APPENDIX

F

Technical Assessments

Appendix F.1

Updated Biodiversity Development Assessment Report Volume 1

EMM
creating opportunities

Birriwa Solar and Battery Project

Biodiversity Development Assessment Report

Prepared for ACEN Australia Pty Ltd

September 2023

Birriwa Solar and Battery Project

Biodiversity Development Assessment Report

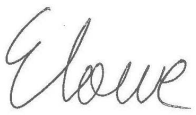
ACEN Australia Pty Ltd

J210553 Birriwa Solar and Battery Project - BDAR

September 2023

Version	Date	Prepared by	Reviewed by	Comments
V-Final	27 September 2023	Bianca Seal Luke O'Brien Erin Lowe Eugene Dodd	Maya Potapowicz Erin Lowe Nicole Armit Rachel Dodd	Final for submission

Approved by



Erin Lowe
Associate Ecologist
27 September 2023

Level 3 175 Scott Street
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Executive Summary

ES1 Project description

ACEN Australia Pty Ltd (ACEN) proposes to develop the Birriwa Solar and Battery Project; a large scale solar photovoltaic (PV) generation facility along with battery energy storage system (BESS) and associated infrastructure (the project). The solar component of the project will have an indicative capacity of around 600 megawatts (MW) and include a centralised BESS of up to 600 MW and 2 hour duration. The project will also include a temporary accommodation facility, to provide accommodation for up to 500 construction staff during the construction phase of the project. The project will be developed within a study area (project area) of approximately 1,535 hectares (ha) and will connect to the proposed Central-West Orana Renewable Energy Zone's Merotherie Hub.

The project is on Wiradjuri Country, in the localities of Birriwa and Merotherie, approximately 15 kilometres (km) south-west of the township of Dunedoo, in the Central West of New South Wales (NSW). The project is within the Mid-Western Regional Council local government area (LGA) with part of its access (road corridor) within Warrumbungle Shire Council and is within the Central-West Orana (CWO) Renewable Energy Zone (REZ).

The project is State significant development (SSD) under Schedule 1, section 20 (electricity generating works) of State Environmental Planning Policy (Planning Systems) 2021. Project approval is sought under Division 4.7 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The development application and environmental impact statement (EIS) (application number SSD-29508870) were submitted to the NSW Department of Planning and Environment (DPE) and publicly exhibited from 14 October 2022 to 10 November 2022.

Following the public exhibition of the EIS, the Biodiversity, Conservation and Science Directorate (BCS), North West office, of the DPE provided five recommendations on the BDAR. This Biodiversity Development Assessment Report (BDAR), prepared in accordance with the Biodiversity Assessment Method (BAM) (DPIE 2020), has been updated to address the recommendations from the BCS.

In response to matters raised in submissions and outcomes of ongoing engagement with the local community, government agencies, project landholders, and other stakeholders, ACEN has made amendments to the project, as follows:

1. The addition of a temporary accommodation facility, on an adjacent property south-east of the original project study area presented in the EIS and BDAR, to provide accommodation for up to 500 construction staff during the construction phase of the project.

2. A refinement to the development footprint associated with the solar component of the project, to include the south-eastern corner (approximately 5 ha). This area was conservatively mapped as derived native grassland (DNG) of plant community type (PCT) 80 (and therefore a threatened ecological community) and previously excluded from the EIS and BDAR. Subsequently, this area has been surveyed by EMM ecologists since submission of the EIS and BDAR and is confirmed as low condition DNG of PCT 479 (rather than DNG of PCT 80), and therefore does not need to be avoided on the basis of ecological constraints.

This BDAR, prepared in accordance with the (BAM) (DPIE 2020), has been updated to include assessment of the accommodation facility and access tracks (the project amendment).

ES2 Landscape features

The subject land is within the NSW South Western Slopes Interim Biogeographic Regionalisation for Australia (IBRA) bioregion and the Inland Slopes IBRA subregion. The Talbragar – Upper Macquarie Terrace Sands and Gravels NSW (Mitchell) Landscape dominates the assessment area with Cope Hill Granite mapped in the southern half of the assessment area. Smaller occurrences of additional NSW (Mitchell) Landscapes within the assessment area include:

- Gulgong Ranges
- Liverpool Range Valleys and Footslopes
- Goonoo Slopes.

The majority of the assessment area within the solar and BESS study area is located in the Talbragar – Upper Macquarie Terrace Sands and Gravels NSW (Mitchell) Landscape and this was the landscape used in this assessment. The Cope Hill Granite NSW (Mitchell) Landscape covers the majority of the proposed accommodation facility and access tracks, and therefore was the landscape used for the assessment of those areas. The locality of the subject land is considered highly fragmented with native vegetation often occurring in isolated patches surrounded by a matrix of agricultural land. A vegetated road corridor provides connectivity along the western extent of the subject land.

Areas of geological significance include karsts, caves, crevices, cliffs, rocks and other geological features of significance as outlined in Section 3.1.3 of the BAM (DPIE 2020). A ridgeline occurs within the assessment area which is likely to have areas of geological significance such as crevices and geological habitat. This ridge line is associated with the higher slopes to the south of the subject land.

The percent of native vegetation within the assessment area is estimated at approximately 48%, based on the Central West Lachlan vegetation mapping, the NSW State Vegetation Type Map, and aerial imagery. The patch size is calculated to be greater than 100 ha due to contiguity (within 100 m) of vegetation within the subject land with nearby vegetation within the region.

ES3 Native vegetation

The subject land reflects regional vegetation mapping with areas dominated by exotic vegetation and native pasture. All vegetation within the subject land has been impacted by past land use, particularly with ongoing grazing, with the grasslands supporting little native species cover and a lack of native species diversity. Remnant vegetation is restricted to small patches, isolated paddock trees and a vegetated road corridor consisting primarily of Grey Box (*Eucalyptus microcarpa*), Blakely's Red Gum (*Eucalyptus blakelyi*) and Yellow Box (*Eucalyptus melliodora*).

Three plant community types (PCTs) occur within the subject land:

- PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion (added into the assessment due to the inclusion of the accommodation facility and access tracks).

Two PCTs within the subject land meet the criteria for inclusion as the following two *NSW Biodiversity Conservation Act 2016* (BC Act) listed Threatened Ecological Communities (TECs):

- PCT 80: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Endangered)
- PCT 281: White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Critically Endangered).

In addition, PCT 281 is a candidate entity for Serious and Irreversible Impacts (SAII).

ES4 Threatened species

Habitat assessments within the subject land concluded that targeted surveys were required for seven flora species and 14 fauna species. No candidate flora species were recorded during the surveys. One candidate fauna species, the Koala, was recorded in the form of scats during dog detection surveys. The presence of the Koala is associated with the high condition vegetation zones of PCTs 80 and 281, which are also connected to the wider landscape. No other candidate fauna species were recorded during targeted surveys. Presence has been assumed for *Chalinolobus dwyeri* (Large-eared Pied Bat) due to potential habitat within the subject land, and no targeted surveys being undertaken for this candidate fauna species. Presence has also been assumed for Superb Parrot (*Polytelis swainsonii*) in some small areas of the subject land that were not surveyed for this species, due to project timing constraints.

ES5 Aquatic and riparian biodiversity

The waterways within the subject land and assessment area largely lack riparian vegetation which may support aquatic and terrestrial species. These waterways have been highly altered and degraded, with numerous online dams primarily providing water for livestock. These dams lack riparian vegetation and have high turbidity and sediment load due to stock access. Where waterways are connected within the subject land, a highly eroded gully occurs due to the apparent sandy substrate associated with the landscape. These gullies are very shallow and are disconnected by man-made weirs and roads.

Browns Creek and White Creek are mapped as Key Fish Habitat (KFH) (DPI 2021b). These creeks, in addition to Huxleys Creek, are also mapped within the freshwater threatened species distribution for the Purple-Spotted Gudgeon (*Mogurnda adspersa*) (DPI 2021a).

No nationally important or RAMSAR wetlands have been mapped within the subject land or are located within the locality.

ES6 Impact avoidance, minimisation and mitigation

The construction and operation of the project will result in direct and indirect impacts.

Measures to avoid and minimise impacts to vegetation were considered during the project refinement process, resulting in avoidance of significant biodiversity values.

Public road crossings have been located within the subject land within areas of minimal vegetation, thereby avoiding the need to remove vegetation for these crossings.

Refinements to the project layout have also excluded as many higher order streams from the subject land, as possible. Three third order streams are excluded from the subject land, thereby avoiding impacts to any associate riparian vegetation, with the exception of that required for the provision of fencing, access and electrical reticulation (i.e. private internal access roads and electrical cables).

In addition, a key design principle within the project refinement process has been to maximise the placement of project infrastructure in cleared areas and, wherever possible, limit impacts to native vegetation of low quality only.

In relation to the road upgrade corridor within the subject land, the conceptual road upgrade design has sought to minimise the clearance of native vegetation as much as possible. The concept design was developed in consultation with EMM ecologists and with Mid-Western Regional Council and Warrumbungle Shire Council to develop a design that avoids as much of the native vegetation along the existing road verge as possible. Residual impacts to biodiversity values will be mitigated through pre-clearance surveys, planting locally native species characteristic of Box Gum woodland and Grey Box woodland in future landscaping, retention of logs and debris in the subject land post-construction, and weed hygiene measures.

A site selection process for two locations for the accommodation facility and access tracks (the project amendment) was undertaken, namely the 'northern' option (chosen) and 'southern' option. This allowed the facility to be situated in areas of lower biodiversity value. Key avoidance measures that have been implemented for the accommodation facility and access tracks include:

- avoidance of all areas of PCT 479 high and moderate condition zones, due to micro siting of the accommodation facility and associated access tracks in areas of lower quality PCT 479 DNG and PCT 281 pasture
- avoidance of approximately 2 ha of rocky habitat that is suitable for Pink-tailed Legless Lizard (*Aprasia parapulchella*) (in 'southern' accommodation facility option) via selection of the 'northern' accommodation facility option.

ES7 Impact assessment

After avoidance and minimisation, the project will result in residual impact to:

- 76.80 ha of PCT 80, of which only 1.18 ha is of condition to require offsetting under the NSW Biodiversity Offset Scheme (BOS), and associated habitat for flora and fauna species
- 300.46 ha of PCT 281, of which only 7.45 ha is of condition to require offsetting under the NSW BOS, and associated habitat for flora and fauna species
- 28.45 ha of PCT 479, which is grassland of low condition and does not require offsetting under the NSW BOS.

One BC Act listed TEC at risk of SAII occurs within the subject land and two BC Act listed fauna species at risk of SAII have the potential to occur within the subject land:

- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions
- Large-eared Pied Bat
- *Anthochaera phrygia* (Regent Honeyeater).

The TEC and species have been assessed in accordance with Section 9.1 of the BAM (DPIE 2020).

Whilst this BDAR presents the overall impact of the amended project (i.e. the project as a whole), it is important to note the change in project design assessed in the EIS (and previous BDAR) and the project amendment (and this current BDAR). The change of biodiversity impacts from the previously submitted BDAR and this current BDAR is a result of the BCS recommendations on the previous BDAR as well as the project amendment, comprising the addition of the temporary accommodation facility and access tracks, and refinement to the development footprint associated with the solar component of the project, to include the south-eastern corner. The changes (impacts on PCTs and species) between the previous BDAR and this BDAR is summarised in Table ES1.

Table ES1 Summary of impacts - previous BDAR and updated BDAR

Entity	Previous BDAR (September 2022)		Updated BDAR (this BDAR)	
	Area (ha)/count	Number of credits	Area (ha)/count	Number of credits
PCT 80	76.80 ha	51	76.80	55
PCT 281	291.91 ha	230	300.46	216
PCT 479	-	-	28.45	0
Large-eared Pied Bat	0.48 ha	17	0.48	17
Barking Owl (Ninox connivens)[1]	3.88 ha	33	-	-
Powerful Owl (*Ninox strenua*)[1]	3.88 ha	33	-	-
Koala	8.62 ha	234	8.62	227
Masked Owl (*Tyto novaehollandiae*)[1]	3.88 ha	33	-	-
Superb Parrot	-	-	3.25	21

Notes: 1. The previous BDAR assumed presence of the forest owls, due to a lack of targeted survey. The project amendment allowed time for targeted survey, resulting in no owls being detected, therefore removal of the forest owls credits.

ES8 Assessment of impacts under other relevant biodiversity legislation

ES8.1 Environment Protection and Biodiversity Conservation Act 1999

The high condition vegetation zones of PCTs 80 and 281 mapped within the subject land meet the criteria for inclusion as the following *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Listed TECs:

- PCT 80: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia endangered ecological community (Endangered) (comprising 1.01 ha)
- PCT 281: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (Critically Endangered) (comprising 0.35 ha).

One EPBC Act listed fauna species was recorded within the subject land; the Koala. A further six EPBC Act listed fauna species were assessed as potential impact, due to their likelihood of occurrence; namely:

- Regent Honeyeater
- Superb Parrot
- *Callocephalon fimbriatum* (Gang-gang Cockatoo)
- *Grantiella picta* (Painted Honeyeater)

- *Hirundapus caudacutus* (White-throated Needletail)
- Large-eared Pied Bat.

Assessments in accordance with the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (DoE 2013) concluded that the project is unlikely to result in a significant impact on the above listed Matters of National Environmental Significance (MNES).

ES8.2 Fisheries Management Act 1994

Browns Creek and White Creek are mapped as KFH. These creeks, in addition to Huxleys Creek, are also mapped within the freshwater threatened species distribution for the Purple-Spotted Gudgeon.

A likelihood of occurrence assessment for species listed under the FM Act was conducted based on database searches. The assessment concluded that no aquatic threatened ecological communities, endangered populations or species have a moderate to high likelihood of occurring within the subject land, therefore assessment under section 220ZZ and 220ZZA of the FM Act is not required.

ES8.3 Biosecurity Act 2015

Two priority weeds of the Central Tablelands were recorded in the subject land, namely Coolatai Grass (*Hyparrhenia hirta*) and St. Johns Wort (*Hypericum perforatum*).

ES9 Biodiversity offsets

To compensate for impacts on native vegetation and species habitat, the following credits are required:

- 52 ecosystem credits of PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- 219 ecosystem credits of PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
- 17 species credits for Large-eared Pied Bat
- 227 species credits for Koala (*Phascolarctos cinereus*)
- 21 credits for Superb Parrot (*Polytelis swainsonii*).

Three vegetation zones within the subject land (the pasture zone for PCT 80 and PCT 281 and the Derived Native Grassland (DNG) zone of PCT 479) do not require offsetting as the vegetation integrity (VI) score of these zones fall below the offset threshold under the BAM (DPIE 2020). Additional areas which do not require offsetting include existing cleared access tracks and watercourses, both of which occur within the subject land.

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Attachments

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Figures

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1 Introduction

1.1 The project

ACEN Australia Pty Ltd, operating as ACEN Australia (ACEN) proposes to develop the Birriwa Solar and Battery Project; a large scale solar photovoltaic (PV) generation facility along with battery energy storage system (BESS) and associated infrastructure (the project). The solar component of the project will have an indicative capacity of around 600 megawatts (MW) and will include a centralised BESS of up to 600 MW for a 2 hour duration. The BESS will enable energy from solar to be stored and then released during times of demand. The project will also include a temporary accommodation facility, to provide accommodation for up to 500 construction staff during the construction phase of the solar and battery project.

The project is on Wiradjuri Country, in the localities of Birriwa and Merotherie, approximately 15 kilometres (km) south-west of the township of Dunedoo, in the Central West of New South Wales (NSW) (Figure 1.1). The project is within the Mid-Western Regional Council local government area (LGA) with parts of its access within Warrumbungle Shire Council and is within the Central-West Orana (CWO) Renewable Energy Zone (REZ).

The project is State significant development (SSD) under Schedule 1, Section 20 (electricity generating works) of State Environmental Planning Policy (Planning Systems) 2021. Project approval is sought under Division 4.7 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This Biodiversity Development Assessment Report (BDAR) forms part of the Environmental Impact Statement (EIS).

EMM has conducted the necessary biodiversity assessments required under the Biodiversity Offset Scheme (BOS) and the Secretary's Environmental Assessment Requirements (SEARS) (see Section 1.4) to assess impacts of the project under the NSW *Biodiversity Conservation Act 2016* (BC Act), the NSW *Fisheries Management Act 1994* (FM Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

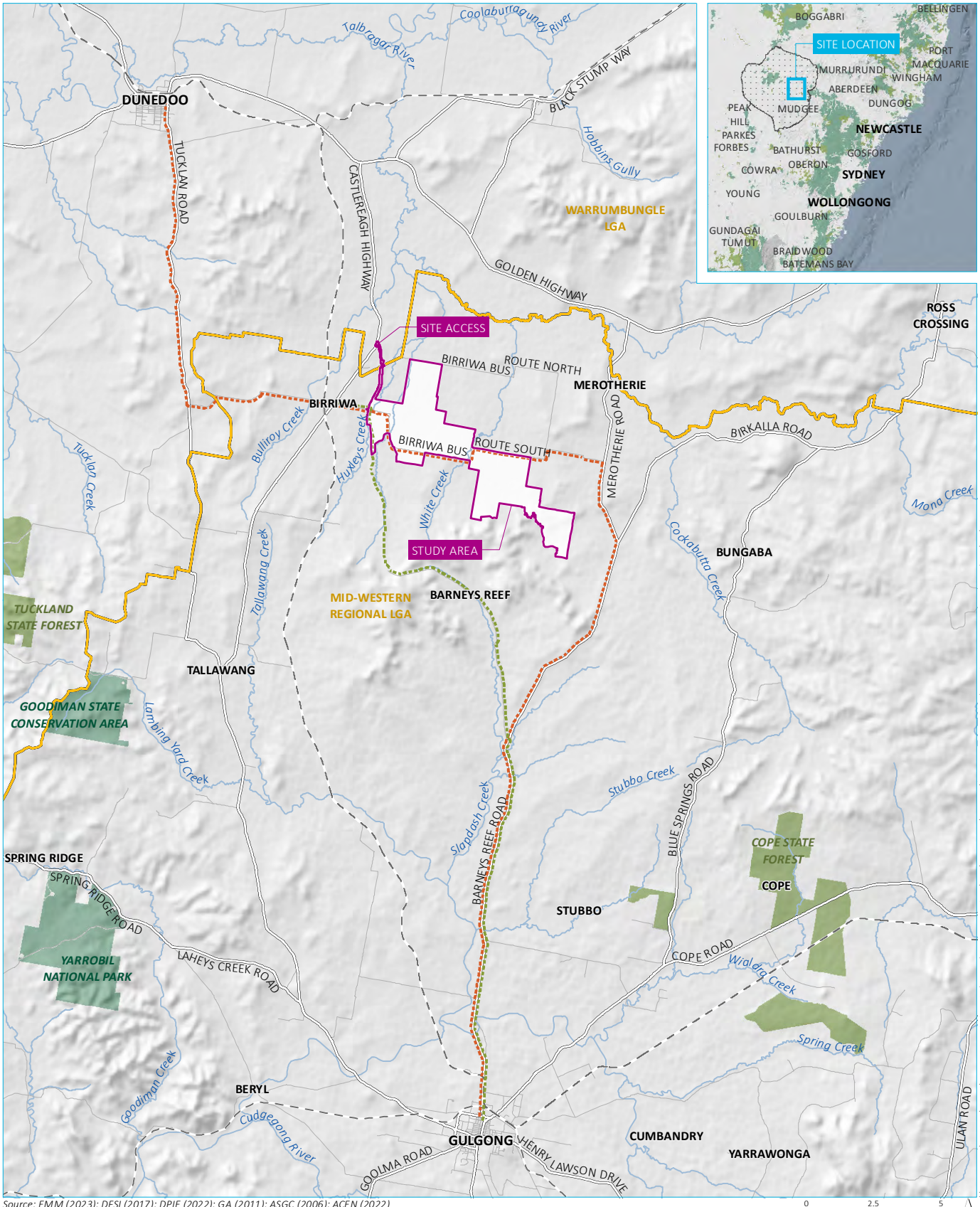
1.2 Site description

The project will be developed within a study area of approximately 1,535 hectares (ha) and is comprised of 20 freehold land parcels (Figure 1.2). The properties within the study area are currently primarily used for sheep and cattle grazing as well as low intensity dry land cropping.

The subject land is the land within the study area that will be used for the construction and operation of the project, which excludes certain areas of environmental value or social considerations (Figure 1.2). The subject land has been refined through an iterative design process throughout the preparation of the EIS and has been informed by the outcomes of community and stakeholder engagement and environmental, social and economic assessments.

The road upgrade corridor within the subject land is the area of direct impact for public road upgrade works along the access route, which comprises part of Barneys Reef Road and Birriwa Bus Route South (connecting the access point to the project with the Castlereagh Highway). It also includes three public road crossings along Birriwa Bus Route South, two of them being outside the road upgrade corridor. Public road crossings will allow construction and operation traffic to access different areas of the project with limited impacts on Birriwa Bus Route South.

The study area will be accessed via the Castlereagh Highway, Barneys Reef Road and Birriwa Bus Route (Figure 1.2). From the project access point, private internal roads will be used to traverse the subject land. The different areas of the subject land can be accessed via public road crossings located along Birriwa Bus Route South. A section of each of Barneys Reef Road and Birriwa Bus Route within the road upgrade corridor component of the subject land will require upgrade to provide safe access to the solar farm during construction of the project. The accommodation facility will be accessed from the primary vehicle access route of the project through to a new internal access track between the solar and battery project and the accommodation facility. A secondary track will be constructed south of the accommodation facility, for emergency vehicles use only (Figure 1.2).



Source: EMM (2023); DFSI (2017); DPIE (2022); GA (2011); ASGC (2006); ACEN (2022)

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GDA 1994 MGA Zone 55

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KEY

- Study area

Existing environment

- Rail line
- Major road
- Minor road
- Named watercourse
- Local government area
- Central West Orana Renewable Energy Zone (see inset)
- NPWS reserve
- State forest

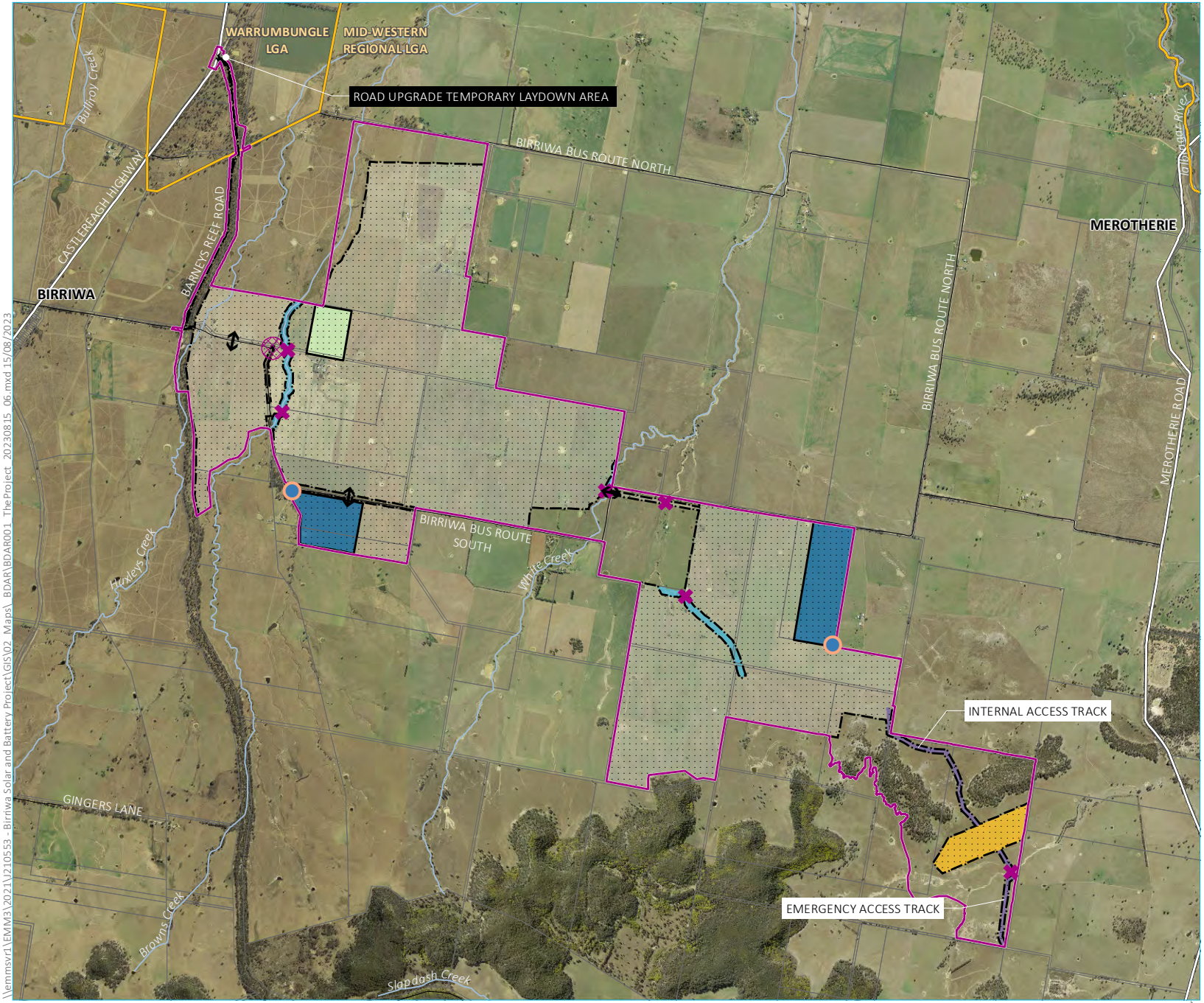
Central West Cycle (CWC) Trail

- CWC main route - Gulgong to Dunedoo
- CWC alternate route - Slap Dash Creek side trail

Regional context

Birriwa Solar and Battery Project
Biodiversity Development Assessment Report
Figure 1.1

EMM creating opportunities



KEY

- Study area (project area)
- Subject land

Project layout

- Potential crossing point
- Potential public road crossing location
- Proposed access point to the project
- Connection point (option A or B)
- Proposed operational infrastructure area including substation, operational facility and BESS (option A or B)
- Accommodation infrastructure area
- Access track
- Temporary laydown area
- Restricted development area

Existing environment

- Major road
- Minor road
- Named watercourse
- Cadastral boundary
- Local government area boundary

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Source: EMM (2023); DFSI (2017, 2022); GA (2011); ACEN (2022)

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GDA 1994 MGA Zone 55

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The project

Birriwa Solar and Battery Project
Biodiversity Development Assessment Report
Figure 1.2

EMM creating opportunities

1.3 Terms and definitions

Project elements referred to in this BDAR are described in Table 1.1.

