage, vehicle and plant equipment. All populations and associated habitat for threatened flora species will be available in GIS files for all contractors and will be designated no-go areas during construction. Mitigation measures will include protection for these areas and inadvertent impacts such as trampling is considered unlikely.

INDIRECT IMPACT	CONSTRUCTION / OPERATIONAL	NATURE	EXTENT	DURATION	CONSEQUENCE
Wood collection	Construction	Terrestrial fauna species	PCT 88	Short term	**Negligible**. Removal of dead wood is listed as a key threatening process under the BC Act and will occur during the construction phase of the Modification within the development footprint. Wood collection in adjacent habitat is unlikely to occur and is unlikely that a decrease in the integrity of available habitat for species of animal, such as reptiles and small ground-dwelling mammals and woodland birds, which depend on these resources for shelter and foraging substrates. Any significant dead wood to be removed during construction would be retained and reused in adjacent habitat, mine rehabilitation areas, or biodiversity offset areas, in accordance with BCMs comprehensive Biodiversity Management Plan (2018); specifically including Appendix B – Clearing and Fauna Management Procedure (WSP, 2018b).
Bush rock removal and disturbance	Construction	Terrestrial fauna species	PCT 88	Short term	**Negligible**. Removal of bush rock is listed as a key threatening process under the BC Act. Bush rock was not observed in the Modification study area during field survey informing this report. However, if during construction of the Modification bush rock is encountered, be retained and reused in adjacent habitat, mine rehabilitation areas, or biodiversity offset areas in accordance with BCMs comprehensive Biodiversity Management Plan (2018); specifically including Appendix B – Clearing and Fauna Management Procedure (WSP, 2018b).
Increase in predatory species populations	Construction / operation	All fauna species	All PCTs	Long term	**Low**. Predation by feral cats and the Fox are listed as key threatening processes under the BC Act and have potential to impact local fauna populations in adjacent habitat. It is unlikely that the Modification would further exacerbate the impact predator species populations than what currently exists within Leard State Forest. Current management of pest animal and predatory species is undertaken by Boggabri Coal within the Biodiversity Management Plan (BMP) and would continue to be undertaken post-construction.
Increased risk of fire	Construction / operational	Native vegetation All flora & fauna species	PCT 88	Long term	**Low.** Bushfire risk is unlikely to be exacerbated because of the Modification than what currently exists within the Modification study area. Bushfire risk will be managed in accordance with the BCMs comprehensive BMP (WSP, 2018b).

9.3 PRESCRIBED BIODIVERSITY IMPACTS

Assessment of prescribed impacts is prepared in accordance with Section 9.2 of the BAM and outlined in Table 9.5.

Table 9.5 Prescribed biodiversity impacts

PRESCRIBED BIODIVERSITY IMPACTS	PROPOSAL PLANNING
(a) impacts of development on the habitat of threatened species or ecological communities associated with: *(i) karst, caves, crevices, cliffs and other geological features of significance, or* *(ii) rocks, or* *(iii) human made structures, or* *(iv) non-native vegetation*	No areas of geological significance are present. No karst, caves, cervices, cliffs or rocks, which may provide potential breeding habitat for threatened fauna (i.e. microchiropteran bats) were recorded. No human made structures were identified in the development footprint that would provide suitable habitat for any threatened species. Non-native vegetation type recorded within the development footprint are not subject to further assessment as outlined in section 9.5.
(b) impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	The proposed Modification occurs immediately adjacent to existing open cut coal mine operations and ROM haul road and infrastructure. Whilst the Modification will impact intact vegetation with connectivity to large patches of native vegetation, areas of connectivity are not severed. As such the Modification is not considered likely to adversely impact wildlife connectivity or movement in the locality. Indeed, the Modification will enable the enhancement of connectivity between habitat patches through the construction of fauna connectivity structures across the ROM haul road. As such, the Modification will not adversely affect the movement of species that maintain their population and life history traits.
(c) impacts of development on movement of threatened species that maintains their life cycle	
(d) impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities	No threatened aquatic habitat occurs in the Modification study area. However, several drainage lines (Strahler 4/5th Order streams) occur to the south and west of the Modification study area, which flow intermittently following sustained and substantial local rainfall. The Modification will not directly impact any mapped waterbody/creek line or result in any adverse changes to the local hydrology. The Modification is unlikely to impact water quality appropriate sediment and erosion controls will be installed to ensure any potential water quality impacts will be mitigated. Although no indirect impacts to GDEs within the Modification study area are predicted, there may be negligible drawdown impacts to the alluvium located immediately south west of the BCM mining area (currently covered by mine infrastructure). These impacts are predicted to be an additional drawdown impact of 0.6 m compared to the existing BCM project's drawdown impact. The groundwater assessment completed for the Modification concluded that these impacts are fundamentally equivelant to the approved mining (Australian Groundwater & Environmental Consultants Pty Ltd, 2021). As some of these areas are already disturbed, it is considered that threatened ecological communities and threatened species habitat are at low risk of being impacted because of the potential drawdown impacts.

PRESCRIBED BIODIVERSITY IMPACTS	PROPOSAL PLANNING
	Furthermore, vegetation communities recorded within proximity to this location are not considered to be solely dependent on groundwater. This is based on the depth of groundwater near this location (i.e. approximately 10 m from the surface) and the canopy of vegetation mapped being dominated by Eucalypt species, which are capable of sourcing water from multiple sources (including surface water, soil moisture after flooding and rainfall and/or groundwater). As such, these these communities are not considered to be solely reliant on groundwater, but rather facultative (Holloway *et al.*, 2013). Refer to Section 5.5 and Section 9.7 for further details.
(e) impacts of wind turbine strikes on protected animals	Wind turbines are not associated with the Modification.
(f) Impacts of vehicle strikes on protected animals	Vehicle strike because of the Modification is unlikely to have a significant impact on any local fauna populations. The construction phase of the Modification may contribute to temporary increased traffic volumes; however, the aim of the Modification is to enhance habitat connectivity and to reduce the potential impact of vehicle strike on fauna within the locality.

9.4 SERIOUS AND IRREVERSIBLE IMPACTS

This section identifies every potential serious and irreversible impact (SAII) entity that are listed in the Guidance to assist a decision-maker to determine a serious and irreversible impact that would be impacted on by the development footprint.

Impact assessment of potential entities of SAII impacts on biodiversity values are outlined under Section 10.2 of the BAM and addressed below.

9.4.1 THREATENED ECOLOGICAL COMMUNITIES

No Serious and Irreversible Impacts to threatened ecological community entities under the BC Act will be impacted by the Modification.

9.4.2 THREATENED SPECIES

No Serious and Irreversible Impacts to threatened species entities under the BC Act will be impacted by the Modification.

9.5 IMPACTS NOT REQUIRING ASSESSMENT

In accordance with Section 10.4 of the BAM, an assessment is not required to assess areas of land on the development site without native vegetation unless:

- they are proposed for restoration as part of an offset
- they are assessed as habitat for threatened species.

All land likely to be impacted by the Modification is commensurate with an NSW PCT. Accordingly, the impact to native vegetation requires assessment under the BAM.

9.6 IMPACTS REQUIRING OFFSETS

Impacts that require biodiversity offsets are determined through applying thresholds outlined in Sections 10.3 and 10.4 of the BAM. These thresholds identify where no further assessment is required or where no offsets is required for the proposed impact for some biodiversity values and/or discrete areas of the disturbance footprint. All biodiversity values that exceed these thresholds are required to provide offsets in accordance with the BAM and Biodiversity Conservation Regulation 2017. The thresholds for determining biodiversity offsets are:

- An assessment of ecosystem credits is not required for areas on the subject land (development footprint) without native vegetation (in accordance with Chapters 4 or 5).
- An ecosystem credit obligation is not required for a vegetation zone that has a vegetation integrity score of either:
  - <15 where the PCT is representative of an endangered or critically endangered ecological community
  - <17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community
  - <20 where the PCT is not representative of a TEC or associated with threatened species habitat (as represented by ecosystem credits).

Impacts requiring biodiversity offsets because of the Modification include all PCTs and associated vegetation zones where the vegetation integrity score is greater than or equal to 17. All biodiversity values that require offsets are shown in Section 11.

9.7 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Impacts on MNES listed under the EPBC Act are summarised in the sections below.

9.7.1 THREATENED ECOLOGICAL COMMUNITIES

No threatened ecological community listed under the EPBC Act will be impacted by the Modification.

9.7.1.1 POTENTIAL IMPACTS TO THREATENED ECOLOGICAL COMMUNITIES FROM GROUNDWATER DRAWDOWN

Although no EPBC Act listed threatened ecological communities were recorded within the Modification development footprint, one was recorded in the Modification study area and an additional five have been previously identified as occurring within the locality as part of other investigations completed for the BCM project or by DPIE's broad-scale vegetation mapping (i.e. State Vegetation Type Map: Border Rivers Gwydir / Namoi Region Version 2.0 VIS_ID 4467 (Department of Planning, Industry and Environment, 2016)). These EPBC Act listed threatened ecological communities include:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (Endangered).
- Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland (Endangered).
- Poplar Box Woodland on Alluvial Plains (Endangered).
- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (Endangered).
- Weeping Myall woodlands (Endangered).
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (Critically Endangered).

Of these, four have been previously recorded or are considered highly likely to occur within the locality of the Modification study area and areas which are predicted to experience potential groundwater drawdown impacts; being:

- Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland (Endangered).
- Poplar Box Woodland on Alluvial Plains (Endangered).
- Weeping Myall woodlands (Endangered); and
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (Critically Endangered).

It is noted that the listing for Poplar Box Woodland on Alluvial Plains occurred in 2019, after vegetation mapping was completed for the BOAs. Accordingly, further field verification would be required to confirm if vegetation previously mapped complies to the Poplar Box Woodland on Alluvial Plains EPBC Act listing. It has been conservatively assumed for this assessment that all areas previously mapped as PCT 88 (not including derived native grassland) meets the Poplar Box Woodland on Alluvial Plains EPBC Act listing. As detailed in Section 7.1.1.2, PCT 88 within the Modification study area does not confirm to the threatened ecological community.

Vegetation that is considered to conform to the Natural grasslands on basalt and fine-textured alluvial plains of northern NSW and southern Queensland and Weeping Myall woodlands threatened ecological communities are not considered to be dependent on groundwater as the roots of *Acacia pendula,* grasses and other herbaceous plants are shallow and are unlikely to reach the groundwater table. Based on the recent groundwater modelling for the Boggabri, Tarrawonga and Maules Creek (BTM) mines, the groundwater table is typically more than 5 m below ground level where this vegetation is mapped to occur.

Vegetation potentially conforming to Poplar Box Woodland on Alluvial Plains is mapped to the south west and west of the BCM mining operations on the broader areas of the Namoi floodplain. This community predominantly occurs within areas that are not affected by groundwater drawdown impacts associated with the approved mining operations of the BTM Complex (Australian Groundwater & Environmental Consultants Pty Ltd, 2021).

Furthermore, Eucalypt species can source water from multiple sources (including surface water, soil moisture after flooding and rainfall and/or groundwater) due to their dimorphic root system which contains lateral roots close to the surface and a taproot or 'sinker' that penetrates deep into the soil (Holloway *et al*., 2013). Therefore, their reliance on groundwater is facultative (optional) (DSITIA, 2013). In addition, most Eucalypt species rely on flooding for regeneration, not baseflow (Holloway *et al*., 2013).

Notwithstanding the above, the closest patch of vegetation which potentially conforms to Poplar Box Woodland on Alluvial Plains is mapped to occur along Nagero Creek immediately adjacent to the existing BCM mine infrastructure area. Water levels at this patch are simulated to be less than 10 m below ground level (Australian Groundwater & Environmental Consultants Pty Ltd, 2021). Modelling indicates that the alluvial aquifer within this area is predicted to experience around 1 m of drawdown due to approved mining operations within the BTM Complex. It is expected that the proposed changes to mining operations may lead to a minor residual increase in drawdown to the alluvial aquifer within this area.

Given that the simulated water levels within this area are around 10 m (rather than closer to the surface where the Eucalypt roots are likely to occur), the potential Polar Box Woodland on Alluvial Plains is considered to only opportunistically access groundwater. Opportunistic dependency occurs when ecosystems use groundwater as required, for example when surface water / soil moisture is unavailable, such as at the end of a dry period (Serov et al., 2012). Whilst Poplar Box Woodland is mapped to occur on the floodplain areas where water levels are generally less than 10 m of the surface, this community is also observed to occur on the lower slopes of the surrounding terrain where groundwater elevations extend beyond 20 m. Depsite this, the existing vegetation monitoring program (as described within Section 4.1.8 of the approved Groundwater Management Plan) will be used to monitor whether the drawdown expected from the increased mining depth will result in adverse impacts to this vegetation community.

Within the BTM Complex and the BCM BOAs, White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands threatened ecological community (Box Gum Woodland) has been mapped as present in areas

where the water table is located less than 20 m below the land surface as well as areas where the water table is closer to the surface (Australian Groundwater & Environmental Consultants Pty Ltd, 2021). Whilst some trees of this community (such as Yellow Box) may occur exclusively in areas where groundwater is periodically within reach, it is noted that other woodland species of this community (such as White Box) are found in areas where water table is much greater than 20 m. Further, as noted above, Eucalypt species are known to be able to source water from multiple sources (including surface water, soil moisture after flooding and rainfall and/or groundwater) and their reliance and use on groundwater is considered facultative (optional). Accordingly, the anticipated impacts on the Box Gum Woodland CEEC because of the residual changes in the water table for the Modification are likely to be low risk.

In summary, no EEC or CEEC listed under the EPBC Act occur within the Modification development footprint, or where present within the locality, are not considered to have groundwater dependency or be associated with a GDE. As such, EPBC Act listed threatened ecological communities are considered likely to be at low risk of being impacted by the potential groundwater drawdown impacts associated with the Modification. Furthermore, based on AGE's groundwater assessment (2021) the Modification's potential drawdown impacts to the alluvium in proximity to the Modification study area are considered to be negilible and largely consistent with the current impacts associated with the BCM project.

9.7.2 THREATENED FLORA

One threatened species of flora, *Tylophora linearis*, which is listed as Endangered under the EPBC Act, was considered to have a moderate or higher likelihood of occurring within the Modification study area based on the availability of habitat. Surveys conducted as part of the current investigation identified seven *Tylophora linearis* individuals as occurring within the Modification study area (Figure 6.2). Within the Modification study area, the species was observed as a small herbaceous plant short and erect (to 50 cm tall) with a climbing habit with some individuals attached to dead/alive shrubs. The plant generally occurred as scattered individuals or small groups scattered across the area in which it occupied.

The species was observed growing within PCT 88 in association with *Eucalyptus pilligaensis, Allocasuarina luehmannii, Callitris glaucophylla, Notelaea microcarpa* var. *microcarpa, Geijera parviflora, Acacia deanei* subsp. *deanei, Solanum parvifolium, Dodonaea viscosa* subsp. *angustifolia, Olearia eliptica, Austrostipa scabra, Aristida ramosa, Einadia nutans* subsp. *linifolia* and *Oxytes brachypodium.*

Tylophora linearis is known to grow on flats and hills in dry scrub, open forest and dry woodlands in association with *Eucalyptus albens*, *Callitris glaucophylla*, *Callitris endlicheri*, *Eucalypts fibrosa*, *Eucalyptus sideroxylen* and *Allocasuarina luehmannii* (Environment Energy and Science Group, 2020d).

Thousands of *Tylophora linearis* have been recorded throughout Leard State Forest as part of previous surveys completed for BCM as part of tree clearing operations, annual biodiversity monitoring and targeted survey. Within Leard State Forest, the species has been recorded from a range of vegetation types including PCT 88, PCT 1313 and PCT 1383, all of which occur in the Modification study area.

An assessment of significance was completed for the *Tylophora linearis* in accordance with the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Appendix D). The assessment concluded that as the species was not recorded in the development footprint during targeted searches, works associated with the proposed Modification are not likely to significantly impact this species.

9.7.3 THREATENED FAUNA

Nine EPBC Act listed threatened fauna are considered to have a moderate or higher likelihood of occurring within the development footprint based on the availability of habitat (Table 9.6).

Assessments for each species was done in accordance with the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Appendix D) and a summary of the outcomes of these are provided in Table 9.6.

Table 9.6 Nationally threatened fauna recorded or with a moderate or higher likelihood of occurrence

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	SIGNIFICANT IMPACT?
Birds (5)			
Anthochaera phrygia	Regent Honeyeater	CE	**No** - the Modification is considered unlikely to have a significant impact on the species. The removal of 3.31 ha of vegetation (PCT 88), which contains potential foraging resources, could be utilised by this species intermittently during periods of seasonal blossom variation.
Grantiella picta	Painted Honeyeater	V	**No** - the Modification is considered unlikely to have a significant impact on the species. The removal of 3.31 ha of vegetation (PCT 88), which contained marginally suitable foraging resources, could be utilised by this species intermittently during landscape movements.
Hirundapus caudacutus	White-throated Needletail	V, M	**No** - the Modification is considered unlikely to have a significant impact on the species. The removal of 3.31 ha of vegetation (PCT 88). The species is known to be an aerial forager and recorded most often above wooded areas. It is unlikely to rely on the terrestrial habitat available within PCT 88.
Polytelis swainsonii	Superb Parrot	V	**No** - the Modification is considered unlikely to have a significant impact on the species. The removal of 3.31 ha of vegetation (PCT 88), which contains potential foraging resources, could be utilised by this species intermittently during seasonal contexts. The species is known migrate north to the region of the upper Namoi and Gwydir Rivers outside breeding periods and thus would not be utilising the development footprint for breeding purposes. It is unlikely that the Modification study area contains important habitat for this species, however, its occurrence cannot be discounted as potential intermittent foraging habitat during seasonal movements.
Lathamus discolor	Swift Parrot	CE	**No** - the Modification is considered unlikely to have a significant impact on the species. The removal of 3.31 ha of vegetation (PCT 88), which contains potential foraging resources, could be used by this species intermittently during periods of seasonal blossom variation. However, considering the abundance of high-quality foraging resources in surrounding landscape, the foraging habitat to be removed is considered marginal and small in terms of what is available locally to this species. Considering the mobility of this species, the Modification will not fragment or isolate any locally occurring population. In addition, the species does not breed in NSW and therefore no breeding habitat would be impacted due to the Modification.

SCIENTIFIC NAME	COMMON NAME	EPBC ACT[1]	SIGNIFICANT IMPACT?
Mammals (4)			
Nyctophilus corbeni	Corben's Long-eared Bat	V	**No -** the Modification is considered unlikely to have a significant impact on the species. The removal of 3.31 ha of vegetation (PCT 88), which contains foraging and breeding resources (hollow-bearing trees), could be utilised by this species intermittently. Considering the mobility of this species, the Modification will not fragment or isolate the locally occurring population.
Phascolarctos cinereus	Koala	V	**No -** Vegetation in the Modification study area and development footprint contained supplementary feed tree species only, it is likely that Modification study area may be used on an intermittent basis during local movements. Due to the relatively small area of impact, the low utilisation of habitat, and the lack of preferred feed trees, the Modification is considered unlikely to have a significant impact on the species.
Dasyurus maculatus	Spotted-tailed Quoll	E	**No -** the Modification is considered unlikely to have a significant impact on the species. The removal of 3.31 ha of vegetation (PCT 88), could be utilised by this species intermittently during larger home range movements. Considering the mobility of this species, the Modification will not fragment or isolate any locally occurring individuals.
Chalinolobus dwyeri	Large-eared Pied Bat	V	**No -** the Modification is considered unlikely to have a significant impact on the species. The removal of 3.31 ha of vegetation (PCT 88), which contained potential foraging resources, could be utilised by this species intermittently. Considering the mobility of this species, the Modification will not fragment or isolate any locally occurring population. In addition, no breeding habitat occurred in the development footprint or larger Modification study area.

(1) Listed under the Commonwealth EPBC Act - CE = Critically Endangered, E= Endangered, V= Vulnerable, M= Migratory.

9.7.4 MIGRATORY SPECIES

Based on EPBC Protected Matters Area Search Tool and other desktop database searches, two migratory species were considered to have suitable habitat within the Modification study area (Table 9.7).

Table 9.7 Migratory species with suitable habitat within the Modification study area

SCIENTIFIC NAME	COMMON NAME	EPBC STATUS[1]	HABITAT SUITABILITY
Apus pacificus	Fork-tailed Swift	M	**Moderate.** May occur in aerial habitats over the Modification study area on a seasonal basis.
Hirundapus caudacutus	White-throated Needletail	V; M	**Moderate.** Although local records are sparse, due to wide ranging habitats may occur in aerial habitats over the Modification study area on a seasonal basis.

(1) Listed under the Commonwealth EPBC Act - M = Migratory, Ma = Marine, V= Vulnerable.

The habitats within the Modification study area are unlikely to constitute important habitat for the Fork-tailed Swift or White-throated Needletail. These species use a variety of habitats, including disturbed/modified areas, and habitat present is unlikely to support an ecologically significant proportion of the population of any migratory species nor are the

habitats critical to any life stage of these species. Due to their aerial and mobile nature, these species would use available habitats over a large area.

9.7.5 WETLANDS OF NATIONAL AND INTERNATIONAL IMPORTANCE

No nationally or internationally important wetlands were identified by the PMST as occurring within or in proximity to the Modification study area. As such, the Modification is unlikely to impact on nationally important wetlands.

9.7.6 WORLD AND NATIONAL HERITAGE

No World Heritage Properties or National Heritage Places are located within or nearby the Modification study area.

10 MITIGATION AND MANAGEMENT MEASURES

This section has been prepared in accordance with Section 9.3 of the BAM to address the potential impacts of the Modification on biodiversity as discussed in Section 9. Mitigation and management measures have been developed and would be implemented as part of the Modification, including undertaking construction works in accordance with BCMs comprehensive Biodiversity Management Plan (2018b). Table 10.1 outlines mitigation measures for each impact discussed in Section 9 and identifies construction phase, timing and responsibility.