Table 1.1 Project elements referred to in this BDAR

Project elements	Definition
Assessment area	1,500 m buffer of the subject land (site-based developments only).
Study area	Area that was surveyed for ecological values. Note, this is referenced as 'project area' within the amendment report and encompasses the solar and BESS study area and the accommodation facility study area.
Subject land	Area subject to all proposed direct impacts in accordance with the 'subject land' described in the BAM (DPIE 2020). This equates to the 'project development footprint' described in the EIS and the amendment report and includes the maximum extent of ground disturbing work (impact footprint). This area also includes temporary laydown areas and ancillary structures, including the provision of bushfire Asset Protection Zones (APZs), where required. It also includes the road upgrade corridor and access tracks. For the purposes of this BDAR, the calculations have been split as per the following key components: • road upgrade corridor • the accommodation facility and associated access tracks • the development footprint of the solar and BESS. This allows for the flexibility of the project components to be offset and constructed separately. It is likely that the accommodation facility will commence construction in parallel with the road upgrade corridor; however, the components may all overlap. Three separate Biodiversity Assessment Method Calculator (BAMC) cases, which align with each of the proposed credit retirement stages, have been submitted to allow for the retirement of credits for each component independently. Biodiversity offset liabilities will be finalised before the commencement of each stage

1.4 Assessment requirements

ACEN submitted a request for Secretary's environmental assessment requirements (SEARs) to the Department of Planning and Environment (DPE) along with supporting documentation describing the project, stakeholder engagement, key matters to be addressed in the EIS and the proposed assessment methods. The SEARs were issued on 5 November 2021. The relevant requirements of the SEARs, and where they are addressed in this BDAR, are listed in Table 1.2.

Table 1.2 Secretary's Environmental Assessment Requirements

Requirement	Section addressed
Biodiversity An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method (BAM) and documented in a Biodiversity Development Assessment Report (BDAR), unless BCS and DPIE determine the proposed development is not likely to have any significant impacts on biodiversity values.	All sections of this BDAR.
The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM.	Chapter 6

Table 1.2 Secretary's Environmental Assessment Requirements

Requirement	Section addressed
An assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the *Fisheries Management Act 1994*, and a description of the measures to minimise and rehabilitate impacts.	Sections 3.1.2 and 7.2
If an offset is required, details of the measures proposed to address the offset obligation.	Sections 6.6 and 6.7

A development application and EIS (inclusive of this BDAR) were submitted for the project to the NSW Department of Planning and Environment (DPE) in 2022 and were publicly exhibited from 14 October 2022 to 10 November 2022.

1.5 Response to submissions

Following the public exhibition of the EIS, 92 submissions were received from the public, councils, and special interest groups. In addition, 14 government agencies provided advice on the project. A submissions report (EMM 2023) has been prepared to respond to matters raised in these submissions and agency advice. The Biodiversity, Conservation and Science Directorate (BCS), North West office, of the DPE provided five recommendations on the BDAR (refer to Attachment 1).

This BDAR has been updated to address the recommendations from the BCS.

1.6 Project amendment

In response to matters raised in submissions and outcomes of ongoing engagement with the local community, government agencies, project landholders, and other stakeholders, ACEN has made amendments to the project, as follows:

1. The addition of a temporary accommodation facility, on an adjacent property south-east of the original project study area presented in the BDAR (refer to Figure 1.2), to provide temporary accommodation for up to 500 construction staff during the construction phase of the project.

2. A refinement to the development footprint (subject land) associated with the solar component of the project, to include the south-eastern corner (approximately 5 ha). This area was conservatively mapped as derived native grassland (DNG) of plant community type (PCT) 80 (and therefore a threatened ecological community) and previously excluded from the EIS and BDAR. Subsequently, this area has been surveyed by EMM ecologists since submission of the EIS and BDAR, and is confirmed as lower quality DNG of PCT 479 (rather than DNG of PCT 80), and therefore does not need to be avoided on the basis of ecological constraints.

The temporary accommodation facility will be suitable to accommodate up to 500 people (construction workforce). The accommodation facility will have the potential to expand, enabling capacity for up to 1,000 people subject to future approvals, to accommodate a workforce from future ACEN developments within the CWO REZ, if deemed required and subject to future accommodation needs.

This BDAR has been updated to include assessment of the accommodation facility and access tracks (the project amendment).

1.7 Purpose of this report

The specific objectives of this assessment are to:

- describe biodiversity values of the subject land
- assess the likelihood that threatened species and communities (threatened biodiversity) listed under relevant the NSW *Biodiversity Conservation Act 2016* (BC Act), Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Fisheries Management Act 1994* (FM Act) could occur in the subject land
- document the strategies implemented to avoid and/or minimise impacts of the project on threatened biodiversity
- assess residual threatened biodiversity impacts, after avoidance and minimisation strategies have been implemented
- provide environmental safeguards to mitigate threatened biodiversity impacts during construction and operation.

1.8 Information sources

1.8.1 Publications and databases

To provide context for the project, information about flora and fauna species, populations, communities and habitats from the locality (generally within 20 km) was obtained from the following databases:

- BioNet Atlas of NSW Wildlife for previous threatened species records (BCS 2021a)
- Commonwealth Department of Agriculture, Water and the Environment (DAWE) (now the Department of Climate Change, Energy, the Environment and Water, DCCEEW) Protected Matters Search Tool (PMST) (DAWE 2022d) for Matters of National Environmental Significance (MNES) likely to occur within the subject lands
- the NSW Plant Community Types (PCTs), as held within the BioNet Vegetation Classification database.

1.8.2 Spatial data

Spatial data encompassing the subject land, was obtained from ACEN. Base map data was obtained from Department of Finance, Services and Innovation (DFSI) NSW databases, with cadastral data obtained from DFSI digital cadastral database. Mapping for stream orders was obtained from NSW Department of Primary Industries (DPI).

The following spatial datasets were utilised during the development of this report:

- *State Vegetation Type Map: Central West/Lachlan Region version 1.4. VIS_ID 4468* (DPIE 2015)
- *NSW State Vegetation Type Map* (DPE 2022)
- *Mitchell Landscapes Version V3.1* (OEH 2017)
- *Interim Biogeographic Regionalisation of Australia (IBRA) Version 7* (DoEE 2018)
- Strahler Stream Order (DPI 2015)

- Freshwater threatened species distribution maps (DPI 2021a)
- Key fish habitat map – Murray Darling Basin North (DPI 2021b)
- Fisheries NSW Spatial Data Portal (DPI 2022a)
- Fish stocking (DPI 2022b)
- Local Government Area (DFSI 2017)
- Road Segment (DFSI 2017)
- NPWS Reserve (DFSI 2017)
- State Forest (DFSI 2017)
- BAM – Important Areas viewer maps (BCS 2022b).

Mapping undertaken during the site assessment was conducted using a hand-held Global Positioning System (GPS) unit, mobile tablet computers running Collector for ArcGIS™ and Survey123 for ArcGIS™ and aerial photo interpretation. Accuracy is subject to accuracy of GPS devices, generally ± 5 m. Mapping has been produced using a Geographic Information System (GIS; ArcGIS 10.5).

Spatial data relevant to this BDAR was provided to the DPE following lodgement of the BDAR.

1.9 Declarations

1.9.1 Certification under clause 6.15 Biodiversity Conservation Act 2016

I certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method (DPIE 2020) and Clause 6.15 of the BC Act.

1.9.2 Conflict of interest

As per the Accredited BAM Assessor Code of Conduct, BAM Accredited Assessors must not act in circumstances where there is actual, perceived, or potential conflict of interest. I declare that I have considered the circumstances and there is no actual, perceived, or potential conflict of interest. This declaration has been made in the interests of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature: 

Date: 27 September 2023

BAM Assessor Accreditation no: BAAS18135

1.9.3 Contributors

The qualifications and experience of the personnel involved in the preparation of this BDAR are listed within Table 1.3

Table 1.3 Personnel involved in preparing this BDAR

Name	Qualifications	Experience	Tasks performed
Cecilia Phu	BScience (Hons) Accredited BAM assessor: BAAS17058	15 years	• Technical advice
Erin Lowe	BScience (Sustainable Resource Management) BNatHistIllus Accredited BAM assessor: BAAS18135	12 years	• Report preparation • Report review • BAMC review
Eugene Dodd	BScience (Hons) Master Research (Ecology and Environmental Management) Accredited BAM assessor: BAAS17009	12 years	• Candidate species habitat assessment • Vegetation mapping • BAM plot surveys • Targeted threatened flora surveys • Targeted threatened fauna surveys
Bianca Seal	BSc (Sustainable Resource Mgt and Marine Sc) Post Grad Dip (GIS) BAM accredited assessor (BAAS23008)	4 years	• BAM plot surveys • Vegetation mapping • Report preparation
Luke O'Brien	BEnvScMgt BScience (Hons) BAM accredited assessor (BAAS22017)	7 years	• BAM plot surveys • Owl surveys • Report preparation
Madeleine Hunt	BEnvScMgt (Marine Science)	1 year	• BAM plot surveys • Owl surveys
Candace Lim	BEnvScMgt	2 years	• BAM plot surveys • Owl surveys
Erica-Danae Goldsmith	BScience (Zoology)	8 years	• Targeted flora and fauna surveys • Report preparation
Peter Tolley	BEnvScience MGIS	4 years	• Report figures • GIS support
Michael Forbes	BAppliedSc (Ecology)	17 years	• Report figures • GIS support
Maya Potapowicz	BEnvSc (Env Management) BAM accredited assessor (BAAS18157)	22 years	• Report review

2 Legislative context

This chapter provides a brief outline of the key biodiversity legislation and government policy considered in this assessment.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as Matters of National Environmental Significance (MNES) under the EPBC Act. These are:

- world heritage properties
- places listed on the National Heritage Register
- Ramsar wetlands of international significance
- threatened flora and fauna species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, an action that may have a significant impact on a MNES is deemed to be a 'controlled action' and can only proceed with the approval of the Commonwealth Minister for the Environment. An action that may potentially have a significant impact on a MNES is to be referred to DCCEEW for determination as to whether it is a controlled action. If deemed a controlled action the project is assessed under the EPBC Act, and a decision made as to whether or not to grant approval.

Consultation, in the form of a pre-referral meeting, was undertaken with DCCEEW on 2 June 2022, to advise DCCEEW of the intention to refer the project. AECN provided DCEEW with a summary of proposed impacts, and measure taken to avoid significant impacts upon MNES.

An assessment of the project against the EPBC Act is provided in Section 7.1. As described in Section 7.1, the assessment concluded that the project is unlikely to result in a significant impact on MNES.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The NSW EP&A Act was enacted to encourage the consideration and management of impacts of proposed development or land-use changes on the environment and the community. The EP&A Act is administered by the NSW Department of Planning and Environment (DPE).

The EP&A Act provides the overarching structure for planning in NSW; however, is supported by other statutory environmental planning instruments (EPIs) including State Environmental Planning Policies (SEPPs). EPIs relevant to the natural environment are outlined further below.

i State Environmental Planning Policy (Biodiversity and Conservation) 2021

The *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (Biodiversity and Conservation SEPP) was ratified on the 1 March 2022 and consolidates, transfers and repeals provisions of numerous SEPPs, which includes the former *State Environmental Planning Policy (Koala Habitat Protection) 2020* (Koala SEPP 2020) and *State Environmental Planning Policy (Koala Habitat Protection) 2021* (Koala SEPP 2021). No policy changes have been made to the Koala SEPPs.

The former Koala SEPP 2020 and 2021 together aimed to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline. In nine metropolitan Sydney local government areas (Blue Mountains, Campbelltown, Hawkesbury, Ku-Ring-Gai, Liverpool, Northern Beaches, Hornsby, Wollondilly) and the Central Coast LGA Koala SEPP 2021 applies to all land use zones. Outside of these areas Koala SEPP 2020 continues to apply to all land zoned RU1, RU2, and RU3.

As SSD, the project does not require approval from Council, and thus consideration of the provisions of former Koala SEPP 2020 and Koala SEPP 2021 are not triggered. Nonetheless, consideration has been given to the potential occurrence and impacts upon the Koala (*Phascolarctos cinereus*) within this report, as required by the BC Act and EPBC Act.

2.3 Biodiversity Conservation Act 2016

The NSW BC Act is the legislation responsible for the conservation of biodiversity in NSW through the protection of threatened flora and fauna species, populations and ecological communities. The BC Act, together with the Biodiversity Conservation Regulation 2017 (BC Regulation), established the Biodiversity Offsets Scheme (BOS).

The BOS includes establishment of the Biodiversity Assessment Method (the BAM, DPIE 2020) for use by accredited persons in biodiversity assessment under the scheme. The purpose of the BAM (DPIE 2020) is to assess the impact of actions on threatened species and threatened ecological communities, and their habitats and determine offset requirements. For major projects, use of the BAM (DPIE 2020) is mandatory, unless a BDAR waiver is granted.

The BAM (DPIE 2020) sets out the requirements for a repeatable and transparent assessment of terrestrial biodiversity values on land to:

- identify the biodiversity values on land subject to a proposed development
- determine the impacts of a proposed development, following all measures to avoid, minimise and mitigate impacts
- quantify and describe the biodiversity credits required to offset the residual impacts of proposed development on biodiversity values.

This BDAR has been undertaken in accordance with the requirements of the BAM (DPIE 2020).

2.4 Fisheries Management Act 1994

The NSW FM Act contains provisions for the conservation of fish stocks, key fish habitat, biodiversity, threatened species, populations and ecological communities. It regulates the conservation of fish, vegetation and some aquatic macroinvertebrates and the development and sharing of the fishery resources of NSW for present and future generations. The FM Act lists threatened species, populations and ecological communities, key threatening processes (KTPs) and declared critical habitat. Assessment guidelines to determine whether a significant impact is expected are detailed in section 220ZZ and 220ZZA of the FM Act.

Another objective of the FM Act is to conserve key fish habitat (KFH). These are defined as aquatic habitats that are important to the sustainability of recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. KFH is defined in Section 3.2.1 and 3.2.2 of the *Policy and Guidelines for Fish Conservation and Management* (DPI 2013).

The impact of the project on threatened aquatic species, populations, communities, habitats and KFH have been assessed in Section 3.1.2, Chapter 6 and Section 7.2.

2.5 Biosecurity Act 2015

The primary objective of the NSW *Biosecurity Act 2015* (Biosecurity 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, carriers or potential carriers.

The Biosecurity Act stipulates management arrangements for weed biosecurity risks in NSW, with the aim to prevent, eliminate and minimise risks. Management arrangements include:

- any land managers and users of land have a responsibility for managing weed biosecurity risks that they know about or could reasonably be expected to know about
- applies to all land within NSW and all waters within the limits of the State
- local strategic weed management plans will provide guidance on the outcomes expected to discharge duty for the weeds in that plan.

NSW WeedWise (DPI 2022c) identifies relevant weed species by region. The relevant region for the project is the Central Tablelands. 104 priority weed species are listed for the Central Tablelands region (DPI 2022c).

The *Central Tablelands Regional Strategic Weed Management Plan 2017–2022* (LLS 2017) supports regional implementation of the Biosecurity Act by articulating community expectations in relation to effective weed management and facilitating a coordinated approach to weed management in the region. The plan identifies weed management in the region, weed risk assessment and prioritisation, actions, details regarding how to apply the actions, and measures proposed to increase the chance of success and for continuous improvement. Attachment 1 of the plan provides a list of priority weeds for the Central West LLS region and Attachment 2 identifies other weeds of regional concern. Should any of these species be recorded on the subject land the management actions provided in the plan will need to be implemented.

The provisions of the Biosecurity Act are discussed further in Section 7.3.

2.6 Water Management Act 2000

Division 6 of the NSW *Water Management Act 2000* (WM Act) requires consideration of controlled activities on waterfront land (i.e. activities within 40 m of top of bank) and aquifer interference activities. The NSW Aquifer Interference Policy (DPI 2012) also requires an assessment of potential impacts on groundwater users, including groundwater dependent ecosystems.

The project will be constructed within 40 m of waterfront land; however, a water use approval under Section 89, a water management work approval under Section 90 or an activity approval (other than an aquifer interference approval) under Section 91 of the WM Act will not be required pursuant to Section 4.41 of the EP&A Act. Section 91 of the WM Act states that a controlled activity approval confers a right on its holder to carry out a specified controlled activity at a specified location in, on or under waterfront land. Under Section 4.41 of the EP&A Act states that SSD does not require a controlled activity approval. The WM Act is further discussed in Section 4.4 of the EIS.

Groundwater will not be intercepted for the project and therefore it does not represent an aquifer interference activity.

Stage 1 – Biodiversity assessment

3 Landscape features

3.1 Landscape features

The landscape features described in the following sections are shown on Figure 3.1 and Figure 3.2.

3.1.1 Bioregions and landscapes

The subject land is within the NSW South Western Slopes Interim Biogeographic Regionalisation for Australia (IBRA) bioregion and the Inland Slopes IBRA subregion. The Talbragar – Upper Macquarie Terrace Sands and Gravels NSW (Mitchell) Landscape dominates the assessment area with Cope Hill Granite mapped in the southern half of the assessment area. Smaller occurrences of additional NSW (Mitchell) Landscapes within the assessment area include:

- Gulgong Ranges
- Liverpool Range Valleys and Footslopes
- Goonoo Slopes.

As the majority of the subject land and assessment area is located in the Talbragar – Upper Macquarie Terrace Sands and Gravels NSW (Mitchell) Landscape, this was the landscape used in this assessment.

3.1.2 Rivers, streams, estuaries and wetlands

The subject land is located within the Macquarie-Bogan catchment. The Macquarie-Bogan catchment covers 74,800 square kilometres of central-west NSW (DPIE n.d). The catchment originates from the Great Dividing Range to the east and flows north-westerly until it joins the Barwon River.

A number of named creeks occur within the subject land, in addition to multiple unnamed first and second order streams. The named creeks include (Figure 3.2):

- Huxleys Creek
- Browns Creek
- White Creek.

These creeks flow in a northerly direction into Talbragar River, approximately 2.4 km from the subject land.

In total, the subject land and assessment area contain:

- 55 first-order water courses
- 17 second-order water courses
- 10 third-order water courses
- 4 fourth-order water courses.

The waterways within the subject land and assessment area largely lack wooded riparian vegetation which may support aquatic and terrestrial species, however there are some riparian remnants which occur downstream immediately outside of the subject land which provide canopy cover and shading for the creek lines (Photograph 3.1). These creeks have a sandy substrate, which is common to all waterways within the subject land and is characteristic of a highly erodible landform. Browns Creek and White Creek have highly eroded gullies as a result, which lack bank vegetation (Photograph 3.2).

The aquatic habitat within these creeks occurs as slow-flowing creeks with no rocky habitat or substrate to provide refuge for aquatic species. Intermittent pools do occur within these creeks, which provide aquatic vegetation in the form of sedges, rushes and a limited diversity of macrophytes (Photograph 3.3). Whilst the creeks provide limited aquatic habitat to aquatic species, these creek lines have been highly altered and degraded and are disconnected by man-made culverts and roads (Photograph 3.4). One of these culverts provides rocky habitat and snags within Browns Creek, however this waterway shows evidence of livestock runoff and pollution as a result of current livestock practices (Photograph 3.5). Cows were observed within Browns Creek during surveys.

There is an unnamed watercourse in the south-east of the subject land (accommodation facility access track) that lacks wooded riparian vegetation, has a sandy substrate, with highly eroded gullies as a result (Photograph 3.6 and Photograph 3.7).

The subject land also has a large number of online dams primarily providing water for livestock. These dams lack riparian vegetation and have high turbidity and sediment load due to stock access.

Browns Creek and White Creek are mapped as KFH (DPI 2021b). These creeks, in addition to Huxleys Creek, are also mapped within the freshwater threatened species distribution for the Purple-Spotted Gudgeon (*Mogurnda adspersa*) (DPI 2021a). Talbragar River is also mapped within the freshwater threatened species distribution of the Eel-tailed Catfish (*Tandanus tandanus*).

No nationally important or RAMSAR wetlands have been mapped within the subject land or are located within the locality.

Photograph 3.1 Browns Creek immediately north of the subject land

Photograph 3.2 **Unnamed tributary which flows into White Creek**

Photograph 3.3 **Aquatic habitat associated with White Creek**

Photograph 3.4 Large culverts underneath the tributary connected to White Creek

Photograph 3.5 Culvert associated with Brown Creek underneath road crossing

Photograph 3.6 **Unnamed tributary (accommodation facility access track crossing point)**

Photograph 3.7 **Unnamed tributary (accommodation facility access track crossing point)**

3.1.3 Connectivity

The locality of the subject land is considered highly fragmented with native vegetation often occurring in isolated patches surrounded by a matrix of agricultural land. A vegetated road corridor provides connectivity along the western extent of the subject land. This allows for connectivity of vegetation to the south of the subject land, primarily associated with intact native vegetation located on the higher slopes and ridgelines to the south.

Several waterways occur within the subject land (see above). These waterways lack the wooded riparian vegetation which is likely to provide connectivity to terrestrial species within the landscape.

3.1.4 Areas of geological significance

Areas of geological significance include karsts, caves, crevices, cliffs, rocks and other geological features of significance as outlined in Section 3.1.3 of the BAM (DPIE 2020). A ridgeline occurs within the assessment area which is likely to have areas of geological significance such as crevices and geological habitat. This ridge line is associated with the higher slopes to the south of the subject land.

3.1.5 Areas of outstanding biodiversity value

There are no areas of outstanding biodiversity value, as declared by the NSW Minister for Energy and Environment, within the subject land or assessment area.

3.2 Native vegetation cover

Native vegetation cover on the has been assessed in accordance with Section 3.2 of the BAM (DPIE 2020) and is outlined within the following section.

3.2.1 Native vegetation extent

Vegetation mapping across the subject land and locality (DPIE 2015) identifies a small number of vegetation communities. To calculate native vegetation cover, these vegetation types were classified as native or non-native (Table 3.1) The native vegetation extent was then assessed against aerial imagery to adjust for inconsistencies between the regional vegetation mapping and aerial imagery. Areas such as cropped farmland were excluded, whilst treed waterways and planted vegetation screens were included. The area of native vegetation within the assessment area and the percent native vegetation was then calculated, consistent with the requirements of the BAM (DPIE 2020). The extent of native vegetation cover based on this data source is shown in Figure 3.1.

Table 3.1 Native vegetation assessment

PCT (DPIE 2015)	Classification
76 – Western Grey Box tall grassy woodland on alluvial loam and clay soils in the NSW South Western Slopes and Riverina Bioregions	Native
81 – Western Grey Box – cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion	Native
272 – White Box – Black Cypress Pine – red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes	Native
281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Native
330 – Mugga Ironbark – Black Cypress Pine – Red Stringybark – Blakelys Red Gum – Red Ironbark woodland on hillslopes and in valleys on ranges in the NSW central western slopes	Native

Table 3.1 Native vegetation assessment

PCT (DPIE 2015)	Classification
437 – Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion	Native
440 – Red Stringybark – Narrow-leaved Ironbark – Black Cypress Pine – hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion	Native
461 – Tumbledown Gum woodland on hills in the northern NSW South Western Slopes Bioregion and southern Brigalow Belt South Bioregion	Native
467 – Blue-leaved Ironbark – Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion (including Goonoo)	Native
468 – Narrow-leaved Ironbark – Black Cypress Pine +/- Blakelys Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)	Native
477 – Inland Scribbly Gum – Red Stringybark – Black Cypress Pine – Red Ironbark open forest on sandstone hills in the southern Brigalow Belt South Bioregion and northern NSW South Western Slopes Bioregion	Native
478 – Red Ironbark – Black Cypress Pine – stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong – Mendooran region, southern Brigalow Belt South Bioregion	Native
479 – Narrow-leaved Ironbark – Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Native
511 – Queensland Bluegrass – Redleg Grass – Rats Tail Grass – spear grass – panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion	Native
599 – Blakelys Red Gum – Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	Native
796 – Derived grassland of the NSW South Western Slopes	Native
Not native	Not native

Vegetation proximal to the subject land is highly fragmented, with native vegetation often occurring in isolated patches surrounded by a matrix of agricultural land (Figure 3.2). A large extent of native woodland occurs south of the assessment area associated with the higher slopes and ranges (Figure 3.1). Native vegetation cover for the assessment area is provided in Table 3.2.

Table 3.2 Percentage native vegetation cover

IBRA subregion	Native vegetation in assessment area (ha)	Assessment area (ha)	Approximate percentage of native vegetation in assessment area (%)	Cover class (%)
Inland Slopes	3,115.3	6,516.5	48	30–70

KEY

- Assessment area (6,516.5 ha)
- Subject land

Existing environment

- Rail line
- Major road
- Minor road
- Local government area boundary
- Native vegetation cover (3,115.3 ha - 47.8%)

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order

Mitchell landscape (v3.1)

- Cope Hills Granite
- Goonoo Slopes
- Gulgong Ranges
- Liverpool Range Valleys and Footslopes
- Talbragar - Upper Macquarie Terrace Sands and Gravels

Note: entire view extent is within the:
- NSW South Western Slopes IBRA7 region
- Inland Slopes IBRA7 subregion

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Source: EMM (2023); DFSI (2017, 2020, 2022); DPI (2015); GA (2011); ACEN (2022); OEH (2017)

0 1 2 km

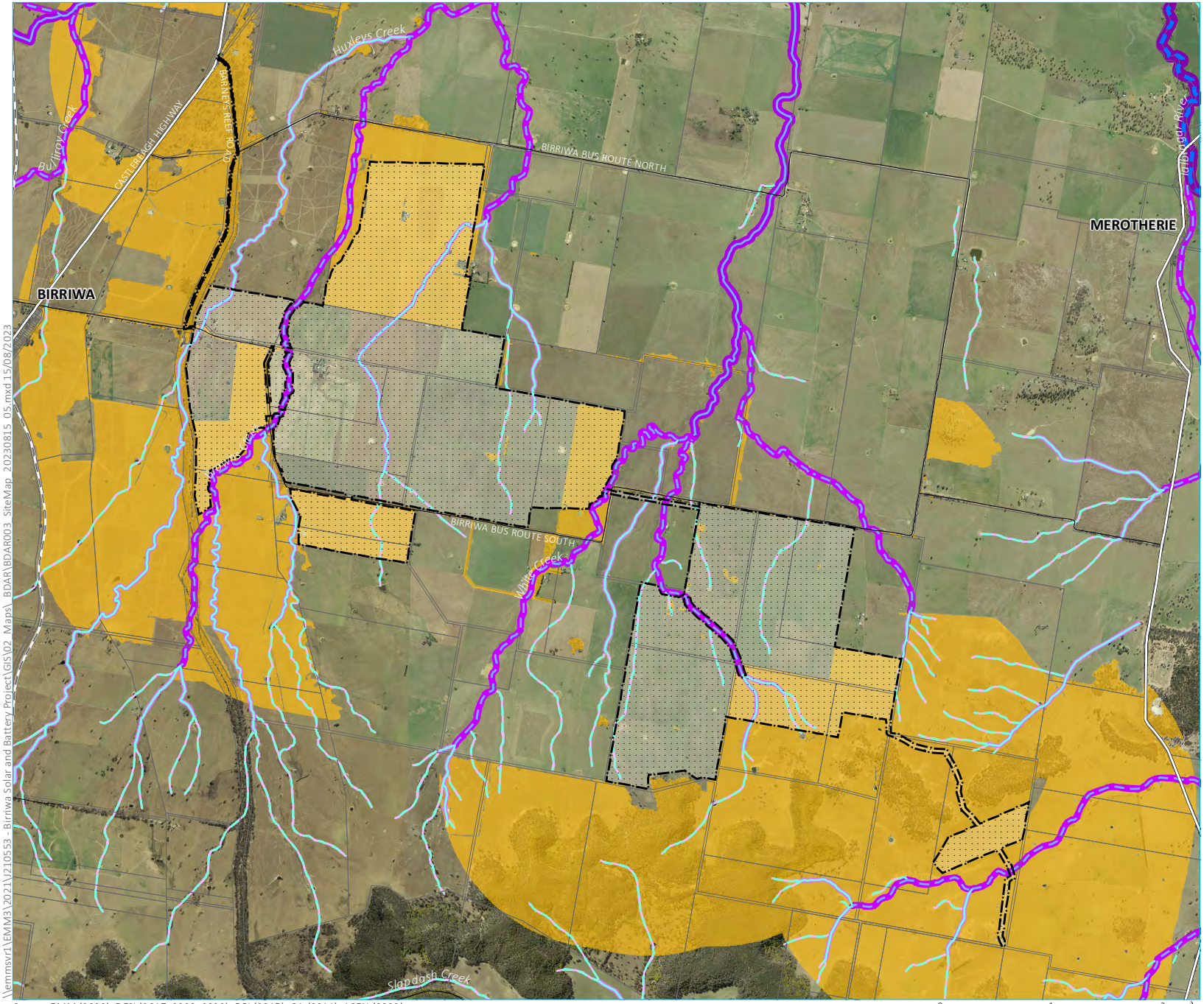
GDA 1994 MGA Zone 55

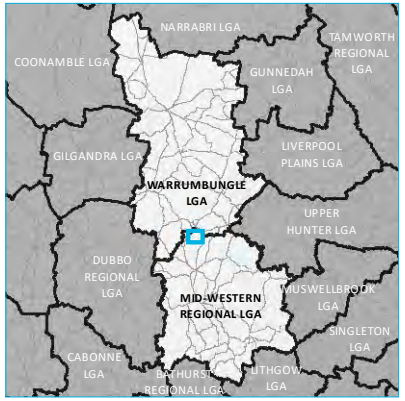
N

Location map

Birriwa Solar and Battery Project
Biodiversity Development Assessment Report
Figure 3.1

EMM creating opportunities





KEY

- Subject land

Existing environment

- Rail line
- Major road
- Minor road
- Cadastral boundary
- Native vegetation cover

Strahler stream order

- 1st order
- 2nd order
- 3rd order
- 4th order
- 6th order

Riparian buffer

- 10 m
- 20 m
- 30 m
- 40 m
- 50 m

Source: EMM (2023); DFSI (2017, 2020, 2022); DPI (2015); GA (2011); ACEN (2022)

\\emmsvr1\EMM3\2021\P210553 - Birriwa Solar and Battery Project\GIS\02 Maps\ BDAR\BDAR003 SiteMap 20230815 05.mxd 15/08/2023

Site map

Birriwa Solar and Battery Project
Biodiversity Development Assessment Report
Figure 3.2

EMM creating opportunities

4 Native vegetation

The assessment of native vegetation within the subject land was determined using Section 4 of the BAM (DPIE 2020), as summarised within this chapter.

4.1 Background review

Review of the State Vegetation Type Mapping (SVTM), Central West/Lachlan Region (DPIE 2015) and NSW SVTM (DPE 2022) indicates that most of the subject land is listed as non-native and considered cleared. This is supported by recent and historical aerial imagery with widespread evidence of agriculture including plough lines, farm dams and cropping. The SVTM also indicates that there are small patches of native vegetation, with eleven Plant Community Types (PCTs) mapped (Table 4.1).

Table 4.1 Plant Community Types and Threatened Ecological Communities mapped within the study area (STVM)

Plant Community Type	BC Act	EPBC Act
81 – Western Grey Box – cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion	Grey Box woodland and grassland [1.]	Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia Endangered Ecological Community (EEC) (Grey Box woodland and grassland)
272 – White Box – Black Cypress Pine – red gum +/- Mugga Ironbark shrubby woodland in hills of the NSW central western slopes	-	-
281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Box Gum Woodland and derived native grassland[2.]	Box Gum Woodland and derived native grassland[3.]
330 – Mugga Ironbark – Black Cypress Pine – Red Stringybark – Blakely's Red Gum - Red Ironbark woodland on hillslopes and in valleys on ranges in the NSW central western slopes	-	-
437 – Yellow Box grassy woodland on lower hillslopes and valley flats in the southern NSW Brigalow Belt South Bioregion	Box Gum Woodland and derived native grassland[2.]	Box Gum Woodland and derived native grassland[3.]
440 – Red Stringybark – Narrow-leaved Ironbark – Black Cypress Pine – hill red gum sandstone woodland of southern NSW Brigalow Belt South Bioregion	-	-
468 – Narrow-leaved Ironbark – Black Cypress Pine/Blakely's Red Gum shrubby open forest on sandstone low hills in the southern Brigalow Belt South Bioregion (including Goonoo)	-	-
478 – Red Ironbark – Black Cypress Pine – stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	-	-
479 – Narrow-leaved Ironbark – Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	-	-

Table 4.1 Plant Community Types and Threatened Ecological Communities mapped within the study area (STVM)

Plant Community Type	BC Act	EPBC Act
511 – Queensland Bluegrass – Redleg Grass – Rats Tail Grass – spear grass – panic grass derived grassland of the Nandewar Bioregion and Brigalow Belt South Bioregion	Box Gum Woodland and derived native grassland[2.]	Box Gum Woodland and derived native grassland[3.]
796 – Derived grassland of the NSW South Western Slopes	Box Gum Woodland and derived native grassland[2.]	Box Gum Woodland and derived native grassland[3.]

1. Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (BC Act – Endangered Ecological Community).
2. White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (BC Act – Critically Endangered Ecological Community).
3. White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (EPBC Act – Critically Endangered Ecological Community).

As shown in Table 4.1, five of the regionally mapped PCTs are aligned with two different BC Act listed Threatened Ecological Communities (TECs):

- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Endangered) (referred to as Grey Box woodland and grassland)
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Critically Endangered) (referred to as Box Gum Woodland and derived native grassland).

In addition, the Box Gum Woodland and derived native grassland is a candidate entity for Serious and Irreversible Impacts (SAII) under the BAM (DPIE 2020).

As shown in Table 4.1, both BC Act listed TECs are also listed under the EPBC Act, albeit with different names:

- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia endangered ecological community (Endangered)
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (Critically Endangered).

The EPBC Act also listings have different determinations, with specific condition requirements for woodland and derived native grassland (DNG) to meet the EPBC Act listings. In contrast, the BC Act listings have few condition requirements.

4.2 Methods

The following sections outline the methods employed to map vegetation, and to assess the vegetation integrity of native vegetation within the subject land in accordance with Section 4.3 of the BAM (DPIE 2020).

4.2.1 Detailed vegetation mapping and habitat assessment

An assessment of the subject land was undertaken on 17–20 August 2021. This assessment included detailed vegetation mapping and habitat assessments. The study area was traversed in a vehicle and on foot, with vegetation mapped and aligned with NSW PCTs. PCTs were stratified into vegetation zones based on broad condition state using the definitions in Table 4.2.

Table 4.2 Definitions used in delineation of vegetation zones

Condition class	Description
High	Largely intact with all strata present and minimal disturbance.
Medium	Tree stratum and mid stratum present, with various levels of native and exotic understorey growth.
Poor	Tree stratum present, but mid stratum primarily absent. Understorey vegetation degraded due to weeds or other major disturbance such as regular maintenance or grazing.
Pasture	Tree stratum and mid stratum missing. Grassland areas with various levels of improvement and seeding. Native vegetation is restricted to low diversity grasslands with high native cover.
Derived Native Grassland (DNG)	Tree stratum and mid stratum missing. Grassland areas with various levels of improvement and seeding. Grassland is considered to conform to an EPBC Act listing.
Planted	Treed vegetation which occurs in patches and appears to be planted based on the uniform age, spacing and landscaped shape of the canopy species.

Where there was some uncertainty about correct PCT alignment, or to justify PCT alignment, a series of rapid vegetation assessments (RVAs) were undertaken, with the three dominant species in the overstorey, midstorey and groundcover recorded. Vegetation was mapped in the field using GPS-enabled tablet computers using Collector for ArcGIS™.

4.2.2 Vegetation integrity assessment

Following the stratification of vegetation zones within the subject land, native vegetation integrity was assessed using data obtained via a series of plots, as per the methodology outlined in Section 4.2.1, 4.3.3 and 4.3.4 of the BAM (DPIE 2020). Plot data was collected from the subject land on 26–28 October 2021, 14–17 December 2021, 11–14 January 2022, 11–14 April 2022, 13–16 June 2023, 26–30 June 2023, and 17–21 July 2023. At each plot location the following was undertaken:

- one 20 x 20 m plot, for assessment of composition and structure
- one 20 x 50 m plot, for assessment of function, including a series of five 1 x 1 m plots to assess average leaf litter cover.

The assessment of composition and structure, based on a 20 x 20 m plot, recorded species name, stratum, growth form, cover and abundance rating for each species present within the plot. Cover (foliage cover) was estimated for all species rooted in or overhanging the plot, and recorded using decimals (if less than 1%, rounded to whole number (1%–5%) or estimated to the nearest 5% (5%–100%). Abundance was counted (up to 20) and estimated above 20, and recorded using the following intervals: 1, 2, 3, 4, 5, 10, 20, 50, 100, 500, 1,000, 1,500, 2,000, etc.

The assessment of function recorded the number of large trees, the presence of tree stem size class, tree regeneration, number of trees with hollows and length of fallen logs, as well as leaf litter cover within the 20 x 50 m plot and five 1 x 1 m subplots. The minimum number of plots and transects per vegetation zone was determined using Table 3 of the BAM (DPIE 2020). A total of 34 plots were undertaken within the study area.

The plot surveys were conducted prior to the final design of the project. For this reason, some plots are located outside of the subject land but are still situated within proximity of the subject land. Despite falling outside of the final design of the subject land, these are representative and occur in contiguous vegetation zones and have been used to inform the stratification of management zones within the subject land (Table 4.2).

Datasheets are provided in Attachment 2 while compiled plot data is provided in Attachment 3.

4.3 Results

4.3.1 Vegetation description and high threat weeds

The subject land reflects regional vegetation mapping (DPIE, 2015) with areas of exotic vegetation and native pasture dominating the subject land. All vegetation within the subject land has been impacted by past land use, particularly with ongoing grazing, with the grasslands supporting little native species cover and a lack of species diversity. Remnant vegetation is restricted to small patches and isolated paddock trees consisting primarily of Grey Box (*Eucalyptus microcarpa*), Blakely's Red Gum (*Eucalyptus blakelyi*) and Yellow Box (*Eucalyptus melliodora*). The road upgrade corridor occurs along a highly vegetated road corridor which also include these species. Whilst the remnant patches and paddock trees generally lack any native mid-stratum and contain a disturbed native understorey, the vegetated road corridor contains intact shrub and understorey strata due to less disturbance when compared to the remnant patches and paddocks. The road corridor has been classed as a high condition vegetation zone for this reason.

A total of 226 species (132 native and 94 exotic) were recorded within the study area. Most of these species were native and exotic groundcovers, with a small number of native shrub species present and a total of seven tree species. Of the 94 exotic species, 12 are high threat weeds and primarily include herbaceous groundcover and grasses (Attachment 3).

4.3.2 Plant community types and vegetation zones

The vegetation within the subject land has been classified as three PCTs (Table 4.3).

Table 4.3 Vegetation within the subject land

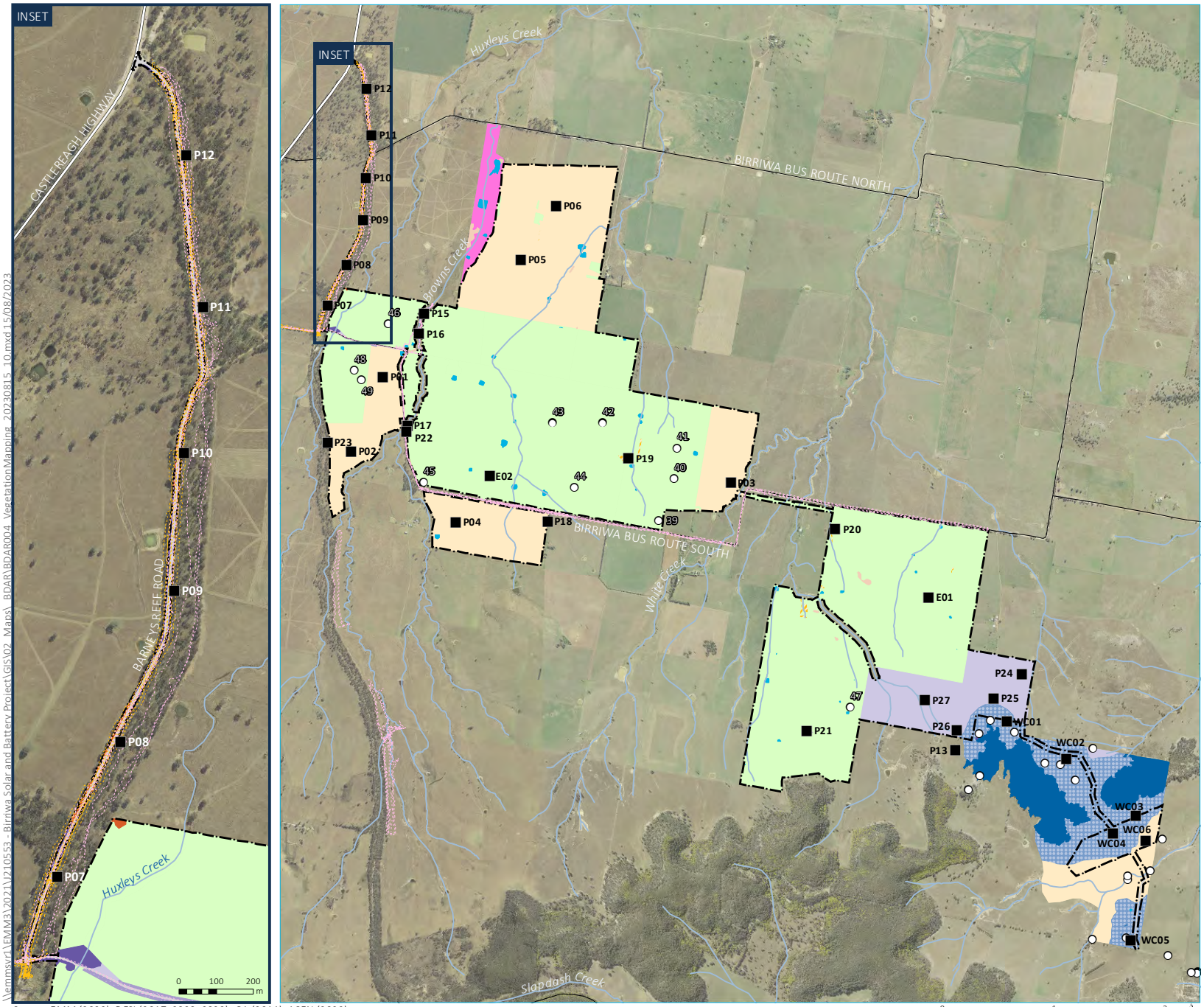
Vegetation type	Vegetation class	Vegetation formation	Percent cleared	Area (ha)
PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	Floodplain Transition Woodlands	Grassy Woodlands	83	76.80
PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Western Slopes Grassy Woodlands	Grassy Woodlands	67	300.46
PCT 479 - Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	Western Slopes Dry Sclerophyll Forests	Dry Sclerophyll Forests	40	28.45
Exotic grassland	-	-	-	776.66
Exotic trees	-	-	-	4.73
Dam	-	-	-	5.02
Cleared	-	-	-	4.39
Total area in hectares (to 2 decimal place)				**1,196.51**

Each PCT recorded within the subject land is represented by multiple vegetation zones. Details for each vegetation zone are summarised in Table 4.4.

Table 4.4 Vegetation zones identified within the subject land along with broad condition state as identified by EMM

Vegetation zone			PCT ID	PCT name	Condition	Extent in subject land	Vegetation integrity score
Road corridor	Solar and BESS project	Accommodation facility and access tracks					
1	1	-	80	Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	High	1.01	95.2
2	2	-			Pasture	75.62	4.6
-	3	-			Poor	0.17	46.2
3	4	-	281	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	High	0.35	99.8
-	5	-			Medium	0.55	58.3
4	6	1			Pasture	293.02	3.6
-	7	-			Planted	2.59	50
-	8	-			Poor	3.95	39
-	9	2	479	Narrow-leaved Ironbark – Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	DNG	28.45	13.2
Total area in hectares (to 2 decimal place)						405.71	-

The PCTs and condition zones are presented in Figure 4.1 with detailed descriptions of each PCT provided in Table 4.5, Table 4.6 and Table 4.7.



\\emmsyr1\EMM3\2021\P210553 - Birriwa Solar and Battery Project\GIS\02_Maps_BDAR\BDAR004_VegetationMapping_20230815_10.mxd 15/08/2023

Source: EMM (2023); DFSI (2017, 2020, 2022); GA (2011); ACEN (2022)

KEY

- Subject land

Targeted flora survey

- September 2021
- December 2021
- Plot location
- Rapid vegetation assessment

Existing environment

- Major road
- Minor road
- Watercourse/drainage line
- Cleared
- Dam
- Exotic (trees, grassland)

PCT 80 | Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

- High
- Poor
- Derived native grassland (DNG)
- Pasture

PCT 281 | Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

- High
- Medium
- Poor
- Pasture
- Planted
- Tussock

PCT 479 | Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion

- High
- Moderate
- Derived native grassland (DNG)

Threatened ecological communities:

- **PCT 281**: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Critically Endangered) (BC Act and EPBC Act)
- **PCT 80**: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions (Endangered) (BC Act)
- **PCT 80 (High; DNG)**: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (Endangered) (EPBC Act)

Plant community types in the subject land and plot/transect locations

Birriwa Solar and Battery Project
Biodiversity Development Assessment Report
Figure 4.1

EMM creating opportunities

Table 4.5 PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

Attribute	Description
PCT ID	80
Common name	Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
Vegetation class	Floodplain Transition Woodlands
Extent within subject land	76.80 hectares (ha), comprising: • high: 1.01 ha (Photograph 4.1) • pasture: 75.26 ha • poor: 0.17 ha.
Survey effort	Plots. 12, 7, 9, 13, 24, 25, 26, 27 and 21
Description and condition	This PCT was identified within the road upgrade corridor in addition to small patches in paddocks and large grasslands to the east of the subject land. The PCT comprises mature Western Grey Box (*Eucalyptus microcarpa*) individuals, which are also likely to have historically occurred within the grassland patches. A number of shrub species occur within this PCT and primarily include *Acacia* spp. in addition to Cough Bush (*Cassinia laevis*), Small-leaf Bluebush (*Maireana microphylla*) and *Solanum chenopodinum* and Narrawa Burr *(Solanum cinereum)*. The groundcover shows signs of disturbance due to current grazing and a moderate exotic species cover. Despite the weed encroachment in vegetation zones, a number of native forbs and grasses persist. These include Hairy Joyweed (*Alternanthera nana*), Yellow Burr Daisy (*Calotis lappulacea*), Swamp Dock (*Rumex brownii*), Slender Rat's Tail Grass (*Sporobolus creber*) and Red Grass (*Bothriochloa decipiens*). Exotic species do occur within the groundcover, including St. Johns Wort (*Hypericum perforatum*), Paspalum (*Paspalum dilatatum*), Bathurst Burr (*Xanthium spinosum*), Saffron Thistle (*Carthamus lanatus*) and Khaki Weed (*Alternanthera pungens*) which are high threat weeds (HTWs). Other common exotic herbaceous species include Flaxleaf Fleabane (*Conyza bonariensis*), Purpletop (*Verbena bonariensis*) and Common Sowthistle (*Sonchus oleraceus*).

Table 4.5 PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

Attribute	Description
Justification of evidence used to identify the PCT	The pasture grasslands of PCT 80 within the subject land have been modified from the original community, whilst woodland remnants occur as intact canopy. Based upon the data contained in BioNet Vegetation Classification database (DPIE 2022), PCT 80 is considered to be the best fit based on: • presence of Western Grey Box (*Eucalyptus microcarpa*) as an indicator species • occurrence on alluvial plains • occurrence in the NSW South Western Slopes IBRA Bioregion and the Inland Slopes subregion • floristic description which reflects the floristic assemblage within the PCT in the subject land including: – Western Grey Box – Small-leaf Bluebush – Cough Bush – Purple Burr-Daisy (*Calotis cuneifolia*) – Corrugated Sida (*Sida corrugata*) – Curly Windmill Grass (*Enteropogon acicularis*) – Oxalis perennans – Yellow Burr-daisy – Rock Fern (*Cheilanthes sieberi*) – Climbing Saltbush (*Einadia nutans*) – Amulla (*Eremophila debilis*) – Knob Sedge (*Carex inversa*) – Kidney Weed (*Dichondra repens*) – Swamp Dock – Purple Wiregrass (*Aristida ramosa*) – Variable Glycine (*Glycine tabacina*) – Tufted Bluebell (*Wahlenbergia communis*) – Stinking Pennywort (*Hydrocotyle laxiflora*).

Table 4.5 PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

Attribute	Description
Status	**BC Act status:** Conforms to the threatened ecological community Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions EEC on the following points (NSW TSSC 2019): • occurs in the NSW South Western Slopes Bioregion on relatively fertile soils of the western slopes and plains of NSW in which *Eucalyptus microcarpa* (Inland Grey Box) dominates • floristic description reflects the floristic assemblage within the PCT in the subject land • occurs in the Mid-western Regional Council LGA. All zones for PCT 80 within the subject land meet the criteria for inclusion as the BC Act listed community. **EPBC Act status:** The EPBC Act Policy Statement for the Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia endangered ecological community (EEC) (DSEWPac 2012) describes the listed community as a woodland or derived native grassland, characterised by a native understorey with a varying proportion of shrubs, grasses and herbs, that is or was historically dominated by Grey Box. To be considered part of the listed community, remnants must also: • be at least 0.5 ha in size • have less than 30% of non-grass weeds cover in the ground layer • where treed, have more than 10% tree cover in a patch (for woodlands). Further criteria apply to woodland and grassland patches, which is described further in Table 7.3. Using the above criteria, the areas mapped PCT 80-high within the subject land meet the criteria for Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC as listed under the EPBC Act (see Table 7.3 for detailed assessment). Due to differences in the results of the vegetation integrity plots within the same PCT 80-pasture vegetation zone, a different vegetation zone (PCT 80-DNG) was delineated based on results of plot data and ecological principles (see Table 7.3); this zone has also been considered to conform to the EPBC listing. The remaining two vegetation zones for this PCT, namely PCT 80-poor and 80-pasture do not meet these criteria.
Estimate of percent cleared value of PCT	83%

Table 4.6 PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Attribute	Description
PCT ID	281
Common name	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
Vegetation class	Western Slopes Grassy Woodlands
Extent within subject land	300.46 hectares (ha), comprising: • high: 0.35 ha (Photograph 4.2) • medium: 0.55 ha • pasture: 293.02 ha (Photograph 4.3) • planted: 2.59 ha • poor: 3.95 ha.
Survey effort	Plots 1–6, 8, 10, 11, 15–20, 22, 23, and WC01.
Description and condition	This PCT was identified within the road upgrade corridor in addition to small patches in paddocks and large grasslands, primarily in the western parts of the subject land associated with flats and drainage lines. The PCT comprises mature Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*Eucalyptus blakelyi*). A number of shrub species occur within this PCT and primarily include *Acacia* spp. in addition to *Cassinia Sifton*, Cough Bush, Amulla (*Eremophila debilis*), Sticky Hop-bush (*Dodonaea viscosa*) and Small-leaf Bluebush. The groundcover shows signs of disturbance due to current grazing and a moderate exotic species cover. Despite the weed encroachment in vegetation zones, a number of native forbs, sedges and grasses persist. These include Hairy Joyweed, Yellow Burr Daisy, Tall Sedge (*Carex appressa*), Swamp Dock, Slender Rat's Tail Grass, Kangaroo Grass (*Themeda triandra*) and *Austrostipa* spp. Exotic species do occur within the groundcover, including St. Johns Wort, Paspalum, Bathurst Burr, Saffron Thistle and Khaki Weed which are HTWs. Other common exotic herbaceous species include Purpletop, *Trifolium* spp., Black-berry Nightshade (*Solanum nigrum*) and Perennial Ryegrass (*Lolium perenne*).

Table 4.6 PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Attribute	Description
Justification of evidence used to identify the PCT	The pasture grasslands of PCT 281 within the subject land have been modified from the original community, whilst woodland remnants occur as intact canopy. Based upon the data contained in BioNet Vegetation Classification database (DPIE 2022), PCT 281 is considered to be the best fit based on: • occurrence within the NSW South Western Slopes IBRA Bioregion and the Inland Slopes subregion • association with valley floors, flats and drainage lines • presence of Yellow Box and Blakely's Red Gum within the subject land • presence of characteristic species described by the database, present within the subject land including: – Rough-barked Apple (*Angophora floribunda*) – Blakely's Red Gum – River Red Gum (*Eucalyptus camaldulensis*) – Yellow Box – Hickory Wattle (*Acacia implexa*) – Sticky Hop-bush – Slender Bamboo Grass (*Austrostipa verticillata*) – Purple Wiregrass – Yellow Burr-daisy – Themeda triandra – Climbing Saltbush – Juncus continuus – Brown's Lovegrass (*Eragrostis brownii*) – Stinking Pennywort – Slender Tick-trefoil (*Desmodium varians*) – Pitted Bluegrass (*Bothriochloa decipiens* var. *decipiens*) – Tall Sedge – *Oncinocalyx betchei* – Weeping Grass (*Microlaena stipoides*) – Nodding Chocolate Lily (*Dichopogon fimbriatus*) – Rock Fern – Stinging Nettle (*Urtica incisa*) – Native Geranium (*Geranium solanderi*) – Twining glycine (*Glycine clandestina*) – Berry Saltbush (*Einadia hastata*) – Oxalis perennans – Bear's Ear (*Cymbonotus lawsonianus*) – *Vittadinia dissecta* – Purple Burr-Daisy.