Table 10.1 Recommended mitigation and management measures

POTENTIAL IMPACT	MITIGATION MEASURES	OUTCOME	PRE-CONSTRUCTION	CONSTRUCTION	OPERATION	RESPONSIBILITY
Direct impact to native vegetation and habitat: — Removal of hollow bearing trees and other habitat features during construction — Injury or death during construction	Tree clearing and habitat removal will be undertaken in accordance with *Appendix B – Clearing and fauna management procedure* as detailed in BCMs Biodiversity Management Plan (2018).	Protection of habitat for fauna and threatened species		☑		Project manager / Environmental superintendent / Project ecologist
	Hollow-bearing trees are to be preserved where possible during detailed design.	Protection of habitat for hollow dependant fauna (including threatened species)	☑			Project manager / Environmental superintendent
	Limit disturbance of vegetation to the minimum necessary for construction works through detailed design.	Protection of flora and fauna in outside the development footprint	☑			Project manager / Environmental superintendent
	Timing works to avoid critical life cycle events such as breeding or nursing. Habitat removal will be undertaken in accordance with *Appendix B – Clearing and fauna management procedure* as detailed in BCMs Biodiversity Management Plan (2018).	Protection of fauna likely to utilise the development site for breeding (including threatened species)	☑	☑		Project manager / Environmental superintendent
	The presence of a trained ecologist or licensed wildlife handler during clearing events to relocate any displaced fauna to nearby habitat.	Protection of fauna likely to utilise the development footprint		☑		Project manager / Project ecologist
	Relocation of habitat features (fallen timber, hollow logs) from the development footprint into areas identified for retention in accordance with *Appendix B –*	Enhancement of habitat in adjacent vegetation	☑			Project manager / Environmental superintendent

POTENTIAL IMPACT	MITIGATION MEASURES	OUTCOME	PRE-CONSTRUCTION	CONSTRUCTION	OPERATION	RESPONSIBILITY
	Clearing and fauna management procedure as detailed in BCMs Biodiversity Management Plan (2018).					
Indirect impact to native vegetation and habitat: — Disruption to established home range — Disruption to connections between suitable habitat for foraging and dispersal — Reduced viability of habitat due to edge effects — Transport of weeds to adjacent vegetation/habitat — Transport of pathogens to adjacent vegetation/habitat — Reduced viability of adjacent habitat due to noise, dust or light spill — Loss of breeding habitat — Rubbish dumping — Wood collection — Increase in pest and predatory species	Implement clearing protocols within *Appendix B – Clearing and fauna management procedure*, including: — identify vegetation to be retained to prevent inadvertent damage or over-clearing — minimise unnecessary soil disturbance.	Protection of vegetation and habitat in indirect impact zones	☑	☑		Project manager / Environmental superintendent
	— Hi-visibility fencing (or similar) around development footprint.	Minimise inadvertent damage or over-clearing, wood collection, rubbish dumping in adjacent vegetation and flora and fauna habitat	☑	☑		Project manager / Environmental superintendent
	Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas will be done in accordance with Appendix H of BCMs Biodiversity Management Plan (2018).	Protection of vegetation (including potential threatened ecological communities and flora) in adjacent vegetation	☑	☑		Project manager / Environmental superintendent
	Lighting associated with the Modification is to be designed in general accordance with Australian Standards and minimise light spill to adjacent habitat.	Protection of fauna in adjacent vegetation	☑	☑	☑	Project manager / Environmental superintendent
	Noise or daily/seasonal timing of construction and operational activities to reduce impacts of noise will be	Protection of fauna in adjacent vegetation		☑	☑	Project manager / Environmental superintendent

POTENTIAL IMPACT	MITIGATION MEASURES	OUTCOME	PRE-CONSTRUCTION	CONSTRUCTION	OPERATION	RESPONSIBILITY
	managed in accordance with BCMs Biodiversity Management Plan (2018).					
	Restrict compounds, carparking, equipment storage and stockpiling of resources to designated areas in cleared land or within the disturbance footprint.	Protection of flora and fauna adjacent vegetation		☑		Project manager / Project Engineer / Environmental superintendent
	Environmental inductions for all staff involved with the Modification will be undertaken.	Protection of flora and fauna within and adjacent to the development footprint	☑	☑		Project manager / Environmental superintendent
	Provision for the ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation/ habitat on or adjacent to the development footprint will be conducted in accordance with BCMs Rehabilitation Management Plan and Biodiversity Management Plan (2018).	Protection of flora and fauna adjacent vegetation		☑		Project manager / Environmental superintendent
	Management of pest species will be managed and comply with the Weed and Pest Management Strategy (Appendix C) outlined in the BMP (2018).	Manage weed, pest and predatory species within adjacent vegetation		☑	☑	Project manager / Environmental superintendent
Prescribed impacts: — changes to hydrology — vehicle strike	Incorporate relevant Water Sensitive Design (Wong, Breen, & Lloyd, 2000) elements such as porous pavements, swale drains, buffer strips, etc., wherever practical/appropriate.	Manage stormwater and protection adjacent vegetation	☑			Project manager / Project engineer

POTENTIAL IMPACT	MITIGATION MEASURES	OUTCOME	PRE-CONSTRUCTION	CONSTRUCTION	OPERATION	RESPONSIBILITY
	Avoid working during heavy rain as this is likely to increase the intensity of potential impacts associated with erosion, drainage and sedimentation.	Manage sedimentation and erosion		☑		Project manager / Environmental superintendent
	During construction install sediment curtains to avoid increased sedimentation and erosion impacts.		☑	☑		Project manager / Environmental superintendent
	Fencing or other measures to control animal and vehicle interactions.	Protection of fauna from vehicle strike		☑	☑	Project manager / Environmental superintendent
	Implement speed limits around and within development site during construction works in accordance with onsite management measures implemented within the mining lease.	Protection of fauna from vehicle strike	☑	☑		Project manager
Sedimentation, erosion and hydrology	The Modification will be undertaken in accordance with Boggabri Coal Mine's Groundwater Management Plan (2017a) and Surface Water Management Plan (2017b).	Manage sedimentation and erosion	☑	☑	☑	Project manager / Environmental superintendent
	Existing vegetation monitoring program (as described within Section 4.1.8 of the approved Groundwater Management Plan) will be utilised to monitor whether the drawdown expected from the increased mining depth will result in adverse impacts to Poplar Box Woodland on Alluvial Plains ecological community.	Monitor potential indirect groundwater drawdown impacts on native vegetation			☑	Environmental superintendent

11 BIODIVERSITY OFFSETTING

11.1 IMPACTS NOT REQUIRING OFFSETS

In accordance with section 10.3.2.2 of the BAM, an offset is not required for impacts on threatened species habitat where a vegetation integrity score of ≤17 was generated. All vegetation zones recorded within the Modification development footprint generated a score of ≥17 and therefore, require biodiversity offsets. Biodiversity offsetting for residual impacts on BC Act biodiversity values is mandatory for Part 4 being assessed under Part 7 of the BC Act and subject to a BDAR. Biodiversity offset obligations have been determined using the BAM credit calculator. The required ecosystem and species credit obligations are outlined below. Biodiversity values which generated ecosystem and species credits require offset, which are detailed below.

11.2 ECOSYSTEM CREDITS

The required ecosystem credit obligation, as determined using the BAM calculator for the Modification illustrated in Figure 11.1 and detailed in Table 11.1 and Table 11.2.

Table 11.1 Ecosystem credits required to offset development impacts

PLANT COMMUNITY TYPE (PCT)	VEGETATION ZONE	THREATENED ECOLOGICAL COMMUNITY	BIODIVERSITY RISK WEIGHTING	AREA IMPACTED (HA)[1]	ECOSYSTEM CREDIT OBLIGATION
PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Intact)	Intact	Not listed	1.5	3.31	120

(1) The area impacted was selected to enable flexibility in the detailed engineering design, micro-siting of fauna connectivity structures and represent a worst case scenario. It estimated that a final disturbance footprint of 1.21 ha (110 m x 110 m) will be required for construction of the Modification.

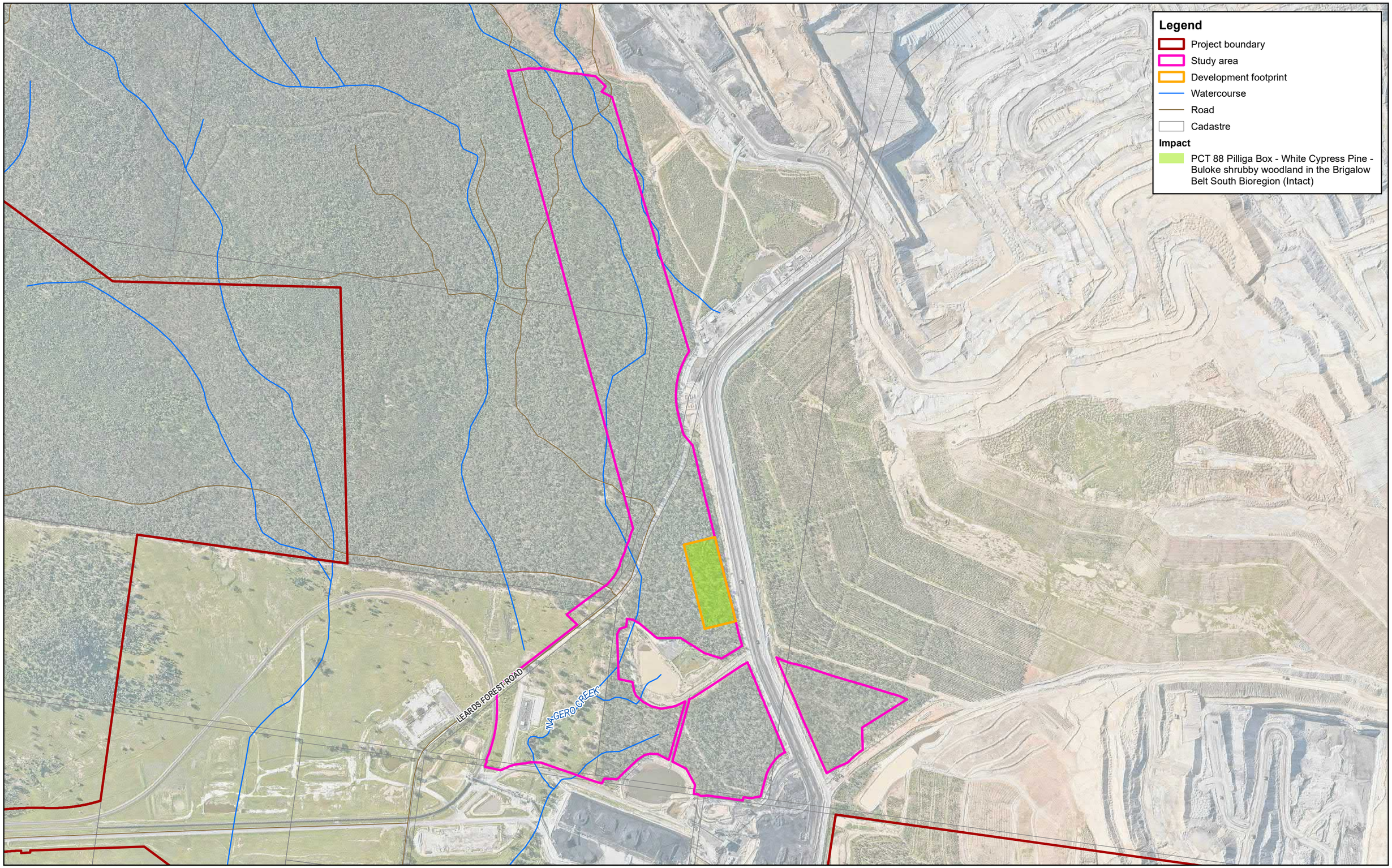
11.3 SPECIES CREDITS

The required species credit obligation, as determined using the BAM calculator, for the development is provided in Table 11.2.

Table 11.2 Biodiversity offset species credit obligation

COMMON NAME	SCIENTIFIC NAME	BC ACT[1]	VI LOSS	VEGETATION ZONE	BIODIVERSITY RISK WEIGHTING	SAII?	AREA / COUNT[2]	SPECIES CREDITS
Squirrel Glider	*Petaurus norfolcensis*	V	96.5	PCT 88 (Intact)	2	No	3.31 ha	160
Koala	*Phascolarctos cinereus*	V	96.5	PCT 88 (Intact)	2	No	3.31 ha	160
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	96.5	PCT 88 (Intact)	2	No	3.31 ha	160
							Total species credits obligation	**480**

(1) Listed under the BC Act – V = Vulnerable.
(2) The area impacted was selected to enable flexibility in the detailed engineering design, micro-siting of fauna connectivity structures and represent a worst case scenario. It estimated that a final disturbance footprint of 1.21 ha (110 m x 110 m) will be required for construction of the Modification.



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Scale 1:12,000

Projection: Transverse Mercator
Coordinate System: GDA 1994 MGA Zone 56
Scale correct when printed at A3 Landscape

Imagery: BCOPL 2020

DOCUMENT	BC2020_PS120722_BDAR_014_A1
AUTHOR.	suansrir
EDITED BY.	Emily.Mitchell
DATE.	14/09/2020

IDEMITSU
BOGGABRI COAL

FIGURE **11-1**

TITLE. **IMPACTS REQUIRING OFFSET**

Idemitsu Australia Resources Pty Ltd

DRAWING: \\corp.pbwan.net\ANZ\Projects\AU\PS120xxx\PS120722_Boggabri_MOD_8_Ec\5_Shared\GIS\BC2020_PS120722_BDAR_014_A1.mxd

11.4 OFFSETTING STRATEGY

11.4.1.1 NEGOTIATIONS WITH REGULATIVE AUTHORITIES

The project has reduced the area of vegetation clearing originally assessed and approved under SSD 09_0182; specifically including the proposed impact associated with the Dragline Erection pad and walk road. As the project provided biodiversity offsets for this clearing in the Revised Biodiversity Offset Strategy (WSP, 2018c), it is proposed that the Dragline Infrastructure (construction pad and walk road) will be surrendered as part of the Modification. Using the estimated final disturbance of 1.21 ha associated with the Modification, surrendering the Dragline Infrastructure would result in a net decrease of approximately 2.06 ha of impact associated with the project and thus, a net gain in biodiversity values.

Table 11.3 Comparison of impacts associated with MOD 8 against Dragline Infrastructure

PLANT COMMUNITY TYPE	MOD 8 ESTIMATED FINAL DISTURBANCE AREA (HA)	DRAGLINE (HA)[1]	SURRENDERED DRAGLINE (HA)[2]	BIODIVERSITY GAIN (HA)[3]
PCT 88 Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion, Intact	1.21	0.98	0.96	-0.25
PCT 88 Pilliga Box – White Cypress Pine – Buloke shrubby woodland in the Brigalow Belt South Bioregion, Derived Native Grassland	–	2.52	1.28	1.28
PCT 1313 White Cypress Pine – Narrow-leaved Ironbark shrub/ grass open forest of the western Nandewar Bioregion, Intact	–	0.48	0.48	0.48
PCT 1383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion, Intact	–	0.1	0.1	0.1
PCT 511 Queensland Bluegrass – Redleg Grass – Rats Tail Grass – Spear Grass – Panic Grass derived grassland, Derived Native Grassland	–	0.34	0.15	0.15
Miscellaneous ecosystems (highly disturbed area with no or limited native vegetation)	–	0.36	0.3	0.3
Total	**1.21**	**4.78**	**3.27**	**2.06**

(1) Dragline Infrastructure (construction pad and walk road) approved under the Continuation of Boggabri Coal Mine – Biodiversity Impact Assessment (Parsons Brinckerhoff (2010a))

(2) Surrendered Dragline Infrastructure (construction pad and walk road) less impacts associated with Modification 7, which intersected the construction pad in the south west (Figure 1.2).

(3) The net biodiversity gain achieved with MOD 8 if the approved Dragline Infrastructure is surrendered. Importantly, biodiversity offsets where provided for impacts associated with the Dragline Infrastructure for the project's comprehensive Biodiversity Offset Strategy and Revised Biodiversity Offset Strategy (WSP, 2018c).

Negotiations within DPIE and the Biodiversity and Conservation Division will be undertaken to identify an appropriate offset strategy required to compensate for impacts associated with Modification.

12 CONCLUSION

BCOPL seeks a Modification to SSD Approval 09_0182 under Section 4.55 of the EP&A Act to increase the depth of approved mining operations and to facilitate the construction of a fauna movement crossing of the existing haul road at BCM. This BDAR has been prepared to meet the requirements of the Biodiversity Assessment Method (BAM) established under Section 6.7 of the BC Act. This BDAR describes the biodiversity values present in the Modification study area and development footprint, assesses impacts to threatened species and ecological communities, recommends appropriate mitigation and management measures and details biodiversity credit liability associated with unavoidable impacts to biodiversity values.

To enable flexibility in the detailed engineering design and micro-siting of fauna connectivity structures, potential impacts were assessed using a maximum area and worst case scenario of 3.31 ha (300 m x 110 m). However, it is anticipated that following detailed design, the fauna crossing structure would only disturb up to 1.21 ha (110 m x 110 m) inside the 3.31 ha area.

Four native PCTs, categorised into eight vegetation zones (based on broad condition categories), and one miscellaneous ecosystem were recorded in the Modification study area. However, only one PCT, totalling 3.31 ha was mapped in the Modification development footprint, comprising:

- PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion (Intact).

Impacts on threatened species have been determined in accordance with the BAM based on predicted or ecosystem credit species and species credit species. Impacts resulting from the Modification on threatened species include:

- a total of 24 threatened fauna species identified as predicted ecosystem credit species
- a total of three threatened fauna species credit species identified as affected by the Modification, including:
  - 3.31 hectares of habitat for Koala, which is listed as Vulnerable under the BC Act
  - 3.31 hectares of habitat for Squirrel Glider, which is listed as Vulnerable under the BC Act
  - 3.31 hectares of habitat for Pale-headed Snake, which is listed as Vulnerable under the BC Act
- no candidate threatened flora are predicted to be impacted as a result of the Modification.

The residual unavoidable impacts of the Modification were calculated in accordance with BAM by utilising the Biodiversity Assessment Method Credit Calculator. A combined total of 600 ecosystem and species credits are required to offset the residual impacts associated with the Modification, including:

- 120 ecosystem credits
- 480 species credits.

As BCOPL require flexibility in detailed engineering design and the micro-siting of fauna connectivity structures, it is anticipated that direct impacts will be less than the 3.31 ha subject to this assessment. Accordingly, BCOPL will endeavour to seek concurrence with the DPIE and the Biodiversity and Conservation Division of the Environment, Energy and Science Group in DPIE, to update calculations in this BDAR following the detailed design process to determine the actual disturbance required, and to refine biodiversity credit liability associated with a reduced development footprint. Alternatively, BCOPL has indicated a preference to surrender the proposed disturbance area associated with the Dragline Erection pad and walk road, which was approved under SSD 09_0182 and compensated for under Boggabri Coal Mine's Revised Biodiversity Offset Strategy. Using the estimated final disturbance area of 1.21 ha associated with the Modification, surrendering the Dragline Infrastructure (construction pad and walk road) would result in a net decrease of approximately 2.06 ha of impact associated with the project and thus, a net gain in biodiversity values. Additionally, biodiversity offsets where provided for impacts associated with the Dragline Infrastructure for the project's comprehensive Biodiversity Offset Strategy and Revised Biodiversity Offset Strategy.

An assessment of PCTs recorded in the Modification study area determined that all patches of PCT 599 and PCT 1383 meet the listing criteria for *White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands'* threatened ecological community, which is listed as Critically Endangered under the BC Act and EPBC Act.

A corollary of this included that the Modification development footprint was micro-sited to avoid impacts to this Critically Endangered community.

Seven threatened species of plant listed under the EPBC Act were identified to have a moderate or higher likelihood of occurrence based on previous records and availability of potential habitat. One threatened species of plant, *Tylophora linearis*, which is listed as Endangered under the EPBC Act, was recorded via in the Modification study area via targeted searches. This species was observed in association with PCT 88, to the west of the development footprint. Although this species was not recorded in the development footprint during targeted searches, the Modification will impact 3.3 ha of suitable habitat.

No threatened fauna listed under the EPBC Act were recorded in the Modification study area during survey informing this report. However, nine species are considered to have a moderate or higher likelihood of occurring within the development footprint based on the availability of habitat. Several of these species have previously been recorded in the larger Leard State Forest remnant, including Corben's Long-eared Bat, Swift Parrot, White-throated Needletail and Koala, whilst the Painted Honeyeater is regularly recorded immediately south of the southern boundary of Leard State Forest in association with Weeping Myall Woodland.

Assessments of significance have been prepared in accordance with the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (DoE 2013) for impacts on threatened species. These assessments concluded that the Modification is not likely to have a significant impact on these MNES.

No migratory species were recorded during surveys completed, however the Modification study area provides aerial foraging habitat for the Fork-tailed Swift and White-throated Needletail, both of which have previously been recorded in aerial space over Leard State Forest. However, the Modification is considered unlikely to substantially modify, destroy or isolate an area of important habitat for any EPBC Act listed migratory species and is unlikely to disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.

13 LIMITATIONS

This Report is provided by WSP Australia Pty Limited (*WSP*) for Hansen Bailey Pty Ltd (*Client*) in response to specific instructions from the Client and in accordance with WSP's proposal dated 26 May 2020 and agreement with the Client dated 24 April 2012 (*Agreement*).

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13.5 FIELD SURVEY LIMITATIONS

No sampling technique can eliminate the possibility that a species is present within a Modification study area. For example, some species of plant may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present within the Modification study area during surveys. The conclusions in this report are based upon data acquired for the proposal and the environmental field surveys, therefore, they are merely indicative of the environmental condition of the Modification study area at the time of preparing the report, including the presence or otherwise of species. It should be recognised that Modification study area conditions, including the presence of threatened species, can change with time.

Targeted surveys have been conducted to detect target sedentary animal species and threatened flora species that are considered likely to occur within the Modification study area based on habitat characteristics and previous records. As the actual distribution and the range of habitat utilised by some species is not fully understood, there is always a small possibility that other species could occur on the site despite being considered to have a low likelihood of occurrence based on their known range and known habitats.