Table 4.6 PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Attribute	Description
Status	**BC Act status:** PCT 281 within the subject land represents White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions (Box Gum Woodland) CEEC (NSW TSSC 2020) listed under the BC Act as it: • occurs on fertile soils in the NSW South Western Slopes IBRA region, where the subject land is located • is dominated by Yellow Box and Blakely's Red Gum, representative canopy species which occur within the subject land • has an understorey comprising grasses and herbs, which occurs, albeit at low diversity in some vegetation zones within the subject land, which are similar species to the listed floristic description • has a sparse shrub layer. All zones for PCT 281 within the subject land meet the criteria for inclusion as the BC Act listed community. **EPBC Act status:** The EPBC Act Policy Statement for White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands (DEH 2006) describes the listed community (under the EPBC Act) as a woodland or derived native grassland, characterised by a species-rich understorey of native tussock grasses, herbs and scattered shrubs, that is dominated by White Box, Yellow Box and/or Blakely's Red Gum. To be considered part of the listed community, remnants must also: • have a predominantly native understorey (i.e. more than 50% of the perennial ground layer must comprise native species) • be 0.1 ha or greater in size and contain 12 or more native understorey species (excluding grasses), including one or more identified important species, or • be 2 ha or greater in size and have either natural regeneration of the overstorey species or an average of 20 or more mature trees per ha. Using the above criteria, the areas mapped PCT 281-high within the subject land meet the criteria for White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered Ecological Community (CEEC) as listed under the EPBC Act (see Table 7.2 for detailed assessment). All other vegetation zones mapped for PCT 281 do not meet these criteria.
Estimate of percent cleared value of PCT	67%

Table 4.7 PCT 479 - Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion

Attribute	Description
PCT ID	479
Common name	Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion
Vegetation class	Western Slopes Dry Sclerophyll Forests
Extent within subject land	28.45 hectares (ha), comprising: • Derived Native Grassland (DNG): 28.45 ha (Photograph 4.4 and Photograph 4.5).
Survey effort	Plots WC01–WC04.
Description and condition	This PCT was identified within the south east of the subject land, in the location of the proposed accommodation facility and access tracks. In this area of the subject land, the PCT occurs as a large expanse of derived native grassland (DNG), with mid and canopy layer species absent, due to past clearing and ongoing agricultural use. Forested remnants with an intact canopy occur adjacent to and upslope of this vegetation zone (outside of the subject land). These areas contain mature Narrow-leaved Ironbark (*Eucalyptus crebra*), Black Cypress Pine (*Callitris endlicheri*), Dwyer's Red Gum (*Eucalyptus dwyeri*), Mugga Ironbark (*Eucalyptus sideroxylon*) and Red Stringybark (*Eucalyptus macrorhyncha*). Within the subject land itself, the DNG shows signs of disturbance due to current grazing and a moderate exotic species cover. Despite the weed encroachment, a number of native grasses and forbs persist. These include Slender Rat's Tail Grass, Pitted Bluegrass (*Bothriochloa decipiens var. decipiens*), Red Grass (*Bothriochloa decipiens)*, Threeawn Speargrass (*Aristida vagans*), Paddock Lovegrass (*Eragrostis leptostachya*), *Rytidosperma* spp., Brown's Lovegrass (*Eragrostis brownii*), Tall Sedge (*Carex appressa*), and *Dichelachne* spp. Exotic species do occur within the grassland, including Purpletop (*Verbena bonariensis*), *Juncus effusus,* St. Johns Wort (*Hypericum perforatum*), Spear Thistle (*Cirsium vulgare*), *Setaria parviflora*, *Medicago* spp., and Dandelion (*Taraxacum officinale*).
Justification of evidence used to identify the PCT	The DNG of PCT 479 within the subject land has been modified from the original community. Forest remnants occur as intact canopy upslope and downslope of these areas (but outside of the subject land). Based upon the data contained in BioNet Vegetation Classification database (DPIE 2022), PCT 479 is considered to be the best fit based on: • occurrence within the NSW South Western Slopes IBRA Bioregion and the Inland Slopes subregion • association with red-brown loamy clay to sandy loam soils derived from sandstone and siltstone in hill and low hill landforms in northern NSW South Western Slopes (the lithology of this section of the subject land is sandstone, siltstone and mudstone) • presence of Narrow-leaved Ironbark, Black Cypress Pine, Mugga Ironbark and Dwyer's Red Gum in the forest remnants of this community (but outside of the subject land) • presence of characteristic species described by the database, present within the subject land including: – Narrow-leaved Ironbark – Black Cypress Pine – Dwyer's Red Gum – Mugga Ironbark – Red Stringybark – Cassinia spp.

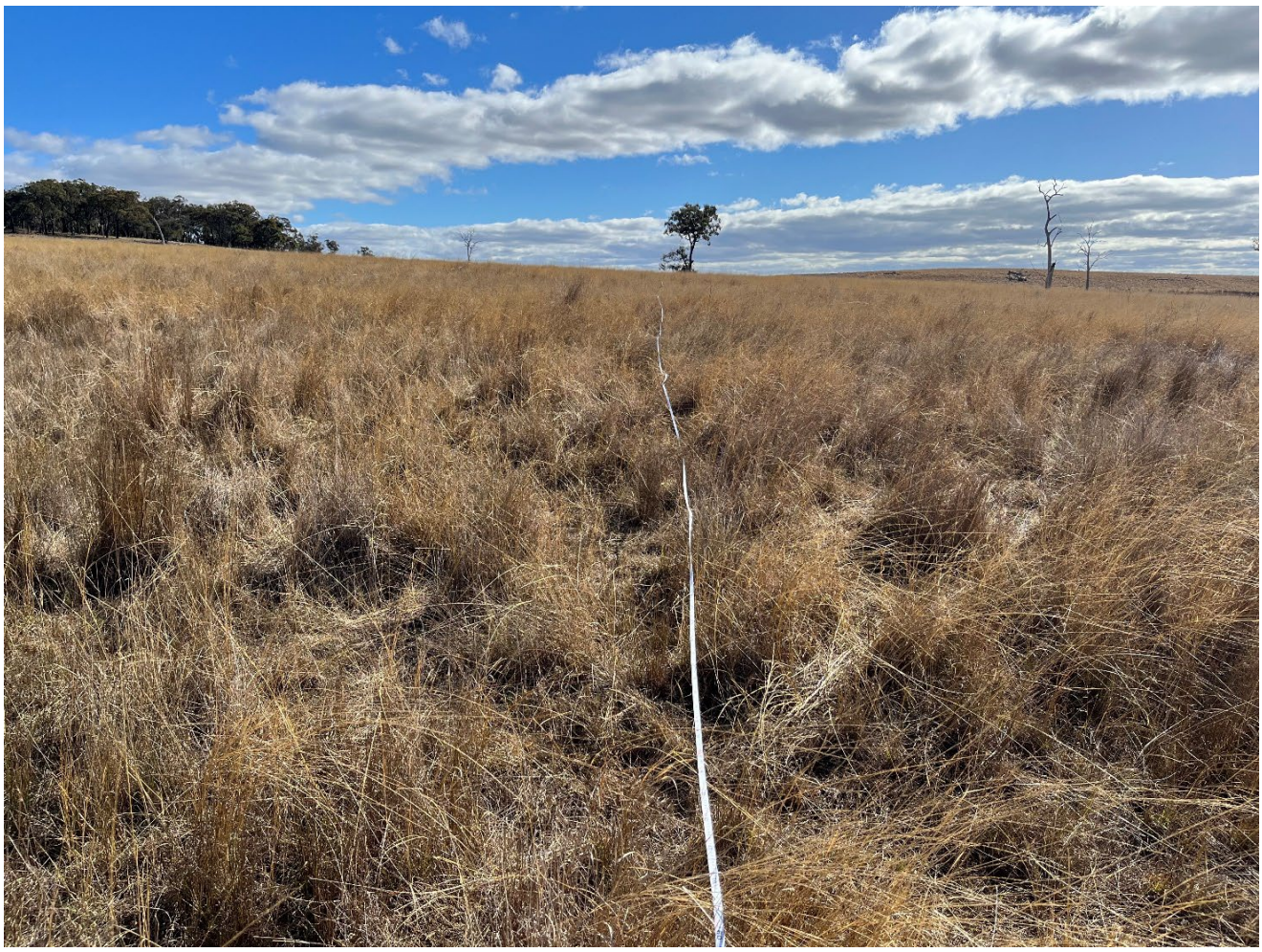
Table 4.7 **PCT 479 - Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion**

Attribute	Description
Status	**BC Act status:** • PCT 479 does not align with any BC Act listed threatened ecological communities. **EPBC Act status:** • PCT 479 does not align with any EPBC Act listed threatened ecological communities.
Estimate of percent cleared value of PCT	40%

Photograph 4.1 **PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion (high condition in road corridor) (plot 7)**

Photograph 4.2 **PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion (high condition in road corridor) (plot 11)**

Photograph 4.3 **PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion (pasture condition) (plot WC06)**



Photograph 4.4 **PCT 479 – Narrow-leaved Ironbark – Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion (DNG condition) (plot WC02)**

Photograph 4.5 **PCT 479 – Narrow-leaved Ironbark – Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion (DNG condition) (view looking northeast from proposed accommodation facility access track across DNG to hill where canopy layer is present, outside of the subject land)**

Table 4.8 Exotic vegetation

Attribute	Description
PCT ID	Not applicable
Common name	Exotic vegetation
Vegetation class	Not applicable
Extent within subject land	Exotic grassland and cropping: 776.66 ha Exotic trees: 4.73 ha
Survey effort	Detailed vegetation mapping was undertaken as described in Section 4.2.1. A spectrum of grassland occurs within study area, ranging from almost entirely exotic to areas where there is a mixture of exotic and native species (albeit at a low diversity). Where a mixture of native and exotic species occurred, these were assigned the most likely PCT and assigned to 'pasture'. Exotic grassland, cropping and areas of exotic trees refer specifically to the areas which are clearly dominated by exotic species. Where the dominant species were exotic, the vegetation zone was mapped within the exotic grassland (lacking a canopy stratum) or exotic trees vegetation zone. Additional plots (EO1 and E02) (Attachment 2 and Attachment 3) and rapid vegetation assessments (RVAs) (Attachment 4) were collected in June and July of 2023 to provide additional detail on the areas mapped as 'exotic vegetation' (Figure 4.1) (Photograph 4.8 and Photograph 4.9).
Description and condition	Exotic vegetation included cropping, exotic grassland, and exotic trees. Cropping includes areas which are either ploughed or sown with crops. No native ground cover species are typically present, and if so, limited to very low coverage. Exotic trees include small stands near to farmsteads, such as Pepper Tree (*Schinus molle* var. *areira*) and Willow (*Salix* sp.) along watercourses. These areas were mapped as exotic, providing any other vegetation were also exotic (i.e. cropping or exotic grassland). Exotic grassland was mapped where exotic grasses and forbs clearly dominate (refer to Photograph 4.6 and Photograph 4.7). Typically, species include Ryegrass (*Lolium* sp), *Phalaris* sp. and Saffron Thistle (*Carthamus lanatus*). Typically, these areas had been ploughed, sown with exotic pasture species, and improved with fertiliser. Native species, where present had a low coverage, diversity and often grazing tolerant. Refer to Photograph 4.10 for an aerial view (drone photography, July 2023) of a section of the exotic dominated grassland/cropped paddocks. The plots collected in this vegetation zone resulted in a combined VI score of 10.4.
Justification of evidence used to identify the PCT	Not applicable
Status	Not listed
Estimate of percent cleared value of PCT	Not applicable

Photograph 4.6 **Exotic Grassland dominated by Saffron Thistle and exotic grass species (2021)**

Photograph 4.7 **Exotic grassland dominated by Perennial Rye (*Lolium perenne*) (2021)**

Photograph 4.8 RVA 39 (July 2023) (Figure 4.1)

Photograph 4.9 RVA 42 (July 2023) (Figure 4.1)

Photograph 4.10 **Aerial view of exotic grassland and cropped paddocks (mapped as 'Exotic') in the north-west of the subject land (drone photography, July 2023)**

5 Threatened species

5.1 Threatened species habitat description

The subject land occurs as a highly fragmented agricultural landscape with intact woodland restricted to the road upgrade corridor, riparian vegetation and small patches and paddocks trees. The land is primarily utilised for agricultural pasture, which has resulted in exotic grassland and native pasture dominating the subject land. These grasslands have limited native diversity and lack habitat features such as hollow logs and rocky areas. The grasslands do contain a small number of isolated paddock trees which contain hollows and are likely to provide refuge to bird species which might traverse these grasslands.

Areas of remnant vegetation in high and moderate condition contain a moderate level of fallen timber and litter cover. The roadside vegetation comprises mature trees which provide suitable small to large hollows for arboreal mammals and large bird species such as cockatoo and owl species. No large raptor nests were observed within the subject land during the habitat assessment. The remnant roadside vegetation within and immediately adjacent the subject land is also likely to provide foraging habitat for many species including birds and arboreal mammals.

Waterways within the subject land are highly degraded due to historical and current agricultural practices and are limited to a series of isolated online dams. These dams lack riparian vegetation and have high turbidity and sediment load due to stock access. Where waterways are connected within the subject land, a highly eroded gully occurs due to the apparent sandy substrate associated with the landscape. These gullies are very shallow and are disconnected by man-made weirs and roads. These waterways are unlikely to provide habitat for threatened fish species.

5.2 Ecosystem credit species

In accordance with Step 3 (Section 5.2.3 of BAM, DPIE 2020), an assessment of habitat constraints and microhabitats was undertaken in the field to determine the suitability of habitat within the subject land for:

- predicted species (ecosystem credit species associated with recorded PCTs, predicted by the Biodiversity Assessment Method Calculator – BAMC).

Ecosystem credits species are threatened species that can be reliably predicted to use an area of land based on habitat surrogates. For the purposes of the BAM (DPIE 2020), ecosystem credit species are deemed to be offset through the habitat surrogates (PCTs) in which they occur.

A list of ecosystem credit species predicted to occur within the subject land, based on the PCTs present and generated by the calculator associated within the BAM (DPIE 2020) is provided in Table 5.1. The potential for these species to occur within the subject land was assessed in accordance with Section 5.2.2 of the BAM (DPIE 2020).

Table 5.1 Assessment of ecosystem credit species within the subject land

Scientific name	Common name	Sensitivity to gain class	Justification for exclusion
Anthochaera phrygia	Regent Honeyeater (Foraging)	High	Excluded from cleared vegetation zones (condition class pasture and DNG).
Artamus cyanopterus	Dusky Woodswallow	Moderate	Excluded from cleared vegetation zones (condition class pasture and DNG).
Callocephalon fimbriatum	Gang-gang Cockatoo (Foraging)	Moderate	Excluded from cleared vegetation zones (condition class pasture).
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	High	Excluded no trees from the Casuarinaceae (Sheoaks) family were recorded within the subject land which is their primary food source (As per habitat constraint).
Certhionyx variegatus	Pied Honeyeater	Moderate	Not excluded.
Chalinolobus picatus	Little Pied Bat	High	Not excluded.
Chthonicola sagittata	Speckled Warbler	High	Not excluded.
Circus assimilis	Spotted Harrier	Moderate	Not excluded.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	High	Excluded from cleared vegetation zones (condition class pasture and DNG).
Daphoenositta chrysoptera	Varied Sittella	Moderate	Excluded from cleared vegetation zones (condition class pasture and DNG).
Dasyurus maculatus	Spotted-tailed Quoll	High	Excluded from cleared vegetation zones (condition class pasture and DNG).
Falco subniger	Black Falcon	Moderate	Not excluded.
Glossopsitta pusilla	Little Lorikeet	High	Excluded from cleared vegetation zones (condition class pasture and DNG).
Grantiella picta	Painted Honeyeater	Moderate	Excluded from cleared vegetation zones (condition class pasture and DNG).
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)	High	Not excluded.
Hieraaetus morphnoides	Little Eagle (Foraging)	Moderate	Not excluded.
Hirundapus caudacutus	White-throated Needletail	High	Not excluded.
Lathamus discolor	Swift Parrot (Foraging)	Moderate	Excluded from cleared vegetation zones (condition class pasture and DNG).
Lophochroa leadbeateri	Major Mitchell's Cockatoo (Foraging)	Moderate	Not excluded.

Table 5.1 Assessment of ecosystem credit species within the subject land

Scientific name	Common name	Sensitivity to gain class	Justification for exclusion
Lophoictinia isura	Square-tailed Kite (Foraging)	Moderate	Not excluded.
Melanodryas cucullata	Hooded Robin (south-eastern form)	Moderate	Excluded from cleared vegetation zones (condition class pasture and DNG).
Melithreptus gularis	Black-chinned Honeyeater (eastern subspecies)	Moderate	Excluded from cleared vegetation zones (condition class pasture and DNG).
Miniopterus orianae oceanensis	Large Bent-winged Bat (Foraging)	High	Not excluded.
Neophema pulchella	Turquoise Parrot	High	Not excluded.
Ninox connivens	Barking Owl (Foraging)	High	Not excluded.
Ninox strenua	Powerful Owl (Foraging)	High	Not excluded.
Nyctophilus corbeni	Corben's Long-eared Bat	High	Not excluded.
Pachycephala inornata	Gilbert's Whistler	Moderate	Excluded from cleared vegetation zones (condition class pasture and DNG).
Petroica boodang	Scarlet Robin	Moderate	Not excluded.
Petroica phoenicea	Flame Robin	Moderate	Not excluded.
Polytelis swainsonii	Superb Parrot (Foraging)	Moderate	Not excluded.
Pomatostomus temporalis	Grey-crowned Babbler (eastern subspecies)	Moderate	Excluded from cleared vegetation zones (condition class pasture and DNG).
Pteropus poliocephalus	Grey-headed Flying-fox (Foraging)	High	Excluded from cleared vegetation zones (condition class pasture and DNG).
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	High	Not excluded.
Stagonopleura guttata	Diamond Firetail	Moderate	Not excluded.
Tyto novaehollandiae	Masked Owl (Foraging)	High	Not excluded.
Varanus rosenbergi	Rosenberg's Goanna	High	Excluded. Geographic limitations include south-east of a line that runs between Tarcutta and Galong. Birriwa is located approximately 280 km north of Galong.

5.3 Species credit species

5.3.1 Candidate species assessment

In accordance with Step 3 (Section 5.2.3 of BAM (DPIE 2020)), an assessment of habitat constraints and microhabitats was undertaken in the field to determine the suitability of habitat within the subject land for:

- candidate species (species credit species associated with specific geographic and landscape feature constraints).

Candidate species predicted by the BAMC are shown in Table 5.2. An assessment of the geographic and landscape constraints has been provided for each species, with a justification provided where species have been excluded, in accordance with Steps 1 to 3 (Section 5.2.1 to 5.2.3) of the BAM (DPIE 2020).

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
Acacia ausfeldii	Ausfeld's Wattle	Footslopes and low rises on sandstone.	Yes	N/A	Yes. Footslopes and low rises within the subject land.
Anthochaera phrygia	Regent Honeyeater (Breeding)	As per Important Habitat Map	No	N/A	No. The subject land is not within mapped important habitat.
Aprasia parapulchella	Pink-tailed Legless Lizard	Rocky areas, or within 50 m of rocky areas.	No	N/A	No. Rocky areas are absent from the subject land.
Austrostipa wakoolica	*A spear-grass*	Alluvial plains and plains. West of Cowra.	No	N/A	No. Whilst alluvial plains and plains are within the subject land, it is north-east of Cowra.
Burhinus grallarius	Bush Stone-curlew	Fallen/standing dead timber including logs.	Yes	No	Yes. The subject land contains some open areas of Box Gum Woodland with fallen timber.
Caladenia arenaria	Sand-hill Spider Orchid	N/A	N/A	N/A	No. The species occurs in woodland with sandy soil, especially that dominated by White Cypress Pine (*Callitris glaucophylla*) (BCS 2022a). PlantNET states the species grows in sclerophyll forest and on sandhills, usually under Callitris; south from Mudgee district (PlantNET 2022). Callitris is largely absent from the subject land and no sand hill habitat is present, therefore it is considered that suitable microhabitats are absent.
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	Eucalypt tree species with hollows at least 3 m above the ground and with hollow diameter of 7 cm or larger	Yes	No	No. Although the subject land contains eucalypts with hollows greater than 7 cm diameter, breeding for the Gang-gang Cockatoo usually occurs between October and January (Summer) where they primarily inhabit mature, wet sclerophyll forests at higher altitudes (DAWE 2022c). As the species breeds in higher altitudes associated with tall mountain forests breeding habitat is not considered to occur within the subject land.

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
Calyptorhynchus lathami	Glossy Black-Cockatoo (Breeding)	Living or dead tree with hollows greater than 15 cm diameter and greater than 5 m above ground.	Yes	No	Yes. Suitable hollows within the study area.
Cercartetus nanus	Eastern Pygmy-possum	N/A	N/A	No	Yes. Found in a broad range of habitats, usually with a complex midstorey. The habitat in the subject land is considered marginal and there are no recent records within proximity to the subject land. Roadside vegetation with tree and some shrub cover is considered marginal habitat for the species. However, a precautionary assessment has been undertaken and the species has been included as a candidate species. Potential to occur in PCTs 80 and PCT 281, excluding areas lacking tree or shrub cover.
Chalinolobus dwyeri	Large-eared Pied Bat	Cliffs; within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.[1]	Yes	No	Yes. Cliffs and rocky areas occur less than 2 km south of the subject land associated with the ridgeline south of the subject land. There will be no direct disturbance to these potential breeding and roosting areas. In accordance with the BAMC, NSW BioNet Threatened Biodiversity Data Collection (TBDC) and '*Species credit' threatened bats and their habitat: NSW survey guide for the Biodiversity Assessment Method* (OEH 2018), a 2 km buffer has been applied to the identified ridgeline to determine native vegetation that would represent potential foraging/hunting habitat for the species. It is considered unlikely that the species would hunt in the small and isolated patches of woodland within the subject land that are intersected by the 2 km buffer from the ridgeline (refer Figure 6.2). This is because the woodland patches are very small and separated from the identified roosting/breeding habitat (the ridgeline outside of the subject land) by vast areas of predominantly exotic pasture. However, the small and isolated woodland patches within the 2 km buffer have been included conservatively, as species polygon.

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
					Therefore, the species polygon for potential foraging/hunting habitat for the Large-eared Pied Bat includes PCTs 281_Planted, 281_Poor and 80_Poor within the subject land. PCT 80_Pasture has been excluded as it is considered degraded in accordance with Section 5.2.3 (2) (a) of the BAM (DPIE 2020), and Section 2.3 of '*Species credit' threatened bats and their habitat: NSW survey guide for the Biodiversity Assessment Method* (OEH 2018), as follows: • The TBDC describes the following for the species habitat and ecology: 1. 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. 2. Found in well-timbered areas containing gullies. 3. The relatively short, broad wing combined with the low weight per unit area of wing indicates manoeuvrable flight. This species probably forages for small, flying insects below the forest canopy. • The habitat and micro habitats on which the species depend are sufficiently degraded such that the species is unlikely to use the PCT 80_Pasture within the subject land. This vegetation zone has a VI score of 4.8 with the following attribute scores recorded across the five plots in this zone: – Trees: composition of 0 and 0% cover. – Shrubs: composition of 0 and 0% cover. – Stem classes: absent across all classes. – Hollow-bearing tree: absent.

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
					• These scores demonstrate that the microhabitats required by the species are absent from PCT 80_Pasture in the subject land (there are no trees and shrubs), and that the habitat is degraded to the point that the species is unlikely to use PCT 80_Pasture in the subject land as foraging/hunting habitat. There is no potential breeding habitat within the subject land, or within 100 m of the subject land, therefore there will be no impact to breeding habitat for the species.
Crinia sloanei	Sloanes Froglet	Semi-permanent/ ephemeral wet areas, containing relatively shallow sections with submergent and emergent vegetation, or within 500 m of wet area. Within 500 m of swamps and waterbodies.	No	No	No. The subject land contains the habitat constraints however the habitat is degraded. The subject land does not support permanent streams, with all waterways declining to disconnected man-made dams during low flow. The subject land does not provide suitable habitat for this species. The subject land is east of the species known distribution. The species is also known to have contracted in range further compared to historical records. There are no recent records of the species within proximity to the subject land.
Dichanthium setosum	Bluegrass	N/A	N/A	N/A	Yes. Potential habitat in within the subject land.
Diuris tricolor	Pine Donkey Orchid	N/A	N/A	N/A	Yes. Potential habitat in derived native grassland and woodland areas with a predominantly native groundcover of PCT 80 and 281.
Euphrasia arguta	-	-	-	-	Yes. Suitable habitat present.

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	Living or dead mature trees within suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines.			Yes. The subject land contains ephemeral creeks but is greater than 1 km from major rivers, creeks, wetlands. Potential nest trees within study area and subject land.
Hieraaetus morphnoides	Little Eagle (Breeding)	Nest trees – live (occasionally dead) large old trees within vegetation.			Yes. Potential nest trees within study area and subject land.
Lathamus discolor	Swift Parrot (Breeding)	As per Important Habitat Map.			No. The subject land is not within mapped important habitat.
Litoria booroolongensis	Booroolong Frog	N/A			No. Habitat degraded. The subject land does not support permanent streams, with all waterways declining to disconnected man-made dams during low flow. Further, waterways within the subject land do not support cobble banks or other rock substrate along stream margins that would provide breeding habitat for this species. The subject land does not provide suitable habitat for this species.
Lophochroa leadbeateri	Major Mitchell's Cockatoo (Breeding)	Hollow bearing trees. Living or dead tree with hollows greater than 10 cm diameter.			Yes. Suitable hollows within the study area.
Lophoictinia isura	Square-tailed Kite (Breeding)	Nest trees.			Yes. Suitable potential nest trees within the subject land.

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	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.[1]			No. The required habitat constraints are absent from the subject land. No caves, tunnels, culverts or other structure known or suspected to be used for breeding were identified within the subject land, or within 100 m of the subject land.
Ninox connivens	Barking Owl (Breeding)	Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.	Yes	No	Yes. The subject land contains living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.
Ninox strenua	Powerful Owl (Breeding)	Living or dead trees with hollow greater than 20 cm diameter.	Yes	No	Yes. The subject land contains living or dead trees with hollow greater than 20 cm diameter.
Persoonia marginata	Clandulla Geebung	N/A	N/A	N/A	No. Habitat degraded (Section 5.2.3 (2)(a)(ii) of the BAM). This species grows in dry sclerophyll forest and woodland communities on sandstone (BCS 2022a). It may initially respond favourably to disturbance, with greater densities found along the edges of tracks and in areas disturbed by forestry activities (BCS 2022a). In the subject land, this species is associated with PCT 479 only (southeast section of the subject land). However, PCT 479 within the subject land has been historically cleared and is used for grazing, consisting of DNG, with no shrub species present.

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
Petaurus norfolcensis	Squirrel Glider	N/A	N/A	No	Yes. The subject land supports forests and woodlands dominated by Box species, including a shrubby or *Acacia* spp. dominated midstorey in some vegetation zones. Species was considered likely to occur in all PCTs excluding areas lacking tree cover.
Petaurus norfolcensis - endangered population	Squirrel Glider in the Wagga Wagga Local Government Area	Wagga Wagga LGA			No. Subject land not located within the Wagga Wagga LGA.
Petrogale penicillata	Brush-tailed Rock-wallaby	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines.			No. Habitat degraded. Despite the subject land being located within 1 km of the ridgeline to the south-east, the species is unlikely to utilise the pastures or native woodland patches surrounding this ridgeline due to the isolated and degraded condition of these vegetation zones within the subject land. This habitat is highly fragmented and does not provide suitably connected foraging habitat.
Phascogale tapoatafa	Brush-tailed Phascogale	North of Hwy from Ulan to Gulgong, North of Hwy East from Gulgong to Wellington, N/NW of highway from Wellington to Molong, W/NW of Hwy from Molong to Forbes.	N/A	No	Yes. Subject land contains suitable habitat.

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
Phascolarctos cinereus	Koala (Breeding)	Important' habitat (however this is not a mapped important habitat area), defined by the density of koalas and quality of habitat determined by on-site survey.	Yes	No	Yes. Subject land contains suitable habitat.
Polytelis swainsonii	Superb Parrot (Breeding)	Living or dead *E. blakelyi, E. melliodora, E. albens, E. camaldulensis, E. microcarpa, E. polyanthemos, E. mannifera, E. intertexta* with hollows greater than 5 cm diameter; greater than 4 m above ground or trees with a DBH of greater than 30 cm.	Yes	Yes	Yes. Subject land contains suitable habitat.

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
Pomaderris cotoneaster	Cotoneaster Pomaderris	East of Tumut.	Yes	N/A	No. The subject land is east of Tumut, meeting the geographic limitation. However, habitat is degraded (Section 5.2.3 (2)(a)(ii) of the BAM). BCS (2022a) reports that Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs (BCS 2022a). Of the PCTs that occur in the subject land, this species is associated with PCT 281 only. The majority of PCT 281 within the subject land is pasture, that has been historically cleared and is used for grazing and cropping, with no shrub or canopy species present. Therefore, there is no habitat for this species in the pasture. There are smaller and relatively intact areas of PCT 281 that are in high condition along Barneys Reef Road reserve (0.35 ha). In addition, there are smaller mapped patches as scattered trees in paddocks: Medium (0.55 ha), Planted (2.59 ha) and Poor (3.95 ha) that are in lower condition than the road corridor. Regardless, the patches of PCT 281 mapped in the subject land do not meet the habitat description of 'deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs' (BCS 2022a). The TBDC shows habitat photos for this species as rocky creek sides in gullies. The habitat features do not occur in the subject land.
Prasophyllum petilum	Tarengo Leek Orchid	East of Binalong, south and east of Boorowa.	-	-	Yes. Subject land is east of Binalong, south and east of Boorowa, and contains suitable habitat.
Prasophyllum sp. Wybong	-	-	-	-	Yes. Subject land contains suitable habitat.
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	Breeding camps	No	No	No. No breeding camps occur within the subject land.
Swainsona sericea	Silky Swainson-pea	N/A	N/A	N/A	Yes. Species is associated with Box Gum Woodland, which occurs on the subject land.

Table 5.2 Candidate threatened species assessment

Step 1 – Identify threatened species for assessment		Step 2 – Assessment of habitat constraints and vagrant species			Step 3 – Identify candidate species for further assessment
Scientific name	**Common name**	**Habitat/geographic constraints**	**Constraint present in subject land?**	**Vagrant species?**	**Candidate species (yes/no) and rationale**
Tylophora linearis	-	N/A	N/A	N/A	No. Habitat degraded (Section 5.2.3 (2)(a)(ii) of the BAM). This species grows in dry scrub and open forest. It is recorded from low-altitude sedimentary flats in dry woodlands of *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, Callitris endlicheri, Callitris glaucophylla* and *Allocasuarina luehmannii* (BCS 2022a). This species also grows in association with *Acacia hakeoides, Acacia lineata, Melaleuca uncinata, Myoporum* and *Casuarina* species (BCS 2022a). In the subject land, this species is associated with PCT 479 (southeast section of the subject land). Canopy species associated with *Tylophora linearis,* namely *Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus albens, and Callitris endlicheri,* occur in the forested slopes well outside of the subject land and may provide habitat. However, PCT 479 within the subject land has been historically cleared and is used for grazing, consisting of DNG, with no tree or shrub species present, and no potential habitat for this species.
Tyto novaehollandiae	Masked Owl (Breeding)	Hollow bearing trees Living or dead trees with hollows greater than 20 cm diameter.	-	-	Yes. The subject land contains living or dead trees with hollow greater than 20 cm diameters.

5.3.2 Candidate species credit species requiring further assessment

Following on from the assessment in Table 5.2, the candidate species requiring further assessment are listed in Table 5.3.

Table 5.3 Candidate species credit species requiring further assessment

Scientific name	Common name	EPBC Act listing	BC Act listing	Flora or fauna
Acacia ausfeldii	Ausfeld's Wattle	-	V	Flora
Burhinus grallarius	Bush-stone Curlew	-	E	Fauna
Calyptorhynchus lathami	Glossy Black Cockatoo	-	V	Fauna
Cercartetus nanus	Eastern Pygmy possum	-	V	Fauna
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Fauna – foraging habitat assumed present
Dichanthium setosum	Bluegrass	V	V	Flora
Diuris tricolor	Pine Donkey Orchid	-	V	Flora
Euphrasia arguta	-	CE	CE	Flora
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	Ma	Fauna
Hieraaetus morphnoides	Little Eagle	-	V	Fauna
Lophochroa leadbeateri	Major Mitchells Cockatoo	-	V	Fauna
Lophoictinia isura	Square-tailed Kite	-	V	Fauna
Ninox connivens	Barking Owl	-	V	Fauna
Ninox strenua	Powerful Owl	-	V	Fauna
Petaurus norfolcensis	Squirrel Glider	-	V	Fauna
Phascogale tapoatafa	Brush-tailed Phascogale	-	V	Fauna
Phascolarctos cinereus	Koala	E	V	Fauna
Polytelis swainsonii	Superb Parrot	V	V	Fauna
Prasophyllum petilum	Tarengo Leek Orchid	E	E	Flora
Prasophyllum sp. Wybong	-	CE	-	Flora
Swainsona sericea	Silky Swainson-pea	-	V	Flora
Tyto novaehollandiae	Masked Owl	-	V	Fauna

V= Vulnerable; E= Endangered; CE= Critically Endangered; Ma= Marine

One bat species which requires survey as per Table 5.3 has been assumed as present, and subsequently retained in the BAMC within suitable habitat or via species polygons (refer to Section 5.3.4). In addition, presence has been assumed for Superb Parrot (*Polytelis swainsonii*) in some small areas of the subject land that were not surveyed for this species, due to project timing constraints of the amendment report.

5.3.3 Targeted survey methods

i Targeted flora surveys

Targeted flora searches were conducted in accordance with *Surveying threatened plants and their habitats- NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020).

Parallel field traverses were conducted at a spacing of 10 m across the subject land, in accordance with the requirements outlined by DPIE (2020). The high condition woodland occurs as an open woodland, therefore meeting the 10 m spacing requirement in DPIE (2020) for open vegetation and groundcover species. The traverses were undertaken on 20 to 24 September 2021, and 14 to 17 December 2021.This meets the survey timing requirements for the target species (Table 5.4). All traverses were recorded using a global positioning system (GPS) and are shown in Figure 4.1 and Figure 5.1. Survey effort totalled 59.9 km in September and 33.9 km in December. In the September survey effort one GPS unit malfunctioned, with no track recorded for one person. The adjacent person's GPS was duplicated for purposes of calculating field effort. The reduced survey effort in December was due to reductions of the study area due to project design changes.

The closest known reference sites were checked for species with a short or variable flowering period, with Pine Donkey orchid (*Diuris tricolor*) surveyed near Muswellbrook, and Silky Swainson-pea (*Swainsonia sericea*) near Mudgee. Both reference populations were detected in flower on 20 and 21 September 2021 respectively, validating the targeted flora surveys within the study area.

The flora surveys were focused in areas of PCT 80 and PCT 281 in high condition, where native species richness was typically high. In addition, surveys were also conducted along both road verges of Birriwa Bus Route South and Barney Reef Road (Figure 4.1 and Figure 5.1). This included several sections now excluded from the project following refinements. Road verges were selected for survey as they were of higher habitat quality than the adjacent pastures and cropped areas. While the road verges remain highly disturbed and dominated by exotic species, there were patches of native grasses and forbs. The verges are also fenced therefore less heavily grazed than the pastures and not subjected to regular tilling/ploughing and improvement by fertiliser. As such, these areas have the potential to act as refuges for threatened flora and considered as having potential habitat to support disturbance tolerant species such as Bluegrass (*Dichanthium setosum*).

Targeted flora surveys were also conducted in an area of derived native grassland, between Barneys Reef Road and Brown Creek (refer to transect shown in the south-east of Figure 4.1). These areas were selected based on their higher native component than other pasture areas, owing to its proximity to woodland and less agricultural management, with Brown Creek acting as a natural (partial) barrier to livestock and management. This area was subsequently avoided during the project refinement and avoidance process.

The aim of selecting high condition and moderately disturbed habitats, was to maximise the chances of detecting threatened flora. If any threatened species were recorded, targeted surveys would be expanded (including into lower quality habitat) to determine the extent of the population. Targeted surveys were not conducted on areas of exotic grassland or areas of PCT 80 Pasture or PCT 281 Pasture (Photograph 5.1 and Photograph 5.2). These areas had a low native species diversity, dominated by grazing tolerant grasses and sown species. Agricultural practices included tilling/ploughing, improvement with fertiliser, hay making and livestock grazing. This has altered the original PCT irrevocably and were considered unsuitable habitat for threatened flora species, including those disturbance tolerant species, especially given that no threatened species were recorded in higher condition habitats (refer to Section 5.3.4). There were also no known populations of threatened flora species adjacent to the study area, reducing the chance of local dispersal into the study area.

The boundaries between PCT 281 and PCT 81 are not disjunct with an ecotone occurring. Given this, and the similar groundcover species and disturbance characteristics, a conservative approach was undertaken for species associations. For example, Pine Donkey Orchid is aligned with PCT 81 and not 281. Rather than limit survey to just PCT 81 it was surveyed for in both PCTs.

Photograph 5.1 **Pasture grassland taken 21 September 2021**

Photograph 5.2 **Pasture grassland taken 13 April 2022**

Table 5.4 Targeted flora survey method

Scientific name	Common name	Recommended survey period (BioNet TBDC/BAMC)	Survey date
Acacia ausfeldii	Ausfeld's Wattle	August–October	20–24 September 2021
Dichanthium setosum	Bluegrass	November–May	14–17 December 2021
Diuris tricolor	Pine Donkey Orchid	September–October	20–24 September 2021
Euphrasia arguta	–	November–March	14–17 December 2021
Prasophyllum petilum	Tarengo Leek Orchid	September–December	20–24 September 2021
Prasophyllum sp. Wybong	–	September–October	20–24 September 2021
Swainsona sericea	Silky Swainson-pea	September–November	20–24 September 2021

ii Targeted fauna surveys

Targeted fauna surveys were undertaken over 39 days between 20 September 2021 to 7 January 2022. Survey methods and effort for all fauna species targeted are summarised in Table 5.5, and are further discussed for each fauna group below. Fauna survey locations are illustrated in Figure 5.1.

Table 5.5 Targeted fauna survey method

Target species group	Target species	Survey method	Recommended survey period (TBDC/BAMC)	Survey timing
Arboreal mammals	Squirrel Glider (*Petaurus norfolcensis*)	• Arboreal trapping; 40 traps 4 nights. • Spotlighting. • Camera trapping-incidental.	Year round	20–24 September 2021; 11–14 January 2022.
	Brush-tailed Phascogale (*Phascogale tapoatafa*)	• Arboreal trapping. • Camera trapping. • Spotlighting.	December to June	20–24 September 2021; 14–17 December 2021; 11–14 January 2022.
	Eastern Pygmy Possum (*Cercartetus nanus*)	• Camera trapping. • Spotlighting.	October to March	14–17 December 2021; 11–14 January 2022.
	Koala (*Phascolarctos cinereus*)	• Spotlighting. • Dog detection surveys.	Year round	11–14 January 2022; 3–5 May 2022.
Diurnal birds	Glossy Black Cockatoo (*Calyptorhynchus lathami*)	• Transect and area searches. • Targeted nest surveys.	January to September	20–24 September 2021.
	Major Mitchells Cockatoo (*Lophochroa leadbeateri*)		September to December	
	White-bellied Sea-Eagle (*Haliaeetus leucogaster*)		July to December	

Table 5.5 Targeted fauna survey method

Target species group	Target species	Survey method	Recommended survey period (TBDC/BAMC)	Survey timing
	Little Eagle (*Hieraaetus morphnoides*)		August to October	
	Square-tailed Kite (*Lophoictinia isura*)		September to January	
	Superb Parrot (*Polytelis swainsonii*)		September to November	
Nocturnal birds	Bush-stone Curlew (*Burhinus grallarius*)	• Call playback.	Year-round	11–14 January 2022.
	Powerful Owl (*Ninox strenua*) Masked Owl (*Tyto novaehollandiae)*	• Call playback. • Targeted hollow surveys (habitat assessment, stag watch).	May-August	26–30 June 2023; 17–21 July 2023.
	Barking Owl (*Ninox connivens*)	• Call playback. • Targeted hollow surveys (habitat assessment, stag watch).	May-December	26–30 June 2023; 17–21 July 2023.

a Arboreal mammals

Arboreal mammal surveys were undertaken for the following species:

- Squirrel Glider
- Brush-tailed Phascogale
- Eastern Pygmy possum
- Koala.

Methods and survey effort have been developed in accordance with DEC (2004), DSEWPaC (2011) and Phillips and Callaghan (2011) for the Koala. Methods and survey effort is outlined in Table 5.6.

Table 5.6 Methods and survey effort – arboreal mammals

Method	Survey description	Survey effort
Arboreal trapping	Forty Elliot B traps were placed at 2 m above the ground. Where possible, traps were placed at least 50 m apart on suitable trees within and adjacent to the subject land: • traps were baited with a mixture of peanut butter, rolled oats and honey • a mixture of water and honey was sprayed on each tree trunk • traps were checked early in the morning and closed for the day • traps were re-opened and rebaited in the late afternoon.	DEC (2004) requires 24 trap nights over 3–4 consecutive days per 50 ha of stratification unit, with replication for every additional 100 ha. Based on the above stratification units, this would equate to a minimum survey effort of 72 trap nights. Due to the small size of stratification units within the subject land and isolated nature of each vegetation zone, traps were placed in suitable habitat within and adjacent to the subject land. This included the road upgrade corridor and connected vegetation which extends outside of the subject land. Surveys were undertaken within the subject land and adjacent habitat over 4 nights, equating to 160 trap nights. The minimum survey effort was exceeded.
Spotlighting	Spotlight surveys were undertaken using handheld LED spotlights and included: • 2 km transects were undertaken by two observers (4 km total transect length). • Observers moved at a speed of less than 1 km per hour (i.e. one hour for the 1 km transect) scanning vegetation and trees for animals using both spotlights.	DSEWPaC (2011) recommends two parallel transects per 5 ha site, while DEC (2004) recommends two transects per 200 ha of stratification unit, repeated across two nights. In line with DSEWPaC (2011) and DEC (2004), a survey effort of two transects was undertaken within and immediately adjacent to suitable habitat within the subject land. Three transects (2 km minimum distance) were completed across 3 nights, totalling 6 km in length.
Camera trapping	Ten arboreal camera traps were placed in areas of high condition woodland where the species is most likely to occur. The camera traps were placed on suitable trees within and adjacent to the subject land: • traps were baited with a mixture of peanut butter, rolled oats and honey • a mixture of water and honey was sprayed on each tree trunk.	DEC (2004) has not described camera trapping survey effort. The threatened biodiversity profile data collection (TBDC) states that for the Brush-tailed phascogale survey effort must be undertaken using baited cameras: • A baited canister with small holes and capped at either end, to limit bait theft by other species, or honey-water, sprayed very liberally in front of each camera. Cameras should be set at head height, or above, facing the branch or tree trunk where a honey-based bait has been placed. • Cameras must remain in place for a minimum of 4 weeks with cameras checked and baits replaced after 2 weeks. • A minimum of 4 cameras, independent of the size of the subject land, must be used for sites up to 1 ha, then an additional 2 cameras for every ha of potential habitat thereafter. For 1.36 ha of suitable habitat within the subject land, this equates to 168 camera trap nights. As per the arboreal trapping, cameras were placed in suitable habitat within and adjacent to the subject land. This included roadside and connected vegetation which extends outside of the subject land. A total of 10 arboreal camera traps were installed across the study area over 28 nights, equalling a total of 280 camera trap nights. The minimum survey effort was exceeded.

Table 5.6 Methods and survey effort – arboreal mammals

Method	Survey description	Survey effort
Koala detection dogs	A field detection dog was used to detect Koala scats, comprising the following method: • A handheld GPS unit was used to record scat locations. Tracks were also recorded. • The dog was led through the study area where suitable habitat for the Koala occurs. • Qualified dog detection professionals were used to complete the surveys (Tate Animals).	One handler and one dog over two days.

b Diurnal birds

Diurnal bird surveys were undertaken for the following species:

- Glossy Black Cockatoo
- Major Mitchells Cockatoo
- White-bellied Sea Eagle
- Little Eagle
- Square-tailed Kite
- Superb Parrot.

Bird survey methods and survey effort have been developed in accordance with DEC (2004) and DSEWPaC (2010) guidelines. Methods include a mix of transect and area searches, to record bird activity, and targeted nest and hollow surveys. Methods and survey effort are outlined in Table 5.7.

Table 5.7 Methods and survey effort – diurnal birds

Method	Survey description	Survey effort
Transect and area searches	• Land based areas searches and transects. • Surveyors walked transect and conducted area searches within and immediately adjacent to the subject land. • All calls and habitat features were investigated.	DEC (2004) has not resolved bird survey requirements and does not provide guidance on survey effort. For the Glossy Black Cockatoo and Major Mitchell's Cockatoo, the TBCD outlines that signs of breeding should be assessed (begging birds of any age or sex, lone individuals identified during the breeding season or an occupied nest). If these are observed, potential nest trees should be identified. For the raptor species, the TBCD outlines that breeding habitat may constitute 'live' (occasionally dead) large old trees within suitable vegetation and the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy. For the Superb Parrot, the TBDC states that breeding habitat can be identified by the presence of habitat features and observed nest, or two or more birds seen on site. DSEWPaC (2010) was reviewed, and sympatric species survey efforts indicated a requirement for 12 hours over 4 days (3 hours per day) for sites less than 50 ha. No survey effort for larger sites is provided. A total of four bird surveys have been completed within the study area, with a total of sixteen people hours.
Targeted nest searches	• Targeted nest searches were completed in conjunction with transect and area searches. • Observers travelled across available habitat, seeking out habitat features including nest trees and hollows. • Suitable nest or breeding hollows were marked.	DEC (2004) has not resolved nest search requirements and does not provide guidance on survey effort. DSEWPaC (2010) was reviewed, and sympatric species survey efforts indicated 12 hours over 4 days (3 hours per day) for sites less than 50 ha. A total of sixteen hours was completed across four days during 2021. Additional targeted nest searches were undertaken during 13–16 June 2023, 26–30 June 2023, and 17–21 July 2023. These surveys occurred within and adjacent to the additional area of subject land associated with the accommodation facility and access tracks.

c Nocturnal birds

Nocturnal bird surveys were undertaken for the following species:

- Bush-stone Curlew
- Barking Owl
- Masked Owl
- Powerful Owl.

Nocturnal bird survey methods and survey effort were developed in accordance with both DEC (2004) and the specific advice contained in the TBDC for each bird species. Methods included call playback, spotlighting, and stag watching.

On 27 June 2023 two EMM Ecologists and Candice Larkin, A/Senior Conservation Planning Officer – Planning North West, Biodiversity, Conservation and Science Directorate (BCS), held a meeting to discuss the owl survey method and effort for the project (refer to Attachment 5). The outcome of the meeting was that the survey method would involve use of both DEC (2004) and the survey requirements listed in the TBDC for the owl species:

- searches for owl signs around bases of trees containing large (>20 cm diameter), owl suitable hollows
- stag watching suitable hollows 30 minutes before dark and 60 minutes after dark
- call playback consisting of broadcast of owl calls cycling between playing calls and listening for responses.

The survey effort for owls comprised of a total of 10 nights (five nights, followed by two weeks break, then five additional nights) which was considered by EMM and BCS as being appropriate for the number and spatial arrangement of suitable hollows in/adjacent to the subject land.

The methods and survey effort for nocturnal birds are detailed in Table 5.8.

Table 5.8 Methods and survey effort – nocturnal birds

Method	Survey description	Survey effort
Call playback and spotlighting	DEC (2004) recommends call playback and spotlighting are undertaken. • Surveys commenced with a 15 minute listening period. Calls were played for 30 seconds, followed by 4.5 minutes of listening. This 5 minute cycle was repeated three times. • Call playback was conducted at each end of the subject land, at the furthest points from the previous call playback survey (for Bush-stone Curlew). • Call playback was conducted in the proximity of stag watching locations following stag watching surveys (for the owls) • This was followed by spotlighting on foot for one hour throughout the study area.	DEC (2004) recommends a number of survey methods for the Bush-stone Curlew including: • Call Playback – 2–4 km apart and conducted during the breeding season. • Day habitat search – flushing of Bush-stone Curlew by walking through potential habitat. • Spotlighting: by foot or from a vehicle driven in first gear. • Call playbacks and spotlighting were completed simultaneously. Based on the above, and availability of suitable habitat, call playback sites were surveyed in conjunction with three transects (2 km minimum distance) completed across 3 consecutive nights, totalling 6 km in length. The minimum survey effort was reached for Bush-stone Curlew). The survey methods for detection of owls recommended by DEC (2004) include: • Call playback – at least 5 nights for Powerful Owl and Barking Owl, and at least 8 visits for Masked Owl. • Day habitat search – searches for likely hollows and pellets. • Stag-watching – observing potential roost hollows for 30 minutes prior to sunset and 60 minutes following sunset. Call playback was used sparingly for forest owls during the survey periods in the subject land, due to ethical considerations of disrupting breeding activity. This was discussed with BCS, prior to surveys. Priority was instead given to the TBDC requirements of habitat assessment and stag-watching, as outlined in the row below.

Table 5.8 Methods and survey effort – nocturnal birds

Method	Survey description	Survey effort
TBDC requirements for threatened owls	There is no nest tree(s) within or adjacent to the subject land for which high fidelity from the threatened owl species is known to occur. Therefore, the TBDC requires: 1. Look for signs of breeding on site as follows; suitable habitat and (a) presence of male and female or (b) calling to each other (duetting) or (c) find nest. 2. Where signs of breeding on site are present, potential nest trees should be identified. Potential nest trees are living or dead trees with hollows: – > 20 cm diameter (Powerful Owl and Masked Owl). – >20 cm diameter and > 4 m above the ground (Barking Owl). 3. Where potential nest trees are identified on site, night monitoring at the identified potential nest locations for a minimum of 2 nights should be undertaken to detect the presence of any owl of these species using a potential nest tree or demonstrating behaviour focussed on a potential nest tree (e.g. investigating the hollow or roosting within 10 m).	For the threatened owls, the TBDC states that DPE is currently developing survey guidance for threatened bird species. In the interim assessors must undertake species surveys using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements) Following correspondent with BCS, the owl survey method and effort comprises: • Searches for owl signs around bases of trees containing large (>20 cm diameter), owl suitable hollows. • Stag watching (and quiet listening) suitable hollows 30 minutes before dark and 60 minutes after dark. • Call playback consisting of broadcast of owl calls cycling between playing calls and listening for responses. Calls were played for approximately two minutes followed by five minutes of listening. This was repeated for each species targeted. The survey effort for owls comprised of a total of 10 nights: • five consecutive evening/nights, 26–30 June 2023 • five consecutive evening/nights, 17–21 July 2023 A total of 15 hollows were watched by two ecologists over 10 nights. No evidence of owls was found under any of the suitably sized hollows, however those hollows that were most suitable for owls were still watched twice. Survey effort totalled 19 individual stag watch events and a total of 28.5 people hours of stag watching. A total of 10 call playback events took place, over nine evenings (26, 28, 29, 30 June and 17, 18, 19, 20, 21 July 2023). Call playback locations were selected based on the location of the potential owl hollows in the subject land, with an 8 km distance between the furthest two locations in the subject land.

5.3.4 Targeted survey results

i Targeted flora survey

Reference sites were visited for both Pine Donkey orchid (*Diuris tricolor*) near Muswellbrook, and Silky Swainson-pea (*Swainsona sericea*) near Mudgee at the time of the September survey, with both refence populations detected in flower (Photograph 5.3 and Photograph 5.4), validating the timing of the surveys within the study area.

No candidate flora species were detected during the targeted flora surveys in September or December 2021, nor were any other threatened flora species recorded incidentally during the multiple survey events. There are no records of any threatened flora species close to or within the study area with potential habitat largely limited to remnant woodland along roadsides. The majority of the subject land is unsuitable for threatened flora species owing to high levels of agricultural disturbance.

Photograph 5.3 Silky Swainson-pea at a reference site near Mudgee (21 September 2021)

Photograph 5.4 Pine Donkey Orchid at a reference site near Muswellbrook (20 September 2021)

ii Targeted fauna surveys

a Arboreal mammals

The Koala was recorded in the form of scats during the Koala dog detection surveys (Figure 5.1). The presence of the Koala is associated with the high condition vegetation zones of PCTs 80 and 281, which are also connected to the vegetation in the wider landscape.

No other candidate arboreal mammals were recorded during the targeted surveys.

b Diurnal birds

No candidate diurnal birds were recorded during the targeted surveys.

c Nocturnal birds

No evidence of owls were recorded at the surveyed hollows within or adjacent to the subject land. The following non-candidate fauna species were recorded utilizing some of the hollows:

- *Tyto alba* (Barn Owl)
- *Ninox boobook* (Southern Boobook)
- *Trichosurus vulpecula* (Common brush-tailed Possum).