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APPENDIX A

NATIVE VEGETATION

A1 PLANT SPECIES RECORDED

Table A.1 Flora species recorded within the Modification study area

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Exotic flora species recoded					
Amaranthaceae	*Gomphrena celosioides**	Gomphrena Weed	Exotic		
Apiaceae	*Cyclospermum leptophyllum**	Slender Celery	Exotic		
Apocynaceae	*Gomphocarpus fruticosus**	Narrow-leaved Cotton Bush	Exotic		
Asteraceae	*Bidens pilosa**	Cobblers Pegs	Exotic		
Asteraceae	*Centaurea melitensis**	Maltese Thistle	Exotic		
Asteraceae	*Chondrilla juncea**	Skeleton Weed	Exotic		
Asteraceae	*Cirsium vulgare**	Spear Thistle	Exotic		
Asteraceae	*Conyza sumatrensis**	Tall Feabane	Exotic		
Asteraceae	*Cyanthillium cinereum**	Iron Weed	Exotic		
Asteraceae	*Hypochaeris radicata**	Catsear	Exotic		
Asteraceae	*Lactuca serriola* f. *serriola**	Prickly Lettuce	Exotic		
Asteraceae	*Leontodon rhagadioloides**	Cretan Weed	Exotic		
Asteraceae	*Schkuhria pinnata**	Curious Weed	Exotic		
Asteraceae	*Sisymbrium irio**	London Rocket	Exotic		
Asteraceae	*Sisymbrium orientale**	Indian Hedge Mustard	Exotic		
Asteraceae	*Sonchus oleraceus**	Common Snowthistle	Exotic		
Asteraceae	*Taraxacum officinale**	Dandelion	Exotic		
Asteraceae	*Xanthium spinosum**	Bathurst Burr	Exotic		
Boraginaceae	*Buglossoides arvensis**	Sheepweed	Exotic		
Brassicaceae	*Capsella bursa-pastoris**	Shepherd's Purse	Exotic		
Brassicaceae	*Lepidium africanum**	-	Exotic		
Brassicaceae	*Lepidium bonariense**	-	Exotic		
Brassicaceae	*Rapistrum rugosum**	Turnip Weed	Exotic		
Cactaceae	*Cylindropuntia imbricate**	Devil's Rope	Exotic		
Cactaceae	*Opuntia stricta**	Prickly Pear	Exotic		
Cactaceae	*Opuntia tomentose**	Velvet Tree Pear	Exotic		
Cactaceae	*Opuntia aurantiaca**	Tiger Pear	Exotic		
Caryophyllaceae	*Arenaria leptoclados**	Lesser Thyme-leaved Sandwort	Exotic		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Caryophyllaceae	*Cerastium glomeratum**	Mouse-ear Chickweed	Exotic		
Caryophyllaceae	*Petrorhagia nanteuilii**	-	Exotic		
Caryophyllaceae	*Polycarpon tetraphyllum**	Four-leaved Allseed	Exotic		
Cucurbitaceae	*Cucumis myriocarpus* subsp. *myriocarpus**	Paddy Melon	Exotic		
Fabaceae (Faboideae)	*Medicago minima**	Woolly Burr Medic	Exotic		
Fabaceae (Faboideae)	*Medicago polymorpha**	Burr Medic	Exotic		
Fabaceae (Faboideae)	*Melilotus indicus**	Hexham Scent	Exotic		
Fabaceae (Faboideae)	*Trifolium arvense**	Haresfoot Clover	Exotic		
Fabaceae (Faboideae)	*Trifolium glomeratum**	Clustered Clover	Exotic		
Lamiaceae	*Stachys arvensis**	Stagger Weed'	Exotic		
Malvaceae	*Malva parviflora**	Small-flowered Mallow	Exotic		
Malvaceae	*Malvastrum americanum**	Spiked Malvastrum	Exotic		
Malvaceae	*Sida spinosa**	-	Exotic		
Plantaginaceae	*Echium plantagineum**	Paterson's Curse	Exotic		
Plantaginaceae	*Linaria arvensis**	-	Exotic		
Plantaginaceae	*Misopates orontium**	Lesser Snapdragon	Exotic		
Poaceae	*Chloris virgate**	Feathertop Rhodes Grass	Exotic		
Poaceae	*Eleusine indica**	Crowsfoot Grass	Exotic		
Poaceae	*Eragrostis cilianensis**	Stinkgrass	Exotic		
Poaceae	*Lolium perenne**	Perennial Ryegrass	Exotic		
Poaceae	*Megathyrsus maximus**	Guinea Grass	Exotic		
Polygonaceae	*Emex australis**	Spiny Emex	Exotic		
Primulaceae	*Lysimachia arvensis**	Scarlet Pimpernel	Exotic		
Solanaceae	*Lycium ferocissimum**	African Boxthorn	Exotic		
Solanaceae	*Solanum nigrum**	Black-berry Nightshade'	Exotic		
Verbenaceae	*Glandularia aristigera**	Mayne's Pest	Exotic		
Verbenaceae	*Verbena quadrangularis**	-	Exotic		
Asteraceae	*Carthamus lanatus*	Slender Thistle	Exotic		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Native flora species recorded					
Acanthaceae	*Brunoniella australis*	Blue trumpet	Native		
Acanthaceae	*Rostellularia adscendens* var. *adscendens*	-	Native		
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed	Native		
Amaryllidaceae	*Crinum flaccidum*	Darling Lily	Native		
Anthericaceae	*Arthropodium milleflorum*	Pale Vanilla Lily	Native		
Anthericaceae	*Arthropodium minus*	Small Vanilla Lily	Native		
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily	Native		
Anthericaceae	*Tricoryne elatior*	Yellow Autumn-lily	Native		
Apiaceae	*Daucus glochidiatus*	Native Carrot	Native		
Apocynaceae	*Alstonia constricta* "Type form"	Quinine Bush	Native		
Apocynaceae	*Marsdenia viridiflora* subsp. *viridiflora*	Native Pear	Native		
Apocynaceae	*Parsonsia eucalyptophylla*	Gargaloo	Native		
Apocynaceae	*Tylophora linearis*	-	Native	V	E
Asphodelaceae	*Bulbine bulbosa*	Native Leek	Native		
Asteraceae	*Brachyscome multifida* var. *multifida*	Cut-leaf Daisy	Native		
Asteraceae	*Brachyscome diversifolia*	Large-headed Daisy	Native		
Asteraceae	*Calotis cuneifolia*	Purple Burr-daisy	Native		
Asteraceae	*Calotis hispidula*	Bogan Flea	Native		
Asteraceae	*Calotis lappulacea*	Yellow Burr-daisy	Native		
Asteraceae	*Cassinia laevis*	Cough Bush	Native		
Asteraceae	*Centipeda cunninghamii*	Common Sneezeweed	Native		
Asteraceae	*Centipeda thespidioides*	Desert Sneezeweed	Native		
Asteraceae	*Chrysocephalum apiculatum*	Common Everlasting	Native		
Asteraceae	*Chrysocephalum semipapposum*	Clustered Everlasting	Native		
Asteraceae	*Cotula australis*	Common Cotula	Native		
Asteraceae	*Cymbonotus lawsonianus*	Bears-ear	Native		
Asteraceae	*Euchiton involucratus*	Star Cudweed	Native		
Asteraceae	*Glossocardia bidens*	Cobblers Tack	Native		
Asteraceae	*Olearia elliptica* subsp. *elliptica*	Sticky Daisy Bush	Native		
Asteraceae	*Rhodanthe anthemoides*	Chamomile Sunray	Native		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Asteraceae	*Senecio quadridentatus*	Cotton Fireweed	Native		
Asteraceae	*Sigesbeckia australiensis*	-	Native		
Asteraceae	*Solenogyne bellioides*	-	Native		
Asteraceae	*Stuartina hamata*	Hooked Cudweed	Native		
Asteraceae	*Vittadinia cervicularis* var. *subcervicularis*	-	Native		
Asteraceae	*Vittadinia dissecta* var. *hirta*	-	Native		
Asteraceae	*Vittadinia muelleri*	-	Native		
Asteraceae	*Vittadinia pterochaeta*	Winged New Holland Daisy	Native		
Asteraceae	*Vittadinia sp.*	-	Native		
Asteraceae	*Vittadinia sulcata*	-	Native		
Asteraceae	*Xerochrysum viscosum*	Sticky Everlasting	Native		
Boraginaceae	*Cynoglossum australe*	-	Native		
Boraginaceae	*Ehretia membranifolia*	Peach Bush	Native		
Brassicaceae	*Cardamine paucijuga*	-	Native		
Campanulaceae	*Wahlenbergia communis*	Tufted Bluebell	Native		
Campanulaceae	*Wahlenbergia gracilis*	Sprawling Bluebell	Native		
Campanulaceae	*Wahlenbergia luteola*	-	Native		
Campanulaceae	*Wahlenbergia* sp.	Bluebell	Native		
Caryophyllaceae	*Gypsophila tubulosa*	Annual Chalkwort	Native		
Caryophyllaceae	*Spergularia brevifolia*	Lesser Sea-spurrey	Native		
Casuarinaceae	*Allocasuarina luehmannii*	Bulloak, Buloke	Native		
Celastraceae	*Denhamia cunninghamii*	-	Native		
Chenopodiaceae	*Dysphania carinata*	Keeled Goosefoot	Native		
Chenopodiaceae	*Dysphania pumilio*	Small Crumbweed	Native		
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	Native		
Chenopodiaceae	*Einadia nutans* subsp. *linifolia*	Climbing saltbush	Native		
Chenopodiaceae	*Einadia nutans* subsp. *nutans*	Climbing Saltbush	Native		
Chenopodiaceae	*Einadia polygonoides*		Native		
Chenopodiaceae	*Einadia trigonos*	Fishweed	Native		
Chenopodiaceae	*Maireana enchylaenoides*	Wingless Bluebush	Native		
Chenopodiaceae	*Maireana microphylla*	Small-leaf Bluebush	Native		
Chenopodiaceae	*Rhagodia parabolica*	Mealy Saltbush	Native		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Chenopodiaceae	*Salsola australis*	-	Native		
Chenopodiaceae	*Sclerolaena birchii*	Galvanised Burr	Native		
Chenopodiaceae	*Sclerolaena muricata* var. *muricata*	Black Rolypoly	Native		
Chenopodiaceae	*Sclerolaena muricata* var. *semiglabra*	Black Rolypoly	Native		
Colchicaceae	*Wurmbea biglandulosa* subsp. *biglandulosa*	-	Native		
Convolvulaceae	*Convolvulus angustissimus*	-	Native		
Convolvulaceae	*Convolvulus clementii*	Desert Binweed	Native		
Convolvulaceae	*Dichondra repens*	Kidney Weed	Native		
Convolvulaceae	*Dichondra sp. A*	Kidney Weed	Native		
Convolvulaceae	*Evolvulus alsinoides* var. *decumbens*	-	Native		
Crassulaceae	*Crassula colorata* var. *acuminata*	-	Native		
Cupressaceae	*Callitris glaucophylla*	White Cypress Pine	Native		
Cyperaceae	*Carex inversa*	-	Native		
Cyperaceae	*Cyperus difformis*	-	Native		
Cyperaceae	*Cyperus gracilis*	Slender Flat-sedge	Native		
Cyperaceae	*Cyperus rigidellus*	Curley Flat-sedge	Native		
Cyperaceae	*Fimbristylis dichotoma*	Common Fringe-sedge	Native		
Cyperaceae	*Lepidosperma laterale*	-	Native		
Cyperaceae	*Scleria mackaviensis*	-	Native		
Dilleniaceae	*Hibbertia obtusifolia*	Hoary guinea flower	Native		
Epacridaceae	*Melichrus urceolatus*	Urn Heath	Native		
Euphorbiaceae	*Beyeria viscosa*	Pinkwood	Native		
Euphorbiaceae	*Euphorbia drummondii*	Caustic Weed	Native		
Euphorbiaceae	*Euphorbia tannensis* subsp. *eremophila*	Desert Spurge	Native		
Fabaceae (Faboideae)	*Cullen tenax*	Tough Scurf-pea	Native		
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil	Native		
Fabaceae (Faboideae)	*Glycine canescens*	Silky Glycine	Native		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Fabaceae (Faboideae)	*Glycine clandestina*	-	Native		
Fabaceae (Faboideae)	*Glycine tabacina*	-	Native		
Fabaceae (Faboideae)	*Glycine tomentella*	Woolly Glycine	Native		
Fabaceae (Faboideae)	*Indigofera adesmiifolia*	Tick Indigo	Native		
Fabaceae (Faboideae)	*Oxytes brachypoda*	Large Tick-trefoil	Native		
Fabaceae (Faboideae)	*Senna aciphylla*	Sprawling Cassia	Native		
Fabaceae (Faboideae)	*Senna artemisioides* subsp. *zygophylla*	-	Native		
Fabaceae (Faboideae)	*Swainsona galegifolia*	Smooth Darling Pea	Native		
Fabaceae (Faboideae)	*Templetonia stenophylla*	Leafy Templetonia	Native		
Fabaceae (Faboideae)	*Zornia dyctiocarpa* var. *dyctiocarpa*	Zornia	Native		
Fabaceae (Mimosoideae)	*Acacia deanei* subsp. *deanei*	Green Wattle	Native		
Fabaceae (Mimosoideae)	*Acacia decora*	Western Golden Wattle	Native		
Geraniaceae	*Erodium crinitum*	Blue Storksbill	Native		
Geraniaceae	*Geranium solanderi*	Native Geranium	Native		
Goodeniaceae	*Goodenia fascicularis*	-	Native		
Goodeniaceae	*Goodenia hederacea* subsp. *hederacea*	Forest Goodenia	Native		
Goodeniaceae	*Goodenia cycloptera*	-	Native		
Goodeniaceae	*Goodenia rotundifolia*	-	Native		
Haloragaceae	*Haloragis heterophylla*	Rough Raspwort	Native		
Juncaceae	*Juncus usitatus*	-	Native		
Lamiaceae	*Ajuga australis*	Austral Bugle	Native		
Lamiaceae	*Teucrium betchei*	-	Native		
Linaceae	*Linum marginale*	Native Flax	Native		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Lomandraceae	*Lomandra filiformis* subsp. *coriacea*	Wattle Matt-rush	Native		
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Matt-rush	Native		
Lomandraceae	*Lomandra longifolia*	Spiney Mat-rush	Native		
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush	Native		
Loranthaceae	*Amyema miquelii*	-	Native		
Loranthaceae	*Amyema quandang* var. *quandang*	-	Native		
Loranthaceae	*Lysiana subfalcata*	-	Native		
Malvaceae	*Abutilon oxycarpum*	Straggly Lantern-bush	Native		
Malvaceae	*Brachychiton populneus* subsp. *populneus*	Kurrajong	Native		
Malvaceae	*Sida corrugata*	Corrugated Sida, Variable Sida	Native		
Malvaceae	*Sida cunninghamii*	Ridged Sida	Native		
Malvaceae	*Sida trichopoda*	Hairy Sida	Native		
Malvaceae	*Sida hackettiana*	Golden Rod	Native		
Marsileaceae	*Marsilea drummondii*	Common Nardoo	Native		
Myrtaceae	*Eucalyptus albens*	White Box	Native		
Myrtaceae	*Eucalyptus blakelyi*	Blakely's Red Gum	Native		
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	Native		
Myrtaceae	*Eucalyptus melliodora*	Yellow Box	Native		
Myrtaceae	*Eucalyptus pilligaensis*	Narrow-leaved Grey Box	Native		
Myrtaceae	*Eucalyptus populnea* subsp. *bimbil*	Bimble Box	Native		
Nyctaginaceae	*Boerhavia dominii*	Tarvine	Native		
Oleaceae	*Jasminum suavissimum*	-	Native		
Oleaceae	*Notelaea microcarpa* var. *microcarpa*	Native Olive	Native		
Orchidaceae	*Cymbidium canaliculatum*	Tiger Orchid	Native		
Orchidaceae	*Pterostylis longicurva*	Long-tongues Greenhood	Native		
Orchidaceae	*Pterostylis praetermissa*	Greenhood Orchid	Native		
Orchidaceae	*Pterostylis* sp.	-	Native		
Oxalidaceae	*Oxalis chnoodes*	-	Native		
Oxalidaceae	*Oxalis perennans*	-	Native		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Phormiaceae	*Dianella longifolia*	Blueberry Lily	Native		
Phormiaceae	*Dianella revoluta* var. *revoluta*	Blue Flax-lily	Native		
Phyllanthaceae	*Breynia oblongifolia*	coffee bush	Native		
Phyllanthaceae	*Phyllanthus thesioides*	Shrubby Spurge	Native		
Phyllanthaceae	*Phyllanthus virgatus*	-	Native		
Pittosporaceae	*Pittosporum angustifolium*	Weeping Pittosporum	Native		
Plantaginaceae	*Plantago debilis*	Shade Plantain	Native		
Plantaginaceae	*Plantago gaudichaudii*	Narrow Plantain	Native		
Plantaginaceae	*Stemodia florulenta*	Blue-rod	Native		
Plantaginaceae	*Veronica plebeia*	Trailing Speedwell	Native		
Poaceae	*Anthosachne scabra*	Wheatgrass	Native		
Poaceae	*Aristida leptopoda*	Cane Wire-grass	Native		
Poaceae	*Aristida personata*	Purple Wire-grass	Native		
Poaceae	*Aristida ramosa*	Cane Wire-grass	Native		
Poaceae	*Aristida vagans*	Threeawn Speargrass	Native		
Poaceae	*Aristida caput-medusae*	Many-headed Wiregrass	Native		
Poaceae	*Austrostipa scabra*	Speargrass	Native		
Poaceae	*Austrostipa verticillata*	Slender Bamboo Grass	Native		
Poaceae	*Bothriochloa decipiens* var. *decipiens*	Red Grass	Native		
Poaceae	*Bothriochloa macra*		Native		
Poaceae	*Chloris truncata*	Windmill Grass	Native		
Poaceae	*Chloris ventricosa*	Plump Windmill Grass	Native		
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass	Native		
Poaceae	*Cynodon dactylon*	Couch	Native		
Poaceae	*Dactyloctenium radulans*	Button Grass	Native		
Poaceae	*Dichanthium sericeum* subsp. *sericeum*	Queensland Bluegrass	Native		
Poaceae	*Digitaria breviglumis*	-	Native		
Poaceae	*Digitaria brownii*	Cotton Panic Grass	Native		
Poaceae	*Digitaria diffusa*	Open Summer-grass	Native		
Poaceae	*Digitaria divaricatissima*	Umbrella Grass	Native		
Poaceae	*Echinochloa colona*	Awnless Barnyard Grass	Native		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Poaceae	*Enneapogon gracilis*	Slender Bottle-washers	Native		
Poaceae	*Enteropogon acicularis*	-	Native		
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	Native		
Poaceae	*Eragrostis elongata*	Clustered Lovegrass	Native		
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	Native		
Poaceae	*Eragrostis megalosperma*	-	Native		
Poaceae	*Eragrostis parviflora*	Weeping Lovegrass	Native		
Poaceae	*Eriochloa pseudoacrotricha*	Early Spring Grass	Native		
Poaceae	*Leptochloa asthenes*	-	Native		
Poaceae	*Microlaena stipoides*	Weeping Grass	Native		
Poaceae	*Panicum buncei*	-	Native		
Poaceae	*Panicum effusum*	Hairy Panic	Native		
Poaceae	*Panicum queenslandicum*	Yadbila Grass	Native		
Poaceae	*Panicum* sp.	-	Native		
Poaceae	*Paspalidium constrictum*	Knottybutt Grass	Native		
Poaceae	*Paspalidium criniforme*	-	Native		
Poaceae	*Paspalidium gracile*	Slender Panic	Native		
Poaceae	*Poa sieberiana*	-	Native		
Poaceae	*Rytidosperma bipartitum*	Wallaby Grass	Native		
Poaceae	*Rytidosperma caespitosum*	Ringed Wallaby Grass	Native		
Poaceae	*Rytidosperma fulvum*	Wallaby Grass	Native		
Poaceae	*Rytidosperma racemosum* var. *obtusatum*	-	Native		
Poaceae	*Rytidosperma racemosum* var. *racemosum*	-	Native		
Poaceae	*Rytidosperma setaceum*	Smallflower Wallaby Grass	Native		
Poacaea	*Rytidosperma* sp.	-	Native		
Poaceae	*Sporobolus caroli*	Fairy Grass	Native		
Poaceae	*Sporobolus creber*	Western Rat-tail Grass	Native		
Poaceae	*Tragus australianus*	Small Burrgrass	Native		
Poaceae	*Tripogon loliiformis*	Fiveminute Grass	Native		
Polygonaceae	*Rumex brownii*	Swamp Dock	Native		
Portulaceae	*Portulaca oleracea*	Pigweed	Native		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS	BC ACT[1]	EPBC ACT[2]
Pteridaceae	*Cheilanthes distans*	Bristly Cloak Fern	Native		
Pteridaceae	*Cheilanthes sieberi* subsp. *sieberi*	Mulga Fern	Native		
Ranunculaceae	*Clematis microphylla*	Small-leaved Clematis	Native		
Ranunculaceae	*Ranunculus pumilio* var. *pumilio*	Ferny Buttercup	Native		
Rubiaceae	*Asperula conferta*	Common Woodruff	Native		
Rubiaceae	*Galium gaudichaudii* subsp. *gaudichaudii*	Rough Bedstraw	Native		
Rubiaceae	*Gonocarpus elatus*	-	Native		
Rubiaceae	*Pomax umbellata*	-	Native		
Rubiaceae	*Psydrax odorata* subsp. *australiana*	Shiny-leaved Canthium	Native		
Rutaceae	*Geijera parviflora*	Wilga	Native		
Santalaceae	*Exocarpos cupressiformis*	Native Cherry	Native		
Sapindaceae	*Alectryon oleifolius* subsp. *elongatus*	Western Rosewood	Native		
Sapindaceae	*Atalaya hemiglauca*	Whitewood	Native		
Sapindaceae	*Dodonaea sinuolata* subsp. *sinuolata*	-	Native		
Sapindaceae	*Dodonaea viscosa* subsp. *angustifolia*	Sticky Hop-bush	Native		
Sapindaceae	*Dodonaea viscosa* subsp. *cuneata*	Wedge-leaf Hop-bush	Native		
Sapindaceae	*Dodonaea viscosa* subsp. *mucronata*	-	Native		
Scrophulariaceae	*Eremophila debilis*	Winter Apple	Native		
Solanaceae	*Solanum cinereum*	Narrawa Burr	Native		
Solanaceae	*Solanum cleistogamum*	-	Native		
Solanaceae	*Solanum esuriale*	Quena	Native		
Solanaceae	*Solanum parvifolium* subsp. *parvifolium*	-	Native		
Stackhousiaceae	*Stackhousia viminea*	Slender Stackhousia	Native		
Thymelaeaceae	*Pimelea neo-anglica*	Poison Pimelea	Native		
Xanthorrhoeaceae	*Xanthorrhoea glauca*	Grass Tree	Native		
Zygophyllaceae	*Tribulus micrococcus*	Yellow Vine	Native		

(1) Listed as V = Vulnerable under the BC Act.

(2) Listed as E = Endangered under the EPBC Act.

A2 VEGETATION INTEGRITY PLOT DATA

Table A.2 BAM vegetation integrity plot data summary

PLOT	TREE RICHNESS	SHRUB RICHNESS	GRASS RICHNESS	FORB RICHNESS	FERN RICHNESS	OTHER RICHNESS	TREE COVER	SHRUB COVER	GRASS COVER	FORB COVER	FERN COVER	OTHER COVER	FALLEN LOGS	LITTER COVER	LARGE TREES	CONDITION
PCT 88 Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion																
BM[1]	**5**	**8**	**8**	**9**	**1**	**2**	**50**	**22**	**25**	**5**	**0**	**0**	**48**	**61**	**3 (50cm)**	**Benchmark**
Q39	2	4	13	20	0	1	2	0.7	3.5	3.1	0	0.1	0	26.4	0	DNG
Q45	0	1	17	20	1	1	0	7	68.6	10.9	0.6	0.1	0	26	0	DNG
Q53	0	1	9	17	0	0	0	1	91	9.1	0	0	0	0	0	DNG
Q56	0	2	16	20	1	1	0	16.4	60.4	13	0.5	0.3	0	4	0	DNG
Q43	0	4	18	25	1	1	0	21.3	82.6	22.2	0.4	0.4	0	26	0	Regrowth
Q52	1	4	18	26	1	3	0.6	32.5	87.1	17.1	2	2.3	0	10	0	Regrowth
Q42	4	7	21	33	1	4	30.1	16.6	56.2	6.4	0.4	0.9	5	58	2	Modified
Q44	3	4	17	20	1	2	8.5	18.5	46.3	14.9	0.6	0.4	0	56	0	Modified
Q24	6	7	8	9	2	1	19.1	25.7	22.5	1.3	0.3	0.1	183	44	2	Intact
Q36	5	5	6	6	1	1	62	8.5	10.9	1.4	0.2	0.1	89	98	3	Intact
Q38	5	4	6	3	0	1	65	3.3	2.3	1	0	2	179	89.6	1	Intact
Q40	3	6	21	27	2	3	35	17	90.2	10.3	0.4	0.6	114	25	2	Intact
Q46	4	9	19	27	2	2	51	19.2	60.8	20.2	0.8	0.2	32	61	2	Intact

PLOT	TREE RICHNESS	SHRUB RICHNESS	GRASS RICHNESS	FORB RICHNESS	FERN RICHNESS	OTHER RICHNESS	TREE COVER	SHRUB COVER	GRASS COVER	FORB COVER	FERN COVER	OTHER COVER	FALLEN LOGS	LITTER COVER	LARGE TREES	CONDITION
PCT 599 Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion																
BM[1]	**3**	**4**	**9**	**12**	**1**	**2**	**18**	**2**	**42**	**6**	**0**	**1**	**41**	**30**	**2 (50cm)**	**Benchmark**
Q37	5	5	12	15	0	3	41	28.9	27.9	4	0	0.3	146.6	71	0	Intact
Q54	5	13	19	33	2	1	22	22.3	74.9	10.8	2.3	1	106	49	2	Intact
Q41	4	10	21	22	1	3	41.3	16.5	79.5	8.1	0.1	3.5	106	49	1	Intact
PCT 1313 White Cypress Pine - Narrow-leaved Ironbark shrub/grass open forest of the western Nandewar Bioregion																
BM[1]	**5**	**11**	**8**	**8**	**1**	**2**	**61**	**28**	**22**	**5**	**0**	**0**	**60**	**70**	**1 (50cm)**	**Benchmark**
Q28	3	7	5	9	2	2	39.5	16	11.1	10.5	3.4	0.4	85.5	76.4	1	Intact
Q47	4	9	23	44	1	2	62.3	7	62.5	25.8	1	1.8	50.8	1	1	Intact
Q50	2	6	22	31	2	5	34	32.6	77	20.5	1.2	2.3	96	50	2	Intact
Q51	2	5	22	31	1	4	33	7.8	100.8	17.9	1.1	0.8	23	53	2	Intact
Q55	2	5	18	30	1	5	34	5.2	63	34.7	0.9	2.7	29	37	1	Intact
PCT383 White Box grassy woodland of the Nandewar Bioregion and Brigalow Belt South Bioregion																
BM[1]	**3**	**4**	**9**	**12**	**1**	**2**	**18**	**2**	**42**	**8**	**0**	**1**	**34**	**35**	**2 (50cm)**	**Benchmark**
Q29	5	8	6	12	0	2	42.1	17.1	12.5	4.8	0	0.3	129	68	1	Intact
Q48	5	7	22	31	1	5	38	9.4	78.6	24.2	0.4	3.3	37	68	0	Intact
Q49	4	7	17	31	1	2	47.1	12.1	49.2	17.3	0.3	0.7	52	65	2	Intact

(1) Benchmark data for equivalent community in NSW Brigalow Belt South IBRA Bioregion: source (NSW BioNet Vegetation Classification database accessed September 2020 and cross referenced with Biodiversity Assessment Calculator).

APPENDIX B

RECORDED FAUNA

B1 RECORDED FAUNA

Table B.1 Recorded fauna

FAUNA GROUP	COMMON NAME	SCIENTIFIC NAME	NATIVE (N) OR INTRODUCED (I)	BC ACT[1]	EPBC ACT[2]
Amphibian	Spotted Marsh Frog	*Limnodynastes tasmaniensis*	N		
Bird	Apostlebird	*Struthidea cinerea*	N		
Bird	Australian King-Parrot	*Alisterus scapularis*	N		
Bird	Australian Magpie	*Cracticus tibicen*	N		
Bird	Australian Owlet-nightjar	*Aegotheles cristatus*	N		
Bird	Australian Raven	*Corvus coronoides*	N		
Bird	Australian Wood Duck	*Chenonetta jubata*	N		
Bird	Bar-shouldered Dove	*Geopelia humeralis*	N		
Bird	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	N		
Bird	Brown Treecreeper	*Climacteris picumnus victoriae*	N	V	
Bird	Common Bronzewing	*Phaps chalcoptera*	N		
Bird	Crested Pigeon	*Ocyphaps lophotes*	N		
Bird	Crested Shrike-tit	*Falcunculus frontatus*	N		
Bird	Crimson Rosella	*Platycercus elegans*	N		
Bird	Diamond Dove	*Geopelia cuneata*	N		
Bird	Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	N	V	
Bird	Eastern Spinebill	*Acanthorhynchus tenuirostris*	N		
Bird	Eastern Yellow Robin	*Eopsaltria australis*	N		
Bird	Fuscous Honeyeater	*Lichenostomus fuscus*	N		
Bird	Galah	*Eolophus roseicapilla*	N		
Bird	Grey Butcherbird	*Cracticus torquatus*	N		
Bird	Grey Fantail	*Rhipidura albiscapa*	N		
Bird	Grey Shrike-thrush	*Colluricincla harmonica*	N		
Bird	Grey Teal	*Anas gracilis*	N		
Bird	Inland Thornbill	*Acanthiza apicalis*	N		
Bird	Jacky Winter	*Microeca fascinans*	N		
Bird	Laughing Kookaburra	*Dacelo novaeguineae*	N		
Bird	Little Lorikeet	*Glossopsitta pusilla*	N	V	

FAUNA GROUP	COMMON NAME	SCIENTIFIC NAME	NATIVE (N) OR INTRODUCED (I)	BC ACT[1]	EPBC ACT[2]
Bird	Musk Lorikeet	*Glossopsitta concinna*	N		
Bird	Noisy Friarbird	*Philemon corniculatus*	N		
Bird	Noisy Miner	*Manorina melanocephala*	N		
Bird	Olive-backed Oriole	*Oriolus sagittatus*	N		
Bird	Peaceful Dove	*Geopelia placida*	N		
Bird	Pied Butcherbird	*Cracticus nigrogularis*	N		
Bird	Pied Currawong	*Strepera graculina*	N		
Bird	Plum-headed Finch	*Neochmia modesta*	N		
Bird	Red-rumped Parrot	*Psephotus haematonotus*	N		
Bird	Red-winged Parrot	*Aprosmictus erythropterus*	N		
Bird	Rufous Whistler	*Pachycephala rufiventris*	N		
Bird	Speckled Warbler	*Chthonicola sagittata*	N	V	
Bird	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	N		
Bird	Striated Pardalote	*Pardalotus striatus*	N		
Bird	Striped Honeyeater	*Plectorhyncha lanceolata*	N		
Bird	Sulphur-crested Cockatoo	*Cacatua galerita*	N		
Bird	Superb Fairy-wren	*Malurus cyaneus*	N		
Bird	Tree Martin	*Petrochelidon nigricans*	N		
Bird	Turquoise Parrot	*Neophema pulchella*	N	V	
Bird	Varied Sittella	*Daphoenositta chrysoptera*	N	V	
Bird	Variegated Fairy-wren	*Malurus lamberti*	N		
Bird	Wedge-tailed Eagle	*Aquila audax*	N		
Bird	Weebill	*Smicrornis brevirostris*	N		
Bird	White-bellied Cuckoo-shrike	*Coracina papuensis*	N		
Bird	White-browed Babbler	*Pomatostomus superciliosus*	N		
Bird	White-plumed Honeyeater	*Lichenostomus penicillatus*	N		
Bird	White-throated Treecreeper	*Cormobates leucophaea*	`N		
Bird	White-winged Fairy-wren	*Malurus leucopterus*	N		
Bird	Willie Wagtail	*Rhipidura leucophrys*	N		
Bird	Yellow Thornbill	*Acanthiza nana*	N		
Bird	Yellow-faced Honeyeater	*Lichenostomus chrysops*	N		

FAUNA GROUP	COMMON NAME	SCIENTIFIC NAME	NATIVE (N) OR INTRODUCED (I)	BC ACT[1]	EPBC ACT[2]
Bird	Zebra Finch	*Taeniopygia guttata*	N		
Mammal	Common Brush-tailed Possum	*Trichosurus vulpecula*	N		
Mammal	Common Wallaroo	*Macropus robustus*	N		
Mammal	Eastern Grey Kangaroo	*Macropus giganteus*	N		
Mammal	Fox	*Vuples vuples*	I		
Mammal	Pig	*Sus scrofa*	I		
Mammal	Red-necked wallaby	*Macropus rufogriseus*	N		
Mammal	Swamp Wallaby	*Wallabia bicolor*	N		
Reptile	Copper-tailed Skink	*Ctenotus taeniolatus*	N		
Reptile	Eastern Brown Snake	*Pseudonaja textilis*	N		
Reptile	Elegant Snake-eyed Skink	*Cryptoblepharus pulcher*	N		
Reptile	Lace Monitor	*Varanus varius*	N		
Reptile	Tree Dtella	*Gehyra variegata*	N		
Reptile	Tree Skink	*Egernia striolata*	N		
Reptile	Wall Skink	*Cryptoblepharus virgatus*	N		

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered

(2) Threat status under the EPBC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered.

APPENDIX C

THREATENED SPECIES HABITAT SUITABILITY TABLES

C1 THREATENED SPECIES HABITAT SUITABILITY

Table C.1 Threatened flora habitat suitability

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII	SOURCE[3]	HABITAT SUITABILITY[4]	LIKELIHOOD OF OCCURRENCE	OUTCOME
Androcalva procumbens	-	V	V	No	PMST, PlantNet	**Habitat Description** Mainly confined to the Dubbo-Mendooran-Gilgandra region, but also in the Pilliga and Nymagee areas. Recent collections made from the Upper Hunter region, and additional populations found in Goonoo SCA in response to the 2007 fires. Species has been recorded in *Eucalyptus dealbata* and *Eucalyptus sideroxylon* communities, *Melaleuca uncinata* scrub, under mallee eucalypts with a *Calytrix tetragona* understorey, and in a recently burnt Ironbark and Callitris area. Also in *Eucalyptus fibrosa* subsp. *nubila, Eucalyptus dealbata, Eucalyptus albens* and *Callitris glaucophylla* woodlands north of Dubbo. Grows in sandy sites, often found as a pioneer species of disturbed habitats. It has been recorded colonising disturbed areas such as roadsides, the edges of quarries and gravel stockpiles and a recently cleared easement under power lines. **Habitat within the Modification study area** Associated PCTs in the form of PCT 88, PCT 1313 and PCT 1383 recorded within the Modification study area. **Survey requirements** TBDC survey period: August to May	**Moderate** Associated PCTs recorded within the Modification study area which provides potential habitat for the species and species recorded in the broader locality.	**Considered further as a candidate species credit species** **Considered further in MNES sections of BDAR**
Bertya opponens	Coolabah Bertya	V	V	No	PlantNet	**Habitat Description** Coolabah Bertya occurs in a range of habitats including stony mallee ridges and cypress pine forest on red soils. The wide variation in habitat type between the populations makes the identification of critical habitat very difficult. Consideration of disturbance regimes and grazing management are probably more important to the survival of populations in the long term. Associated species at Jacks Creek State Forest include *Eucalyptus chloroclada, Callitris glaucophylla* and *Eucalyptus fibrosa*. **Habitat within the Modification study area** Associated PCTs in the form of PCT 88 and PCT 1313 recorded in the Modification study area.	Low No suitable habitat recorded and Modification study area occurs outside the species known distribution (nearest records at the Pilliga).	Not a candidate species credit species and not considered further. Not considered further in MNES sections.
Cadellia pentastylis	Ooline	V	V	No	PMST, PlantNet, BioNet	**Habitat Description** Forms a closed or open canopy mixing with eucalypt and cypress pine species. There appears to be a strong correlation between the presence of Ooline and low- to medium-nutrient soils of sandy clay or clayey consistencies, with a typical soil profile having a sandy loam surface layer, grading from a light clay to a medium clay with depth. **Habitat within the Modification study area** No associated PCTs recorded within the Modification study area.	Low Although recorded in the locality, no suitable habitat occurs within the Modification study area.	Not a candidate species credit species and not considered further. Not considered further in MNES sections.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII	SOURCE[3]	HABITAT SUITABILITY[4]	LIKELIHOOD OF OCCURRENCE	OUTCOME
Cyperus conicus	-	E	-	No	BAM-C (s), PlantNet	**Habitat requirements** Grows in open woodland on sandy soil. In central Australia, the species grows near waterholes and on the banks of streams in sandy soils. In Qld the species usually found on heavy soils. Recorded from Callitris forest in the Pilliga area, growing in sandy soil with *Cyperus gracilis, C. squarrosus* and *C. fulvus*. **Habitat within the Modification study area** Associated PCTs in the form of PCT 88 and PCT 1313 recorded in the Modification study area. **Survey requirements** TBDC survey period: January to May General survey notes: Survey Jan - May, after rain.	**Moderate** Potential habitat recorded within the Modification study area.	**Considered further as a candidate species credit species**
Dichanthium setosum	Bluegrass	V	V	No	BAM-C (s), PMST, PlantNet, BioNet	**Habitat requirements** 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. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched and water-enriched). Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis, Myoporum debilis, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Leptorhynchos squamatus, Lomandra* aff. *longifolia, Ajuga australis, Calotis hispidula and Austrodanthonia, Dichopogon, Brachyscome, Vittadinia, Wahlenbergia* and *Psoralea* species. **Habitat within the Modfication study area** Suitable habitat in the form of PCT 599, PCT 1313 and PCT 1383. **Survey requirements** TBDC survey period: November to April General survey notes: Survey Nov - May, 3 to 4 weeks after effective rainfall.	**Moderate** Suitable habitat recorded within the Modification study area and species recorded in the locality.	**Considered further as a candidate species credit species** **Considered further in MNES sections of BDAR**
Digitaria porrecta	Finger Panic Grass	E	-	No	BAM-C (s), PlantNet, BioNet	**Habitat requirements** In NSW, the most frequently recorded associated tree species are *Eucalyptus albens* and *Acacia pendula*. Common associated grasses and forbs in NSW sites include *Austrostipa aristiglumis, Enteropogon acicularis, Cyperus bifax, Hibiscus trionum* and *Neptunia gracilis.* **Habitat within the Modification study area** Associated PCTs in the form of PCT 599 and PCT 1383 recorded within the Modification study area. **Survey requirements** TBDC survey period: January to February General survey notes: Survey mid-January to late February.	**Moderate** Suitable habitat recorded within the Modification study area and species recorded in the locality.	**Considered further as a candidate species credit species**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII	SOURCE[3]	HABITAT SUITABILITY[4]	LIKELIHOOD OF OCCURRENCE	OUTCOME
Diuris tricolor	Pine Donkey Orchid	V	-	No	PlantNet	**Habitat Description** Associated species include *Callitris glaucophylla*, *Eucalyptus populnea*, *Eucalyptus intertexta*, Ironbark and Acacia shrubland. The understorey is often grassy with herbaceous plants such as Bulbine species. The Pine Donkey Orchid grows in sclerophyll forest among grass, often with native Cypress Pine (Callitris spp.). It is found in sandy soils, either on flats or small rises. Also recorded from a red earth soil in a Bimble Box community in western NSW. **Habitat within the Modification study area** Associated PCTs in the form of PCT 88 and PCT 1313 recorded in the Modification study area. **Survey requirements** TBDC survey period: September - October	**Moderate** Associated PCTs recorded within the Modification study area which provides potential habitat for the species and species recorded in the broader locality.	**Considered further as a candidate species credit species**
Eriocaulon australasicum	Austral Pipewort	E	E	Yes	PlantNet	**Habitat Description** Known in NSW from widely separated populations: a very early "Murray River" collection and recent collections near Braidwood and in the Pilliga. Type habitat described as "wet places along the Murray towards junction of Murrumbidgee". In populations near Braidwood and in the Pilliga, it grows in mud in ephemeral water bodies. **Habitat within the Modification study area** No associated PCTs recorded within the study area.	Low No potential habitat recorded and species has not been recorded in the locality. Modification study area occurs outside the species known distribution.	Not a candidate species credit species and not considered further. Not considered further in MNES sections.
Euphrasia arguta	-	CE	CE	Yes	PMST	**Habitat Description** *Euphrasia arguta* was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008. Prior to this, it had not been collected for 100 years. Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance. **Habitat within the Modification study area** Associated PCTs in the Nandewar IBRA subregion in the form of PCT 599 and PCT 1383 recorded in the Modification study area.	Low Despite associated PCTs recorded, the only recent records occur in the Nundle area. Species is not known from the Brigalow Belt South IBRA bioregion (EES species profile).	Not a candidate species credit species and not considered further. Not considered further in MNES sections.
Homopholis belsonii	Belson's Panic	E	V	No	PMST, PlantNet	**Habitat Description** It occurs on the northwest slopes and plains of NSW, mostly between Wee Waa, Goondiwindi and Glen Innes. It also occurs in Queensland, mainly in the Brigalow Belt South bioregion. Grows in dry woodland (e.g. Belah) often on poor soils, although sometimes found in basalt-enriched sites north of Warialda and in alluvial clay soils. **Habitat constraints** An associated PCT (PCT 1383) recorded within the Modification study area. Preferred habitat generally absent from the Modification study area.	Low Although an associated vegetation type was recorded, the Modification study area generally occurs outside the species known distribution (known from Narrabri region north to QLD, except for 2 isolated records at Victory SF and Manilla). Species also not detected during targeted surveys.	Not a candidate species credit species and not considered further. Not considered further in MNES sections.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII	SOURCE[3]	HABITAT SUITABILITY[4]	LIKELIHOOD OF OCCURRENCE	OUTCOME
Lepidium aschersonii	Spiny Peppercress	V	V	No	BAM-C (s), PlantNet, BioNet	**Habitat Description** Found on ridges of gilgai clays dominated by Brigalow (*Acacia harpophylla*), Belah (*Casuarina cristata*), Buloke (*Allocasuarina luehmanii*) and Grey Box (*Eucalyptus microcarpa*). In the south has been recorded growing in Bull Mallee (*Eucalyptus behriana*). Often the understorey is dominated by introduced plants. The species grows as a component of the ground flora, in grey loamy clays. Vegetation structure varies from open to dense, with sparse grassy understorey and occasional heavy litter. **Habitat within the Modification study area** Associated PCT (PCT 88) recorded within the Modification study area. **Survey requirements** TBDC survey period: November to April General survey notes: Usually during warmer months, typically found in gilgais.	**Moderate** Potential habitat recorded in the Modification study area and species has been recorded within the locality.	**Considered further as a candidate species credit species** **Considered further in MNES sections of BDAR**
Lepidium monoplocoides	Winged Peppercress	E	E	No	PlantNet	**Habitat Description** Occurs on seasonally moist to waterlogged sites, on heavy fertile soils, with a mean annual rainfall of around 300–500 mm. Predominant vegetation is usually an open woodland dominated by *Allocasuarina luehmannii* (Bulloak) and/or eucalypts, particularly *Eucalyptus largiflorens* (Black Box) or *Eucalyptus populnea* (Poplar Box). The field layer of the surrounding woodland is dominated by tussock grasses. **Habitat within the Modification study area** Associated PCT (PCT 88) recorded within the Modification study area. **Survey requirements** TBDC survey period: November to February General survey notes: Survey about 1 month after significant rain.	**Moderate** Potential habitat recorded in the Modification study area and species has been recorded within the broader locality.	**Considered further as a candidate species credit species** **Considered further in MNES sections of BDAR**
Lepidium peregrinum	Wandering Peppercress	E	E	Yes	PlantNet	**Habitat Description** Thought to be extinct until recently rediscovered in NSW and Queensland. Targeted searches conducted in 2001 confirmed the species occurs in scattered refugia in north-eastern NSW (near Tenterfield) and south-eastern Queensland. Occurs in an open riparian forest on the banks of the Tenterfield creek at Clifton. Sandy alluvium is the main soil type at the site. Associated species at the Clifton site are dominated by *Eucalyptus camaldulensis* and *Casuarina cunninghamiana,* with a variably dense shrubby understorey. **Habitat within the Modification study area** No associated PCTs or preferred habitat (i.e. sandy alluvium soils in open riparian forest) recorded within the Modification study area.	Low No suitable habitat recorded and Modification study area outside species known distribution (known only from the Tenterfield region in NSW).	Not a candidate species credit species and not considered further. Not considered further in MNES sections.
Muehlenbeckia sp. Mt Norman (J.T.Hunter 3847) Makinson *(Synonym Muehlenbeckia costata)*	-	V	-	No	PlantNet	**Habitat Description** Scattered distribution from Queensland to the Blue Mountains in NSW. Records on the New England Tablelands and North West Slopes include Bald Rock north of Tenterfield, Warra and Butterleaf National Parks near Glen Innes and Mt Kaputar. Grows in coarse sandy soils and peat in heath, mallee and open eucalypt woodland on granite or acid volcanic outcrops at higher altitudes. **Habitat within the Modification study area** No associated PCTs or preferred habitat (i.e. soils derived from granite or acid volcanic outcrops) recorded within the Modification study area.	Low No records within the locality and species is not known or predicted to occur within the Brigalow Belt South IBRA bioregion. Furthermore, no suitable habitat occurs within the Modification study area.	Not a candidate species credit species and not considered further.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII	SOURCE[3]	HABITAT SUITABILITY[4]	LIKELIHOOD OF OCCURRENCE	OUTCOME
Myriophyllum implicatum	-	CE	–	Yes	PlantNet	**Habitat Description** This species was previously thought to be extinct in NSW; however, the plant was recently discovered in the Pilliga National Park, south of Narrabri. Occurs in moist situations, extending away from fresh water. Recent population found in a large open partly inundated gilgai depression on cracking clay soil. **Habitat within the Modification study area** No associated PCTs or preferred habitat (i.e. gilgai depressions on cracking clay soil) recorded within the Modification study area.	Low No records within the locality. Species was previously thought extinct however is only known from Pilliga National Park. Furthermore, no suitable habitat occurs within the Modification study area.	Not a candidate species credit species and not considered further.
Polygala linariifolia	Native Milwort	E	-	No	BAM-C (s), PlantNet	**Habitat Description** Sandy soils in dry eucalypt forest and woodland with a sparse understorey. The species has been recorded from the Inverell and Torrington districts growing in dark sandy loam on granite in shrubby forest of *Eucalyptus caleyi, Eucalyptus dealbata* and Callitris, and in yellow podsolic soil on granite in layered open forest. **Habitat within the Modification study area** Associated PCTs including PCT 88, PCT 1313 and PCT 1383 recorded within the study area. Preferred habitat (i.e. soil derived from granite geology) not recorded within the Modification study area. **Survey requirements** TBDC survey period: October to February General survey notes: Use flowers to identify, as easily confused with *Polygala japonica*. Reliably flowering, Oct - Feb, but will flower sporadically at other times throughout the year.	Low Although vegetation associations recorded, preferred habitat does not occur within the Modification study area and species has not been recorded in the locality.	**Considered further as a candidate species credit species**
Pomaderris queenslandica	Scant Pomaderris	E	-	No	BAM-C (s), PlantNet, BioNet	**Habitat requirements** Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. **Habitat within the Modification study area** Associated PCTs providing suitable habitat in the form of PCT 599 and PCT 1313 recorded within the Modification study area. **Survey requirements** TBDC survey period: All year General survey notes: optimal survey period when flowering however species can be distinguished by leaf morphology.	**Moderate** Species has been recorded in the locality (incl. records within LSF) and suitable habitat for the species occurs within the Modification study area.	**Considered further as a candidate species credit species**
Pterostylis cobarensis	Cobar Rustyhood	V	-	No	PlantNet	**Habitat Description** Habitats are eucalypt woodlands, open mallee or Callitris shrublands on low stony ridges and slopes in skeletal sandy-loam soils. **Habitat within the Modification study area** Associated habitat in the form of PCT 88 and PCT 1313 recorded within the Modification study area. Preferred habitat in the form of low stony ridges and slopes in skeletal sand-loam soils not recorded within the Modification study area.	Low Preferred habitat not recorded within the study area and species not recorded within the locality. Modification study area occurs outside the species known distribution limit.	Not a candidate species credit species and not considered further.

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII	SOURCE[3]	HABITAT SUITABILITY[4]	LIKELIHOOD OF OCCURRENCE	OUTCOME
Pultenaea setulosa	-	-	V	No	PlantNet	**Habitat Description** *Pultenaea setulosa* is confined to Queensland where it occurs in the Marlborough district and south to Rockhampton and Mt Fairview. *Pultenaea setulosa* is restricted to hillsides and ridges with serpentinite soils. It occurs in open eucalypt forest of Red Ironbark (*Eucalyptus fibrosa*), Glen Geddes Bloodwood (*Corymbia xanthope*) and Clarkson's Bloodwood (*Corymbia clarksoniana*). **Habitat within the Modification study area** Habitat for *Pultenaea seulosa* not recorded in the Modification study area.	Not applicable Although recorded within the LSF this species is only listed as a threatened species in QLD where it is confined to the Marlborough district and south to Rockhampton and Mt Fairview.	Not considered further in MNES sections.
Swainsona murrayana	Slender Darling Pea	V	V	No	BAM-C (s), PMST, PlantNet	**Habitat Requirements** The species has been collected from clay-based soils, ranging from grey, red and brown cracking clays to red-brown earths and loams. Grows in a variety of vegetation types including bladder saltbush, black box and grassland communities on level plains, floodplains and depressions and is often found with Maireana species. Plants have been found in remnant native grasslands or grassy woodlands that have been intermittently grazed or cultivated. **Habitat within the Modification study area** Associated PCT providing suitable habitat in the form of PCT 1383 recorded within the Modification study area. **Survey requirements** TBDC survey period: September General survey notes: Based on expert knowledge and observation.	**Moderate** Marginal habitat recorded in the Modification study area and species has been recorded in the broader locality.	**Considered further as a candidate species credit species** **Considered further in MNES sections of BDAR**
Thesium australe	Austral Toadflax	V	V	No	BAM-C (s), PMST	**Habitat requirements** Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*). **Habitat within the Modification study area** Associated PCTs providing suitable habitat in the form of PCT 599 and PCT 1383 recorded within the Modification study area. **Survey requirements** TBDC survey period: November to February General survey notes: Species may be perennial below ground and ephemeral above ground.	**Moderate** Vegetation associations recorded (PCT 599 and PCT 1383) and species has been recorded in the broader locality.	**Considered further as a candidate species credit species** **Considered further in MNES sections of BDAR**
Tylophora linearis	-	V	E	No	BAM-C (s), PMST, PlantNet, BioNet	**Habitat Requirements** Grows in dry scrub and open forest. Recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii*. **Habitat within the Modification study area** Suitable habitat in the form of PCT 88, PCT 599, PCT 1313 and PCT 1383. **Survey requirements** TBDC survey period: October to May General survey notes: Use flowers and fruit to locate and identify. Easily confused with other climbers when not in flower or fruit.	**Recorded** Species was recorded within the Modification study area in suitable habitat including PCT 88. PCT 1313 and 1383.	**Considered further as a candidate species credit species** **Considered further in MNES sections of BDAR**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SAII	SOURCE[3]	HABITAT SUITABILITY[4]	LIKELIHOOD OF OCCURRENCE	OUTCOME
Zieria odorifera subsp. *copelandii*	-	CE	-	Yes	PlantNet	**Habitat Description** *Zieria odorifera* subsp. *copelandii* is endemic to New South Wales. Its distribution is very highly restricted, known only from a single population in Mount Kaputar National Park near Narrabri. The number of mature individuals is estimated to be extremely low with surveys in 2012 and 2014 locating 15 individuals over an area of 1 ha. Species recorded growing in heath with *Prostanthera cruciflora, Calytrix tetragona* and *Kunzea sp.* on rocky slopes near rock outcrops **Habitat within the Modification study area** No suitable habitat (i.e. rocky slopes near rock outcrops) recorded within the Modification study area.	Low Species only known from a single population in Mount Kaputar National Park. No suitable habitat for the species occurs within the Modification study area.	Not a candidate species credit species and not considered further.