No candidate nocturnal species were recorded during the targeted surveys.

iii Candidate species presence, extent and habitat quality

Table 5.9 defines the presence (or absence) of candidate species in the subject land and habitat quality. The number of individuals impacted by the project is provided for count-based species, while the area of habitat impacted is provided for area-based species. The area of habitat has been used to define the species polygon for area-based species, in accordance with Step 4 to 6 of the BAM (DPIE 2020) (Section 5.2.4 to 5.2.6).

Table 5.9 Candidate species presence, extent and habitat quality

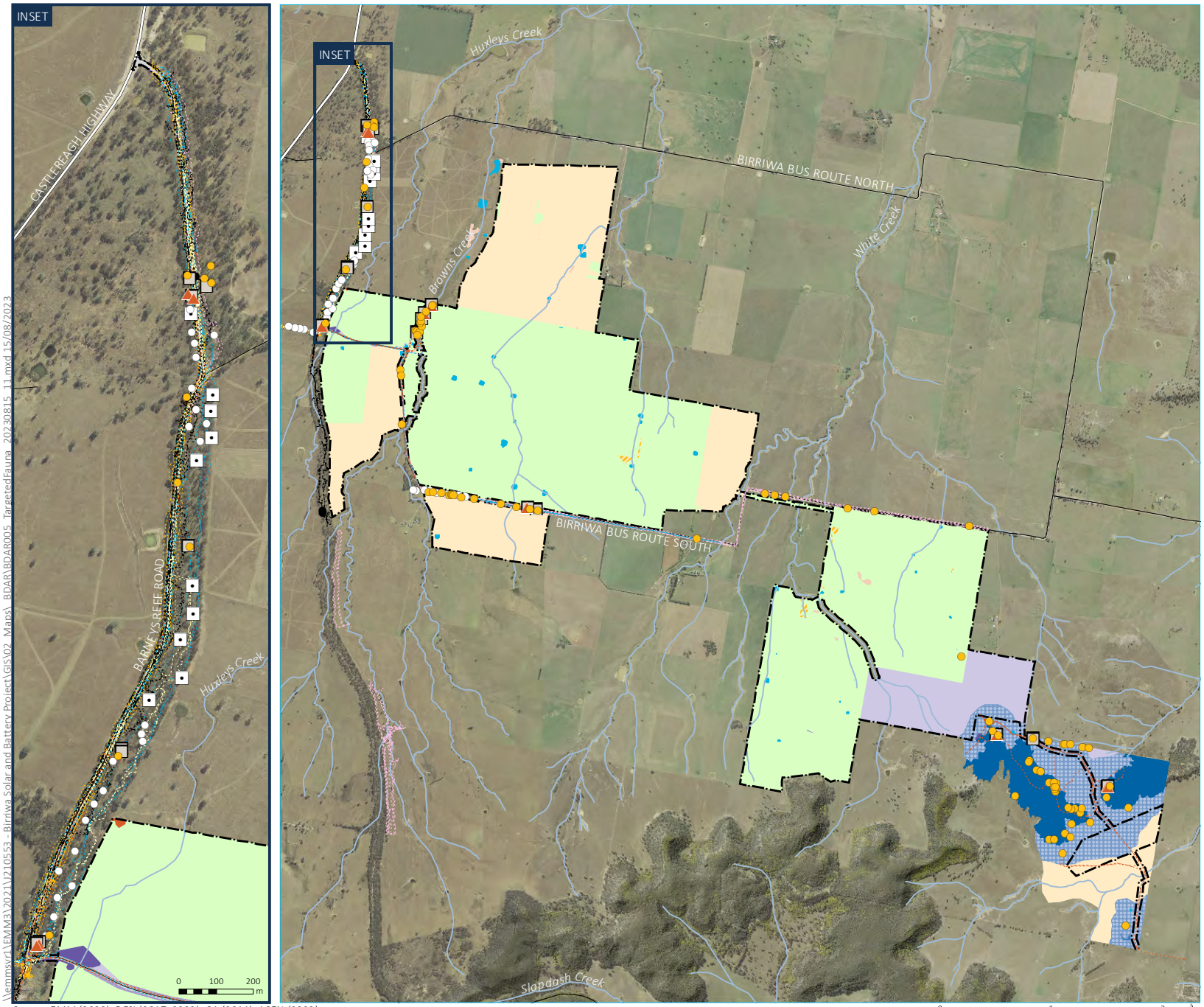
Scientific name	Common name	Step 4 – determine candidate species presence/absence	Step 5 – determine the area or count, and location of suitable habitat for a species credit species		Step 6 – determine the habitat condition within the species polygon for species assessed by area			
			Individuals impacted (count-based species)	Area impacted (area-based species)	Associated vegetation zone/s (Road corridor)	Associated vegetation zone/s (Solar and BESS project)	Associated vegetation zone/s (Accommodation facility and access tracks)	Vegetation integrity score
Acacia ausfeldii	Ausfeld's Wattle	Not recorded	-	-	-	-	-	-
Burhinus grallarius	Bush-stone Curlew	Not recorded	-	-	-	-	-	-
Calyptorhynchus lathami	Glossy Black Cockatoo	Not recorded	-	-	-	-	-	-
Cercartetus nanus	Eastern Pygmy Possum	Not recorded	-	-	-	-	-	-
Chalinolobus dwyeri	Large-eared Pied Bat	Assumed present based on suitable foraging habitat (woodland patches) within the subject land	-	0.48 ha	-	281_Planted (0.19 ha) 281_Poor (0.12 ha) 80_Poor (0.17 ha)	-	281_Planted: 50 281_Poor: 39 80_Poor: 46.2
Dichanthium setosum	Bluegrass	Not recorded	-	-	-	-	-	-
Diuris tricolor	Pine Donkey Orchid	Not recorded	-	-	-	-	-	-
Euphrasia arguta	-	Not recorded	-	-	-	-	-	-
Hieraaetus morphnoides	Little Eagle	Not recorded	-	-	-	-	-	-

Table 5.9 Candidate species presence, extent and habitat quality

Scientific name	Common name	Step 4 – determine candidate species presence/absence	Step 5 – determine the area or count, and location of suitable habitat for a species credit species		Step 6 – determine the habitat condition within the species polygon for species assessed by area			
			Individuals impacted (count-based species)	Area impacted (area-based species)	Associated vegetation zone/s (Road corridor)	Associated vegetation zone/s (Solar and BESS project)	Associated vegetation zone/s (Accommodation facility and access tracks)	Vegetation integrity score
Lophochroa leadbeateri	Major Mitchells Cockatoo	Not recorded	-	-	-	-	-	-
Lophoictinia isura	Square-tailed Kite	Not recorded	-	-	-	-	-	-
Ninox connivens	Barking Owl	Not recorded	-	-	-	-	-	-
Ninox strenua	Powerful Owl	Not recorded	-	-	-	-	-	-
Petaurus norfolcensis	Squirrel Glider	Not recorded	-	-	-	-	-	-
Phascogale tapoatafa	Brush-tailed Phascogale	Not recorded	-	-	-	-	-	-
Phascolarctos cinereus	Koala	Recorded during targeted survey	N/A	8.62 ha	80_High (0.49 ha) 281_High (0.30 ha)	80_High (0.52 ha) 80_Poor (0.17 ha) 281_High (0.05 ha) 281_Medium (0.55 ha) 281_Planted (2.59 ha) 281_Poor (3.95 ha)	-	80_High: 95.2 80_Poor: 46.2 281_High: 99.8 281_Medium: 58.3 281_Planted: 50 281_Poor: 39

Table 5.9 Candidate species presence, extent and habitat quality

Scientific name	Common name	Step 4 – determine candidate species presence/absence	Step 5 – determine the area or count, and location of suitable habitat for a species credit species		Step 6 – determine the habitat condition within the species polygon for species assessed by area			
			Individuals impacted (count-based species)	Area impacted (area-based species)	Associated vegetation zone/s (Road corridor)	Associated vegetation zone/s (Solar and BESS project)	Associated vegetation zone/s (Accommodation facility and access tracks)	Vegetation integrity score
Polytelis swainsonii	Superb Parrot	Not recorded	-	-	-	-	479_DNG (3.25 ha)	479_DNG: 13.2
Prasophyllum petilum	Tarengo Leek Orchid	Not recorded	-	-	-	-	-	
Prasophyllum sp. Wybong	Prasophyllum sp. Wybong	Not recorded	-	-	-	-	-	-
Swainsona sericea	Silky Swainson-pea	Not recorded	-	-	-	-	-	-
Tyto novaehollandiae	Masked Owl	Not recorded	-	-	-	-	-	-



KEY

- Subject land
- Hollow-bearing tree

Mammal survey

- Camera trap - December 2021 - January 2022
- Arboreal Elliot B trapping - September 2021
- Koala scats
- Koala Detection Dog survey - May 2022
- Spotlight transect - January 2022

Owl survey

- Stag watch
- Broadcast survey
- Owl survey track

Diurnal bird survey

- September 2021

Targeted flora survey

- September 2021
- December 2021

Existing environment

- Major road
- Minor road
- Watercourse/drainage line
- Cleared
- Dam
- Exotic (trees, grassland)

Plant community type

PCT 80 | Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

- High
- Poor
- Derived native grassland (DNG)
- Pasture

PCT 281 | Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

- High
- Medium
- Poor
- Pasture
- Planted
- Tussock

PCT 479 | Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion

- High
- Moderate
- Derived native grassland (DNG)

Source: EMM (2023); DFSI (2017, 2022); GA (2011); ACEN (2022)

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Targeted survey method and results

Birriwa Solar and Battery Project
Biodiversity Development Assessment Report
Figure 5.1

EMM creating opportunities

Stage 2 – Impact assessment

6 Impact assessment

This chapter identifies the potential impacts of the project on biodiversity values and the measures taken to avoid and minimise impacts. This chapter also makes recommendations to assist in the design of a project that further avoids any residual impacts.

6.1 Potential direct, indirect and prescribed impacts

6.1.1 Direct impacts

Without any measures to avoid, minimise or mitigate impacts, the project would result in the following impacts on biodiversity:

- direct impacts:
  - loss of native vegetation
  - loss and degradation of native fauna habitats.

ACEN is committed to avoiding areas of high environmental value in the development of its solar projects. Wherever possible, direct impacts have been avoided and/or minimised through the design of the project (Section 6.3). Impacts will be further managed and mitigated through the development of a biodiversity management plan (BMP), using the measures recommended in the below sections. Any residual impacts would be compensated through implementation of the biodiversity offset scheme.

6.1.2 Indirect impacts

Section 8.2 of the BAM (DPIE 2020) requires the assessment of indirect impacts on native vegetation, TECs and threatened species habitats.

Without any measures to avoid, minimise or mitigate impacts, the project would result in the following indirect impacts on biodiversity:

- erosion and sedimentation
- weed introduction and spread
- potential inadvertent disturbance of retained habitats
- increased noise, vibration and dust levels resulting in disturbance of fauna species, and consequent abandonment of habitat, or changes in behaviour (including breeding behaviour).

i Erosion and sedimentation

Construction of the project may lead to erosion and sedimentation and potential reduction in water quality to several watercourses within the subject land, including Huxleys, Browns and White Creeks. During the project, sediment may be mobilised and transported by surface water during rainfall events, potentially discharging into watercourses and drainage lines and potentially reducing water quality in downstream aquatic habitats and the Talbragar River. Increased suspended sediments can reduce light penetration into the water column, reducing photosynthesis of aquatic macrophytes, and decreasing dissolved oxygen levels.

Erosion and sediment control measures will be implemented during the project. Strict controls will be put in place to ensure sediment does not runoff into watercourses, and includes the measures outlined in Section 6.3.

ii Weed introduction and spread

The project has the potential to facilitate dispersal of weed species. As the subject land contains high threat weeds and additional exotic species, weed spread has the potential to occur across the subject land. Uncontrolled movement of vehicles, equipment and personnel within the subject land is the key vector of transmission, in particular vehicles and equipment sourced from regions beyond the subject land which may also introduce new species. Many weed species thrive on ground disturbance and will rapidly colonise disturbed areas in advance of native species recolonisation.

Weed impacts will be mitigated during the proposed activity and includes the measures outlined in Section 6.3.

iii Disturbance of retained habitats

Potential inadvertent disturbance of retained habitats could occur if vegetation to be retained is not clearly marked and defined during construction of the project. These impacts will be mitigated via exclusion fencing ('no-go' zones) and signage and includes the measures outlined in Section 6.3.

Exclusion fencing ('no-go' zones) shall be used that includes temporary fencing, bunting tape or similar and signage to protect or avoid habitats to be retained. This should be maintained and checked daily through construction.

iv Noise and dust disturbance

Noise may adversely affect fauna by interfering with communication (e.g. territorial bird song), masking the sound of predators and prey, causing avoidance reactions and displacement from habitat. Noise will be generated by the project through the use of equipment and vehicles and will vary from short intermittent noise from plant and equipment. Night works are not expected to occur as part of the project.

Increased dust from vegetation clearing and vehicle movements during construction has the potential to temporarily and locally impact flora and fauna values in the vicinity of the subject land. Excess generation of dust and subsequent deposition on leaves can impair plant photosynthesis and productivity (also resulting in reduced habitat quality for fauna) and impact on respiratory systems of fauna.

Potential noise and dust impacts will be temporary as they will only be evident during vegetation clearing and construction. Dust levels will be monitored and when needed dust suppression implemented such as wetting down dirt roads or reducing vehicle speeds, as per the measures outlined in Section 6.3.

6.2 Prescribed and uncertain impacts

An assessment of prescribed and uncertain impacts has been undertaken in accordance with Section 6 of the BAM (DPIE 2020) and is provided in Table 6.1.

Table 6.1 Assessment of prescribed and uncertain impacts

Prescribed/uncertain impact	The project
Impacts of development on the habitat of threatened species associated with: • karst, caves, crevices, cliffs, rocks, and other geological features of significance; or human-made structures and non-native vegetation.	A ridgeline occurs within the assessment area which is likely to have areas of geological significance such as crevices and geological habitat. This ridgeline does not occur within the subject land itself and will not be impacted by the project. A species polygon has been created for the Large-eared Pied Bat which may use these geological features and has been offset accordingly. Species polygons have also been created for Large-eared Pied Bat, Barking Owl, Masked Owl and Powerful Owl which intersect non-native vegetation and therefore will not generate species credits under the BAM (DPIE 2020). Mitigation measures to minimise impacts to these species ensure prescribed impacts to the species are addressed in Section 6.3.
Impacts of development on the connectivity of different areas of habitat of threatened entities that facilitates the movement of those entities across their range.	The locality of the subject land is considered highly fragmented with native vegetation often occurring in isolated patches surrounded by a matrix of agricultural land. A vegetated road corridor provides connectivity along the western extent of the subject land to the ridgeline to the south. Ecosystem and species credit species predicted to occur in the subject land predominantly comprise highly mobile birds and mammals, and therefore most species will not be impacted by fragmentation. The road corridor is known to provide habitat for the Koala; however fragmentation is unlikely to occur due to the nature of the project (see Section 7.1.2).
Impacts of development on movement of threatened entities that maintains their life cycle.	The main impact to threatened entities life cycles is fragmentation, as species like Koalas need some level of connectivity in vegetation to access mates during the breeding season. As fragmentation impacts are temporary and restricted to the construction period, potential life-cycle impacts will be managed through managing connectivity. Impact to connectivity such as fragmentation is unlikely to occur due to the nature of the project removing linear patches of woodland along the road corridor and already isolated woodland patches within the subject land (see Section 7.1.2).
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened entities (including from subsidence or upsidence resulting from underground mining).	The subject land intersects a number of named and unnamed waterways including Huxleys Creek, Browns Creek and White Creek. The waterways within the subject land and assessment area largely lack wooded riparian vegetation which may support aquatic and terrestrial species, however there are some riparian remnants which occur downstream immediately outside of the subject land which provide canopy cover and shading for the creek lines. The project has been designed to exclude Huxleys Creek, Browns Creek and White Creek where possible, with exception of six bridges to allow access (Figure 1.2). These bridges are not expected to contain instream structures or impact on the aquatic environment. The bridges will be designed to have impact to the surrounding terrestrial environment, which has been included in this BDAR and will be offset. ACEN have committed to avoiding in stream impacts regarding bridge design. Mitigation measures will be in place to minimise potential impacts to these waterways and are outlined in Section 6.3. Due to the nature of the project, the project is not expected to intersect groundwater or impact on groundwater dependent ecosystems. Therefore, impacts on threatened species and ecological communities because of changes in water quality, water bodies and hydrological processes are not expected during construction or operation.
Impacts of wind turbine strikes on protected animals.	The project does not include wind turbines; therefore this prescribed impact is not relevant to the project. Accordingly, management of this prescribed impact is not required.
Impacts of vehicle strikes on threatened fauna, or on animals that are part of a TEC.	The project traffic impact assessment (appended to the EIS) concluded that the project would result in up to 360 light vehicle trips and up to 135 heavy vehicle trips per day during the construction phase, and minor increases in vehicle movements during operation. A BMP will address mitigation measures for Koala and animal strike. The Koala is already found in the existing road upgrade corridor, the project is not predicted to significantly increase animal vehicle strikes above existing levels. Accordingly, management of this prescribed impact is not required.

6.3 Avoidance and minimisation strategy

This BDAR has been carried out in parallel with, and has informed the evolution of, the project design. As part of consultation with landowners and associated technical assessments, the original design of the project has been reduced and located in areas with lower biodiversity values, where possible. This process has ensured the avoidance of environmental constraints, including impacts on Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC as listed under the EPBC Act and high condition White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions. Threatened species habitat has also been avoided as far as practicable.

The accommodation facility and associated access tracks study area encompassed approximately 230 ha due to two locations being assessed for the facility, the 'northern' (chosen) and 'southern' options. This allowed the facility to be situated in areas of lower biodiversity value.

Iterative project planning, informed by the baseline studies outlined above, has allowed a range of impacts to be avoided and others to be minimised throughout the life of the project. To compensate for unavoidable disturbance, biodiversity offsets will be provided.

Key avoidance measures that have been implemented by ACEN comprise:

- avoidance of 20.7 ha of PCT 281 – tussock in the north portion of the study area
- minimisation of impacts to PCT 281-high and PCT 80-high wherever feasible
- minimisation of direct impacts by utilising an existing access track within the subject land
- avoidance of Huxleys Creek, Browns Creek and White Creek where possible and avoidance of instream impacts as part of the bridge design
- avoidance of all areas of PCT 479 high and moderate condition zones, due to micro siting of the accommodation facility and associated access tracks in areas of lower quality PCT 479 DNG and PCT 281 pasture
- avoidance of approximately 2 ha of rocky habitat that is suitable for Pink-tailed Legless Lizard (*Aprasia parapulchella*) (in 'southern' accommodation facility option) via selection of the 'northern' accommodation facility option.

Public road crossings have been located within the subject land within areas of minimal vegetation, thereby avoiding the need to remove vegetation for these crossings.

Refinements to the project layout have also excluded as many higher order streams from the subject land, as possible. Three third order streams are excluded from the subject land, thereby avoiding impacts to any associate riparian vegetation, with the exception of that required for the provision of fencing, access and electrical reticulation (i.e. private internal access roads and electrical cables).

In addition, a key design principle within the project refinement process has been to maximise the placement of project infrastructure in cleared areas and, wherever possible, limit impacts to native vegetation of low quality only.

In relation to the road upgrade corridor within the subject land, the conceptual road upgrade design has sought to minimise the clearance of native vegetation as much as possible. The concept design was developed in consultation with EMM ecologists and with Mid-Western Regional Council and Warrumbungle Shire Council to develop a design that avoids as much of the native vegetation along the existing road verge as possible. Residual impacts to biodiversity values will be mitigated through pre-clearance surveys, planting locally native species characteristic of Box Gum woodland and Grey Box woodland in future landscaping, retention of logs and debris in the subject land post-construction, and weed hygiene measures. It is also noted that ACEN will continue its consultation post EIS lodgement with both Councils with the view to refine the road design and further reduce its impacts on the roadside vegetation. An updated design is expected prior to Determination.

The study area for the project encompassed approximately 1,353 ha. The final area of the subject land has been reduced to 1,196.51 ha, which is a reduction in the original design by 156.49 ha and will reduce impacts on the TECs within the study area. Accordingly, the reduction in impact on Box Gum Woodland and derived native grassland and Grey Box woodland and grassland also reduces the impact on native flora and fauna habitat.

Table 6.2 summarises the avoidance and minimisation measures to minimise the potential for development-related impacts on biodiversity.

Table 6.2 Impact avoidance and minimisation strategy

Impact	Action	Intended outcome	Timing
Removal of Box Gum Woodland and derived native grassland and Grey Box woodland and grassland.	Change design to occur primarily within cropped land to avoid intact woodland.	Prioritise retention of high to moderate quality Box Gum Woodland and derived native grassland and Grey Box woodland and grassland, minimise impact on TECs resulting from project.	Design
Removal of Box Gum Woodland and derived native grassland and Grey Box woodland and grassland.	Following construction, include species consistent with PCT 80 and PCT 281 into landscaping.	Increase the floristic and structural diversity present in the subject land consistent with PCT 80 and PCT 281.	Post-construction
Removal of potential habitat for native fauna (including hollow-bearing trees).	Pre-clearance surveys, by a suitably qualified ecologist, to be conducted prior to removal of hollow-bearing trees within the subject land (at the locations specified in the BDAR) (Figure 5.1).	Mitigate injury to potential fauna species inhabiting hollows.	Pre-construction
Removal of logs and debris from the subject land.	Retain hollow logs and debris to be used post construction.	Retain and improve potential fauna habitat within the indirect impact area and study area post construction.	Post-construction
Indirect impacts on native vegetation to be retained including Box Gum woodland and Grey Box woodland to be retained.	Exclusion fencing ('no-go' zones) shall be used that includes temporary fencing, bunting tape or similar and signage to protect or avoid habitats to be retained. This should be maintained and checked daily through construction.	Avoid indirect impact to retained trees.	Pre-construction; construction
Indirect impacts on native vegetation to be retained including Box Gum woodland and Grey Box woodland to be retained.	All workers to be made aware of ecologically sensitive areas and the need to avoid impacts. This includes adjacent native vegetation.	Avoid unintentional impacts to Box Gum woodland, Grey Box woodland and native vegetation.	Pre-construction

Table 6.2 Impact avoidance and minimisation strategy

Impact	Action	Intended outcome	Timing
Indirect impacts on native vegetation to be retained including Box Gum woodland and Grey Box woodland to be retained.	Chemicals and fuel will be managed in accordance with Safe Work Australia guidelines (e.g. employ use of barriers, inspecting tanks and containers, etc) use of appropriate spill containment materials (or spill kits) to clean-up spills if they occur.	Avoid unintentional impacts to Box Gum woodland, Grey Box woodland and native vegetation due to chemical or fuel runoff.	Construction
Erosion and sedimentation	Sediment controls, including fencing and sediments traps, should be installed in any areas where works will occur in proximity to waterways.	Avoid increased sedimentation and erosion of watercourses within the subject land.	Pre-construction
Weed introduction and spread	Dependent on the weed species and cover in any particular construction area, remove weeds prior to or during clearing. Weeds are to be stockpiled appropriately prior to removal from the subject land to avoid the spread of seed and other propagules.	Minimise weed introduction and spread.	Construction
Weed introduction and spread	Weed hygiene protocols are in place prior to entering the subject land. This includes wash-down procedures to all plant and machinery.	Avoid weed introduction from outside of the subject land.	Construction
Weed introduction and spread	Coolatai Grass (*Hyparrhenia hirta*), and St. Johns Wort (*Hypericum perforatum*) are to be managed as per the *Biosecurity Act 2015* and their regional recommended measures (Section 7.3). If any other priority weeds of NSW are identified in the subject land during construction, they must be removed from the subject land. 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.	Avoid spread and introduction of priority weeds within the subject land	Construction
Dust disturbance	Monitor dust levels and implement suppression strategies where required such as wetting down dirt roads or reducing vehicle speeds.	Reduce dust settlement on native vegetation and habitat for native species.	Construction

6.4 Serious and Irreversible Impacts

An impact is to be regarded as serious and irreversible (SAII) if it is likely to contribute significantly to the risk of a threatened species (including endangered populations) or an ecological community becoming extinct based on the following 4 principles:

- Principle 1: The impact will cause a further decline of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline.

- Principle 2: The impact will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size.
- Principle 3: The impact is made on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.
- Principle 4: The impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity, and therefore its members are not replaceable.

Candidate SAII entities with regards to the project are listed in Table 6.3, along with the relevant principles for the listing of the SAII entity, based on information from the Threatened Biodiversity Data Collection (TBDC). No assessment of any other threatened entities at risk of an SAII has been requested by the decision-maker. SAII assessments are provided in Sections 6.4.1 and 6.4.2.

Table 6.3 Candidate SAII entities for the project

Threatened community or species	Principle 1	Principle 2	Principle 3	Principle 4
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Population reduction of >=80% in 10 years or three generations	<50 individuals or <250 individuals where threats are known	-	-
Regent Honeyeater	Population reduction of >=80% in 10 years or three generations	<50 individuals or <250 individuals where threats are known	-	-
Large-eared Pied Bat[1]	-	-	-	-

1. TBCD does not provide information as to which principle the Large-eared Pied Bat meets threshold.

6.4.1 Threatened ecological communities

Section 9.1.1 of BAM (DPIE 2020) requires additional impact assessment for threatened ecological communities that are also listed as candidate entities for Serious and Irreversible Impacts (SAII). An assessment of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland against the assessment criteria provided in Section 9.1.1 of BAM (DPIE 2020) is provided in Table 6.4 and Table 6.5.

Table 6.4 Current status of White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland CEEC

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Current total geographic extent (ha) of the threatened ecological community (TEC) in NSW.	White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland has undergone a very large reduction in geographic distribution. The best estimate of the extent of occurrence (EOO) is 702,800 km^2, based on a minimum convex polygon enclosing likely occurrences of the community. The best estimate of the area of occupancy (AOO) is 151,100 km^2.	• NSW TSSC 2020	Not all areas occupied by the community are covered by maps of appropriate scale and accuracy. Therefore, the values for EOO and AOO quoted may underestimate the true values.
Estimated reduction in geographic extent of the TEC since 1970	Approximately greater than 90% reduction in pre-1750 distribution. According to the NSW TSSC (2020): • The TSSC (2006) estimated that less than 5% of the original distribution remained, however the extent to which remaining examples continue to support characteristic biota, their interactions and function is unknown. • The very large historical decline in geographic distribution is corroborated by other sources although there is some uncertainty surrounding the current extent of the community and its pre-1750 distribution. Considering the evidence for historical, recent and contemporary clearing in combination, it is very likely that the reduction in the distribution of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland exceeds 90% when averaged across the entire range of the community.	• NSW TSSC 2020 • Commonwealth TSSC 2006	No estimate of vegetation extent as of 1970 is available.