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, E2 = Endangered Population, CE = Critically Endangered

(2) Threat status under the EPBC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered

(3) Data source: PMST – DAWE's EPBC Protected Matters Search Tool, BioNet = EES's BioNet Atlas of NSW Wildlife , PlantNet = NSW Flora online spatial search, BAM-C = NSW Government's Biodiversity Assessment Methodology Calculator where 's' indicates predicted species credit species and 'e' indicates a predicted ecosystem species.

(4) Habitat suitability information sourced from species EES's threatened species profile (2020) and DAWE's Species Profile and Threats Database (SPRAT) profile (2020).

Table C.2 Threatened fauna habitat suitability

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Birds (46)							
Actitis hypoleucos	Common Sandpiper	-	M	PMST	**Habitat requirements** Frequents a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity. It is mostly encountered along muddy margins or rocky shores and rarely on mudflats. It has been recorded in estuaries and deltas of streams, banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow, and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves. **Type of credit:** n/a	Low No associated habitat within Modification study area	Not considered further
Anthochaera phrygia	Regent Honeyeater	CE	CE	BAM-C (s), BAM-C (e), BioNet, PMST	**Habitat requirements** The Regent Honeyeater is a flagship threatened woodland bird whose conservation will benefit a large suite of other threatened and declining woodland fauna. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. **Habitat within the Modification study area** Predicted habitat in PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Dual species/ecosystem credit **Species credit –** Important habitat i.e. As per mapped areas. **Ecosystem –** All areas of other habitat.	**Moderate.** Potential foraging habitat within the Modification study area. Modification study area is outside mapped 'important habitat'	**Predicted ecosystem credit species**
Apus pacificus	Fork-tailed Swift	-	M	PMST	**Habitat requirements** Breeds in the northern hemisphere, wintering south to Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. It mostly occurs over inland plains but sometimes above foothills or in coastal areas over cliffs, beaches, islands and well out to sea. It also occurs over towns and cities. It mostly occurs over dry and/or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh, grassland, spinifex sandplains, farmland and sand-dunes. It sometimes occurs above forests. It probably roosts aerially, but has occasionally been observed to land. **Habitat within the Modification study area** Predicted habitat in PCT 599, PCT 1313 and PCT 1383. **Type of credit:** n/a	**Moderate.** May occur in aerial habitats over the proposal Modification study area on a seasonal basis.	**Considered further in MNES section**
Ardeotis australis	Australian Bustard	E	-	BAM-C (s)	**Habitat requirements** Occurs in inland Australia and is now scarce or absent from southern and south-eastern Australia. In NSW, they are mainly found in the north-west corner and less often recorded in the lower western and central west plains regions. Occasional vagrants are still seen as far east as the western slopes and Riverine plain. Breeding now only occurs in the north-west region of NSW. Mainly inhabits tussock and hummock grasslands, though prefers tussock grasses to hummock grasses; also occurs in low shrublands and low open grassy woodlands; occasionally seen in pastoral and cropping country, golf courses and near dams. Breeds on bare ground on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover; roosts on ground among shrubs and long grasses or under trees. **Habitat within the Modification study area** Predicted habitat in PCT 599 and PCT 1383. **Type of credit:** Species credit	Low Marginal habitat within Modification study area. No records in locality.	**Candidate Species credit species**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	BioNet, BAM-C (e)	**Habitat requirements** Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland. **Habitat within the Modification study area** Predicted habitat occurs within PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Recorded.** Known to occur within locality.	**Predicted ecosystem credit species**
Botaurus poiciloptilus	Australasian Bittern	E	E	PMST	**Habitat requirements** In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds. **Type of credit:** Ecosystem credit	Low. Marginal habitat within Modification study area. Lack of permanent wetlands which are preferred by the species	Not considered further
Burhinus grallarius	Bush Stone-curlew	E	-	BAM-C (s)	**Habitat requirements** The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights. **Habitat within the Modification study area** Predicted habitat occurs in PCT 88, PCT 599 and PCT 1383. **Type of credit:** Species credit	**Moderate.** Potential habitat within Modification study area. However, species has drastically reduced in range.	**Candidate species credit species**
Calidris acuminata	Sharp-tailed Sandpiper	-	M	PMST	**Habitat requirements** Occurs in a variety of habitats: tidal mudflat, mangrove swamps, saltmarshes, shallow fresh, brackish, salt inland swamps and lakes; flooded and irrigated paddocks, sewage farms and commercial saltfields. **Type of credit:** n/a	Low. Lack of preferred habitat within Modification study area.	Not considered further
Calidris ferruginea	Curlew Sandpiper	E	M	PMST	**Habitat requirements** Occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states during the non-breeding period, and also during the breeding season when many non-breeding one year old birds remain in Australia rather than migrating north. mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes, and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters. **Type of credit:** Dual species/ecosystem credit **Species credit –** Important habitat i.e. As per mapped areas. **Ecosystem –** All areas of other habitat.	Low. Lack of preferred habitat within Modification study area.	Not considered further

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Calidris melanotos	Pectoral Sandpiper	-	M	PMST	**Habitat requirements** In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species frequents coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. It is usually found in coastal or near coastal habitat but occasionally further inland. It prefers wetlands that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. It has also been recorded in swamp overgrown with lignum. They forage in shallow water or soft mud at the edge of wetlands. **Type of credit:** n/a	Low. Lack of preferred habitat within Modification study area.	Not considered further
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	BAM-C (s), BAM-C (e), BioNet	**Habitat requirements** Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, *Allocasuaraina diminuta*, and *A. gymnathera*. Belah is also utilised and may be a critical food source for some populations. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599 and PCT 1313. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Breeding habitat i.e. Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground. **Ecosystem credit:** Foraging habitat.	**Moderate**. Suitable habitat within Modification study area. High density of bulloak in PCT 88	**Considered further as both a predicted ecosystem credit and candidate species credit.**
Certhionyx variegatus	Pied Honeyeater	V	-	BioNet	**Habitat requirements** Widespread throughout acacia, mallee and spinifex scrubs of arid and semi-arid Australia. Inhabits wattle shrub, primarily Mulga (*Acacia aneura*), mallee, spinifex and eucalypt woodlands, usually when shrubs are flowering; feeds on nectar, predominantly from various species of emu-bushes (*Eremophila* spp.); also from mistletoes and various other shrubs (e.g. *Grevillea* spp.); also eats saltbush fruit, berries, seed, flowers and insects. Highly nomadic, following the erratic flowering of shrubs; can be locally common at times. **Habitat within the Modification study area** Suitable habitat in PCT 88, 599, 1313, 1383 **Type of credit:** Ecosystem credit	**Moderate.** Associated habitats, including eucalypt woodlands with presence of mistelties recorded. May intermittently occur during nomadic movements and seasonal flowering/fruiting of feed species.	**Predicted ecosystem credit species**
Chthonicola sagittata	Speckled Warbler	V	-	BioNet, BAM-C (E)	**Habitat requirements** Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Recorded**. Suitable habitat in Modification study area.	**Predicted ecosystem credit species**
Circus assimilis	Spotted Harrier	V	-	BioNet, BAM-C (E)	**Habitat requirements** Occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Preys on terrestrial mammals (e.g. bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Moderate.** Local records and the Modification study area traverses suitable habitat.	**Predicted ecosystem credit species**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	BioNet, BAM-C €	**Habitat requirements** Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Recorded**. Suitable habitat in Modification study area.	**Predicted ecosystem credit species**
Daphoenositta chrysoptera	Varied Sittella	V	-	BioNet, BAM-C (E)	**Habitat requirements** Sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Recorded**. Suitable habitat in Modification study area.	**Predicted ecosystem credit species**
Ephippiorhynchus asiaticus	Black-necked Stork	V	-	BioNet	**Habitat requirements** Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries. **Type of credit:** Ecosystem credit	Low. Lack of preferred habitat within Modification study area.	Not considered further
Erythrotriorchis radiatus	Red Goshawk	CE	V	PMST	**Habitat requirements** Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus forest of coastal rivers. **Type of credit:** Species credit	Low. Lack of preferred habitat within Modification study area.	Not considered further
Falco hypoleucos	Grey Falcon	E	V	PMST	**Habitat requirements** Sparsely distributed in NSW, chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. **Type of credit:** Ecosystem credit	Low. Marginal habitat within Modification study area. More commonly recorded in more arid habitat. May occur within Modification study area intermittently.	Not considered further

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Falco subniger	Black Falcon	V	-	BioNet	**Habitat requirements** Widely, but sparsely, distributed in New South Wales, mostly occurring woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees. It is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts. Habitat selection is generally influenced more by prey densities than by specific aspects of habitat floristics or condition, although in agricultural landscapes it tends to nest in healthy, riparian woodland remnants with a diverse avi-fauna. **Habitat within the Modification study area** Predicted habitat in PCT 88, 599, 1313 & 1383. **Type of credit:** Ecosystem credit	**Moderate.** Species is known to occur locally. Suitable habitat in Modification study area.	**Predicted ecosystem credit species**
Gallinago hardwickii	Latham's Snipe	-	M	PMST	**Habitat requirements** Occurs in freshwater or brackish wetlands generally near protective vegetation cover. This species feeds on small invertebrates, seeds and vegetation. It migrates to the northern hemisphere to breed. **Type of credit:** n/a	Low. Lack of preferred habitat within Modification study area.	Not considered further
Glossopsitta pusilla	Little Lorikeet	V	-	BioNet, BAM-C (e)	**Habitat requirements** Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. Roosts in treetops, often distant from feeding areas. **Habitat within the Modification study area** Predicted habitat in PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Recorded**. Suitable habitat in Modification study area.	**Predicted ecosystem credit species**
Grantiella picta	Painted Honeyeater	V	V	BioNet, BAM-C (e), PMST	**Habitat requirements** The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Moderate.** Potential foraging habitat within the Modification study area.	**Predicted ecosystem credit species** **Considered further in MNES section**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	Ma	BAM-C (s), BAM-C (E)	**Habitat requirements** In NSW it is widespread along the east coast, and along all major inland rivers and waterways. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs in vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion. **Habitat within the Modification study area** Predicted habitat in PCT 88 and PCT 599. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Breeding habitat i.e. Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines. **Ecosystem credit:** Foraging habitat.	**Moderate**. Marginal habitat within Modification study area in the form of sclerophyll woodland. Lack of large freshwater swamps, lakes, dams, reservoirs, billabongs and saltmarsh which are normally preferred breeding areas.	**Predicted ecosystem credit.** **Considered further in MNES section**
Hamirostra melanosternon	Black-breasted Buzzard	V	-	BAM-C (s), BAM-C (e)	**Habitat requirements** Found sparsely in areas of less than 500mm rainfall. Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered woodlands. Breeds from August to October near water in a tall tree. The stick nest is large and flat and lined with green leaves. **Habitat within the Modification study area** Predicted habitat in PCT 88. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Breeding habitat i.e. Land within 40 m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts **Ecosystem credit:** Foraging habitat.	**Moderate**. Potential foraging habitat within Modification study area. No breeding habitat in the form of habitat within 40m of riparian woodland on inland watercourses/waterholes containing dead or dying eucalypts	**Predicted ecosystem credit**
Hieraaetus morphnoides	Little Eagle	V	-	BAM-C (s), BAM-C (e), BioNet	**Habitat requirements** Found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Breeding habitat i.e. Nest trees - live (occasionally dead) large old trees within vegetation. **Ecosystem credit:** Foraging habitat.	**Recorded.** Suitable habitat within Modification study area	**Considered further as both a predicted ecosystem credit and candidate species credit.**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Hirundapus caudacutus	White-throated Needletail	-	VM	BioNet, PMST	**Habitat requirements** Widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. It is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Species credit	**Moderate.** Although local records are sparse, due to wide ranging habitats may occur in aerial habitats over the Modification study area on a seasonal basis.	**Considered further in MNES section**
Lathamus discolor	Swift Parrot	E	CE	BAM-C (s), BAM-C (E), PMST	**Habitat requirements** Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta)*, Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C.gummifera*), Mugga Ironbark (*E.sideroxylon*), and White Box (*E.albens*). Commonly used lerp infested trees include Inland Grey Box (*E. macrocarpa*), Grey Box (*E.moluccana*) and Blackbutt (*E.pilularis*). **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Important habitat i.e. As per mapped areas. **Ecosystem credit:** All area of other habitat.	**Moderate.** Potential foraging habitat within the Modification study area. Modification study area outside important mapped habitat	**Predicted ecosystem credit.** **Considered further in MNES section**
Leipoa ocellata	Malleefowl	E	VM	PMST	**Habitat requirements** The stronghold for this species in NSW is the mallee in the south west centred on Mallee Cliffs NP and extending east to near Balranald and scattered records as far north as Mungo NP. West of the Darling River a population also occurs in the Scotia mallee including Tarawi NR and Scotia Sanctuary and is part of a larger population north of the Murray River in South Australia. Predominantly inhabit mallee communities, preferring the tall, dense and floristically-rich mallee found in higher rainfall (300 – 450 mm mean annual rainfall) areas. Utilises mallee with a spinifex understorey, but usually at lower densities than in areas with a shrub understorey. Less frequently found in other eucalypt woodlands, such as Inland Grey Box, Ironbark or Bimble Box Woodlands with thick understorey, or in other woodlands such dominated by Mulga or native Cypress Pine species. Prefers areas of light sandy to sandy loam soils and habitats with a dense but discontinuous canopy and dense and diverse shrub and herb layers. **Type of credit:** Ecosystem credit	Low. Lack of suitable habitat within Modification study area. No records in locality.	Not considered further

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Lophoictinia isura	Square-tailed Kite	V	-	BAM-C (s), BAM-C (E), BioNet	**Habitat requirements** Ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Breeding habitat i.e. Nest trees **Ecosystem credit:** Foraging habitat.	**Moderate.** Suitable habitat within Modification study area.	**Considered further as both a predicted ecosystem credit and candidate species credit.**
Melanodryas cucullata cucullata	Hooded Robin (South-Eastern)	V	-	BioNet, BAM-C (e)	**Habitat requirements** The south-eastern form (subspecies *cucullata*) is found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west, where it is replaced by subspecies *picata*. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Moderate.** Suitable habitat within Modification study area.	**Predicted ecosystem credit species**
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	BioNet, BAM-C (e)	**Habitat requirements** In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E.albens*), Inland Grey Box (*E.microcarpa*), Yellow Box (*E.melliodora*), Blakely's Red Gum (*E.blakelyi*) and Forest Red Gum (*E.tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Moderate** Suitable habitat within Modification study area.	**Predicted ecosystem credit species**
Motacilla flava	Yellow Wagtail	-	M	PMST	**Habitat requirements** This species occurs in a range of habitats including estuarine habitats such as sand dunes, mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams. This species migrates from Asia to Australia in spring-summer. It has been recorded in the estuarine areas of the Hunter River in Newcastle NSW and in QLD and the north of NT and WA. **Type of credit:** n/a	Low. Migration species, no records in locality. Lack of preferred habitat	Not considered further

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Myiagra cyanoleuca	Satin Flycatcher	-	M	PMST	**Habitat requirements** In NSW, they are widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. Mainly recorded in eucalypt forests, often near wetlands or watercourses. Also occur in moister, taller forests, often occurring in gullies. In addition, can occur in eucalypt woodlands with open understorey and grass ground cover, and are generally absent from rainforest. In south-eastern Australia, they occur at elevations of up to 1400 m above sea level, and in the ACT, they occur mainly between 800 m above sea level and the treeline. **Type of credit:** n/a	Low. No preferred habitat associated with Modification study area.	Not considered further
Neophema pulchella	Turquoise Parrot	V	-	BioNet, BAM-C (E)	**Habitat requirements** Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants or browsing on vegetable matter. Forages quietly and may be quite tolerant of disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Recorded.** Suitbale habitat within Modification study area.	**Predicted ecosystem credit species**
Ninox connivens	Barking Owl	V	-	BAM-C (s), BAM-C (e), BioNet	**Habitat requirements** Found throughout continental Australia except for the central arid regions. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile riparian soils. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Breeding habitat i.e. Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground. **Ecosystem credit:** Foraging habitat.	**High.** Suitable habitat recorded within the Modification study area. Previously recorded in close proximimty to Modification study area.	**Considered further as both a predicted ecosystem credit and candidate species credit.**
Ninox strenua	Powerful Owl	V	-	BAM-C (s), BAM-C (e)	**Habitat requirements** The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation. **Habitat within the Modification study area** Predicted habitat in PCT 1383. **Type of credit:** Dual species/ecosystem credit **Species credit –** Breeding habitat i.e. living or dead trees with hollow greater than 20cm diameter. **Ecosystem -** Foraging habitat.	**Moderate.** Suitable habitat recorded within the Modification study area.	**Candidate species credit species and ecosystem credit species**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Pandion cristatus (syn. P. haliaetus)	Eastern Osprey	V	M	PMST	**Habitat requirements** Found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Breeding habitat i.e. Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting **Ecosystem credit:** Foraging habitat.	Low. Lack of suitable associated habitat.	Not considered further
Petroica boodang	Scarlet Robin	V	-	BAM-C (E)	**Habitat requirements** The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Moderate.** Suitable habiat within Modification study area	**Predicted ecosystem credit species**
Petroica phoenicea	Flame Robin	V	-	BioNet, BAM-C (e)	**Habitat requirements** In NSW the Flame Robin breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. It migrates in winter to more open lowland habitats. In winter lives in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees. In winter, occasionally seen in heathland or other shrublands in coastal areas. Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. **Habitat within the Modification study area** Predicted habitat in PCT 599. **Type of credit:** Ecosystem credit	**Moderate.** Suitable habiat within Modification study area	**Predicted ecosystem credit species**
Polytelis swainsonii	Superb Parrot	V	V	BAM-C (s), BAM-C (e)	**Habitat requirements** Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest. In the Riverina the birds nest in the hollows of large trees (dead or alive) mainly in tall riparian River Red Gum Forest or Woodland. On the South West Slopes nest trees can be in open Box-Gum Woodland or isolated paddock trees. Species known to be used are Blakely's Red Gum, Yellow Box, Apple Box and Red Box. May forage up to 10 km from nesting sites, primarily in grassy box woodland. **Habitat within the Modification study area** Predicted habitat in PCT 88 and PCT 1383. **Type of credit:** Dual species/ecosystem credit **Species credit –** Breeding habitat i.e. Living or dead *E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta* with hollows greater than 5cm diameter; greater than 4m above ground or trees with a DBH of greater than 30cm. **Ecosystem -** Foraging habitat.	**Moderate.** Suitable habitat within Modification study area	**Candidate species credit species and ecosystem credit species**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Pomatostomus temporalis temporalis	Grey-Crowned Babbler (eastern subspecies)	V	-	BioNet, BAM-C (e)	**Habitat requirements** In NSW, the eastern sub-species occurs on the western slopes of the Great Dividing Range, and on the western plains reaching as far as Louth and Balranald. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. It may be extinct in the southern, central and New England tablelands. Inhabits open Box-Gum Woodlands on the slopes, and Box-Cypress-pine and open Box Woodlands on alluvial plains. Woodlands on fertile soils in coastal regions. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Recorded.** Suitable habitat within Modification study area	**Predicted ecosystem credit species**
Rostratula australis (syn. R. benghalensis)	Australian Painted Snipe (Painted Snipe)	E	E	PMST	**Habitat requirements** Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. **Type of credit:** Ecosystem credit	Low. Lack of sutibale habitat within Modification study area	Not considered further
Stagonopleura guttata	Diamond Firetail	V	-	BioNet, BAM-C (e)	**Habitat requirements** Endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (*Eucalyptus pauciflora*) Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Moderate.** Known to occur within locality.	**Predicted ecosystem credit species**
Stictonetta naevosa	Freckled Duck	V	-	BioNet	**Habitat requirements** Found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat. The species may also occur as far as coastal NSW and Victoria during such times. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. **Type of credit:** Ecosystem credit	Low. Lack of suitable habitat in Modification study area	Not considered further
Tyto novaehollandiae	Masked Owl	V	-	BAM-C (s), BAM-C (e), BioNet	**Habitat requirements** Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Dual species/ecosystem credit **Species credit –** Breeding habitat i.e. Living or dead trees with hollows greater than 20cm diameter. **Ecosystem -** Foraging habitat.	**High.** Previously recorded within the locality and suitable habitat occurs within the Modification study area. Previously recorded in close proximimty to Modification study area.	**Candidate species credit species and ecosystem credit species**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Fish (5)							
Bidyanus bidyanus	Silver Perch	V*	CE	DPI	**Habitat requirements** The most abundant remaining natural population occurs in the central Murray River downstream of Yarrawonga Weir as well as several of its anabranches and tributaries. The central Murray population is considered secure and self-sustaining. There have also been reports of self-sustaining populations in other rivers, including the MacIntyre and Macquarie Rivers in northern NSW and the Warrego River in Queensland, mostly from recreational anglers. It prefers fast-flowing waters but is also known from rivers, lakes and reservoirs. **Habitat within the Modification study area** No predicted habitat within the Modification study area. **Type of credit:** n/a	Low No habitat occurs within the Modification study area.	Not considered further
Ambassis agassizii	Olive Perchlet	E2*	-	DPI	**Habitat requirements** Olive Perchlet inhabit rivers, creeks, ponds and swamps. They are usually found in slow flowing or still waters. They are usually found in sheltered areas such as overhanging vegetation, aquatic macrophyte beds, logs, dead branches and boulders during the day, and disperse to feed during the night. **Habitat within the Modification study area** No predicted habitat within the Modification study area. **Type of credit:** n/a	Low No habitat occurs within the Modification study area.	Not considered further
Maccullochella peelii	Murray Cod	-	V	PMST	**Habitat requirements** The Murray Cod was historically distributed throughout the Murray-Darling Basin (the Basin), which extends from southern Queensland, through New South Wales (NSW), the Australian Capital Territory (ACT) and Victoria to South Australia, with the exception of the upper reaches of some tributaries. The species still occurs in most parts of this natural distribution, up to approximately 1000 m above sea level. It utilises a diverse range of habitats from clear rocky streams, such as those found in the upper western slopes of NSW (including the ACT), to slow-flowing, turbid lowland rivers and billabongs. Preferred microhabitat consists of complex structural features in streams such as large rocks, snags (pieces of large submerged woody debris), overhanging stream banks and vegetation, tree stumps, logs, branches and other woody structures. **Habitat within the Modification study area** No predicted habitat within the Modification study area. **Type of credit:** n/a	Low No habitat occurs within the Modification study area.	Not considered further
Mogurnda adsperma	Purple Spotted Gudegeon	E*	-	DPI	**Habitat requirements** Benthic species that can be found in a variety of habitat types such as rivers, creeks and billabongs with slow-moving or still waters or in streams with low turbidity. Cover in the form of aquatic vegetation, overhanging vegetation from river banks, leaf litter, rocks or snags are important for the species. **Habitat within the Modification study area** No predicted habitat within the Modification study area. **Type of credit:** n/a	Low No habitat occurs within the Modification study area.	Not considered further