Table 6.4 Current status of White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland CEEC

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Extent of reduction in ecological function, describing the degree of environmental degradation or disruption to biotic processes	The Threatened Biodiversity Profile description (BCS 2022a) lists the following threats affecting the ecological function of the TEC: • habitat loss, degradation and fragmentation from agricultural, forestry, mining, infrastructure and residential development • degradation by over grazing and trampling by introduced and native herbivores resulting in losses of plant species and structural diversity (simplification of the understorey and ground layer and suppression of overstorey regeneration), erosion and other soil changes (e.g. loss of cryptogams, increased nutrient status) • degradation of remnants by non-native plant species, including noxious weeds, exotic pasture species and environmental weeds, including garden escapes, olives and pines • degradation of remnants by feral pest animals resulting in the loss or modification of habitat and predation of native fauna that are part of the White Box Yellow Box Blakely's Red Gum Woodland TEC • removal of native ground layer in box-gum woodland remnants where trees have been partially or fully removed • altered fire regimes. These threats affect the ecological function of the TEC at varying levels and lead to different states of the TEC. The extent to which this reflects a permanent or temporary loss depends on the mechanism and severity of disturbance as well as any measures that are undertaken to reverse decline. As such, the extent of reduction in ecological function is unknown.	• BCS 2022a • NSW TSSC 2020	Data on the extent of reduction is not available.
Evidence of restricted geographic distribution based on the TEC's geographic range in NSW:			
Extent of occurrence (ha)	702,800 km^2	• NSW TSSC 2020	Not all areas occupied by the community are covered by maps of appropriate scale and accuracy. Therefore, the values for EOO and AOO quoted may underestimate the true values.

Table 6.4 Current status of White Box Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland CEEC

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Area of occupancy (ha)	151,100 km^2	• NSW TSSC 2020	Not all areas occupied by the community are covered by maps of appropriate scale and accuracy. Therefore, the values for EOO and AOO quoted may underestimate the true values.
Number of threat-defined locations	The BAM (DPIE 2020) defines threat-defined locations in terms of threatened species but does not mention TECs. According to the Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria (IUCN 2017), a threat-defined location is: • A geographically or ecologically distinct area in which a single threatening event can rapidly affect all occurrences of an ecosystem type. The IUCN definition is similar to that included in the BAM (DPIE 2020)and is considered to encompass the intent of the requirements of BAM (DPIE 2020) for TECs. The most serious plausible threat to the TEC is land clearing, particularly for agriculture, including the intensification of agricultural activity through conversion of land use from grazing of native pastures to improved pastures or cropping. In line with the approach suggested in IUCN (2017), broad interpretation of threat-defined locations identifies two jurisdictional zones with different regulatory controls on land clearing: • the leasehold Western Division of New South Wales • the freehold Central Division and Eastern Division of New South Wales. An alternative interpretation of threat-defined locations based on biogeographical regions (bioregions) would produce an estimate of six threat-defined locations.	• DPIE 2020 • IUCN 2017 • NSW TSSC 2020	Data is not strictly defined by the BAM (DPIE 2020). Assumptions have been made from additional data sources.

Table 6.5 Impact assessment of White Box Yellow Box Blakely's Red Gum Woodland CEEC

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Impact on the geographic extent of the TEC (Principles 1 and 3)			
Area of TEC to be impacted by the proposal (ha)	The project would impact on 300.46 ha of the TEC.	-	-
Area of TEC to be impacted by the proposal as a % of the current geographic extent in NSW (%)	The best estimate of the extent of occurrence (EOO) is 702,800 km^2. The project would impact on 0.00042% of its current extent.	NSW TSSC 2020	Not all areas occupied by the community are covered by maps of appropriate scale and accuracy. Therefore, the values for EOO and AOO quoted may underestimate the true values.
Direct/indirect impacts likely as a result of the proposal to contribute to loss of flora/fauna species characteristic of the TEC	The project would result in the removal of 300.46 ha of the TEC, which is 0.00042% of the current extent. Indirect impacts to the TEC include weed introduction and spread and erosion and sedimentation. Retained areas of the TEC outside the subject land will be avoided. Weed management and erosion mitigation measures in accordance with Table 6.2 will also be developed and implemented in retained areas of the community within the indirect impact areas. There will be no change to fire regimes.	-	-
Impacts likely to contribute to further environmental degradation or disruption of biotic processes (Principle 2)			
Remaining extent of isolated areas of TEC (ha)	The remaining connected local occurrence of the TEC includes approximately 58 ha which is connected to the subject land (see Section 7.1.2). This occurrence primarily consists of woodland and surrounded by patches of grassland in varying condition.	• DPIE 2015	Patch connectivity has been assessed using regional vegetation mapping
Average distance between remaining remnants – remnant is retained (m)	Were the remnant is to be retained, the patch would remain connected to adjacent patches (including derived grasslands of the TEC).	-	-
Average distance between remaining remnants – remnant is removed (m)	Were the remnant to be removed, the patch would remain connected to adjacent patches (including derived grasslands of the TEC). The project would result in the removal of the TEC where connectedness of patches will vary, from immediately connected adjacent to the subject land and approximately 1.5 km in a north-south direction and 1 km in an east-west direction, however the TEC is likely to continue to be connected outside of the subject land based on regional mapping (DPIE 2015).	-	-

Table 6.5 Impact assessment of White Box Yellow Box Blakely's Red Gum Woodland CEEC

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Estimated maximum dispersal distance of species associated with the TEC (km)	According to Corlett (2009), typical maximum dispersal distances for different dispersal mechanisms are as follows: No specialised mechanism: 0–10 m Ant dispersal: 0–10 m Wind (large-winged fruits): 10–100 m Rodents: 10–100 m Small to medium-sized forest birds and arboreal mammals: 100 m–1 km Flying-foxes (large seeds): 100 m–1 km Large and open-country birds: 1–10 km Wind (small plumed seeds): 1–10 km Terrestrial mammals: 1–10 km Wind (tiny seeds/spores, and very small plumed seeds): > 10 km Flying-foxes (small seeds): > 10 km Eucalyptus spp. (including *Eucalyptus melliodora and Eucalyptus blakelyi* characteristic of the tree growth form component of the TEC within the subject land) have very limited seed dispersal capabilities, likely in the 0–10 range or 10–100 m range for any given event and species and are considered capable of migrating across landscapes only in the order of ~71–142 m in 71 years (Booth, 2017).	• Corlett 2009 • Booth 2017 • Corangamite Seed Supply & Revegetation Network and references therein, 2006	-

Table 6.5 Impact assessment of White Box Yellow Box Blakely's Red Gum Woodland CEEC

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
	Hickory Wattle and Sticky Hop-bush are shrub species which are characteristic of the TEC and occur within the subject land. Hickory Wattle has large pods which are likely dispersed by birds and ants (Corangamite Seed Supply & Revegetation Network and references therein, 2006). This results in a maximum dispersal distance of up to 1 km by small to medium-sized forest birds. Sticky Hop-bush on the other hand is likely dispersed by wind, however, has large winged seeds which limit dispersal of the seed by up to 100 m. The subject land contains characteristic grass species of the TEC in the genera Aristida and Austrostipa and are likely to be animal-dispersed and capable of dispersing between 1 and 10 km. The grasses in the genera *Bothriochloa* spp. are likely wind-dispersed, as are most species of forbs in the family Asteraceae. The wind-dispersed grasses are likely to be capable of dispersing between 1 and 10 km. The very small plumed seeds of many species of in the Asteraceae (daisy family) are likely to be capable of dispersing more than 10 km. Many of the forb and grass species that make up the ground layer of the TEC are likely to have no specialised dispersal mechanism or to be ant-dispersed and only capable of dispersal to distances of less than 10 m.		
Area to perimeter ratio of remaining remnants (ratio)	The project is unlikely to significantly increase the edge to area ratio of remaining areas of the TEC, due to the high condition woodland patches occurring adjacent to an existing road. The existing areas of the TEC are already exposed to edge effects including weed encroachment.	-	-

Table 6.5 Impact assessment of White Box Yellow Box Blakely's Red Gum Woodland CEEC

<table>
<tr><th>Criteria</th><th>Data/information</th><th>Data sources</th><th>Details of data deficiency, assumptions, reasons for low confidence in information</th></tr>
<tr><td>Vegetation integrity analysis</td><td>Vegetation integrity for the TEC is presented in the summary table below:
<table>
<tr><th>Vegetation zone</th><th>Area in subject land (ha) (Road corridor)</th><th>Area in subject land (ha) (Solar and BESS project))</th><th>Area in subject land (ha) (Accommodation facility and access tracks))</th><th>VI score</th></tr>
<tr><td>PCT 281_high</td><td>0.30</td><td>0.05</td><td>-</td><td>99.8</td></tr>
<tr><td>PCT 281_medium</td><td>-</td><td>0.55</td><td>-</td><td>58.3</td></tr>
<tr><td>PCT 281_pasture</td><td>0.26</td><td>284.2</td><td>8.56</td><td>3.6</td></tr>
<tr><td>PCT 281_planted</td><td>-</td><td>2.59</td><td>-</td><td>50</td></tr>
<tr><td>PCT 281_poor</td><td>-</td><td>3.95</td><td>-</td><td>39</td></tr>
<tr><td>Total</td><td></td><td>300.46</td><td></td><td>-</td></tr>
</table></td><td></td><td></td></tr>
</table>

6.4.2 Threatened species

Section 9.1.2 of the BAM (DPIE 2020) requires additional impact assessment for threatened species that are also listed as candidate entities for Serious and Irreversible Impacts (SAII). An assessment of the Regent Honeyeater and Large-eared Pied Bat against the assessment criteria provided in Section 9.1.2 of BAM (DPIE 2020) are provided in Table 6.6 to Table 6.9.

i Regent Honeyeater

Table 6.6 Current status of Regent Honeyeater

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Evidence of rapid decline (Principle 1)			
Change in population size in NSW in the past 10 years or 3 generations (indicate whether as a direct estimate of the population or if indicated by an index or surrogate).	The Regent Honeyeater has undergone a population reduction and continuing decline, with the apparent loss of some of its minor breeding populations and its two major breeding sites; Capertee Valley and Bundarra-Barraba (NSW TSSC 2021). In 1997 the global population of Regent Honeyeaters was estimated as 1,500 mature birds, with 1,000 shared between the Capertee Valley and Bundarra-Barraba breeding sites; however the Capertee Valley population declined from around 140 birds in spring 2005 to 40 birds in spring 2006 and in 2007, no breeding was detected. In autumn 2008, about 40 birds reappeared in the Capertee Valley and persisted until August. The apparent decline in the Capertee Valley, from hundreds in the mid 1990s to tens in 2008, represents a decline in index of abundance of more than 80% in three generations (15 years), although the influence of greater dispersal due to failed eucalypt flowering combined with variable survey effort may have contributed to this apparent decline. In the Bundarra-Barraba area, numbers have apparently declined from around 100 in the 1990s, to 50 birds in subsequent breeding seasons, and about 30 birds in recent years. In 2007 there was no eucalypt flowering, and no Regent Honeyeaters could be found in the Bundarra-Barraba region and northwards to Inverell-Ashford.	• NSW TSSC 2021	N/A

Table 6.6 Current status of Regent Honeyeater

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Evidence of small population size (Principle 2)			
Current population size in NSW	As of 2010, the total population size is estimated at 350–400 mature individuals within Australia. It is estimated that the NSW population of Regent Honeyeaters may now be fewer than 250 mature individuals. A population count within NSW in 2009 resulted in a maximum count of 40 individuals.	• DE 2016 • NSW TSSC 2021 • DE 2015a	Population surveys within NSW have not been conducted since 2009/2010.
Decline in species' population size in 3 years or one generation	Data is not available on population decline within the previous three years or one generation.	No data available	Insufficient survey data exists to provide an accurate or current assessment of population trends.
Number or percentage of mature individuals in each subpopulation or whether the species is likely to undergo extreme fluctuations	Populations of Regent Honeyeaters at particular locations fluctuate greatly between years and sites, according to seasonal conditions (Garnett & Crowley 2000). The Capertree Valley population varies from around 100 birds in good years to fewer than 10 found in poor years.	• NSW TSSC 2021 • Garnett & Crowley 2000	N/A
Evidence of limited geographic range (Principle 3)			
Extent of occurrence	The global extent of occurrence (EOO) of the Regent Honeyeater was estimated as 300 000 km^2 in 2000, with a high level of confidence, with about 70% of its distribution falling in NSW. The species' EOO in NSW would therefore be less than 210 000 km^2.	• NSW TSSC 2021	The extent of occurrence has not updated since 2000.
Area of occupancy	The global area of occupancy (AOO) of the species was estimated as 250 km^2 in 2000, with a low level of confidence; most of this area (about 80%) would fall in NSW. The species' AOO in NSW would therefore be less than 200 km^2.	• NSW TSSC 2021	The area of occupancy has not updated since 2000.

Table 6.6 Current status of Regent Honeyeater

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Number of threat-defined locations	The BAM (DPIE 2020) defines threat-defined locations as geographically or ecologically distinct areas in which a single threatening event may rapidly affect species occurrences. Where two or more subpopulations occur in an area that may be threatened by one such event, they are counted as a single location. Where a subpopulation covers an area larger than what a single event is likely to impact, this is counted as two or more locations. The main threats to the Regent Honeyeater are clearing, fragmentation and degradation of its habitat (DE 2015a and references therein). The Regent Honeyeater occurs as breeding sub-populations in NSW, which are fragmented and now occur mainly around the Capertee Valley in central-eastern NSW and the Bundarra-Barraba region in northern inland NSW. Each of these sub-populations are likely to represent a separate threat-defined location.	• DE 2015a and references therein	N/A
Whether the species' population is likely to undergo extreme fluctuations	Populations of Regent Honeyeaters at particular locations fluctuate greatly between years and sites, according to seasonal conditions (Garnett & Crowley 2000). The Capertree Valley population varies from around 100 birds in good years to fewer than 10 found in poor years.	• Garnett & Crowley 2000 • NSW TSSC 2021	N/A

Table 6.7 SAII assessment for Regent Honeyeater

Assessment question	Response
Number of individuals (mature and immature) present in the subpopulation on the subject land	The subject land does not contain any previous records of Regent Honeyeater (BioNet). The purpose of the SAII assessment is due to potential foraging habitat occurring within the subject land. The nearest previously recorded Regent Honeyeater was located approximately 11 km from the subject land, associated with Tuckland State Forest.
Number of individuals (mature and immature) present as a percentage of total NSW population (%)	As above, the subject land does not contain any known occurrences of the Regent Honeyeater (in the form of previous records).
Number of individuals (mature and immature) to be impacted by the proposal	The number of individuals expected to be impacted by the proposal is unknown. This is due to the subject land containing potential foraging habitat, and not containing any known occurrences of the species. The potential foraging habitat within the subject land occurs across 8.62 ha, which may support a small number of individuals of the species if it was to occur.
Individuals (mature and immature) to be impacted by the proposal as a percentage of total NSW population (%)	As above, the subject land does not contain any known occurrences of the Regent Honeyeater. Given the small area of potential foraging habitat in the subject land (when compared to habitat within the locality), a small proportion of the total NSW population could be impacted.
Area of habitat to be impacted (ha) (for species measured by area only)	8.62 ha of potential foraging habitat would be impacted by the project.
Area of the species' geographic range to be impacted by the proposal	The estimated geographic range of Regent Honeyeater is 210 000 km^2. The 8.62 ha of potential habitat within the subject land represents less than 0.0001% of the species' geographic range.
Area of the species' geographic range to be impacted as a percentage of the total area or extent of occupancy (%)	8.62 ha of potential foraging habitat within the subject land represents 0.04 % of the species known area of occupancy (less than 200 km^2).
Individuals impacted	No known occurrences of Regent Honeyeater will be impacted. The potential foraging habitat within the subject land occurs across 8.62 ha, which may support a small number of individuals of the species if it was to occur.
Viability of a fragmented population	No known population is likely to be fragmented because of the proposed development. The 8.62 ha of potential foraging habitat within the subject land occurs in a fragmented landscape, however, is still connected to additional foraging habitat to the south. The species is also highly mobile; the removal of 8.62 ha of foraging habitat is unlikely to fragment surrounding individuals or populations.

ii Large-eared Pied Bat

Table 6.8 Current status of Large-eared Pied Bat

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Evidence of rapid decline (Principle 1)			
Change in population size in NSW in the past 10 years or 3 generations (indicate whether as a direct estimate of the population or if indicated by an index or surrogate).	The species is listed as vulnerable under the EPBC act on the basis of population decline (DERM 2011). Data is not available on population decline.	No data available	Insufficient survey data exists to provide an accurate or current assessment of population trends.
Evidence of small population size (Principle 2)			
Current population size in NSW.	Data is not available on population decline.	No data available	Insufficient survey data exists to provide an accurate or current assessment of population trends.
Decline in species' population size in 3 years or one generation.	Data is not available on population decline.	No data available	Insufficient survey data exists to provide an accurate or current assessment of population trends.
Number or percentage of mature individuals in each subpopulation or whether the species is likely to undergo extreme fluctuations.	Data is not available on population fluctuations.	No data available	Insufficient survey data exists to provide an accurate or current assessment of population trends.
Evidence of limited geographic range (Principle 3)			
Extent of occurrence.	The EOO of the Large-eared Pied Bat is estimated as 400,000 km^2 within NSW, QLD and ACT, with about 65% of its distribution falling in NSW.	(DERM 2011).	These area calculations have been estimated from information provided in DERM 2011.
Area of occupancy.	The estimated AOO for the Large-eared Pied Bat is around 250,000 km^2 in NSW.	(DERM 2011).	These area calculations have been estimated from information provided in DERM 2011.

Table 6.8 Current status of Large-eared Pied Bat

Criteria	Data/information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information
Number of threat-defined locations.	The BAM (DPIE 2020) defines threat-defined locations as geographically or ecologically distinct areas in which a single threatening event may rapidly affect species occurrences. Where two or more subpopulations occur in an area that may be threatened by one such event, they are counted as a single location. Where a subpopulation covers an area larger than what a single event is likely to impact, this is counted as two or more locations. The main threats to the Large-eared Pied Bat are: • Destruction of and interference with maternity and other roosts. • Mining of roosts. • Mine induced subsidence of cliff lines. • Disturbance from human recreational activities. • Habitat disturbance by other animals, including livestock and feral animals. • Predation by introduced predators. • Vegetation clearance in the proximity of roosts. • Fire in the proximity of roosts. • Loss of genetic diversity. It has not been determined if specific populations of the Large-eared Pied Bat are at higher threat levels than others. A better understanding of distribution, population size, roost preference and threats is required before particular populations can be identified as being under greater threat than others. Proposed surveys and research will better identify the populations under direct threat and allow management plans to be developed in order to target a reduction in pressure to these populations (DERM 2011).	(DERM 2011).	Maternity caves are likely to be where this species is most at risk.
Whether the species' population is likely to undergo extreme fluctuations.	Data is not available on population fluctuations.	No data available	Insufficient survey data exists to provide an accurate or current assessment of population trends.

Table 6.9 SAII assessment for Large-eared Pied Bat

Assessment question	Response
Number of individuals (mature and immature) present in the subpopulation on the subject land.	The size of the population in the locality has not been comprehensively studied. There is a total of 62 records of Large-eared Pied Bat within the BioNet database from within a 20 km radius of the subject land (BCS 2021). No key management sites occur within or surrounding the subject land. There are no caves or roosting habitat within the subject land. The proposal will result in the clearing of approximately 0.48 ha of potential foraging/hunting habitat within 2 km of potential breeding habitat. This is considered a relatively minor reduction in available foraging habitat in comparison the available higher quality foraging habitat within the locality.
Number of individuals (mature and immature) present as a percentage of total NSW population (%).	The subject land does not contain any roosting habitat and is only likely to be utilised for foraging/hunting and bats flying over while dispersing to other locations to hunt or roost.
Number of individuals (mature and immature) to be impacted by the proposal.	The proposal is not likely to impact any individuals of Large-eared pied Bat. The proposal will slightly reduce the amount of foraging/hunting habitat within the locality by 0.48 ha.
Individuals (mature and immature) to be impacted by the proposal as a percentage of total NSW population (%).	As mentioned above, the proposal is not likely to impact any individuals of Large-eared pied Bat. The proposal will slightly reduce the amount of foraging/hunting habitat within the locality by 0.48 ha.
Area of habitat to be impacted (ha) (for species measured by area only).	0.48 ha of potential foraging/hunting habitat.
Area of the species' geographic range to be impacted by the proposal (ha).	0.48 ha of foraging/hunting habitat to be removed by the proposal is a negligible amount considering the species has a geographic range around 400,000 km^2, or 40 million hectares.
Area of the species' geographic range to be impacted as a percentage of the total area or extent of occupancy (%).	The amount of foraging/hunting habitat to be removed by the proposal is a negligible amount in comparison to the extent of occupancy.
Individuals impacted.	No known occurrences of Large-eared Pied Bat will be impacted. The potential foraging/hunting habitat within the subject land occurs across 0.48 ha, which may support a small number of individuals of the species if it was to occur.
Viability of a fragmented population.	No known population is likely to be fragmented because of the proposed development. The 0.48 ha of potential foraging/hunting habitat within the subject land occurs in a fragmented landscape, however large areas of foraging habitat exist within the locality. The species is also highly mobile; the removal of 0.48 ha of foraging habitat is unlikely to fragment surrounding individuals or populations, considering these small and highly fragmented woodland patches are already surround by predominately exotic pasture.

6.5 Impacts not requiring offsets

In accordance with Section 9.2.1 of BAM (DPIE 2020), impacts on vegetation zones and threatened species habitat do not require offsets where:

- a vegetation zone representative of a critically endangered or endangered ecological community has a vegetation integrity score less than, or equal to, 15
- a vegetation zone representative of a vulnerable ecological community and/or threatened species habitat has a vegetation integrity score less than, or equal to, 17
- a vegetation zone that is not listed has a vegetation integrity score less than, or equal to, 20.

A summary of the vegetation zones that do not trigger the above thresholds are provided Table 6.10 (road corridor), Table 6.11 (solar and BESS project), and Table 6.12 (accommodation facility and access tracks). These vegetation zones are shown in Figure 6.1.

Table 6.10 Summary of impacts not requiring offsets – ecosystem credits – road corridor

Vegetation zone	PCT	Vegetation zone name	Area (ha)	Current VI score	Future VI score	Change in VI score	Biodiversity risk weighting	Ecosystem credits required
2	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	80_Pasture	0.24	4.6	0.0	-4.6	2	0
4	PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281_Pasture	0.26	3.6	0.0	-3.6	2.5	0

Table 6.11 Summary of impacts not requiring offsets – ecosystem credits –solar and BESS project

Vegetation zone	PCT	Vegetation zone name	Area (ha)	Current VI score	Future VI score	Change in VI score	Biodiversity risk weighting	Ecosystem credits required
2	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	80_Pasture	75.38	4.6	0.0	-4.6	2	0
6	PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281_Pasture	284.2	3.6	0.0	-3.6	2.5	0

Table 6.11 Summary of impacts not requiring offsets – ecosystem credits –solar and BESS project

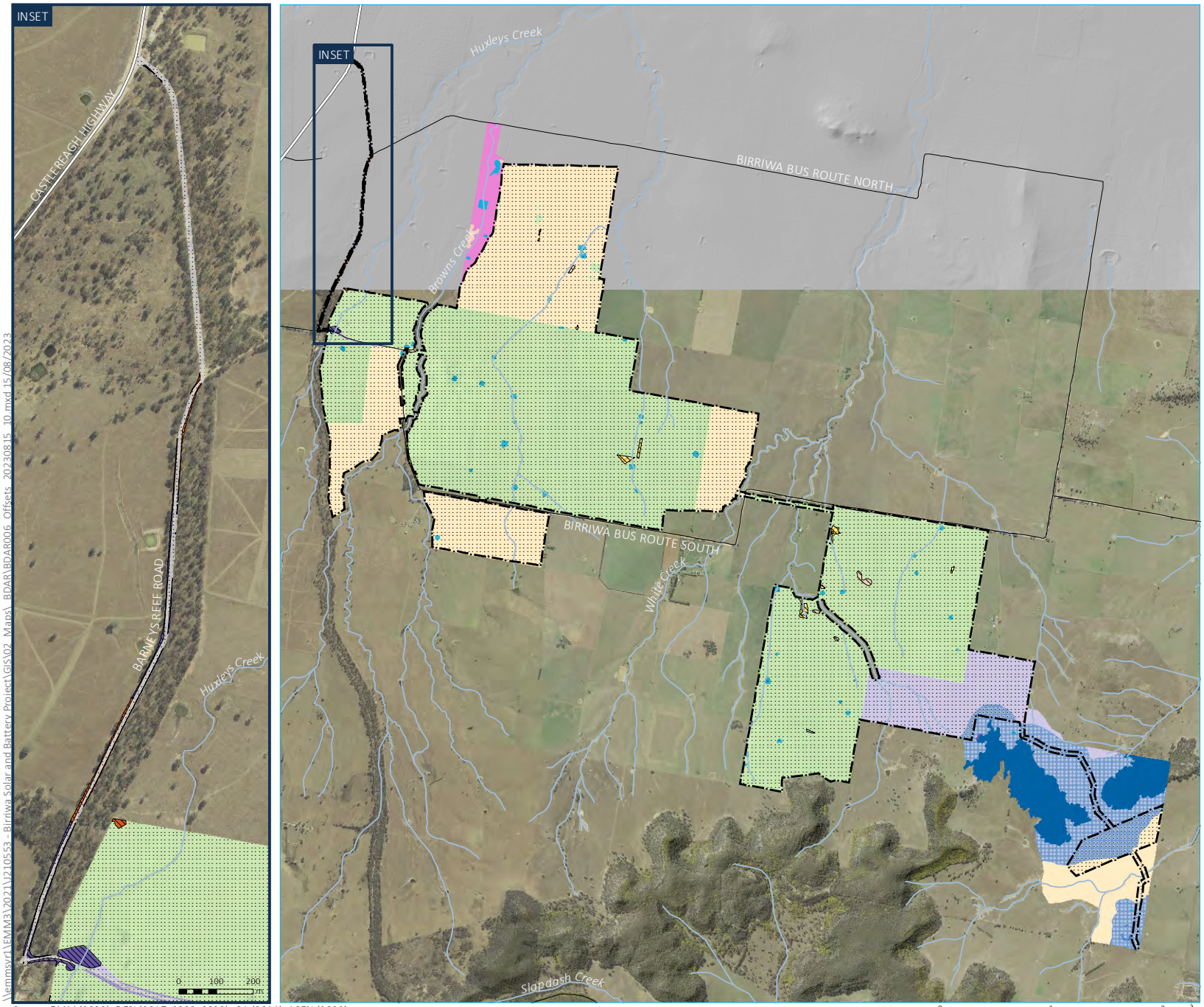
Vegetation zone	PCT	Vegetation zone name	Area (ha)	Current VI score	Future VI score	Change in VI score	Biodiversity risk weighting	Ecosystem credits required
9	PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	479_DNG	4.94	13.2	0.0	-13.2	1.5	0

Table 6.12 Summary of impacts not requiring offsets – ecosystem credits –accommodation facility and access tracks

Vegetation zone	PCT	Vegetation zone name	Area (ha)	Current VI score	Future VI score	Change in VI score	Biodiversity risk weighting	Ecosystem credits required
1	PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281_Pasture	8.56	3.6	0.0	-3.6	2.5	0
6	PCT 479 – Narrow-leaved Ironbark – Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion	479_DNG	23.51	13.2	0.0	-13.2	1.5	0

Areas not requiring assessment in accordance with Section 9.3 of BAM (DPIE 2020) include:

- existing roads
- cleared and highly disturbed land
- watercourses.