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Tandanus tandanus	Eel-tailed Catfish	E2*	-	DPI	**Habitat requirements** Eel Tailed Catfish are naturally distributed throughout the Murray-Darling Basin and in the Eastern drainages NSW north of Newcastle. Occupies a wide range of habitats including rivers, creeks, lakes, billabongs and lagoons. It inhabits flowing streams but prefers slow and still waters and can be found in clear or turbid water over substrates including mud, gravel and rock. **Habitat within the Modification study area** No predicted habitat within the Modification study area. **Type of credit:** n/a	Low No predicted habitat occurs within the Modification study area.	Not considered further
Mammals (17)							
Aepyprymnus rufescens	Rufous Bettong	V	-	BAM-C (s)	**Habitat requirements** Rufous Bettongs inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter. **Habitat within the Modification study area** Predicted habitat in PCT 599 and PCT 1313. **Type of credit:** Species credit	Low. Marginal habitat within Modification study area. Lack of records within locality. Known to be largely vanished from inland areas	**Candidate species credit**
Cercartetus nanus	Eastern Pygmy-possum	V	-	BAM-C (s)	**Habitat requirements** Found in a 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. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599 and PCT 1383. **Type of credit:** Species credit	**Moderate**. Potential habitat within Modification study area	**Candidate species credit**
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	BAM-C (s), BioNet, PMST	**Habitat requirements** Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Species credit with habitat constraints which include caves and areas within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.	**High.** Suitable habitat within Modification study area. Known to occur in locality. However, no presence of breeding habitat identified within Modification study area.	Not considered further
Chalinolobus picatus	Little Pied Bat	V	-	BAM-C (e)	**Habitat requirements** Occurs in dry open forest, open woodland, mulga woodlands, chenopod shrublands, cypress pine forest and mallee and Bimbil box woodlands. Roosts in caves, rock outcrops, mine shafts, tunnels, tree hollows and buildings. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Moderate.** Suitable habiat within Modification study area	**Predicted ecosystem credit species**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Dasyurus maculatus maculatus	Spotted-Tailed Quoll (Southern Subspecies)	V	E	BioNet, BAM-C (E), PMST	**Habitat requirements** Found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. 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. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines. **Habitat within the Modification study area** Predicted habitat in PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**Moderate.** Suitable habitat within Modification study area	**Predicted ecosystem species** **Considered further in MNES**
Macropus dorsalis	Black-striped Wallaby	E	-	BAM-C (e)	**Habitat requirements** Preferred habitat is characterised by dense woody or shrubby vegetation within three metres of the ground. This dense vegetation must occur near a more open, grassy area to provide suitable feeding habitat. On the north west slopes, associated with dense vegetation, including brigalow, ooline and semi-evergreen vine thicket. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	Low. Lacks preferred habitat of dense vegetation, including brigalow, ooline and semi-evergreen vine thicket.	Not considered further
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	BioNet	**Habitat requirements** Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost maily in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	Low. Marginal habitat within the Modification study area. Outside known distribution for the species. Records within greater locality, likely to be misidentifications.	Not considered further.
Miniopterus orianae oceanensis	Large Bent-wing Bat	V	-	BioNet	**Habitat requirements** Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Breeding habitat i.e. Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500. **Ecosystem credit:** Foraging habitat.	**Moderate.** Suitable foraging habitat in Modification study area	**Predicted ecosystem credit species**
Nyctophilus corbeni (syn. N. timoriensis)	Corben's Long-eared Bat (South-eastern Long-eared Bat and Greater Long-eared Bat)	V	V	BioNet, BAM-C (e), PMST	**Habitat requirements** Overall, the distribution of the south eastern form coincides approximately with the Murray Darling Basin with the Pilliga Scrub region being the distinct stronghold for this species. Inhabits a variety of vegetation types, including mallee, bulloke (*Allocasuarina leuhmanni*) and box eucalypt dominated communities, but it is distinctly more common in box/ironbark/cypress-pine vegetation that occurs in a north-south belt along the western slopes and plains of NSW and southern Queensland. Roosts in tree hollows, crevices, and under loose bark. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**High.** Suitbale habitat within Modification study area. Recorded within proximity to Modification study area.	**Predicted ecosystem credit species** **Considered further in MNES section**

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Petaurus norfolcensis	Squirrel Glider	V	-	BAM-C (s), BioNet	**Habitat requirements** Inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599 and PCT 1313. **Type of credit:** Species credit which relies on large old trees with hollows for breeding and nesting.	**Moderate.** Potential habitat within Modification study area	**Candidate species credit**
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	BAM-C (s), BioNet, PMST	**Habitat requirements** Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night when foraging. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599 and PCT 1313. **Type of credit:** Species credit with habitat constraints which include land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines	Low. Lack of preferred habitat within Modification study area (i.e. rocky escarpments, outcrops and cliffs).	Not considered further
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	BAM-C (s)	**Habitat requirements** Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599 and PCT 1313. **Type of credit:** Species credit if detected or presence is assumed the species polygon is drawn around the outer-edge of the PCTs that the species is associated, as defined in the TBDC.	**Moderate**. Potential habitat within Modification study area.	**Candidate species credit**
Phascolarctos cinereus	Koala	V	V	BAM-C (s), BAM-C (e), BioNet, PMST	**Habitat requirements** Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Some preferred species include Forest Red Gum, Grey Gum. In coastal areas, Tallowwood and Swamp Mahogany are important food species, while in inland areas White Box, Bimble Box and River Red Gum are favoured. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599 and PCT 1313. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Important habitat i.e. Areas identified via survey as important habitat. **Ecosystem credit:** All area of other habitat.	**High**. Potential habitat within Modification study area. Previous recorded in locality.	**Candidate species credit species and ecosystem credit species**
Pseudomys pilligaensis	Pilliga Mouse	V	V	BAM-C (e)	**Habitat requirements** Within the Pilliga region this species is largely restricted to low-nutrient deep sand soils which are recognised as supporting a distinctive vegetation type referred to as the Pilliga Scrub. Recent studies indicate that the Pilliga Mouse is found in greatest abundance in recently burnt moist gullies, areas dominated by broombush and areas containing an understorey of kurricabah (*Acacia burrowii*) with a bloodwood (*Corymbia trachyphloia*) overstorey. Consistent features of the latter two habitats were: a relatively high plant species richness; a moderate to high density of low-level shrub cover; and a moist groundcover of plants, litter and fungi. The gully where the highest rates of capture were encountered had an extensive cover of low grasses and sedges, with little shrub cover and large areas of ash-covered ground. **Type of credit:** Ecosystem credit	Low. Modification study area lacks preferred habitat. Records confined to the Pilliga.	Not considered further

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	PMST	**Habitat requirements** Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. **Habitat within the Modification study area** Predicted habitat in PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Dual Species/Ecosystem credit **Species credit:** Important habitat i.e. Breeding camps **Ecosystem credit:** All areas of other habitat.	Low. Marginal habitat within Modification study area. Lack of records in locality.	Not considered further
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	BioNet, BAM-C (E)	**Habitat Requirements** Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Ecosystem credit	**High** Suitable habitat. Recorded in proximity to Modification study area.	**Predicted ecosystem credit species**
Vespadelus troughtoni	Eastern Cave Bat	V	-	BAM-C (s), BioNet	**Habitat requirements** A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT 1313 and PCT 1383. **Type of credit:** Species credit with habitat constraints which include caves or areas within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds.	**High.** Suitable habitat within Modification study area. Known to occur in locality. However, no presence of breeding habitat identified within Modification study area.	Not considered further
Reptiles (3)							
Aprasia parapulchella	Pink-tailed Worm Lizard (syn. Pink-tailed Legless Lizard)	V	V	BAM-C (s), PMST	**Habitat Requirements** Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter. Occupied sites often have a dense tree canopy that helps create a sparse understorey. Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks. 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. **Habitat within the Modification study area** Predicted habitat in PCT 599 and PCT 1383. **Type of credit:** Species credit with rocky areas or land within 50m of rocky areas being a habitat constraint.	Low. Outside the known distribution for this species. No records within locality.	Not considered further

SCIENTIFIC NAME	COMMON NAME	BC ACT[1]	EPBC ACT[2]	SOURCE[3]	HABITAT REQUIREMENTS / SUITABILITY	LIKELIHOOD OF OCCURRENCE	OUTCOME
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	BAM-C (s), BioNet	**Habitat Requirements** Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest. In drier environments, it appears to favour habitats close to riparian areas. The Species is a highly cryptic and can spend weeks at a time hidden in tree hollows. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599, PCT1313 and PCT 1383. **Type of credit:** Species credit	**High** Suitable habitat within Modification study area. Recorded in proximity to Modification study area.	**Candidate species credit species**
Uvidicolus sphyrurus	Border Thick-tailed Gecko	V	V	BAM-C (s), PMST	**Habitat Requirements** As implied by another of its common names (Granite Thick-tailed Gecko), this species often occurs on steep rocky or scree slopes, especially granite. Recent records from basalt and metasediment slopes and flats indicate its habitat selection is broader than formerly thought and may have extended into areas that were cleared for agriculture. Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter. Occupied sites often have a dense tree canopy that helps create a sparse understorey. **Habitat within the Modification study area** Predicted habitat in PCT 88, PCT 599 and PCT 1313. **Type of credit:** Species credit	Low. Marginal habitat within Modification study area. Modification study area lacks preferred habitat of steep rocky or scree slopes with presence of granite.	**Candidate species credit species**

(1) Threat status under the BC Act: V = Vulnerable, E = Endangered, E2 = Endangered Population, CE = Critically Endangered

(2) Threat status under the EPBC Act: V = Vulnerable, E = Endangered, CE = Critically Endangered, M = Migratory

(3) Data source: PMST – DAWE's EPBC Protected Matters Search Tool, BioNet = EES's BioNet Atlas of NSW Wildlife, PlantNet = NSW Flora online spatial search, BAM-C = NSW Government's Biodiversity Assessment Methodology Calculator where 's' indicates predicted species credit species and 'e' indicates a predicted ecosystem species.

(4) Habitat suitability information sourced from species EES's threatened species profile (2020), DAWE's Species Profile and Threats Database (SPRAT) profile (2020) and/or DPIs' threatened aquatic species Primefact species sheets.

APPENDIX D

MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

COMMONWEALTH EPBC ACT ASSESSMENTS OF SIGNIFICANCE TABLE OF CONTENTS

CONTENTS (Continued)

D1 TYLOPHORA LINEARIS

D1.1 STATUS

Tylophora linearis is listed as Endangered under the EPBC Act.

D1.2 SPECIFIC IMPACTS

Tylophora linearis is known to grow on flats and hills in dry scrub, open forest and dry woodlands in association with *Eucalyptus albens*, *Callitris glaucophylla*, *Callitris endlicheri*, *Eucalypts fibrosa*, *Eucalyptus sideroxylen* and *Allocasuarina luehmannii* (Environment Energy and Science Group, 2020d).

Targeted field surveys recorded *Tylophora linearis* within the Modification study area but not within the development footprint. *Tylophora linearis* was recorded within PCT 88 within the Modification study area and therefore the development footprint is considered to be potential habitat for this species. The Modification will result in direct removal of up to 3.31 ha (300 m x 110 m) of potential habitat for this species in the form of PCT 88.

D1.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013).

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

LEAD TO A LONG-TERM DECREASE IN THE SIZE OF A POPULATION

Tylophora linearis was recorded within the Modification study area but not within the development footprint. The Modification will result in direct removal of up to 3.31 ha (300 m x 110 m) of potential habitat for this species (PCT 88).

Thousands of *Tylophora linearis* have been recorded throughout Leard State Forest as part of previous surveys. Within Leard State Forest the species has been recorded from within a range of vegetation types including PCT 88, PCT 1313 and PCT 1383 which occur within the Modification study area.

The Modification is unlikely to have significant impact on a local population, given the surrounding records and habitat. The Modification is therefore unlikely to lead to a long term decrease in the size of the population of this species.

REDUCE THE AREA OF OCCUPANCY OF THE SPECIES

Tylophora linearis has not been recorded within the development footprint, however, this species has been recorded within the Modification study area and widely throughout Leard State Forest. The Modification will result in direct removal of up to 3.31 ha (300 m x 110 m) of potential habitat for this species in the form of PCT 88.

FRAGMENT AN EXISTING POPULATION INTO TWO OR MORE POPULATIONS

Tylophora linearis has not been recorded within the development footprint, however, this species has been recorded within the Modification study area and widely throughout Leard State Forest. The Modification will result in direct removal of up to 3.31 ha (300 m x 110 m) of potential habitat for this species in the form of PCT 88. With thousands of *Tylophora linearis* recorded throughout Leard State Forest, and this species relying on wind for seed dispersal, the Modification is therefore unlikely to fragment an existing population of this species into two or more populations.

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

No critical habitat is listed for this species under the EPBC Act.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development
- for the reintroduction of populations or recovery of the species or ecological community (Department of Environment, 2013).

Given the surrounding habitat within the locality, it is unlikely that these areas to be impacted are important to the long-term survival of the species in the locality. The Modification is therefore unlikely affect habitat of critical importance to this species. Furthermore, the Modification will avoid and minimise impacts to through the implementation of mitigation measures.

DISRUPT THE BREEDING CYCLE OF A POPULATION

Tylophora linearis produces plumed seeds and most likely relies on wind for seed dispersal. As these processes are unlikely to be significantly affected by the Modification it is conceded that the breeding cycle for *Tylophora linearis* population are unlikely to be significantly affected.

MODIFY, DESTROY, REMOVE, ISOLATE OR DECREASE THE AVAILABILITY OR QUALITY OF HABITAT TO THE EXTENT THAT THE SPECIES IS LIKELY TO DECLINE

The Modification will impact up to 3.31 ha of potential habitat within the Modification study area. However, this does not constitute a significant proportion of the habitat available within the region, and as such is unlikely to result in a decline in the species.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO A CRITICALLY ENDANGERED OR ENDANGERED SPECIES BECOMING ESTABLISHED IN THE ENDANGERED OR CRITICALLY ENDANGERED SPECIES' HABITAT

The Modification is unlikely to significantly increase the spread of existing invasive species or contribute to the introduction of new species that are harmful to *Tylophora linearis*. If appropriate weed control management plans are implemented, impacts to potential habitat or any populations that are potentially present can be minimised.

Mitigation measures would be implemented to minimise the likelihood of introducing invasive species into the habitat of this species including:

- preventing access to areas of habitat through erection of temporary fencing
- providing washing down procedures to reduce the spread of weeds via vehicles and machinery
- targeting areas of potential new outbreaks for weed control including soil stockpiles, roadsides and any other disturbed areas
- cleaning of vehicle tyres, undersides and radiator grills before leaving a property, cleaning of footwear and minimising soil movement between locations
- monitoring programs for noxious and problematic weeds and pests on site and in the adjacent to the proposed works area to ensure the requirements of *Biosecurity Act 2015* are met
- controlling noxious and problematic weeds should they be found
- ensuring that imported material (crushed rock only) is weed free
- working from clean area towards weedy area to reduce the spread of weeds into areas that are currently weed free.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE, OR

This species is not known to be under threat from disease. Despite this, mitigation measures have been included to minimise the likelihood of spread of pathogens into the habitat of these species. Measures include:

- preventing access to areas of habitat through erection of temporary fencing
- implementing washing down procedures to minimise the risk of the spread of pathogens via vehicles and machinery
- cleaning of vehicle tyres, undersides and radiator grills before leaving a property, cleaning of footwear and minimising soil movement between locations.

INTERFERE WITH THE RECOVERY OF THE SPECIES.

A recovery plan has not been prepared for the species, however, management actions as part of the saving our species program have been identified. The Modification will not interfere significantly with any of the identified management actions.

CONCLUSION

Tylophora linearis was recorded within the Modification study area but not within the development footprint. The Modification will result in direct removal of up to 3.31 ha (300 m x 110 m) of potential habitat for this species (PCT 88).

Thousands of *Tylophora linearis* have been recorded throughout Leard State Forest as part of previous surveys. Within Leard State Forest the species has been recorded from within a range of vegetation types including PCT 88, PCT 1313 and PCT 1383 which occur within the Modification study area. The Modification is unlikely to have significant impact on any existing local population, given the surrounding records and habitat within Leard State Forest.

It is considered unlikely that the Modification will to lead to a long-term decrease in a local population, fragment an existing population, adversely affect critical habitat for these species, disrupt the breeding cycle of these species, introduce or lead to the establishment of invasive species to a degree that would result in the decline of these species.

Given this, the Modification is considered unlikely to lead to a significant impact on this species or their habitat.

D2 REGENT HONEYEATER

D2.1 STATUS

Regent Honeyeater *(Anthochaera phrygia (syn. Xanthomyza phrygia))* is listed as Critically Endangered under the EPBC Act.

D2.2 SPECIFIC IMPACTS

This species was not recorded during field surveys; however, potential habitat was recorded within the Modification study area and there are historic records for this species locally. The Modification will impact up to 3.31 ha of marginal foraging habitat for this species, in the form of PCT 88. However, this impact area was selected to enable flexibility in the detailed engineering design, micro-siting of fauna connectivity structures and represents a worst case scenario. It is estimated that final disturbance footprint of 1.21 ha will be required for construction of the Modification.

D2.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013).

AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A CRITICALLY ENDANGERED OR ENDANGERED SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL RESULT IN ONE OR MORE OF THE FOLLOWING:

LEAD TO A LONG-TERM DECREASE IN THE SIZE OF A POPULATION OF A SPECIES

Approximately 3.31 ha of potential foraging habitat for the Regent Honeyeater would be affected by the Modification. While habitat in the development footprint has the potential to be used by these species, it is not likely to be of high importance due to its relatively small area and the availability of greater quality habitat within the locality and wider region. This includes the larger Leard State Forest remnant and the project's approved Biodiversity Offset Areas, which currently reserve approximately 7,120 ha of extant remnant habitat.

While the Regent Honeyeater has not been recorded in association with the project, the project is situated approximately 50 km to the south-west of one of two main breeding areas for the species in NSW; being the Bundarra-Barraba area. Within the North-West Slopes and Plains Region of NSW, the Regent Honeyeater is largely observed in the east between Tamworth and Inverell, and in the west in association with the Pilliga Forests and the Warrumbungle National Park (Environment Energy and Science Group, 2020b). However, there is a general paucity of records for the species in the Liverpool Plains IBRA Sub-region, with four observations recorded between 1998 and 2016 (Environment Energy and Science Group, 2020b).

Although it is estimated that between 10 to <30 % of the Regent Honeyeaters modelled likely and known distribution occurred within 2019/2020 fire affected areas, the Liverpool Plains IBRA Sub-region, was largely spared the extent of bushfire impacts observed in southern and eastern Australia. Any identified population of Regent Honeyeater in the project locality would not be restricted to habitat within the Modification study area and due to the species' large home range and nomadic nature, similar foraging habitat can be accessed in the locality. The project's currently approved biodiversity offsets reserve approximately 7,120 ha of extant remnant habitat. Therefore, the Modification is not considered likely to significantly contribute to a long-term decline in the size of a population of these species.

REDUCE THE AREA OF OCCUPANCY OF THE SPECIES

It is estimated that between 10 to <30 % of the Regent Honeyeaters modelled likely and known distribution occurred within 2019/2020 fire affected areas. However, the Liverpool Plains IBRA Sub-region, where the Modification is

located, was largely spared the extent of bushfire impacts observed in southern and eastern Australia. Approximately 97 ha of potential Regent Honeyeater habitat was impacted in the Liverpool Plains IBRA Sub-region during the 2019/2020 bushfires. In a worst case scenario, the Modification is likely to affect approximately 3.31 ha of potential foraging habitat for this species. Although the Modification will result in the loss of potential foraging habitat, the incremental loss of a small area of potential habitat, only represents a small component of similar locally occurring resources accessible to this species.

While the Modification would remove up to 3.31 ha and this would add to the remnant woodland already removed as part of the wider BCM Project, it is considered that the Modification would not reduce the area of occupancy of this species given the better quality habitat in the locality and greater region. The project's approved biodiversity offsets currently reserve approximately 7,120 ha of extant remnant habitat.

Nevertheless, the removal of approximately 3.31 ha of potential habitat is considered to be a small incremental loss of suitable habitat locally and as such has the potential to incrementally reduce the area of occupancy for the Regent Honeyeater during seasons when individuals of this species may be reliant on local resources.

FRAGMENT AN EXISTING POPULATION INTO TWO OR MORE POPULATIONS

Habitat connectivity is not likely to be affected by the proposed work, given that this species is highly mobile and nomadic, the Modification would not present a significant barrier to these species. It is not considered likely that habitat would become further isolated or fragmented significantly beyond that currently existing in the Modification study area.

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

No critical habitat has been listed for the Regent Honeyeater to date. As outlined in the National Recovery Plan Habitat critical to the survival of the Regent Honeyeater includes:

- any breeding or foraging areas where the species is likely to occur
- any newly discovered breeding or foraging locations.

While the Regent Honeyeater has not been recorded in association with the project, the project is situated approximately 50 km to the south-west of one of two main breeding areas for the species in NSW; being the Bundarra-Barraba area. However, there is a general paucity of records for the species in the Liverpool Plains IBRA Sub-region, with four observations recorded between 1998 and 2016. Although it appears that Regent Honeyeaters are usually associated with habitats to the east and west of the project, it is likely that the species may use habitat resources in proximity to the project on at least a transient basis. As the Modification study area does not contain any breeding and the species is not restricted to or reliant on habitat therein for foraging, it is unlikely that this Modification will adversely affect habitat critical to the survival of this species.

DISRUPT THE BREEDING CYCLE OF A POPULATION

Within the Regent Honeyeaters current distribution there are four known key breeding areas where the species is regularly recorded. These are the Bundarra-Barraba, Capertee Valley and Hunter Valley districts in New South Wales, and the Chiltern area in north-east Victoria. The Modification study area does not occur within these known breeding areas. Furthermore, this species is highly mobile and is known to disperse widely (Higgins et al., 2001). The 3.31 ha potential marginal foraging habitat likely to be affected is representative of larger patches of locally occurring resources that would be accessible to this species. Therefore, the removal of about 3.31 ha of potential marginal foraging habitat is unlikely to disrupt the breeding cycle of a population of Regent Honeyeater.

MODIFY, DESTROY, REMOVE, ISOLATE OR DECREASE THE AVAILABILITY OR QUALITY OF HABITAT TO THE EXTENT THAT THE SPECIES IS LIKELY TO DECLINE

The Modification will disturb approximately 3.31 ha of native vegetation considered to be foraging habitat for this species. The removal of approximately 3.31 ha of potential habitat is considered to be an incremental loss, decreasing the amount of suitable foraging habitat available locally. However, this species is likely to forage in the higher quality habitat within greater locality. Considering the mobile nature of this species, this action is unlikely to isolate the species habitat

significantly. Given the marginal condition of habitat observed it is unlikely that the Modification will modify, destroy, remove or isolate habitat for this species to the extent that is likely to cause the species to decline.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO AN ENDANGERED SPECIES BECOMING ESTABLISHED IN THE ENDANGERED SPECIES´ HABITAT

It is not likely that invasive species (such as introduced predators) that are potentially harmful to the Regent Honeyeater would become further established as a result of the Modification.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE

No. It is unlikely that disease would be increased by the Modification.

INTERFERE WITH THE RECOVERY OF THE SPECIES

For the Regent Honeyeater, the *Action Plan for Australian Birds* (Garnett and Crowley, 2000) addresses the need for further ecological research on the species and the conservation and protection of roosting habitat and identification of specific breeding requirements.

Recovery strategies outlined in Regent Honeyeater Recovery Plan (Department of the Environment, 2016b) include:

- improve the extent and quality of regent honeyeater habitat
- bolster the wild population with captive-bred birds until the wild population becomes self-sustaining
- increase understanding of the size, structure, trajectory and viability of the wild population
- maintain and increase community awareness, understanding and involvement in the recovery program.

The Modification would be in conflict with the first objective above to a small extent, by not improving the extent of habitat for the Regent Honeyeater. It is unlikely that the impact of relatively small areas of marginal habitat would significantly exacerbate the recovery of the species and significantly impact this species.

CONCLUSION

Although it is estimated that between 10 to <30 % of the Regent Honeyeaters modelled likely and known distribution occurred within 2019/2020 fire affected areas, the Liverpool Plains IBRA Sub-region, was largely spared the extent of bushfire impacts observed in southern and eastern Australia. The extent of native vegetation clearing and foraging habitat removal associated with the Modification is considered to be small in terms of available habitat for the species within region and there is a general paucity of records for the species in the Liverpool Plains IBRA Sub-region, with four observations recorded between 1998 and 2016. The irregular distribution of blossom resources, which is a key driver of nomadism of this species, may cause this species to occasionally forage within the Modification study area. Although it is considered unlikely that the loss of potential foraging habitat will cause the local extinction of the Regent Honeyeater, the removal of 3.31 ha of vegetation could be utilised by this species intermittently during periods of seasonal blossom variation. The project's currently approved biodiversity offsets reserve approximately 7,120 ha of extant remnant habitat. The Modification is not considered to fragment any locally occurring populations, affect habitat critical to their survival, disrupt their breeding cycles, or interfere with the recovery of these species. The Modification therefore, is considered to represent an incremental loss of available local habitat, although it is not considered likely to have a significant impact as it is unlikely to affect the long-term viability of the species.

D3 SWIFT PARROT

D3.1 STATUS

The Swift Parrot (*Lathamus discolor*) is listed as Critically Endangered under the EPBC Act.

D3.2 SPECIFIC IMPACTS

This species was not recorded during field surveys; however, potential habitat was recorded within the Modification study area and there are records for this species locally. The Modification will result in direct removal of up to 3.31 ha of marginal foraging habitat for this species, in the form of PCT 88. However, this impact area was selected to enable flexibility in the detailed engineering design, micro-siting of fauna connectivity structures and represents a worst case scenario. It is estimated that final disturbance footprint of 1.21 ha will be required for construction of the Modification.

D3.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013).

AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A CRITICALLY ENDANGERED OR ENDANGERED SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL RESULT IN ONE OR MORE OF THE FOLLOWING:

LEAD TO A LONG-TERM DECREASE IN THE SIZE OF A POPULATION OF A SPECIES

The Swift Parrot distribution extends generally from Brisbane in the north to Tasmania in the south and across to Adelaide in the west (Higgins, 1999). The entire population resides in Tasmania from September to April during the breeding period, and no Swift Parrots breed on the mainland. On the mainland during the winter months they are widely nomadic in response to the varying distribution of blossom (Higgins, 1999). Swift Parrot movements locally vary from year to year in response to resources in their range. Approximately 3.31 ha of potential foraging habitat for the Swift Parrot would be affected by the Modification. While the limited habitat in the Modification study area has the potential to be used by these species, it is not likely to be of high importance due to its relatively small area and the availability of greater quality habitat within the locality and wider region. This includes the larger Leard State Forest remnant and the project's approved Biodiversity Offset Areas, which currently reserve approximately 7,120 ha of extant remnant habitat.

Although it is estimated that between 10 to <30 % of the Swift Parrots modelled likely and known distribution occurred within 2019/2020 fire affected areas, the Liverpool Plains IBRA Sub-region, was largely spared the extent of bushfire impacts observed in southern and eastern Australia. Any identified population of Swift Parrot in the project locality would not be restricted to habitat within the Modification study area and due to the species' large home range and nomadic nature, similar foraging habitat can be accessed in the locality. Therefore, the Modification is not considered likely to significantly contribute to a long-term decline in the size of a population of the species.

REDUCE THE AREA OF OCCUPANCY OF THE SPECIES

It is estimated that between 10 to <30 % of the Swift Parrots modelled likely and known distribution occurred within 2019/2020 fire affected areas. However, the Liverpool Plains IBRA Sub-region, where the Modification is located, was largely spared the extent of bushfire impacts observed in southern and eastern Australia. Approximately 97 ha of potential Swift Parrot habitat was impacted in the Liverpool Plains IBRA Sub-region during the 2019/2020 bushfires. In a worst case scenario, Modification is likely to affect approximately 3.31 ha of potential foraging habitat for these species. Although the Modification will result in the loss of potential foraging habitat, the incremental loss of a small area of potential habitat, only represents a small component of similar locally occurring resources accessible to these species.

While the Modification would remove up to 3.31 ha and this would add to the remnant woodland already removed as part of the wider BCM Project, it is considered that the Modification would not reduce the area of occupancy of this species given the better-quality habitat in the locality and greater region. The project's approved biodiversity offsets currently reserve approximately 7,120 ha of extant remnant habitat.

Nevertheless, the removal of approximately 3.31 ha of potential habitat is considered to be a small incremental loss of suitable habitat locally and as such has the potential to incrementally reduce the area of occupancy for the Swift Parrot during seasons when individuals of this species may be reliant on local resources.

FRAGMENT AN EXISTING POPULATION INTO TWO OR MORE POPULATIONS

Habitat connectivity is not likely to be affected by the Modification, given that this species is highly mobile and nomadic, the development footprint would not present a significant barrier to these species. It is not considered likely that habitat would become further isolated or fragmented significantly beyond that currently existing in the Modification study area.

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

No critical habitat has been listed for the Swift Parrot to date.

DISRUPT THE BREEDING CYCLE OF A POPULATION

Swift Parrots breed in Tasmania during spring and summer, migrating to south-eastern Australia during autumn and winter (Department of Environment and Conservation, 2006). While Swift Parrots are dependent on flowering resources across a wide range of habitats (woodlands and forests) within their NSW wintering grounds, the removal of approximately 3.31 ha of potential foraging habitat is unlikely to disrupt their movements to Tasmanian breeding grounds. As such the Modification is unlikely to affect their breeding cycle.

MODIFY, DESTROY, REMOVE, ISOLATE OR DECREASE THE AVAILABILITY OR QUALITY OF HABITAT TO THE EXTENT THAT THE SPECIES IS LIKELY TO DECLINE

The Modification will disturb approximately 3.31 ha of native vegetation considered to be foraging habitat for this nomadic blossom forager. The removal of approximately 3.31 ha of potential habitat is considered to be an incremental loss, decreasing the amount of suitable foraging habitat available locally. However, this species is likely to forage in the higher quality habitat within greater locality. Considering the mobile nature of this species, this action is unlikely to isolate the species habitat significantly. Given the marginal condition of habitat observed it is unlikely that the Modification will modify, destroy, remove or isolate habitat for this species to the extent that is likely to cause the species to decline.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO AN ENDANGERED SPECIES BECOMING ESTABLISHED IN THE ENDANGERED SPECIES´ HABITAT

It is not likely that invasive species (such as introduced predators) that are potentially harmful to the Swift Parrot would become further established as a result of the Modification.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE

No. It is unlikely that disease would be increased by the Modification.

INTERFERE WITH THE RECOVERY OF THE SPECIES

The *Action Plan for Australian Birds* (Garnett and Crowley, 2000) notes pressure on Swift Parrot breeding areas from forestry and firewood collection in Tasmania. On the mainland though pressures relate to the loss of foraging habitats due to clearing for agriculture and residential development (Garnett and Crowley, 2000). A National Recovery Plan for the Swift Parrot *Lathamus discolor* was prepared in 2011 (Saunders, 2011). Recovery actions outlined in this plan include:

- identify the extent and quality of habitat
- manage and protect swift parrot habitat at the landscape scale
- monitor and manage the impact of collisions, competition and disease
- monitor population and habitat.

The Modification would be in conflict with the second recovery action above, to manage and protect swift parrot habitat at the landscape scale.

CONCLUSION

Although it is estimated that between 10 to <30 % of the Swift Parrots modelled likely and known distribution occurred within 2019/2020 fire affected areas, the Liverpool Plains IBRA Sub-region, was largely spared the extent of bushfire impacts observed in southern and eastern Australia. The removal of 3.31 ha of vegetation, which contains potential foraging resources, could be utilised by this species intermittently during periods of seasonal blossom variation. However, considering the abundance of high-quality foraging resources in surrounding landscape, including the project's approved biodiversity offsets that currently reserve approximately 7,120 ha of extant remnant habitat, the foraging habitat to be removed is considered marginal and small in terms of what is available locally to this species. Considering the mobility of this species, the Modification will not fragment or isolate any locally occurring population. In addition, the species does not breed in NSW and therefore no breeding habitat would be impacted due to the Modification.

The Modification therefore, is considered to represent an incremental loss of available local habitat, although it is not considered likely to have a significant impact as it is unlikely to affect the long-term viability of the species.

D4 PAINTED HONEYEATER

D4.1 STATUS

The Painted Honeyeater (*Grantiella picta*) is listed as Vulnerable under both the EPBC Act.

D4.2 SPECIFIC IMPACTS

This species was not recorded during field surveys; however, potential habitat was recorded within the Modification study area and there are records for this species locally. Species regularly recorded in association with *Acacia pendula* immediately south of Leard State Forest. The Painted Honeyeaters primary food source in mistletoe (*Amyema* genus) was recorded in Modification study area. The Modification will result in direct removal of up to 3.31 ha of marginal foraging habitat for this species, in the form of PCT 88.

D4.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

IS THIS PART OF AN IMPORTANT POPULATION?

The Painted Honeyeater is sparsely distributed from south-eastern Australia to north-western Queensland and eastern Northern Territory. The greatest concentrations and almost all records of breeding come from south of 26ºS, on inland slopes of the Great Dividing Range between the Grampians, Victoria and Roma, Queensland. Fruiting mistletoe primarily influences the Painted Honeyeater's seasonal north-south movements, with its breeding season closely matched. After breeding, many birds move in to semi-arid regions such as north-eastern South Australia, central and western Queensland, and central Northern Territory. Breeding occurs from October to March when mistletoe fruits are most available (TSSC, 2015).

The species is a mistletoe specialist, and inhabits mistletoes in eucalypt forests/woodlands, riparian woodlands of Black Box and River Red Gum, Box-ironbark-yellow Gum woodlands, Acacia-dominated woodlands, Paperbarks, Casuarinas, Callitris, and trees on farmland or gardens. The species prefers woodlands which contain a higher number of mature trees, as these host more mistletoes, and is more common in wider blocks of remnant woodland than in narrower strips (TSSC, 2015).

As the core range for Painted Honeyeaters is inland south-eastern Australia where its natural habitat is subtropical or tropical dry forests, and species population strongholds and breeding areas occur on the inland slopes of the Great Dividing Range (outside of the Modification study area). If any population is present, they are unlikely to be key source populations for dispersal or for maintaining genetic diversity. Also, this location is not at the limit of this species known range. As such any individual or population recorded within the Modification study area would not be considered part of an important population.

AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A VULNERABLE SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL RESULT IN ONE OR MORE OF THE FOLLOWING: LEAD TO A LONG-TERM DECREASE IN THE SIZE OF AN IMPORTANT POPULATION OF A SPECIES

Not applicable, not part of an important population see above.

REDUCE THE AREA OF OCCUPANCY OF AN IMPORTANT POPULATION OF THE SPECIES

Not applicable, not part of an important population see above.

FRAGMENT AN EXISTING IMPORTANT POPULATION INTO TWO OR MORE POPULATIONS

Not applicable, not part of an important population see above.

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

No critical habitat is listed for this species under the EPBC Act.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of Environment 2013).

The relatively small area of potential habitat likely to be affected by Modification (3.31 ha) represents a relatively small component of locally occurring resources that would be accessible to this species. Therefore, the removal of about 3.31 ha of potential habitat would not be considered critical to the survival of this species.

DISRUPT THE BREEDING CYCLE OF AN IMPORTANT POPULATION

Not applicable, not part of an important population see above.

WILL THE ACTION MODIFY, DESTROY, REMOVE, ISOLATE OR DECREASE THE AVAILABILITY OR QUALITY OF HABITAT TO THE EXTENT THAT THE SPECIES IS LIKELY TO DECLINE?

The Modification would remove approximately 3.31 ha of potential habitat for this species. It is not expected that the Modification will significantly modify, destroy, remove, isolate or decrease the availability or quality of habitat for the Painted Honeyeater to cause the species to decline. Although vegetation clearing will represent a small loss within the area, it is not considered likely that the action would result in disturbance to the extent that the species would decline.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO A VULNERABLE SPECIES BECOMING ESTABLISHED IN THE VULNERABLE SPECIES´ HABITAT

The local area currently exhibits disturbance regimes associated with agriculture, grazing and mining. These disturbances include vegetation clearing and habitat removal, artificial noise/light regimes and some weed invasion. It is not likely that invasive species (such as introduced predators) that are potentially harmful to the Painted Honeyeater would become further established as a result of the Modification.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE

There are no known diseases causing potential species decline to the Painted Honeyeater, or diseases to its preferred food source, mistletoe.

WILL THE ACTION INTERFERE WITH THE RECOVERY OF THE SPECIES?

The Modification is contrary to the recovery objectives and actions outlined in the Saving Our Species program and the National Recovery Program for the Painted Honeyeater. Contributing to the degradation and removal of habitat (i.e. mature trees containing mistletoe). It is considered unlikely that the amount of potential clearing would interfere substantially with the recovery of the species.

Due to the abundance of similar, and likely better-quality habitat in the locality and greater region, the Modification is not likely to interfere with the recovery of this species.

CONCLUSION

Although the Painted Honeyeater was not recorded during field surveys, there is potential foraging resources for this species within the Modification study area. While the Modification would remove up to 3.31 ha and this would add to the remnant woodland already removed as part of the wider BCM Project, it is considered that the Modification would not reduce the area of occupancy of this species given the better-quality habitat in the locality and greater region. As core populations, breeding areas, and the species stronghold do not occur within the locality, it is considered unlikely that the Modification would have a significant impact on the Painted Honeyeater.

D5 WHITE-THROATED NEEDLETAIL

D5.1 STATUS

The White-throated Needletail (*Hirundapus caudacutus)* is listed as Vulnerable and Migratory under the EPBC Act.

D5.2 SPECIFIC IMPACTS

This species previously recorded in aerial habitats over Leard State Forest. The Modification study area only provides aerial foraging habitat for this species. The Modification will result in the removal of approximately 3.31 ha of potential habitat for the species that is likely utilised for foraging as part of a far larger home range.

D5.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of the Environment, 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

IS THIS PART OF AN IMPORTANT POPULATION?

The White-throated Needletail a migratory species and occurs in Australia only between late spring and early autumn but mostly in summer. This species are non-breeding migrants with breeding taking place in Northern Asia (Birdlife Australia, 2020). The White-throated Needletail feeds on flying insects, such as termites, ants, beetles and flies. They catch the insects in flight in their wide gaping beaks. They have been recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows. Probably recorded most often above wooded areas, including open forest and rainforest (Birdlife Australia, 2020). This species is not or near the limit of its range as it occurs over eastern and northern Australia and in Northern Asia (Birdlife Australia, 2020).

White-throated Needletail is almost exclusively aerial and although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps

As the Modification study area does not contain key resources for breeding or dispersal, does not occur at the limit of the species distribution range and is unlikely to be necessary for maintaining genetic diversity populations which may occur are not considered to form part of an 'important population'.

AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A VULNERABLE SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL RESULT IN ONE OR MORE OF THE FOLLOWING: LEAD TO A LONG-TERM DECREASE IN THE SIZE OF AN IMPORTANT POPULATION OF A SPECIES

Not applicable. White-throated Needletail occurring in the Modification study area is not part of an important population.

REDUCE THE AREA OF OCCUPANCY OF AN IMPORTANT POPULATION

Not applicable. White-throated Needletail occurring in the Modification study area is not part of an important population.

FRAGMENT AN EXISTING IMPORTANT POPULATION INTO TWO OR MORE POPULATIONS

Not applicable. White-throated Needletail occurring in the Modification study area is not part of an important population.

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

No critical habitat is listed for this species under the EPBC Act. Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of the Environment Water Heritage and the Arts, 2009).

The Modification will remove a small area 3.31 ha of potential aerial foraging habitat for this species. The White-throated Needletail is a migratory species and breeds in northern Asia. This species forages on the wing and the vegetation within the Modification study area is likely to provide aerial foraging habitat for this species. This species occurs widely along the coast of NSW and QLD whilst in Australia suitable foraging resources could be accessed widely throughout the locality and beyond. Therefore, this would not meet the above criteria and the Modification study area is not critical to the survival of the White-throated Needletail.

DISRUPT THE BREEDING CYCLE OF AN IMPORTANT POPULATION

Not applicable. White-throated Needletail does not breed within Australia and therefore is not part of an important population.

MODIFY, DESTROY, REMOVE OR ISOLATE OR DECREASE THE AVAILABILITY OR QUALITY OF HABITAT TO THE EXTENT THAT THE SPECIES IS LIKELY TO DECLINE

No, not likely to result in species decline.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO A VULNERABLE SPECIES BECOMING ESTABLISHED IN THE VULNERABLE SPECIES' HABITAT

It is not likely that invasive species (such as introduced predators) that are harmful to the White-throated Needletail would become further established as a result of the Modification.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE

No. There are no known diseases that are likely to increase in the area as a result of the Modification.

INTERFERE SUBSTANTIALLY WITH THE RECOVERY OF THE SPECIES

As this species does not breed in Australia and forages on the wing and has the potential to occur intermittently within the locality, the Modification is not likely to interfere with the recovery of this species.

CONCLUSION

The Modification study area only provides aerial foraging habitat with no breeding occurring within Australia. The White-throated Needletail is likely to use the Modification study area for aerial foraging on an intermittent basis and the Modification is not likely to have a significant impact upon available resources for this species in the vicinity of the Modification study area or its wider locality. Therefore, the habitat to be impacted is not considered important to the long-term survival of the White-throated Needletail.

D6 SUPERB PARROT

D6.1 STATUS

The Superb Parrot (*Polytelis swainsonii*) is listed as Vulnerable under the EPBC Act.

D6.2 SPECIFIC IMPACTS

This species was not recorded during field surveys; however, potential habitat was recorded within the Modification study area and there are records for this species locally. The Modification will result in direct removal of up to 3.31 ha of marginal foraging habitat for this species, in the form of PCT 88.

D6.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

IS THIS PART OF AN IMPORTANT POPULATION?

This species has a breeding range occurring in three main areas, being; the Murray and Edwards Rivers; along the Murrumbidgee River; and an area bounded by Molong, Yass and Young (Department of Environment and Conservation 2006c). At least part of the population of the Superb Parrot undertakes regular seasonal movements, vacating breeding areas at the conclusion of the breeding season and heading north to the eucalypt-pine woodlands of central-west NSW (Department of Environment and Conservation 2006c) (Department of Environment Water Heritage & Arts 2009).

While this species is dependent on flowering resources across a wide range of habitats (woodlands and forests) in its wintering grounds in NSW, the removal of 3.31 ha of potential habitat is not likely to disrupt their migratory pattern, which generally occurs 50 km to the west of the Modification study area. As such, the Modification study area is not likely to be a key source for breeding or dispersal.

The Superb Parrot is found throughout all regions of eastern inland NSW. The north of this species' range (for that part of the population which migrates annually) extends to around Wee Waa and Narrabri from a line joining Coonabarabran and Narrabri, and extends as far west as Quambone, with occasional records further west (Department of Environment and Conservation 2006c). If present, this species would not be at the distributional limit of its known distribution.

For these reasons, if present within the site, individuals of this species would not be considered to be part of an important population.

AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A VULNERABLE SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL RESULT IN ONE OR MORE OF THE FOLLOWING: LEAD TO A LONG-TERM DECREASE IN THE SIZE OF AN IMPORTANT POPULATION OF A SPECIES

Not applicable, not part of an important population see above.

REDUCE THE AREA OF OCCUPANCY OF AN IMPORTANT POPULATION OF THE SPECIES

Not applicable, not part of an important population see above.

FRAGMENT AN EXISTING IMPORTANT POPULATION INTO TWO OR MORE POPULATIONS

Not applicable, not part of an important population see above.

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

No critical habitat is listed for this species under the EPBC Act.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community (Department of Environment 2013).

The relatively small area of potential habitat likely to be affected by the Modification (3.31 ha) represents a relatively small component of locally occurring resources that would be accessible to this species. Therefore, the removal of about 3.31 ha of potential habitat would not be considered critical to the survival of this species.

DISRUPT THE BREEDING CYCLE OF AN IMPORTANT POPULATION

Not applicable, not part of an important population see above.

WILL THE ACTION MODIFY, DESTROY, REMOVE, ISOLATE OR DECREASE THE AVAILABILITY OR QUALITY OF HABITAT TO THE EXTENT THAT THE SPECIES IS LIKELY TO DECLINE?

The Modification would remove approximately 3.31 ha of potential habitat for this species. It is not expected that the Modification will significantly modify, destroy, remove, isolate or decrease the availability or quality of habitat for the Superb Parrot to cause the species to decline.

This species has a breeding range occurring in three main areas, being; the Murray and Edwards Rivers; along the Murrumbidgee River; and an area bounded by Molong, Yass and Young (Department of Environment and Conservation 2006c). Therefore, no breeding habitat would be affected by the Modification.

The Superb Parrot would not be restricted to habitat resources in the proposed Modification study area; it is considered that the Modification would not reduce the area of habitat for this species considering the availability of habitat within the locality.

The area of potential habitat likely to be affected (3.31 ha) represents a small component of locally occurring resources that would be accessible to this highly mobile species. Therefore, the removal of about 3.31 ha of potential habitat, is unlikely modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO A VULNERABLE SPECIES BECOMING ESTABLISHED IN THE VULNERABLE SPECIES´ HABITAT

The wider Modification study area currently exhibits disturbance regimes associated with agriculture, grazing and mining. These disturbances include vegetation clearing and habitat removal, artificial noise/light regimes and some weed invasion. It is not likely that invasive species (such as introduced predators) that are potentially harmful to the Superb Parrot would become further established as a result of the Modification.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE

It is not likely that diseases that are potentially harmful to the Superb Parrot would become further established or introduced as a result of the Modification.

WILL THE ACTION INTERFERE WITH THE RECOVERY OF THE SPECIES?

The National Recovery plan for the Superb Parrot (Baker-Gabb 2011) has been approved and outlines that the long-term objective of recovery is to minimise the probability of extinction of the Superb Parrot in the wild, and to increase the probability of important populations becoming self-sustaining in the long term.

Specific objectives of recovery for the Superb Parrot (Baker-Gabb 2011) are to:

1. Determine population trends in the Superb Parrot.
2. Increase the level of knowledge of the Superb Parrot's ecological requirements.
3. Develop and implement threat abatement strategies
4. Increase community involvement in and awareness of the Superb Parrot recovery program.

Due to the marginal habitat likely to be affected by the Modification and the abundance of similar, and likely better-quality habitat in the locality and greater region, the Modification is not likely to interfere with the recovery of this species.

CONCLUSION

Although the Superb Parrot was not recorded during field surveys, there is potential foraging resources for that part of the population that migrates north at the conclusion of the breeding season (winter). While the Modification would affect 3.31 ha and this would add to the remnant woodland being removed as part of the wider BCM Project, it is considered that the Modification would not reduce the area of occupancy of this species as the general area that this species occupies during migration, essentially occurs (approximately) 50 km to the west of the Modification study area. While vagrant records of this species may occur within the vicinity of the Modification, it is not likely that this species would be significantly affected by the Modification.

D7 LARGE-EARED PIED BAT

D7.1 STATUS

The Large-eared Pied Bat (*Chalinolobus dwyeri)* is listed as Vulnerable under the EPBC Act.

D7.2 SPECIFIC IMPACTS

This species has not been recorded during field surveys within the Modification study area, but the species are known to occur within wider locality. Potential foraging habitat for this species occurred within the survey area.

The Modification will remove up to 3.31 ha of vegetation (PCT 88), which contained potential foraging resources for this species.

D7.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

IS AN IMPORTANT POPULATION LIKELY TO BE PRESENT?

This species has not been recorded within the survey area, but the species are known to occur within wider locality. This species, if occurring in the Modification study area, would not be at the limit of their known range; nor would any population there be likely to be a key source population or necessary for maintaining genetic diversity. As well as no breeding habitat will be impacted upon. Therefore, it is considered that any population of either species that may be present is unlikely to be an 'important population'.