KEY

- Subject land
- Impacts requiring offsets
- Impacts not requiring offsets

Existing environment

- Major road
- Minor road
- Watercourse/drainage line
- Cleared
- Dam
- Exotic (trees, grassland)

Plant community type

PCT 80 | Western Grey Box - White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion

- High
- Poor
- Derived native grassland (DNG)
- Pasture

PCT 281 | Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

- High
- Medium
- Poor
- Pasture
- Planted
- Tussock

PCT 479 | Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion

- High
- Moderate
- Derived native grassland (DNG)

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Source: EMM (2023); DFSI (2017, 2020, 2022); GA (2011); ACEN (2022)

Impacts requiring offsets, impacts not requiring offsets and areas not requiring assessment

Birriwa Solar and Battery Project
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Figure 6.1

EMM creating opportunities

6.6 Impacts requiring offset

This section provides an assessment of the impacts requiring offsetting in accordance with Section 9.2 of BAM (DPIE 2020).

i Impacts on native vegetation

Impacts to native vegetation requiring offsets include:

- direct impacts on 1.18 ha of PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion
- direct impacts on 7.45 ha of PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion.

A summary of the ecosystem credits required for all vegetation zones, including changes in vegetation integrity score, are provided in Table 6.13 (road corridor), Table 6.14 (solar and BESS project), and are shown in Figure 6.1. A total of 271 ecosystem credits are required to offset the residual impacts of the project, comprising 42 ecosystem credits for the road corridor and 229 ecosystem credits for the solar and BESS project. There are no ecosystem credits requiring offsetting for the accommodation facility and access tracks. Credit reports are provided in Attachment 10.

Table 6.13 Summary of impacts requiring offsets – ecosystem credits – road corridor

Vegetation zone number	PCT	Vegetation zone name	Area (ha)	Current VI score	Future VI score	Change in VI score	Biodiversity Risk Weighting	Ecosystem credits required
1	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	80_High	0.49	95.2	0.0	-95.2	2	23
3	PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281_High	0.30	99.8	0.0	-99.8	2.5	19
Total number of ecosystem credits required – road corridor								**42**

Table 6.14 Summary of impacts requiring offsets – ecosystem credits – solar and BESS project

Vegetation zone number	PCT	Vegetation zone name	Area (ha)	Current VI score	Future VI score	Change in VI score	Biodiversity Risk Weighting	Ecosystem credits required
1	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	80_High	0.52	95.2	0.0	-95.2	2	25
3	PCT 80 – Western Grey Box – White Cypress Pine tall woodland on loam soil on alluvial plains of NSW South Western Slopes Bioregion and Riverina Bioregion	80_Poor	0.17	46.2	0.0	-46.2	2	4
4	PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281_High	0.05	99.8	0.0	-99.8	2.5	3
5	PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281_Medium	0.55	58.3	0.0	-58.3	2.5	20
7	PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281_Planted	2.59	50	0.0	-50	2.5	81
8	PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	281_Poor	3.95	39	0.0	-39	2.5	96
Total number of ecosystem credits required – all other development areas								**229**

ii Impacts on threatened species

Impacts to threatened species habitat requiring offsets include:

- direct impacts on 0.48 ha of foraging habitat for the Large-eared Pied Bat
- direct impacts on 8.62 ha of habitat for the Koala
- direct impacts on 3.25 ha of potential habitat for Superb Parrot (assumed present).

A summary of the species credits required for all vegetation zones occupied by the threatened species, including changes in vegetation integrity score, are provided in Table 6.15 (road corridor), Table 6.16 (solar and BESS project) and Table 6.17 (accommodation facility and access tracks). The species polygons are displayed on Figure 6.2. A total of 265 species credits are required to offset the residual impacts of the project, comprising 38 species credits for the road corridor, 206 species credits for the solar and BESS project and 21 credits for the accommodation facility and access tracks (Table 6.17). Credit reports are provided in Attachment 10.

Table 6.15 Impacts that require offsets – species credits – road corridor

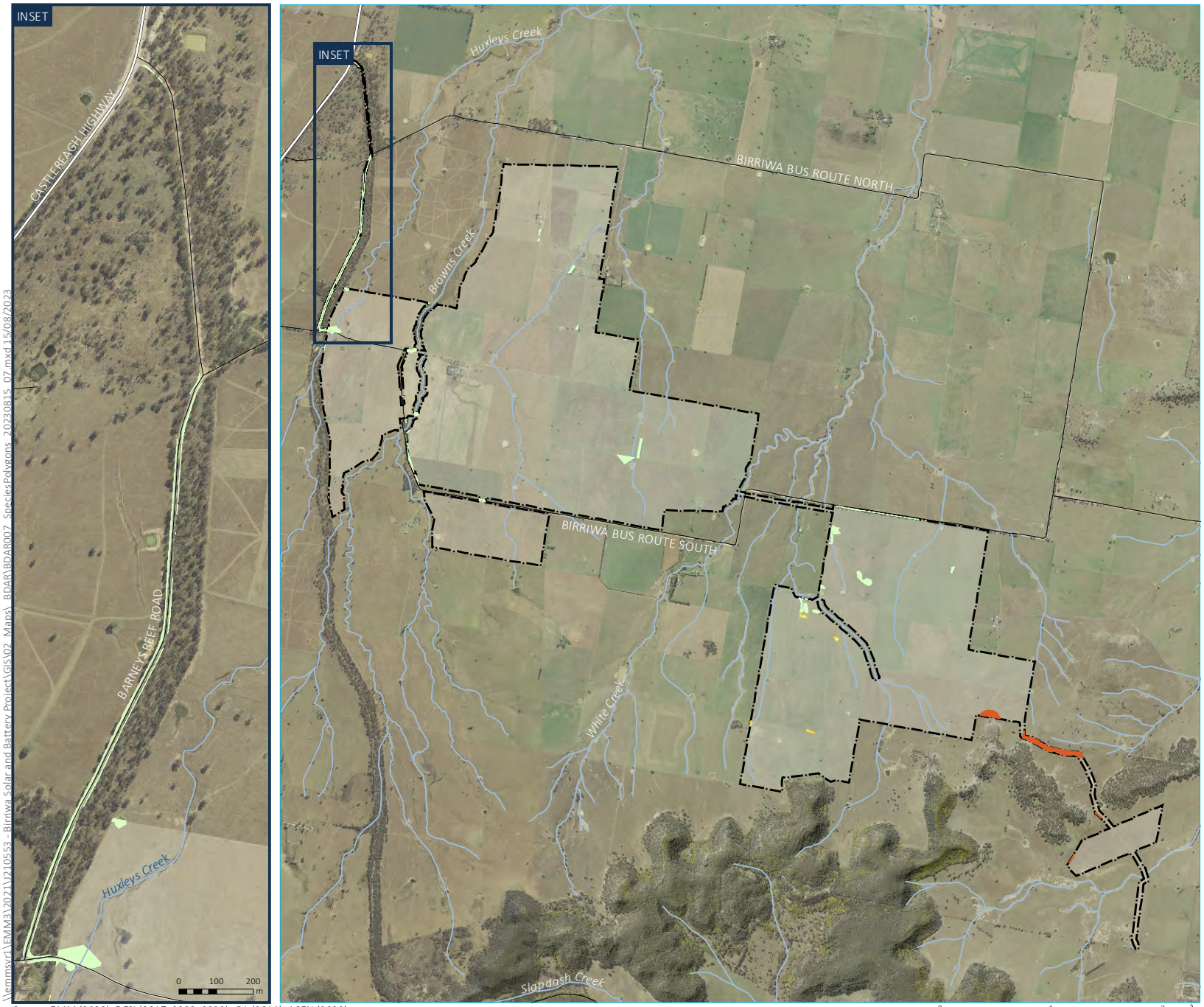
Species	Vegetation zone name	Area (ha)/individual (HL)	Habitat condition (VI score)	Future habitat condition	Loss of habitat condition (VI loss)	Candidate SAII	Biodiversity Risk Weighting	Species credits required
Koala	80_High	0.49	95.2	0.0	-95.2	No	2	23
	281_High	0.30	99.8	0.0	-99.8			15
Total number of species credits required – road corridor								**38**

Table 6.16 Impacts that require offsets – species credits – solar and BESS project

Species	Vegetation zone name	Area (ha)/individual (HL)	Habitat condition (VI score)	Future habitat condition	Loss of habitat condition (VI loss)	Candidate SAII	Biodiversity Risk Weighting	Species credits required
Large-eared Pied Bat	80_Poor	0.17	46.2	0.0	-46.2	Yes	3	6
	281_Planted	0.19	50	0.0	-50			7
	281_Poor	0.12	39	0.0	-39			4
Koala	80_High	0.52	95.2	0.0	-95.2	No	2	25
	80_Poor	0.17	46.2	0.0	-46.2			4
	281_High	0.05	99.8	0.0	-99.8			2
	281_Medium	0.55	58.3	0.0	-58.3			16
	281_Planted	2.59	50	0.0	-50			65
	281_Poor	3.95	39	0.0	-39			77
Total number of species credits required – all other development areas								**206**

Table 6.17 Impacts that require offsets – species credits –accommodation facility and access tracks

Species	Vegetation zone name	Area (ha)/individual (HL)	Habitat condition (VI score)	Future habitat condition	Loss of habitat condition (VI loss)	Candidate SAII	Biodiversity Risk Weighting	Species credits required
Superb Parrot	479_DNG	3.25	13.2	0.0	-13.2	No	2	21
Total number of species credits required – road corridor								**21**



KEY

- Subject land
- Koala species polygon
- Large-eared Pied Bat species polygon
- Superb Parrot species polygon

Existing environment

- Major road
- Minor road
- Watercourse/drainage line

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Source: EMM (2023); DFSI (2017, 2020, 2022); GA (2011); ACEN (2022)

Species polygons

Birriwa Solar and Battery Project
Biodiversity Development Assessment Report
Figure 6.2

EMM
creating opportunities

6.7 Biodiversity offset strategy

Offsets will be provided in accordance with the Biodiversity Offset Scheme.

Regarding the satisfaction of credit obligations prior to commencing any on-ground works for the project, it is ACEN's intent to upgrade the site access (road upgrade corridor) before the accommodation facility and solar components, to enable a staged offset delivery model. This strategy is based on clearly defined activities that require vegetation clearance for the project, as per the following key components:

- road upgrade corridor
- accommodation facility and access tracks
- solar and BESS project.

Biodiversity offset liabilities will be finalised before the commencement of each activity. It is ACEN's intent to meet the offset obligations for the key components independently. This allows flexibility in starting construction for the road upgrade corridor, accommodation facility/access tracks, and solar/BESS separately to each other.

In regard to the accommodation facility and access tracks, due to the proposal's avoidance of woodland patches and impact on lower quality grassland only (PCT 479 DNG and PCT 281 pasture), there are no ecosystem offset requirements for this stage of the project. There are some species credits associated with the accommodation facility and access tracks, which would be offset independently from the road upgrade corridor and solar/BESS project.

A summary of the total credit requirements (ecosystem and species) for the road upgrade corridor, the accommodation facility/access tracks, and solar/BESS is provided within Table 6.18.

Table 6.18 Summary of staged offset delivery

PCT/species	Road upgrade corridor	Credits[1]	Accommodation facility and access tracks	Credits[1]	Solar farm and BESS project	Credits[1]	Total project credits
	Area (ha)		Area (ha)		Area (ha)		
PCT 281	0.30	19	-	-	7.14	200	
PCT 80	0.49	23	-	-	0.69	29	
Total PCT credits		**42**				**229**	**271**
Large-eared Pied Bat	0.00	0	-	-	0.48	17	
Koala	0.79	38	-	-	7.83	189	
Superb Parrot	-	-	3.25	21	-	-	
Total species credits		**38**		**21**		**206**	**265**

Notes: 1. All zones of PCTs 281 and 80 requiring offset, require Hollow Bearing Tree (HBT) credits (refer like-for-like credit reports, Attachment 10)

Three credit reports, one for the road upgrade corridor, one for the accommodation facility and access tracks, and one for the solar and BESS project are provided in Attachment 10.

7 Assessment of other relevant biodiversity legislation

7.1 Environment Protection and Biodiversity Conservation Act 1999

This section provides an assessment of the project's impacts specific to species and communities listed under the EPBC Act (together defined as MNES).

7.1.1 Likelihood of occurrence assessment

The Protected Matters Search Tool (PMST) (DAWE 2022d) (Attachment 7) produced a list of MNES that may occur within the subject land. A likelihood of occurrence (LoO) assessment was undertaken to assess the likelihood that these MNES could occur within or adjacent to the subject land. The criteria for assessing LoO for the list of MNES predicted by the PMST is listed in Table 7.1.

Table 7.1 Likelihood of occurrence criteria

Likelihood	Description	Further assessment conducted?
Negligible	• The potential for the species to occur in the subject land is considered so unlikely as to not be worth considering.	No
Low	• Based on data collected during field investigations it was considered that the species was unlikely to occur in the subject land or use habitats in the subject land. The species may utilise the study area on rare occasions. • The species is considered vagrant in the bioregion and is thus considered unlikely to occur in the subject land.	No
Moderate	• The species is known to occur in the locality and the subject land provides some habitat value for the species. Habitat values are somewhat degraded and considered suboptimal.	Yes
High	• The species is known to occur in the locality and the subject land supports optimal habitat features for the species.	Yes
Known	• The species has been recorded during current surveys.	Yes

The LoO assessment is provided in Attachment 8, with a summary of the assessment presented in the following sections.

i Threatened ecological communities

Three TECs were predicted to occur within the subject land by the PMST (DAWE 2022d) (Attachment 7):

- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia
- Weeping Myall Woodlands.

PCT 281 is consistent with White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered ecological community (CEEC). PCT 80 is consistent with Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia Endangered ecological community (EEC).

The EPBC listing for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is dependent on condition, patch size and presence or absence of important species. Table 7.2 outlines the assessment process taken place to determine whether the vegetation zones (in relation to associated BAM plots) within the subject land conform to the EPBC listing (DEH 2006).

Table 7.2 EPBC listing determination against White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland criteria (DEH 2006)

Question	Criteria	Determination	Associated BAM plot	Discussion	Condition pathway
1	Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakely's Red Gum (or Western Grey Box or Coastal Grey Box in the Nandewar Bioregion)?	Yes	All plots	All vegetation zones are dominated by Yellow Box or Blakely's Red Gum, or are considered to be a derived grassland from the TEC.	Move to question 2
2	Does the patch have a predominantly native understorey?	Yes	Plots 8, 10, 11, 15, 18, 19 and 20.	Percentages range from 69% to 99% cover.	Move to question 3
		No	Plots 1, 2, 3, 4, 5, 6, 16 and 17.	Percentages fall below 50% cover. These plots do not meet the condition threshold.	Not listed under the EPBC Act
3	Is the patch 0.1 ha or greater in size?	Yes	Plots 8, 10, 11, 15, 18, 19 and 20.	Patch sizes range from 0.51 ha to greater than 49 ha.	Move to question 4
4	There are 12 or more native understorey species present (excluding grasses). There must be at least one important species.	Yes	Plots 8, 10 and 11.	These plots range from 14 to 20 native understorey species with 5 to 9 important species.	**These plots meet the EPBC Act condition thresholds. These plots occur within the PCT 281_High vegetation condition**
		No	Plots 15, 18, 19 and 20.	These plots do not have at least 12 or more native understorey species present.	Move to question 5
5	Is the patch 2 ha or greater in size?	Yes	Plot 18	Patch size is greater than 49 ha.	Move to question 6
		No	Plots 15, 19 and 20.	Patch sizes range from 0.51 ha to 1.9 ha.	Not listed under the EPBC Act
6	Does the patch have an average of 20 or more mature trees per hectare, or is there natural regeneration of the dominant overstorey eucalypts?	No	Plot 18	Plot 18 is associated with 281_pasture vegetation zone- no canopy or regeneration of canopy is present.	Not listed under the EPBC Act

The EPBC listing for Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia Endangered ecological community (EEC) is also dependent on a number of condition thresholds (DEWSPaC 2012). Table 7.3 outlines the assessment process taken place to determine whether the vegetation zones (in relation to associated BAM plots) within the subject land and study area conform to the EPBC listing (DEWSPaC 2012).

Table 7.3 EPBC listing determination against Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands criteria (DEWSPaC 2012)

Question	Criteria	Determination	Associated BAM plot	Discussion	Condition pathway
1	Is the property within or near the area shown on the Grey Box Grassy Woodland distribution map on page 13?	Yes	All plots	The subject land is located within the mapped distribution.	Move to question 2
2	Is at least 50% of the plant cover in the ground layer made up of perennial native species? OR Is at least 10% of plant cover in ground layer made up of perennial native grass species?	Yes	All plots	All plots with the exception of plot 27, range in percentage from 64% to 99% perennial native species. Plot 27 has a percentage of 49%, however does have a perennial native grass cover of 26%.	Move to question 3
3	Is (or was previously) the most common tree species (or group of species) one of the following? Grey box (*Eucalyptus microcarpa*)	Yes	All plots	All plots have or were previously associated with Grey Box.	Move to question 4 (Flowchart 2)
4	Is the patch at least 0.5 ha in size?	Yes	Plots 7, 9, 12, 13, 24, 25, 26 and 27.	Patch sizes range from greater than 2 ha to greater than 80 ha.	Move to question 5
		No	Plot 21	Plot 21 has a patch size of 0.102 ha.	Not listed under the EPBC Act
5	Do non-grass weeds make up more than 30% of the plant cover in the ground layer?	No	Plots 7, 9, 12, 13, 24, 25, 26 and 27.	Percentage of non-grass weed cover ranges from 0.7% to 27.4%.	Move to question 6
6	Do trees cover at least 10% of patch?	Yes	Plots 7, 9 and 12.	Tree cover ranges from 30% to 35%.	Move to question 7
		No	Plots 13, 24, 25, 26 and 27.	These plots are associated with 80_pasture vegetation zone, no canopy is present.	Move to question 10.
7	Is the patch bigger than 2 ha?	Yes	Plots 7, 9 and 12.	Patch sizes range from greater than 2 ha to 5.58 ha.	Move to question 8

Table 7.3 EPBC listing determination against Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands criteria (DEWSPaC 2012)

Question	Criteria	Determination	Associated BAM plot	Discussion	Condition pathway
8	Are there at least 8 trees/ha: a) that contain hollows; or b) have a diameter >60 cm at 1.3 m above ground level?	Yes	Plots 7, 9 and 12.	These plots all have suitable tree density per hectare with trees greater than 60 DBH and hollows	Move to question 9
9	Is at least 10% of the plant cover in the ground layer made up of perennial native grass species?	Yes	Plots 7, 9 and 12.	Percentages range from 20% to 68.5%.	**These plots meet the EPBC Act condition thresholds. These plots occur within the PCT 80_High vegetation condition**
10	Is there evidence that Grey Box trees were once common in the patch?	Yes	Plots 13, 24, 25, 26 and 27.	It is evident from surrounding vegetation that Grey Box was historically common.	Move to question 11
11	Are there at least 12 perennial native species in the mid and ground layers?	Yes	Plot 13	This plot has 19 perennial native species.	Move to question 12
		No	Plots 24, 25, 26 and 27.	Perennial native species diversity ranges from 5 to 9 species.	Not listed under the EPBC Act.
12	Is at least 50% of the plant cover in the ground layer made up of perennial native species?	Yes	Plot 13	This plot has 80.8% of perennial native species.	**Meets EPBC Act condition threshold. Vegetation zone 80_DNG has been excluded from the subject land to avoid impacts.**

No Weeping Myall Woodlands TEC occurs within the study area.

ii Threatened species

The PMST (DAWE 2022d) and/or BAMC predicted that 43 species listed as a threatened species under the EPBC Act could occur within the subject land. The likelihood of occurrence for these species is assessed in Attachment 8. One EPBC Act listed species was recorded in the subject land; Koala. Five species were considered to have a moderate to high likelihood of occurrence following the desktop assessment and field survey. These species include:

- Koala (*Phascolarctos cinereus*)- recorded within the subject land
- Painted Honeyeater (*Grantiella picta*)
- Regent Honeyeater (*Anthochaera phrygia*)
- Superb Parrot (*Polytelis swainsonii*)
- White-throated Needletail (*Hirundapus caudacutus*)

- Gang-gang Cockatoo (*Callocephalon fimbriatum*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*).

The significant impact assessments are provided in Attachment 9, with the results of the assessments listed in Table 7.4.

iii Migratory species

Eleven species listed as migratory species under the EPBC Act were predicted to occur in the subject land based on database searches undertaken. Three of these species have already been assessed as they are also listed as a threatened species under the EPBC Act (Attachment 8). An assessment of the likelihood of the remaining eight migratory species utilising habitat within the subject land was carried out. No species listed as migratory or marine under the EPBC Act were recorded as being present in subject land. One migratory species is considered to have moderate likelihood of occurrence in the subject land; White-throated Needletail.

An impact assessment based on the migratory specification for the White-throated Needletail has been completed (Attachment 9). The remaining migratory species may fly high over the subject land but are unlikely to utilise the vegetation or other habitats present at or near ground level.

7.1.2 Significant impact assessments results

Two TECs and five species listed under the EPBC Act were considered to have a moderate to known likelihood of occurrence following the desktop assessment and field survey. These species and the result of the significant impact assessment are listed in Table 7.4. As outlined in Table 7.4, the project is considered unlikely to significantly impact the identified TECs and species considered to have moderate to known likelihood of occurrence within the subject land.

Table 7.4 TECs and species considered to have moderate to known likelihood of occurrence and subject to significant impact assessments

Scientific name	Common name	EPBC status	Likelihood of occurrence	Significant impact assessment result
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	-	Critically Endangered	Known	Unlikely
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia EEC	-	Endangered	Known	Unlikely
Phascolarctos cinereus	Koala	Endangered	Known	Unlikely
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Moderate	Unlikely
Polytelis swainsonii	Superb Parrot	Vulnerable	Moderate	Unlikely
Callocephalon fimbriatum	Gang-gang Cockatoo	Endangered	Moderate	Unlikely
Grantiella picta	Painted Honeyeater	Vulnerable	Low	Unlikely
Hirundapus caudacutus	White-throated Needletail	Vulnerable; Migratory	Low	Unlikely

Table 7.4 TECs and species considered to have moderate to known likelihood of occurrence and subject to significant impact assessments

Scientific name	Common name	EPBC status	Likelihood of occurrence	Significant impact assessment result
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Moderate	Unlikely

7.2 Fisheries Management Act 1994

As discussed in Section 3.1.2, Browns Creek and White Creek are mapped as KFH (DPI 2021b). These creeks, in addition to Huxleys Creek, are also mapped within the freshwater threatened species distribution for the Purple-Spotted Gudgeon (*Mogurnda adspersa*) (DPI 2021a).

A likelihood of occurrence assessment for species listed under the FM Act was conducted based on database searches (Section 1.8, Attachment 8) and concluded that no aquatic threatened ecological communities, endangered populations or species have a moderate to high likelihood of occurring within the subject land.

7.3 Biosecurity Act 2015

Two state priority weeds identified in the *Central Tablelands Regional Strategic Weed Management Plan 2017-2022* (LLS, 2017) were identified within the subject land:

- Coolatai Grass (*Hyparrhenia hirta*)
- St. Johns Wort (*Hypericum perforatum*).

The Mid-Western Regional Council and Warrumbungle LGA are classed as a core infestation areas for Coolatai Grass (DPI n.d). Land managers should mitigate spread from their land and reduce impacts from the plant on priority assets. The St John's Wort is regulated with a regional recommended measure to mitigate spread on land whilst the plant should not be bought, sold, grown, carried or released into the environment. An additional measure is to protect grazing land that is free of St. John's wort.

The biodiversity management plan for the project would directly address the control of both these priority weeds.

If any other priority weeds of NSW are identified in the subject land during construction, they must be removed from the subject land. 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. Conservation areas, natural environments and primary production lands should be protected that are free of the priority weeds.

8 Conclusion

This BDAR has been prepared based on the requirements of, and information provided under, the BAM (DPIE 2020) and clause 6.15 of the BC Act.

The mitigation actions recommended within this BDAR have been developed in parallel with, and have informed the evolution of, the project design. This process has ensured the avoidance and minimisation of biodiversity constraints as far as practicable. Residual impacts include:

- loss of 76.80 ha of PCT 80, of which 1.18 ha requires offsetting, and associated habitat for flora and fauna species
- loss of 300.46 ha of PCT 281, of which 7.45 ha requires offsetting, and associated habitat for flora and fauna species
- loss of 28.45 ha of PCT 479, which is grassland of low condition and does not require offsetting under the NSW BOS.

Mitigation and management measures have been proposed to address predicted impacts on biodiversity. These include pre-clearance, construction, and operational phase measures to avoid impacts at all stages of the project.

The offset requirements determined for the project are summarised in Table 8.1.

Table 8.1 Summary of credit requirements

Entity	Area (ha)/count	Number of credits (road corridor)	Number of credits (accommodation facility and access tracks)	Number of credits (solar and BESS project)
PCT 80	76.80 ha	23	-	32
PCT 281	300.46 ha	19	-	197
PCT 479	28.45	-	-	-
Large-eared Pied Bat	0.48 ha	-	-	17
Koala	8.62 ha	38	-	189
Superb Parrot	3.25 ha	-	21	-

For the purposes of this BDAR, BAMC calculations have been split as per key components:

- road upgrade corridor
- accommodation facility and access tracks
- solar and BESS project.

This allows for the flexibility of the project components to be offset and constructed separately. It likely that the accommodation facility will commence construction in parallel with the road upgrade corridor; however, the components may all overlap. All credit reports have been included within Attachment 10.

This BDAR has informed assessments of SAII TECs and species which occur or have the potential to occur within the subject land:

- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland
- Regent Honeyeater
- Large-eared Pied Bat.

ACEN will compensate for these residual impacts through the implementation of a biodiversity offset strategy.

The BDAR has also considered impacts on species and ecological communities listed under the EPBC Act. The proposed development is not expected to result in significant impacts to MNES including threatened ecological communities and species, and migratory species.

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