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

LEAD TO A LONG-TERM DECREASE IN THE SIZE OF AN IMPORTANT POPULATION OF A SPECIES

Not applicable as an 'important population' is unlikely to exist in the Modification study area (see above).

REDUCE THE AREA OF OCCUPANCY OF AN IMPORTANT POPULATION

Not applicable as an 'important population' is unlikely to exist in the Modification study area (see above).

FRAGMENT AN EXISTING IMPORTANT POPULATION INTO TWO OR MORE POPULATIONS

Not applicable as an 'important population' is unlikely to exist in the Modification study area (see above).

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

Potential impacts associated with the Modification include removal of up to 3.31 ha of vegetation (PCT 88), which contained potential foraging resources for this species. No roosting habitat (caves) will be affected by this Modification.

Given the nature of the works and the Modification study area is typical of habitat in adjacent woodland, it is unlikely that these are important to the long-term survival of the species in the locality. The Modification is therefore unlikely affect habitat of critical importance to this species.

DISRUPT THE BREEDING CYCLE OF AN IMPORTANT POPULATION

Not applicable as an 'important population' is unlikely to exist in the Modification study area (see above).

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 may remove up to 3.31 ha of potential foraging habitat. No roosting habitat (caves) will be affected by this Modification. Given the small scale of the works and the Modification study area is typical of habitat in adjacent woodland, it is unlikely that these are important to the long-term survival of the species in the locality. The Modification is therefore unlikely to cause the species to decline.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO A VULNERABLE SPECIES BECOMING ESTABLISHED IN THE VULNERABLE SPECIES´ HABITAT

Invasion of predator species is unlikely to increase as a result of the Modification given the existing nature of the Modification study area. Given the small scale of the works to be undertaken the condition of this vegetation and its associated fauna habitat is unlikely to change significantly as a result of the Modification.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE

There are no knows diseases causing potential species decline to Large-eared Pied Bat.

WILL THE ACTION INTERFERE WITH THE RECOVERY OF THE SPECIES?

A national recovery plan has not been developed for the Large-eared Pied Bat.

CONCLUSION

The Modification is considered unlikely to have a significant impact on the species. The removal of 3.31 ha of vegetation (PCT 88), which contained potential foraging resources, could be utilised by this species intermittently. The habitat affected is a very small proportion of potential habitat for the species in the locality. Considering the mobility of this species, the Modification will not fragment or isolate any locally occurring population. In addition, no breeding habitat occurred in the development footprint or larger Modification study area. Therefore, it is unlikely that this species would be significantly affected by the Modification.

D8 CORBEN'S LONG-EARED BAT

D8.1 STATUS

The Corben's Long-eared Bat (*Nyctophilus corbeni)* is listed as Vulnerable under the EPBC Act.

D8.2 SPECIFIC IMPACTS

This species has not been recorded during field surveys within the Modification study area, but the species is known from Leard State Forest and the wider project locality. Potential foraging and breeding habitat occurred within the Modification study area for this species.

The Modification will remove up to 3.31 ha of vegetation (PCT 88), which contained potential foraging and roosting/breeding resources (hollow bearing trees) for this species. However, this impact area was selected to enable flexibility in the detailed engineering design and micro-siting of the fauna connectivity structure and represents a worst case scenario. It is estimated that final disturbance footprint of 1.21 ha will be required for construction of the Modification.

D8.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

IS AN IMPORTANT POPULATION LIKELY TO BE PRESENT?

Corben's Long-eared Bat distribution coincides approximately with the Murray Darling Basin, with the Pilliga Forest region being the distinct stronghold (Environment Energy and Science Group, 2020d). Although the Commonwealth Department of Agriculture, Water and the Environment has not detailed any important population of this species, it is considered that the Pilliga Forest, which occurs to the west of the Modification, is likely to constitute an important population. Furthermore, given the extent of remnant habitat associated with Leard State Forest and that Corben's Long-eared has been recorded numerously therein, Leard State Forest could be considered 'core habitat' in terms of metapopulation dynamics, whereby large populations, occurring in larger patches provide a source population to smaller patches of habitat in the surrounding matrix. Therefore, by reducing the size of the overall population of this species, the source for other remote populations is also reduced, potentially affecting the lifecycle of remote populations. Accordingly, Corben's Long-eared potentially occurring in the Modification study area could also be considered part an important population. An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

LEAD TO A LONG-TERM DECREASE IN THE SIZE OF AN IMPORTANT POPULATION OF A SPECIES

Corben's Long-eared bat potentially occurring in the Modification study area is considered to be part of an important population.

Approximately 3.31 ha of known habitat for the Corben's Long-eared Bat could be affected by the Modification. While habitat in the development footprint has the potential to be used by these species, it is not likely to be of high importance due to its relatively small area and the availability of greater quality habitat within the locality and wider region. This includes the larger Leard State Forest remnant and the project's approved Biodiversity Offset Areas, which currently

reserve approximately 7,120 ha of extant remnant habitat. Corben's Long-eared Bat has been recorded annually since 2014, encompassing the project's BOAs (Eastern, Central, Namoi and Western Offsets) and Leard State Forest Biodiversity Corridor during annual targeted trapping. Therefore, the Modification is not considered likely to significantly contribute to a long-term decline in the size of a population of this species.

REDUCE THE AREA OF OCCUPANCY OF AN IMPORTANT POPULATION

The population of Corben's Long-eared Bat in the Modification study area is considered to be part of an important population.

In a worst case scenario, the Modification would reduce this species area of occupancy by approximately 3.31 ha. However, it is anticipated that following detailed engineering design and micro-siting of the fauna connectivity structure, a final disturbance footprint of 1.21 ha will be required for construction of the Modification. Importantly, the development footprint will be immediately rehabilitated as part of the crossing construction program.

A local population of Corben's Long-eared Bat would not be restricted to habitat resources in the Modification study area, with the species recorded numerously in Leard State Forest, including the Biodiversity Corridor between Boggabri Coal Mine and Maules Creek Mine. In addition, the project's approved biodiversity offsets reserve approximately 7,120 ha of extant remnant habitat in which this species has been recorded annually since 2014.

FRAGMENT AN EXISTING IMPORTANT POPULATION INTO TWO OR MORE POPULATIONS

The population of Corben's Long-eared Bat in the Modification study area is considered to be part of an important population.

Habitat connectivity will not be affected by the Modification. The modification is positioned immediately adjacent to the Run of Mine Haul Road and other mine infrastructure to the east and contiguous remnant woodland associated with the broader Leard State Forest to the west. Given the species mobility and that known roosting/ breeding habitat occur at densities outside the development footprint, it is not likely that the Modification would isolate habitat or fragment an existing population into two or more populations.

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

No critical habitat is listed for this species under the EPBC Act.

Potential impacts associated with the Modification include removal of up to 3.31 ha of vegetation, which contained potential foraging and breeding (hollowing-bearing trees) resources for this species.

Given the nature of the works and the Modification study area is typical of habitat in adjacent woodland, it is unlikely that these are important to the long-term survival of the species in the locality. The Modification is therefore unlikely affect habitat of critical importance to this species.

DISRUPT THE BREEDING CYCLE OF AN IMPORTANT POPULATION

The population of Corben's Long-eared Bat in the Modification study area is considered to be part of an important population.

In a worst case scenario, the Modification would reduce this species area of occupancy by approximately 3.31 ha. However, it is anticipated that following detailed engineering design and micro-siting of the fauna connectivity structure, a final disturbance footprint of 1.21 ha will be required for construction of the Modification. Importantly, the development footprint will be immediately rehabilitated as part of the crossing construction program.

Whilst the Modification will impact habitat attributes important for the breeding cycle of Corben's Long-eared Bat, a local population of the species would not be restricted to habitat resources therein. Given the species mobility and that known roosting/ breeding habitat occur at similar densities outside the development footprint, it is not likely that the Modification will disrupt the breeding cycle of Corben's Long-eared Bat.

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 is likely to impact suitable foraging and roosting (and possible breeding) habitat for Corben's Long-eared Bat. However, given the availability of surrounding habitat and dispersive nature of this species, it is unlikely that the action would cause the species to decline. In addition, the project's approved biodiversity offsets reserve approximately 7,120 ha of extant remnant habitat in which this species has been recorded annually since 2014.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO A VULNERABLE SPECIES BECOMING ESTABLISHED IN THE VULNERABLE SPECIES´ HABITAT

Invasion of predator species is unlikely to increase as a result of the Modification given the existing nature of the Modification study area. Given the small scale of the works to be undertaken the condition of this vegetation and its associated fauna habitat is unlikely to change significantly as a result of the Modification.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE

There are no knows diseases causing potential species decline to Corben's Long-eared Bat.

WILL THE ACTION INTERFERE WITH THE RECOVERY OF THE SPECIES?

A national recovery plan has not been developed for the Corben's Long-eared Bat.

CONCLUSION

In a worst case scenario, the Modification could impact approximately 3.31 ha. However, it is anticipated that following detailed engineering design and micro-siting of the fauna connectivity structure, a final disturbance footprint of 1.21 ha will be required for construction of the Modification. Importantly, the development footprint will be immediately rehabilitated as part of the crossing construction program.

While habitat in the development footprint has the potential to be used by these species, it is not likely to be of high importance due to its relatively small area and the availability of greater quality habitat within the locality and wider region. This includes the larger Leard State Forest remnant and the project's approved Biodiversity Offset Areas, which currently reserve approximately 7,120 ha of extant remnant habitat. Corben's Long-eared Bat has been recorded annually since 2014, encompassing the project's BOAs (Eastern, Central, Namoi and Western Offsets) and Leard State Forest Biodiversity Corridor during annual targeted trapping. Therefore, the Modification is not considered likely to significantly impact Corben's Long-eared Bat.

D9 SPOTTED-TAILED QUOLL

D9.1 STATUS

The Spotted-tailed Quoll (*Dasyurus maculatus)* is listed as Endangered under the EPBC Act.

D9.2 SPECIFIC IMPACTS

There are a few historic records within the locality of this species. The Spotted-tailed Quoll was previously widely distributed from south-east Queensland, eastern NSW, Victoria, south-east South Australia and Tasmania. In Queensland, the Spotted-tailed Quoll occurs in south-east Queensland along the coast and ranges from Gladstone to the border and inland to Monto and Stanthorpe. Occurrences from five broad geographic areas are known, four of which are from coastal ranges and the Great Dividing Range from the NSW border to Gladstone.

Potential impacts to the Spotted-tailed Quoll from the Modification are habitat loss. It is possible that a population of the Spotted-tailed Quoll may occur in the locality and may occur periodically within the Modification study area as part of a larger home range, when seeking prey. This habitat to be removed supports viable prey resources (e.g. ground dwelling mammals). No denning or breeding resources have been recorded within the Modification study area.

Therefore, the Modification will remove up to 3.31 ha of vegetation (PCT 88), which contained potential foraging resources for this species.

D9.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013).

AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON AN ENDANGERED OR CRITICALLY ENDANGERED SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
LEAD TO A LONG-TERM DECREASE IN THE SIZE OF A POPULATION

A review of fauna records does not indicate this species is regularly recorded in the locality. If a population of the Spotted-tailed Quoll is present in the locality, individuals from this population may potentially occur periodically within the Modification study area as part of a larger home range, when seeking prey.

Given their large home ranges and mobile nature, a population of Spotted-tailed Quoll is unlikely to permanently reside in the Modification study area. Therefore, it is unlikely that the Modification would to lead to a long-term decrease of a population of the Spotted-tailed Quoll within the meaning of this criterion, as a population is unlikely to currently occur and persist in the Modification study area.

REDUCE THE AREA OF OCCUPANCY OF THE SPECIES

Spotted-tailed Quoll has not been recorded within the Modification study area. There are a few historic records within the locality.

The Modification and would add incrementally to the overall reduction of occupancy of the species (if present). Given their large home ranges and mobile nature, a population of Spotted-tailed Quoll is unlikely to permanently reside in the Modification study area. The Modification is unlikely to reduce the area of occupancy of the Spotted-tailed Quoll (if present).

FRAGMENT AN EXISTING POPULATION INTO TWO OR MORE POPULATIONS

The documented home range for the Spotted-tailed Quoll is relatively large with a home range of 992 ± 276 ha for males, and 244 ± 72 ha for females (DoEE, 2019b). The potential habitat within wider Modification study area is highly fragmented and historically disturbed (agriculture and mining), thereby limiting the potential for any substantial additional fragmentation to occur. Given the ability of this species to disperse over these cleared areas, is it considered unlikely that the action would fragment an existing population or reduce the area of occupancy for the species.

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

The *National Recovery Plan for the Spotted-tailed Quoll Dasyurus maculatus* stipulates that habitat critical to the survival of the Spotted-tailed Quoll occurs as large patches of forest with adequate denning / breeding resources and relatively high densities of medium-sized mammalian prey (DoELWP, 2016). There is relatively high abundance of medium sized mammalian prey within the Modification study area as revealed by field surveys (e.g. possums and birds).

The Modification study area is much smaller than the documented home range for the species, 992 ± 276 ha for males and 244 ± 72 ha for females. Typically, such home ranges would only be supported by large contiguous patches of habitat, like that associated with National Parks and State Forests in the locality.

The potential habitat within the Modification study area is not likely to constitute habitat critical to the survival of the species, because:

- it is unlikely to support habitat for denning and breeding
- is not large enough for effective species dispersal
- is unlikely to be important for the long-term maintenance of the species
- is unlikely to be important for maintaining genetic diversity
- it is unviable as a location for the reintroduction of the species, due to the absence of denning / breeding resources.

Therefore, the proposed footprint does not provide habitat critical to the survival of the species, due to it not being able to support all of the species' life cycle needs.

DISRUPT THE BREEDING CYCLE OF A POPULATION

The Modification study area does not support denning / breeding resources for this species. Therefore, the Modification is unlikely to impact the breeding cycle of a local population (if present), as the species is highly unlikely to breed within the Modification study area.

MODIFY, DESTROY, REMOVE OR ISOLATE OR DECREASE THE AVAILABILITY OR QUALITY OF HABITAT TO THE EXTENT THAT THE SPECIES IS LIKELY TO DECLINE

There are a few historic records within the locality. This could suggest the species is already in decline within the locality and may not actually use habitats within the Modification study area. The potential habitat within wider locality is highly fragmented and disturbed (i.e. agriculture and mining uses) and is relatively insignificant in contrast to the availability of larger contiguous and better-quality habitats in locality. It is therefore unlikely the Modification would modify, destroy, remove or isolate or decrease the availability or quality of potential foraging habitat to the extent that the species is likely to decline.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO A CRITICALLY ENDANGERED OR ENDANGERED SPECIES BECOMING ESTABLISHED IN THE ENDANGERED OR CRITICALLY ENDANGERED SPECIES' HABITAT

Considering the surrounding active mine operations, the removal of potential habitat is unlikely to contribute towards any increases in Feral Dog, Dingo or Feral Cat populations, which may be harmful to the Spotted-tailed Quoll.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE

Not applicable, as there are known diseases that are harmful to the Spotted-tailed Quoll.

INTERFERE SUBSTANTIALLY WITH THE RECOVERY OF THE SPECIES

The *National Recovery Plan for the Spotted-tailed Quoll Dasyurus maculatus* identifies 11 specific objectives to guide the recovery of the Spotted-tailed Quoll, including:

1. Determine the distribution and status of Spotted-tailed Quoll populations throughout the range and identify key threats and implement threat abatement management practices.
2. Investigate key aspects of the biology and ecology of the Spotted-tailed Quoll to acquire targeted information to aid recovery.
3. Reduce the rate of habitat loss and fragmentation on private land.
4. Evaluate and manage the risk posed by silvicultural practices.
5. Determine and manage the threat posed by introduced predators (foxes, cats, wild dogs) and of predator control practices on Spotted-tailed Quoll populations.
6. Determine and manage the impact of fire regimes on Spotted-tailed Quoll populations.
7. Reduce deliberate killings of Spotted-tailed Quolls.
8. Reduce the frequency of Spotted-tailed Quoll road mortality.
9. Assess the threat Cane Toads pose to Spotted-tailed Quolls and develop threat abatement actions if necessary.
10. Determine the likely impact of climate change on Spotted-tailed Quoll populations.
11. Increase community awareness of the Spotted-tailed Quoll and involvement in the Recovery Program.

The Modification would interfere with objective 3.

CONCLUSION

While the Modification would add incrementally to the loss of Spotted-tailed Quoll habitat at the local scale, it is not likely to further fragment or isolate habitat or be detrimental to the long-term persistence of a local population of the species (if present). In addition, the potentially affected habitat is unlikely to be important for the conservation of the local Spotted-tailed Quoll population over the long-term. In summary, the Modification is unlikely to have a significant impact on the Spotted-tailed Quoll.

D10 KOALA

D10.1 STATUS

The Koala (*Phascolarctos cinereus)* is listed as Vulnerable under EPBC Act.

D10.2 SPECIFIC IMPACTS

Although this species was not recorded during field surveys, potential habitat was observed and there are records locally for this species. Suitable foraging habitat for the Koala was identified in Modification study area and development footprint, which comprised supplementary feed tree species only. Therefore, it is likely that the Modification study area may be used on an intermittent basis during local movements. The Modification will remove up to 3.31 ha of vegetation (PCT 88), with large areas of similar habitat or higher quality habitat for the species occur in surrounding woodland/ forest in the locality.

D10.3 EPBC ACT SIGNIFICANT IMPACT ASSESSMENT

The following assessment has been undertaken following the Matters of National Environmental Significance, Significant Impact Guidelines 1.1 (Department of Environment, 2013). Under the Act, important populations are:

- likely to be key source populations either for breeding or dispersal
- likely to be necessary for maintaining genetic diversity, and/or
- at or near the limit of the species range.

IS AN IMPORTANT POPULATION LIKELY TO BE PRESENT?

No individuals were recorded within the Modification study area; however, records do occur in the locality. Vegetation in the Modification study area and development footprint contained supplementary feed tree species only, and the Modification study area may be used on an intermittent basis during local movements, but it is not likely to represent important habitat. Although the site does provide supplementary feed tree species and marginal potential foraging habitat, similar and more preferable habitat occurs more widely within the locality.

This species, if occurring within the Modification study area, would not be at the limit of its known range; nor would the population there be likely to be a key source population or necessary for maintaining genetic diversity. Therefore, it is considered that a population of these species, if present, is unlikely to be an ‘important population’.

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

LEAD TO A LONG-TERM DECREASE IN THE SIZE OF AN IMPORTANT POPULATION OF A SPECIES

Not applicable as an ‘important population’ is unlikely to exist in the Modification study area (see above).

REDUCE THE AREA OF OCCUPANCY OF AN IMPORTANT POPULATION

Not applicable as an ‘important population’ is unlikely to exist in the Modification study area (see above).

FRAGMENT AN EXISTING IMPORTANT POPULATION INTO TWO OR MORE POPULATIONS

Not applicable as an ‘important population’ is unlikely to exist in the Modification study area (see above).

ADVERSELY AFFECT HABITAT CRITICAL TO THE SURVIVAL OF A SPECIES

Although the site does provide supplementary feed tree species and marginal potential foraging habitat, similar and more preferable habitat occurs more widely within the locality. The Modification study area may be used on an intermittent

basis during local movements, but it is not likely to represent important habitat for this species. The Modification is therefore unlikely affect habitat of critical importance to these species.

DISRUPT THE BREEDING CYCLE OF AN IMPORTANT POPULATION

Not applicable as an 'important population' is unlikely to exist in the Modification study area (see above).

MODIFY, DESTROY, REMOVE OR ISOLATE OR DECREASE THE AVAILABILITY OR QUALITY OF HABITAT TO THE EXTENT THAT THE SPECIES IS LIKELY TO DECLINE

Although the site does provide supplementary feed tree species and marginal potential foraging habitat, similar and more preferable habitat occurs more widely within the locality. The Modification study area may be used on an intermittent basis during local movements, but it is not likely to represent important habitat for this species. Considering these species large home ranges and mobility, the Modification is therefore unlikely to fragment or modify the habitat in a way that will cause these species to decline.

RESULT IN INVASIVE SPECIES THAT ARE HARMFUL TO A VULNERABLE SPECIES BECOMING ESTABLISHED IN THE VULNERABLE SPECIES´ HABITAT

It is not likely that invasive species (such as introduced predators) that are potentially harmful to the Koala would become further established as a result of the Modification.

INTRODUCE DISEASE THAT MAY CAUSE THE SPECIES TO DECLINE

It is considered unlikely that the Modification would significantly fragment a koala population to the point where dispersal is limited and therefore disease transmission between individuals is increased. As *Chlamydia* bacteria in Koalas and Koala Retrovirus is primarily transmitted between Koala individuals (DECC, 2008), it is unlikely that the Modification would introduce disease that may cause the species to decline.

WILL THE ACTION INTERFERE WITH THE RECOVERY OF THE SPECIES?

The Modification would not interfere with the Saving Our Species (OEH, 2017) recovery strategy or Approved Recovery Plan (DECC, 2008). The Modification study area does not occur within any priority management or koala management areas for the species (OEH, 2017; DECC, 2008).

CONCLUSION

Vegetation in the Modification study area and development footprint contained supplementary feed tree species only, it is likely that Modification study area may be used on an intermittent basis during local movements.

While the Modification would remove up to 3.31 ha and this would add to the remnant woodland already removed as part of the wider BCM Project, it is considered that the Modification would not reduce the area of occupancy of this species given the better quality habitat in the locality and greater region.

The Modification is unlikely to represent significant increases to habitat isolation and or fragmentation. Considering these species large home ranges and mobility, the Modification would not impact the long-term survival of populations in the locality and is unlikely to further create a movement barrier for these species. Due to the relatively small area of impact, the low utilisation of habitat, and the lack of preferred feed trees, the Modification is considered unlikely to have a significant impact on the species.

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APPENDIX E

BIODIVERSITY CREDIT REPORT

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00021339/BAAS18076/20/00021340

Assessor Name
Tanya Bangel

Proponent Names

Assessment Revision
1

Proposal Name
Boggabri Coal Mine - Modification 8

Assessor Number
BAAS18076

Report Created
01/10/2020

Assessment Type
Part 4 Developments (General)

BAM data last updated *
20/08/2020

BAM Data version *
30

BAM Case Status
Open

Date Finalised
To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Nil

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

BAM Biodiversity Credit Report (Like for like)

Predicted Threatened Species Not On Site

Name
Macropus dorsalis / Black-striped Wallaby
Pseudomys pilligaensis / Pilliga Mouse

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion	Not a TEC	3.3	120.00

88-Pilliga Box - White Cypress Pine - Buloke shrubby woodland in the Brigalow Belt South Bioregion

Like-for-like credit retirement options

Class	Trading group	HBT	IBRA region
Pilliga Outwash Dry Sclerophyll Forests This includes PCT's: 88, 141, 148, 397, 411, 702, 1090, 1384	Pilliga Outwash Dry Sclerophyll Forests <50%	Yes	Liverpool Plains, Castlereagh-Barwon, Kaputar, Liverpool Range, Northern Basalts, Northern Outwash, Peel, Pilliga and Pilliga Outwash. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Species Credit Summary

Species	Area	Credits
Hoplocephalus bitorquatus / Pale-headed Snake	3.3	160.00
Petaurus norfolcensis / Squirrel Glider	3.3	160.00
Phascolarctos cinereus / Koala	3.3	160.00

Hoplocephalus bitorquatus/ Pale-headed Snake	88_Intact	**Like-for-like credit retirement options**
		Spp: IBRA region
		Hoplocephalus bitorquatus/Pale-headed Snake: Any in NSW
Petaurus norfolcensis/ Squirrel Glider	88_Intact	**Like-for-like credit retirement options**
		Spp: IBRA region
		Petaurus norfolcensis/Squirrel Glider: Any in NSW
Phascolarctos cinereus/ Koala	88_Intact	**Like-for-like credit retirement options**
		Spp: IBRA region

		Phascolarctos cinereus/Koala	Any in NSW

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